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Public views on the dangers and importance of climate change: predicting climate change beliefs in the United States through income moderated by party identification

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Abstract Previous research has identified the interaction between political orientation and education as an important predictor of climate change beliefs. Using data from the 2010 General Social Survey, this article looks at the moderating effect of party identification on income in predicting climate change beliefs in the U.S. Probing this interaction reveals that increased income predicts a higher probability of dismissing climate dangers among Republican-leaning individuals when compared with Independents and Democrats. Alternatively, increased income predicts a higher probability of ranking climate change as the most important environmental problem facing the United States among Democratic-leaning individuals compared with Republicans. The results indicate that income only predicts climate change beliefs in the presence of certain political orientations, with poorer Republicans less likely to dismiss climate change dangers than their affluent counterparts.

1 Introduction

Research on climate change beliefs and concern consistently demonstrates the significant effect of political orientation in predicting environmental attitudes and alignment with established scientific opinion even, when controlling for a variety of social and demographic variables (Dunlap and McCright 2008; Hamilton 2008, 2011; Hamilton and Keim 2009; Krosnick et al. 2000; McCright 2008, 2011; McCright and Dunlap 2011a, b; Wood and Vedlitz 2007). Going beyond the surface, however, reveals a more complex reality. Political orientation moderates the effects of some relevant factors in predicting beliefs about climate change. For example, we might assume that increased educational attainment or self-reported scientific understanding decreases the likelihood that an individual reports climate skeptic attitudes. However, the effects of these factors in predicting climate change opinion are contingent upon a person's ideological or party identification. While increased education predicts more scientifically accurate beliefs among Democrats and liberals regarding climate change, it predicts less accurate beliefs among Republicans and conservatives (Hamilton 2008, 2011; Hamilton and Keim 2009; McCright 2011; McCright and Dunlap 2011a).

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In this article, I extend research on climate change beliefs that looks at the moderating effect of political orientation beyond education and perceived scientific understanding. Specifically, I consider the interaction between income and political party identification, which predicts climate change beliefs along two fronts: the perception of risk associated with climate change and the ranking of climate change as an important environmental problem. Compared with Independents or Democrats, increased income predicted a greater probability of dismissing the dangers associated with climate change among Republicans. Alternatively, compared with Republicans, increased income predicted a greater probability of ranking climate change as the most important environmental problem facing the U.S. among Democrats. This research further substantiates the moderator effect of political orientation in predicting climate change beliefs by demonstrating its significant interaction with a factor previously unexplored—an individual's family income.

These results provide further evidence for understanding the political context of climate change opinion in the U.S. Explaining polarized climate change beliefs as the outcome of a conservative movement seeking to defend a political order of industrial capitalist relations is consistent with the relationship revealed in this article between party identification and income (McCright 2011; McCright and Dunlap 2010, 2011a). Importantly, this analysis reveals that middle- and higher-income Republicans are more likely to dismiss the dangers associated with climate change than their lower-income counterparts.

The next section reviews prior research on the moderating effect of political orientation in predicting climate change beliefs and theoretical explanations for these dynamics. This research is then related to what we should expect to find between the interaction of income and political orientation in predicting climate change beliefs. After describing the data and methods used in this analysis, results from the interaction between income and party identification are visualized. These visualizations provide the basis for discussion and conclusion.

2 Moderator effect of political orientation

An interesting aspect of predicting climate change opinion is that the effects of numerous factors are contingent upon an individual's political orientation, whether these factors are educational attainment (Hamilton 2008; Hamilton and Keim 2009; McCright 2011; McCright and Dunlap 2011a), self-assessed scientific understanding (Hamilton 2011; McCright and Dunlap 2011a), objectively-assessed scientific understanding (Hamilton et al. 2012), or income (the contribution of the present study). Across all of these categories, greater political polarization is found among relative elites.

McCright (2011) suggested two theoretical perspectives—information processing theory and the elite cues hypothesis—that might explain the interaction between political orientation and education in predicting climate change concern and belief. Information processing theory explains how values shape the way individuals understand the presentation of new information on a given issue. Many scholars have questioned the efficacy of a purely information-based strategy when communicating about climate change, as political orientation appears to play such a dominant role in structuring how an individual reacts to scientific knowledge. Information processing theory explains this by noting that many individuals lack the cognitive skills necessary to process all types of information they come across, instead processing information through experiential, social, and ideological filters (Wood and Vedlitz 2007). In cases of ambiguity, people especially engage in information processing, relying on their predispositions to form opinion (Jones and Baumgartner 2005). Thus, in the case of processing

information on climate change, we can expect an individual's political values to play an important role in developing beliefs.

Consistent with information processing theory is the elite cues hypothesis. Rather than reacting directly to scientific information, people may also take cues from political elites they identify as trustworthy when forming opinions on controversial issues. In cases of controversial issues that undergo intense public debates, people are willing to change their attitudes in accordance with cues taken from political elites. When the Clinton administration campaigned to build support for the Kyoto treaty, public debates did little to change the overall balance of national public opinion. Beneath this, however, strong Democrats and strong Republicans each rallied around the respective positions of their partisan leaders (Krosnick et al. 2000).

Ideally, survey researchers can measure scientific knowledge by quizzing respondents on a range of questions assessing their objective knowledge on an issue in order to understand its influence in forming opinions about scientific controversies (Malka et al. 2009). However, many surveys instead ask respondents to report their understanding of a given issue (which may be measuring how tuned in an individual feels to a particular information source as opposed to their objective knowledge). Both types of research find that increased levels of scientific knowledge or self-reported understanding predicts a smaller likelihood of climate skepticism for liberals and Democrats, but has either no effect on or *increases* the likelihood of climate skepticism for conservatives and Republicans (Malka et al. 2009; McCright and Dunlap 2011a).

Other research approaches the topic of scientific literacy indirectly through educational attainment. This research finds similar patterns regarding climate skepticism, as educational attainment works differently for liberals and Democrats than it does for conservatives and Republicans. Hamilton (2008) initiated this line of research through an analysis of national public opinion regarding the polar regions. He found that increased education predicted greater levels of concern over global warming among liberals and moderates, but predicted lower levels of concern among conservatives. These findings were replicated at the regional scale by Hamilton and Keim (2009), Hamilton (2011), and Hamilton and Lemcke-Stampone (2013). McCright and Dunlap (2011a) tested this relationship through 10 years of national survey data in the U.S., finding both ideology and partisan identification to have significant interactions with education in predicting attitudes about climate change. They expanded previous research to find that, among conservatives and Republicans, increased levels of both education and self-reported scientific understanding predicted lower levels of concern and less accurate beliefs about global warming. In related research, Gauchat (2012) found that increased education among conservatives predicted greater levels of distrust in scientific authority.

McCright (2011) connected the moderator effect of political orientation on education to information processing theory and the elite cues hypothesis noting that in an age of self-selecting media constellations, increasingly educated individuals may view themselves as very informed on a scientific issue even if they do not expose themselves to informed perspectives. Even if conservative individuals are very in tune with the information communicated through talk radio, FOX News, or conservative think tanks, they may not have accurate understandings of climate change despite how informed they feel. Thus, "greater educational attainment and more focused attention to their respectively favored news outlets and political elites may increase how much citizens think they understand about the issue" (2011:249). But because liberals and conservatives diverge in selecting their information sources, the effects of increased education work differently across these groups in predicting global warming beliefs and concern.

What has not been previously considered is the possibility of a similar interaction effect between political orientation and income. Much research within environmental sociology

indicates that income serves as a poor predictor of environmental concern in the U.S. (Van Liere and Dunlap 1980; Jones and Dunlap 1992; Mohai and Bryant 1998). Some argue that a relationship exists between increased income and pro-environmental concern, such as the affluence hypothesis (Franzen 2003; Franzen and Meyer 2010) and the postmaterialism perspective (Inglehart 1990, 1995). However, these perspectives have been criticized for overlooking how environmental concern can be expressed through nonfinancial means, how materialist values can express concern over environmental degradation, or that shifts in pro-environmental values are not limited to affluent societies (Brechin and Kempton 1994; Dunlap and Mertig 1997; Dunlap and York 2008).

Recalling McCright's (2011) interpretation, we should expect to find a similar interaction between party identification and income in predicting climate change risk perception as seen between political orientation and education in predicting climate change beliefs. People occupying an advantageous place in systems of economic benefits would likely seek information sources validating the defense of their socioeconomic position. Individuals composing their media universe through conservative talk radio, cable news, or online think tanks and blogs are exposed to information sources that both admonish policy attempts to mitigate economic inequality and question the legitimacy of scientific knowledge regarding climate change. Thus, the relationship between income and political orientation in shaping climate change beliefs would be consistent with information processing theory and the elite cues hypothesis. Since confronting large-scale environmental problems challenges the hegemony of industrial capitalist orders (Austin 2002; McCright and Dunlap 2010; McCright 2011), we should further expect to find that the interaction of conservative political identification and high income affects beliefs about climate change (Tables 1 and 2).

3 Data and methods

Data for this analysis came from the 2010 General Social Survey (GSS). The GSS is an in-person survey administered by the National Opinion Research Center, and offers a representative sample of the non-institutionalized U.S. adult population while collecting extensive measures on demographic characteristics and political attitudes.

Table 1 Descriptive data of variables used in analysis

Variable	Range	*M*	*SD*
Dismissal of climate change dangers	0–1	0.196	0.397
Climate change most important problem	0–1	0.108	0.311
White	0–1	0.755	0.430
Male	0–1	0.461	0.499
Senior (65 and older)	0–1	0.156	0.363
Young adult (30 and younger)	0–1	0.217	0.412
Degree (bachelor's degree = 0)	−2–1	−1.242	1.092
Income (middle quintile = 0)	−2–2	0.094	1.375
Liberal	0–1	0.292	0.454
Independent	0–1	0.162	0.368
Republican	0–1	0.343	0.475

Data is weighted

Table 2 Unstandardized coefficients and standard errors (in parentheses) from logistic regressions

	Dismissal of climate change dangers (N=1,125)			Climate change is most important problem (N=1,056)		
Model	1	2	3	4	5	6
White	0.455(0.277)	0.453(0.279)	0.468(0.277)	−0.087(0.275)	−0.061(0.279)	−0.038(0.280)
Male	0.315(0.187)	0.316(0.186)	0.311(0.189)	0.493(0.241)*	0.495(0.242)*	0.514(0.242)*
Senior	0.703(0.257)**	0.705(0.257)**	0.763(0.255)**	0.089(0.310)	0.106(0.319)	0.091(0.319)
Young adult	0.391(0.251)	0.389(0.252)	0.440(0.250)	0.489(0.295)	0.523(0.294)	0.494(0.297)
Degree	0.025(0.086)	0.029(0.170)	0.127(0.166)	0.186(0.112)	0.361(0.134)**	0.323(0.137)*
Income	0.215(0.079)**	0.217(0.079)**	−0.028(0.159)	0.147(0.108)	0.146(0.111)	0.238(0.128)
Liberal	−0.954(0.293)***	−0.953(0.289)***	−0.911(0.289)**	0.421(0.259)	0.308(0.269)	0.261(0.280)
Independent	0.973(0.294)***	0.885(0.477)	0.902(0.471)	0.022(0.341)	−0.251(0.457)	−0.472(0.588)
Republican	1.465(0.216)***	1.474(334)***	1.154(0.333)***	−0.943(0.353)**	−1.975(0.569)***	−1.643(0.575)**
Degree × party						
Independent	–	−0.060(0.289)	−0.049(0.289)	–	−0.222(0.270)	−0.350(0.357)
Republican	–	0.007(0.202)	−0.164(0.202)	–	−0.810(0.312)**	−0.597(0.328)
Income × party						
Independent	–	–	0.086(0.245)	–	–	0.139(0.293)
Republican	–	–	0.439(0.180)*	–	–	−0.570(0.277)*
LR chi-square(df)[a]	165.54(9)***	165.64(11)	174.65(13)*	41.33(9)**	51.17(11)**	60.16(13)*
Constant	−2.808(0.354)***	−2.802(0.364)***	−2.699(0.351)***	−2.139(0.284)***	−1.937(0.298)***	−1.996(0.302)***

Data is weighted

*$p \leq 0.05$ **$p \leq 0.01$ ***$p \leq 0.001$

[a] The significance levels for the chi-square statistics reported for Models 2–3 and 5–6 reflect the significance of the difference with the previous model

The dependent variables are taken from two questions about climate change belief. First, the GSS asked respondents, "In general, do you think that a rise in the world's temperature caused by climate change is extremely dangerous for the environment, very dangerous, somewhat dangerous, not very dangerous, or not dangerous at all for the environment?" A dummy variable was created with respondents answering "not very dangerous" or "not dangerous at all" coded as 1. Approximately one in five respondents identified with the belief that temperature rise does not present environmental danger.

The second dependent variable measures whether respondents ranked climate change as the most important environmental problem facing the U.S. In addition to climate change, respondents were presented with a range of environmental problems to select as the most important, including: air pollution, chemicals and pesticides, water shortage, water pollution, nuclear waste, domestic waste disposal, genetically modified foods, using up our natural resources, or none of these. Respondents who selected climate change as the most important environmental problem facing the U.S. were coded as 1. Approximately one in ten respondents identified climate change as the most important problem facing the U.S.

The focus of this research concerns the interaction between party identification and income. Two questions produced measurements of political orientation. For party identification, respondents were able to identify as weak or strong Republicans or Democrats, Independents, or Independents who lean Republican or Democrat. Those identifying as "other party" were deleted from analysis (less than 3 % of the sample). Republican was coded = 1 for those respondents who selected strong or weak Republican as well as Independent leaning Republican. A dummy variable was also created for those identifying as Independent (with Democrats constituting the reference category). In addition, liberal was coded = 1 for those respondents identifying as slightly liberal to extremely liberal when asked to identify their position along a seven-point measure of ideological orientation.

Income was measured by total family income from the previous year. Income was measured in terms of quintiles and centered on the middle quintile for modeling purposes. Degree refers to the highest educational degree obtained (−2 = high school or less, −1 = junior college, 0 = bachelor's, 1 = graduate). Interaction terms were created between each of these and party identification, yielding four interactions: Independent × income, Republican × income, Independent × degree, and Republican × degree.

Several control measurements were included in the models. Dummy variables were created for race (1 = white) and gender (1 = male), factors that past research has shown to demonstrate relationships to climate change beliefs. As older age is sometimes found to negatively predict environmental concern in the U.S., two measurements of age were included to test whether youth or older age predicted climate change beliefs: senior (1 = 65 and older) and young adult (30 and younger).

Because the dependent variables are binary, logistic regression is suitable for statistical analysis. Missing data was handled using listwise deletion in all models. Likelihood ratio chi-square tests were calculated to test improvement in model fit. Since the measures of income and degree are centered, the coefficients of the variables constituting the interactions may be interpreted as the main effects of X on Y when $Z=0$ (so, for example, the effect of Republican status on the outcome among those attaining a bachelor's degree). To help interpretation, predicted probabilities of denying the danger associated with climate change as well as ranking climate change as the most important environmental problem were calculated for party identification by income using the MARGINS command in Stata 13 (Mitchell 2012).

4 Results

Looking at the results from logistic regression in Model 1, five variables predict the dismissal of climate change dangers with statistical significance. Measurements for senior, income, Independent, and Republican all positively predicted whether an individual dismisses climate change risks, while liberals were much less likely to dismiss climate change risks. These results confirm past research that demonstrates the strong influence of political orientation on climate change beliefs.

Model 2 includes the party × degree interactions. Neither of these interactions was statistically significant in predicting the perception of climate change danger. However, the Republican × income interaction added in Model 3 was statistically significant, and a likelihood ratio chi-square test indicated that adding the income interactions improved model fit with statistical significance ($p<0.05$) over the model only considering party interactions with educational degree.

The predicted probability of dismissing climate change dangers by the interaction of income and party identification is plotted in Fig. 1. Increased income has virtually no effect on predicting the dismissal of climate change dangers among Democrats and predicts slightly higher probabilities among Independents (18.9 % vs. 22.5 % between the bottom and top quintiles, respectively). However, increased income has large effects on predicting the denial of climate change danger among Republicans, ranging from a probability of 17.7 % at the bottom quintile to 51.2 % at the top quintile. At the bottom quintile of income, Republicans are not significantly different from either Independents or Democrats. However, Republicans display a statistically significant difference from Democrats among the second through top quintiles of income, and from Independents among the fourth and top quintiles of income.

Models 4–6 analyzed a different aspect of climate change beliefs: how likely climate change is perceived as the most serious problem relative to other environmental problems. A different pattern emerged in these models compared with dismissing the dangers of climate change. In Model 4, the main effects of income were not statistically significant, nor were age, race, or ideological orientation as seen in the previous model. Men were more likely to rank climate change as the most serious environmental problem among the presented options. Republicans were much less likely to rank climate change as the most serious

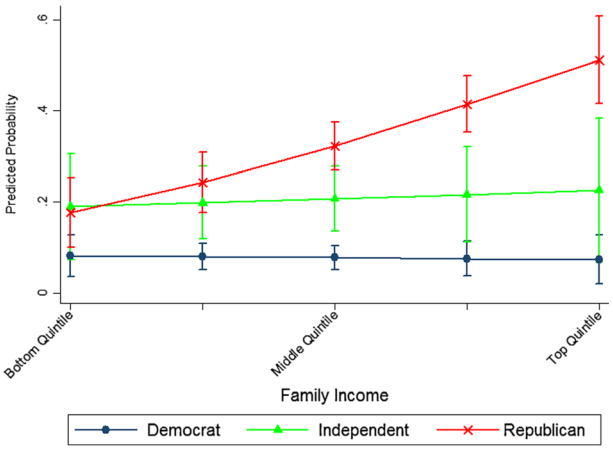

Fig. 1 Predicted probabilities of dismissing climate change dangers by party identification and family income. Note: Marginal effects were calculated holding all other predictors in Model 3 from Table 2 at their means

environmental problem, and this was the only variable that was statistically significant in both Models 1 and 4.

Model 5 included the interaction terms between party identification and degree attainment. Here the Republican × degree interaction was statistically significant, and adding these terms improved model fit to a statistically significant degree. However, this interaction was not statistically significant in Model 6 (p=0.07), while the Republican × income interaction was statistically significant. A likelihood ratio chi-square test shows that adding the party × income interactions improved model fit to a statistically significant degree (p<0.05) over the model only considering interactions with educational degree.

The predicted probabilities of ranking climate change as the most serious environmental problem for party identification by income are plotted in Fig. 2. While increased income positively predicted the outcome among Independents and Democrats, it negatively predicted the outcome among Republicans, ranging from a 10.0 % predicted probability at the bottom quintile to a 2.9 % predicted probability at the top quintile. While there was no statistically significant difference between Republicans and Independents, Republicans were less likely than Democrats to rank climate change as the most important environmental issue at the middle, fourth, and top quintiles of income.

The conditional effects of Republican identification by income level on climate change beliefs parallels evidence produced in prior research that indicates that conservative political orientation has a moderating effect on various predictors of climate change beliefs. However, the models presented here may be specifically suited for explaining the risk perceptions associated with climate change, which has not always been the dependent variable in other studies. For example, Hamilton et al. (2012) pooled 2006 and 2010 GSS data to analyze the moderating effect of ideology on scientific literacy in predicting concern over various aspects of polar-region warming such as polar bear extinction, threats to penguins, or the Inuit way of life. These polar-related beliefs were tested with the models presented here, and results showed that party × income interactions serve as statistically insignificant predictors. This discrepancy may suggest that interactions between income and party identification are better suited for explaining outcomes characterized by risk perception while interactions involving scientific

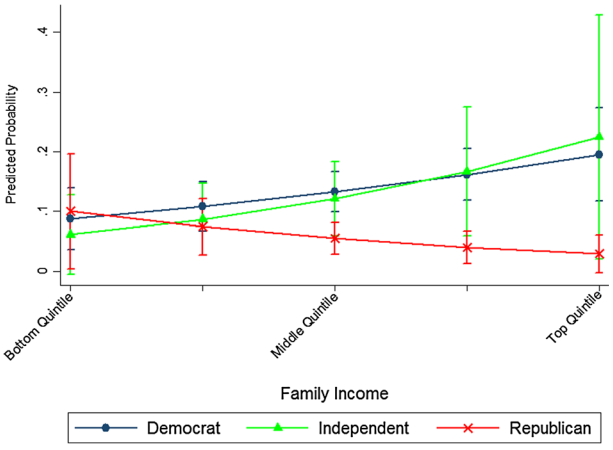

Fig. 2 Predicted probabilities of ranking climate change as the most important environmental problem by party identification and family income. Note: Marginal effects were calculated holding all other predictors in Model 6 from Table 2 at their means

literacy or education with political orientation may be better suited for explaining outcomes characterized by concern.

5 Conclusion

Previous research on the social bases of climate skepticism documented how political orientation moderates the effect of education and knowledge in predicting global warming beliefs and concerns. While increased education or scientific understanding predicts greater levels of concern and beliefs more aligned with the scientific consensus on climate change among liberals and Democrats, it has the opposite effect among conservatives and Republicans. The research presented in this article extends the political moderator effect to other areas of climate change beliefs by showing that the moderating effects of party identification are also present when we look at the interaction with income. Republicans in the middle and upper income levels were more likely to reject the environmental danger associated with climate change than Republicans in lower-income categories, and less likely to rank climate change as the most important environmental problem facing the U.S.

Consistent with past interpretations of the political moderator effect, higher levels of income could correlate with an individual's increased awareness of group interests, alignment with ideologically driven media, or familiarity with political party leadership. Future research could explore the interaction between income and party in predicting climate change beliefs through differences in sociopolitical values or economic interests. In terms of values, party identification may reflect different types of desired social solidarity (collectivism vs individualism) that are more pronounced at higher levels of income. There may be a parallel between believing that climate change is not dangerous on the one hand (thus requiring no action) with rejecting collective action to mitigate social problems on the other. Conservative party identification could also reflect the political organization of economic interests more dependent upon environmental extraction, which could explain why there is a difference in climate change beliefs between poorer and more affluent Republicans. More research would be required to validate either of these explanations.

Of course, the results regarding perceived dangers associated with climate change should be interpreted with some caution when thinking about the larger topic of climate skepticism that has received much attention in recent years. Limitations in the data restricted analysis to attitudes about the perceived consequences of climate change rather than the reality or causes of climate change. Further research is needed in order to assess whether party-income interactions extend to predicting climate skepticism more directly. There is a conceptual justification for expecting a connection between perceptions of climate risk and climate skepticism, as a key theme of organized climate skepticism concerns the effects of climate change. Previous research on climate skeptic organizations revealed how skeptics routinely argue that even if climate change were occurring, the effects of climate change would be minimal or beneficial (McCright and Dunlap 2000). Thus, it is plausible that many of the individuals denying the dangers associated with climate change may also deny that humans are causing global climate change.

Adding this research to existing literature on climate change attitudes can provide a point of reflection on the difficult nature of developing political support for climate mitigation. As an unintended consequence of industrial capitalist development, climate change presents a great collective risk in the modern era, and perceptions of these risks can greatly impact public support for policy responses (Leiserowitz 2005, 2006). However, to the extent that attitudes about climate change consequences constitute a political obstacle for addressing anthropogenic

drivers of climate change, better communication of risk and scientific knowledge will be insufficient for convincing large portions of the general population because people filter information on complex political issues through personally held values. Among individuals with conservative political orientation, there is a correlation between occupying advantageous positions within industrial economic systems and an unwillingness to acknowledge the risks associated with climate change. Perhaps to validate their economic interests, these individuals are more likely to process information on climate science through political filters that result in denying the risks produced by climate change. Not reducible to political orientation or income alone, we can understand climate change beliefs through the intersection of party identification and economic location. McCright's (2011) suggestion of reinstating the Fairness Doctrine is welcome as it may reduce the extent to which radio and television networks are able to present information through exclusive ideological preferences. However, although this could provide a greater base of shared facts, it could also enhance the role of ideologically driven online media sources unaffected by the regulation of broadcasting licenses.

In the end, there are economic interests and political norms involved in forming attitudes toward climate change. While some level of political opposition to climate mitigation will always be present, policy efforts could strategically identify areas where the mitigation of climate change overlaps with economic concern. For example, one analysis of the economic impact of the Regional Greenhouse Gas Initiative (a carbon trading market covering states in the American Northeast) found that the program resulted in a net benefit of $1.6 billion for ten participating states over the first 3 years, generating public funds mostly at the expense of net revenues to the power industry (Hibbard and Tierney 2011). While some states used these funds to address budget shortfalls, others directed the money toward economic development or assistance for low-income energy consumers. Others advocate approaches such as "cap and dividend," where emissions permits are auctioned off to carbon energy producers and proceeds redistributed directly to citizens. Approaches like these are expected to produce more economically progressive distributional effects (Büchs et al. 2011; Parry 2004). If addressing the dangers of climate change can also address economic insecurity, then the results presented here suggest that political polarization will be less intense within lower levels of family income.

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