



Neutral and negative effects of policy bundling on support for decarbonization

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Abstract

Decarbonization policies are frequently combined with other policies to increase public support or address related societal issues. To investigate the consequences of policy bundling, we conducted a survey experiment with 2,521 U.S. adults. We examined the effects of bundling decarbonization with policies favored by liberals (social justice and economic redistribution), broad bipartisan coalitions (infrastructure), and conservatives (pausing EPA regulations) on public support and polarization. Bundling with pausing EPA regulations decreased support and polarization by reducing liberal support without significantly increasing conservative support. Bundling with social justice decreased support while increasing polarization by reducing conservative support without significantly increasing liberal support. Bundling with economic redistribution and infrastructure did not significantly change support or polarization. Policy bundling thus risks decreasing public support for decarbonization policies by alienating one ideological side of the electorate without gaining support from the other side. This risk exists even when policy bundling reduces polarization.

Keywords Political polarization · Policy bundling · Decarbonization · Climate policy

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1 Introduction

Given the coupling between public opinion and policy (Stimson et al. 1995), as well as the reelection incentives of elected officials (Canes-Wrone et al. 2002), addressing climate change requires public support for decarbonization policies. Such policies in the United States generally garner greater support from liberals than conservatives (Egan and Mullin 2017; Miniard et al. 2020). To broaden policy support, policymakers often propose bundling emissions-reduction policies with other policies that enjoy greater support among conservatives and moderates, such as pausing new environmental regulations and revitalizing infrastructure. For instance, the bipartisan Energy Innovation and Carbon Dividend Act of 2019 (H.R. 763, which failed in committee) combined a revenue-neutral carbon tax with a pause on new Environmental Protection Agency (EPA) regulations and renewable energy funding was included in the 2021 bipartisan infrastructure bill (H.R. 3684). The underlying logic is that bundling components that appeal to conservatives and moderates will decrease polarization and increase overall public support for the bundled decarbonization policy. Of course, this assumes that such bundles would not receive less support from liberals.

Other advocates advance a bundling strategy that pairs disproportionately liberal-supported policies, such as social justice, with decarbonization to increase the scope of societal problems addressed by a single piece of legislation. For instance, the Sunrise Movement advocated for a Green New Deal, which bundled climate mitigation policies with a number of economic and social policies aimed at reducing economic and racial inequality (Sunrise Movement 2021). This would increase overall support for the bundled decarbonization policy if it increased support among liberals without reducing support among conservatives.

Even if a policy bundling strategy increased support, it might still make decarbonization policies more polarizing. For example, a recent survey experiment found that bundling some economically progressive non-decarbonization policies, discussed in the context of the Green New Deal, increased public support relative to decarbonization alone (Bergquist et al. 2020). Here, bundling increased overall support by increasing Democrats' support without affecting Republicans' support. Conversely, bundling strategies might reduce overall support if they alienate some supporters without attracting new supporters. Thus, assessing the effects of bundling on decarbonization policy support is a key research need (Kallbekken 2023; Fesenfeld 2022; Wicki et al. 2019).

Here, we evaluate a set of four bundling strategies in a large pre-registered survey experiment of U.S. adults,¹ exploring whether bundling decarbonization with policies appealing to liberals, conservatives, or bipartisan coalitions can increase support for decarbonization while decreasing polarization of this support. The survey instrument and subsequent analysis focus on the content of the policy bundles rather than the size, cost, or partisan attachments. In fact, we remove explicit partisan cues to avoid source cues that can lead to prioritization of party over policy (Van Boven et al. 2018). For external validity, our treatment policies were based on real policies or proposals recently considered by federal or state governments (Table 1).

None of the bundles increased support compared to decarbonization presented alone and some reduced support in our sample. Some bundles reduced issue support polarization,

¹ *How does bundling climate policies with economic and social policies affect voter support?* https://aspre dictated.org/53Y_557 (2022).

which we operationalize as differences between liberals' and conservatives' support, while other bundles increased polarization. Our operationalization of polarization differs from conceptualizations that span multiple issues (Hetherington 2009; Fiorina and Pope 2011). It is issue-specific (Castle and Stepp 2021; Mason 2015) and intends to capture whether a bundled policy treatment appeals relatively more equally to segments of the electorate than when decarbonization is presented alone.

1.1 Policy bundling background and hypotheses

Whether bundling policies together is likely to increase support among various segments of the electorate or the electorate as a whole depends on what the public infers from the bundling.

1.1.1 Overall support hypothesis

The choice to bundle a policy with another policy relies on the idea that bundling can increase support. Bundling policies together could improve overall support by drawing support for the bundle from different portions of the public, engaging voters who may not have previously identified as proponents of a single policy priority (Schattschneider 1960; Beland and Cox 2016). This rationale would apply to bundling decarbonization with conservative-preferred policies or policies that appeal to moderates. Overall policy support may also increase when decarbonization policy is paired with a policy that appeals to the same liberal portion of the ideological spectrum if liberal support increases but conservative support does not decrease, as Bergquist et al. (2020) found for economically progressive policies. The overall effect of bundling on support depends on how people respond – whether they increase support for a bundle when another policy they support is included and whether they decrease support for the bundle when a policy they oppose is added. For example, pairing decarbonization with pausing EPA regulations could increase overall support if conservatives increase their support for the bundle and liberals do not decrease their existing support for decarbonization (or if liberals decrease their support by less than conservatives increase their support).

H1: Pairing decarbonization policy with an additional policy that appeals to various ideological groups (liberals, moderates, or conservatives) will increase overall support, driven by strengthened support from those groups.

1.1.2 Polarization hypothesis

We expect that polarization will change in the presence of the bundling treatments in comparison to the control group because the bundled policies offer ideological cues that appeal to some respondents more than others. In the absence of source cues, policy content itself provides voters with clues as to whether a policy aligns with their partisan identity and ideology. Thus, the very content of a policy may help voters to align their position with their partisan and ideological positions (Ciuk and Yost 2016). Since Americans hold relatively unconstrained policy positions (Converse 1964; Achen and Bartels 2016; Kinder and Kalmoe 2017), their preferences on bundled policies could be shaped by cues from policy content that appeals to their ideology (Mason 2018).

The idea of bundling decarbonization with policies that appeal to other segments of the electorate – moderates or conservatives, rather than liberals – is to increase the support from those segments. If policies that appeal to a segment of the electorate bring the support of that portion to the combined policy, they will reduce polarization of support (regardless of their effect on the existing supporters). Thus, we expect that polarization will decrease in the moderate-appealing and conservative-appealing bundled policies (infrastructure and pausing EPA regulations) because moderate and conservative support will increase relative to the control. The gap between liberal and conservative respondents will narrow. On the other hand, we expect that polarization will increase in the liberal-appealing bundle since more liberals may support the policy and there is nothing in it to additionally appeal to moderates or conservatives. The gap in support between liberal and conservative respondents will widen.

H2: Polarization will decrease (increase) in the moderate-appealing and conservative-appealing (liberal-appealing) bundled treatments because moderates and conservatives (liberals) will like the bundle more than decarbonization alone.

Of course, if increased support on one side is offset by decreased support on the opposing side, overall support may decrease or not change even as polarization decreases. For example, if liberals oppose reduced regulation more than conservatives support reduced regulation, bundling that policy with decarbonization policy could reduce overall support. Therefore, reducing polarization and increasing support do not necessarily go together, which is why it is worthwhile to investigate both.

2 Methods

2.1 Questionnaire design

To test the above hypotheses (H1 and H2), we randomly assigned a quota sample (details below) of 2,521 U.S. adults into five groups on the Qualtrics survey platform, conducted between August 26 and September 7, 2021. We sampled using quotas on gender, ethnicity, and age based on the most recent U.S. Census data, and political ideology with a 50%-50% split between liberals and conservatives, which we measured on a six-point scale (Very liberal, Liberal, Somewhat liberal, Somewhat conservative, Conservative, Very conservative).

We asked respondents to report their support for four decarbonization policies, which appeared one at a time either bundled with an additional policy or presented alone. Each appeared in the same order for all participants. We used a simple paired design, over a more complex conjoint analysis, to be consistent with public opinion organizations such as Pew Research (2021) and to maximize external validity given that the public typically considers only one of a few policy bundles at any one time.

Following the four policy support questions, participants indicated how much they perceive that each of the policies would affect their household economic well-being and how important their views on these policies are to their identities (both not analyzed here). Participants were asked about their political ideology (Very liberal; Liberal; Slightly liberal; Slightly conservative; Conservative; Very conservative). Lastly, participants were presented with demographic questions (household income, education level, voting registration status). Age, gender, and ethnicity questions appeared at the beginning of the survey as

per Qualtrics quota guidelines for representative sampling. Political questions appeared at the end of the questionnaire to avoid priming respondents (see Table S1 for full variable descriptions).

2.1.1 Control and treatment group descriptions

We modeled four representative decarbonization policies off of real policies that have received considerable attention in policy-making circles and the news media. They include consumer-level incentives for investing in renewable energy technologies; research and development subsidies for new energy technologies; an economy-wide tax on carbon; and a carbon-free electricity standard. Renewable incentives exist as part of several sub-national and federal decarbonization policies that incentivize the installation and use of renewable energy (Crew et al. 2020; Hsu and Kelly 2019). Research and development subsidies for solar, wind, energy storage, and energy efficiency projects were included in the \$900 billion bipartisan COVID-19 relief bill of December 2020 (Kaplan and Grandoni 2020). An economy-wide carbon tax was central to the Energy Innovation and Carbon Dividend Act of 2021 proposal that was reintroduced in the House of Representatives in April 2021 (H.R.2307). A carbon-free electricity standard, which would require the power sector to achieve 100 percent clean energy by 2035, was proposed as part of President Biden's American Jobs Plan (Slesinski 2021). We tested a broad range of decarbonization policies—all chosen based on real proposals to maximize external validity—including some that have not been tested in this way. Of course, there are many additional policies that could be tested in this kind of experimental setting.

The control group answered questions about their support levels for the four decarbonization policies presented alone. The four other groups answered questions about their support for each decarbonization policy (listed first) when it was bundled with one additional policy (listed second) related to pausing new EPA regulations, infrastructure, economic redistribution, and social justice. The overall design of the study is summarized in Table 1.

The four bundled policies were likewise designed for external validity, and they vary in their support levels across demographic and political constituencies (national polling data is summarized in Fig. 1). We included a policy that pauses new Environmental Protection Agency (EPA) regulations, which could garner support from conservative respondents who disproportionately disapprove of a strict regulatory posture on environmental issues (Kennedy 2016). To represent a moderate-appealing policy, we included upgrading infrastructure like road, bridges, and rail systems, which are a frequent focus of bipartisan bills, such as the Infrastructure Investment and Jobs Act of 2022 (H.R.3684).

We also tested bundling with two liberal-appealing policy treatments – economic redistribution and social justice. Recent studies suggest that support for social justice policies may be concentrated among the most liberal respondents, while support for economic redistribution may be broader (English and Kalla 2021; Marshall and Burgess 2022). Multiple policies were tested within these treatments to examine the robustness of the policy bundles to variations and to reduce the likelihood that any findings were specifically tied to one operationalization. We randomized participants in the economic redistribution group to see one of four policies commonly discussed in the context of the Green New Deal (see Table 1) paired with each decarbonization policy. In the social justice treatment, we randomized participants to see one of the three social justice policies combined with all four decarbonization policies. Policy support levels are averaged for all main analyses, yielding four treatment groups and one control group for this analysis.

Table 1 Control and treatment group descriptions

| Treatment | Description | Similar Real-World Example(s) |
|---|---|--|
| Control: Decarbonization policies | <p>Policy 1: Economy-wide tax on carbon with revenue going back to taxpayers in the form of monthly checks</p> <p>Policy 2: Funding for research and development of new energy technologies, technologies that remove carbon from the atmosphere, and other innovations through federal government agencies like the Department of Energy</p> <p>Policy 3: A personal or property tax incentive for households and businesses that invest in renewable energy systems or energy efficiency technologies</p> <p>Policy 4: A national 80 percent carbon-free electricity requirement by 2030</p> | <p>Energy Innovation and Carbon Dividend Act (H.R.2307, 2021)</p> <p>\$900 billion bipartisan COVID-19 relief bill of December 2020 (H.R. 133)</p> <p>Self-generation incentive program (CA AB 1144, 2019)</p> <p>President Biden's American Jobs Plan (2021)</p> |
| Decarbonization policies+ Social Justice | <p><i>Respondents see the four decarbonization policies paired with one of the following policies:</i></p> <ul style="list-style-type: none"> - Creating a justice and equity commission to monitor effects of policies on marginalized communities and making recommendations to remedy those (implicit) - Creating a commission to monitor effects of policies on women and racial minorities and making recommendations to remedy those (race- and gender-explicit, with non-specific intended effects), - Awarding at least a quarter of new infrastructure contracts to women and/or racial-minority-owned businesses (race- and gender-explicit, with specific intended effects) | <p>Virginia's H.B.1042 (2020) and Illinois' S.B. 2920 (2016) created environmental justice commissions. Section 1005 and the Restaurant Revitalization Fund of the American Rescue Plan Act (H.R.1319, 2021) prioritized women- and/or minority-owned businesses for benefits. The Justice40 initiative requires 'disadvantaged communities' to receive 40% of the benefits of certain investments</p> |
| Decarbonization policies+ Economic Redistribution | <p><i>Respondents see each of the four decarbonization policies paired with one of these randomly selected policies (each respondent may see any of the following paired with each decarbonization policy):</i></p> <ul style="list-style-type: none"> - A tax increase for households making over \$400,000 - A monthly cash payment program to citizens - A national health insurance public option - Reducing obstacles to unionized labor and creating good-paying, unionized clean energy jobs | <p>Discussed in context of the Green New Deal (H.Res.109, 2019)</p> |
| Decarbonization policies+ Infrastructure | Upgrade America's roads, bridges, and rail systems | Bipartisan Infrastructure Investment and Jobs Act (H.R. 3684, 2021) |
| Decarbonization policies+ Pausing Regulation | Pausing new EPA regulations | Energy Innovation and Carbon Dividend Act (H.R. 763, 2019) |

To validate the appeal of the policies across the ideological spectrum, Fig. 1 summarizes results of major national polls for policies similar to those in our treatments. See Supplementary Information (SI) Table S2 for details on the policies used for comparison and how closely they match the policies used in the study. The decarbonization, economic redistribution, and social justice policies are disproportionately supported by liberals, with decarbonization being the most popular of these. Reducing environmental regulation is disproportionately supported by conservatives and unpopular overall compared to the others. Infrastructure is largely non-partisan and relatively popular.



Fig. 1 Polling data regarding U.S. voters' support for decarbonization policies (gray lines on each panel) and other policies considered in this study. The x-axis shows political ideology from Liberal/Democrat to Moderate/Independent to Conservative/Republican. Polling data from the sources in Table S2 are averaged for Liberal/Democrats, Moderate/Independents, and Conservative/Republicans for each of the categories. Panel **A** includes polling data from Citizens for Responsible Energy Solutions (CRES) February 2022 and Pew Research Center January 2022. Panel **B** includes polling data from CRES February 2022, Pew Research Center September 2019, and July 2020. Panel **C** includes polling data from CRES February 2022, YouGovAmerica January 2018, and AP-NORC July 2021. Panel **D** includes polling data from CRES February 2022, Pew Research Center December 2016, and February 2019

2.1.2 Dependent variables

All respondents indicated their policy preferences using the following four classifications that were converted to a one-point scale and specified as the dependent variable in the analysis: strongly oppose (0), slightly oppose (0.333), slightly support (0.667), and strongly support (1). The following question was used to gather respondents' support levels.

To what extent would you support the following policies?

(Strongly oppose; 0, slightly oppose; 0.3333, slightly support; 0.6667, strongly support; 1)

The policy support levels for each of the decarbonization policies were averaged in the main analyses. Additional statistical models specify the support levels for the decarbonization policies separately and find similar results.

2.1.3 Independent variables

The independent variables include the treatment groups (decarbonization alone, decarbonization with social justice, decarbonization with economic redistribution, decarbonization with infrastructure, and decarbonization with pausing EPA regulations), political ideology, and demographic controls (ethnicity, gender, age, and household income). See Table S1 for additional information about each variable.

2.2 Statistical approach

First, balance checks were performed on the main respondent demographic and political identity variables. There was no evidence of substantive or statistically significant differences across treatment and control groups with respect to their covariate profiles (Table S3). Second, we used a series of Ordinary Least Squares (OLS) models to compare the policy support levels of the treatment groups to the control group. OLS is appropriate to model the average within-person support across policy items, as this variable can take a large number of possible values given that each participant rates four policies on a four-point scale. For the sake of consistency and because the interpretation is much easier, we also report the linear probability models (OLS) for the individual levels of policy support. Results are robust to the use of ordinal logit for the separate decarbonization policy models (Table S9).

To test the overall support hypothesis (H1), we regressed the average decarbonization policy support across the four decarbonization policies onto the treatment variable, controlling for political ideology, gender, age, ethnicity, and income (Table 2; Main specification).

To test the polarization hypothesis (H2), we used two-sample t-tests to compare mean liberal and conservative respondent support levels by treatment group (very liberal, liberal groups combined; very conservative and conservative groups combined). An OLS estimation with an interaction term for political ideology was used to compare the differences between liberal and conservative respondent support among treatment groups to the difference between liberal and conservative respondent support in the control group. That is, we analyzed and visualized respondent policy support by political ideology in this OLS

specification (Table S4; Fig. 2). We used the average support across the four policies as the dependent variable for analyses underlying Fig. 2.

3 Results

In our sample, none of the policy bundles significantly increased support relative to decarbonization alone, either overall or among various segments of the electorate. Instead, two of the bundles (pausing regulation and social justice) reduced support and several bundles increased polarization of support between the ends of the political spectrum. Where there was a reduction in polarization of support for the bundled policy, it was driven by a reduction in support from one end of the spectrum rather than by garnering support from some respondents. We report average treatment effects (ATE) and treatment effects (TE) as averages of support across the four decarbonization policies for the main OLS specification. Four additional specifications show the treatment effects associated with support for each of the decarbonization policies separately. Coefficients on demographic controls including age, income, ethnicity, and gender are generally consistent with findings in previous studies on climate change attitudes (Ballew et al. 2019; YPCCC and Mason 4C 2022), with some minor nuances pertaining to age and ethnicity (Table S5). These nuances may be more specific to the policies tested in this study than general climate-related attitudes.

3.1 Overall Support

In no case did bundling increase overall support in our sample; bundling either reduced overall support or had no effect. Table 2 presents the results of five OLS models that show how policy support (dependent variable) changes with the addition of each bundled policy compared to the control group independent of political ideology. The dependent variables in the first four models separate policy support for each decarbonization policy. The fifth model (main OLS specification, bolded) specifies the averaged support levels for the four decarbonization policies as the dependent variable, which illustrates a robust concept of decarbonization by capturing multiple commonly considered policy instruments. Treatment effects are reported for the main specification.

Bundling the decarbonization policies with policies appealing to moderate and conservative respondents resulted either in no change or a decrease in overall support, opposite to the predictions of H1. Bundling a moderate policy (infrastructure) with decarbonization policies resulted in no significant change in support (Table 2; Change in Average Policy Support (ATE) = -0.01, *standard error* (*s.e.*) = 0.02) and bundling a policy with an incongruent ideological cue (pausing EPA regulation, a conservative policy) resulted in a significant decrease in overall support in our sample (Table 2; ATE = -0.08, *s.e.* = 0.02).

Bundling liberal policies (economic redistribution and social justice indicators) with the decarbonization policies also resulted in decreases in overall support or no change. There was no significant increase in overall support for decarbonization policies when bundled with economic redistribution policies (Table 2; ATE = 0.00, *s.e.* = 0.02). There was a significant decrease in overall support for decarbonization policies when bundled with policies with a social justice focus (Table 2; ATE = -0.05, *s.e.* = 0.02), which represents a substantial decline in support on the one-point scale. The bundling strategies have substantive and statistically similar treatment effects on policy support for all four decarbonization policies.

Table 2 Respondent policy support by treatment group controlling for political ideology, gender, ethnicity, age, and income. The control group that evaluated decarbonization policies alone and very liberal-identifying respondents are the reference categories. The first four models treat support for each decarbonization policy as separate dependent variables, and the fifth model (main specification) treats average support across the four decarbonization policies as the dependent variable. Estimates are listed first followed by robust standard errors

| | Carbon Tax Support | R + D Funding Support | Renewable Incentive Support | CES Support | Average Policy Support (Main Specification) |
|---|--------------------|-----------------------|-----------------------------|--------------------|---|
| (Intercept) | 0.66*** (0.03) | 0.74*** (0.03) | 0.74*** (0.03) | 0.82*** (0.03) | 0.74*** (0.03) |
| Decarb. + Econ Redistribution | 0.02 (0.02) | 0.00 (0.02) | -0.02 (0.02) | 0.01 (0.02) | 0.00 (0.02) |
| Decarb. + Infrastructure | 0.01 (0.02) | -0.02 (0.02) | -0.03 (0.02) | -0.02 (0.02) | -0.01 (0.02) |
| Decarb. + Pausing Regulation | -0.07*** (0.02) | -0.06*** (0.02) | -0.08*** (0.02) | -0.08*** (0.02) | -0.08*** (0.02) |
| Decarb. + Social Justice | -0.04* (0.02) | -0.05** (0.02) | -0.06*** (0.02) | -0.04* (0.02) | -0.05** (0.02) |
| Political Ideology: Liberal | -0.03 (0.03) | -0.04 (0.02) | -0.03 (0.03) | -0.05* (0.03) | -0.04 (0.02) |
| Political Ideology: Somewhat liberal | -0.05* (0.03) | -0.04 (0.02) | -0.06*** (0.02) | -0.09*** (0.02) | -0.06** (0.02) |
| Political Ideology: Somewhat conservative | -0.14*** (0.03) | -0.14*** (0.02) | -0.10*** (0.02) | -0.19*** (0.02) | -0.14*** (0.02) |
| Political Ideology: Conservative | -0.22*** (0.03) | -0.24*** (0.03) | -0.19*** (0.03) | -0.32*** (0.03) | -0.24*** (0.02) |
| Political Ideology: Very conservative | -0.28*** (0.04) | -0.37*** (0.03) | -0.28*** (0.03) | -0.39*** (0.03) | -0.33*** (0.03) |
| Male (compared to Female) | -0.04** (0.01) | -0.03* (0.01) | -0.03*** (0.01) | -0.03* (0.01) | -0.03** (0.01) |
| White (compared to Non-White) | 0.00 (0.00) | 0.02 (0.02) | -0.00 (0.00) | -0.03 (0.03) | -0.00 (0.03) |

Table 2 (continued)

| | Carbon Tax Support | R + D Funding Support | Renewable Incentive Support | CES Support | Average Policy Support (Main Specification) |
|---|--------------------|-----------------------|-----------------------------|------------------|---|
| <i>Age: Compared to 18–29</i> | | | | | |
| 30–49 | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) |
| | 0.10*** (0.02) | 0.07*** (0.02) | 0.08*** (0.02) | 0.01 (0.02) | 0.06*** (0.01) |
| 50–69 | 0.05* (0.02) | 0.05* (0.02) | 0.04* (0.02) | -0.04* (0.02) | 0.02 (0.01) |
| > 70 | 0.02 (0.03) | 0.06* (0.02) | 0.01 (0.02) | -0.05 (0.03) | 0.01 (0.02) |
| <i>Income: Compared to Less than \$19,000</i> | | | | | |
| Between \$20,000 and \$49,000 | -0.00 (0.02) | 0.01 (0.02) | -0.01 (0.02) | 0.01 (0.02) | 0.00 (0.02) |
| Between \$50,000 and \$79,000 | -0.03 (0.02) | -0.00 (0.02) | -0.03 (0.02) | -0.00 (0.02) | -0.02 (0.02) |
| Between \$80,000 and \$99,000 | -0.07** (0.03) | 0.01 (0.02) | -0.03 (0.02) | -0.02 (0.03) | -0.03 (0.02) |
| Over \$100,000 | -0.07** (0.02) | -0.04 (0.02) | -0.02 (0.02) | -0.04 (0.02) | -0.04* (0.02) |
| R ² | 0.11 | 0.13 | 0.08 | 0.16 | 0.17 |
| Adj. R ² | 0.10 | 0.13 | 0.08 | 0.16 | 0.16 |
| Num. obs | 2412 | 2412 | 2412 | 2412 | 2412 |

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

Consistent with the polling data, conservative respondents were less supportive of decarbonization policy than liberal respondents. In comparison to very liberal respondents, somewhat conservative (Table 2; Change relative to very liberal respondents (Δ) = -0.14, *s.e.* = 0.02), conservative (Table 2; Δ = -0.24, *s.e.* = 0.02), and very conservative (Table 2; Δ = -0.33, *s.e.* = 0.03) respondents supported decarbonization policies significantly less. The clean electricity standard garnered the highest baseline support level (0.82, *s.e.* = 0.03) while the carbon tax garnered the lowest baseline support level (0.66, *s.e.* = 0.03).

3.2 Polarization

We considered differences in policy support according to respondents' political ideology in each treatment group by regressing policy support on the treatment groups with an interaction term for respondents' political ideology (see Table S4 for the results of this OLS estimation). Figure 2 shows respondents' average support for decarbonization

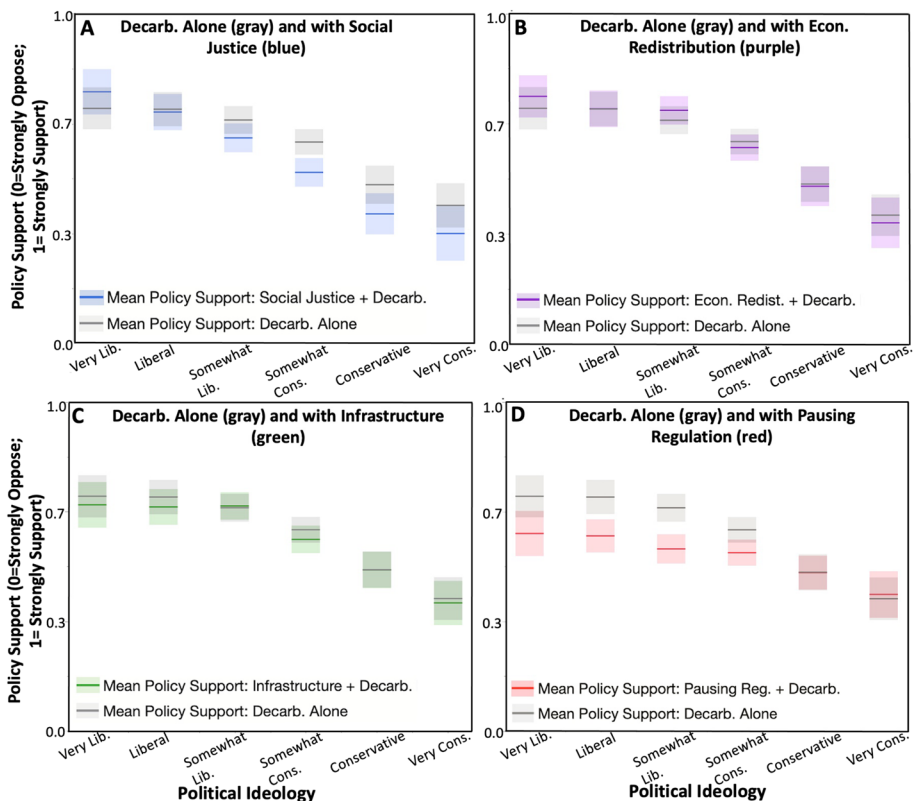


Fig. 2 Respondent policy support for decarbonization policies presented alone and in bundles with additional policies which vary in their support across political ideology (liberal to conservative). Support levels are shown on a scale with four levels ranging from 0 (Strongly oppose), 0.333 (Slightly oppose), 0.667 (Slightly support), and 1 (Strongly support). Bolded lines signify the mean support levels for each political ideology group. The shaded regions represent 95% confidence intervals. Panel A shows support for social justice policy. Panel B shows support for economic redistribution policy. Panel C shows support for infrastructure policy. Panel D shows support for pausing EPA regulation

policies presented alone (shaded in gray) and bundled with social justice (Fig. 2a), economic redistribution (Fig. 2b), infrastructure (Fig. 2c), and pausing EPA regulations (Fig. 2d). They show the patterns of policy support for self-identified very liberal to very conservative respondents for each treatment group. The y-axes show policy support from strongly oppose to strongly support. An OLS model specifying an interaction between bundling treatment and political ideology underlies Fig. 2 (Table S4).

Partially consistent with H2, polarization decreased in the conservative-appealing bundle. However, it was driven by a loss in liberal respondents' support without significant gains in conservative respondents' support. Support for the pausing EPA regulation bundle was significantly lower than support for decarbonization policy alone among liberal respondents (Table S4: Treatment Effect (TE) for very liberal respondents -0.11 , $p=0.06$; TE for liberals -0.12 , $p=0.001$; TE for somewhat liberal respondents -0.12 , $p=1.2 \times 10^{-5}$) and it was not higher among conservative respondents (TE for very conservative respondents 0.03 , $p=0.66$; TE for conservatives -0.0004 , $p=0.94$; TE for somewhat conservative respondents -0.07 , $p=0.004$).

On the other end of the ideological spectrum, polarization increased as expected in one of the liberal-appealing bundles; however, it was driven by a loss in conservative respondents' support without significant gain in liberal respondents' support. Support for the social justice bundle was significantly lower than support for decarbonization policy alone among conservative respondents (TE for conservatives -0.09 , $p=0.05$; TE for somewhat conservative respondents -0.09 , $p=0.001$) and support was not higher among liberal respondents compared to the decarbonization policies presented alone (TE for very liberal respondents 0.05 , $p=0.36$; TE for liberals -0.01 , $p=0.72$; TE for somewhat liberal respondents is -0.05 , $p=0.06$). As predicted by H2, polarization increased when decarbonization policy was bundled with liberal-appealing policy.

Lastly, in contrast to the predictions in H2, the economic redistribution (liberal-supported) and infrastructure (moderate-supported) bundles did not significantly change polarization because they did not increase or decrease liberal or conservative respondents' support. Liberal respondents who saw the economic redistribution bundle did not have significantly different support levels than those who saw the decarbonization policies in isolation (TE for very liberal respondents 0.04 , $p=0.52$; TE for liberals -0.0003 , $p=0.93$; TE for somewhat liberal respondents 0.03 , $p=0.26$). Nor did conservative respondents have different levels of support for the economic redistribution bundle compared to the decarbonization policies presented alone (TE for very conservatives -0.02 , $p=0.72$; TE for conservatives -0.01 , $p=0.88$; TE for somewhat conservative respondents -0.01 , $p=0.48$). Likewise, liberal respondents did not have different levels of support for the infrastructure bundle than decarbonization alone (TE for very liberal respondents -0.03 , $p=0.66$; TE for liberals -0.04 , $p=0.37$; TE for somewhat liberal respondents 0.01 , $p=0.81$) nor did conservative respondents (TE for very conservative respondents -0.01 , $p=0.97$; TE for conservatives 0.005 , $p=0.91$; TE for somewhat conservative respondents -0.03 , $p=0.25$).

Table 3 illustrates the differences in support levels between liberal and conservative respondents in the different treatment conditions. Very liberal and liberal respondents were grouped, and very conservative and conservative respondents were grouped. We used two-sample, two-tailed *t*-tests to calculate the differences and assess whether issue support polarization – the difference between their average support levels as defined for the purposes of this study – increased or decreased in each bundling strategy. The difference in support between liberal and conservative respondents in the control group is 0.27 on a one-point scale (Table 3; row 1, column 5). This difference increased with policy bundles designed to appeal to liberals, to 0.35 in the social justice treatment group and to 0.29 in the economic redistribution group. For policy treatments that appeal to moderates

Table 3 Mean policy support among liberal and conservative respondents. Two-sample *t*-tests show the differences between the mean support levels for the control and treatment groups. The top row shows the control group, which saw decarbonization policies in isolation

| Treatment group | Liberal respondent mean policy support | Cons. respondent mean policy support | <i>p</i> -value <i>t</i> -value | Difference between liberal and conservative respondents |
|--------------------------------|--|--------------------------------------|---|---|
| Decarb. Alone (Control) | 0.71 <i>n</i> = 125 | 0.44 <i>n</i> = 130 | <i>p</i> = 2.5e-14 <i>t</i> = -8.09 df = 252.15 | 0.27 |
| Decarb. + Social Justice | 0.725 <i>n</i> = 134 | 0.37 <i>n</i> = 99 | <i>p</i> = 2.2e-16 <i>t</i> = -9.78 df = 178.01 | 0.35 |
| Decarb. + Econ. Redistribution | 0.73 <i>n</i> = 132 | 0.44 <i>n</i> = 105 | <i>p</i> = 2.8e-14 <i>t</i> = -8.18 df = 26.16 | 0.29 |
| Decarb. + Infrastructure | 0.68 <i>n</i> = 123 | 0.45 <i>n</i> = 123 | <i>p</i> = 4.3e-11 <i>t</i> = -6.91 df = 243.54 | 0.23 |
| Decarb. + Pausing Reg | 0.59 <i>n</i> = 131 | 0.46 <i>n</i> = 125 | <i>p</i> = 3.3e-05 <i>t</i> = -4.23 df = 249.56 | 0.13 |

and conservatives, polarization slightly decreased in the infrastructure group to 0.23 and decreased to 0.14 in the pausing regulation group.

Using an OLS specification that includes an interaction between bundling treatment and political ideology (Table S4), we calculated the difference between the differences in Table 3. Only the pausing regulation treatment difference was significantly lower than the treatment group difference (Table 4; 0.13(0.05), *p* = 0.004). The social justice treatment difference approaches statistical significance (Table 4; -0.08(0.05),

Table 4 Difference between the differences in liberal-conservative policy support by treatment. Coefficients, standard errors, and significance levels drawn from Table S4, which shows the OLS estimation where political ideology and bundling treatment variables are interacted and regressed on the dependent variable (policy support). The difference between the differences expressed in Table 2, column 5 are presented starting with coefficients, followed by standard errors in parentheses and *p*-values

| Treatment group | Treatment group differences between liberal and conservative respondents compared to control group difference (0.27) |
|--------------------------------|--|
| Decarb. + Social Justice | -0.08 (0.05) <i>p</i> = 0.08 |
| Decarb. + Econ. Redistribution | -0.02 (0.05) <i>p</i> = 0.64 |
| Decarb. + Infrastructure | 0.03 (0.05) <i>p</i> = 0.46 |
| Decarb. + Pausing Reg | 0.13 (0.05)** <i>p</i> = 0.004 |

****p* < 0.001; ***p* < 0.01; **p* < 0.05

$p = 0.08$) and the other differences show a directional relationship but were not statistically significant.

3.3 Robustness Checks

We estimated a robustness check with party identification instead of political ideology, weighted according to 2020 American National Election Study (ANES) party identification (ANES 2021). Democrats were slightly overrepresented, while Republicans and Independents were slightly underrepresented in our sample. The five models in Table S6 show policy support for each of the four decarbonization policies (models 1–4) and support for those policies averaged (model 5) as a function of bundling treatment and party affiliation. Party affiliation and political ideology are correlated (correlation coefficient = 0.54) and the results are consistent across the weighted party affiliation and political ideology (used in main analysis) measures.

We specified the same models using the political ideology predictor from the main analysis grouped into three bins. Very liberal and Liberal respondents were assigned ‘Liberal,’ Very conservative and Conservative respondents were assigned ‘Conservative,’ and Somewhat liberal and Somewhat conservatives were assigned ‘Moderate’ (Table S7). This specification shows that there are negligible differences in magnitudes of bundling treatment coefficients with no changes in direction or statistical significance in comparison to the main specification in Table 2.

The results were similar when restricting the sample to registered voters (Table S8 column 1). Patterns of support among respondents who are registered to vote may better represent the electoral situation faced by legislators. An additional linear probability model was performed with policy support coded as a binary support/oppose variable to estimate a relationship that better represents the decision a respondent might have to make (e.g., for a ballot initiative; Gomila 2021) (see Table S8 column 2), which returns similar results as the main specification in Table 2. The negative coefficients associated with social justice and pausing regulations bundles were slightly larger in both models compared to the coefficients in the main specification (Table S8). Lastly, given that the structure of the dependent variable includes four levels (strongly oppose, slightly oppose, slightly support, and strongly support), we fit ordinal logistic regressions which specify support for the four individual decarbonization policies as the dependent variables and control for political ideology and demographic variables. Again, we find that the results are substantively similar (Table S9).

4 Discussion

4.1 Key takeaways

Our randomized survey experiment on a quota of 2,521 U.S. adults examined the effects of bundling additional policies on support for decarbonization policies, both overall and by ideological groups. We tested the hypothesis that bundling decarbonization policies with other policies would lead to increased overall support from a broader coalition of voters than the original decarbonization policy proposed alone. Instead, we found that bundling either has no impact or decreases overall policy support across the four treatments.

The relationship between polarization and support also did not play out as some advocates of policy frameworks often predict. The difference between very liberal and very conservative respondents decreased in the pausing EPA regulations treatment and increased in the social justice treatment. In both cases, the change in polarization was driven by the loss of some segments of respondents without significant gains from the respondents on the opposite end of the political spectrum. Crucially, decreased polarization did *not* lead to increased overall support. Since bundling is one way for policymakers to expand the scope of political conflict to include new segments of the public in a supportive coalition (Kinder and Kalmoe 2017), we also might expect some individuals who originally supported the policy to lessen their support as a result of this expansion.

4.2 Additional explanations

The psychological effects of negativity bias may explain why decreased polarization did not increase support in our sample. Psychology research suggests that individuals weigh negative attributes, or losses, more heavily in their evaluations of information (Baumeister et al. 2001). Relatedly, loss aversion within prospect theory posits that individuals expect pain of losses to outweigh pleasure of equivalent gains (Kahneman and Tversky 1979). Negativity bias could lead to lower support if those who supported the policy alone reduce their support because of their aversion to the additional policy. Bundles made up of policies that are supported by individuals from opposite ends of the ideological spectrum may trigger negativity bias, particularly because partisanship is important to individuals' social identities (West and Iyengar 2022). At the least, our respondents do not appear to simply look within a bundle for a policy they might support without consideration of its other elements.

Additionally, there are potential interacting mechanisms that may shape opinion, including strength of the partisan signal in a treatment and policy complexity (Van Boven et al. 2018; Fesenfeld 2022). Our results suggest that individuals may decrease their support for policies that appeal to the other end of the ideological spectrum even without the presence of explicit partisan cues or other potential factors such as cost. Additional studies should use similar treatments and incorporate these variables to better control for how respondents react to their presence in policy design.

4.3 Directions for future work

Our results raise interesting questions about legislators' rationales for policy bundling. Combined with evidence that legislators reject compromise when they fear voter retribution and that those voters who punish compromise are subsets of the primary electorate (Anderson et al. 2020), these results would suggest that legislators might want to avoid bundling. Yet, they seem to regularly combine policies together. Many policies pass via omnibus legislation or bundled legislation despite this evidence that bundling risks reducing support. A primary goal of bundling policies together may be to gain votes from specific legislators via logrolling rather than gaining public support (Evans 2004; Buchanan and Tullock 1965). For example, the recent Inflation Reduction Act of 2022 included historic investments in clean energy measures along with provisions for oil and gas producers and investments in the U.S. transmission system. These additional provisions were included to gain support from moderate Democrats like Senator Joe Manchin (Bittle 2022). Thus, why legislators decide to bundle policies together and how the public opinion elements of bundling play out in the representational relationship are ripe areas for research on the dynamics of policy bundling.

This paper delves deeply into how the ideological appeal of bundled policies shapes overall opinion and issue support polarization. A previous study found that bundling climate policies with policies similar to those in our economic redistribution treatment significantly increased support by increasing support among liberal respondents without decreasing support among conservative respondents (Bergquist et al. 2020). We also found that bundling with economic redistribution increased liberal support and decreased conservative support by a smaller amount (Fig. 2B), but neither effect was significant in our study. The effects of this type of bundle on support therefore merit further study.

Future empirical studies could investigate these features and their mechanisms more fully. First, further research could examine the symmetry of our findings by starting out with an originally conservative-appealing policy. While we aim to test a broad range of policies with various goals and appeal across the ideological spectrum bundled with decarbonization policy, there are more that could be tested to better understand the mechanism of policy bundling beyond decarbonization policy research. Additionally, we tested these specific decarbonization policies because they loom large in policy discussions, though there are additional types of climate-related policies that could be tested in similar future experiments (e.g., carbon sequestration via reforestation). Therefore, future research could examine more hypothetical policies and investigate whether there are possible policies that might have more positive effects on overall support. We also did not measure attitudes toward bundled policies independent of decarbonization policies, which precludes the examination of how the two portions are integrated. Future experiments could measure these attitudes to see how they compare to public opinion polling data on the bundled policy issues.

Lastly, future research should explore the heterogeneity of policy bundling dynamics at the subnational level. Recent literature explores the differences between states in decarbonization policy successes and failures (Marshall and Burgess 2022; Hess et al. 2016). Bills in these analyses include multiple provisions – some climate-related and others social-justice or economically targeted. Understanding differences in policy bundling success at the state level can help policy makers better tailor bundling efforts for specific political situations and build on existing research.

5 Conclusion

When addressing climate change and other pressing societal issues in politically feasible and lasting ways, it is important to understand how proposing multiple policies at the same time could contribute to or detract from broad public support coalitions. Bundling may risk decreasing overall policy support *even when the additional policy reduces polarization*. These results highlight that an overly optimistic approach to bundling might backfire, losing support from some subsets of the electorate without increasing it among the target populations. The current findings suggest that bundling decarbonization policies with other policies (liberal, conservative, or moderate) has no effect or reduces support. They also suggest that reduced polarization does not necessarily translate to increased overall support. When bundling policies together that appeal to different portions of the ideological spectrum reduces what we call issue support polarization, it does so at the cost of reduced support among those who supported the original decarbonization policy, rather than by increasing the support from others. We caution that our findings are not a prescription to avoid bundling various policies together. Rather, they empirically highlight some of the risks associated with policy bundling and indicate that there is much more to understand about this strategy.

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Author contributions R. M., L.A-S., and M.G.B. designed the survey. R.M. and M.G.B. performed the survey. R.M., S.E.A., L.V.B., and M.G.B. designed the analysis. R.M. analyzed the data. R.M., S.E.A., L.V.B., L.A-S., and M.G.B. wrote the paper.

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Data availability Raw data is subject to controlled access. Participants in this study consented to their data being stored securely with the research team and did not consent to their data being shared. Code for data analysis is available on request.

Declarations

Ethics approval CU Boulder Institutional Review Board (IRB) deemed this study 'exempt,' from review. Reference number is 21–0309.

Consent to participate The questionnaire and associated informed consent form are available in the supplementary information file.

Competing interests The authors declare no competing interests.

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