Public support for natural gas bans in the United States

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Abstract

Policies to reduce greenhouse gas emissions in the US have largely treated natural gas as a clean fuel due to its lower dioxide-to-energy content than other fuels. However, recent local decarbonization initiatives seek to ban residential uses of natural gas. Public support for such policies will determine whether other localities adopt natural gas bans and whether state and federal policies may follow. At the same time, several states adopted policies prohibiting natural gas bans. In this study, we show that public support for gas bans depends on policy design. Our survey experiment shows that health effects of proposed policies are associated with public support, whereas monthly energy costs, industry support, and information about climate effects and political support for the proposed policy do not influence public opinion.

Full Text

The United States remains one of the most significant greenhouse gas polluters globally, in terms of aggregate carbon dioxide emissions on a per capita basis[1]. At the same time, the country has become less dependent on coal for its energy needs, as natural gas replaced coal to a significant extent. In the 1970s, natural gas began to emerge as a critical source of cleaner energy: its resource base was extensive, the environmental advantages were well acknowledged, and the gas-using products and technologies turned out to be markedly efficient[2]. In 2015, natural gas accounted for 32 percent of total electricity production, up from 9 percent in the late 1980s, whereas the share of coal in electricity production declined from 58 to 34 percent during the same period[3-4]. Natural gas acquired a reputation as a clean fuel due to its lower carbon dioxide-to-energy content compared to coal[5] and became an acceptable replacement for more-polluting coal and liquid fuels in the energy system. As a result, many economic sectors, including electric generation, transportation, and commercial cooling, switched to natural gas to a significant degree.

Despite this perception, gas combustion generates greenhouse gases and contributes to climate change. Scholars, policymakers, and environmental activists criticize natural gas for its environmental risks from the global climate perspective[6-10]. In particular, recent studies point to problems of flaring, venting, and methane leaks along the natural gas supply chain[11]. These problems have led to the conclusion that no sustainable energy mix can include fossil fuels, thereby questioning continued natural gas use. In addition, natural gas tends to exacerbate public health problems as gas development often contaminates air and water, increases industrial noise and traffic, and leads to residential community changes[12]. Finally, the role of natural gas as a transition fuel has come under criticism after 196 countries adopted the Paris Agreement in 2015 in an effort to limit greenhouse gas emissions as soon as possible. The agreement necessitates the gas industry to provide a reliable and long-term decarbonization strategy (e.g., through the production and use of biomethane and low-carbon hydrogen).

One of the recent strategies to address climate change seeks to reduce dependence on natural gas in the residential sector. In 2019, Berkeley, CA, became the first municipality to ban natural gas hookups in new

construction[13]. Now, over 40 local energy ordinances in California either ban or discourage natural gas connections in new buildings[14]. Other areas in the US, including Denver, CO, Brookline, MA, and New York, NY, are turning to similar measures to eliminate natural gas use in new homes and buildings, thereby reducing greenhouse gas emissions. At the same time, these efforts to ban natural gas in new construction have caused a backlash from the gas industry and gas-dependent utilities. Since 2019, 19 US states, i.e., Alabama, Arizona, Arkansas, Florida, Georgia, Indiana, Iowa, Kansas, Kentucky, Louisiana, Mississippi, Missouri, Ohio, Oklahoma, Tennessee, Texas, Utah, West Virginia, and Wyoming, have passed state-level restrictions that prohibit local governments from banning or placing limits on natural gas. While other states seem to be taking a middle path, it is clear that the future of natural gas remains a contested political issue.

Adoption of measures restricting natural gas in the residential sector depends on public support. Previous research suggests that public support is critical for implementing renewable energy and climate change policies[15-20]. However, no studies currently investigate factors that influence public opinion on natural gas bans. We aim to close this research gap and seek to understand whether and under what conditions the public may support or oppose natural gas bans. Our study contributes to the formulation of clean and efficient energy policies by focusing on individuals' preferences over the design and framing of gas bans, which can directly impact households and provide measurable benefits for individuals. The 2021 Morning Consult survey underscores the importance of taking public opinion into account when developing policies to ban natural gas in new construction. While 44% of adults would support such a ban and 37% would not, a significant share – 20% of respondents – do not have an opinion on this policy. The survey shows minimal regional variation in the share of respondents without an opinion: from 21% in the Northeast and Midwest to 20% in the South and 17% in the West, despite regional differences in adopted and proposed policies to ban natural gas or prohibit such bans. These statistics suggest that there is significant room for expanding the support base for this policy; therefore, policy design should take into account factors that are associated with greater support.

We conduct a survey experiment to identify factors that explain public support for natural gas bans. A growing number of municipalities in different parts of the US have adopted measures to ban natural gas hookups in newly constructed buildings. These ordinances require or encourage all-electric construction, which means that new homes will have only electric appliances. Our survey experiment aims to evaluate which factors affect participants' support for this energy policy. We draw on previous findings in the area of environmental and energy policymaking and public opinion. Specifically, existing studies show that economic considerations, including energy costs, affect individual-level support for various energy policies[21-22]. Public health benefits also appear to determine public support for renewable energy policies[23]. Together, these insights inform our study in identifying political, economic, and public health motivations that can explain individual responses to a proposed policy banning natural gas in new residential construction.

Effect Of Information About The Expected Effects Of Natural Gas Ban Policy

To identify which types of information or attributes of the natural gan ban policy affect public support, we conducted an online survey experiment. Following the existing studies on public support for renewable policies[23], we utilized a single conjoint experiment design, in which we provided respondents with randomized sets of information about the effects of a proposed natural gas ban policy. The conjoint design allows researchers to identify nonparametrically and estimate causal effects of various types of treatment information on respondents' multidimensional preferences simultaneously and, hence, mitigate social desirability biases that often mask respondents' true preferences[24–25]. Also, in the conjoint design, treatment effects of each attribute value are estimated relative to the reference category. In our experiment, those respondents who were not exposed to any information about a given treatment attribute serve as the reference category (i.e., control group).

To describe the effects of a natural gas ban policy for our respondents, we include (1) costs of the policy for consumers; (2) interest groups' opinions regarding the policy; (3) the policy's effects on health; (4) the policy's effects on climate change; and (5) political support for policy adoption. After presenting a randomly chosen set of policy effects, we asked how strongly the respondent supports or opposes the policy using a 5-point scale (strongly support, moderately support, neither support nor oppose, moderately oppose and strongly oppose). We fielded our survey using the Quatrics online platform and recruited a total of 2,623 US respondents through Dynata in September 2021. To evaluate the causal effect of each treatment component on support for policy, we estimate linear regression models where the dependent variable is the policy support level (on a 5-point scale) and binary indicators of each treatment component serve as regressors (see Methods section for details).

Findings

In this section, we report the results of a survey experiment that examines the effects of various treatments on public support for the natural gas ban policy. We summarize our results in Figs. 1 and 2. Our survey experiment uses a national sample of 2,623 respondents to investigate which of the five included factors, i.e., monthly costs, industry position, health effects, climate change, and political support, explain individual-level preferences for a policy eliminating natural gas from new residential construction.

Figure 1 presents the main findings from the survey experiment. Among the five dimensions of policy design and framing, health concerns are the only significant determinant that explains public support for the natural gas ban policy. Respondents exposed to the information about adverse effects of air pollution on their and their children's health are significantly more likely to support the natural gas ban policy, than those who were not exposed to such information. This implies that citizens are most sensitive to non-economic health frames when evaluating the policy restricting natural gas use.

Next, we find only suggestive evidence that consumer costs matter in explaining public support for the natural gas ban policy. Respondents tend to oppose the gas ban when the policy increases their energy expenditures, which is consistent with existing studies on public support for renewable or environmental policies[23,26], but these treatments failed to reach the conventional threshold of statistical significance. We also conclude that the information describing the policy stance of energy companies, i.e., natural gas industry opposition or renewable energy industry support, does not affect public preferences toward the natural gas ban policy. This implies that economic frames such as consumer costs and industry support are not as important as we would expect, compared with non-economic frames, in explaining the public support for restrictions on natural gas use.

In addition, we find that public support does not have a significant association with climate change frames, echoing the findings of previous studies on public opinion toward renewable policies[23,27]. This may suggest the limited effectiveness of climate change frames, which have been viewed by environmental groups as an important tool for influencing public opinion. Similarly, our analysis does not yield any evidence of government officials' sway over political support. Neither federal nor local politicians appear to have any influence on public opinion regarding the policy banning natural gas use.

Next, we investigate whether the effect of health-related information depends on survey participants' characteristics. Figure 2a points to the importance of gender: female respondents are likely to support a natural gas ban when they see the health treatment, whereas male respondents' support does not increase when we present them with this information. Similarly, Fig. 2b indicates that individuals' exposure to harmful products of natural gas combustion due to regular cooking is linked to increased support for the policy in the group that sees health-related information. In contrast, respondents who do not cook at home are not swayed by adverse health impacts. Together, these two sets of findings are consistent with a traditional gender-based division of household responsibilities, when women tend to do most of the cooking. Given the amount of time women spend close to the source of pollution, they have incentives to pay closer attention to information about the negative health impacts of this type of air pollution.

Another individual-level characteristic that is associated with varying levels of responsiveness to health information is partisanship. Independents are more likely to express their support for the policy if we present them with information regarding harmful effects for child health (Fig. 2e). At the same time, we do not find significant heterogeneity across parties for our main health treatment.

In addition, we explore differences that can be attributed to characteristics of our respondents' states of residence. Our results show that policy support among residents of gas-producing states does not change when we highlight the health consequences of cooking with gas. However, individuals who live in other states are more likely to increase their support for a gas ban when they receive information about harm to their health or their children's health (Fig. 2d). This discrepancy could stem from economic motivations: those who reside in gas-producing states might worry about the loss of jobs and tax

revenues from gas production if a natural gas ban goes into force, and that may cancel out any health concerns.

We also find a divide between states that moved towards banning natural gas, that made such bans illegal, and that have not adopted any policies regarding natural gas use in residences. Figure 2c indicates that information about adverse effects of gas on child health is associated with a greater likelihood of increased support for this policy in states without any existing policies. This means that residents of these states may be relatively less informed about a natural gas ban (or a counter-ban) and possess weaker prior beliefs regarding the utility of this policy. Given this finding, one strategy for increasing support in states that are yet to adopt any policy should center on informing residents about the harms of indoor air pollution and, by extension, the benefits of natural gas bans.

Conclusion

What explains Americans' support for policies that restrict natural gas use by banning gas from new residential constructions? While the carbon dioxide emissions resulting from natural gas consumption are lower than from other fossil fuels, scholars and policymakers have become concerned with the deleterious consequences of burning natural gas for human health and the environment. Some U.S. states moved to adopt policies to ban natural gas in new construction, whereas other states are going in the opposite direction by prohibiting local authorities from passing similar bans. At the same time, a number of states are yet to adopt any policies in this policy area. Thus, it is crucial to understand the formation of public opinion on the natural gas ban policy while policymakers attempt to advance new measures to combat climate change and protect human health. This paper seeks to understand which factors influence public support for natural gas bans by conducting a survey experiment.

Our results show that the U.S. public significantly supports natural gas bans when members of the public are informed that natural gas is harmful to their (or their children's) health. Health concerns play a key role in increasing public support for the natural gas ban policy. Other treatments, such as information regarding consumer costs, industry position, climate change, and political support, fail to explain public support for the bans. We also find that the effects of health-related information vary with survey participants' characteristics, such as household responsibilities and economic incentives. For example, respondents with more household responsibilities support the natural gas ban when they respondents receive information about health hazards associated with natural gas use. However, respondents who might expect the loss of jobs and revenues due to the ban do not change their opinions when we expose them to the same information.

These experimental findings offer important policy implications. As the energy system is undergoing a transition away from all fossil fuels, public support is essential for policymakers who seek to advance policies restricting the use of natural gas. Our study suggests that policymakers can increase public support for this policy by tailoring its design and framing to focus on health consequences. Future research may further explore policy design implications by gauging the public's willingness to absorb the

costs of natural gas bans or cover the costs of transition away from fossil fuels and towards renewable energy.

Methods

Survey Experiment Sample

We fielded an online survey experiment exposing U.S. adults to information regarding a proposed natural gas ban policy that varied by expected effects in different areas, policy content, and political support. A total of 2,623 U.S. adults were recruited by Dynata to participate in an online survey in September 2021. Employing various recruitment channels (e.g., open enrollment and parnerships with thousands of websites, and affiliate networks including schools and communities), Dynata recruits hard-to-reach groups, such as ethnic minorities and seniors. As a result, Dynata possesses a diverse group of panels. Our survey sample is drawn from Dynata's U.S. panel, which aims to achieve the closest match to the U.S. Census and social benchmarks. In order to have a diverse sample that is close to the nationally representative sample, we employed soft quotas with regard to gender, age, regions, and education (based on the adult population, as reflected in the Census, i.e., 18 years of age and older). See Table A1 for the summary statistics of survey participants in comparison to the Census averages. Though our sample includes a slightly larger proportion of female respondents, a somewhat less educated and younger group, and underrepresents West, the differences with the Census averages are only marginal.

Table A1
Summary statistics of survey participants in comparison to the Census averages.

	Our sample	Census averages
Female	51.1%	50.8%
High school degree or less	40.5%	38.9%
Age less than 44	49.5%	46.1%
Northeast	19.1%	17.3%
Midwest	21.8%	20.7%
South	42.9%	38.2%
West	16.1%	23.8%

To ensure reliable, accurate responses, we first rely on Dynata's in-house screening processes based on "Total Research Quality® system," which monitor data quality employing various quality check methods. In addition, we screened out responses that did not pass our own validation check embedded in the survey. In the middle of the survey, we included 'the skip response check,' asking respondents to skip the

question without choosing any answers. Those who did not read the instruction and randomly chose responses were considered as inattentive respondents and removed from the sample.

Survey Experiment Design

To assess how the information about the expected outcomes or attributes of the natural gas ban policy affects public support, we employ a single conjoint design, in which we simultaneously randomize key attributes (or “treatments”) of a hypothetical proposed policy banning natural gas; this allows us to derive reliable estimates of each attribute as well as potential interactions between attributes. In our experiment, each respondent receives a series of statements about the natural gas ban policy. Our experiment begins with the following short description of a proposed natural gas ban policy:

Since 2019, over 40 cities in different parts of the US have adopted measures to ban natural gas hookups in newly constructed buildings. These ordinances require or encourage all-electric construction, which means that new homes will have only electric appliances. In the next year or two, a similar measure may be considered in your area, which would eliminate natural gas from all new homes. Consider the following effects of the proposed natural gas ban in your area:

We focus on the following five pieces of information about the natural gas ban policy that scholars and practitioners have previously identified as potentially influential factors, namely (1) economic costs for households, (2) the effects of the policy on the gas and renewables industries, (3) the effects of natural gas use on health, (4) the implications of natural gas use for climate change, and (5) political support for the policy at the local or federal levels.

(1) Economic costs (for households)

First, we present information about the economic costs for households (i.e., changes in consumers’ energy bills). Studies provide some mixed results regarding the public’s willingness to pay higher costs for cleaner energy. On the one hand, scholars find that individuals prefer energy at a lower cost[28]. Therefore, exposure to cost information reduces support for renewable energy policies[29]. In contrast, an average U.S. consumer shows support for a national clean energy standard even if that leads to higher electricity bills[30].

(2) Industry (gas vs. renewables)

Second, the effects of the policy on the natural gas and renewable energy industries can be another important factor shaping public support for the natural gas ban policy. Natural gas industry has been effective in establishing this fuel as a transitional solution to the problem of greenhouse gas emissions[31]. Therefore, support for this industry can lead to opposition to measures reducing reliance on natural gas. At the same time, renewable energy industry has grown in importance in terms of its size and a broad range of economic benefits provided to consumers and local economies, including new jobs and

business opportunities for local suppliers[32]. This suggests that this industry's interests may shape individuals' support for renewable energy policies.

(3) Health

Concerns about air pollution and resulting adverse health effects increase public support for cleaner energy generation alternatives[33]. Such benefits fit with individuals' perception of localized and more tangible social benefits connected to reduced reliance on fossil fuels[23,28]. However, these studies do not differentiate between ambient (or outdoor) air pollution, which has the most direct link with traditional, fossil-fuel energy generation, and household (or indoor) air pollution, which is the focus of this study.

(4) Climate change (GHG)

Overall, environmental concerns influence individual energy preferences. However, these concerns do not focus on the global environment; they tend to be more localized[28,34]. Hence, clean energy policies with global environmental benefits receive less support than policies producing local benefits[23].

The use of natural gas in clean energy transitions is a two-edged sword. The need to stop using coal is clear, which positions natural gas as an interim fuel on the path of decarbonization[35]. At the same time, this temporary solution is risky: reliance on natural gas could result in carbon lock-in, thereby delaying the process of decarbonization[36]. Therefore, the public support for natural gas reflects this duality: the use of natural gas to produce electricity receives support as an environmentally friendly solution, but the recognition of its contribution to global warming reduces support for continued gas use[37].

(5) Political support (local vs. federal)

Lastly, the presence of political support may also be an important factor underlying public support for the natural gas ban policy. Individuals tend to experience different levels of trust for local, state and federal governments and consequently show different support for policies adopted by these governments[38]. Citizens also believe that different levels of government should specialize in certain issue areas[39], and in the U.S. context specifically, the public views energy policy as the policy domain of the national (or central) government[40]. However, support for narrowly-focused energy extraction policies show variation based on individuals' feelings toward the federal and local governments[41].

Table A2 provides a summary of these attributes and their levels. For each attribute, the control group, which serves as a reference category in estimating treatment effects, received no information about a given attribute. Thus, it is possible that a few respondents viewed no information for any of the five treatments.

Table A2: Attributes and Levels in the Conjoint Experiment

Attributes	Control	Value 1	Value 2	Value 3
Costs	[No information is given]	Cost estimates suggest that all-electric new construction homes would likely see consumer bill savings.	Cost estimates suggest that all-electric new construction homes would likely see a consumer bill increase of less than $100 per year.	Cost estimates suggest that all-electric new construction homes would likely see a consumer bill increase of more than $100 per year.
Industry	[No information is given]	The expected effect of the ban on the natural gas industry is negative, which leads to opposition from this industry.	The expected effect of the ban on the renewable energy industry is positive, which leads to support from this industry.	
Health	[No information is given]	Regarding public health effects, experts expect that the ban will reduce indoor air pollution from gas combustion, including toxins such as nitrogen dioxide, which damages lung and cardiovascular health in exposed individuals.	Regarding public health effects, experts expect that the ban will reduce indoor air pollution from gas combustion, including toxins such as nitrogen dioxide, which damages lung and cardiovascular health in exposed children.	
Climate Change	[No information is given]	When it comes to climate change effects, estimates show that an all-electric single-family home would reduce annual greenhouse gas emissions by 76–88% compared to a natural gas-fueled home, because burning natural gas creates greenhouse gas emissions, which cause climate change.	When it comes to climate change effects, estimates show that natural gas produces approximately 50% less emissions per unit of energy compared with coal, so burning natural gas instead helps to cut greenhouse gas emissions, which cause climate change.	When it comes to climate change effects, some experts state that natural gas produces less greenhouse gas pollution than coal, while other experts argue that burning natural gas still creates greenhouse gas emissions, which cause climate change.
Politician Support	[No information is given]	Politically, this type of gas ban receives significant political support at the local level.	Politically, this type of gas ban receives significant political support at the federal level.	

After reading the statements with information about the natural gas ban policy, respondents were asked how much they support or oppose the hypothetical natural gas ban policy. The answers to this question

are on a 1–5 scale provided to respondents with 1 marked as ‘strongly oppose’ and 5 as ‘strongly support.’ In the survey, respondents were also asked basic demographic and socio-economic questions, including their 7-point partisan ID, age, gender, race, education, employment status, and the state of residence. Additionally, we asked how often respondents or their family members cook at home, given that those who cook at home (and cook more often) may have a greater level of sensitivity to certain types of information (e.g., health hazards) related to the natural gas ban policy.

Regression and Subgroup Analysis

In order to evaluate the causal effects of provided information about the policy on public support for the proposed ban, we estimate an ordinary least-squares regression, which is asymptotically equivalent to average marginal component effect (AMCE) estimators[24]. The AMCE, which does not rely on functional form assumptions about the choice probabilities, captures causal average effects of each attribute value of treatment information over all possible combinations of other attributes on the probability that the natural gas ban policy will be supported. Note that in the conjoint experiment respondents receive multiple treatments simultaneously and combinations of treatments, their values and orders are randomly chosen; thus, estimating regression models with all of the treatments simultaneously does not lead to biased estimates. To be specific, we estimate the following linear regression model:

$$\mathrm{Y_i} = \alpha + \beta_1 \mathrm{Costs} + \beta_2 \mathrm{Industry} + \beta_3 \mathrm{Health} + \beta_4 \mathrm{Climate} + \beta_5 \mathrm{PoliticalSupport} + {}_i \quad (1)$$

where i indexes each respondent, and Y denotes the respondents’ support for the natural gas ban policy on a 5-point scale. Costs, Industry, Health, Climate and PoliticalSupport represent a vector of binary indicators for specific values in each treatment attribute.

As robustness checks, we estimate OLS models with basic demographic covariates such as gender, income, education, partisanship, and whether the respondent has a child or not, and ordered probit models. The results, presented in Supplementary Tables A1 and A2, show that our main findings remain essentially unchanged.

We also examine the possibly heterogeneous effects in terms of (1) the respondent’s gender (male or female), (2) whether the respondent frequently cooks home, (3) whether the respondent resides in a gas producing state, (4) whether the respondent’s state has already taken policy action on natural gas, and (5) the party identification (Republicans, Democrats, or independents). We estimate the same OLS models used in the main analysis, but after splitting the samples for each category to explore heterogeneity in treatment effects.

To code whether the respondent cooks at home frequently, we asked “How often do you or your family cook at home?” on a 5-point scale (Never / Rarely / Sometimes / Often / Most of the time). We treat those who chose either “Often” or “Most of the time” as the individuals who cook at home frequently. We expect that the effects of health-related information are systematically different for those who cook at home

often, because they may be more directly exposed to adverse health effects of burning natural gas in the kitchen.

In addition, we examine potential heterogeneity in the effects of health-related information across respondents' states of residence. Specifically, we investigate if the effects vary depending on whether the respondent resides in a gas producing state, and whether the respondent's state has already adopting a policy banning natural gas or prohibiting such bans. To identify whether the respondent's state of residence produces natural gas, we utilize the state-level natural gas production data from the U.S. Energy Information Administration (EIA). We coded the respondent as a resident of a state producing natural gas if her state has produced any natural gas in 2020. Also, based on the S&P Global Market Ingelligence report on gas ban policies in the U.S. from November 2021[42], we categorized states into 3 groups—states advancing natural gas ban policies, states prohibiting natural gas ban policies, and states without any policy actions in this area. Those states that introduced related policies but have not formally adopted them are coded as states without policy actions.

For party identification, we asked, "Generally speaking, do you usually think of yourself as a Republican, Democrat, or as an independent (check the option that best applies)?" on a 7-point scale. We coded a respondent as a Republican (Democrat), if she answered "Strong Republican (Democrat) or Republican (Democrat)". We coded a respondent as independent if she chose either of "Independent, but lean Republican", "Independent", or "Independent, but lean Democrat."

Declarations

Ethics statement

The University of Buffalo, State University of New York Institutional Review Board (IRB) approved the survey experiment described in this article. We have also registered a pre-analysis plan (PAP) on a commonly used repository, but are unable to provide the details due to confidentiality in the blind review process.

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Figures

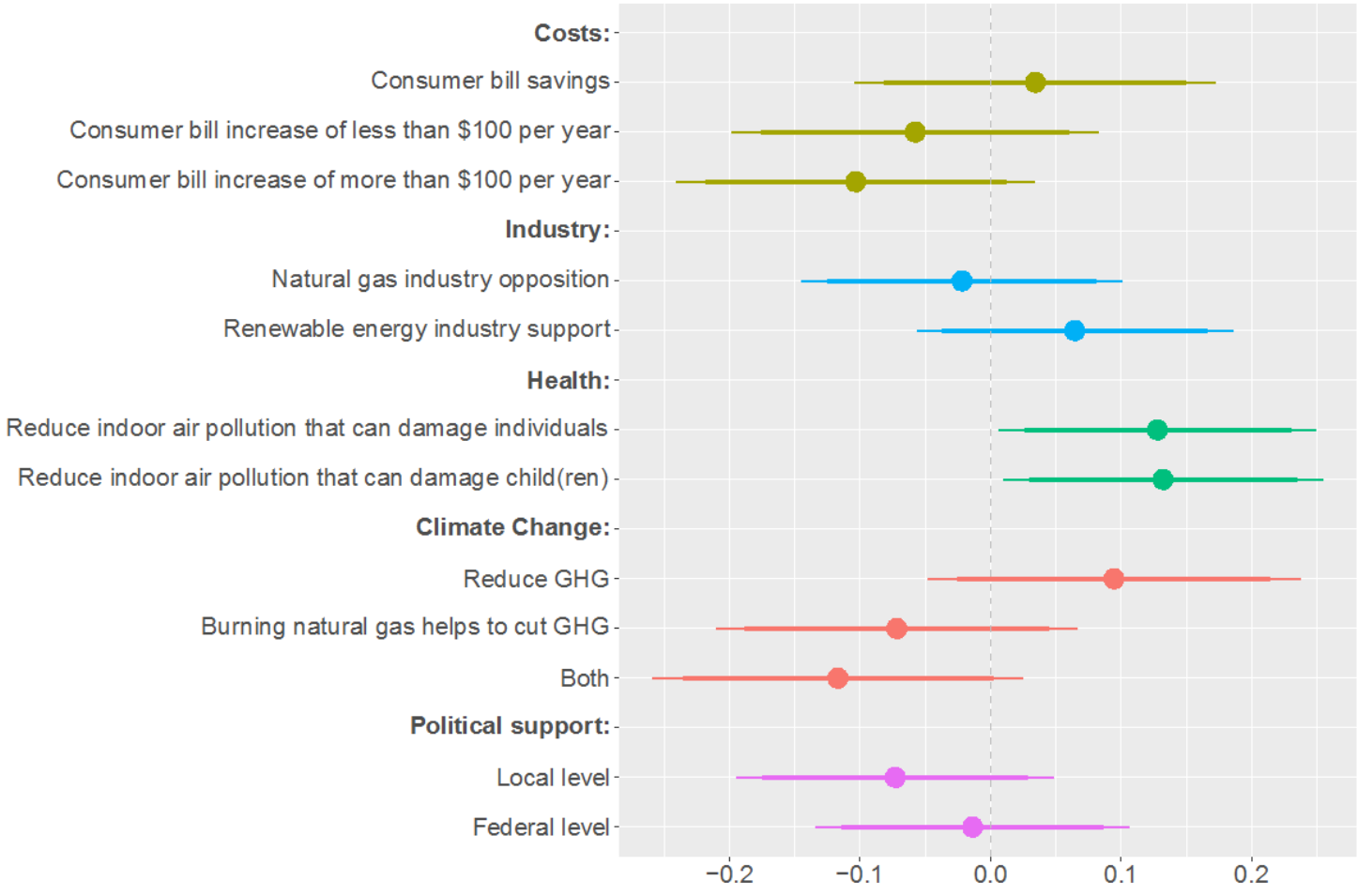

Figure 1

The effects of each treatment on public support for the natural gas ban policy. Estimates are plotted relative to the control group (i.e., those who received no information for a given treatment). This plot presents estimates of the effect of a randomly assigned treatment on a 5-point scale of policy support. The lines refer to 90% (thicker lines) and 95% (thinner lines) confidence intervals based on robust standard errors clustered by respondents.

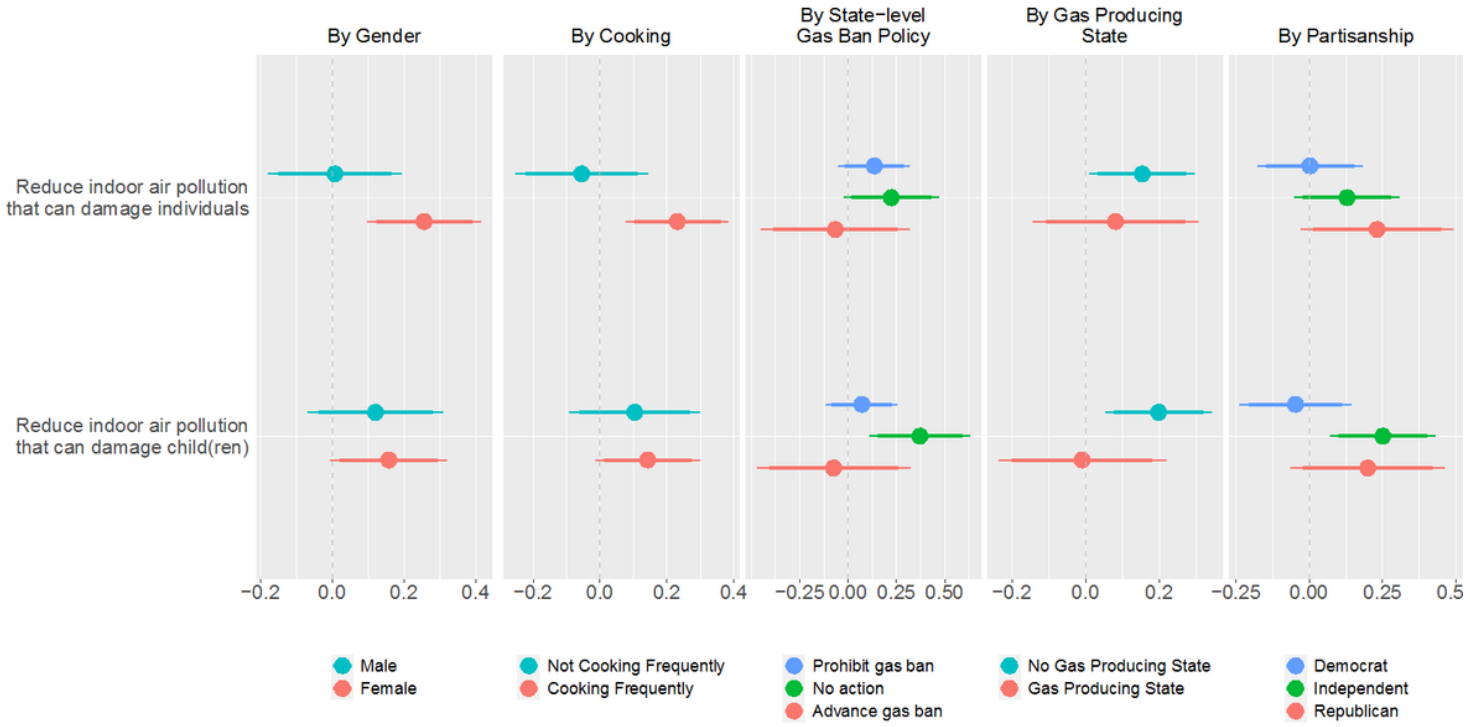

Figure 2

The heterogeneous effects of each treatment on public support for the natural gas ban policy by (a) gender, (b) cooking frequency, (c) residency in gas-producing states, (d) the type of natural gas policy adopted in the respondent's state, and (e) partisanship. Estimates are plotted relative to the control group (i.e., those who received no information for a given treatment). This plot presents estimates of the effect of randomly assigned treatment on a 5-point scale of policy support. The lines refer to 90% (thicker lines) and 95% (thinner lines) confidence intervals based on robust standard errors clustered by respondents. Supplementary Figures A1-A5 provide results for other treatment attributes.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Appendixanon.docx
- PAPanonNENERGY22040761.pdf