

Public preferences for a state-level carbon cap-and-trade program

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ABSTRACT

We use survey-based choice experiments to assess individual demand for a state-level carbon cap-and-trade program with different attributes. We estimate implied social marginal benefits of carbon emissions reductions (SBC)—a willingness-to-pay measure that complements existing avoided-cost measures captured by the social cost of carbon (SCC). Household willingness to bear the cost of any given program depends on the emissions reduction the program would provide, as well as the likely changes in the number of jobs in carbon-intensive industries and in “green” industries in the respondent’s county. We estimate marginal rates of substitution between “carbon” jobs and “green” jobs. The share of permits auctioned, and the share of any auction revenue spent on new technology has a less-discernible effect on program preferences, but people do care how much of any auction revenue is used to help workers and communities adapt to the program. People also prefer programs that include additional regulations to limit co-pollutant emissions by firms that buy permits. We account for systematic sample selection in our estimating sample, relative to the quota-driven sample of invitees from our internet panel. We also re-estimate our model using only systematic jurisdiction-level heterogeneity in preferences, as identified via LASSO methods, and use this model in a benefits-function transfer to predict willingness to pay for specific programs across all jurisdictions in the lower-48 U.S. states.

JEL classifications: Q54, Q51, Q58, C25

Keywords: Carbon cap-and-trade programs; choice experiments; carbon policy

1 Introduction

Even as the destructive effects attributed to climate change intensify (Intergovernmental Panel on Climate Change (IPCC) (2018) Intergovernmental Panel on Climate Change (IPCC) (2021)), the United States remains polarized about climate change policy (Egan and Mullin (2017)). Optimal design and successful implementation of carbon mitigation policy has proven to be exceedingly difficult, despite its importance (Aldy and Pizer (2009)). Carbon pricing is often touted as the economically efficient and potentially politically feasible approach to carbon emissions management (e.g. Metcalf (2009), Chen and Hafstead (2019)). Carbon cap-and-trade programs have thus gained traction as a promising tool for climate change mitigation (Newell et al. (2014), Raymond (2019)).

Regional carbon cap-and-trade programs have been adopted, but the United States has yet to launch such a program at the federal level (see Schmalensee and Stavins (2017) for discussion). The increasingly urgent need for mitigation policy, along with federal inaction, may necessitate that regional coalitions or individual states, other than just California and Washington State, implement policies at a sub-federal level (Fullerton and Karney (2018)). In 2019 and 2020, Oregon's legislature twice attempted, unsuccessfully, to create a carbon cap-and-trade program. Oregon's attempts and failure to launch such a program highlight the complicated and contentious political, environmental, and social concerns regarding environmental regulation (Farber (2012), Deryugina et al. (2019) and Fowlie et al. (2020)). Successful passage of a carbon cap-and-trade program for Oregon, as for many other states, will rely on the extent to which policy makers understand population preferences for a number of key program attributes.

Lack of support for carbon cap-and-trade programs could be the product of a number of different factors. For instance, conservative politicians who oppose many types of regulations have employed the phrase "job-killing regulations" to sour the public against programs like cap-and-trade, despite a lack of conclusive evidence from existing programs (Coglianese et al. (2013)). Addi-

tionally, market-based carbon emission solutions, like cap-and-trade, have been criticized for their inattention to distributional impacts (e.g. Fullerton and Muehlegger (2019), Goulder et al. (2019) Pizer and Sexton (2019), and Feger and Radulescu (2020)). A number of the papers in the literature have found evidence that carbon pricing can be regressive (e.g. Burtraw et al. (2009), Grainger and Kolstad (2010), and Moz-Christofolletti and Pereda (2021)).¹ Carbon cap-and-trade programs also raise environmental justice concerns with respect to their distributional effects (Kaswan (2008), Farber (2012)). To date, these theoretically possible concerns have been largely unsubstantiated (e.g. [Fowlie et al. (2012), Anderson et al. (2018) and Hernandez-Cortes and Meng (2020)). They remain an impediment nonetheless.

The biggest obstacle to public support may simply be partisanship. A review of climate change opinion surveys in the United States by Egan and Mullin (2017) finds that not only is partisanship the most important determinant of support for carbon-reduction policies, but the gap between Republicans and Democrats has become even more pronounced in recent years. This assessment has been corroborated using revealed preference precinct-level voting data (e.g. Anderson et al. (2019)). This partisan division appears to be due, at least in part, to a considerable effort on the part of some corporations to encourage opposition to climate policies through misinformation campaigns (Farrell (2016), Westervelt (2018)). A better understanding of the factors that affect willingness to pursue these programs is necessary if policy makers are to design a carbon cap-and-trade program that has adequate public support.

In this study, we conduct a stated-preference survey to measure individual preferences for key attributes of carbon cap-and-trade programs. Using randomized choice experiments in an online survey, we collect a quota-based sample of 1,050 Oregonians. Each survey asks respondents to consider six unique cap-and-trade programs. In each choice scenario, the respondent can cast an advisory vote (a) in favor of the program or (b) to keep the status quo (i.e. no program). We then use these six votes per person to estimate a random utility model. The marginal utilities

¹Carbon pricing policies also have the potential to be regressive in their benefits (Fullerton (2011)).

estimated for this model allow us to calculate individuals' marginal willingness to pay (MWTP) for various program attributes. Importantly, the survey also collects sociodemographic information about each respondent. This enables us to infer differences in MWTP for programs with different attributes *across different sociodemographic groups* (e.g. income levels, zip codes, and political ideologies). Another feature of our analysis is our assembly of sociodemographic characteristics for quota-screened and eligible invited participants who either decline to take our survey or who subsequently drop out of the survey. These data permit us to estimate a response/nonresponse model which permits us to undertake systematic sample selection correction.²

The present study makes contributions to a number of different veins of research in the broader literature.³ First, we contribute to the literature using stated-preference studies to understand public preferences for carbon pricing policies. Carattini et al. (2018) provide a survey of recent stated-preference work aimed at understanding public opposition to carbon pricing.⁴ The bulk of the extant literature focuses on carbon taxes or undefined carbon reduction policies (Raymond, 2019). For instance, Kotchen et al. (2017) conducted a survey of Americans to measure the WTP for a carbon tax as well as preferences for how the tax revenue is spent. Their results indicate a substantial mean WTP (\$177 per year). Additionally, 80% of their respondents indicate they would favor using the revenue to fund green projects and 70% would favor using it to support a “just transition” for coal workers. Carattini et al. (2017) use a recent real ballot initiative as their context for a follow-up stated-preference survey. They focus on a carbon tax and find lump sum redistribution of tax revenue and “social cushioning” to be popular. They also find that including more information about a policy improves its acceptability.

²The survey screens potential respondents against quotas, and we learn the age, race, gender, and income level of every invitee based on their panelist profile. We also collect the zip code of every potential respondent before they learn the topic of the survey.

³Appendix A provides more-detailed reviews of other papers in the related literature. Here, we merely summarize these papers by group.

⁴Other examples of stated preference studies that focus on preferences regarding carbon pricing include Berrens et al. (2004), Aldy et al. (2012), Kotchen et al. (2013), Duan et al. (2014), Yang et al. (2014), Gevrek and Uyduranoglu (2015), Raux et al. (2015), Lee and Heo (2016), Tvinnereim et al. (2017), Li et al. (2019), Rotaris and Danielis (2019), Böhringer et al. (2020), and Daziano et al. (2021).

Research has found that revenue recycling, and providing the public with tangible public benefits, could significantly improve support for carbon pricing (Amdur et al. (2014), Beiser-McGrath and Bernauer (2019)). In a similar vein, some national-level studies have focused on measuring preferences for the distribution of costs imposed by a climate change policy (e.g. Lee and Cameron (2008), Cai et al. (2010)). Brannlund and Persson (2012) use an internet-based survey in Sweden to measure preferences concerning an unspecified carbon pricing policy. They described policy alternatives in terms of (a) their development of green tech, (b) their ability to increase climate change awareness, (c) their monthly cost, (d) their *distribution* of costs, and (e) their geographic distribution of carbon reductions. They find that their respondents prefer policies that are (a) progressive, (b) have lower costs, and (c) raise awareness for climate change. On the other hand, Baranzini and Carattini (2017) conduct a qualitative-quantitative hybrid survey and find that individuals are more concerned about the environmental effectiveness of a carbon tax than with the distributional challenges that result, or the potential effects of the tax on firm competitiveness. Public preferences for carbon policies may differ systematically across contexts and geography.

In general, studies have avoided asking the public about a detailed carbon cap-and-trade program (e.g. Alberini et al. (2018)). However, there have been a few studies that have asked respondents about cap-and-trade programs in comparison to other types of programs. For instance, Kotchen et al. (2013) conducted a stated-preference survey that measured WTP for carbon reduction across different policy instruments (e.g. carbon tax, cap-and-trade, and a “policy to regulate carbon dioxide as a pollutant”) and find no preference across instruments. However, their survey does relatively little to inform respondents about the substantive differences between these policies. Choi et al. (2018) and Baranzini et al. (2018) conduct surveys that focus on “offset” preferences, where offsets are one aspect of many carbon cap-and-trade programs.

We also contribute to the broader body of work that characterizes public opinion regarding carbon policy at the state level (e.g. Holian and Kahn (2015), Burkhardt and Chan (2017), and Anderson et al. (2019)). Anderson et al. (2019) use voting data from two failed carbon tax bills in

Washington State and find that political party affiliation is by far the biggest indicator of support or opposition to the policies, with political ideology accounting for 91% of the variation in vote shares across precincts. This finding is consistent with the broad review of climate change opinion surveys by Egan and Mullin (2017). We rely on hypothetical advisory votes, but this permits us to use individual-level data, rather than precinct-level data.⁵

Our study has the added benefit of measuring climate change policy opinions in a particular U.S. state (Oregon) that has recently experienced an onslaught of extreme temperatures and serious wildfires that are most likely attributable, at least in part, to the effects of climate change on long-term drought conditions. Using zip code information, we can match respondents to their local context, including local weather-related conditions, recent drought conditions, and wildfire exposure. This permits us to estimate the effects of respondents' recent exposure to some likely consequences of climate change on their preferences for climate-change mitigation policy. This dimension of our analysis complements other work measuring the so-called "exposure effect" (e.g. Spence et al. (2011), Bain et al. (2012), and Scannell and Gifford (2013)). An expanded discussion of the broader literature related to our work is contained in Appendix A in the online Supplementary Materials associated with this paper.

2 Choice Models

This section outlines our specific random utility models in terms of the cap-and-trade program attributes featured in our survey. We also outline our various estimation methods.

⁵Individual-level data reduces concern about the "ecological fallacy" associated with the use of aggregated data to model individual-level processes.

2.1 Homogeneous preferences

Our choice experiments describe each potential cap-and-trade program in terms of nine attributes: (1) the monthly cost per household; (2) the percent change in carbon emissions (all negative); (3) the percent change in carbon-industry jobs (all negative); (4) the percent change in green-industry jobs (all positive); (5) the percent of carbon emissions permits that would be auctioned to firms, rather than given away for free; (6) the percent of auction revenue that would be used to fund equipment/machinery as the economy adapt to carbon pricing; (7) the percent of auction revenue that would be used to help displaced workers or affected communities adapt to carbon pricing; (8) the percent of auction revenue that would be placed into the state's General Fund to replace existing taxes; and finally, (9) whether the program would include additional regulations on other co-pollutants, to prevent their levels from increasing around firms that may buy enough carbon permits to allow their emissions of carbon (and other co-pollutants) to increase.

Our model is based on the indirect utility of respondent i under carbon cap-and-trade Program A. Similar to the usual specification for a public policy choice model in the stated-preference literature, our simplest model is linear and additively separable in the attributes for each program:

$$(1) \quad V_i^A = \beta_1(Y_i - C_i^A) - \beta_2(\% \Delta \text{carbon emissions})_i^A \\ + \beta_3(\% \Delta \text{carbon jobs})_i^A + \beta_4(\% \Delta \text{green jobs})_i^A \\ + \beta_5(\% \text{permits auctioned})_i^A + \beta_6(\% \text{revenue to equip})_i^A \\ + \beta_7(\% \text{revenue to workers})_i^A + \beta_8 \mathbf{1}(\text{pollution regs})_i^A + \eta_i^A,$$

Given that the three percentages of auction revenue sum to 100, we designate the percent of permit auction revenue going to the state's General Fund as the omitted category, with this share determined by the percentages not destined for the other two uses.

Indirect utility for respondent i under the status quo, V_i^N , involves no policy and therefore no

decrease in household income, no carbon reduction, no changes in the numbers of carbon jobs or green jobs in the respondent's county, no auctioned permits and therefore no permit auction revenue to spend on equipment, workers, or to provide tax relief, and no extra regulations to prevent increases in local pollution. However, most researchers allow for some "inertia" associated with the status quo, and include a status quo indicator variable, $SQ^N = 1$ for the No Program alternative, where $SQ^A = 0$ (implicitly) in equation (1). This utility for the No Program alternative is given simply by:

$$(2) \quad V_i^N = \beta_1 Y_i + \beta_9 SQ^N + \eta_i^N,$$

since none of the features of Program A will be experienced.

Each respondent's choice between policy A and the status quo is determined by whether policy A yields greater utility. Let $\Delta V_i^A = V_i^A - V_i^N$ be the difference in indirect utilities for respondent i from policy A and the status quo option N , so that policy A is chosen if and only if $V_i^A \geq V_i^N$ or $\Delta V_i^A > 0$. Individual i 's baseline level of income drops out, so our simplest linear-in-variables econometric specification is as follows.

$$(3) \quad \begin{aligned} \Delta V_i^A = & \beta_1 (-C_i^A) + \beta_2 (\% \Delta \text{carbon emissions})_i^A \\ & + \beta_3 (\% \Delta \text{carbon jobs})_i^A + \beta_4 (\% \Delta \text{green jobs})_i^A \\ & + \beta_5 (\% \text{permits auctioned})_i^A + \beta_6 (\% \text{revenue to equip})_i^A \\ & + \beta_7 (\% \text{revenue to workers})_i^A + \beta_8 \mathbf{1}(\text{pollution regs})_i^A - \beta_9 SQ^N + \varepsilon_i^A, \end{aligned}$$

where $\varepsilon_i^A = \eta_i^A - \eta_i^N$, an error term that is mean-zero.

The respondent is presumed to know their true utility for a specific program, and will vote for Program A if the utility difference, ΔV_i^A , is positive, and to vote against Program A if the utility difference is negative. The researcher, however, does not observe ε_i^A . The assumed distribution for

this random error term determines the functional form of the log-likelihood function used to estimate the preference parameter vector $(\beta_1, \dots, \beta_9)$ in equation (6) via maximum likelihood methods.

If each individual in the sample is presented with $t = 1, \dots, T$ choices, the joint probability (likelihood) function for this conditional logit model is then given by

$$(4) \quad \mathcal{L}(\beta) = \prod_{i=1}^N \prod_{t=1}^T \prod_{j=1}^J \left(\frac{\exp(V_i^{jt})}{\sum_{k=1}^J \exp(V_i^{kt})} \right)^{y_{itj}}$$

where $y_{itj} = 1$ if alternative j is chosen and is zero otherwise. To yield a unique set of parameter estimates, it is necessary to normalize by differencing utility relative to a numeraire alternative—the No Program option in our case. For the numeraire alternative, the utility differences is zero so that term in the ratio becomes $\exp(0) = 1$:

$$(5) \quad \mathcal{L}(\beta) = \prod_{i=1}^N \prod_{t=1}^T \prod_{j=1}^J \left(\frac{\exp(\Delta V_i^{jt})}{1 + \sum_{k=1}^{J-1} \exp(\Delta V_i^{kt})} \right)^{y_{itj}}$$

In our data, we have 1050 respondents. There are only two alternatives in each choice set, but $T = 6$ choice sets: $j_1 = (A, N)$, $j_2 = (B, N)$, $j_3 = (C, N)$, $j_4 = (D, N)$, $j_5 = (E, N)$, $j_6 = (F, N)$. Thus the likelihood function is even simpler for each choice occasion when $J = 2$ (where a binary conditional logit model could be used for the individual choices):⁶

$$(6) \quad \mathcal{L}(\beta) = \prod_{i=1}^{1050} \prod_{t=1}^6 \prod_{j=1}^2 \left(\frac{\exp(\Delta V_i^{jt})}{1 + \exp(\Delta V_i^{kt})} \right)^{y_{itj}}$$

The fitted model can be used to solve for each respondent's marginal willingness to pay (WTP) for each of the policy attributes described in our choice tasks. For the homogeneous-preferences specification in equation (6), we set the utility difference, ΔV^A , equal to zero and solve for the program cost, C_i^{A*} , that would make their representative individual indifferent between paying

⁶The model is only slightly more complex if there is more than one choice set for each individual and we wish to accommodate similarities among the choices for any given individual.

the cost and enjoying the benefits of the program, or keeping the money and doing without the program. This maximum total willingness to pay for a policy with a specified set of characteristics will be given by:

$$\begin{aligned}
 (7) \quad \widehat{WTP}_i^A = C_i^{A*} = & \frac{\hat{\beta}_2}{\hat{\beta}_1} (\% \Delta \text{carbon emissions})_i^A \\
 & + \frac{\hat{\beta}_3}{\hat{\beta}_1} (\% \Delta \text{carbon jobs})_i^A + \frac{\hat{\beta}_4}{\hat{\beta}_1} (\% \Delta \text{green jobs})_i^A \\
 & + \frac{\hat{\beta}_5}{\hat{\beta}_1} (\% \text{permits auctioned})_i^A + \frac{\hat{\beta}_6}{\hat{\beta}_1} (\% \text{revenue to equip})_i^A \\
 & + \frac{\hat{\beta}_7}{\hat{\beta}_1} (\% \text{revenue to workers})_i^A + \frac{\hat{\beta}_8}{\hat{\beta}_1} \mathbf{1}(\text{pollution regs})_i^A - \frac{\hat{\beta}_9}{\hat{\beta}_1} (-1)
 \end{aligned}$$

where in the difference between any program and the status quo, $\Delta SQ^N = -1$ for any active program. We take advantage of the mean-zero error term and predict WTP_i^A at the mean error.⁷

The parameters in this random utility model, when estimated by maximum likelihood, are distributed asymptotically joint normal (typically with non-zero covariances). Willingness to pay estimates, therefore, rely on one of several methods for accommodating the fact that the ratio of two normally distributed random variables has a mean that is undefined. Researchers often use the Krinsky and Robb (1986) parametric bootstrap simulation method, which relies on a large number of random draws from the joint distribution of the estimated parameter vector, with each draw being used to calculate marginal WTP for a given attribute, or total WTP (TWTP) for a specified program, according to the formula in equation (7). Over the large number of draws, a sampling distribution is built up for \widehat{WTP} . Descriptive statistics for the distribution of individual WTP function coefficients, or for total WTP, are calculated across all these random draws. Researchers typically use the mean and median, and the 90 or 95% interval, which function as point estimates and an interval measure for predicted marginal WTP for each program attribute in equation (7), or

⁷The negative sign on the cost term in equation (6) means that after we set the utility-difference to zero and subtract cost term from both side, the negative sign conveniently cancels.

for total WTP.⁸

Marginal willingness to pay for each program attribute is simply one type of marginal rate of substitution that can be estimated using this choice model. Marginal rates of substitution between any pair of attributes are given by the *negative* of the ratio of the marginal utilities for each attribute.⁹ Equation (6) can likewise be used to quantify other types of trade-offs that people are willing to make in considering carbon cap-and-trade policies, not just the trade-off between income and the the other attributes of the program.

For example, another politically important feature of all these cap-and-trade programs is that they result in a loss of jobs in the carbon-intensive sector. Rather than thinking about willingness to pay (i.e. willingness to put up with higher costs for more of each other attribute), we can instead think about willingness to incur job losses in the carbon sector to enjoy the benefits of the policy. We could again set the utility difference equal to zero and solve for the (*% carbon jobs lost*)_i^A that would make people just indifferent between getting the carbon cap-and-trade program and its carbon-reduction benefits, along with those job losses, or forgoing the program and protecting those jobs. Willingness to swap (WTS) carbon-intensive jobs for a carbon-reduction program with a given set of other attributes could be calculated as:

$$\begin{aligned} WTS(\% \Delta \text{carbon jobs})_i^A &= \frac{\hat{\beta}_1}{\hat{\beta}_3} (C_i^A) - \frac{\hat{\beta}_2}{\hat{\beta}_3} (\% \Delta \text{carbon emissions})_i^A - \frac{\hat{\beta}_4}{\hat{\beta}_3} (\% \Delta \text{green jobs})_i^A \\ &\quad - \frac{\hat{\beta}_5}{\hat{\beta}_3} (\% \text{permits auctioned})_i^A - \frac{\hat{\beta}_6}{\hat{\beta}_3} (\% \text{revenue to equip})_i^A \\ &\quad - \frac{\hat{\beta}_7}{\hat{\beta}_3} (\% \text{revenue to workers})_i^A - \frac{\hat{\beta}_8}{\hat{\beta}_3} \mathbf{1}(\text{pollution regs})_i^A + \frac{\hat{\beta}_9}{\hat{\beta}_3} (-1) \end{aligned}$$

⁸Some alternative strategies for deriving interval estimates for either some marginal WTP or for TWTP include the delta method and Fieller's method. Hole (2007) developed an add-in for Stata (wtp.ado) that can calculate marginal WTP measures in clogit models that are linear and additively separable. Another Stata add-in (wtpcizr) supports models that are either linear or logarithmic in the additively separable net income variable and can be used following probit, logit or bivariate probit commands.

⁹For the WTP calculations, cost C_i^A is technically the attribute of the program, but we model net income as the factor that drives utility for the consumer. The marginal rate of substitution between program attributes and net income ($Y_i - C_i^A$) is positive, although the marginal rate of substitution between program attributes and cost itself (C_i^A , a "bad") would be negative, since more of some desirable attribute would be required to make up for a higher cost.

It can be challenging to keep track of the signs on the variables in the data and how these interact with the signs on the marginal utilities that are specifically associated with *increases* in these variables. For example, all cap-and-trade programs offered in the survey have $(\% \Delta \text{carbon emissions})_i^A < 0$ and $(\% \Delta \text{carbon jobs})_i^A < 0$. But they likewise have $(\% \Delta \text{green jobs})_i^A > 0$. The marginal utility of net income, β_1 , is expected to be positive. The marginal utility for an increase in carbon emissions, β_2 should be negative, at least if the average person is concerned about the negative effects of climate change.

The marginal utilities of (increases in) carbon-intensive jobs and green-industry jobs, β_3 and β_4 , should both be positive (assuming jobs are good). We have no priors, however, about the signs of the coefficients on the other program attributes: β_5 , β_6 , β_7 , β_8 and β_9 . Preferences about ways in which the programs could be implemented, and therefore the possible distributional consequences of these programs, remain an empirical question, and these preferences may be heterogeneous within the sample.

Note that using intuition analogous to that for marginal WTP estimates, equation (7) allows us to determine, for example, what percent of jobs in carbon-intensive industries in their county people would be willing to give up to achieve a given percent *reduction* in carbon emissions, holding all other program characteristics constant. This is an elasticity-type measure. Likewise, we can use this equation to determine what percent of jobs in carbon-intensive industries in their county people would be willing to give up to get given percent increase in the number of green jobs in their county via a cap-and-trade program, holding all other program attributes constant.

Finally, there is also an analog to the concept of a *total* willingness to pay. If we are given the cost and effectiveness of a carbon cap-and-trade program, along with the percent increase in green jobs that would result, as well as the five other attributes that define how the program would be implemented, equation (7) can tell us what percentage of jobs in carbon-intensive industries people would be willing to sacrifice, in that context, to achieve a one percent decrease in carbon

emissions.¹⁰

2.2 Heterogeneous preferences

2.2.1 Mixed logit models

Mixed logit models are *continuous* mixture models. The mixed logit model starts from a homogeneous-preferences specification as in equation (6). However, instead of assuming that each marginal utility parameter is a true but unknown constant, identical for everyone in the sample, the mixed logit allows some or all of the marginal utilities to have a distribution across the population. An explicit functional form must be selected for the assumed distribution of each parameter, and the goal of estimation shifts to estimation of the central tendency and dispersion of these parameters in the population. Instead of just estimating the expected value of marginal utility, therefore, we typically estimate both the mean and the standard deviation of the *distribution* of that marginal utilities, across the population. These distributions accommodate “unobserved heterogeneity” in preferences. We do not seek to attribute this heterogeneity to any specific, observable respondent characteristics. Instead, we merely permit heterogeneity in preferences to exist.

Mixed logit probabilities are the integrals of ordinary conditional logit probabilities, with the integrals taken over the density function for the random parameters in the model. Suppose we begin with the conditional logit choice probabilities that individual i will select alternative j , where we now denote this logit probability as L_{ij} . We now normalize on alternative J , to permit unique estimates of the parameters β :

$$(8) \quad L_{ij}(\beta) = \frac{\exp(\Delta V_i^{jt})}{1 + \sum_{k=1}^{J-1} \exp(\Delta V_i^{kt})}$$

¹⁰A bootstrap approach, or the delta method, or Fieller’s method would likewise need to be used to provide point and interval estimates for this percentage, since we are still dealing with ratios of utility parameters estimated by maximum likelihood.

The mixed-logit probability that individual i will select alternative j is given by:

$$(9) \quad P_{ij}(\beta) = \int L_{ij}(\beta) f(\beta) d\beta$$

where $f(\beta)$ is the density function for the parameter vector that accommodates unobserved heterogeneity in preferences, and the observed portion of utility, V_i^{jt} (which captures at least the baseline attributes of each alternative, as featured in equation (1)), is embedded in the $L_{ij}(\beta)$ term. The mixed logit probability formula can be interpreted as a weighted average of the standard conditional logit formula evaluated at all the different values of the parameter vector β , where the weights are given by the parameter density function $f(\beta)$, also known as the “mixing distribution.” We note that if the mixing distribution is degenerate at a set of fixed β parameters, the mixed logit model collapses to just the standard conditional logit model. If the mixing distribution is discrete, the mixed logit model becomes the latent class model (i.e. a finite mixture model) described in the next section.

Mixed logit estimation algorithms permit the user to choose among a variety of parametric distributions for each random parameter. If the parameter vector is assumed to be multivariate normal with mean vector b and covariance matrix W , then the mixed-logit choice probabilities are given by:

$$(10) \quad P_{ij} = \int \left(\frac{\exp(\Delta V_i^{jt})}{1 + \sum_{k=1}^{J-1} \exp(\Delta V_i^{kt})} \right) \phi(\beta|b, W) d\beta$$

A log-normal distribution is sometimes chosen, however, because of its ability constrain the sign on a parameter. Parameters can also be individually noisy but independent, or they can also be correlated across individuals in the sample. For example, people with a higher-than-average marginal (dis)utility from losses of jobs in the carbon-intensive sector may also derive lower-than-average marginal utility from gains of jobs in the green sector. These could be older workers with less ability to change careers, for example. Other people in the sample may have a lower-than-average

(dis)utility from losses of carbon jobs but a higher-than-average marginal utility from gains in green jobs. These folks could be younger and still flexible in their career choices. A mixed logit with correlated preference parameters permits these more-general forms of heterogeneity in preferences while still permitting us to estimate “average” preferences for use in scaling WTP estimates from a representative sample to the entire population.

In cases where there is more than one choice per individual, there may be some commonalities among different choices by the same individual. In estimation of the mixed logit by maximum simulated likelihood methods, it is appropriate to make one draw from the joint distribution of the preference parameters *per individual*, rather than separate draws for each choice occasion.

Mixed-logit models that allow for unobserved variation in preferences are relatively parsimonious. For our model in equation (6), there are eight basic marginal utility parameters. If we allow each of these parameters to be random but independent, the parameter space expands to 16. If we had enough data to permit all parameters to be random and also correlated across respondents, there would be eight parameter means and eight corresponding parameter standard errors to estimate, along with the $8(8 - 1)/2 = 28$ off-diagonals of the symmetric parameter covariance/correlation matrix to estimate. Random parameters mixed-logit models, especially when there are repeated choices for each respondent, can greatly improve a researcher’s ability to estimate the average preferences in the population, controlling for unobserved heterogeneity. But mixed logit models do not help us identify interesting systematic variation in preferences according to observed respondent characteristics—namely *observed* preference heterogeneity that may be very important to our understanding of the *distributional consequences* of a policy. This information can be very important when we need to understand which groups of people are willing to pay more for these programs (i.e. will derive greater benefits) and which groups are willing to pay less (i.e. will derive lesser benefits).

2.2.2 Latent class models

Many researchers working with choice data now entertain latent-class models. In these models, it is assumed that respondents' preferences are a finite mixture of a small number of underlying preference types, each with its own vector of preference parameters, β_c , for each preference class c , entering into the expression for ΔV_i^{jt} . Within preference class c , individual i 's choice probabilities are given by:

$$(11) \quad P_i(\beta_c) = \prod_{t=1}^T \prod_{j=1}^J \left(\frac{\exp(\Delta V_i^{jt})}{1 + \sum_{k=1}^{J-1} \exp(\Delta V_i^{kt})} \right)^{y_{itj}}$$

These latent preferences are assumed to be homogeneous within class c , so that only the linear-in-variables preference parameters $\beta = (\beta_1, \dots, \beta_9)$ for our linear-in-variables indirect utility function would be estimated for each class.

Preference parameters can be permitted to vary systematically with one or more observable respondent characteristics to permit estimation of different sets of utility parameters for different groups. For latent class models, however, is that we *do not observe* class membership. Instead, preference class membership is only *probabilistic*. These distinct sets of preference parameters are subsumed in a model that also employs a class membership equation. The respondent's latent *class membership* probability depends not on the attributes of the different cap-and-trade programs, but exclusively on the individual or neighborhood characteristics of the respondent. Let s_i be a vector of such (typically sociodemographic) characteristics for respondent i or the population in their geographic area (e.g. ZIP code, county, etc.).

These respondent characteristics do not differ across alternatives in the program choice tasks, so the class-membership part of the model takes the form of a so-called multinomial logit model, where the probability of belonging to a particular class involves a different set of multinomial logit coefficients for each class (and the coefficients are normalized to zero for an arbitrarily designated numeraire class). The same set of respondent characteristics leads to different probabilities

of belonging to each preference class only because the *coefficients* on these characteristics differ across classes. Thus if there are C different preference classes, there will be $C - 1$ sets of coefficients on the vector of respondent or neighborhood characteristics that determine the probabilities of class membership. Then, conditional on class membership, the model embeds a conventional conditional-logit-type choice model for each class that involves homogeneous preferences within that class.

The the probability that individual i belongs to preference class c is given by the multinomial logit probability:

$$(12) \quad \pi_{ic}(\theta_c) = \frac{\exp(s_i \theta_c)}{1 + \sum_{l=1}^{C-1} \exp(s_i \theta_l)}$$

where the vector s_i typically includes a constant term and θ_c is a conformable vector of class-membership model coefficients for class c , with θ_C normalized to 0 for identification (i.e. so that the θ vectors are uniquely estimated). The full set of class membership coefficients is then $\Theta = (\theta_1, \dots, \theta_{C-1})$. For the full latent class model, the joint likelihood of individual i 's choice will then be:¹¹

$$(13) \quad \mathcal{L}(B, \Theta) = \sum_{c=1}^C \pi_{ic}(\theta_c) P_i(\beta_c)$$

Latent class models can be somewhat balky to estimate when there are many respondent characteristics to consider. Suppose there are k_1 individual or neighborhood characteristics for respondents, k_2 carbon cap-and-trade program attributes, and C latent classes are being entertained. Then the parameter space for the model will be on the order of $(C - 1) \times k_1 + C \times k_2$. The greatest success generally comes from starting with an extremely parsimonious specification and gradually adding more respondent characteristics (implicitly freeing up their coefficients to be non-zero). For each

¹¹For repeated choices by the same individual, the model can be estimated to allow for commonalities in choices within an individual.

additional program attribute, C additional parameters are added to the model. For each additional respondent characteristic, $C - 1$ additional coefficients are added. For each additional class of preferences, $k_1 + k_2$ more parameters must be estimated.¹²

2.2.3 Preferences that vary systematically with observable respondent characteristics

When the researcher has a wealth of information about respondent characteristics, it is possible to estimate models where each marginal utility parameter in the choice model is permitted to vary systematically as a function of these characteristics, as indicated by the data. In this paper, we exploit “observable” preference heterogeneity in terms of characteristics of the county in which the respondent resides. We employ a wide range of county-level characteristics, and build interaction terms between each program attributes and all of these county-level characteristics. We use LASSO methods to winnow down the huge array of interaction terms, leaving only those interactions that are empirically most important for explaining differences in people’s policy choices.

We can alternatively limit the interactions between program attributes and respondent characteristics to include only jurisdiction-level characteristics for each respondent’s zip code or county. Such a model permits us to exploit heterogeneity in preferences according to the “community” context for each respondent, rather than their individual characteristics. If one is willing to assume that the individual’s in the estimating sample can be assumed to represent their jurisdiction, such a specification can be used in benefits transfer exercises. We can extrapolate from the variation in preferences across Oregon’s heterogeneous jurisdictions to make inferences about representative preferences—and hence in WTP for cap-and-trade programs—across analogous jurisdictions across all U.S. states.

¹²For the estimates reported in this paper, we use Stata’s *llogit2* algorithm to search for a set of parameter estimates that brings us close to the maximum likelihood solution but does not produce a parameter variance-covariance matrix. These estimates are then used as starting values for the follow-on algorithm, *llogitml2*, to attain the maximum likelihood solution and produce the parameter variance-covariance matrix needed for hypothesis testing and for the calculation of WTP estimates.

3 Outline of Survey and Data

3.1 Sketch of the survey instrument

Our survey was initially drafted in the lead-up to the consideration of Oregon House Bill 2020 in the winter of 2019, but the state legislature’s vote on that bill never took place because the Republican house members left the state to prevent the Democratic members from reaching a quorum. Thus we shelved the project for several months until Oregon Senate Bill 1530 was proposed for the 2020 session. However, a similar exodus of Republican representatives occurred.¹³

After the 2020 legislative session concluded, however, Oregon experienced the worst wildfire season in years, and significant drought conditions continue. We resolved to redesign the cap-and-trade survey and use it to try to determine which features of a potential cap-and-trade program might account for heterogeneity in support. Casual empiricism suggests that attitudes toward climate change are determined predominantly by partisanship. The goal of our survey, therefore, is to explain some of the options for cap-and-trade program design and to learn whether support for cap-and-trade programs in Oregon varies only with political ideology, or whether there is evidence of systematic differences in support as a function of program attributes, other individual characteristics, or “neighborhood” characteristics for the respondent.

The survey used for this paper was developed during the winter and spring of 2021, and the full launch commenced on August 5, 2021. Quota sampling was used to produce a sample of completed responses for which the marginal distributions of age (over 18), gender, race, and household income are consistent with the marginal distributions for these variables in the population of Oregon.

The structure of our survey is described in detail in Appendix B in the online Supplementary

¹³During the fall of 2018, initial plans for this survey were under development, but the project was put on hold given the uncertainty created by these legislative events. On November 8, 2022, Oregon voters approved Measure 113, the Exclusion from Re-election for Legislative Absenteeism Initiative, which discourages such walkouts by disqualifying state legislators for re-election after the end of their term if they are absent from ten or more legislative floor sessions without obtaining permission or providing an acceptable excuse.

materials associated with this paper. One instance of the randomized survey instrument, as it would be viewed by a respondent (but with some added commentary), is included as Appendix C in the online Supplementary Materials.

4 Results and Discussion

4.1 Sample Selection

One challenge in using data based on a voluntary survey is the risk of sample selection bias. If characteristics that determine an individual's propensity to complete the survey also systematically affect their WTP for these programs, then the WTP estimates from a naive model may be biased. For example, people who work in the logging industry might be less likely to respond to our survey *and* have a lower WTP for carbon emission reductions. Basing our estimates strictly on *respondent* preferences, we might tend overestimate WTP for carbon emission reductions in the general population of the state. Another possibility might be that people in higher income brackets have higher marginal values of their time and are thus less likely to complete the survey. If these higher-income people are also more willing to pay the costs of a carbon cap-and-trade program, then we might tend to underestimate the WTP in the general population. Given the highly politicized and socially polarizing nature of climate change policies we are acutely aware of the necessity of evaluating our data for sample bias, and to seek to correct for this bias if it exists.

To address sample selection, we leverage a set of "screening" sociodemographic variables available for all survey invitees, including those who drop out after learning the survey's topic. These variables include self-reported age, gender, race, and income bracket, as well as the potential respondent's ZIP code of residence). Based on the ZIP code information for the respondent's neighborhood (we ask respondents to report their neighborhood ZIP code if they collect their mail from a PO Box), we merge in a host of external information that can be geographically indexed

to ZIP code polygons or centroids.¹⁴ We explicitly model the propensity for an invited respondent to complete the survey. Ideally, each person would be equally likely to respond, so we take the mean predicted response propensity in the invited group and subtract this from the predicted response propensities of everyone in the respondent sample, creating a variable that would be zero if everyone in the estimating sample were equally likely to complete the survey. In our models, we allow for interactions between this demeaned response propensity, denoted $dm : \widehat{RP}$, and every program attribute. We then counterfactually simulate what would be the predicted marginal utilities for each program attribute if everyone had a response propensity equal to the mean among all invited participants (i.e., had $dm : \widehat{RP} = 0$). We use these corrected marginal utilities in calculating the implications of our estimates. For details about our response propensity model, please see Appendix D in the online Supplementary Materials.

4.2 Program choice model: Homogeneous preferences

Our choice experiments involve binary choices between one cap-and-trade program and the status quo. Each of our six cap-and-trade programs is described in terms of a common set of attributes. The cost of the program is in dollars per household per month. The benefit from the program is the *percentage change in carbon emissions* to be achieved with the program (always negative). Other attributes of the program include its consequences in terms of jobs in the respondent's own (named) county: the expected *percentage-point change in carbon-intensive industry jobs* (always negative), and the *expected percentage-point change in green industry jobs* (always positive). Other program attributes include the *percentage share of carbon permits that will be auctioned*, and for permit auction revenues, the *percentage share that will be spent on equipment and machinery* that will help households and industries adapt to a lower-carbon economy, and the *percentage share that will be spent to help workers and communities* adapt to the new conditions. The remaining

¹⁴Additionally, a handful of automatically collected survey-context variables are known for all respondents (e.g. the date and time when survey was accessed and whether the survey was taken on a mobile device).

percentage share of revenues (the omitted numeraire share) will be added to Oregon’s General Fund and used to replace other existing tax revenues. The final attribute of each program is an indicator for whether there will be *new regulations on co-pollutants* to prevent firm that purchase carbon permits from simultaneously increasing their local emissions of conventional pollutants that are not globally uniformly mixing.¹⁵

We consolidate the descriptive statistics for all variables used in the different models in this paper into Tables 1 and ???. Panel 1 of Table 1 provides descriptive statistics for the different cap-and-trade programs offered to respondents; each respondent sees a different set of six randomly generated programs, called A through F. Our sample of 6300 programs reflects six program choices for each of 1050 respondents.

Inferences derived from choice experiments can sometimes be sensitive to the specification of the choice model and its assumed stochastic structure. All of our specifications focus on the nine β parameters appearing in equation (6), but we will report estimates of these marginal utilities from a set of five different estimating specifications:

1. A simple linear-in-parameters conditional logit choice model that assumes homogeneous preferences but allows a respondent’s predicted survey response propensity to shift one of the marginal utilities;
2. A mixed logit model where the marginal utilities for attributes other than program cost are allowed to vary randomly but independently across respondents;
3. A latent class model with two classes where class membership is allowed to vary systematically with a number of respondent characteristics;
4. An alternative latent class model with two classes where (endogenous) political ideologies and attitudes toward climate change influence class membership;
5. A streamlined model where LASSO methods have been employed to select important dimensions of systematic heterogeneity in marginal utilities across a selection of county-level contextual variables for each respondent. This model can be employed, cautiously, for “benefits transfer” exercises to extend the inferences from our study to states other than Oregon.

¹⁵See Appendix E for details on how the choice sets were generated for our cap-and-trade program alternatives.

For ease of comparing our estimates of the β parameters across specifications, we use Table 3 to report just these basic utility parameters for all five models (along with the log-likelihood value and counts of respondents, programs, and alternatives). For Model 1, of course, these are the only parameters to be estimated. For models 2, 3, 4, and 5, however, we provide Tables 4, 5, 6 and 7, each reporting the additional parameters unique to that specification (beyond just the basic marginal utility coefficients).

Our simplest program choice specification is a straightforward conditional logit model with homogeneous preferences, shown as Model (1) in Table 3. The respondent’s choice between the program being offered and “No Program” depends on all of the program attributes as well as the usual “Status quo” indicator variable. The coefficient on “Status quo” conveys the extent to which respondents are systematically more or less likely to choose “No Program” regardless of the attributes of the particular cap-and-trade program they are being offered.¹⁶ Model (1) suggests that all program attributes other than those related to the auctioning of permits and the use of the resulting revenues have non-zero marginal utilities. Higher program costs are undesirable, as are higher carbon emissions, but respondents, on average, derive positive utility from any cap-and-trade program to reduce carbon emissions, regardless of its specific attributes. More jobs are desirable, whether they are carbon jobs or green jobs, as are new regulations on other pollutants. However, the restrictions implicitly embodied in this model are rejected by our richer specifications.

We note, however, that Model (1) in Table 3 shows that our ad hoc selection correction term, $(dm : \widehat{RP}_i)$, has a statistically significant effect on the estimated marginal utility from a proportional change in green jobs in the respondent’s county.¹⁷ After selection correction, the baseline coefficient on marginal utility for green jobs increases in magnitude and remains positive and statistically

¹⁶For ease of interpretation, it will sometimes be convenient to convert this, ex post, to an “Any program” indicator by multiplying both the indicator and its coefficient by -1.

¹⁷An uncorrected model, as well as a model with $dm : \widehat{RP}_i$ permitted to shift all of the marginal utility parameters, are explored in Stanford and Cameron (2022). Model (1) involves eight parameter restrictions relative to the fully interacted model, but the maximized log-likelihood for the more-general model increases by only about three points, suggesting that the restrictions embodied in Model (1) reported here cannot be rejected.

significant at the 5% level. The negative coefficient on the interaction term between the green jobs attribute and the demeaned selection propensity indicates that the *more* likely a respondent is to participate in the survey, the *lower* their marginal utility from an increase in green jobs.¹⁸

4.3 Program choices: Heterogeneous preferences

4.3.1 Unobserved heterogeneity: Mixed logit specifications

As noted in Section 2, heterogeneous preferences can be modeled in a variety of ways in the analysis of choices. If the researcher has no information beyond just the attributes of the alternatives and respondent's preferred option in each choice task, the most common way to accommodate heterogeneity in preferences is to explore mixed logit models (i.e., models with random parameters, where each member of the population is assumed to have different marginal utilities for each attribute, and these marginal utilities have specific parametric distributions). A common exception is the cost variable. Benefit-cost analyses in the U.S. typically assume that everyone shares the identical marginal utility of income, which would imply a common marginal disutility of program cost. We follow the convention of constraining the coefficient on the cost variable to be a fixed parameter, rather than a random parameter. But we let all of the other coefficients in our basic model have normal distributions, and we estimate both means and standard deviations for these parameter distributions.

Model 2 in Table 3 allows each marginal utility other than that for the cost variable to be independently normally distributed. In shifting to this model, the mean values of these marginal utilities for most program features increase in magnitude and in some cases in significance, but the fixed estimate for the cost coefficient also increases, so the net effects on our eventual willingness-to-pay calculations will be smaller. Among the more fragile coefficients on the auction-related attributes,

¹⁸The sign of this coefficient runs counter to our initial expectation. We anticipated that people who are more concerned about climate change and more optimistic about green jobs would be more likely to complete our survey, but it seems that responses were also more likely from people who see climate policy, and especially the shift to green jobs, as a threat to their well-being.

the mean marginal utilities for the share of permits auctioned changes sign but remains statistically insignificant. The marginal utility for the shares of auction revenues going to workers/communities becomes significant at the 5% level. If auction revenue is generated by a given cap-and-trade program, there is thus some suggestion that respondents may approve of revenue recycling directed towards workers and communities. The point estimates suggest that revenue recycling toward businesses, for updating of equipment and machinery, may be viewed less favorably.

The mean marginal utilities for Model (2) differ somewhat from the fixed marginal utilities for Model (1) because Model (2) also estimates standard deviations for these marginal utilities across the sample of respondents. Table 4 gives Model (2)'s additional point estimates and standard errors for these marginal utility standard deviations. The standard deviations of the marginal utilities for several attributes—i.e., “Any program,” carbon emissions, carbon jobs, the share of auction revenues going to workers, and the presence of new regulations on other pollutants—are all statistically significantly different from zero, pointing to discernible heterogeneity in preferences concerning those attributes.¹⁹

4.3.2 Latent class models

For each of our two different latent class models, only two classes of preferences can be reliably distinguished. Each respondent's characteristics are permitted to explain latent class membership in one submodel that has the structure of a multinomial logit model, and one set of marginal utility parameters for program attributes is estimated for each class of preferences, with these two submodels each having a structure analogous to a conditional logit model.

¹⁹Stanford and Cameron (2022) also reports a specification where these marginal utilities (other than that for the cost attribute) are also allowed to be correlated across respondents. Some of these 28 correlations are statistically significant. For example, the marginal utilities for the two types of jobs are positively correlated, suggesting that people either care about jobs in general, or do not care as much about jobs. The marginal utility for regulations on other pollutants is positively correlated with the marginal utility from the status quo, suggesting perhaps that climate skeptics do not want a cap-and-trade program, but they may still be concerned about other types of pollution. However, a likelihood ratio test for all 28 of the additional parameter correlations does not reject the model where parameters are independently distributed, so we report only the model with independently distributed random parameters here.

Our first latent class specification, Model (3), allows class membership to be determined by the set of respondent characteristics with descriptive statistics shown in section 2 of Table ???. The two sets of preference parameters are displayed in Table 3, and the coefficient estimates for the single-index class membership model are shown in auxiliary Table 5. Class membership is a function of broad bins for several sociodemographic characteristics: educational attainment, income, gender, age, parenthood status, awareness of forebearers,²⁰ and past and expected future duration of residence in Oregon.

In the two discernible classes of preferences, the positive baseline marginal utility associated with “Any program” shows that Class 1 preferences are generally in favor of cap-and-trade programs, regardless of their attributes, and Class 2 preferences tend to oppose any of these programs. Both preference classes care about the proportional change in carbon emissions (Class 2 somewhat more so). Both classes care about carbon jobs in Model 3, but only Class 1 cares about carbon jobs in Model (4). Class 1 cares about green jobs in both models, but Class 2 does not care about green jobs in either model. The coefficient for the selection correction term also bears a different sign across these two groups. Given that there is no separately estimated scale factor (error variance) for one of the two sets of preferences, we should be able to compare the marginal utilities for each class. Beyond the sign difference for the “Any program” and selection effects, however, it is not particularly intuitive to compare the two sets of preferences because they do not share the same estimated marginal utility of income (implied by the negative of the marginal (dis)utility of the cost attribute). In a later section, where we discuss the implications of our estimated models, we report comparable estimates of the trade-offs people willingly make, as implied by different preferences, for all our different models, so we postpone discussion of these implications until then.

Model 4 in Table 3 also allows two latent classes of preferences, but explores how class membership is related to four sets of indicators variables that classify respondent’s political ideologies

²⁰We included our questions about forebearers and descendants to permit hypothesis testing about whether someone who feels a greater degree of connection to past (i.e. inter-generational awareness) may feel more obligated to support policies that will reduce climate change damages for future generations.

and attitudes about climate change. Section 3 of Table ?? gives descriptive statistics for the proportions of the sample that identify with the Democratic Party or the Republican Party (where the omitted category is "Independent or other"). The next dimension is whether their political ideology is "liberal" or "very liberal" or "conservative" or "very conservative" (relative to the omitted category of "moderate"). The next set draws from respondents' answers on a five-point Likert scale concerning whether climate change is real and is a serious threat. Finally, we use answers to a Likert-scale question about whether climate change is human-caused (where we combine the two "disagrees" categories due to low numbers). We chose these four dimensions of political ideology or attitudes about climate change because casual empiricism suggests that these factors have been extremely important with respect to Oregon's recent experience with legislation concerning potential carbon cap-and-trade programs.

The marginal utility parameters for the two latent classes of preferences in Model (4) are given in Table 3. The negative status quo effect reveals that Class 1 finds cap-and-trade programs to be desirable in general, whereas Class 2 is more likely to choose "No program," regardless of the levels of the program's other attributes. Class 1, in this case, cares about both carbon jobs and green jobs, whereas Class 2 is not particularly concerned about either kind of jobs (these marginal utilities are not statistically significantly different from zero for Class 2). However, there is some evidence from this specification to suggest that *both* groups view revenue recycling directed to workers as desirable, although both classes are statistically indifferent to the share of permits being auctioned.

We explore four different sets of indicator variables that capture a respondent's political ideology and attitude towards climate change. In Stanford and Cameron (2022), we rotate through these four sets of variables and find that all four sets, individually, have strongly significant effects on class membership. In model (4) of Table 3, we include all four sets of ideological and climate-change attitude variables in the same specification, to determine whether one type of variable dominates when we control for the others. The most statistically significant of the four sets of factors is whether the respondent agrees or strongly agrees that climate change is real, human-

caused and is a significant threat. The negative coefficients on these indicators imply that these respondents are more likely to belong to Class 2. Climate attitudes are clearly a very strong driver of preferences for cap-and-trade programs. One interesting result is that if we use only the party affiliation indicators (e.g. Democrat, Republican, from results reported in Stanford and Cameron (2022)), Republicans are less enthusiastic about cap-and-trade programs than non-Republicans. However, when we control for attitudes about climate change (the level of threat it presents, and whether it is human-caused), Republican respondents are actually more likely to support cap-and-trade programs.

4.4 Program choices: Observable heterogeneity and benefits transfer

Our survey sample was limited to the state of Oregon.²¹ Oregon is sometimes perceived to be a very liberal state, but there is great variation in sociodemographics and political ideologies across urbanized and rural counties in the state. We estimate Model 5 in Table 3 as a choice model with observed heterogeneity as a function only of census ZIP code tabulation area (ZCTA)-level characteristics for each respondent. We allow the best set of predictive ZCTA characteristics within the Oregon estimating sample to be selected by LASSO methods. If the variability across Oregon ZCTAs is sufficient, compared to the variability across all ZCTAs in the lower-48 U.S. states, it may be safe to transfer a model fitted for Oregon ZCTAs to all ZCTAs in other states.

Table 2 reports a LASSO-selected set of ZCTA-level characteristics that capture preferences for cap-and-trade policies. We report the means and standard deviations of these ZCTA proportions associated with each respondent in our sample, along with the same ZCTA-level characteristics for the 430 ZCTAs in Oregon, and then for all 33,300 ZCTAs across the lower-48 states of the U.S.²²

For Model 5, shown in the last column of Table 3, Table 7 shows the interaction terms that sur-

²¹This was an artifact of our funding sources.

²²ZCTAs within a handful of relatively liberal urban counties, many in the northern part of the Oregon, contain much of the population, and most of the eastern counties are very sparsely populated and relatively conservative. It is worth noting that factions in the eastern part of Oregon have occasionally lobbied to join Idaho, rather than stay with the rest of Oregon.

vive the LASSO variable-selection process. The greatest number of dimensions of heterogeneity is evident for the marginal utility from Any Program, independent of the program's attributes. Neighborhood characteristics that account for a statistically significant *increase* in a respondent's utility from any program include the proportion of their ZCTA that: is multiracial (of two or more races), is divorced or separated, has a bachelor's degree, has income between \$15,000 and \$25,000, is a native U.S. citizen but born outside the US, is employed in the utilities industry, uses a smartphone to access the internet, or commutes by "other means." Utility from "Any Program" is statistically significant *lower*, the greater the proportion of the respondent's ZCTA that: has income of \$10,000 or less, or income of \$65,000 to \$75,000, accesses the internet via a tablet or portable wireless device, heats their home with fuel oil, kerosene, or similar, or has one or two vehicles available for commuting.

Table 7 also shows that the marginal (dis)utility from higher carbon emissions is more-negative for someone in a ZCTA with a higher proportion of the population with commuting times of 60 minutes or more (typically people living in suburban areas), and less negative, the higher the proportion of people commuting 10 minutes or less.

Protection of carbon jobs is more important in ZCTAs with higher proportions of people employed in wholesale trade, whereas increases in green jobs are more important where higher proportions of people are employed in real estate, renting, or leasing (more likely in urban/suburban areas).

On average, according to Models 1 through 4, the share of permits auctioned does not have a statistically significant effect on the utility people derive from a carbon cap-and-trade program. However, Table 7 reveals that enthusiasm for the auctioning of permits is statistically significantly greater for respondents who live in ZCTAs with higher proportions of: Native Hawaiian or Pacific Islanders, dial-up-only internet access, or people who commute via public transportation (excluding taxis). Enthusiasm for auctioned permits is less for respondents who live in ZCTAs with higher proportions of: Asians, or people who heat their homes using "Other fuel" or "No fuel".

As to the use of any auction revenues for replacing equipment, there is less support for respondents from ZCTAs with higher proportions of people who speak some other language at home, but still speak English well, and higher proportions of people who are employed in Public Administration. Support for using auction revenues to help workers and communities adjust to higher carbon prices is greater when a ZCTA has a higher proportion of people employed in the Utilities industry, but less when a ZCTA has more people who use “No fuel” for heating.

On average, respondents prefer programs that include new regulations on other pollutants. Table 7 shows that this support is lower, however, the greater the proportion of the respondent’s ZCTA that is American Indian or Alaska Native. However, support for programs with new regulations is stronger, the higher the proportion of people in the respondent’s ZCTA who rely only on a computer for internet access.

4.5 Implications of estimated models

Due to the estimated differences in the marginal utility of income across the two classes in our latent class models, our estimated utility parameters under different model specifications can be less intuitive to compare than the estimates they can be used to produce for a number of valuation measures for different types of cap-and-trade programs. Table 8 collects a number of results based on some key ratios of marginal utility parameters calculated using the distributions of the estimated parameters in each of our five models.²³

We begin with our different models’ implied point estimate of the social benefits from a reduction of one ton of carbon emissions (SBC). These numbers can, in principle, be compared to measures in the literature for the social cost of carbon (SCC). Our marginal utilities for proportion carbon reductions must be converted to the implied per-ton basis. Thus our SBC estimates, for Oregon, start with our estimated marginal willingness to pay (MWTP) carbon reductions. Respon-

²³We rely on the `wtp.ado` code in Stata, developed by Hole (2007), to calculate point and interval estimates for these ratios, with standard errors calculated using the delta method.

dents were shown graphics during the survey that conveyed that the approximate aggregate annual carbon emissions for Oregon at present is about 64 million metric tons, so total carbon emissions per month average about 5,333,333 tons. A 1.0 proportional change in these emissions would thus be about 5,333,333 tons per month. The total number of households in Oregon is about 1,649,000. Thus whatever estimate we get for the $MWTP_{emissions}$ needs to be multiplied by $\frac{1,649,000}{5,333,333}$ to yield the aggregate willingness to pay by Oregon households to have Oregon’s carbon emissions reduced by 1 metric ton.

According to Model 1 in Table 8, with homogeneous preferences, this SBC estimate is about \$47/ton of carbon. Model (2) implies \$61. For our two latent-class models, Class 1 preferences imply an SBC of either \$64 or \$56, and Class 2 preferences imply only \$35 or \$28. For Model (5), where preferences are allowed to depend on county-level characteristics, the SBC for a given county depends on anything which systematically affects the estimated marginal utility of carbon emissions. In Model (5), this utility is affected by the proportion of people who commute less than 10 minutes, or more than 60 minutes (and possibly with access to broadband satellite internet). For Model (5), we estimate the model using demeaned values of all of the interaction terms, so that where these interaction terms are all zero, we obtain an estimate of the SBC “at the means of the data.” This estimate is \$49.

A second measure of interest for each model, in the second row of Table 8, is a point estimate of the marginal rate of substitution (MRS) between carbon jobs and green jobs. This measure involves the estimated coefficients on the proportional change in carbon jobs and the proportional change in green jobs, in the respondent’s own county, as a result of these cap-and-trade programs. The ratio of the two coefficient is:

$$\begin{aligned}
 (14) \quad \frac{\beta_{\text{Prop change in carbon jobs}}}{\beta_{\text{Prop change in green jobs}}} &= \frac{\partial(\text{Green jobs})/\text{Green jobs}}{\partial(\text{Carbon jobs})/\text{Carbon jobs}} \\
 &= \left[\frac{\partial(\text{Green jobs})}{\partial(\text{Carbon jobs})} \right] \left[\frac{\text{Carbon jobs}}{\text{Green jobs}} \right]
 \end{aligned}$$

so that the MRS (i.e., the number of green jobs willingly sacrificed to keep one carbon job):

$$(15) \quad MRS(\text{Carbon jobs, Green jobs}) = \frac{\partial(\text{Green jobs})}{\partial(\text{Carbon jobs})} \\ = \left[\frac{\beta_{\text{Prop change in carbon jobs}}}{\beta_{\text{Prop change in green jobs}}} \right] \left[\frac{\text{Green jobs}}{\text{Carbon jobs}} \right]$$

If we wish to know how many green jobs people would require, on average, to make up for the loss of one carbon job, we would use the negative of this MRS. The ratio of the two coefficients is constant, but the MRS also depends on the ratio of green jobs to carbon jobs. Thus we cannot quote a specific willingness to be compensated by green jobs for lost carbon jobs without specifying the prevailing ratio of these two types of jobs.²⁴ As a representative ratio of green jobs to carbon jobs, we use the state-level ratio, and report a point estimate and a confidence interval for this representative MRS.²⁵

For our models with homogeneous preferences, our estimates suggest that on average, people need about 1.27 to 1.72 green jobs to make up for each carbon job lost due to a cap-and-trade policy. However, our two latent class models reveal very different implications across the two preference classes. In each case, the relatively “pro-cap-and-trade” preference class would be satisfied, on average with only about one new green job for each carbon job lost. From Model 3, we know that Class 1 membership is more likely for younger people who are college graduates, males, and people who expect to stay in the state for at least two more decades. These groups may be more confident that they would be able to retool for a career in a green job, rather than a carbon sector job. Preference Class 2, however, the anti-cap-and-trade class, would demand about 2.2 to 6.8 new green jobs to make up for each carbon job lost. These people are more likely not to be college graduates, to be female, to be older, and to expect to reside in Oregon for less than 20 more

²⁴In general, the MRS will be smaller when there are relatively more carbon jobs and fewer green jobs. It will be larger when there are relatively fewer carbon jobs and more green jobs.

²⁵Stata’s wtp.ado algorithm can be adapted to calculate point and interval estimates for this ratio.

years.²⁶

The remaining rows in Table 8 report, for each of our models, the calculated marginal willingness to pay (MWTP) per month for a program with one more unit of each attribute, along with a confidence interval. For attributes described as proportions or shares, these marginal WTP amounts are for a 1.00 or 100% proportional change, or for a 1.00 or 100% change in share. The reported marginal WTP amounts could be scaled to a 1% change in jobs, or a 1% change in share by dividing the MWTP estimate (and its confidence bounds) by 100.

First, consider the baseline WTP for any type of cap and trade program, regardless of its attributes. This MWTP implied by the coefficient on the “Any Program” indicator. For Models (1) and (2), the estimated (mean) preferences suggest a positive WTP for any program, although this baseline positive WTP could be offset by too-small reductions in carbon emissions or too-great losses of carbon jobs. Each of our two latent-class models, however, reveal very different baseline WTP amounts for cap-and-trade programs across the two preference classes. In both latent class models, Class 1 has a baseline WTP for a cap-and-trade program on the order of about \$253-\$284. Class 2, however, has a negative baseline WTP, on the order of -\$75 to -\$107. This baseline, however, could also be overcome by a sufficiently large reduction in carbon emissions, a sufficiently small loss of carbon jobs, and/or a sufficiently large increase in green jobs, augmented by new regulations on other pollutants.

Second, the distributional effects of alternative cap-and-trade programs will be felt partly through their effects on employment in different sectors. Models (1), (2), and (5), with single estimates of this measure, imply that proportional changes in carbon-sector jobs are valued more highly than proportional changes in green jobs. However, the two latent-class specifications reveal that the pro-cap-and-trade Class 1 preferences are willing to pay much more for jobs of either type

²⁶The statistically significant but negative effect on Class 1 membership of knowing one’s ancestors beyond great-great-grandparents may seem counter-intuitive. We had been curious about whether people who pay attention to their family history might have been more likely to care about what their descendants think of their position on climate change policies. Instead, it may simply be the case that older people are more likely to be interested in genealogy than younger people, but younger people feel greater urgency about limiting climate change.

than are Class 2 preferences. The difference for Class 2 preferences in Model 4 is particularly striking. Class 2 membership is dominated by people who do not think climate change is a threat, or that it is human-caused. Controlling for those attitudes about climate change, they also tend *not* to be Republicans. This preference class has a marginal willingness to pay for proportional changes in carbon jobs of only \$154, and for green jobs of only \$79. The corresponding MWTP estimates for Class 1 in Model (4) are \$527 and \$589! Clearly, social justice in terms of the distribution of employment impacts is vastly more important to Class 1 than Class 2, according to Model (4).

Finally, the MWTP for cap-and-trade policies that include new regulations on other pollutants is positive for all our models. Distributional effects of climate policies may also depend on the extent to which transactions involving carbon permits move production around spatially. If increases in carbon emissions are correlated with increases in other types of pollution, residents in the vicinity of plants that buy carbon permits could be at a disadvantage. Models (1), (2), and (5), and Class 1 preferences in both our latent class specification, imply that programs with new regulations on other pollutants are valued about \$53 to \$62 higher per month than for programs without this feature. Many people care about the environmental justice implications of cap-and-trade programs. For Class 2 in both of our latent class models, however, marginal WTP for a program with new regulations on other pollutants is lower, at about half the size (\$29 to \$35 only). MWTP for this feature is still positive for Class 2, but this group appears to be less concerned about the environmental justice implications of any cap-and-trade program.

4.5.1 Benefit function transfer to all ZCTAs in the lower-48 U.S. states

To accomplish this crude benefits transfer exercise, we need to assume that our fitted preference parameters (from our Model (5) with observable heterogeneity at the respondent's ZCTA level), employed with ZCTA-level characteristics for any other ZCTA in the U.S. can predict an approximate willingness to pay for a cap-and-trade program with specific characteristics for a representative household in that ZCTA.

We could consider any cap-and-trade program that could be described by levels of the attributes we include in our study. For simplicity, however, we will calculate the representative total WTP for each ZCTA in the lower-48 U.S. states for just two programs: (a) a "basic" program that reduces carbon emissions by 40 percent but (artificially) involves no change in the numbers of carbon jobs or green jobs, and (b) an "alternative" program, also with a 40 percent carbon emissions reductions, but with an arbitrary 10% decrease in county-level carbon jobs, a 10% increase in county-level green jobs, 50% of carbon permits auctioned, with 30% of auction revenues going towards equipment (re-tooling) and 30% of auction revenue going to help workers and communities, and with new regulations on other pollutants.

Our first "basic" program auctions no permits, so the shares of revenue for equipment or for workers are also zero, and no new regulations for other pollutants are involved. By setting to zero all the other attributes, we can focus on ZCTA-level estimates of a representative ZCTA resident's willingness to pay for a 40 percent carbon reduction by cap-and-trade *before* factoring in the (distributional) effects of the program on carbon jobs and green jobs, or different attitudes towards auctioning of permits and revenue recycling (another distributional issue) or the need for new regulations to limit other pollutants (also a distributional concern). For this benefit-function transfer exercise, the only heterogeneity in Model (5) that will matter is the heterogeneity in the marginal utility from "Any Program" and the heterogeneity in the marginal utility from a proportional change in carbon emissions.

4.5.2 Distribution of WTP for cap-and-trade programs across ZCTAs

Our benefit-function transfer process yields a distribution of 33,300 different predicted median WTP amounts—one for each ZCTA in the lower-48 U.S. states. The heterogeneity in preferences identified by our LASSO variable selection is considerable. To illustrate this heterogeneity, we provide just one examples of the differing marginal distributions of WTP for our "basic" and "alternative" cap-and-trade programs. We split the 33,300 ZCTAs by terciles of one ZCTA characteristics

(here, the proportion of the population commuting by public transit, not including taxis).

We display the marginal distribution of median WTP amounts for each tercile (11,100 ZCTAs each) and mention the median WTP for each tercile in the legend to the densities. We show the overall national median WTP (after weighting by ZCTA populations) below each combined density plot. For our “basic” program, these ZCTA public transit tercile distributions are shown in Figure 1. Across all ZCTAs in the lower-48 states, the population-weighted median WTP for the basic program is \$70. Median WTP for the lower tercile of public transit use is \$26, while for the upper tercile, it is \$145. Furthermore, within each tercile, there is extensive heterogeneity in WTP for the basic program, due to other characteristics of each ZCTA. Only 0.64% of the 33,300 ZCTAs have predicted WTP for this basic program greater than \$800.²⁷

For our “alternative” program, analogous ZCTA public transit tercile distributions are shown in Figure 2. Across all ZCTAs in the lower-48 states, the population-weighted median WTP for this alternative program is larger, at \$114. Median WTP amounts for each tercile now *decline* with increasing terciles of public transit use (from \$150 to \$116 to \$70), rather than increasing across terciles, as in the case of the basic program. WTP for this alternative program is sufficiently higher that 5.06% of ZCTAs have predicted WTP amounts in excess of \$800.²⁸

4.5.3 Spatial heterogeneity in WTP for different cap-and-trade programs

To visualize the spatial heterogeneity in WTP to reduce carbon emissions by cap-and-trade (distinct from any distributional consequences of such a program), we can apply our model a representative household in each of the 33,300 ZCTAs in the lower-48 states of the U.S. For each ZCTA, we make a large number of draws from the joint distribution of our parameter estimates and calculate an estimate of WTP for each draw. Then we calculate both the mean and median WTP estimates

²⁷Outlier amounts for predicted WTP are due to outlier values of (continuously measured) proportions of one or more of the ZCTA proportions for the characteristics that LASSO has selected for our model with observable heterogeneity. NOTE: “county” reference in figure caption will be corrected to “zcta” in subsequent revision.

²⁸Again, outlier proportions of one or more characteristics in ZCTA populations account for outlier WTP estimates.

for that ZCTA. Then we can map the spatial variation in predicted median WTP estimates in each ZCTA. For our “basic program” example, this spatial heterogeneity is shown in the map in Figure 3.

For our arbitrarily chosen “alternative program” example, different people’s marginal WTP for the potential distributional consequences of non-basic cap-and-trade programs can be illustrated. The spatial heterogeneity in median WTP for our alternative program is shown in the map in Figure 4.

5 Directions for Future Research

Based on our study, respondents do not universally have strong preferences for the percent of permits auctioned or the uses of the auction revenue, although our mixed logit model with correlated marginal utilities suggest there is significant heterogeneity across the population in preferences for the share of permits auctioned and the share of revenue allocated to workers and communities. Thus, people’s auction and revenue recycling preferences might vary across the population in ways that cancel out, on average. Certainly, our LASSO-selected heterogeneity included in Model (5) suggests that people are not universally indifferent to these attributes.

Future explorations of models allowing for attribute interactions are also a possible extension of our work. Another possible explanation for the apparent lack of importance of some cap-and-trade program design features (such as the percent of permits auctioned, and the uses of auction revenue) could, of course, be that our survey was overly complex for the average respondent. Statistically insignificant marginal utility estimates may be a result of inattention to these features on the part of a sufficient number of respondents. Further analysis of a relationship between respondents’ measured and self-reported attention to different program features may help clear up what is going on with these less-robustly estimated average marginal utilities.

We are not yet entirely confident about the reliability of our benefit-function transfer exercise, where we estimate our model of heterogeneous preferences based on observable ZCTA-level char-

acteristics for each of our 1050 Oregon respondents. We use this model of ZCTA-level representative preferences to extend our predictions of WTP for specific types of cap-and-trade programs to all ZCTAs in the lower-48 U.S. states. We plan to enhance our model with ZCTA-level observable heterogeneity to include county-level vote shares for the 2020 Presidential election. Given that our latent class model with heterogeneity in terms of respondent ideology and climate-change attitudes achieved the highest maximized log-likelihood of all our models, we expect that voting data (while available nationally only at the county level, as opposed to the ZCTA level) may greatly improve the predictive power of our model. As a strategy for limiting the influence of outliers in our benefit-transfer exercise, we may also explore binning for our continuous ZCTA proportions.

6 Conclusions

We have described a choice-experiment study of preferences over a variety of attributes of potential carbon cap-and-trade programs to be implemented at the state level. We have considered specifications that assume homogeneous preferences, as well as heterogeneous preferences. In the second category, we include a random-preferences model with purely unobservable heterogeneity, two different latent-class specifications (one with class membership determined by a small set of respondent characteristics and one with class membership determined by respondent attitudes/ideologies), and a model with respondent neighborhood-level observable heterogeneity only (designed to facilitate benefit-function transfer on a national scale).

For our models with a single central tendency for marginal utilities (i.e., Model (1)-homogeneous clogit, and Model (2) (independent mixed logit), the preference parameters are statistically significant for (a) cost per month, (b) an any-program indicator, (d) carbon emission reductions, (d) carbon-intensive jobs, (e) green jobs, and (f) additional regulations.²⁹

²⁹One caveat relating to these results is that our sample-selection correction method, upon which these results are based, is currently an ad hoc approach based on individual deviations from the mean survey response propensity in among eligible respondents. There is some evidence that preferences may differ to some extent between the respondent sample and the general population. Our sample-selection treatment is more-rigorous than most, but could still be

Our estimate of average MWTP for a 1.0 proportional change in carbon emissions by 2050 is between about \$150 and \$200, including the wider variety of models also discussed in Stanford and Cameron (2022). However, proportional changes that large (i.e. 100 percent) were not included in our study. A recent proposal by the state of Oregon suggests reducing emissions by 45% relative to 1990 levels by 2035 and by 80% relative to 1990 levels by 2050. Graphics in our survey for the time trend in emissions for Oregon suggests that 1990 levels were about 57 million metric tons of carbon dioxide equivalent, and that 2021 levels at the time of the survey were about 61 million metric tons. Our survey described the emissions reduction target as "the percent reduction of total annual carbon emissions in Oregon by the year 2050, relative to Oregon's current carbon emissions. The suggested 2050 policy target then suggests reducing total emissions to just 11.4 tons. This 80% emissions reduction was the largest proportional reduction in our randomized choice experiment designs (where we asked respondents to consider reductions between 10% and 80%. But a reduction from the current 61 million tons to just 11.4 tons would be a about an 81% reduction, or a "Prop change in C emissions" of -0.81. For our fixed coefficients logit specification, the MWTP estimate implies an average willingness to pay, per month, of $\$153 * .81 = \124 to achieve the state's goal of roughly an 80% reduction by 2050. By a similar calculation, however, our correlated mixed logit model implies an average willingness to pay, per month, of about $\$166$. A rough interval estimate would be about $\$120$ to about $\$212$.

Our preliminary findings support that, in addition to the obvious cost and benefits of a carbon reduction policy (cost and emissions reductions), a cap-and-trade program's effect on jobs is of great importance to the public. A consistent significant and positive sign on the "Any Program" marginal utility estimate indicates that, on average, the public is supportive of a carbon cap-and-trade policy, regardless of its specific attributes. These two results, taken together, suggest that successful implementation of a carbon program in Oregon is likely to be highly dependent on designing a policy that navigates the contentious "just transition" debate.

improved upon. See a dissertation chapter in Mitchell-Nelson (2022) for a more-sophisticated approach.

In our models with heterogeneous preferences, the presence of additional regulations to limit emissions of other pollutants is generally a statistically significant determinant of support for carbon cap-and-trade programs. This result suggests the likely importance of additional protections for local residents who live around facilities that may buy large numbers of carbon permits if a cap-and-trade program is implemented.

Our estimates for the Social Benefits of Carbon (SBC) emissions reductions represent a useful complementary measure of the extent to which society may value these emissions reductions. The customary benefits measure is, instead, an avoided-cost measure: the Social Cost of Carbon. The Social Cost of Carbon (SCC), or marginal avoided impact of greenhouse gas, has received a considerable amount of attention. Nevertheless, there is no consensus on the true size of the SCC. Depending on the researcher, agency, administration, or country, the estimate of SCC varies widely. Under the Obama administration the SCC has estimated at \$50 per tonne (in 2020 US dollars) of CO_2 , with a range of \$15-\$75, while the Trump administration revalued the SCC at \$1-\$7 per tonne (Wagner et al. (2021)). Subsequently, the Biden administration has established an interim central value of \$51/ton, and a range between \$14 and \$152/ton. It is not surprising that the official SCC is highly dependent on the presiding administration, considering the strong partisan differences in WTP for carbon emissions reductions identified in this study and other research. However, estimates for the SCC are also vary markedly within the field of economics. This uncertainty is due in large part to the fact that the question of how to properly measure the SCC is still up for debate (Pindyck (2019)). Nevertheless, improving our estimation of the SCC is imperative to designing appropriate climate change policies (Aldy et al. (2021)).

Our Social *Benefit* of Carbon (reduction), or SBC, measures the overall social willingness to pay for a one-tonne reduction in carbon emissions via a cap-and-trade program where increased costs will be borne by individual households. Our estimate for our homogeneous clogit is only \$47/ton , but for our more-general mixed logit models, the estimate is \$61 (or as high as \$64 in the correlated mixed logit reported in Stanford and Cameron (2022)), consistent with the Obama and

Biden administration.³⁰ However, our latent class models estimates reveals that different political and ideological groups in society have substantially different SBC estimates.

In comparison to the SCC values laid out by past and current administrations, our SBC estimates tend to be reasonably similar. This suggests reasonable convergent validity for our estimates. This convergent validity is important because the Social Cost of Carbon (SCC) is a fundamentally different way to measure the benefits of carbon emissions reductions, based on avoided damages, compared to our Social Benefits measure, which is based on individual willingness-to-pay for carbon reductions.

The consistency between the SCC and SBC measures suggests that the SBC may be well-suited as an alternative way to measure the effects of carbon emissions on social welfare. This stated-preference approach has the potential to improve benefit-cost analyses of public programs to reduce carbon emissions, and affords an option to consider in more detail the distributional consequences of these policies to reduce carbon emissions.

³⁰The Trump administration's valuation of less than \$10/ton is largely ignored as a legitimate estimate of the SCC.

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Figure 1: Across 33,300 lower-48-state ZCTAs, distribution of predicted WTP for basic cap-and-trade program (40% carbon emissions reduction and no other special features). Example: split by terciles of the proportion of the population commuting by public transit. Overall national median WTP = \$70 per month.

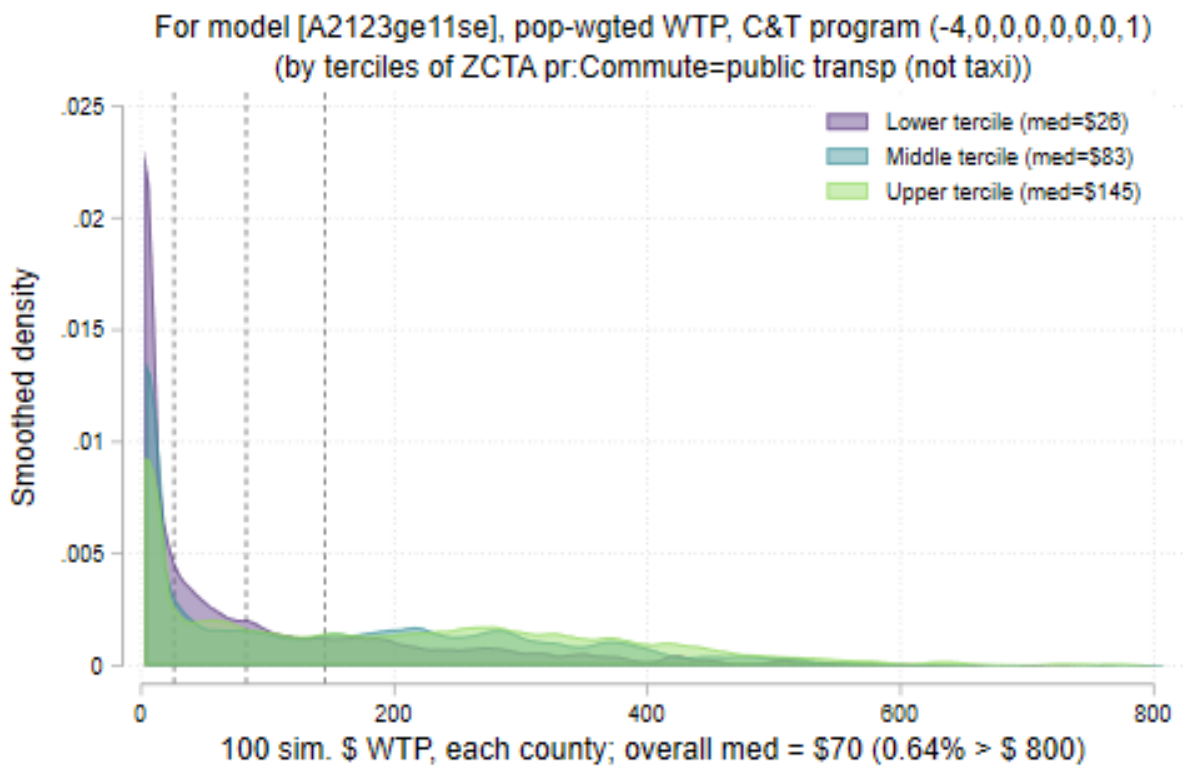


Figure 2: Across 33,300 lower-48-state ZCTAs, distribution of predicted WTP for alternative cap-and-trade program (“(-4,-1,1,5,3,3,1,1)” means 40% carbon emissions reductions, 10% decline in county carbon jobs, 10% increase in county green jobs, 50% of permits auctioned, 30% of auction revenue to equipment, 30% of auction revenue to workers/communities, includes additional regulations on other pollutants, and an “any program” indicator switched on). Example: split by terciles of the proportion of ZCTA population commuting by public transit. Overall national median WTP = \$114 per month.

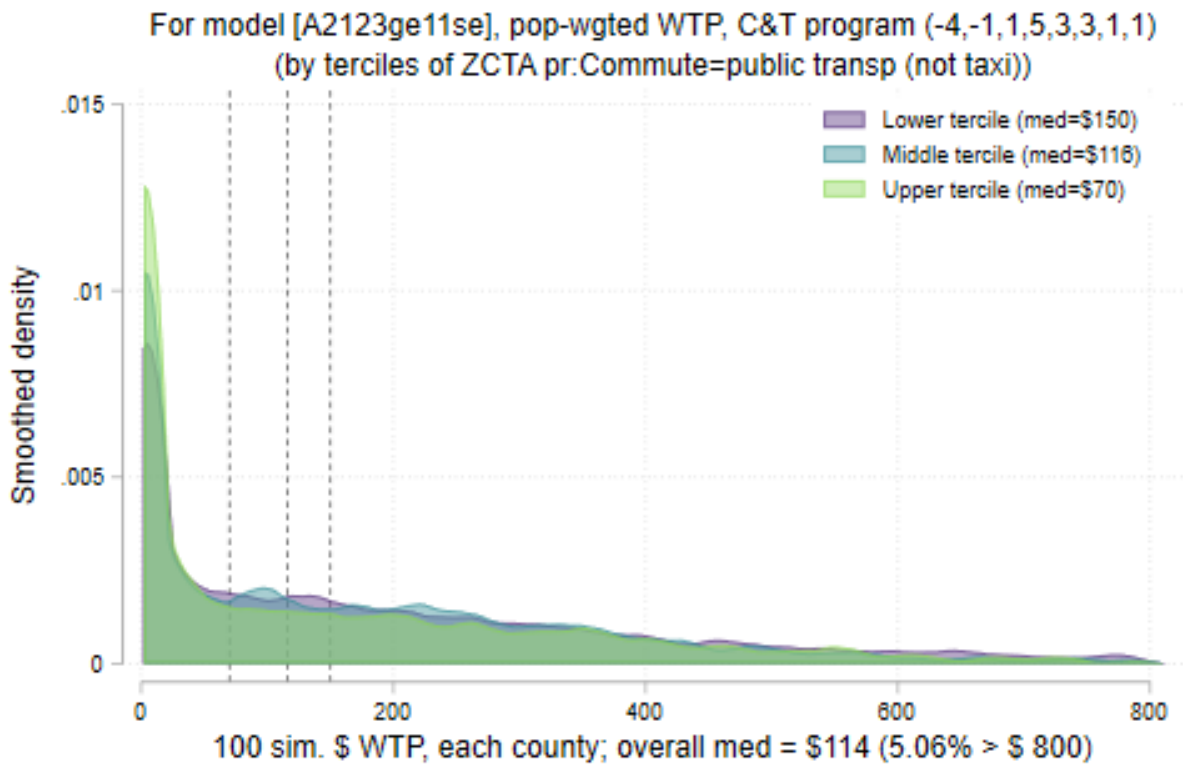


Figure 3: By ZCTA: predicted WTP for basic cap-and-trade program (40% carbon emissions reduction and no other special features)

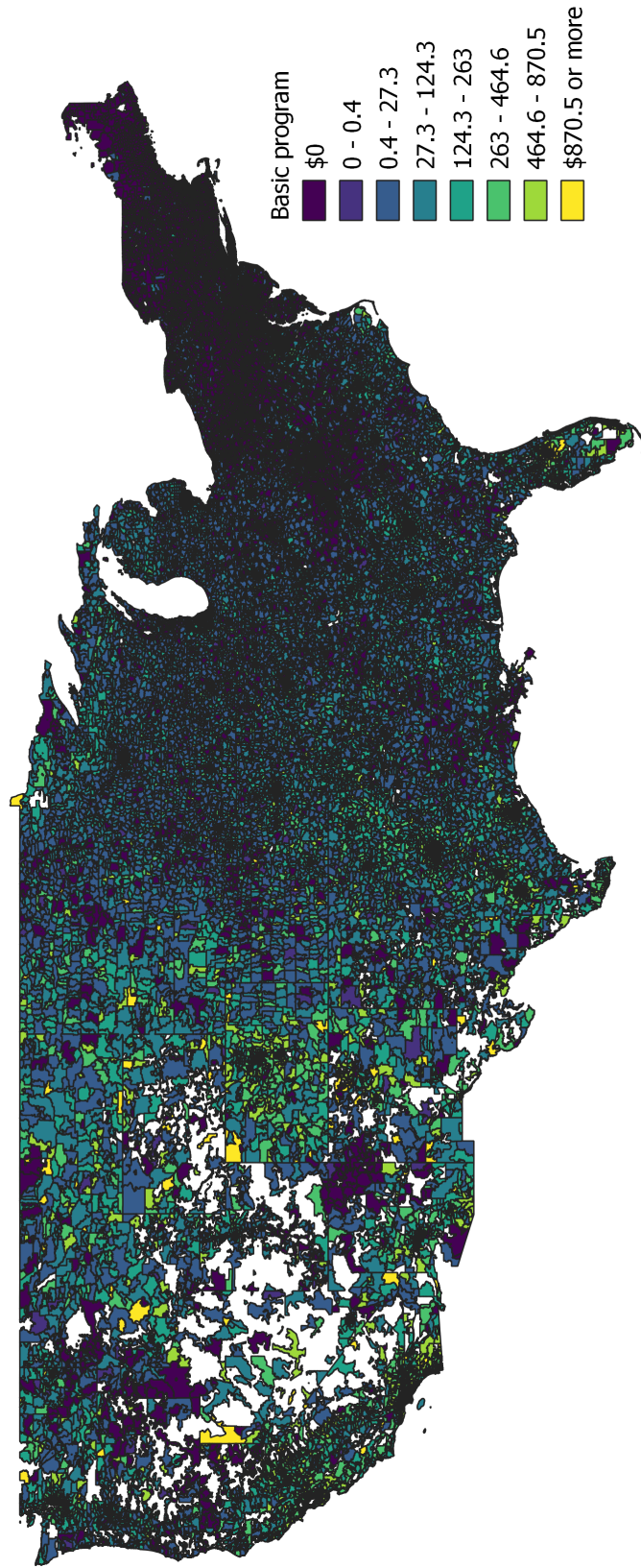


Figure 4: By ZCTA: predicted WTP for alternative cap-and-trade program (40% carbon emissions reduction, 10% decrease in county carbon jobs, 10% increase in county green jobs, 50% of permits auctioned, 30% of auction revenue to equipment, 30% of auction revenue to workers/communities, additional regulations on other pollutants)

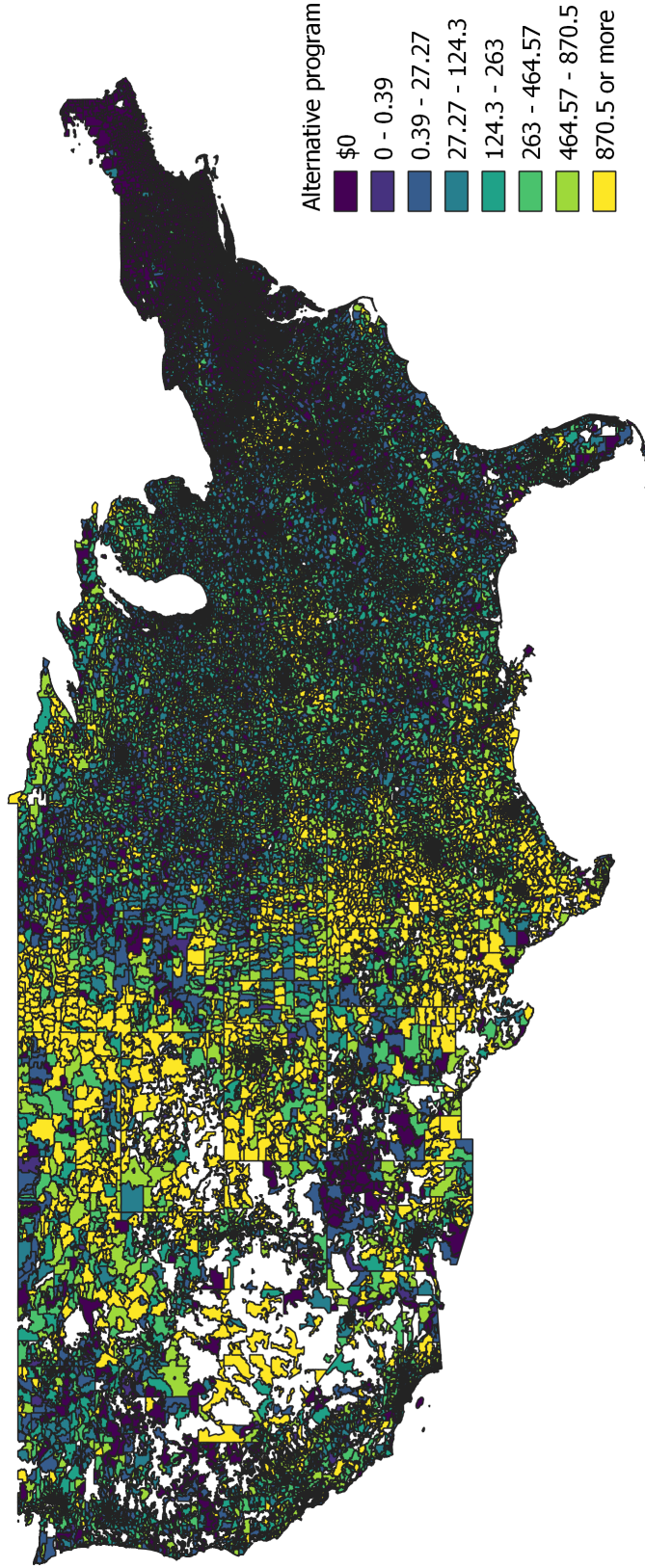


Table 1: Descriptive statistics for cap-and-trade programs and for alternative ways of capturing individual preference heterogeneity

| | mean | (std. dev.) |
|--|--------|-------------|
| 1. Cap-and-trade program attributes (All models, n=6300 programs) | | |
| Monthly cost | 195.31 | (101.87) |
| Prop change in C emissions | -0.456 | (0.226) |
| Prop change in carbon jobs | -0.112 | (0.064) |
| Prop change in green jobs | 0.110 | (0.062) |
| Share of permits auctioned | 0.458 | (0.230) |
| Share of rev. for equip. | 0.304 | (0.213) |
| Share of rev. to workers | 0.305 | (0.215) |
| 1=New regs other pollut. | 0.495 | (0.500) |
| 2. Preference heterogeneity: Individual demographics (Model 3, n=1050 respondents) | | |
| 1=College graduate | 0.427 | 0.495 |
| 1=Income greater than 75K | 0.441 | 0.497 |
| 1=Identifies as non-male | 0.527 | 0.499 |
| 1=Own age:18-34 | 0.335 | 0.472 |
| 1=Own age:65+ | 0.215 | 0.411 |
| 1=Has no children | -0.000 | 0.482 |
| 1=Knows ancestors beyond gg grndprts | 0.403 | 0.490 |
| 1=Has resided in Oregon 18+ years | 0.191 | 0.393 |
| 1=Expect reside Oregon 20+ years | 0.224 | 0.417 |
| 3. Preference heterogeneity: Ideology and opinions about climate change (Model 4, n=1050 respondents) | | |
| 1=Identifies as Democrat | 0.420 | (0.494) |
| 1=Identifies as Republican | 0.246 | (0.431) |
| 1=Ideology:Strongly liberal | 0.178 | (0.383) |
| 1=Ideology:Somewhat liberal | 0.207 | (0.405) |
| 1=Ideology:Somewhat conservative | 0.164 | (0.370) |
| 1=Ideology:Strongly conservative | 0.099 | (0.299) |
| 1=Str.agree clim.change threat | 0.592 | (0.491) |
| 1=Agree clim.change a threat | 0.223 | (0.416) |
| 1=Disagree clim.change a threat | 0.048 | (0.213) |
| 1=Str.disagree clim.change a threat | 0.024 | (0.152) |
| 1=Str.agree clim.change human-caused | 0.450 | (0.497) |
| 1=Agree clim.change human-caused | 0.309 | (0.462) |
| 1=Disagree clim.change human-caused | 0.068 | (0.251) |

Table 2: Descriptive statistics for ZCTA-level heterogeneity in preferences selected by LASSO for Model 5: Compare means (and standard deviations) for estimating sample, for all Oregon ZCTAs, and for National (lower-48 U.S. states) ZCTAs to be employed in benefits-function transfer exercise

| | (1) Est. sample ZCTA data (unwgted) mean/sd | (2) Oregon ZCTA data mean/sd | (3) National ZCTA data mean/sd |
|--|--|--|--|
| ZCTA pr:Two or more races | 0.077 (0.027) | 0.064 (0.050) | 0.046 (0.055) |
| ZCTA pr:American Indian/Alaska Native | 0.010 (0.012) | 0.017 (0.061) | 0.014 (0.077) |
| ZCTA pr:Asian | 0.048 (0.055) | 0.018 (0.033) | 0.022 (0.055) |
| ZCTA pr:Native Hawaiian/Pacific Islander | 0.004 (0.005) | 0.002 (0.007) | 0.001 (0.006) |
| ZCTA pr:Other lang., but English good | 0.100 (0.059) | 0.060 (0.065) | 0.071 (0.103) |
| ZCTA pr:Divorced or separated | 0.143 (0.031) | 0.144 (0.070) | 0.129 (0.080) |
| ZCTA pr:High school grad. (incl. equiv.) | 0.220 (0.084) | 0.279 (0.129) | 0.323 (0.149) |
| ZCTA pr:Bachelor's degree | 0.219 (0.094) | 0.164 (0.104) | 0.159 (0.110) |
| ZCTA pr:Income=10K or less | 0.132 (0.034) | 0.144 (0.075) | 0.139 (0.083) |
| ZCTA pr:Income=15K to 25K | 0.124 (0.030) | 0.142 (0.091) | 0.132 (0.075) |
| ZCTA pr:Income=65K to 75K | 0.044 (0.012) | 0.040 (0.038) | 0.039 (0.035) |
| ZCTA pr:Native US cit.; born outside US | 0.013 (0.006) | 0.009 (0.010) | 0.010 (0.020) |
| ZCTA pr:Indus=Mine/quarry/oil/gas extr. | 0.001 (0.002) | 0.003 (0.027) | 0.010 (0.040) |
| ZCTA pr:Indus=Wholesale trade | 0.025 (0.012) | 0.022 (0.031) | 0.023 (0.035) |
| ZCTA pr:Indus=Utilities | 0.008 (0.006) | 0.010 (0.020) | 0.011 (0.028) |
| ZCTA pr:Indus=Information | 0.016 (0.011) | 0.014 (0.027) | 0.013 (0.025) |
| ZCTA pr:Indus=Real estate/rent/lease | 0.020 (0.011) | 0.016 (0.020) | 0.014 (0.028) |
| ZCTA pr:Indus=Mgt. of companies/enterp | 0.002 (0.003) | 0.001 (0.003) | 0.001 (0.004) |
| ZCTA pr:Indus=Arts/entert./recr. | 0.021 (0.016) | 0.021 (0.042) | 0.018 (0.038) |

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Table 2 – continued from previous page

| | (1) Est. sample ZCTA data (unwgt) | (2) Oregon ZCTA data | (3) National ZCTA data |
|--|---|-------------------------------|---------------------------------|
| ZCTA pr:Indus=Public administration | 0.047 (0.029) | 0.057 (0.083) | 0.050 (0.063) |
| ZCTA pr:Smartphone | 0.883 (0.049) | 0.792 (0.189) | 0.783 (0.187) |
| ZCTA pr:Tablet/portable wireless | 0.650 (0.073) | 0.577 (0.179) | 0.557 (0.186) |
| ZCTA pr:Other computer only | 0.000 (0.001) | 0.000 (0.001) | 0.000 (0.004) |
| ZCTA pr:Dial-up only | 0.003 (0.004) | 0.006 (0.019) | 0.004 (0.019) |
| ZCTA pr:Broadband satellite internet | 0.064 (0.048) | 0.129 (0.144) | 0.094 (0.099) |
| ZCTA pr:Heat=Bottled tank LP gas | 0.016 (0.027) | 0.051 (0.096) | 0.148 (0.188) |
| ZCTA pr:Heat=Fuel oil kero etc. | 0.013 (0.017) | 0.043 (0.081) | 0.075 (0.166) |
| ZCTA pr:Heat=Solar energy | 0.001 (0.003) | 0.001 (0.006) | 0.001 (0.009) |
| ZCTA pr:Heat=Other fuel | 0.007 (0.011) | 0.013 (0.021) | 0.013 (0.039) |
| ZCTA pr:Heat=No fuel used | 0.004 (0.006) | 0.005 (0.012) | 0.006 (0.020) |
| ZCTA pr:Commute=10 min or less | 0.158 (0.085) | 0.214 (0.183) | 0.156 (0.145) |
| ZCTA pr:Commute=25 to 29 min | 0.066 (0.033) | 0.053 (0.055) | 0.065 (0.070) |
| ZCTA pr:Commute=45 to 59 min | 0.065 (0.041) | 0.080 (0.106) | 0.083 (0.088) |
| ZCTA pr:Commute=60 min or more | 0.058 (0.035) | 0.081 (0.102) | 0.091 (0.099) |
| ZCTA pr:Commute=1 vehicle avail | 0.204 (0.087) | 0.150 (0.118) | 0.163 (0.132) |
| ZCTA pr:Commute=2 vehicles avail | 0.399 (0.072) | 0.346 (0.165) | 0.373 (0.168) |
| ZCTA pr:Commute=public transp (not taxi) | 0.036 (0.041) | 0.013 (0.031) | 0.015 (0.054) |
| ZCTA pr:Commute=other means | 0.189 (0.091) | 0.199 (0.172) | 0.128 (0.126) |
| Observations | 1050 | 430 | 33300 |

Table 3: For comparison, differences in baseline marginal utility parameter estimates across alternative specifications. Models 2 through 8 include additional parameters that allow for heterogeneous preferences, to be presented in subsequent tables.

| Model | (1) | | (2) | | (3) | | (4) | | (5) |
|------------------------------------|---------------------------|----------------------------|---------------------------------------|---------------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|--|-----|
| | Homogeneous clogit | Independent mixed logit | Latent Class, demographics class 1 | Latent Class, demographics class 2 | Latent Class, ideology class 1 | Latent Class, ideology class 2 | For transfer (when shifters=0) | | |
| Monthly cost | -0.00308*** (0.000290) | -0.00843*** (0.000846) | -0.00465*** (0.000447) | -0.0127*** (0.00132) | -0.00500*** (0.000395) | -0.0164*** (0.00218) | -0.00344*** (0.000305) | | |
| l=Any program | 0.224* (0.115) | 0.406 (0.275) | 1.319*** (0.186) | -0.957*** (0.346) | 1.268*** (0.161) | -1.747*** (0.565) | 0.239** (0.118) | | |
| Prop change in C emissions | -0.469*** (0.139) | -1.650*** (0.270) | -0.954*** (0.223) | -1.454*** (0.416) | -0.909*** (0.196) | -1.458** (0.639) | -0.541*** (0.144) | | |
| Prop change in carbon jobs | 1.433*** (0.448) | 4.607*** (0.802) | 2.908*** (0.656) | 3.521** (1.502) | 2.638*** (0.590) | 2.519 (2.141) | 1.539*** (0.463) | | |
| Prop change in green jobs | 0.945** (0.457) | 4.114*** (1.118) | 3.668*** (0.864) | 0.585 (1.362) | 2.949*** (0.710) | 1.295 (1.940) | 1.117** (0.480) | | |
| ... \times (dm: \widehat{RP}) | -0.702 (0.481) | -3.579 (2.794) | 2.796*** (1.067) | -0.210 (1.668) | 1.183 (0.801) | -2.428 (2.577) | -0.626 (0.555) | | |
| Share of permits auctioned | 0.0346 (0.117) | -0.0330 (0.195) | -0.0262 (0.185) | 0.146 (0.352) | 0.00734 (0.163) | 0.311 (0.508) | 0.0321 (0.122) | | |
| Share of rev. for equip. | -0.205 (0.128) | -0.300 (0.225) | -0.0362 (0.199) | -0.536 (0.398) | -0.108 (0.177) | -0.282 (0.648) | -0.162 (0.134) | | |

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Table 3 – continued from previous page

| | | | | | | | |
|--|----------------------|----------------------|----------------------|---------------------|----------------------|-------------------|----------------------|
| Share of rev. to workers | 0.170 (0.127) | 0.537** (0.267) | 0.316 (0.204) | 0.674* (0.383) | 0.292 (0.179) | 1.004* (0.579) | 0.185 (0.131) |
| 1=New regs other pollut. | 0.186*** (0.0528) | 0.509*** (0.0994) | 0.289*** (0.0831) | 0.449*** (0.159) | 0.264*** (0.0737) | 0.471* (0.253) | 0.184*** (0.0547) |
| See subsequent tables for additional parameters in each specification | n/a | Table 4 | Table 5 | Table 6 | Table 7 | | |
| Max. log-likelihood | -4268.58 | -3188.72 | -3287.83 | -3181.54 | -3980.82 | | |
| No. respondents | 1050 | 1050 | 1050 | 1050 | 1050 | | |
| No. choices | 6300 | 6300 | 6300 | 6300 | 6300 | | |
| No. alternatives | 12600 | 12600 | 12600 | 12600 | 12600 | | |
| Standard errors in parentheses. For all models, observations are weighted by county population proportions in sample versus general population of the state. | | | | | | | |

Table 4: Additional parameters for Model (2) in Table 3: marginal utility parameter standard deviation estimates for the independent mixed logit specification

| | Coef. Est. | Std. Err. |
|--|------------|-----------|
| $\sigma(1=\text{Any program})$ | -3.056*** | (0.269) |
| $\sigma(\text{Prop change in C emissions})$ | -1.554 | (3.810) |
| $\sigma(\text{Prop change in carbon jobs})$ | -0.502 | (2.723) |
| $\sigma(\text{Prop change in green jobs})$ | -3.845 | (2.432) |
| $\sigma(\text{Prop change in green jobs} \times \text{dm}:\hat{R}P)$ | 11.48*** | (2.052) |
| $\sigma(\text{Share of permits auctioned})$ | -0.134 | (0.429) |
| $\sigma(\text{Share of rev. for equip.})$ | -1.006 | (1.569) |
| $\sigma(\text{Share of rev. to workers})$ | -2.103 | (3.141) |
| $\sigma(1=\text{New regs other pollut.})$ | -0.703** | (0.293) |

Table 5: Additional parameters for Model 3 in Table 3: Sub-model for Class 1 membership propensity as a function of demographic variables.

| Class 1 membership | Coef. Est. | (Std. Err.) |
|--------------------------------------|------------|-------------|
| 1=College graduate | 0.338** | (0.152) |
| 1=Income greater than 75K | 0.213 | (0.153) |
| 1=Identifies as non-male | -0.402*** | (0.142) |
| 1=Own age:18-34 | 0.779*** | (0.172) |
| 1=Own age:65+ | -0.108 | (0.184) |
| 1=Has no children | -0.00796 | (0.154) |
| 1=Knows ancestors beyond gg grndprts | -0.385*** | (0.142) |
| 1=Has resided in Oregon 18+ years | -0.254 | (0.161) |
| 1=Expect reside Oregon 20+ years | 0.311** | (0.153) |
| Constant | 0.194 | (0.236) |

Table 6: Additional parameters for Model 4 in Table 3: Sub-model for Class 1 membership propensity as a function of ideology and opinions about climate change.

| Class 1 membership | Coef. Est. | (Std. Err.) |
|---------------------------------------|------------|-------------|
| 1=Identifies as Democrat | 0.216 | (0.213) |
| 1=Identifies as Republican | 0.432* | (0.254) |
| 1=Ideology:Strongly liberal | 0.157 | (0.275) |
| 1=Ideology:Somewhat liberal | 0.363 | (0.252) |
| 1=Ideology:Somewhat conservative | -0.123 | (0.258) |
| 1=Ideology:Strongly conservative | -0.386 | (0.342) |
| 1=Str. agree clim. change a threat | 1.906*** | (0.336) |
| 1=Agree clim. change a threat | 1.200*** | (0.301) |
| 1=Disagree clim. change a threat | -0.587 | (0.670) |
| 1=Str. disagree clim. change a threat | -2.131 | (1.439) |
| 1=Str.agree clim. change human-caused | 0.793*** | (0.294) |
| 1=Agree clim. change human-caused | 0.602** | (0.257) |
| 1=Disagree clim. change human-caused | -0.702 | (0.504) |
| Constant | -1.434*** | (0.287) |

Table 7: Additional parameters for Model 5 in Table 3: LASSO-selected systematic variation in marginal utilities according to ZCTA-level characteristics (controlling for demeaned individual fitted response propensity)

| Heterogeneity | Coef. Est. | (Std. Err.) |
|--|------------|-------------|
| 1=Any program | | |
| ... × (ZCTA pr:Two or more races) | 7.470*** | (1.350) |
| ... × (ZCTA pr:Asian) | 0.0864 | (1.888) |
| ... × (ZCTA pr:Divorced or separated) | 7.050*** | (1.423) |
| ... × (ZCTA pr:High school grad. (incl. equiv.)) | -1.680 | (1.108) |
| ... × (ZCTA pr:Bachelor's degree) | 3.476*** | (1.131) |
| ... × (ZCTA pr:Income=10K or less) | -4.391*** | (1.158) |
| ... × (ZCTA pr:Income=15K to 25K) | 4.976*** | (1.750) |
| ... × (ZCTA pr:Income=65K to 75K) | -10.53*** | (3.156) |
| ... × (ZCTA pr:Native US cit.; born outside US) | 14.55** | (6.239) |
| ... × (ZCTA pr:Indus=Utilities) | 4.123 | (9.146) |
| ... × (ZCTA pr:Indus=Public administration) | -0.500 | (1.933) |
| ... × (ZCTA pr:Smartphone) | 5.950*** | (1.125) |
| ... × (ZCTA pr:Tablet/portable wireless) | -1.785** | (0.822) |
| ... × (ZCTA pr:Broadband satellite internet) | 0.0220 | (1.722) |
| ... × (ZCTA pr:Heat=Bottled tank LP gas) | 0.968 | (3.289) |
| ... × (ZCTA pr:Heat=Fuel oil kero etc.) | -11.83*** | (2.187) |
| ... × (ZCTA pr:Commute=25 to 29 min) | 0.201 | (1.085) |
| ... × (ZCTA pr:Commute=45 to 59 min) | 0.483 | (1.528) |
| ... × (ZCTA pr:Commute=1 vehicle avail) | -1.207* | (0.652) |
| ... × (ZCTA pr:Commute=2 vehicles avail) | -2.606*** | (0.618) |
| ... × (ZCTA pr:Commute=public transp (not taxi) | -0.194 | (2.060) |
| ... × (ZCTA pr:Commute=other means) | 1.476** | (0.742) |
| Prop change in C emissions | | |
| ... × (ZCTA pr:Broadband satellite internet) | -3.047 | (2.946) |
| ... × (ZCTA pr:Commute=10 min or less) | 3.188*** | (0.982) |
| ... × (ZCTA pr:Commute=60 min or more) | -6.705*** | (2.060) |
| Prop change in carbon jobs | | |
| ... × (ZCTA pr:Asian) | 10.71 | (8.659) |
| ... × (ZCTA pr:Indus=Wholesale trade) | 52.94** | (21.66) |
| ... × (ZCTA pr:Indus=Mgt. of companies/enterp) | -16.22 | (103.7) |
| ... × (ZCTA pr:Indus=Arts/entert./recr.) | -19.87 | (17.40) |
| ... × (ZCTA pr:Heat=Bottled tank LP gas) | -32.60 | (30.42) |
| Prop change in green jobs | | |
| ... × (ZCTA pr:Indus=Real estate/rent/lease) | -114.6*** | (26.28) |
| ... × (dm: \widehat{RP}) | -0.626 | (0.555) |
| Share of permits auctioned | | |
| ... × (ZCTA pr:Asian) | -5.520** | (2.716) |
| ... × (ZCTA pr:Native HI/Pacific Islander) | 32.33*** | (11.80) |
| ... × (ZCTA pr:Indus=Information) | 1.212 | (6.190) |
| ... × (ZCTA pr:Indus=Mgt. of companies/enterp) | 4.873 | (32.54) |
| ... × (ZCTA pr:Dial-up only) | 38.82*** | (14.94) |
| ... × (ZCTA pr:Heat=Other fuel) | -18.93*** | (6.284) |
| ... × (ZCTA pr:Heat=No fuel used) | -28.23* | (16.59) |
| ... × (ZCTA pr:Commute=45 to 59 min) | -3.744 | (2.749) |

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Table 7 – continued from previous page

| | | |
|--|-----------|---------|
| ... × (ZCTA pr:Commute=public transp (not taxi)) | 7.937** | (3.466) |
| Share of rev. for equip. | | |
| ... × (ZCTA pr:Other lang., but English good) | -5.201*** | (1.728) |
| ... × (ZCTA pr:Indus=Mine/quarry/oil/gas extr.) | 93.14 | (59.57) |
| ... × (ZCTA pr:Indus=Mgt. of companies/enterp) | -33.82 | (37.00) |
| ... × (ZCTA pr:Indus=Public administration) | -14.90*** | (5.314) |
| ... × (ZCTA pr:Heat=Solar energy) | 47.07 | (33.12) |
| Share of rev. to workers (none) | | |
| ... × (ZCTA pr:Asian) | -2.663 | (2.369) |
| ... × (ZCTA pr:Indus=Mine/quarry/oil/gas extr.) | 47.53 | (69.20) |
| ... × (ZCTA pr:Indus=Utilities) | 37.19* | (21.56) |
| ... × (ZCTA pr:Heat=No fuel used) | -67.21*** | (19.46) |
| 1=New regs other pollut. | | |
| ... × (ZCTA pr:American Indian/Alaska Native) | -9.992** | (4.767) |
| ... × (ZCTA pr:Indus=Mine/quarry/oil/gas extr.) | 35.62 | (31.46) |
| ... × (ZCTA pr:Other computer only) | 117.6*** | (44.12) |

Table 8: For comparison, different implications of estimated utility parameters across specifications

| Model | (1) | (2) | (3) | | (4) | | (5) |
|-----------------------------------|-----------------------|----------------------------|---------------------------------------|---------------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| | Homogeneous clogit | Independent mixed logit | Latent Class, demographics class 1 | Latent Class, demographics class 2 | Latent Class, ideology class 1 | Latent Class, ideology class 2 | For transfer (when shifters=0) |
| SBC reduct. (dollars/ton) | 47 | 61 | 64 | 35 | 56 | 28 | 49 ^a |
| MRS(cbn jobs, grn jobs) @ mix now | 1.72 (-21, 3.64) | 1.27 (.51, 2.03) | .90 (.33, 1.46) | 6.81 (-24.9, 38.53) | 1.01 (.37, 1.66) | 2.20 (-5.42, 9.83) | 1.56 (-.03, 3.15) |
| MWTP(1=Any program) | 73 (1.53, 144) | 48 (-12, 108) | 284 (199, 369) | -75 (-134, -17) | 253 (187, 320) | -107 (-183, -31) | 70 (4.17, 135) |
| MWTP(Prop change in C emissions) | -153 (-238, -67) | -196 (-264, -127) | -205 (-294, -117) | -115 (-178, -51) | -182 (-254, -110) | -89 (-165, -13) | -157 (-236, -78) |
| MWTP(Prop change in carbon jobs) | 466 (169, 763) | 547 (341, 753) | 626 (327, 925) | 277 (45, 510) | 527 (285, 770) | 154 (-104, 412) | 447 (174, 720) |
| MWTP(Prop change in green jobs) | 307 (12, 603) | 488 (253, 724) | 789 (389, 1190) | 46 (-165, 257) | 589 (295, 884) | 79 (-155, 313) | 325 (47, 603) |
| MWTP(Share of permits auctioned) | 11 (-63, 86) | -3.91 (-49, 42) | -5.64 (-84, 72) | 12 (-42, 65) | 1.47 (-62, 65) | 19 (-41, 79) | 9.32 (-60, 78) |
| MWTP(Share of rev. for equip.) | -67 (-149, 16) | -36 (-88, 17) | -7.8 (-92, 76) | -42 (-104, 20) | -22 (-91, 48) | -17 (-95, 61) | -47 (-124, 30) |
| MWTP(Share of rev. to workers) | 55 (-26, 137) | 64 (2.97, 124) | 68 (-19, 155) | 53 (-6.62, 113) | 58 (-12, 129) | 61 (-8.38, 131) | 54 (-22, 129) |
| MWTP(1=New regs other pollut.) | 60 (25, 96) | 60 (36, 85) | 62 (25, 99) | 35 (9.9, 61) | 53 (23, 83) | 29 (-2.38, 60) | 54 (21, 86) |

Notes: Auction-related attributes did not tend to bear statistically significant coefficients, so we do not report their MWTP.

^aDepends on factors affecting MU(C emissions). ^bInterval estimates for this latent class model pending re-calculation. ^cA simple sign change converts MWTP for the status quo option, regardless of the attributes of the proposed program, into the corresponding MWTP for "Any program".

^dHeterogeneous across counties with different characteristics, so we do not report any single value.

ONLINE SUPPLEMENTARY MATERIALS

to accompany:

Public preferences for a state-level carbon cap-and-trade program

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A Appendix: Expanded Discussion of the Related Literature

A.1 Context

While the United States has yet to adopt a federal carbon cap-and-trade program, regional carbon cap-and-trade programs have been adopted (Schmalensee and Stavins (2017)). Federal inaction may necessitate that regional coalitions and states to implement policies (Fullerton and Karney (2018); Peterson and Rose (2006)). Recently, Oregon attempted twice to adopt a carbon cap-and-trade program. In June of 2019, Oregon’s eleven Republican senators fled the state, preventing the passage of HB-2020, Oregon’s carbon “cap-and-trade” bill. In spring of 2020, SB-1530, the proposed Oregon cap-and-trade program that was modified to be more palatable to rural Oregonians. Despite the modifications, like its predecessor, SB-1530 was again boycotted by Republicans and defeated. Despite substantial support for a carbon tax amongst economists (e.g., Metcalf (2009)), Oregon has been unable to pass legislation for a carbon cap-and-trade program. Oregon’s attempts and (current) failure to create such a program highlights the complicated and contentious political, environmental, and social intersection concerning environmental regulation. Successful passage of a carbon cap-and-trade in Oregon relies on understanding preferences for a number of key program attributes.

A.2 Cap-and-Trade Attributes

Careful consideration was involved in the selection of program attributes to include for the carbon cap-and-trade programs we featured in our survey.³¹ We ultimately chose to include nine total attributes for each program, which is clearly not an exhaustive list. It is typically necessary for choice experiments to avoid making unreasonable demands on the cognitive capacity of respon-

³¹The attributes included are: the level of carbon emission reduction, the program’s impact on carbon-industry and green-industry jobs, the financial cost of the program to households, the program’s permit allocation system, the use of permit auction revenue, and the program’s inclusion of additional regulations. To see more details about our own survey instrument, see Appendix B and Appendix C.

dents. So our featured attributes were selected based on their importance to policy makers as well as the public. We will discuss briefly our motivation for including each feature, with the exception of the emissions reduction achieved (which seems self-explanatory).

A.2.1 Jobs

Perhaps the biggest political impediment for carbon cap-and-trade programs, as for other environmental regulations, has been their potential adverse effects on the economy—namely eliminating jobs in certain industries (Coglianese et al. (2013)). Paramount to successful and equitable implementation of regulatory policy is ensuring that workers and communities are protected in the transition to a greener economy (Look et al. (2021)). However, despite the political clamor about job losses, there has been relatively little systematic evidence that significant job losses accompany carbon pricing.³² Several studies have found a significant negative impact of environmental regulation on jobs, but the authors still argue in these cases that the benefits of the regulations (e.g. the Clean Air Act) have greatly outweighed the costs.³³ A common finding for studies that identify job losses (e.g. Yamazaki (2017); Hafstead and Williams (2018)) is that the job losses occur in regulated sectors and are often accompanied by new jobs in clean industries. However, it should be stressed that it is difficult to assess substitutability among different types of jobs. Even in instances where job losses in some sectors are offset by job gains in other sectors, there can still be significant welfare impacts (Reed Walker (2013); ? Sovacool et al, 2021). Whether warranted or not, concerns about displaced workers remain a key obstacle to public acceptance of carbon emission regulations.³⁴

³²See Berman and Bui (2001), Deschênes (2012), Gray et al. (2014), Liu et al. (2021), Morgenstern et al. (2002), Sheriff et al. (2019), and Yamazaki (2017).

³³See Bartik (2013), Greenstone (2002), Reed Walker (2013)

³⁴Some authors have questioned the validity of findings that show an impact of regulations on employment (? Belova et al, 2015; ? Hafstead and Williams, 2019). For example, inappropriate modeling assumptions common to most earlier research could lead to biased results (Hafstead et al. (2018); Hafstead and Williams (2018)).

A.2.2 Costs

Cap-and-trade programs are largely popular because of their promise of efficiency. However, the system's inattention to distributional impacts have been a source of considerable concern.³⁵ Fullerton (2011) points out that there are a number of ways in which distributional inequities can result from cap-and-trade programs. The most obvious is the upward pressure that cap-and-trade programs put on prices for carbon-intensive products. If the burden of these higher prices falls disproportionately on lower-income households, then the policy is considered regressive. This burden could be a result of lower-income households consuming relatively more carbon-intensive products (e.g. electric cars remain expensive) than higher-income households. Likewise, lower-income households may spend a larger portion of their income on carbon-intensive products (e.g. electricity bills). There is substantial evidence that carbon-pricing policies are regressive³⁶. However, there is also evidence for carbon pricing policies being progressive.^{37 38} In any case, properly addressing the issue of a regressive carbon pricing scheme is challenging because of the distributional effects vary widely across communities and contexts³⁹. Conditional on the need for climate policy, it is possible that market mechanisms, while regressive, could be less regressive than other approaches to carbon management (e.g., see Borenstein and Davis (2016)).

³⁵See (Buchs et al, 2011); Deryugina et al. (2019); Dorband et al. (2019); Farber (2012); Feger and Radulescu (2020); Fullerton and Muehlegger (2019); ? Goudler et al, 2019[?]; Pizer and Sexton (2019); Shammin and Bullard (2009); Wang et al. (2016); Williams et al. (2014) Williams et al, 2015)[?]

³⁶See Bento (2013), Buchs Barsely and Duwe, 2013; Burtraw et al. (2009); da Silva Freitas et al. (2016); Grainger and Kolstad (2010); Kolstad (2014), Jorgenson et al. (2013) Mathur and Morris (2014); Moz-Christofoletti and Pereda (2021); Wier et al. (2005)

³⁷Ohlendorf et al. (2021) point out that, even in the case of a progressive policy, higher consumer prices still increase the risk of poverty for low-income households.

³⁸See Beck et al. (2015); Cronin et al. (2019); Dorband et al. (2019); and Devarajan (2013).

³⁹(See Rausch et al. (2011); Ohlendorf et al. (2021); Fullerton et al. (2012); Pashardes et al. (2014); Fischer and Pizer (2019); Dorband et al. (2019); Pizer et al. (2010); Jorgenson et al. (2013); Pizer and Sexton (2019); and Burtraw et al. (2009)

A.2.3 Permit Allocation

Permit allocation has proven itself to be one of the key design features cap-and-trade programs.⁴⁰ Emission permits are allocated either based on historical output, through a government-coordinate auction, or a combination of the two Fischer and Fox (2007) [?](Fischer and Fox, 2007). The benefit of basing permit allocation on historical output is primarily attributed to improving political feasibility and reducing the economic burden on firms. However, there is considerable criticism of this allocation system. ([?][Huber 2013], Vesterdal and Svendsen (2004) and Mackenzie et al. (2008)). While politically less-palatable, permit auctioning is argued to be the welfare improving option (Cramton and Kerr (2002), Betz et al. (2010), [?] [Belifiori, 2017], and Farber (2012).)

A.2.4 Permit auction revenue use

A decision for the government to auction emission permits will lead to a new source of revenue for the government. This revenue could be recycled to ameliorate the distributional issues.⁴¹ Three particular uses are modeled in this study: subsidizing emission-reducing equipment for firms and households, financing adversely affected workers and communities transition, and reducing state taxes. Research has found that revenue recycling and providing the public with tangible public benefits could significantly improve support for carbon pricing (Amdur et al. (2014); Beiser-McGrath and Bernauer (2019); Raymond (2019)). One caveat to this work is noted by [??] Sallee (2019), who argues that using revenue recycling cannot achieve a Pareto improvement.

⁴⁰Price collars and permit banking are also important considerations of the permit system (Fell et al. (2012), Fuss et al. (2018), Metcalf (2009), Murray et al. (2009), Hasegawa and Salant (2015), Burtraw et al. (2005), and Metcalf (2009))

⁴¹See Boyce (2018); [??] Buchs Barsely and Duwe, 2013; [??] Metcalf 2008; Dinan and Rogers (2002); Wang et al. (2016); Bento (2013); Goulder et al. (2019); Farber (2012); [??]Williams et al 2015; Parry and Williams (2013); Feger and Radulescu (2020); Grainger and Kolstad (2010); Moz-Christofoletti and Pereda (2021); Aubert and Chiroleu-Assouline (2019); Pizer and Sexton (2019).

A.2.5 Additional Regulations

Climate Change's impacts epitomize the issues of the environmental justice movement.⁴² However, despite being one type of a climate change mitigation policy, carbon cap-and-trade programs also raise environmental justice concerns (Farber (2012), Fowlie et al. (2020), Kaswan (2008)). The primary concern is that a market-based system will inevitably lead to a disproportionate accumulation pollution (i.e., "hotspots") in marginalized communities, while the benefits of the program are enjoyed by higher-income and more-empowered communities (Fowlie and Muller (2019)). Research has turned up little evidence to substantiate this concern (Anderson et al. (2018), Corburn (2001), Farber (2012), Fowlie et al. (2012), and Fowlie et al. (2020)). Hernandez-Cortes and Meng (2020) used a dispersion model and find that, under California's carbon cap-and-trade program, environmental equity has actually improved.⁴³ One hypothesis is that the dirtiest places are also the cheapest to clean up (Currie et al. (2020)). On the other hand, Grainger and Ruangmas (2018), contrary to Hernandez-Cortes and Meng (2020), use a dispersion model to demonstrate that low-income communities have been exposed to more pollution. [??] Chan and Morrow (2019) find, however, that under the Regional Greenhouse Gas Initiative in the northeastern United States, electricity generation has shifted relatively towards areas with higher marginal damages from SO_2 emissions. Some argue that carbon cap-and-trade programs are not the tool to address other pollutants and should only be relied upon only to address carbon emissions (e.g., Fowlie et al. (2020); Dulaney et al. (2017)). Like other distributional issues, others contend that despite their challenges, properly designed cap-and-trade programs can mitigate most threats that these programs pose to environmental justice (e.g. Farber (2012); Kaswan (2008)).

⁴²Mohai et al. (2009) give an excellent overview of Environmental Justice and Banzhaf et al. (2019) provide another good overview more specifically prepared for economists.

⁴³Shapiro and Walker (2021) similarly find that offsets do not seem to have created hotspots in California in relation to race or class.

A.3 Political Obstacles

Notwithstanding the considerable economic challenges of designing an optimal carbon cap-and-trade program, perhaps the biggest impediment to policy adoption in the United States is political obstacles (Goulder and Parry (2008); [??]Jenkins, 2014; Klenert et al. (2018)). And at the end of the day, a policy's economic implications are irrelevant if the policy is not passed by lawmakers. Indeed, economic analysis of environmental regulations frequently has little bearing on political popularity (Gillingham et al. (2018)). In part, this is due to compromised government integrity (Baranzini and Carattini (2017); Convery and Redmond (2013)). However, the primary reason carbon cap-and-trade programs and other carbon pricing policies remain largely politically infeasible is due to the public's lack of support (Levi et al. (2020)).

Public support for a policy is highly dependent on the narrative surrounding the policy, as well as the framing of the policy (Alló and Loureiro (2014); Carattini et al. (2018); Bilandzic et al. (2017), Bushell et al. (2017); Dickinson et al. (2013); Terzi (2020)). A considerable amount of effort on the part of energy-intensive corporations has gone toward fostering opposition to climate-change-related policies through misinformation campaigns (Egan and Mullin (2017), Farrell (2016), Westervelt (2018)). Additionally, conservative regulation-opposing politicians have used public concerns about the economy to establish an anti-environmental regulation narrative (Coglianese et al. (2013); Egan and Mullin (2017)). The effects of these campaigns can be seen in research which reveals that the more people understand the impacts of climate change, the more they are willing to participate in (or bear the costs of) climate-change mitigation measures (Bord et al. (2000); Videras et al. (2012), Spence et al. (2011), Scannell and Gifford (2013), and Bain et al. (2012)).

In the United States, political party affiliation is often the primary determinant in attitudes about climate change and mitigation policies. A review of climate change opinion surveys in the United States finds that not only is partisanship the paramount driver in support for policy, but that the gap between the Republicans and Democrats has become even more pronounced in recent

years (Egan and Mullin (2017)). This assessment has been corroborated using revealed preference studies as well. For example, Anderson et al. (2019) use voting data from two failed carbon tax bills in Washington State and find that political party affiliation is by far the biggest indicator of support or opposition to the policies. In their study, political ideology accounts for 91% of the variation in vote shares across precincts.

B Appendix: Structure of the Survey

B.1 Demographic Questions for Screening

The first section of the survey collects five basic pieces of information about the respondent: place of residence (state), age, gender, race, and income. A sixth question asks the respondent to report their Oregon zip code. Their response is cross-referenced against an exhaustive list of Oregon's residential zip codes. What we call "Demographic Questions for Screening," serves multiple essential purposes.

First, in order to measure heterogeneous willingness to pay (WTP) measures across demographics it is essential that we in fact know what are those demographics.

Second, we would like our 1000 observations to be as representative of Oregon, at least on those five categories, as possible. If the respondent answers the six questions (e.g. *White male, age 25-34, with income \$20,000 - \$24,999 a year, and lives in the zip code 97219*) and we observe that we already have "enough" respondents fitting that description, then we excuse the respondent from the rest of the survey.

Finally, the preliminary demographic section allows for sample selection correction. Before any information alluding to the content of the survey is revealed (i.e. that the survey is asking about WTP for a carbon cap-and-trade program), the respondent must answer those five basic questions. If the respondent chooses "Prefer not to say" for any of the categories then they are excused from the survey. If the respondent answers the demographic questions and we deem them eligible for the survey (see the second point above) then we introduce the topic of the survey. At this point, some respondents will drop out of the survey. However, because we have already gathered the demographic information about these dropouts we are able to observe what relationship, if any, exists between willingness to take the survey and the aforementioned demographic characteristics. In other words, we are able to observe if sample selection is occurring and correct for it.⁴⁴

⁴⁴See **Appendix ??** for explanation of the selection correction procedure.

B.2 Intro Questions

After completing the initial demographic information, the respondent is sent to the “Basic Information and Consent” page. It is at this point that the topic of the survey is revealed. The respondent is asked to consent to taking the survey. A followup question asks the respondent to confirm that they will provide “thoughtful and honest answers” as recommended by Johnston et al (2017). A “No” to either of these questions results in termination of the survey.

B.3 Background Information

The next section of the survey provides the respondents with some basic information that is relevant to carbon cap-and-trade (CAT) programs. We begin with a brief explanation of climate change, carbon emissions, and the relationship between the two. We then explain the motivation of understanding Oregonians’ preferences concerning a CAT program. Namely, that Oregon legislators have attempted to pass a CAT in Oregon but have failed to do so in large part because specifics of the program were not agreeable. At this point we briefly explain the mechanics of a CAT. The respondent is then prompted with “How familiar are you with carbon cap and trade programs?” The respondent receives more information about how a CAT works if they answer “I should probably review the basics” or “Not familiar at all.” The respondent skips this further explanation if they answer “Quite familiar.” After the explaining the broad strokes of CAT programs, the survey elucidates which companies will likely be targeted in Oregon. While we cannot know what form policy will take in reality, it is important that the respondents have a similar idea of who is regulated while answering the survey. Because the hypothetical CAT programs our survey asks respondents to make choices about include specific rules about permits⁴⁵ we provide a cursory explanation of permits that complements the earlier explanation of carbon cap-and-trade programs. The respondents are able to pursue a more detailed explanation of permits if they feel inclined. The more

⁴⁵See **Choice Scenarios** below.

detailed explanation does not include unique information, but rather provides a fuller explanation that might be more accessible should the cursory explanation leave respondents confused. The next two pages of the survey describe respectively penitential benefits (global and local) and costs (to households, to businesses, and concerns about equity). The final page of this section asks the respondent which county they live in. Using that response we are able to scale the values of the choice tasks to the county level the individual respondent lives in.

B.4 Tutorial on Program Attributes

The next section of the survey’s purpose is to prepare respondents for the choice tasks. Each choice task presents a hypothetical program in the form of a table. Due to the complexity of the table it is appropriate to spend some time explaining all the moving pieces of the choice task.⁴⁶ The table is codified into five “Feature Groups”: *Results*, *Carbon Permits*, *rules*, *Auction Revenue Uses*, *Additional Regulations*, and *Cost to your household*. Each group has between 1 and 3 different features for a total of nine program features for respondents to consider. The nine program features are discussed below. The tutorial walks respondents through each feature of the table. A brief explanation of the feature is provided as well as a graphic that helps explain and provides relief from too much text. In addition to the explanation in the tutorial, the respondents are instructed that throughout the choice tasks a abbreviated description of any specific feature can be called up by clicking on that feature in the table. The values used in the tutorial section are the same values used in the first choice task. This is done to minimize mental effort on the respondent’s behalf and to help connect the tutorial with the choice task section. Before the feature-by-feature portion of the tutorial begins, respondents are instructed that the every program displayed in the choice task will begin January 1, 2023. Consequently, the various effects of the program will also begin to accrue January 1, 2023.

⁴⁶Pretesting found that thorough explanation was often necessary to convey the parameters of the hypothetical situation we were asking respondents to consider.

Results

The first feature group, *Results*, has three attributes: Carbon emission reduction, Carbon industry jobs lost, and Green industry jobs gained. The first feature, carbon emission reduction, refers to the percent reduction of total annual carbon emissions in Oregon by the year 2050 (relative to current emission levels). By clicking on a link, respondents are able to observe current emission levels in Oregon, which provides context to the reduction goal.

The next feature is *carbon industry jobs lost*. The value presented in the table is not a percent of jobs lost, but rather a sum (e.g. 2,000 jobs). This sum is based in part on the county that the respondent indicated they lived in earlier in the survey.⁴⁷ The respondents are instructed that they should imagine this job loss would occur over the next 30 years—consistent with the carbon emission reduction by 2050. Respondents are able to see how many current⁴⁸ carbon industry jobs are in the respondent’s own county of residence. Respondents are also shown the total number of carbon industry jobs in Oregon. A link is included that clarifies what the survey means by “carbon industries.”

Green industry jobs gained follows the same format as carbon industry jobs lost with the obvious exception that values are based off of green industry jobs, as defined by the BLS.

Carbon Permits, rules

Carbon Permits, rules has only one feature: Share of permits auctioned. This value indicates the percent of the total cap set by the cap-and-trade program that is auctioned. The respondent is reminded that the rest of the permits are allocated for free. The survey does not specify the allocation process, but examples are provided for respondents who are curious earlier in the survey. Respondents have already been provided with information about permits earlier in the survey, but it is important that respondents clearly understand the costs and benefits of this feature. In the

⁴⁷We take the current level of carbon industry jobs in a county (e.g. 40,000) and then scale that number by a randomly generated percent (e.g. 5%) and present that number (e.g. 2000) as the number of carbon industry jobs lost.

⁴⁸Calculations use data from 2019 for the Bureau of Labor Statistics

pretest, initially testers were often unclear about how this feature worked. The survey includes a detailed visualization of the permit rule system to aid in the explanation.

Auction Revenue Uses

The next feature group is *Auction revenue uses*. One of the primary issues to political feasibility of cap-and-trade programs is concern over some groups (e.g. coal miners or low-income households) being economically devastated by shrinking industries or higher costs of goods. A popular, in theory, way to address this heterogeneous burden is by using the funds from the auctioned permits to target groups or sectors in need of assistance. After consideration, this survey asks respondents to consider three possible ways to spend the auction funds: *fund new equipment*, *support communities/workers*, and *Oregon tax relief*. There are a multitude of other ways this money could be spent, but we found these categories to be a good balance of both encompassing most of the ways as well as specific enough for respondents to be able to consider clearly. The values presented are in percent terms (summing to %100 across the three uses). Because no specific dollar value is given in terms of total money raised by the auction, respondents similarly do not see a specific amount of money being allocated to these three uses.

Fund new equipment refers to revenue spent to partially or entirely subsidize the purchase of emission reducing equipment for firms or households. In practice, the more general label for spending of this nature might be referred to as “funding green projects.” However, that label is fairly vague and we believe that being more specific would result in more thoughtful responses.

Support communities/workers refers to revenue spent on communities or workers in certain industries that bear a relatively heavier burden of the costs of the cap-and-trade program. Often referred to as a *Just Transition*, an essential component of a politically feasible program includes a safety plan for those hurt by the program. Some examples are given, for instance “communities with a lot of carbon-intensive jobs.” However, no specific group is explicitly stated as receiving these funds. Furthermore, the vehicle in which the funds are delivered are also left open-ended.

Oregon tax relief refers to revenue spent on reducing the Oregon state taxes. A considerable amount of literature explores the various intricacies using taxes to counteract the costs of carbon pricing. However, in the survey we keep the idea simple to reduce mental effort on the behalf of the respondent. In short, the higher the value this feature takes on the lower “taxes” will be for Oregonians.

Additional Regulations

Additional Regulations has only one feature *limit other pollutants*. This feature is included ad hoc to address environmental justice concerns about unintended hot spots of carbon emission co-pollutants. Under a standard cap-and-trade program, it is possible that certain firms will actually *increase* emissions and thus increase co-pollutants (e.g. NO_x or $PM_{2.5}$). The *limit other pollutants* feature takes on two values, “YES” and “NO.” Respondents are instructed of the potential issue of unintended co-pollutant hot spots under a carbon cap-and-trade program and then this feature indicates whether some form of “additional regulation” would be part of the program. The details of the regulation are left vague, and in practice there are many ways to address the co-pollutant issue (e.g. pollution standard, trading ratio or zonal trading). However, we believe this approach to be a good compromise of an accessible idea for respondents that addresses a key issue in carbon cap-and-trade programs.

Cost to your household

The final feature of the table is the cost to households in *Dollars per month*. *Dollars per month* is explained as the “average monthly costs *your household* would bear if the program is adopted.” We use the per month unit of time because energy bills, as well as consumption budgets, are frequently considered on a monthly scale. For many households these will be the primary sources of program costs. The respondents are instructed that these costs are unavoidable. A change in energy use or not working in a carbon-intensive industry does not absolve the respondent’s household from incurring the cost.

B.5 Choice Scenarios

Each respondent is asked to perform six choice tasks (Program A through Program F). In each choice task they are presented with a hypothetical program in the form of a table (with the features mentioned above) and asked if they would prefer the program or no program. Each program is identical in display and content with the exception of the values that each feature takes on. To reduce mental effort on behalf of the respondent, Program A uses the values displayed in the program attribute tutorial. The choice is presented as a “vote.” The idea being, it is quite conceivable that a cap-and-trade program could be on a future ballot in Oregon so the survey does its best to replicate that scenario. This is one way in which the survey addresses the cheap talk issue that is common in contingent valuation methodology.

In a preamble to the first program (Program A) the respondents receive a few additional instructions. First, they are told that the labels of the programs (A through F) are arbitrary and have no relation to the quality of the program. The preamble also clearly states that in for any given program the respondent should only consider this program and no program at all. In other words, we do not want respondents voting against, for instance Program C, because they prefer Program B or some other program that they have conjured up in their head. This point is belabored by making the voting choices for each program “Program X to begin January 1, 2023” and “No program at all.” The respondents are instructed that voting against a program is a valid choice and that they should act freely since the researchers will not learn their identity. In an additional effort to address cheap talk respondents are instructed that, “In hypothetical choices such as these, people sometimes do not think carefully enough about what they would have to give up to be able to pay the monthly cost of the program. **Please consider what your household would have to sacrifice, if the proposed cap-and-trade program were adopted.**”. Finally, respondents are reminded that they are able to review explanations for a program feature by clicking on it in the table.

The survey is designed such that the entire program table is visible on a screen—this includes cell-phone screens. We presume that many respondents will use cell-phones to take the survey and

in order to consider all the features of a program the respondent should be able to see them all at the same time. Below each program table the respondent is prompted with, “If Program X were the only program to be put to a vote, I would vote for:” followed by the two aforementioned choices.

After the respondent votes on Program A they are taken to different pages depending on their choice. If the respondent votes for Program A they are sent to the next choice task. If the respondent votes for no program they are asked to indicate from a menu of options all the reasons they voted against the program:

- *Too much emission reduction*
- *Too little emission reduction*
- *The economic impacts were too costly*
- *Did not approve of the auction revenue use*
- *Too many permits were auctioned*
- *Too few permits were auctioned*
- *Did not approve of the Additional Regulations on other pollutants*
- *The benefits of Oregon or the World do not justify ANY cost*
- *Program A did not seem believable*
- *Some other reason*

We are able to deduce from the respondents choices here whether they have valid economic reasons for voting no, or whether their no vote signals scenario rejection.⁴⁹

From this page, people who voted no on Program A are then asked if they would vote for any carbon cap-and-trade program. More specifically they are asked to choose from three options: “I did not like **Program A**, but there might be some type of program, at some cost low enough for me, for which I could possibly vote ‘Yes’”, “Carbon cap-and-trade programs are a BAD idea. The

⁴⁹An example of a valid reason would be “The economic impacts were too costly.” An example of an invalid reason would be “Too little emission reduction.” We consider this an invalid reason, because the alternative to Program A is no emission reduction. So this answer indicates that the respondent is not operating in the framework of the hypothetical scenario.

government should not interfere with the free market. **I would vote “No” for ANY carbon cap-and-trade program!**” and “Something needs to be done about carbon emissions, but **a carbon cap-and-trade program is not the solution.**” If the respondent indicates that there is a program they could conceivably vote for they are sent to the Program B choice task. If at this point the respondent indicates they would not vote for any carbon cap-and-trade program they are skipped through the choice tasks to the next section of the survey—this saves the respondent unnecessary effort. If the respondent indicates that something needs to be done about carbon emissions, but the solution is not cap-and-trade they are sent to a further clarifying page.

If a respondent votes against Program A and indicates that carbon cap-and-trade programs are not the appropriate policy response they are asked if they would prefer a carbon cap-and-trade program to no policy at all. If at this point they indicate that they would prefer a cap-and-trade program to nothing at all they are sent to the Program B choice task. If they are staunchly opposed to cap-and-trade programs they are skipped through the choice tasks. Respondents who end up at this page are asked what policy they would prefer to a cap-and-trade program. This is asked after completing the choices tasks or after being skipped through the choice tasks as determined by their answers.

After completing the choice tasks, respondents are asked to indicate which of the program features were most important to them. For respondents who made it through all choice tasks but voted for no in all six choice tasks, they are asked to explain the reasons they did so. They choose from a menu of options:

- *I am not convinced that climate change is actually happening*
- *Even if climate change is actually happening, I don't believe that anything we do (or don't do) will make any real difference*
- *I don't think Oregon produces enough carbon emissions to matter. Instead, states and countries with more heavy industries should be required to cut back*
- *I would be hurt by the effect of the program on my livelihood or the cost of things I buy*
- *I would be hurt by the effect of the program on the cost of transportation*

- *These choice tasks were just too difficult for me to process*
- *Some other reason (Please specify)*

In this way we are able to gain a better understanding of what features are important to them, despite having no “choices.”

B.6 Follow-up Questions

In the final section of the survey the respondent is asked a series of additional socio-demographic questions. Some of these questions would be quite informative if asked to ask in initial demographic question section. For instance, political ideology and political party affiliation are likely determinants in a respondent’s propensity to dropout of the survey. However, due to IRB restrictions this is not possible.

Years in Oregon

Two questions are asked concerning respondents’ residence in Oregon. First we ask respondents “*How many years have you lived in Oregon*” (with a sliding scale from 0 - 100), and then we follow up with “*How many more years do you expect to keep living in Oregon?*” (with a sliding scale from 0 - 100). These questions are included for two separate purposes. The first is to test the hypothesis: Are people who feel more connected to a geographic area (in this case, Oregon) more likely to support long term environmental policy (in this case, carbon cap-and-trade) in that area? The second purpose of this particular pair of questions is to screen out inattentive/careless respondents and bots. Both can potentially be detected by illogical uses of the sliders—especially when cross-referenced against the age question asked at the beginning of the survey. For instance, bots are often programmed to max out sliders. In this case answering 100 years to both years lived so far and future years lived in Oregon will raise a flag.⁵⁰

⁵⁰A very detailed assessment of invalid responses in an online survey panel was provided by Robert Johnston in a session entitled “Contemporary Guidance for Stated Preference Studies: An Update (roundtable)” at the 2021 Annual Conference of the Society for Benefit-Cost Analysis.

General Socio-demographic Questions

We include a series of additional basic socio-demographic questions. The questions are multiple/single choice, with the inclusion of “Prefer not to say” for each question, unless stated otherwise. We force a response to the questions but a respondent’s choice of “Prefer not to say” does not end the survey for them at this point. The questions in the order that they appear are:

- *What is your ethnicity?*. Choices include: “Hispanic,” “Non-Hispanic,” or “Other.”
- *Which industries provide a significant amount of your household’s income?*. We provide a menu of standard NAICS categories with specifically relevant subsectors broken out separately (e.g. Wood Product Manufacturing and Forestry/Logging are separate categories).
- *Politically, do you consider yourself to be:*. Choices range from “Strongly conservative” to “Strongly liberal.”
- *What political party do you most strongly identify with?*. Choices include: “Republican,” “Democrat,” and “Independent.”
- *What is your highest level of education?*. Choices include: “Less than high school,” “High school graduate,” “Some college,” “Bachelor’s degree,” “Master’s degree,” “Doctoral degree,” and “Trade or technical school.”
- *Which best describes your current employment status?*. Choices include: “Self-employed or small business owner,” “Employee, working full-time,” “Employee, working part-time,” “Not employed, looking for work,” “Not employed, NOT looking for work,” “Retired,” “Disabled, not able to work,” “Full-time student,” “Student with part-time work,” and “Other.”

Attitudes about Climate Change

Respondents are asked a series of questions pertaining to their attitudes about climate change. Recall that in the background information section of the survey climate change was briefly discussed. The survey takes the stance that climate change is real, which can be, unfortunately, read as a political stance by some Americans. It is likely that people willing to participate in the survey will need to have some basic acceptance that climate change is real. However, it is informative to have a more nuanced understanding of respondents' attitudes.

Respondents are prompted with, *Climate change is real, and is a serious threat to humanity.* Response options include: "Strongly agree," "Agree," "Neutral," "Disagree," and "Strongly Disagree." If the respondent selects "Strongly disagree" they are skipped past the remainder of the climate change questions.

If they choose any other option respondents are prompted with, *Climate change is the result of human activity.* Response options include: "Strongly agree," "Agree," "Neutral," "Disagree," and "Strongly Disagree." If the respondent selects "Strongly disagree" or "Disagree" they are skipped past the remainder of the climate change questions.

Finally, respondents are asked, *Who is most responsible for slowing or preventing climate change? (Select all that apply).* Response options include: "Local governments," "The Federal government," "Households," "Companies," "People who are wealthier," "People who are responsible for more emissions," "Other" and "Everyone equally."

Generational Questions

Following the climate change attitude portion of the survey, respondents are then asked two generational questions. First they are asked, *Do you have any of the following? (Check all that apply)* with response options of: "Children," "Grandchildren," "Great-grandchildren," "Other descendants (please specify)," "None of the above," and "Don't know / not sure." They are then asked, *How many generations back can you trace at least some of your ancestors? (Check the greatest number)* with response options ranging from "1 generation (i.e. just your parent(s))" to

“7 or more generations.” The hypothesis is that people who see themselves as being remembered as well as they remember their ancestors might be more concerned about climate change and what they do about it now. While the questions perhaps appear non sequitur, being too direct in testing this hypothesis would potentially lead to social desirability bias.⁵¹

Energy Use Questions

Respondent’s are asked two questions concerning fuel-type. First respondents are asked, *What is the primary fuel you use to heat your dwelling?*. Response options include: “Natural gas,” “Electricity from a conventional power plant,” “Electricity from solar panels or wind power,” “Electricity (unsure about source),” “Wood or wood pellets,” “Passive solar (heated water),” “Other (please specify),” “I don’t heat my dwelling,” and “Don’t know / not sure.” Respondents are also asked to indicate *What are your most common forms of transportation? (Check as many as apply)*. Response options include: “Personal vehicle (gasoline or diesel),” “Personal vehicle (hybrid),” “Personal vehicle (electric),” “Public transportation (bus or train),” “Taxi or ride-sharing (e.g., Uber or Lyft),” “Bicycle,” “Walking,” and “Other (please specify).”

It is likely that a large portion of the average costs to households resulting from a carbon cap-and-trade program will come through the form of higher energy prices. While we have already managed to glean information about respondents’ attitudes concerning higher energy costs it is informative to be able to connect a respondent’s attitude about higher costs and their actual energy use. While in the choice task we instruct respondents to assume costs are unavoidable, it is likely that higher energy costs would be more salient for those that use natural gas to heat their homes or always commute via a personal vehicle.⁵² Energy-type use also helps identify which individuals are willing (and able) to make personal efforts to mitigate climate change. Identifying this

⁵¹ Respondents answer how they would like to be seen rather than how they actually feel. While an online survey format helps mitigate this, a loaded question like, “Do you care about future generations?” could lead to untruthful responses.

⁵² It should also be noted that higher energy costs are also more salient for low-income households, because a larger portion of their income goes towards energy use. Recall, income level is one of the demographic pieces of information that is required in order to be eligible for the survey.

preference is informative in our WTP analysis.

Feedback Questions

We give respondents three separate prompts to provide feedback on the survey. The feedback, in addition to informing future studies, also aids in our data collection.

The first feedback prompt is concerned with research team bias. There are two versions (version A and version B) of the prompt page that are randomly assigned to individual respondents. Both version A and B of the prompt page read, *It seemed like the research team wanted me to:*. The difference in the versions is that the order in which the menu of response choices is inverted from version B. The response choices, in the order that they appear in version A, include: “**definitely vote AGAINST** a carbon cap-and-trade program,” “**probably vote AGAINST** a carbon cap-and-trade program,” “vote **according to my own beliefs**,” “**probably vote FOR** a carbon cap-and-trade program,” and “**definitely vote FOR** a carbon cap-and-trade program.” To reiterate, version B has the same choices but an inverted order. The randomized inversion of the response choices is to test for response order bias from the respondents. An ideal survey would result in all respondents choosing “vote **according to my own beliefs**.” However, non-systematic even distributions “**probably vote AGAINST** a carbon cap-and-trade program,” “vote **according to my own beliefs**,” and “**probably vote FOR** a carbon cap-and-trade program” are also acceptable. It is possible that due to the politically charged nature of climate change and related policies, that simply asking about attitudes toward a carbon cap-and-trade program will lead the respondent to assume the research team is biased in favor of a program.

The second feedback prompt asks the respondent to rate the survey using a five star rating system on four categories: “Understandable,” “Relevant to you,” “Interesting,” and “Informative.” In addition to providing useful feedback to future studies, this prompt also serves two additional purposes. First, low scores, especially for “Understandable,” give us an idea about the quality of a particular respondent’s submission. If a respondent only gives the survey 1 out of 5 stars

for “Understandable” then we know that the choice tasks were likely not performed with full comprehension. Second, this star system provides another chance to draw attention to respondents (or bots) who are speeding through the surveys.

Finally, respondents are given an open-ended prompt for feedback. The primary goal of this prompt is to detect respondents who are speeding through the survey or bots. Bots in particular will often enter gibberish or nonsensical answers. Of course, it is always encouraging to read thoughtful comments from respondents.

C Appendix: One Instance of the Survey (Screenshots)

C.1 State of residence

The screening questions on the first 8 pages of this survey of Qualtrics panelists are completed before the page that contains the Consent to Participate in the actual survey. The Consent page is where the respondent first learns about the topic of the survey. This ordering is crucial to any ability to model systematic response/non-response (attrition from the random sample of Qualtrics panelists). Qualtrics prefers that respondents who are ineligible because quotas have already been met should be apprised of this fact before they get too far into a survey for which their answers are not needed. We require that potential respondents, still naïve about the topic of the survey, should at least be willing to supply their state of residence (always Oregon for this study) their age, gender, race, and household income bracket. These are the quota criteria for inclusion.

However, we also require that they enter their ZIP code at the end of the screening section. Our overall target sample (1000) is not large enough to warrant quotas by ZIP code within Oregon, but we need this information to permit us to link every one of these screened and eligible respondents to external auxiliary data that can be geocoded to ZIP codes. For this climate-related study, these external data sources include Census ZCTA data, NOAA climate division data, 2020 Presidential election data by county, state legislative district voting data for Oregon for 2016, along with spatial data on the recent history of wildfires and drought levels. These neighborhood/county characteristics can be used as proxies for the salience of climate change problems to people who live in the same area as the eligible respondent. The partisan reactions to Oregon's actual proposed carbon cap-and-trade programs in recent years suggests that political ideologies in the respondent's neighborhood may make programs to reduce carbon emissions either very attractive or readily dismissed. For the latter group, we expect a lower likelihood of continuing with the survey to completion, after the topic of the survey is revealed.

[Qualtrics can target Oregon in issuing survey invitations. However, to prevent non-Oregonians](#)

from pretending to be from Oregon, we first check to see whether respondents choose "Oregon" when given an opportunity to choose their state. (If they don't choose Oregon, they are given one opportunity to choose again, and are terminated if they don't choose "Oregon" at least on the second try. The follow-up double-check page is not shown here.)

We need to make sure the set of people who take this survey represents the general population of the relevant states. So first, we need to verify that this study still needs information from more people who are like you.

Select the state where you live:

C.2 Age

What is your age bracket?

Under 18 years

18 to 24 years

25 to 34 years

35 to 44 years

45 to 54 years

55 to 64 years

65 to 74 years

75 years or older

Prefer not to say

C.3 Gender

What is your gender?

Male

Female

Non-binary

Prefer not to say

C.4 Race

What is your race?

White

Black or African-American

Asian

American Indian or Alaska Native

Native Hawaiian or Pacific Islander

Some other race

Prefer not to say

C.5 Household income

In 2020, approximately what was your total annual household income, using these standard income brackets?

Click this blue text for a pop-up that explains [who counts](#) as your household. Click the X in the upper right to close the pop-up, or just click anywhere on the screen outside the pop-up.

- Less than \$20,000
- \$20,000 to \$24,999
- \$25,000 to \$29,999
- \$30,000 to \$49,999
- \$50,000 to \$74,999
- \$75,000 to \$99,999
- \$100,000 to \$124,999
- \$125,000 to \$149,999

- \$150,000 to 174,999
- \$175,000 to \$199,999
- \$200,000 or more
- Prefer not to say

C.6 ZIP code

We validate the respondent's zip code entry by checking it against a list of “standard” Oregon ZIP codes—namely ZIP codes that are not for post-office boxes and are not “unique” (typically for government agencies or other large institutions that have their own internal mail systems). Unique ZIP codes are more likely to be workplaces.

What is the 5-digit Oregon ZIP code **where you live**? (This information will help verify that the set of people who take this survey will represent all regions.)



C.7 Check ZIP code

In the background, this page checks whether the zip code you entered, **97403**, is a valid **neighborhood** ZIP code in Oregon.

Meanwhile, if you are taking this survey on a computer, laptop or larger tablet, please maximize the window.

Click through to see the result for the ZIP code you entered.

C.8 Confirm standard ZIP code

Excellent. The ZIP code you entered, **97403**, appears to be valid neighborhood ZIP code in Oregon

C.9 Consent to Participate

This page is where respondents first learn the topic of the survey. We expect that upon learning that the survey will be about carbon cap-and-trade programs to deal with climate change, some share of respondents to lose interest, while others will find the topic especially salient. The questions asked prior to this page allow us to assemble ZIP-code-level, county-level or other geo-coded variables that can help us identify the respondent's community and how its characteristics may be systematically different than the neighborhoods of other potential respondents who either do, or do not, continue to complete the entire survey.

Basic Information & Consent

Excellent. You have qualified for this study. Now we need to tell you a bit more about the study and get your formal consent to take part.

Study Procedures: Oregon's government has been considering a **carbon cap-and-trade** program in the state. If you are a resident of Oregon, and you decide to participate in this research study, you will be asked to complete a **roughly 15-minute survey** about whether and how Oregon should set up a program like this. (The survey may take longer if you haven't heard much about carbon cap-and-trade and you choose to study more of the optional background information we provide.)

We will first explain a bit about carbon cap-and-trade programs and how such a program might work in Oregon. Next, we will **show you some different versions of programs**. Each time, you will be asked to consider the program and to **vote yes or no**. We will then gather some information that will help us understand how preferences for these programs differ across groups of people.

Questions About this Survey? This survey project is funded by the Department of Economics at the University of Oregon. If you have questions or concerns about this survey, or about the study that will use the data it collects, please contact the research team: Professor Trudy Ann Cameron, (cameron@uoregon.edu), or project manager Garrett Stanford, Ph.D. candidate (gos@uoregon.edu), both at the Department of Economics, University of Oregon, Eugene, OR, 97403-1285.

Questions About the Protection of Research Subjects? The University of Oregon's Research Compliance Services can be reached at researchcompliance@uoregon.edu, or at 541-346-2510.

Participation in this Study is Voluntary. Refusal to participate will involve no penalty or loss of any benefits to which the subject is otherwise entitled, and the subject may discontinue participation at any time.

Are you eligible and willing to be a participant in this study? By clicking Yes, you certify that you are an Oregon resident at least 18 years or older, and you consent to have the information you provide used in this study.

Yes

No

C.10 Oath

We care about the quality of our data. Do you commit to thoughtfully provide your best answers to each question in this survey?

I will provide thoughtful and honest answers

I will not provide thoughtful and honest answers

I can't promise either way

C.11 Introduction to climate change

Climate Change:



2017 Eagle Creek wildfire near Cascade Locks, OR (AP photo: Genna Martin)

Almost all climate scientists now agree that greenhouse gases resulting from human activities are causing Earth's climate to change. They also say that climate change has already begun to cause a variety of problems around the world, including droughts, extreme weather, and wildfires.

However, some people remain unconvinced. Some have doubts about whether climate change is really happening. Others agree that the climate seems to be changing, but they question whether humans are responsible.



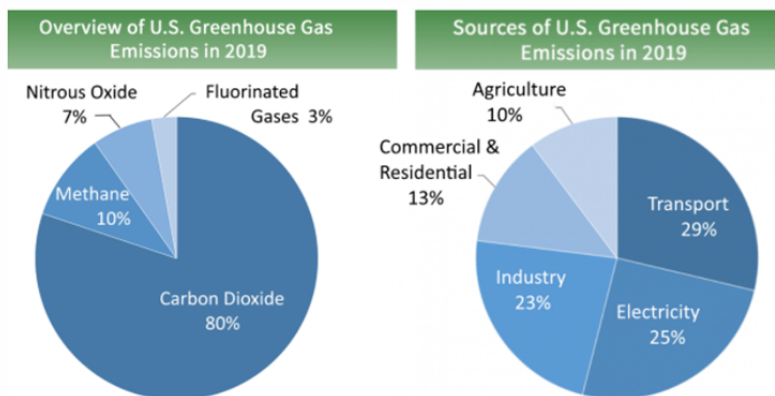
(<https://www.cnn.com/2021/06/10/us/klamath-oregon-drought-water-war/index.html>; photo: Gregg Canes, CNN)

C.12 Introduction to carbon emissions

Carbon Emissions:

The most common greenhouse gas that humans create is **carbon dioxide**. These carbon gas emissions are made when we burn fossil fuels. These fuels power cars, trucks and jets. They include the natural gas that heats our homes, and the coal that some power plants burn to make electricity. Carbon emissions also come from factories and industrial plants.

The following pie charts shows the types and sources of greenhouse gases in the U.S., for 2019, according to the Environmental Protection Agency (EPA):



C.13 Introduction to controversy of cap-and-trade in Oregon

Controversy



Climate activists demonstrate in favor of cap-and-trade bill at Oregon Capitol (Dirk VanderHart photo/OPB)



Loggers and truckers rallying against cap-and-trade bill at Oregon Capitol (Marilyn Deutsch photo @marilyndeutsch)

Twice in recent years, Oregon legislators have considered beginning **carbon cap-and-trade programs**. However, the legislators could not agree on the specifics of the programs. This survey is designed to reveal how different Oregonians feel about a wide variety of possible cap-and-trade programs.

A **carbon cap-and-trade program** is a way to reduce carbon emissions from factories, power plants, and other major sources.

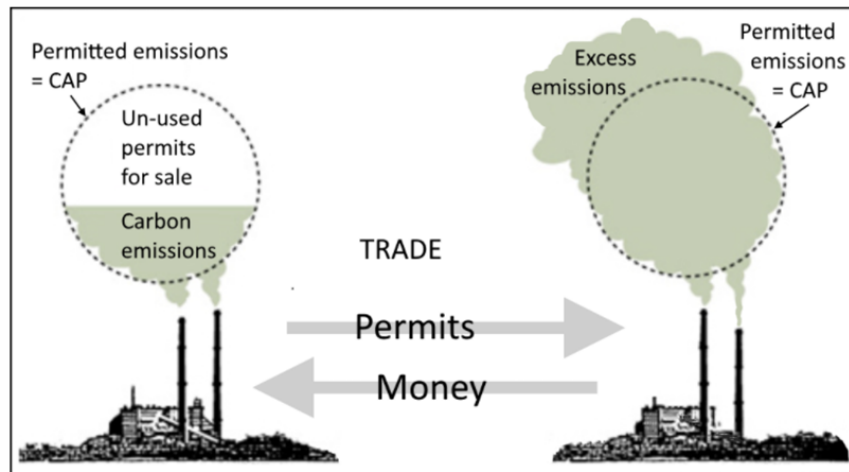
In a cap-and-trade system, the government gives each polluting company some number of permits for carbon emissions. A company's pollution must be less than or equal to the number of permits it has. Each company can decide if they would like to use all their permits themselves, to cover their own carbon emissions, or **trade (sell)** some of their permits to other companies. The company *selling* the permit will get money from the company that *buys* the permit.

How familiar are you with carbon cap and trade programs?

- Quite familiar
- I should probably review the basics
- Not familiar at all

C.14 Introduction to cap-and-trade programs

Cap and Trade



Adapted from image by Ann Carlson, LegalPlanet (UCLA Law), 11/16/11

Here's how a carbon cap-and-trade program works.

- **STEP 1:** The government decides on an overall "cap" on carbon emissions. The cap limits how many total carbon emissions will be allowed across all businesses (companies).
- **STEP 2:** The government gives out permits to businesses. Businesses are allowed to release only the amount of carbon emissions covered by the number of permits they own. The total number of permits given out is equal to the cap decided in Step 1.
- **STEP 3:** Permit holders are allowed to trade! This means businesses will buy and sell permits.
- Over time, steps 1 through 3 are repeated. At intervals, the overall cap is made smaller and smaller so that total carbon emissions become less and less.

Carbon cap-and-trade programs are attractive because they reduce carbon emissions while minimizing the overall burden on businesses. Companies that have a hard time reducing their carbon emissions can buy extra permits from other businesses who can [more cheaply](#) reduce their carbon emissions.

Remember: You can click on most **blue text** for explanations!

Now back to the survey!

C.15 Introduction to program coverage

Which companies are regulated by carbon cap-and-trade?

If Oregon adopts a carbon cap-and-trade program, it must decide which types of companies will be regulated (i.e., which companies will be required to have carbon permits for their carbon emissions). In general, companies that pollute more and create more carbon emissions will be part of the program.



(clockwise from left: utilityproducts.com; oregonlive.com; wsj.com)

It is hard to know exactly which companies will be regulated. However, likely candidates include (but may not be limited to):

- Power plants
- Manufacturing plants
- Transportation companies (airlines, truck lines, train lines etc.)
- Timber and logging companies
- Oil and natural gas companies

C.16 Introduction to program coverage, continued

It is hard to know exactly which companies will be regulated. However, likely candidates include (but may not be limited to):

- Power plants
- Manufacturing plants
- Transportation companies (airlines, truck lines, train lines etc.)
- Timber and logging companies
- Oil and natural gas companies

Thus there are **three** main considerations for permits:

- Share of total permits that will be **sold** at auction (where the rest will be free).
- If some permits are given away for free, **how** are these free permits divided up?
- **What is done** with the money from permit auctions

Learn more about carbon permit auctions

Continue with survey

C.17 Introduction to permit auctions

How many permits will be sold?

When it comes to deciding how many of the total permits the government auctions (sells to companies) it is a balancing act. The **most important thing** to remember is that, in general, **more permits auctioned means more emission reduction and more costs to businesses**. On the flip side, less permits auctioned means less emission reduction and fewer costs to businesses.

Let's think about why this is the case.

1. First, let's consider the situation when all permits are given to companies for free. In this situation, a company will only have to spend money on permits if it wants to buy additional permits from other companies. So in some sense a company can still create emissions for free (as long as it doesn't exceed the permits it was given).
2. Now let's consider the situation when all permits are auctioned to companies. In this situation, a company will have to pay for all of its permits. If a company wants to produce three tones of carbon emissions it must buy three permits from the government or other companies. No more free emissions!

There is a lot of evidence from existing carbon cap-and-trade programs that the more permits that are auctioned the greater the amount of emissions are reduced. However, naturally companies are usually opposed to the government auctioning permits.

In practice, the situations where ALL permits are auctioned or ALL permits are free rarely occur. If you would like to know how free permits can be divided up and what can be done with the money from auctioned permits click "Learn more" below.

Learn more

Back to survey

C.18 Introduction to grandfathering process

How are free permits distributed?

In the case when the government has decided to give permits away for free how many permits companies receive can be complicated and politically tense. It is important to remember that only companies that are regulated (subject to the cap-and-trade program) will receive permits.

There are many ways that the free permits can be distributed. Below are three potential ways:

1. Each company receives an equal share of the permits. For, example, if 10 permits are given away for free and there are 5 companies then each company gets two permits for free.
2. Companies that have traditionally created more carbon emissions receive **more** permits. This is called "Grandfathering" and is designed to reduce costs on businesses while still reducing emissions.
3. Companies that have traditionally created more carbon emissions receive **less** permits. This is called "Reverse Grandfathering" and is designed to put more pressure on the higher polluting plants.

If you would like to know what can be done with the money from auctioned permits click "Learn more" below.

Learn more

Back to survey

C.19 Introduction to revenue distribution

What can be done with permit auction money?

If some carbon emissions permits are auctioned (sold) to companies by the state, then the revenue raised could be used in at least three different ways:

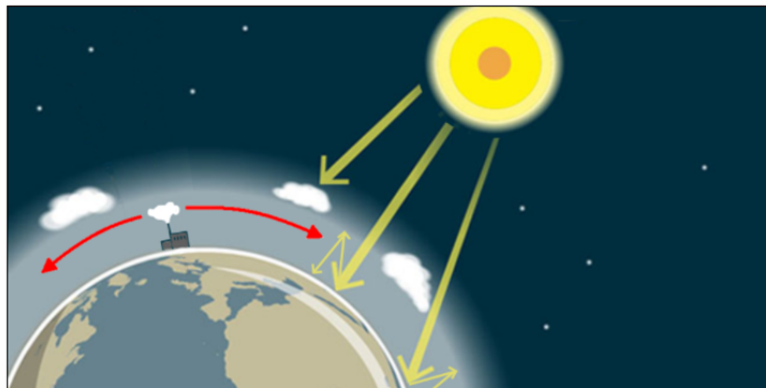
1. To pay for new equipment that will reduce carbon emissions ([Details](#))
2. To support communities and/or workers while they adapt to the cap-and-trade program ([Details](#))
3. To add to Oregon's General Fund, allowing some existing Oregon taxes to be reduced ([Details](#))

C.20 Introduction to benefits of carbon emissions reductions

Benefits of carbon reductions

Global benefits (climate change):

Carbon emissions produced anywhere will spread around the entire globe. So if Oregon reduces its carbon emissions, the **whole world benefits** from less carbon in the atmosphere.



(Image adapted from a British Geological Survey diagram)

The diagram above shows just one factory, in just one location on the globe. The factory's carbon emissions rise into the atmosphere and eventually spread all around the earth (**the red arrows**). Carbon emissions from sources in Oregon do the same thing. When the atmosphere has more carbon dioxide, it holds in more of the sun's heat (**the yellow arrows**).

Regional benefits (other pollutants):

The photo below shows a day in Portland, Oregon, with poor air quality. Sometimes, air pollution in Oregon is due to wildfires burning somewhere in the region. Other times, air pollution comes from factories and vehicles.



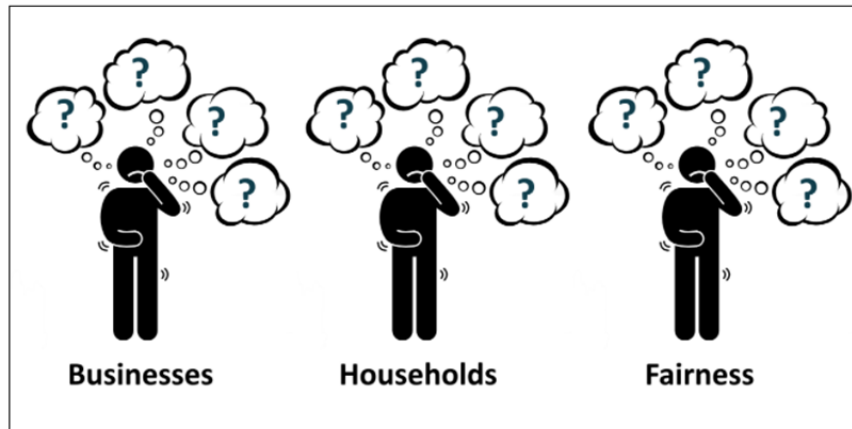
(Photo: Mason Walker, Portland Business Journal blog, 2016)

Depending on how the cap-and-trade program is designed, some benefits could be **received by Oregonians only**. Some types of cap-and-trade programs can:

- Also reduce **other pollutants** that result from the burning of fossil fuels. Burning fossil fuels can harm air quality, as in the picture above. The benefits of reduced air pollution would be felt by communities living close to polluters.
- Provide opportunities for farmers, ranchers, and forest owners to **raise new revenue**.
- Improve Oregon's chances to get a head-start on growing new types of industries (and jobs) in the **green sector**.

C.21 Introduction to possible distributional concerns

Possible concerns



(Adapted from graphic by Gan Khoon Lay)

Alongside the benefits of a carbon cap-and-trade program, some challenges will result from the extra cost of doing business when carbon permits are required.

Challenges for businesses: [higher operating costs](#)

Challenges for households: [more expensive products](#)

Equity and fairness concerns: [unfair burden](#)

These challenges can be lessened by careful program design but they exist nonetheless! Which of these challenges *especially* concern you? (check any that apply)

The burdens on businesses

The burdens on households

Equity and fairness

None of the above

C.22 Oregon county of residence

The respondent selects an Oregon county from the drop-down list provided.

In which Oregon county do you live? We'll describe carbon programs in terms of their effects on people in your area.

Along with each county's name below, we provide that county's population.

C.23 Confirm county of residence

If this confirmation page shows that the respondent checked the wrong county, they get to choose again, after which we just have to assume that they have the right county. This page runs some javascript in the background to associate a variety of county variables with the respondent's own county, and these variables are quoted later in the survey as the effects of each proposed cap-and-trade program are described in quantitative terms.

Your survey questions will be tailored to the county where you live. Your choice on the last page has been recorded as:

Lane County (2019 population = 382,067)

Is this the right county?

Yes

No

C.24 Introduce program summary tables

Policy summaries

Soon, we will ask you to consider some possible carbon cap-and-trade programs for Oregon.

One at a time, we will describe each of six possible programs using compact tables like the one below.

- On the left in [blue](#) are the features of the program. Click on the [blue](#) text in the table at any time for explanations!
- On the right will be the value for each feature

For **every program** you are shown, it would take a while to get things set up. You should assume that **each program would begin January 1, 2023**. In other words, permits will be required for carbon emissions starting January 1, 2023. This means all of the costs and benefits will also begin to accumulate as of January 1, 2023.

This is just an example. **You don't need to do anything yet!**

| Program: | A |
|---|--------|
| Results by 2050: | |
| Carbon emissions reduction | 70% |
| Carbon industry jobs lost | 18,200 |
| Green industry jobs gained | 13,000 |
| Carbon permits, rules: | |
| Share of permits auctioned | 70% |
| Auction revenue uses: | |
| Fund new equipment | 40% |
| Support communities/workers | 60% |
| Oregon tax relief | 0% |
| Additional regulations: | |
| Limit other pollutants | NO |
| Cost to your household: | |
| Dollars per month | \$405 |
| Click blue text for details | A |

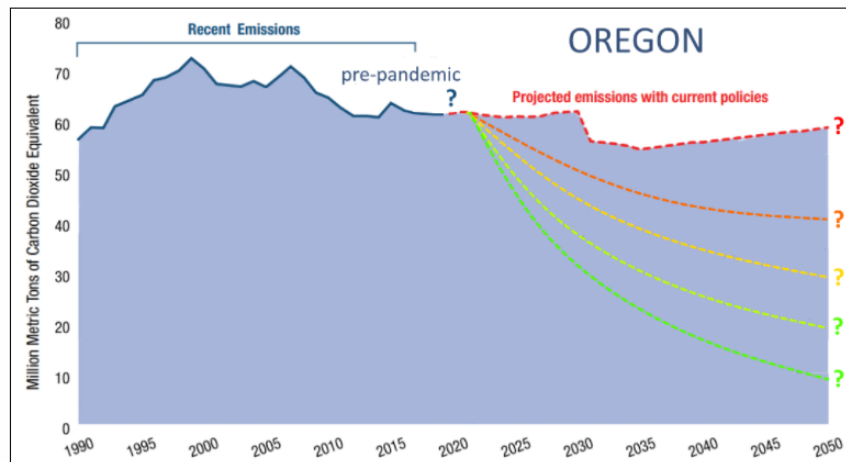
First, we will use the next few screens to explain how to interpret each group of features. Remember, you can click on any feature name for a pop-up window with more information.

C.25 Explain Feature Group 1

FEATURE GROUP 1: Results

The first three rows in the table will give the general environmental and economic effects of the program. Next to each box is the value that will appear for your Program A.

Carbon emissions reduction?



(Adapted from Oregon Department of Energy/Energy in Oregon/Greenhouse Gas Emissions Data)

The row of the table with information about the carbon emissions reduction for the cap-and-trade program will look like this:

| | |
|----------------------------|-----|
| Carbon emissions reduction | 70% |
|----------------------------|-----|

This is the percent reduction of total *annual* carbon emissions in Oregon by the year 2050, relative to Oregon's *current* carbon emissions.

Carbon industry jobs lost?



(The Oregonian, Motoya Nakamura photo)

Lane County had about 79,500 jobs in carbon industries in 2019. Oregon as a whole had about 970,021 carbon industry jobs in 2019.

The row of the table with information about carbon industry jobs will look like this:

| | |
|---------------------------|--------|
| Carbon industry jobs lost | 18,200 |
|---------------------------|--------|

These are the jobs lost in [carbon-intensive industries](#) in **Lane County** in the next 30 years as the economy [adapts](#) to the cap-and-trade program. Nobody knows for certain how many carbon industry jobs will be lost, but the values shown are based on the latest economic research.

Green industry jobs gained?



(The Oregonian, Benjamin Brink photo)

Lane County had about 86,300 jobs in green industries in 2019. Oregon as a whole had about 1,098,486 green industry jobs in 2019.

The row of the table with information about green industry jobs will look like this:

| | |
|----------------------------|--------|
| Green industry jobs gained | 13,000 |
|----------------------------|--------|

These are the jobs gained in **green industries in Lane County** in the next 30 years as companies and households work out **ways to reduce** their carbon emissions. Nobody knows for certain how many green industry jobs will be gained, but the values shown are based on the latest economic research.

[Review full summary table](#)

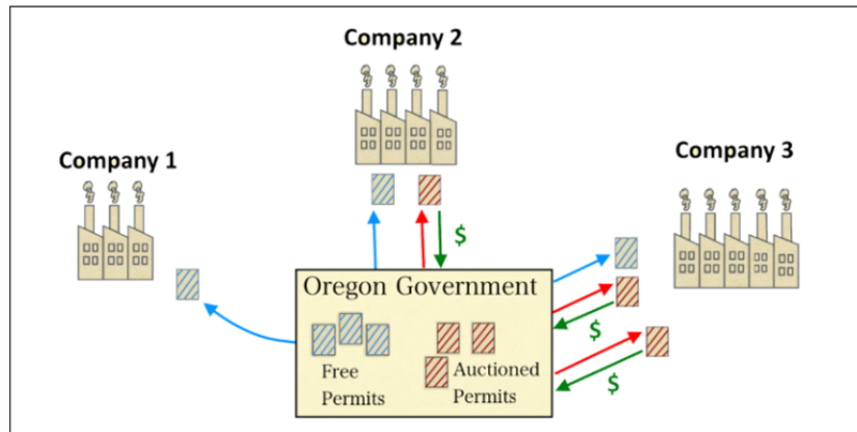
C.26 Explain Feature Group 2

FEATURE GROUP 2: Carbon permits, rules

Companies will try harder to reduce their carbon emissions if they have to pay for permits.

Selling some carbon permits at auction also **raises revenue** that can be used to help companies and workers adapt to a lower-carbon world.

Share of permits auctioned?



The row of the table indicates the percent of total available carbon permits that will be sold to companies at auction:

| | |
|----------------------------|-----|
| Share of permits auctioned | 70% |
|----------------------------|-----|

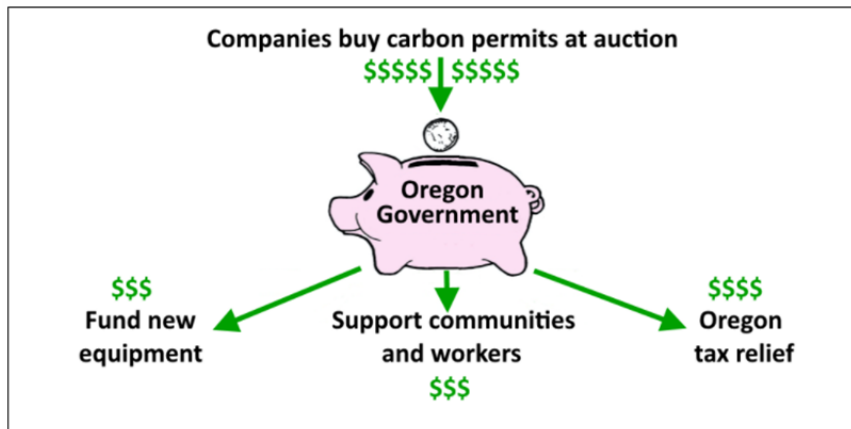
In this case 70% of total available carbon permits will be sold. The rest will be given to participating companies for free, according to a formula based on their past carbon emissions. If companies are unable or unwilling to buy permits, they must get by with only their free permits.

[Review full summary table](#)

C.27 Explain Feature Group 3

FEATURE GROUP 3: Auction revenue uses

How will permit auction revenue be spent?



Three rows in each table describe how money from the carbon permit auction would be spent.

Fund new equipment?

| | |
|--------------------|-----|
| Fund new equipment | 40% |
|--------------------|-----|

Share of permit auction revenue that will be used to help households and companies to buy emission reducing equipment. Such equipment might include an energy efficient washing machine for a family, or more energy efficient machinery for a factory.

Support communities/workers?

| | |
|-----------------------------|-----|
| Support communities/workers | 60% |
|-----------------------------|-----|

Share of revenue that will be used to support communities/workers that bear a relatively heavier burden due to the program's costs. This might include communities with a lot of carbon-intensive jobs, or groups/communities that spend a large proportion of their income on energy for heating or transportation.

Oregon tax relief?

| | |
|-------------------|----|
| Oregon tax relief | 0% |
|-------------------|----|

Share that will go into Oregon's state tax fund. More revenue from permit auctions would allow Oregon to reduce the burden of other existing state taxes paid by Oregon residents.

[Review full summary table](#)

C.28 Explain Feature Group 4

FEATURE 4: Additional Regulations



(Adapted from "Beware of Air" image at nrdc.org)

A cap-and-trade program will reduce **overall** carbon emissions. Many companies will emit less carbon, but permit trading may allow some companies to emit *more*.

Companies that end up producing more carbon emissions may also produce greater amounts of [other pollutants](#).

To protect surrounding communities, a cap-and-trade program may come with additional regulations on these other pollutants.

| | |
|--|----|
| Limit other pollutants | NO |
|--|----|

A **YES** for this feature means that there will be regulations to limit other pollutants to safe levels. A **NO** means that this program includes no additional safeguards against increases in other pollutants.

[Review full summary table](#)

C.29 Explain Feature Group 5

FEATURE 5: Cost to your household



(Images, by row: [dynamicslr.com](#); [spacecoastdaily.com](#); [oregonbusiness.com](#); [ecotextile.com](#))

The last row of the summary table for each cap-and-trade program will give your MONTHLY cost of the program.

| | |
|-------------------|-------|
| Dollars per month | \$405 |
|-------------------|-------|

These are the [unavoidable](#) average monthly costs that *your household* would bear if the program is adopted. These higher costs might result *directly or indirectly* from higher energy prices or from the loss of jobs in carbon-intensive industries.

NOTE: It is possible you *may* see a program or two with VERY high costs in your version of this survey. We don't expect many people to vote for these costly programs.

[Review full summary table](#)

C.30 Program A choice



Program A

This screen is your FIRST chance to vote on a program. You will be asked about six different programs. Their arbitrary labels A through F have nothing to do with the quality of each program.

- Each time you vote, ignore any other programs we may have described elsewhere
- Imagine that the option being offered for each vote is the **ONLY** one available

In any one vote:

- If the program being offered is **better than no program at all**, you should vote “Yes” for the program
- If the monthly cost of the program would be *just too high* for your household or your community—given what it would accomplish and how it would work—you should feel free to vote “No”

Please consider all the features of Program A below, and **vote as if this were a real and secret ballot**. Your actual vote on a secret ballot might be different from the way you would vote if you had to raise your hand in public, and that is OK. We need to know what would happen for a real secret ballot in Oregon. Remember that the research team will not be able to connect your choices to you as an individual.

Remember that **job losses and job gains listed are for Lane County only.**

In hypothetical choices such as these, people sometimes do not think carefully enough about what they would have to give up to be able to pay the monthly cost of the program. **Please consider what your household would have to sacrifice, if the proposed cap-and-trade program were adopted.**

Be sure to consider all the features of a program. If you need to review the explanation for a feature, click on its name (any blue text), then **vote at the bottom of this screen.**

| Program: | A |
|---|--------|
| Results by 2050: | |
| Carbon emissions reduction | 70% |
| Carbon industry jobs lost | 18,200 |
| Green industry jobs gained | 13,000 |
| Carbon permits, rules: | |
| Share of permits auctioned | 70% |
| Auction revenue uses: | |
| Fund new equipment | 40% |
| Support communities/workers | 60% |
| Oregon tax relief | 0% |
| Additional regulations: | |
| Limit other pollutants | NO |
| Cost to your household: | |
| Dollars per month | \$405 |
| Click blue text for details | A |

If Program A were the only program to be put to a vote, I would vote for:

Program A to begin January, 1, 2023

No program at all

C.31 Follow-up to “No” vote: Reasons for vote

Please indicate why you would vote “No program at all” on Program A. Check as many reasons as apply.

Too much emission reduction

Too little emission reduction

The economic impacts were too costly

Did not approve of the auction revenue use

Too many permits were auctioned

Too few permits were auctioned

Did not approve of the Additional Regulations on other pollutants

The benefits of Oregon or the World do not justify ANY cost

Program A did not seem believable

Some other reason

C.32 Follow-up to “No” vote: Will you always vote no?

A cap-and-trade program is not everyone's preferred way to reduce overall carbon emissions. In this survey, we are assuming that the **only alternative** to a cap-and-trade program is **no carbon emission reduction policy**.

I would still vote “No” for ANY carbon cap-and-trade program!

A cap-and-trade program **could be** better than no policy, even though I would rather have some other program for carbon reduction.

C.33 Program B choice

Program B

Now assume that Program A had never been proposed, and instead, that Program B was the only carbon cap-and-trade program under consideration. **Here is your second vote.** Assume that **only Program B is now available.**

Again, vote as if this were a real and secret ballot. If Program B (with its different set of features) would leave you worse off than having no program at all for carbon reduction, you should vote for "No Program".

| Program: B | |
|------------------------------------|----------|
| Results by 2050: | |
| Carbon emissions reduction | 60% |
| Carbon industry jobs lost | 11,200 |
| Green industry jobs gained | 5,200 |
| Carbon permits, rules: | |
| Share of permits auctioned | 30% |
| Auction revenue uses: | |
| Fund new equipment | 60% |
| Support communities/workers | 0% |
| Oregon tax relief | 40% |
| Additional regulations: | |
| Limit other pollutants | YES |
| Cost to your household: | |
| Dollars per month | \$270 |
| <i>Click blue text for details</i> | B |

If Program B were the only program to be put to a vote, I would vote for:

Program B to begin January, 1, 2023

No program at all

C.34 Program C choice

Program C

Now suppose that **neither** Program A nor Program B has been proposed or discussed. Instead, the ballot gives you a choice between **Program C** and **No Program**.

| Program: | C |
|---|--------|
| Results by 2050: | |
| Carbon emissions reduction | 30% |
| Carbon industry jobs lost | 5,600 |
| Green industry jobs gained | 13,800 |
| Carbon permits, rules: | |
| Share of permits auctioned | 10% |
| Auction revenue uses: | |
| Fund new equipment | 10% |
| Support communities/workers | 30% |
| Oregon tax relief | 60% |
| Additional regulations: | |
| Limit other pollutants | NO |
| Cost to your household: | |
| Dollars per month | \$ 80 |
| Click blue text for details | C |

If Program C were the only program to be put to a vote, I would vote for:

Program C to begin January, 1, 2023

No program at all

C.35 Program D choice

Program D

Now erase Programs A, B, and C from your mind. If you were asked to choose instead between just Program D and No Program, how would you vote?

| Program: D | |
|------------------------------------|--------|
| Results by 2050: | |
| Carbon emissions reduction | 60% |
| Carbon industry jobs lost | 11,200 |
| Green industry jobs gained | 13,800 |
| Carbon permits, rules: | |
| Share of permits auctioned | 20% |
| Auction revenue uses: | |
| Fund new equipment | 40% |
| Support communities/workers | 10% |
| Oregon tax relief | 50% |
| Additional regulations: | |
| Limit other pollutants | YES |
| Cost to your household: | |
| Dollars per month | \$180 |
| <i>Click blue text for details</i> | D |

If Program D were the only program to be put to a vote, I would vote for:

Program D to begin January, 1, 2023

No program at all

C.36 Program E choice

Program E

As before, your task on this screen is to decide if you would rather have Program E or no program at all. Assume that Program E, rather than any of the programs on earlier screens, has ended up on the ballot. How would you vote?

| | |
|------------------------------------|----------|
| Program: | E |
| Results by 2050: | |
| Carbon emissions reduction | 80% |
| Carbon industry jobs lost | 12,800 |
| Green industry jobs gained | 19,000 |
| Carbon permits, rules: | |
| Share of permits auctioned | 80% |
| Auction revenue uses: | |
| Fund new equipment | 20% |
| Support communities/workers | 0% |
| Oregon tax relief | 80% |
| Additional regulations: | |
| Limit other pollutants | YES |
| Cost to your household: | |
| Dollars per month | \$325 |
| <i>Click blue text for details</i> | E |

If Program E were the only program to be put to a vote, I would vote for:

Program E to begin January, 1, 2023

No program at all

C.37 Program F choice

Program F

Program F is the final cap-and-trade program we will ask you to consider. Suppose that NONE of the previously offered programs are available. As always, you should feel free to vote "Yes" or "No" on this program, based on whether or not you expect it to make you better off.

| Program: F | |
|--------------------------------|-------|
| Results by 2050: | |
| Carbon emissions reduction | 10% |
| Carbon industry jobs lost | 4,800 |
| Green industry jobs gained | 5,200 |
| Carbon permits, rules: | |
| Share of permits auctioned | 40% |
| Auction revenue uses: | |
| Fund new equipment | 60% |
| Support communities/workers | 30% |
| Oregon tax relief | 10% |
| Additional regulations: | |
| Limit other pollutants | NO |
| Cost to your household: | |
| Dollars per month | \$ 75 |
| Click blue text for details | F |

If Program F were the only program to be put to a vote, I would vote for:

Program F to begin January, 1, 2023

No program at all

C.38 Follow-up to “No” vote

For any of Program A through Program F, if the respondent votes “No” on that program, the survey follows up with the list shown on this page, of potential reasons for voting against these programs. We opted to show this follow-up question only in association with Program F, to avoid repeating the identical screenshot every time.

Please indicate why you would vote “No program at all” on Program F.

Exactly the same reasons why I voted against any previous Programs

Too much emission reduction

Too little emission reduction

The economic impacts were too costly

Did not approve of the auction revenue use

Too many permits were auctioned

Too few permits were auctioned

Did not approve of the Additional Regulations on other pollutants

The benefits of Oregon or the World do not justify ANY cost

Program F did not seem believable

Some other reason

C.39 Preferences for policies other than cap-and-trade

You indicated earlier that you would prefer another type of policy to cap-and-trade when it comes to addressing carbon emissions. What type of policy would you prefer? (Check all that apply)

- A tax on carbon emissions
- Carbon emissions standards (i.e., rules for maximum carbon emissions)
- Technology standards (i.e., rules about carbon-reducing technologies that must be installed)
- A subsidy for carbon emissions reductions (i.e. the government offers money if carbon-emissions are reduced)
- Not sure / Don't know
- Other (Please specify)

C.40 Most important attributes

Think back over all of your program choices. Which program features did you find were **the most important to you**? Select as many as apply.

- Carbon emissions reduction by 2050
- Carbon industry jobs lost
- Green industry jobs gained
- Share of carbon permits auctioned
- Use of auction revenue to fund new equipment
- Use of auction revenue to support communities/workers
- Use of auction revenue for Oregon tax relief
- Additional regulations to limit other pollutants
- Cost of the program to your household
- None of these features were important to me

C.41 Attachment to Oregon

How many years have you lived in Oregon? (Move the slider)

0 10 20 30 40 50 60 70 80 90 100



How many more years do you expect to keep living in Oregon? (Move the slider)

0 10 20 30 40 50 60 70 80 90 100



C.42 Ethnicity

What is your ethnicity?

Hispanic

Non-Hispanic

Other

Prefer not to say

C.43 Sectors providing household income

Which of these industries provides a significant amount of your household's income, either **directly** (through wages and/or business income) or **indirectly** (through pension and/or investment income)? (choose all that apply)

- My household depends on income from investments that are broadly diversified across most of these industries
- Accommodation and Food Services
- Administrative and Support and Waste Management and Remediation Services
- Agriculture, Fishing and Hunting
- Arts, Entertainment, and Recreation
- Construction
- Educational Services
- Finance and Insurance
- Forestry and Logging
- Health Care and Social Assistance
- Information
- Management of Companies and Enterprises
- Mining, Quarrying, and Oil and Gas Extraction
- Other Manufacturing
- Other Services, except Public Administration
- Professional, Scientific, and Technical Services
- Public Administration
- Real Estate and Rental and Leasing
- Retail Trade
- Truck Transportation
- Utilities

C.44 Political ideology

Politically, do you consider yourself to be:

Strongly conservative

Somewhat conservative

Moderate

Somewhat liberal

Strongly liberal

Prefer not to say

C.45 Political party identification

Which political party do you most strongly identify with?

Republican

Democrat

Independent

C.46 Educational Attainment

What is your highest level of education?

Less than high school

High school graduate

Some college

Bachelor's degree

Master's degree

Doctoral degree

Trade or technical school

Prefer not to say

C.47 Employment status

Which best describes your current employment status?

- Self-employed or small business owner
- Employee, working full-time
- Employee, working part-time
- Not employed, looking for work
- Not employed, NOT looking for work
- Retired
- Disabled, not able to work
- Full-time student
- Student with part-time work
- Other
- Prefer not to say

C.48 Attitude: climate change real and serious

"Climate change is real, and is a serious threat to humanity."

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

C.49 Attitude: climate change human-caused

"Climate change is the result of human activity."

Strongly Agree

Agree

Neutral

Disagree

Strongly disagree

C.50 Attitude: responsibility to fix climate

Who is most responsible for slowing or preventing climate change? (Select all that apply)

Local governments

The Federal government

Households

Companies

People who are wealthier

People who are responsible for more emissions

Other

Everyone equally

No one in particular

Don't know / not sure

C.51 Inter-generational concern: descendants

Do you have any of the following? (Check all that apply)

Children

Grandchildren

Great-grandchildren

Other descendants (please specify)

None of the above

Don't know / not sure

C.52 Inter-generational concern: ancestors

How many generations back can you trace at least some of your ancestors?
(Check the greatest number)

1 generation (i.e., just your parent(s))

2 generations (i.e. your grandparent(s))

3 generations (i.e., your great-grandparent(s))

4 generations

5 generations

6 generations

7 or more generations

Don't know / not sure

C.53 Primary heating fuel used

What is the primary fuel you use to heat your dwelling?

- Natural gas
- Electricity from a conventional power plant
- Electricity from solar panels or wind power
- Electricity (unsure about source)
- Wood or wood pellets
- Passive solar (heated water)
- Other (please specify)

- I don't heat my dwelling
- Don't know / not sure

C.54 Usual forms of transportation

What are your most common forms of transportation? (Check as many as apply)

- Personal vehicle (gasoline or diesel)
- Personal vehicle (hybrid fuel)
- Personal vehicle (electric)
- Public transportation (bus or train)
- Taxi or ride-sharing (e.g., Uber or Lyft)
- Bicycle
- Walking
- Other (Please specify)

- Prefer not to say

C.55 Perception of researcher bias

This question about research bias was randomly presented in one of two orders for the answers. Half of respondents saw a list that put “definitely vote FOR a carbon cap-and-trade program” at the top. The other half saw the same list, but in reverse order. This is intended to minimize any systematic order effects if the order is not included as an explanatory variable.

It seemed like the research team wanted me to:

- definitely vote **FOR** a carbon cap-and-trade program
- probably vote **FOR** a carbon cap-and-trade program
- vote **according to my own beliefs**
- probably vote **AGAINST** a carbon cap-and-trade program
- definitely vote **AGAINST** a carbon cap-and-trade program

C.56 Attitude: Respondent’s experience with survey

Please rate the survey you just took (type a number between 1 and 5 in each box):

| | |
|-----------------|----------------------|
| Understandable | <input type="text"/> |
| Relevant to you | <input type="text"/> |
| Interesting | <input type="text"/> |
| Informative | <input type="text"/> |

C.57 Feedback text message

Thank you for sharing your opinions about different types of carbon cap-and-trade programs. If you wish, please provide some feedback before you go:

D Appendix: Selection Model and Selection Correction

For this paper, we correct for sample selection in terms of the willingness of individuals to complete a carbon cap-and-trade survey. However, another potential type of sample selection remains unavoidable: people who are willing to take an (internet) survey upon an invitation from Qualtrics may not be representative of the general population. While this other form of sample selection is perhaps of lesser concern, it exists nonetheless for every consumer research panel and is difficult to address.

D.1 Variable Selection

D.1.1 Inventory of candidate explanatory variables

To correct for sample selection, we use a probit model to estimate an invited participants propensity to complete the survey. We have relatively little information for every invited participant beyond their age, sex, race and income, but we also elicited the ZIP code where they live (prior to these potential respondents learning the topic of our survey). Thus, for a large share of these invited participants, we can merge in ZIP-code-level neighborhood characteristics as potential determinants of their interest in participating in a survey about climate policy.

When creating the zip-code-level profiles, we cast a wide net to find candidate explanatory variables. The external data sets we employed to create profiles of each respondent's neighborhood include: the American Community Survey 5-year ZCTA-level data (2014-2019), the MIT Election Data and Science Lab's County Presidential Election Returns (2020), Oregon State Office Returns for 2016 state legislative district votes (by major party), drought data from National Drought Mitigation Center, and wildfire data from Wildland Fire Decision Support System. We create population proportion sociodemographics (e.g. share of the population for each ZIP code that has access to the internet) as well as a number of climate-related statistics for each zip code (e.g. Drought Monitor rating, or distance to the nearest wildfire in 2020). The zip-code-level pro-

files are constructed to capture political ideologies, salience of climate change, and other sociodemographics that we hypothesize may impact each potential respondent's propensity to continue with the survey, to completion, after learning its topic.

It is not feasible to include, simultaneously, the full set of variables (self-reported screening sociodemographic variables from the survey and all the available zip code variables, and their interactions) in a single probit model. This is far too large a list of variables, given that we have only 1630 invited participants and 1050 completed survey questionnaires. Thus we resort to LASSO methods, in R, to pair down the list of potentially useful explanatory variables. We use all of our available data from panelist profiles (gender, age, race, and income bracket) as well as all our assembled geo-coded data linked to each invited participant by their zip code (where zip code is available), as potential regressors for our selection model.⁵³

If a respondent drops out of the survey at any point after the consent page, they are considered non-respondents and get the value of 0 for the indicator variable *Got to end of survey*. In addition to being zero for cases of attrition, the variable *Got to end of survey* will take on the value of 0 if the survey response is deemed to be of insufficient quality (e.g. where the respondent gave non-sense answers to questions that required a typed response, or when the total time to complete the survey was too little to have permitted anyone to have read the questions with sufficient attention to provide an informed response (i.e. less than 7.5 minutes to complete the survey)).

Complete, the dependent variable for the LASSO equation, is a binary indicator variable that takes on the value of 0 if the respondent does not complete the survey or if they complete the survey in less than 7.5 minutes. Our response rate, $\frac{\text{complete surveys}}{\text{total surveys}}$, is 64%.⁵⁵

Table D1 shows the descriptive statistics for the available explanatory variables that LASSO methods determine to be relevant in predicting people's propensities to respond to the survey. The

⁵³We conduct our LASSO estimation using the "glmnet" package as implemented in R.⁵⁴

⁵⁵The average completion time in the soft launch of the survey was 15 minutes. Anyone who completed the survey in less than half of the average completion time (i.e. 7.5 minutes) was determined a "speeder" and their response was considered invalid on the grounds that they were not providing thoughtful responses.

variables shown were retained by LASSO estimation either individually or as part of a pairwise interaction. The first row, *Outcome: 1=Got to the end of the survey*, is the response rate for this survey. This relatively high response rate, about 65%, may reflect Oregonians’ strong feelings (both positive and negative) toward climate policy. Rows *1=Gender female* through *1=Used a mobile device* represent information collected by the survey for all individuals who make it through the screening process. The variables in the subsequent rows are for the respondent’s ZIP code (Census ZCTA), county, or other geographic proximity.

Table D1: Descriptive statistics: individual explanatory variables used in response/non-response models (retained by LASSO estimation either individually or as part of a pairwise interaction term)

| | mean | sd |
|--|-------|-------|
| Outcome: 1=Got to end of survey | 0.644 | 0.479 |
| 1=Used a mobile device | 0.678 | 0.467 |
| 1=Used iPhone OS | 0.335 | 0.472 |
| 1=Used Windows OS | 0.230 | 0.421 |
| 1=Started survey on a Tue | 0.111 | 0.314 |
| 1=Start: hour end. at 02:00 | 0.020 | 0.141 |
| 1=Start: hour end. at 09:00 | 0.037 | 0.190 |
| 1=Own age:18 to 24 yrs | 0.129 | 0.336 |
| 1=Own age:25 to 34 yrs | 0.247 | 0.431 |
| 1=Own age:75 yrs and up | 0.058 | 0.234 |
| 1=Own race:Black | 0.041 | 0.199 |
| 1=Own race:Asian | 0.058 | 0.234 |
| 1=Own race:Amer. Indian | 0.029 | 0.169 |
| 1=Own race:Other | 0.037 | 0.190 |
| 1=Own hhld inc:lt 20K | 0.142 | 0.349 |
| 1=Own hhld inc:125-150K | 0.070 | 0.255 |
| 1=Own hhld inc:220K up | 0.040 | 0.197 |
| ZCTA pr:Native Hawaiian/Pacific Islander | 0.004 | 0.005 |
| ZCTA pr:Two or more races | 0.079 | 0.027 |
| ZCTA pr:Widowed | 0.049 | 0.018 |
| ZCTA pr:Heat=Solar energy | 0.001 | 0.002 |
| ZCTA pr:Commute=60 min or more | 0.057 | 0.034 |

Continued on next page

Table D1 – continued from previous page

| | | |
|--|--------|---------|
| Nearest wildfire 2020, sqmi area | 71.629 | 118.484 |
| Wildfire w/in 20mi zip centr; 2011 sqmi | 1.472 | 12.853 |
| Wildfire w/in 50mi zip centr; 2015 sqmi | 26.363 | 100.578 |
| Cnty pr:Native; born in state of residence | 0.457 | 0.056 |
| Cnty pr:Indus=Accomm./food services | 0.074 | 0.015 |
| Cnty pr:Heat=Fuel oil kero etc. | 0.015 | 0.014 |
| County COVID cases/50K Jun'21 | 89.665 | 37.424 |
| County COVID deaths/50K Jun'21 | 1.262 | 0.939 |
| Observations | 1630 | |

D.1.2 Probit selection model

LASSO methods are used to identify a set of regressors that have good out-of-sample predictive ability. We use these variables in a probit model to estimate response propensities for a model that uses the explanatory variables (levels and interactions) that are retained by our LASSO models, where these variables are summarized in Table D1).

D.2 Selection Correction Strategy

Our sample-selection correction method is an ad hoc two-step model that does not attempt to take into account any additional unobserved heterogeneity that may account for non-random selection into the respondent sample. We use an ordinary binary probit specification, with our full sample of 1630 invited participants, to explain whether each invited participant submits a completed survey. The fitted probit “index” (the linear combination of estimated probit parameters and explanatory variables) can be interpreted as a latent respondent characteristic called “propensity to complete this survey.” We calculate the fitted completion propensity for every invited participant and calculate the mean fitted response propensity across all of these invitees. We then subtracting this mean from each fitted individual propensity. The “de-meaned response propensity” ($dm : \widehat{RP}_i$) will therefore be zero among the full set of 1630 invited participants.

Suppose the set of respondents who complete the survey are all as likely to provide a a complete

and valid response as the overall pool of invited participants. Then we would expect that the mean response propensity among those who complete the survey would also be zero. However, in this case, the average person contributing a completed survey has a greater response propensity than the average in the pool of invited participants. It is possible that people who are more likely to respond to a survey about cap-and-trade programs for carbon emissions are simultaneously likely to be willing to pay more for these programs. If this is the case, our models will tend to overestimate average WTP in the general population.

If we assume that preferences across cap-and-trade programs can differ systematically according to response propensities, we can simply allow the fitted response propensity to shift each marginal utility parameter in the program choice model.⁵⁶ We can then simulate what the preference parameters would have been, had every person among the invited participants been equally likely to complete a survey, with a response propensity equal to the average response propensity among all invited participants. Specifically, we simulate the preference parameters that would obtain if the *demeaned* response propensity for each person in the sample of completed responses had been zero.

Unlike a conventional Heckman two-step correction method, this ad hoc procedure relies upon a wide variety of *observable* characteristics of the set of invited participants (or their neighborhoods) to explain response propensities. Unlike the Heckman correction method, there is no assumption of a truncated bivariate normal joint distribution for errors in the response/non-response model and the outcome model.

The variables selected by LASSO are thus used to estimate the probit model shown in Table D2, and the fitted model is used to calculate a response propensity for each person in the sample of eligible respondents (recall those who cleared the screening process to the point of encountering the subject of the survey are eligible). We subtract from each individual's response propensities

⁵⁶As in two-stage-least-squares estimation using least squares methods, it is important that there be at least some "instruments" for response propensity that do not also enter directly into the utility function being estimated at the core of the analysis.

our estimate of the mean response propensity in the eligible group. In the Figure D1, we plot the distribution of these response propensities for the entire set of invited participants and for the subset of invitees who completed the survey with responses that passed our basic quality assessment. In the kernel density for each group, we include vertical lines at zero for the “eligible” group, and at the mean (0.073) of the de-meaned response propensity when the sample is limited to just the respondent group.

Table D2: Binary probit parameter estimates for selection model (regressors selected by LASSO methods from a much larger inventory of potential explanatory variable at the individual, ZCTA, and county level; lambda = min)

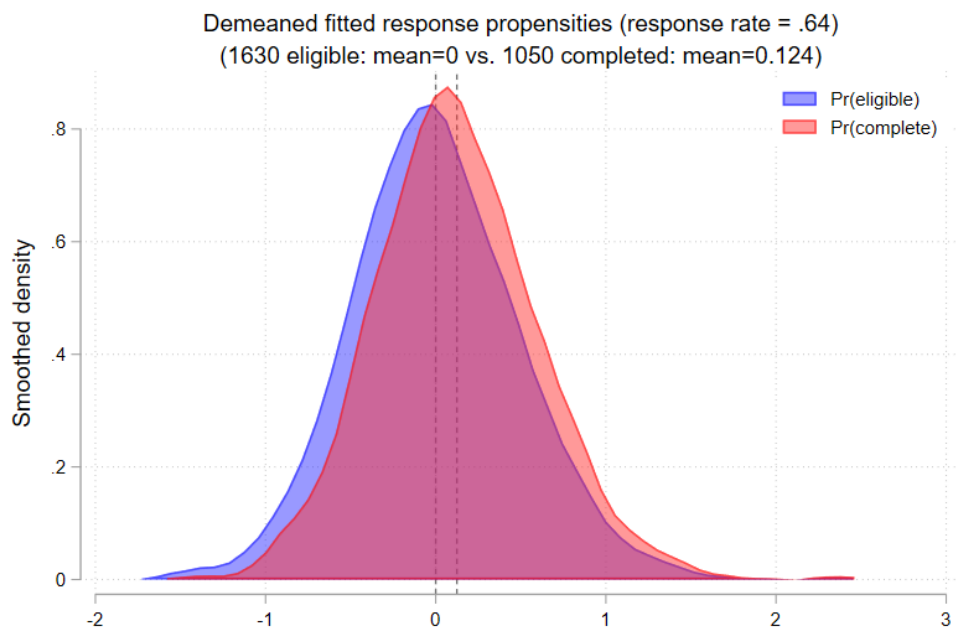
| | Estimate | |
|--|-----------|------------|
| Outcome: 1=Got to end of survey | | |
| 1=Used a mobile device | -0.147 | (0.128) |
| 1=Used iPhone OS | -0.120 | (0.0821) |
| 1=Used Windows OS | 0.388*** | (0.137) |
| 1=Started survey on a Tue | -0.189* | (0.105) |
| 1=Start: hour end. at 02:00 | 0.448* | (0.254) |
| 1=Start: hour end. at 09:00 | 0.692*** | (0.203) |
| 1=Own age:18 to 24 yrs | -0.291*** | (0.106) |
| 1=Own age:25 to 34 yrs | -0.170** | (0.0814) |
| 1=Own age:75 yrs and up | -0.787*** | (0.152) |
| 1=Own race:Black | -0.234 | (0.164) |
| 1=Own race:Asian | -0.397*** | (0.139) |
| 1=Own race:Amer. Indian | -0.477** | (0.196) |
| 1=Own race:Other | 0.331* | (0.183) |
| 1=Own hhld inc:lt 20K | -0.178* | (0.0979) |
| 1=Own hhld inc:125-150K | 0.291** | (0.143) |
| 1=Own hhld inc:220K up | 0.277 | (0.179) |
| ZCTA pr:Native Hawaiian/Pacific Islander | -9.131 | (6.345) |
| ZCTA pr:Two or more races | -3.242** | (1.320) |
| ZCTA pr:Widowed | -4.638** | (2.210) |
| ZCTA pr:Heat=Solar energy | 36.21* | (21.42) |
| ZCTA pr:Commute=60 min or more | 2.506** | (1.106) |
| Nearest wildfire 2020, sqmi area | 0.000185 | (0.000339) |
| Wildfire w/in 20mi zip centr; 2011 sqmi | -0.00396 | (0.00294) |
| Wildfire w/in 50mi zip centr; 2015 sqmi | -0.000403 | (0.000361) |
| Cnty pr:Native; born in state of residence | -0.0716 | (0.785) |
| Cnty pr:Indus=Accomm./food services | -1.606 | (2.540) |
| Cnty pr:Heat=Fuel oil kero etc. | -2.787 | (2.787) |

Continued on next page

Table D2 – continued from previous page

| | | |
|---|---------|-----------|
| County COVID cases/50K Jun'21 | 0.00132 | (0.00114) |
| County COVID deaths/50K Jun'21 | 0.113** | (0.0465) |
| Constant | 0.878** | (0.443) |
| Max. log-likelihood | -973.00 | |
| No. respondents | 1630 | |
| <i>Note:</i> Standard errors in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ | | |

Figure D1



E Appendix: Choice Experiment Randomizations

Unique Choice Tasks

Each choice task table (e.g. Program A) is populated with values randomly generated according to a set of parameters. There is no correlation in values between any of the individual surveys or across any of the six choice tasks within each survey. With 1000 respondents and 6 choice tasks per respondent there are a total of 6000 independently generated choice task tables.

Value Generation Parameters

We populate the choice task tables (hypothetical carbon cap-and-trade programs) with values from a structured randomized data generation process. This process emphasizes both realistic hypothetical carbon cap-and-trade programs and a distribution of values with enough granularity and orthogonality to allow for precise estimation. All 6,000 programs in the survey (6 programs per respondent times 1000 respondents) are independently generated. There are nine program features and each of these nine features is included in every program. Individual features are determined according to their own specific process. Some of the processes are interdependent, but a degree of random noise of independence is present in each process to avoid too much collinearity across variables. The only attribute values that are specific to Oregon in the choice tasks are the *carbon jobs lost* and *carbon jobs gained*, and these values can be fairly easily modified for other geographic locations. The processes can be seen below.

1. Carbon Reduction Values:

Carbon reduction values are independently drawn with replacement from a uniform distribution: 10, 20, 30, 40, 50, 60, 70, 80. We believe that this distribution gives us enough granularity for estimation while also allowing respondents to easily understand the amount

of carbon reduction a program will accomplish. These values are presented as percent reductions achieved by 2050 relative to current emission levels.

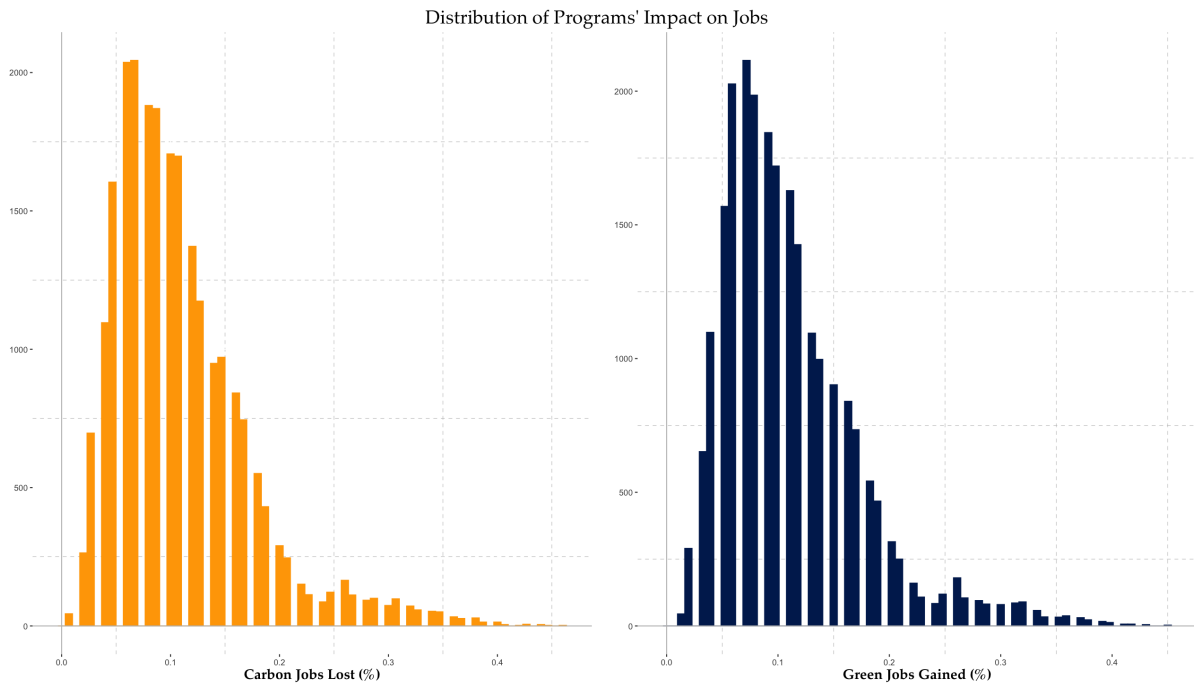
2. Jobs Values

Carbon Jobs Lost and Green Jobs Gained were independently drawn from the following distribution:

$$Value \in \{0.01, 0.02, 0.03, 0.04, 0.05, 0.06, 0.08, 0.10, 0.15, 0.25, 0.30\}$$

$$Probability \in \{0.02, 0.10, 0.11, 0.13, 0.20, 0.15, 0.11, 0.09, 0.05, 0.03, 0.01\}$$

Where *value* indicates the value drawn from the distribution and *probability* indicates the value of drawing the corresponding value. For example, there is a 13% chance of drawing 0.04. The draws for both types of job (carbon and green) were drawn independently and with replacement. These values are generated to reflect percent of jobs lost (gained) as the result of a cap-and-trade program. These values are then uploaded into the survey. However, the values that populate the choice task tables that respondents see are modified. The values that actually populate the tables are the product of these randomly generated values and the current level of jobs in the county in which the respondent resides. For instance, if for a respondent *i* Program A's *green jobs gained* draw took on the value of 0.06 and *respondent i* indicated they lived in Multnomah County (327,000 current green jobs) then the value *respondent i* would see in the Program A table for *green jobs gained* would be $0.06 * 327,000 = 19,620$ jobs. For *respondent i* Program B's *green jobs gained* draw took on the value of 0.01 then the value *respondent i* would see in the Program B table for *green jobs gained* would be $0.01 * 327,000 = 3,270$ jobs. Below is the distribution of generated values used in the survey with $N = 10,000$.



3. Share of Permits Auctioned Values:

The share of permits auctioned are independently drawn with replacement from a uniform distribution: 10, 20, 30, 40, 50, 60, 70, 80. These values are presented as the percent of total permits in the cap-and-trade program that would be auctioned, with the remainder being given away to firms at no cost. In some cap-and-trade programs the percent of permits auctioned will increase overtime. However, including this dynamic process in the survey is likely to overwhelm respondents so we simplified the process by suggesting the percent of permits auctioned is static throughout the existence of the program. The lower bound of 10% was chosen so that the revenue auction uses are always relevant. The upper bound of 80% was chosen to reflect the reality of how cap-and-trade programs have played out so far. For instance, there is precedent in the Small Business Regulatory Enforcement Fairness Act (SBREFA) that some of the permits must be allocated free of charge, so as not to cause excessive financial burden.

4. Permit Auction Revenue Uses:

There are three potential uses for auction revenues: purchase or subsidize cleaner equipment for households and firms, support workers and communities that are disproportionately burdened by program costs, and reduced Oregon taxes.

(a) Clean equipment: values are drawn independently from uniform distribution:

$$equipment_i \in \{0, 10, 20, 30, 40, 50, 60, 70\}.$$

(b) Support for workers and communities: values are drawn independently from uniform distribution: $support_i \in \{0, 10, 20, 30, 40, 50, 60, 70\}$.

(c) Tax Reduction: the values for tax reduction are determined by the values for the preceding two revenue use values. Tax value for instance i is calculated by $100 - equipment_i - support_i$. If this value is negative for a generated program that program is filtered out of the randomizations pool. The process guarantees that the three auction revenue uses sum to 100 as well as non-negative values for the tax feature. Because the equipment values and support values both have a mean of value of 35 the tax values have a mean of 30. We are willing to accept this slight imbalance to guarantee respondents see clean round numbers in the program tables.

5. Additional Regulations On Other Pollutants Values:

Additional regulation on other pollutants can take on two values: "YES" and "NO." These values are drawn independently with a 50% chance of either value being realized. The values are completely orthogonal to all other values in a program.

6. Cost Values:

Cost values are generated according to the following formula:

$$cost_i = K * \left[55 + \beta_i * benefit_i + \alpha_i * auctioned_i - \gamma_{1i} * equipment_i - \gamma_{2i} * support_i - \gamma_{3i} * taxes_i + H_i \right]$$

$$\beta \in \{0.25, 0.5, 1, 2, 3\}$$

$$\alpha \in \{0, 1, 2\}$$

$$\gamma_1 \in \{0, 0.25, 0.5, 0.75\}$$

$$\gamma_2 \in \{0, 0.25, 0.5, 0.85\}$$

$$\gamma_3 \in \{0, 0.25, 0.5, 0.85\}$$

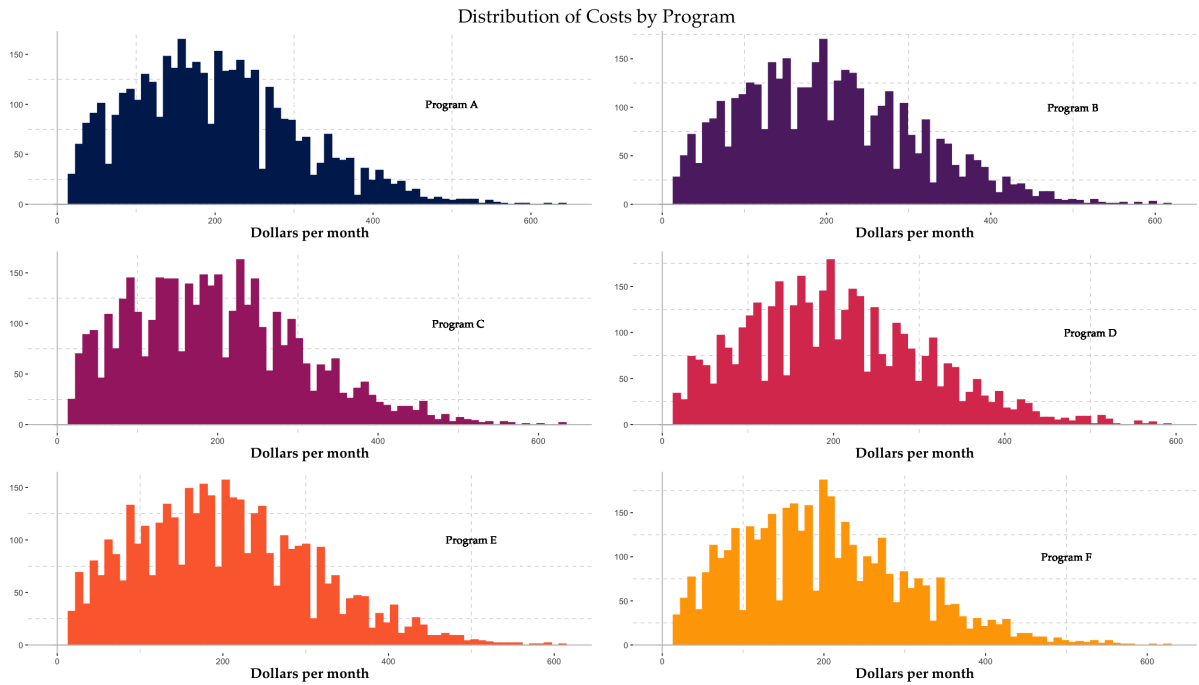
$$H \in \{-50, 150, 20\}$$

$$K = 1.08$$

Values for cost of the program were expressed in \$ per month. As indicated by the subscripts $cost_i$ is generated specific to the other relevant values for $program_i$ and these values are scaled by values randomly generated for each $program_i$. In other words, all 11 variables are regenerated for each program randomization. Logically, the higher the target emission reduction ($benefit$) the higher the cost of the program so β takes on a positive value. α also takes on a positive value under the rationale that if permits are auctioned it will increase production costs for firms. This will raise consumer prices as well as lead to more job loss in carbon-intensive industries. All of the permit auction revenue use variables (buying new equipment, support for communities and workers, and reducing taxes) would likely lead to directly or indirectly to lower costs to individuals. The term H enters the equation as a random shock to cost as a way to increase orthogonality across programs. K was used to scale the cost variable up so that respondents were voting affirmative on programs approximately half of the time. We set a price floor of \$20 for every program so that if the data generation

process resulted in any cost $> \$20$ it was filtered from the randomizations pool.

Below is the distribution of generated values used in the survey with $N = 10,000$.

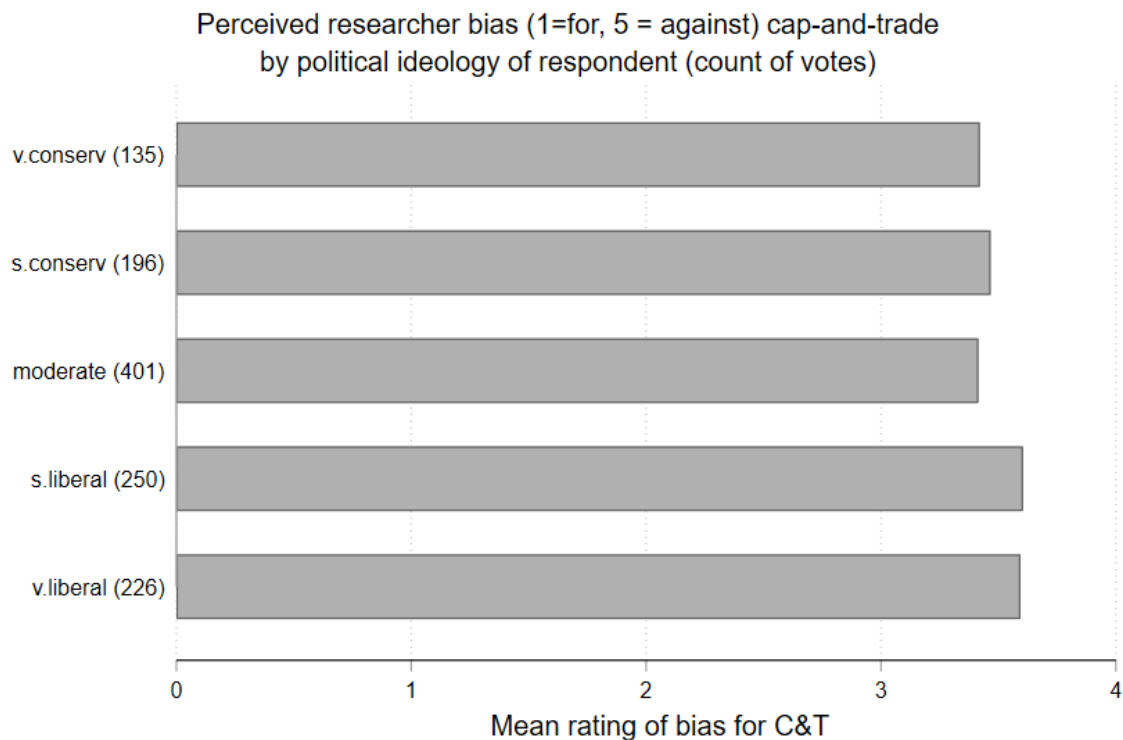


F Appendix: Descriptive Statistics for Some Basic Variable Relationships

Given the randomizations of the attributes of the cap-and-trade programs offered to different respondents, it is informative to look at the joint distributions among a variety of respondent characteristics and some key relationships between these and the way they interact with the survey.

F.1 Relationships among respondent characteristics and attitudes

Figure F1



F.2 Share of "YES" votes for program by category of respondent

Figure F2: categories are shifted

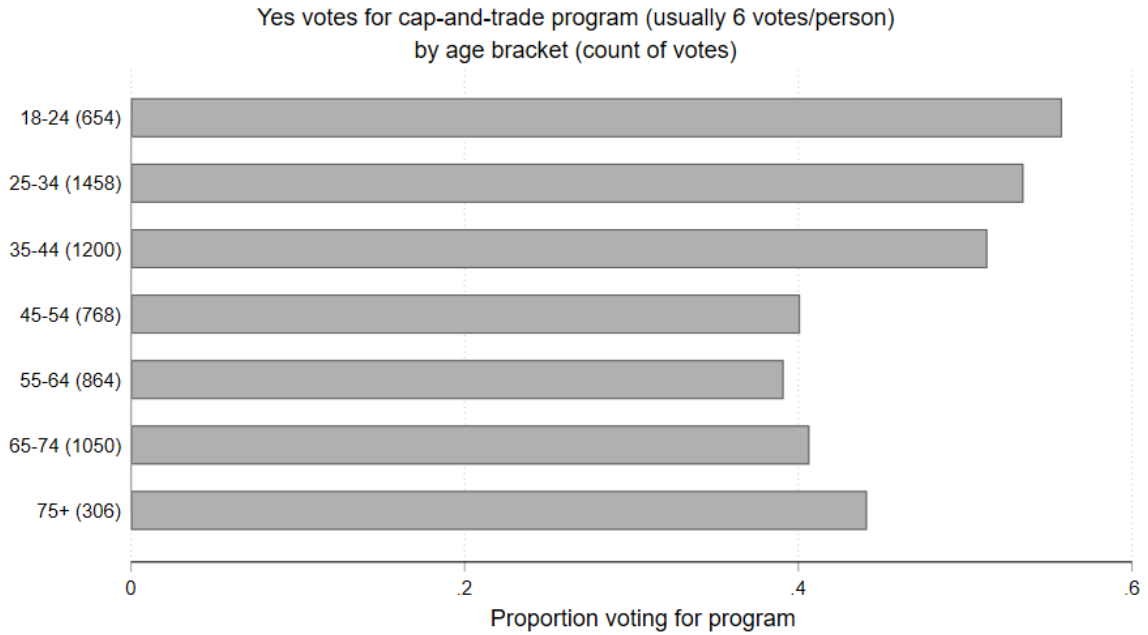


Figure F3

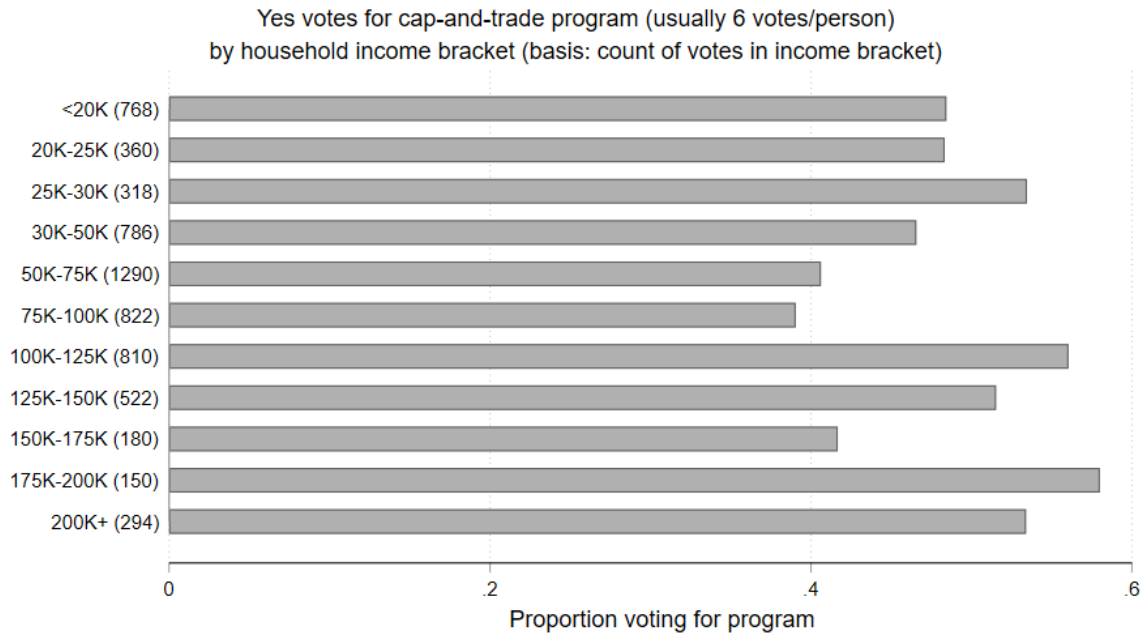


Figure F4

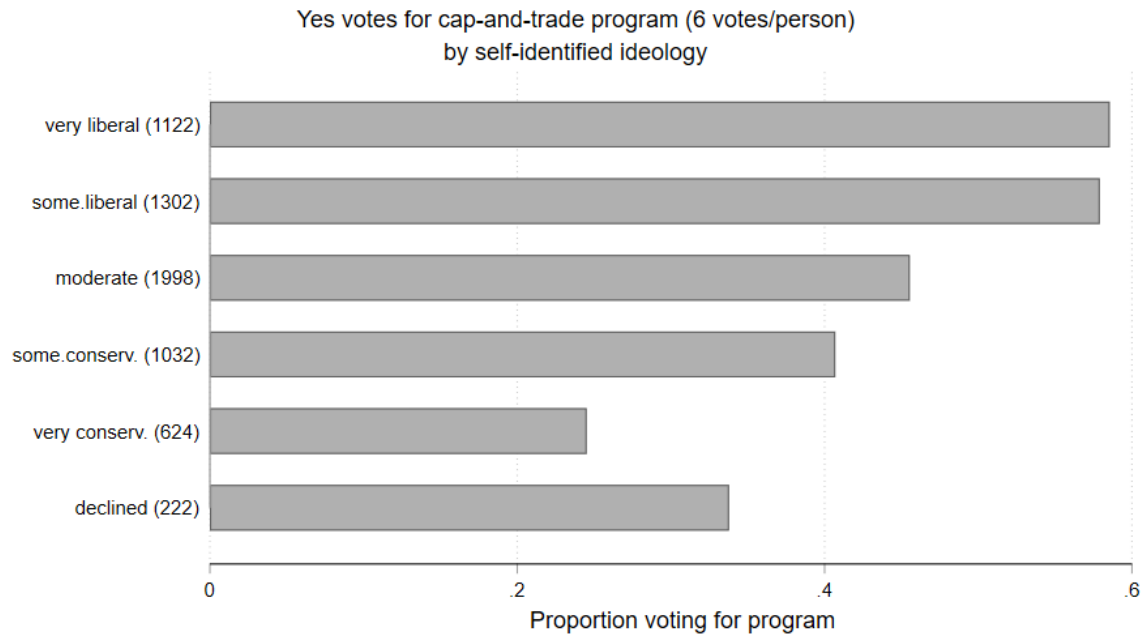


Figure F5

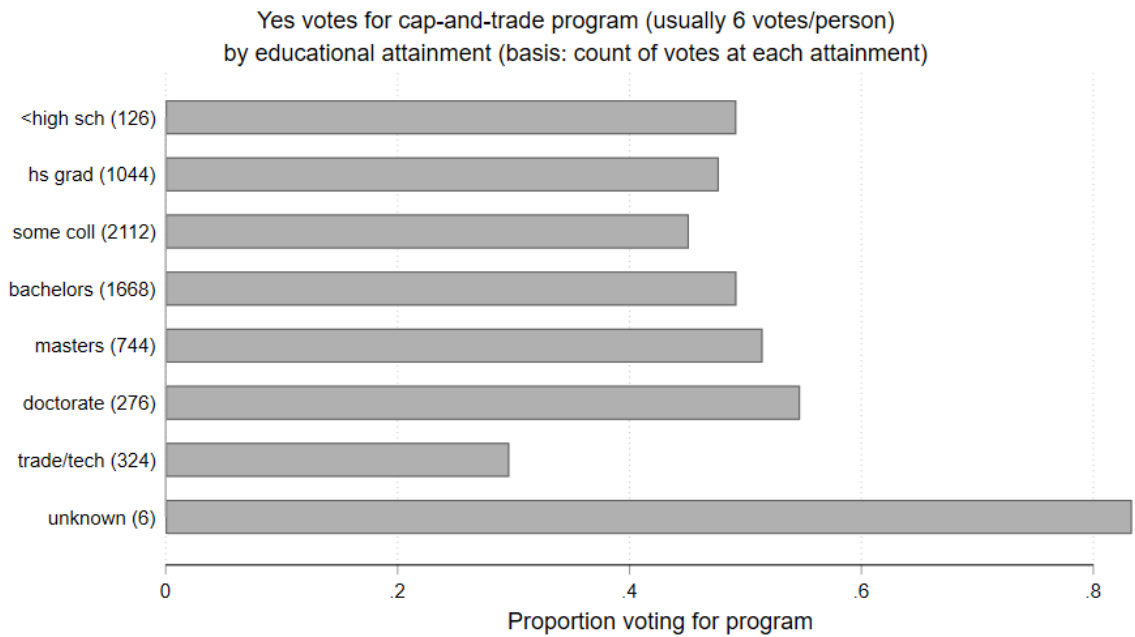


Figure F6

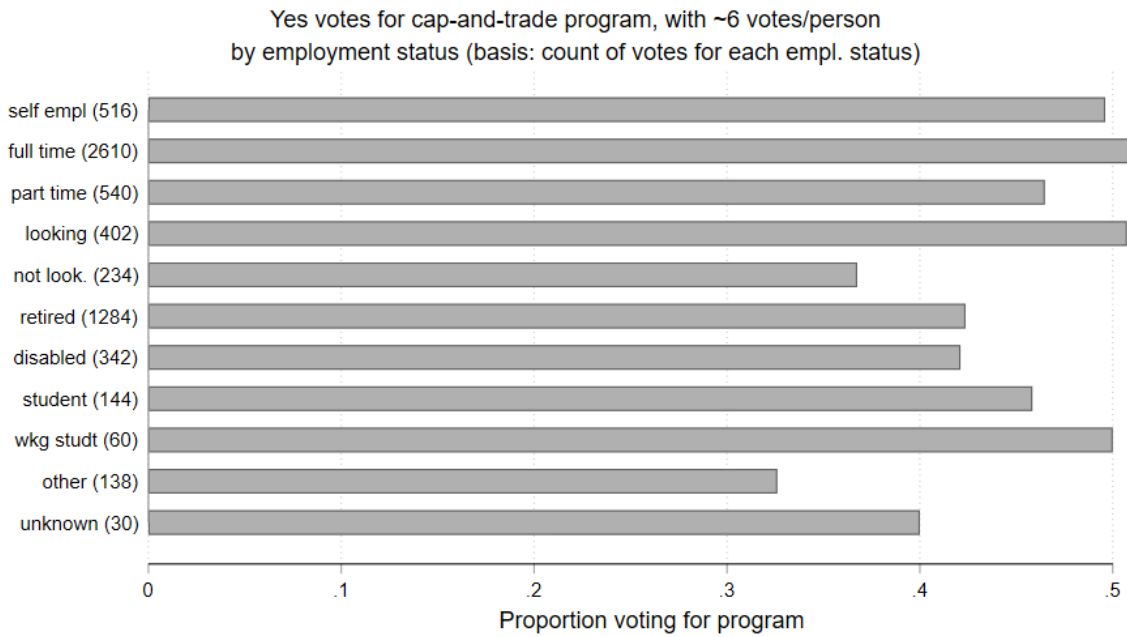


Figure F7

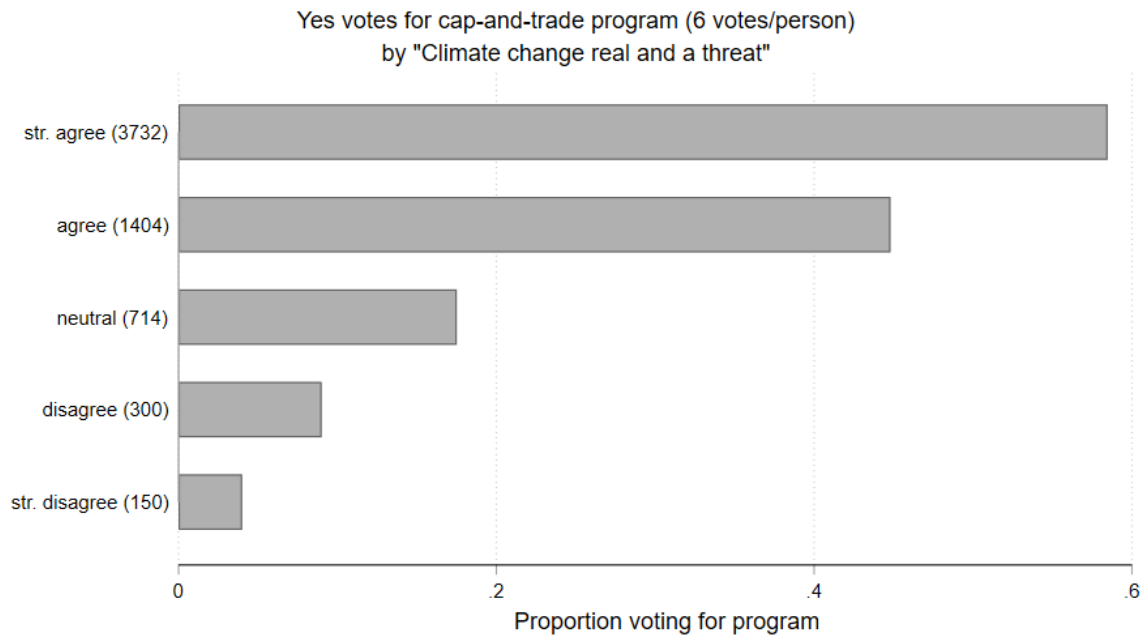


Figure F8

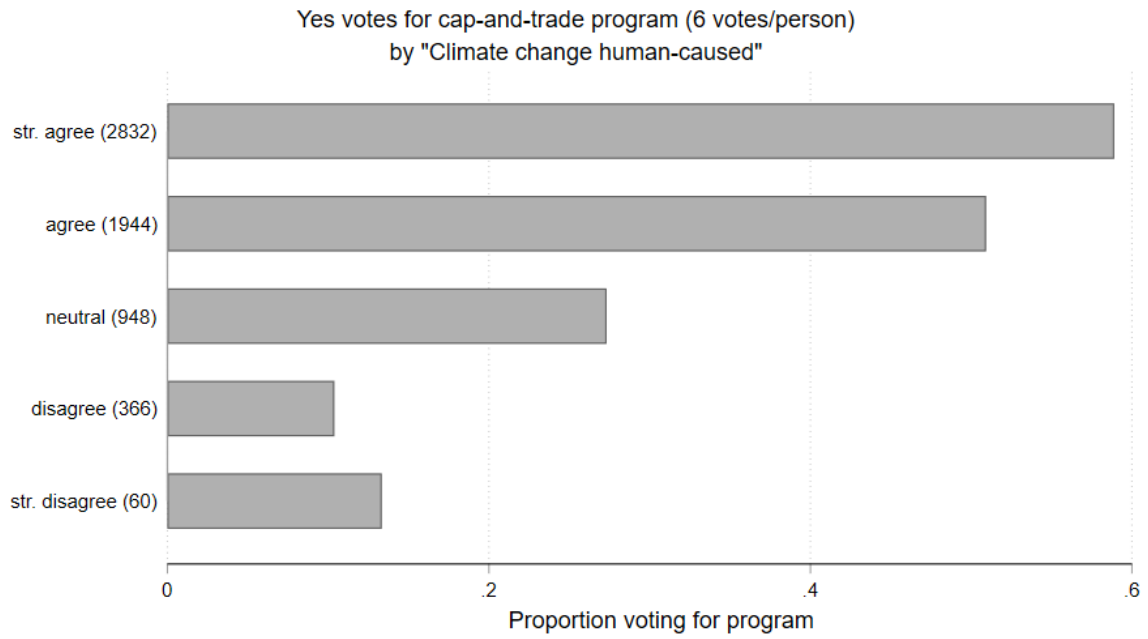


Figure F9

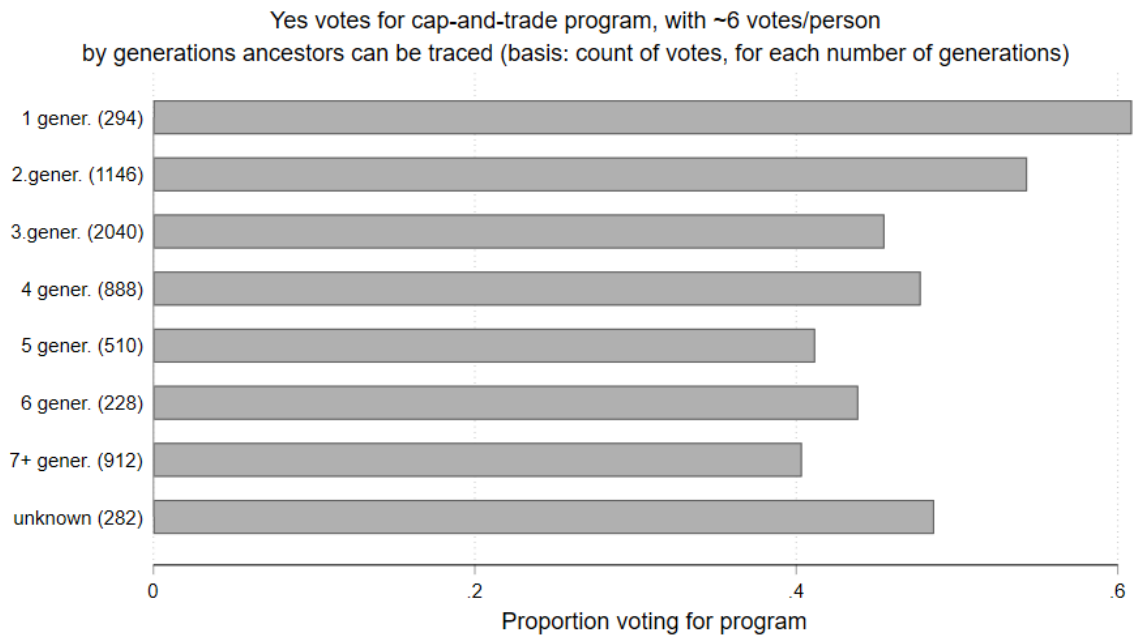


Figure F10

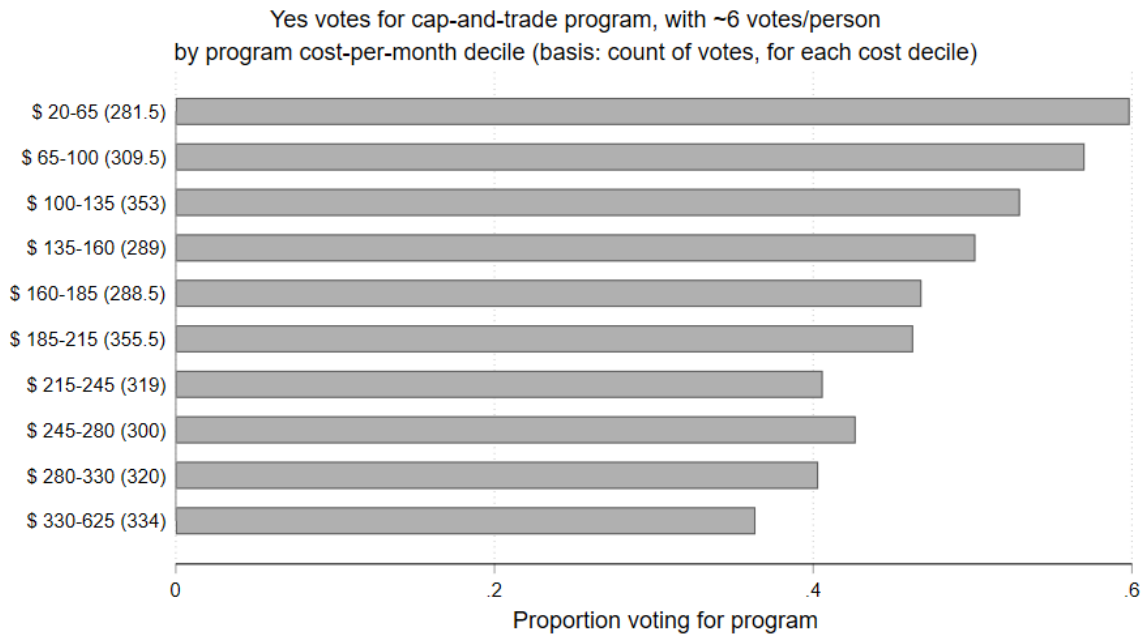
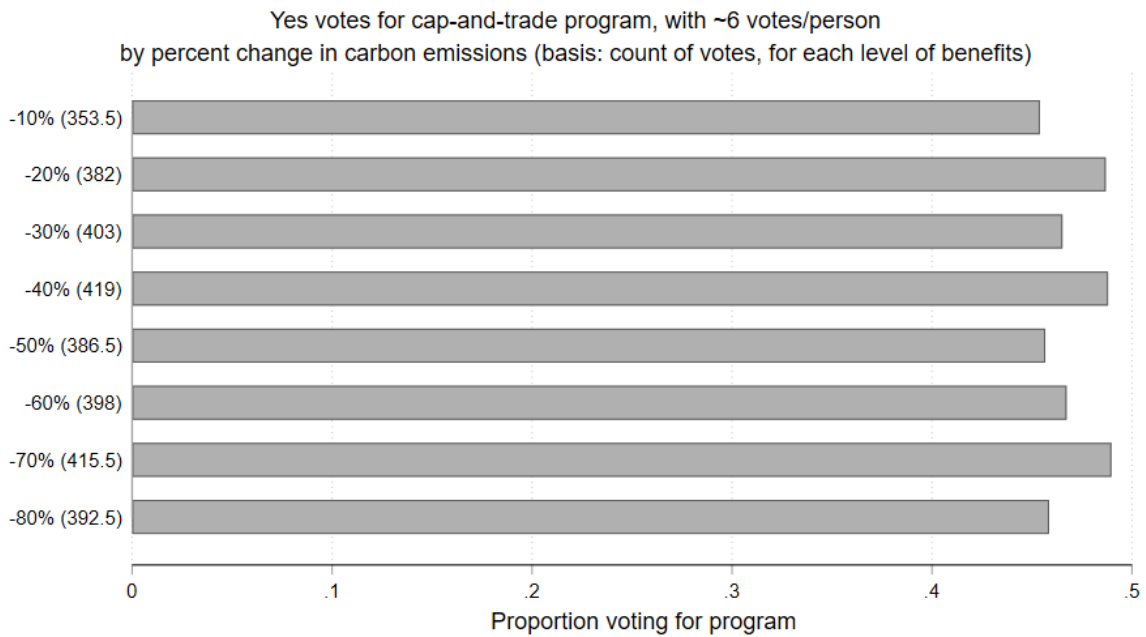


Figure F11



F.3 Share of "YES" votes by aspect of choice task

Recall that each respondent is asked to consider six different carbon cap-and-trade programs, Program A through Program F. All choice experiments that offer respondents more than just a single choice must contend with what happens as the respondent works through a sequence of choices. The attributes of Program A, unique to each individual, are incorporated into that individual's tutorial material as we explain the different groups of program features. Despite this, respondents may require a "burn-in" period as they get their bearings with these choice tasks (and potentially develop some personal choice heuristics). As the respondent works through the six choice tasks, they may also begin to experience fatigue, which may deplete their cognitive resources. Sometimes, respondents may rally as they realize they have reached the final choice task.

In this section, all of the figures show the progression in the specified variable as the individual works through Programs A through F. All of the attributes are randomized, as explained in Appendix E. Thus it is something that is going on with the respondent's engagement as they work through the six choices that leads to changes in voting patterns, not any systematic difference in the attributes of the cap-and-trade programs they are asked to consider.

Attitudes toward climate change policy are known to differ substantially along partisan lines. Thus we break out these voting patterns across choice tasks by party affiliation.

Figure F12

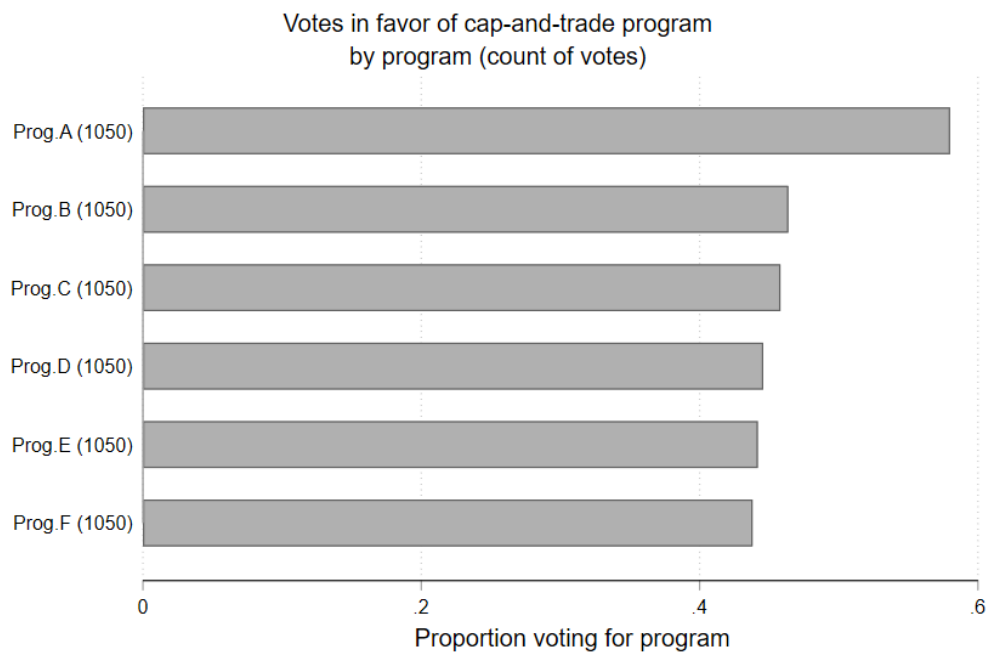


Figure F13

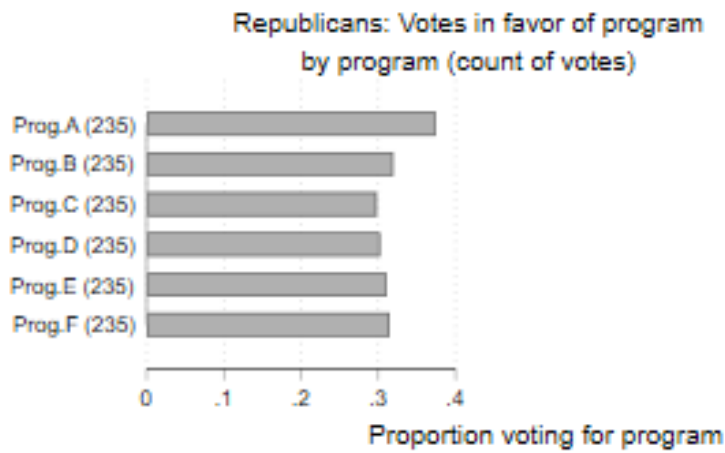
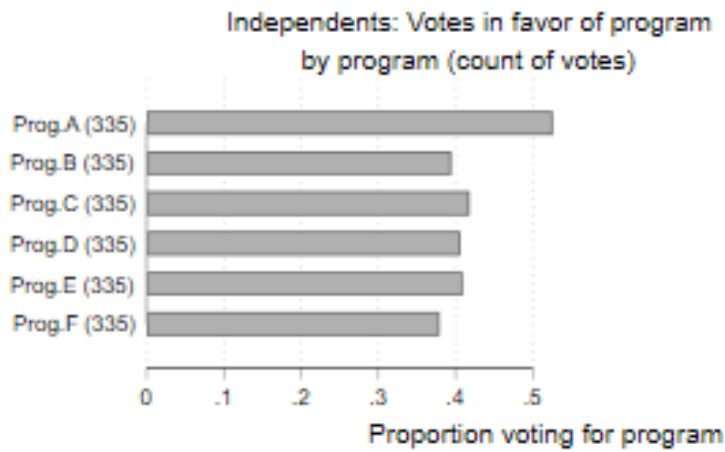
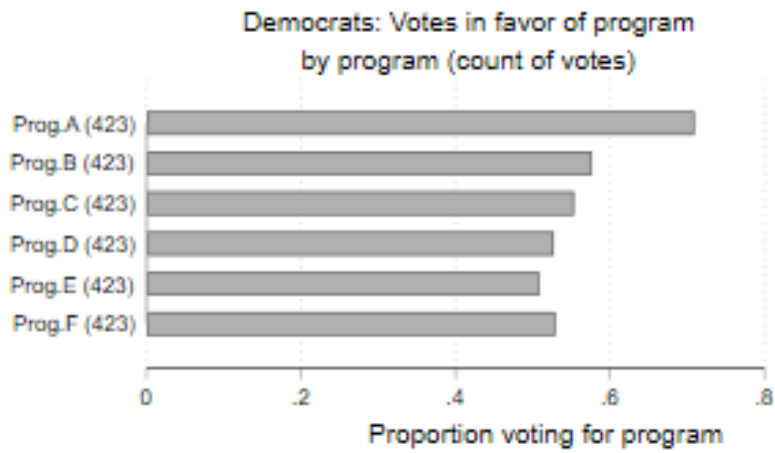


Figure F14

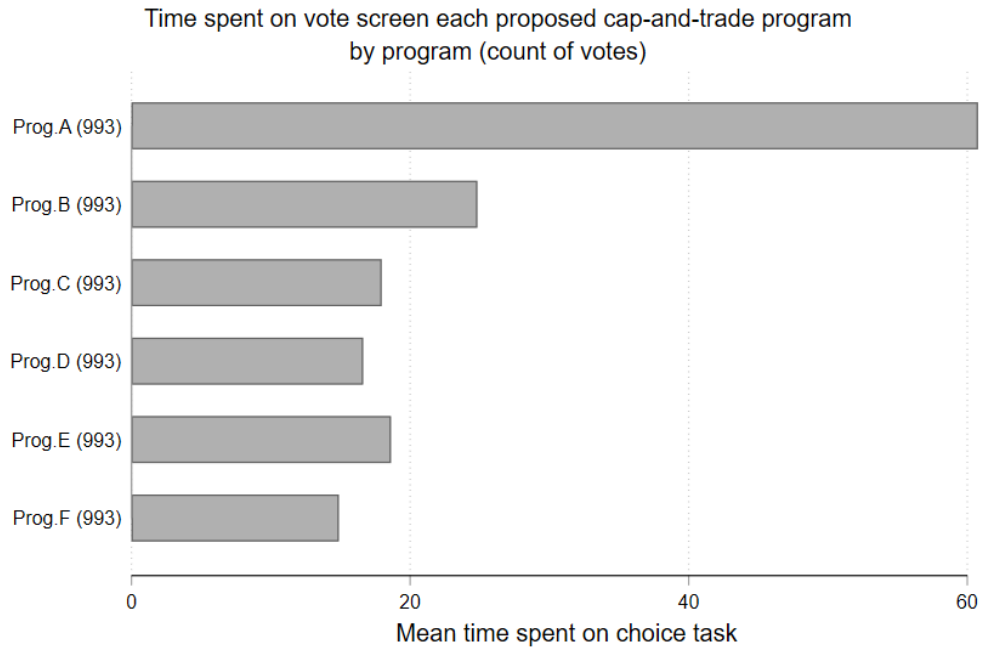


Figure F15

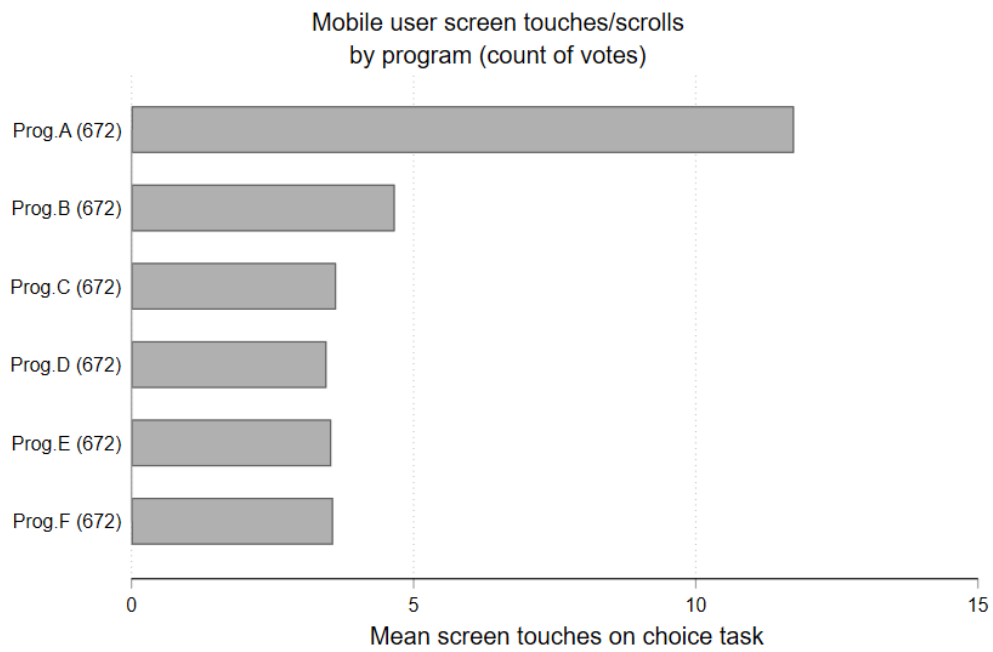
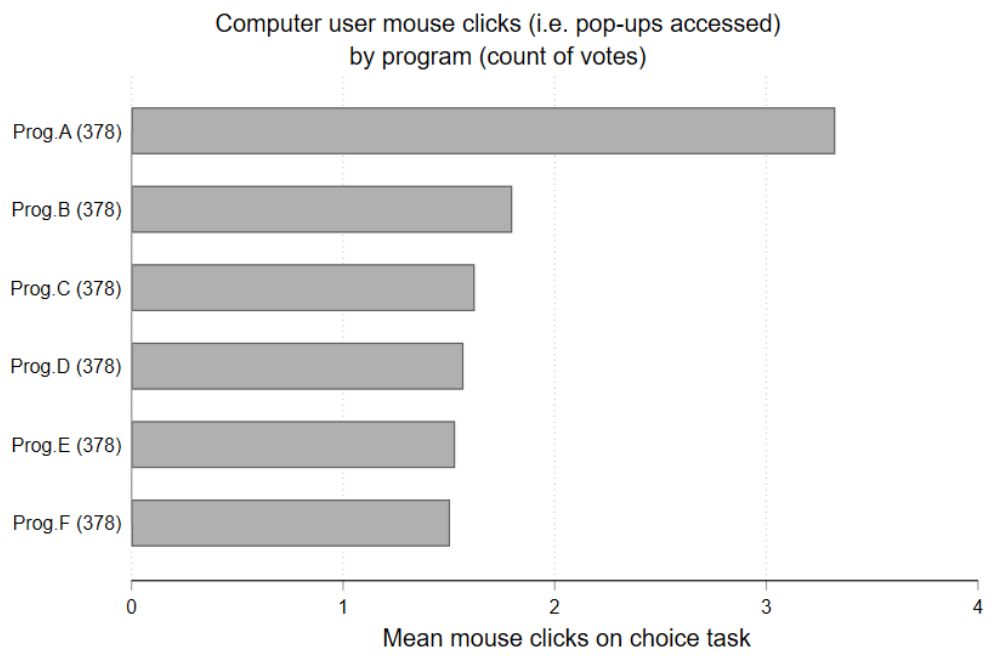


Figure F16



F.4 Identical distributions of program attributes across tasks?

Figure F17

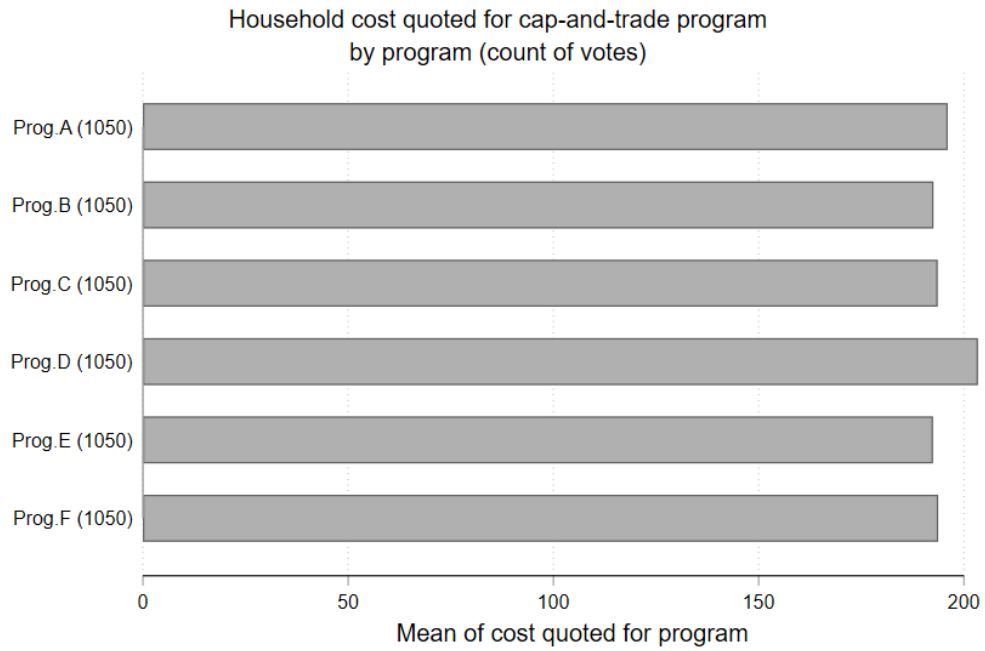


Figure F18

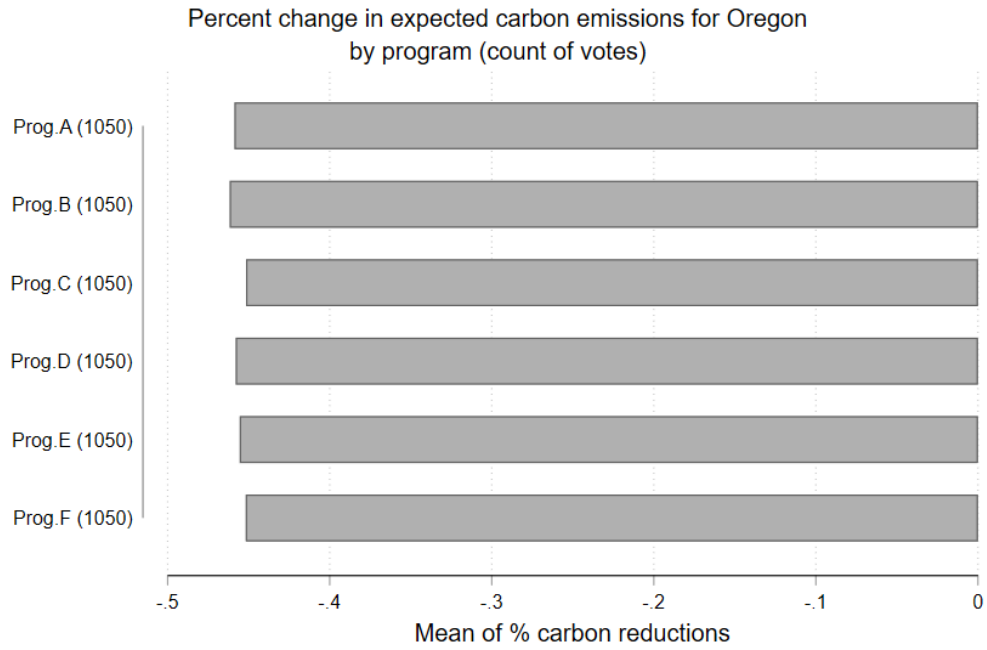


Figure F19

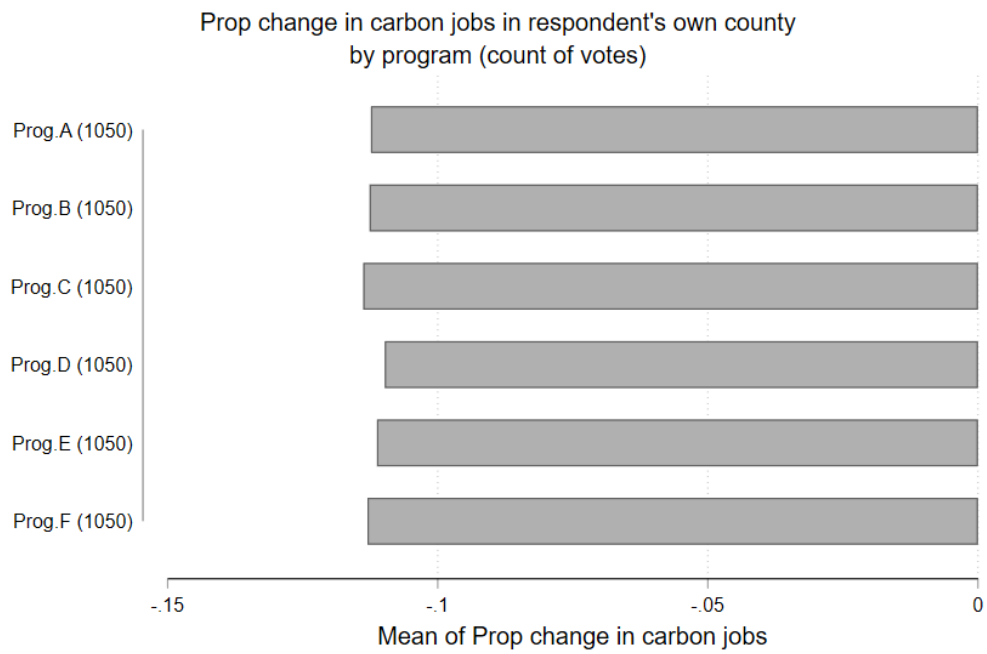


Figure F20

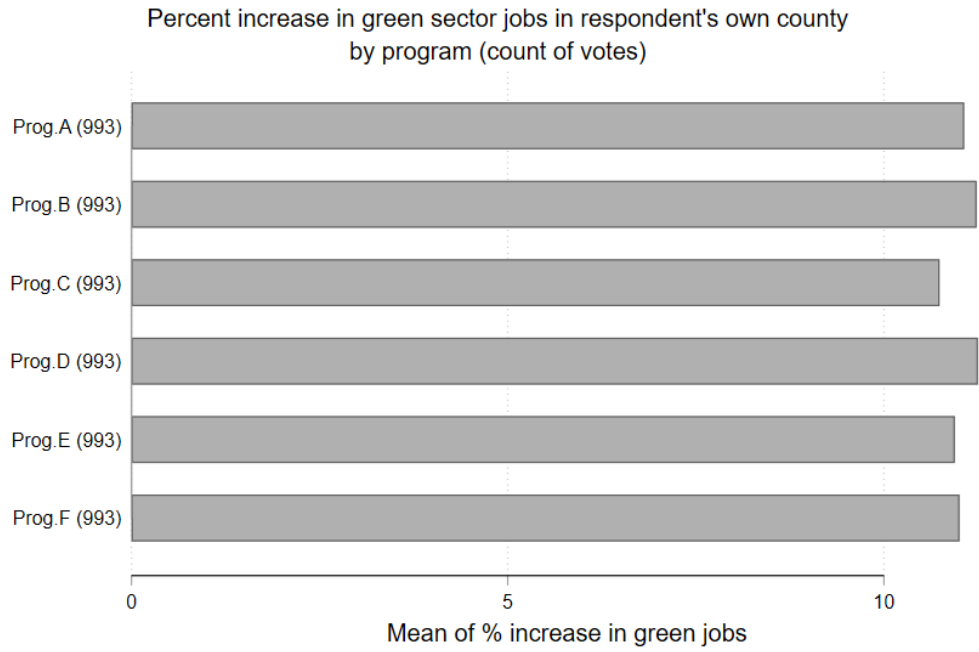


Figure F21

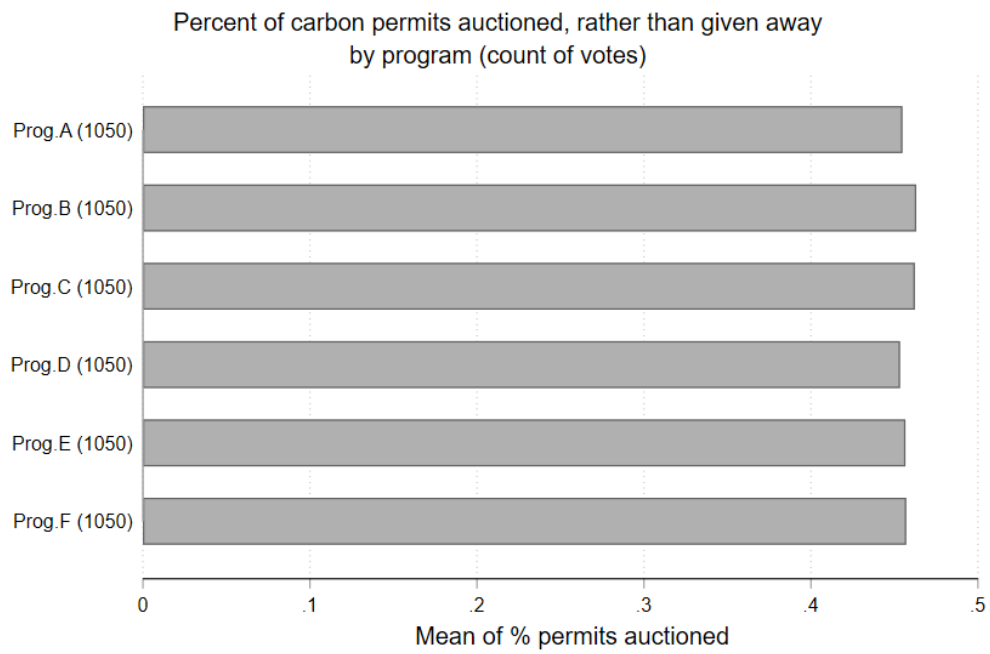


Figure F22

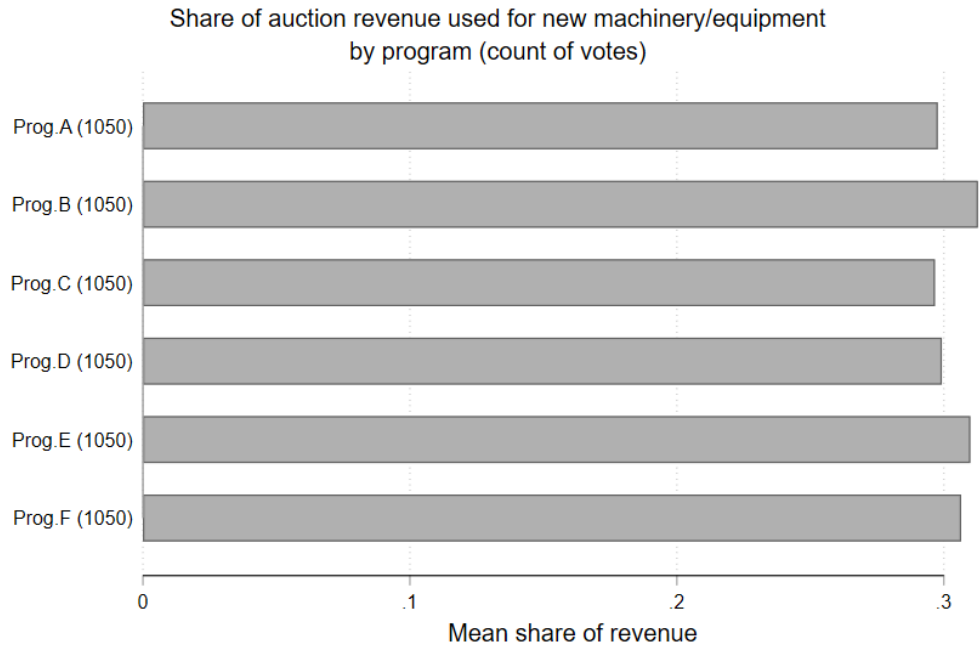


Figure F23

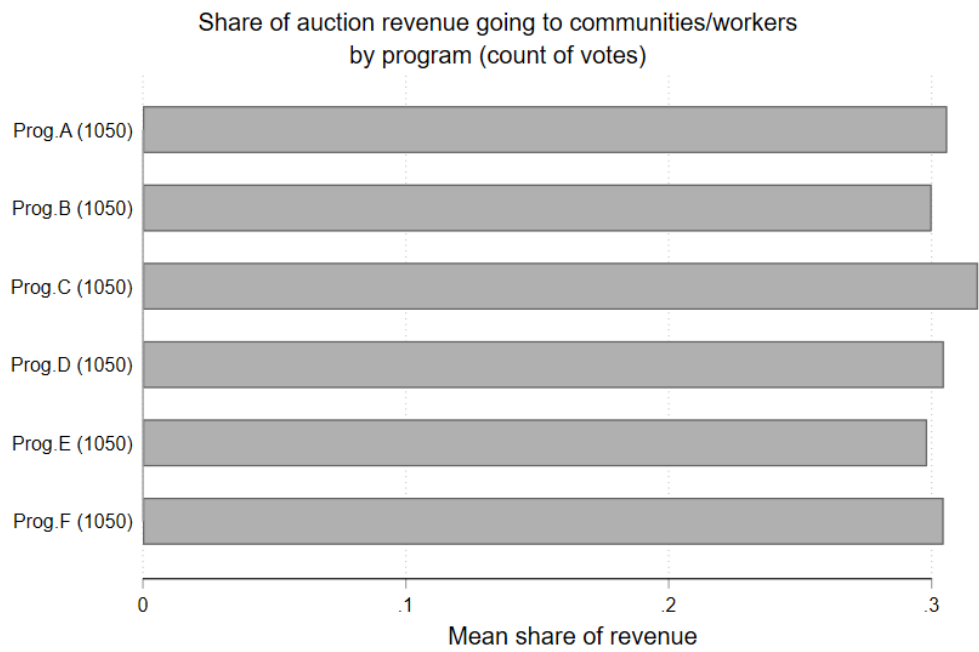


Figure F24

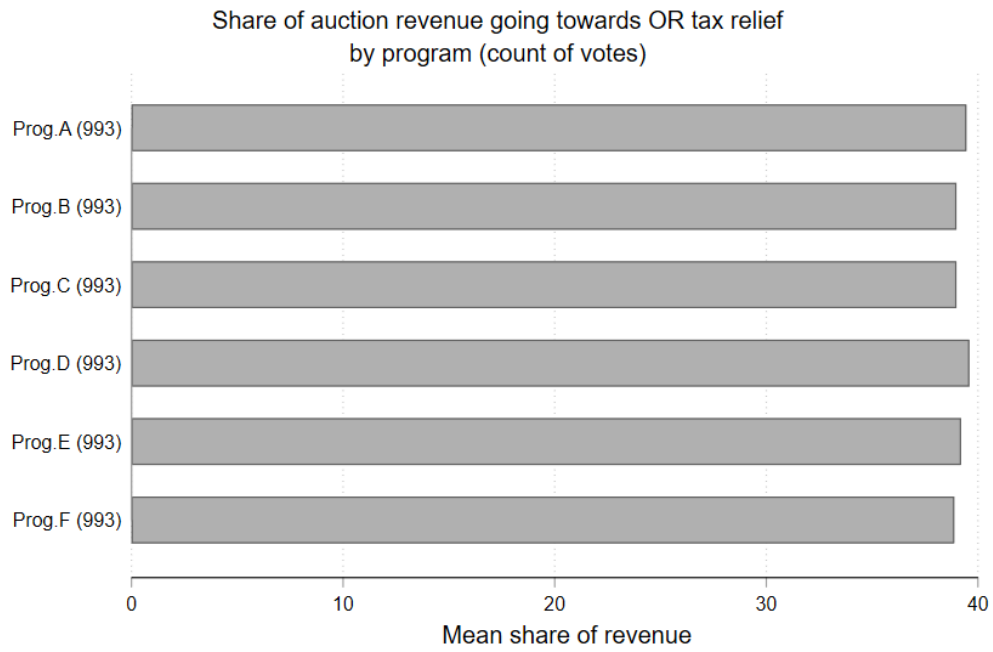
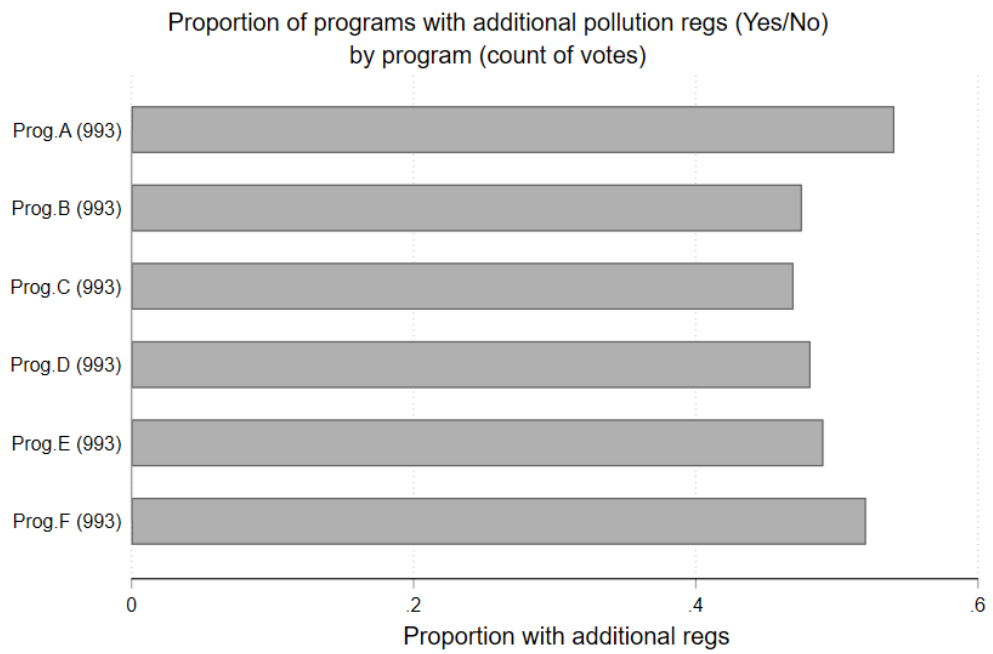


Figure F25



F.5 Votes as a function of non-mutually exclusive categories

Figure F26

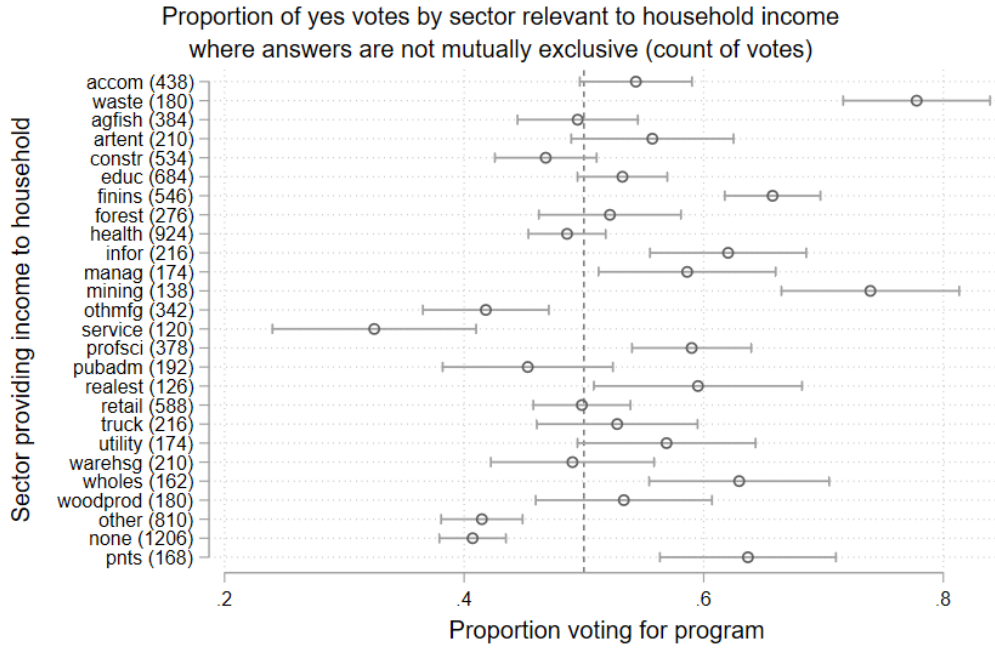


Figure F27

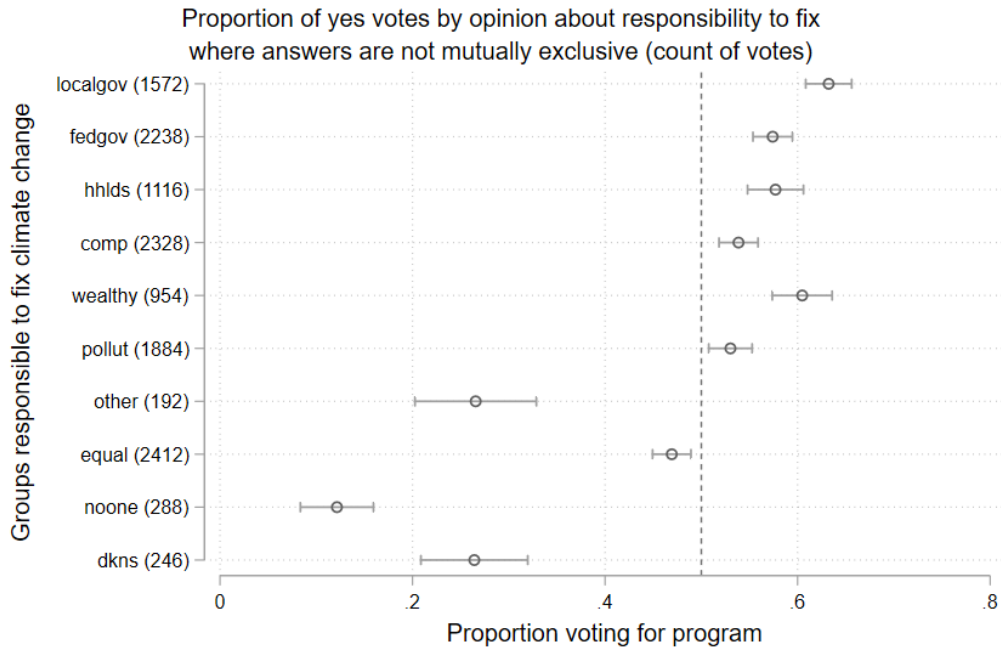


Figure F28

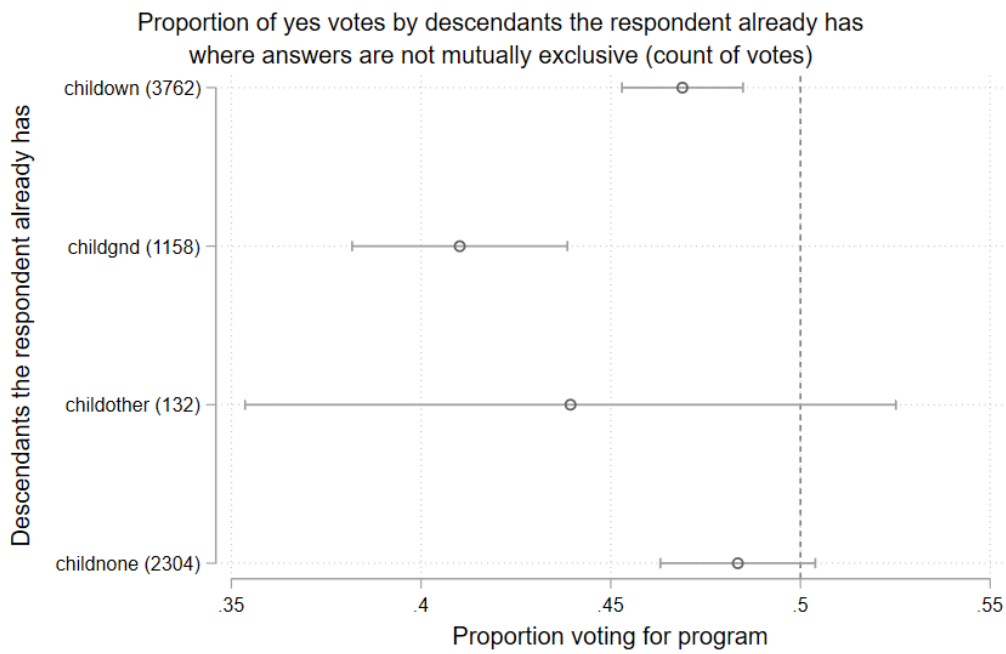
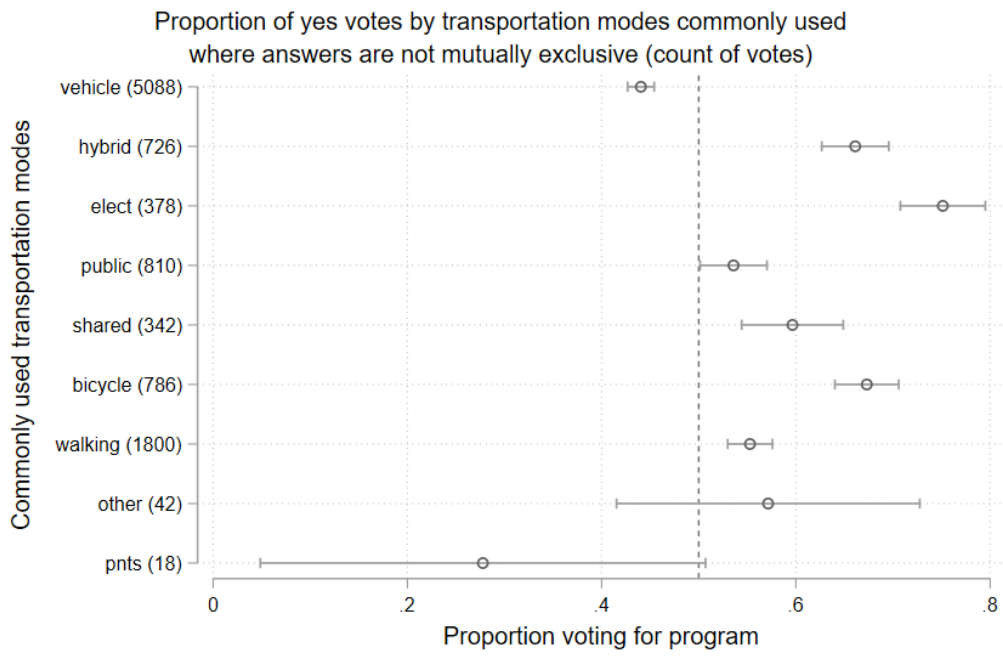


Figure F29



G Appendix: Verbatim Feedback from Respondents

The final question on our survey invited optional respondent feedback. The precise wording of the question was: “Thank you for sharing your opinions about different types of carbon cap-and-trade programs. If you wish, please provide some feedback before you go:” A multi-line text box invited longer comments, should the respondent desire to provide feedback.

The following table is the universe of non-empty responses to this question. We include this information for other prospective survey designers, since respondent feedback can be useful to the design of future surveys.

Table G1: Verbatim responses to final feedback question on the survey

| Arbitrary identifier | Survey started | Text of feedback |
|----------------------|-----------------|---|
| R_3D7PDK0bhro3Ac | 7/30/2021 17:32 | Such an interesting an eye opening survey. Really enjoyed this one. |
| R_2ck2EzkMgLq0aow | 7/30/2021 17:33 | Hope we get some form of a program passed! People will complain about cost. |
| R_1mLyJabWMChTUpF | 7/30/2021 17:34 | Thank you |
| R_2YQ95IwSeIvXwFF | 7/30/2021 17:40 | We need to slow climate change or else Good survey |
| R_2VOMtxCaX3ha0gH | 7/30/2021 17:44 | I love how this survey introduced and laid out the information. Everything was super clear, concise, and well done. I learned a lot:) |
| R_290IXPQHBCkYOjD | 7/30/2021 17:52 | No thank tou |
| R_SW8X41HynCIyev7 | 7/30/2021 18:09 | Great survey thanks |
| R_06Tq4DfIUOLIH33 | 7/30/2021 18:22 | No thanks |
| R_1OCQ9jnRqtAKV8 | 7/30/2021 18:48 | I do not trust the government to be equitable or to use the funds in the manner in which was described |
| R_dbPiKnj9I5ImVvr | 7/30/2021 18:59 | Thank you for giving me information on a subject of such importance. We need to do something! IMO the wealthy business owners care very little about future generations, or even our earth. I don't like that jobs will be lost, although other jobs will be gained, so I think for those that lose employment maybe training in a new field will be beneficial, for them, their families and their future generations. |
| R_qDQhUesi0BphP9f | 7/30/2021 20:55 | Thanjs |
| R_2wQQxkSdAXXJ0WX | 7/30/2021 21:19 | amazing and interesting survey! was never bored throughout it! |
| R_2wNZy5kvFKjeLPj | 7/31/2021 11:47 | Find a better solution |
| R_3kiVjihUmsFTE5O | 7/31/2021 12:29 | No thank you. Trump 2024 |
| R_7TE9CE9XHBRyXYt | 7/31/2021 14:21 | â â â â â . |
| R_2PaP1Kv49IT6b4M | 7/31/2021 6:23 | Very well put. Together survey I liked it |

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Table G1 – continued from previous page

| | | |
|-------------------|-----------------|---|
| R_DkteoAYG6IRXPtD | 7/31/2021 8:32 | N/a |
| R_1erv5RTKfSjiUSQ | 7/31/2021 9:26 | I found this fascinating and exciting that we may actually get something going to help the pollution problem and slow climate change. I enjoyed this survey |
| R_6YzWCuoGLZeWAI9 | 8/10/2021 17:22 | Very clear and concise. Presented in easy, bite sized pieces of info. |
| R_3QEkk5aIaOx0oYN | 8/10/2021 18:05 | The pay needs to be way way way higher for this "survey" if u want quality answers and data to your research. I promise u that u are NOT getting 100% real answers from people. I took the time but I know plenty of people who couldhavedsked their way through for the tiny incentive u gave to take on all the information required to understand to answer the questions correctly. |
| R_cZ08g8gZ2VTPgD7 | 8/10/2021 18:30 | Very interesting survey |
| R_3dFduan3iduoD2Q | 8/10/2021 19:33 | Great survey!!! |
| R_b2xiBgLGjvaDfJ7 | 8/10/2021 20:57 | It was nothing but pro cap and trade propaganda put forth by probably an indoctrinated group of students who never really had to struggle. |
| R_2woU9rGRGga1kwQ | 8/10/2021 21:17 | Thank you, I learned a lot tonight and will be paying more attention to this issue. |
| R_pJLzOwIqqPccVgJ | 8/10/2021 8:17 | Seems like these programs are going to involve a lot of beurocratic red tape that are just going to drive companies out of state and maybe out of the country. |
| R_DOaAXYtdr35MfqV | 8/11/2021 10:20 | Very comprehensive |
| R_qRabWWkvq4WhFtL | 8/11/2021 10:30 | Thank you! I think this is a great and important survey. |
| R_1gjZ1sdSRuNtpch | 8/11/2021 10:56 | I like learning more about climate change. I'm not very informed but I know there is a lot of misinformation going around. |
| R_0kZlhxlwmrnAIIX | 8/11/2021 10:58 | Company, local government and fedral government need to stop making dams as well iy is the main issue for droughts and secound reason for drought is in oregon we have bad forest management so fires get huge and big due to all the under growth and then you need more water to put them out better manage ment all around is what we need better manage ment on dams forests and carbon producing companies |
| R_3JFxnBYnxx5u4em | 8/11/2021 11:03 | Thank you for making the effort to create this survey and ask people to figure out what would be best for everyone. In an ideal world this change would be cheap and free. This change is important for the future of our world. Yeah, the sun will explode but we can slow that down and the burning of earth by preserving earth as best we can and protecting earth as best we can for as long as we can until we can leave if that will be necessary. Saying we don't find some way to refuel the sun so it doesn't explode and burn earth. *shrug* |
| R_1CEzDOPi4jhOpk4 | 8/11/2021 11:04 | Interesting. |
| R_2SCgM9iWqjWwvC1 | 8/11/2021 11:04 | More info |
| R_3fNKMCOvVmUuhlb | 8/11/2021 14:16 | Na |
| R_cCLOag2BH55QIN | 8/11/2021 14:58 | No thank you |
| R_w5fJ4YujchiLNnj | 8/11/2021 16:36 | No |
| R_1ONQYQyJvrucF14 | 8/11/2021 17:05 | thank you this was awesome |
| R_3IaBZTw18MdbpP5 | 8/11/2021 20:19 | This was a very good survey. |
| R_Q4yjlgMpzpSVNoB | 8/11/2021 20:40 | No feedback. Good survey. Keep it up. |
| R_qJ8m693Fci9VtAZ | 8/11/2021 23:59 | Anything Oregon does is a drop in the bucket compared to the pollution that China and other countries generate. The governor is an idiot. |
| R_3oNlih5PTG3IZnN | 8/11/2021 3:39 | interesting survey |

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| | | |
|-------------------|-----------------|--|
| R_2SGZuvYKjHEUyJ4 | 8/11/2021 6:36 | Jobs gained in the green sector should outweigh jobs lost in carbon emitting sector. Industries emitting more should be incentivized to reduce. If that's in tax's or costs. Individual household costs should be offset in taxes. Increase incentives for households to go green. Burden should reflect greatest contributors to emissions not the general public. |
| R_2qElfWQDjv0dT3k | 8/11/2021 7:28 | Good survey |
| R_30ub7IGzmyA1wRz | 8/11/2021 8:07 | Thank you for the time to take this survey. It was interesting to learn about the cap and trade and gain a better understanding. |
| R_3HwshwbHSHuvn7c | 8/11/2021 9:26 | Good |
| R_qwkOP0fJmCa9DC9 | 8/12/2021 0:30 | Very interesting survey |
| R_ebNVjjQQ4QY26lj | 8/12/2021 14:05 | Good survey, lots of info. |
| R_00Ld5Xe2VUbgZkR | 8/12/2021 15:14 | fun survey |
| R_CaELBBS2sEHCizL | 8/12/2021 15:22 | I just hope we calm down on carbon emissions. But we have been a little |
| R_d11nxgfoNVP3KPD | 8/12/2021 15:41 | More needs to be done to power through Renewal energy sources |
| R_1ihDpkmDttDEzrA | 8/12/2021 19:23 | The more appealing the carbon cap-and-trade appears to the general consumer is low household cost AND minimal job losses the more likely it would pass. |
| R_1HkRMfxUS1hIuNr | 8/13/2021 12:28 | Nice article |
| R_9Gmz8I2aaukcxIT | 8/14/2021 19:07 | Cap and trade is going to be difficult to get buy in from a lot of people. Maybe exclude logging from the regulations. Look at margins in some industries, some may not be able to cut emissions without losing money or shutting down. Be careful not to cut off your nose to spite your face. If we lose too many jobs the economy may not be able to recover. Maybe slow down with the emissions reduction. |
| R_2THjsiExSeaM36S | 8/15/2021 10:16 | :) |
| R_2wSqxwKVJL5EH11 | 8/15/2021 16:50 | thanks for the information |
| R_31L7G9ALUQMBxp7 | 8/15/2021 21:08 | I don't believe cap and trade is a moral way to force changes not everyone agrees with. We are highly considering leaving this state after youngest graduates due to increased extreme liberal programs that keep creeping into all parts of life. We believe that the climate is changing (and always has) but certainly not mostly from CO2 and cows. Fossil fuels and nuclear are so much more efficient and consistent than wind or solar. Until battery storage for these is greatly improved they are only usable when it's sunny or windy. While supplementing with a more stable source is doable but requires so much more expense than just using the steady power from a more reliable source. I'm also unsure why Natural Gas which has zero CO2 is never discussed. |
| R_3G8IjWBKEO3aBpT | 8/15/2021 22:05 | Good job |
| R_3rM3jzvPmt8nOLv | 8/15/2021 8:04 | A cap and trade is a no go for me. Job loss is a great now because of the ongoing "pandemic". Cap and trade would further create more jobs lost, and create an increase cost to every type of good imaginable with very little given in return. This is another attempt to have more government control. WE should've been looking at controlling carbon emissions back in the 60's and 70's where it was the greatest. |
| R_bBf9eMj4Um44kYV | 8/16/2021 17:53 | My issue with the options presented are that the ones that reduced a reasonable amount of carbon was devastating on the job market or on cost per month to families. There MUST be a way to balance it better because CLEARLY we need to take some action. Although I have no children or grandchildren to worry about and I am OLD and won't be here for the worst of climate change, I still care deeply and we MUST do something. |
| R_bpaCDLlgMlzVzB7 | 8/16/2021 18:47 | N/A |
| R_3PNza79jby9j5tS | 8/16/2021 18:58 | Don't know |

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| | | |
|-------------------|-----------------|---|
| R_9Fzjj4zJoKJ2ATf | 8/16/2021 19:32 | This was very informative! Thank you! |
| R_2SIZFoHN47yIbAk | 8/16/2021 19:34 | Noticed what seems to be a common error when discussing carbon emissions stating that vehicles emit carbon dioxide not carbon monoxide that is what is the result of motor vehicle operations. Everyone seems to ignore that carbon dioxide is the primary food for green plants - implying that what we should really be looking at is reducing our reduction of trees and plants and actually plant more. |
| R_1gjV33O1RBVHG1y | 8/16/2021 20:58 | Appreciate learning cap an trade |
| R_1j7c5vWb8KCfjvb | 8/16/2021 20:58 | It was a good survey |
| R_25SpcbqzoSCsY6U | 8/16/2021 21:55 | Great |
| R_1f7tHcWVURapL2d | 8/17/2021 12:14 | no |
| R_8BUpsMIhXpIHrH | 8/17/2021 16:32 | Good survey |
| R_1i4mNTpwBpjKUe2 | 8/17/2021 19:51 | i know we as a nation need to start making changes |
| R_piONTnkZiQsextn | 8/17/2021 19:52 | Na |
| R_Olh3mlxgkjtr7II | 8/17/2021 19:52 | Great topic. |
| R_ZIRAIhNDcnfwXoB | 8/17/2021 1:49 | A great survey .. cuz nothing more important than our health |
| R_2BmI4F5GvGgDwJ5 | 8/17/2021 23:45 | N |
| R_294ypaYkTxarSl8 | 8/17/2021 6:23 | My problem is Captain trade is it always ends up costing smaller but this is not the larger businesses larger businesses somehow always keep out of these things and leave the financial costs on small businesses which hurt your community |
| R_1poCEuC5PoODWxo | 8/18/2021 10:58 | Anytime the government sass another level of bureaucracy it is costly, inefficient, and a mess. |
| R_8f9qQbmuNVSp5zH | 8/18/2021 11:15 | None |
| R_6ik2Dddu5C0D3pf | 8/18/2021 11:23 | action on climate change is needed now. we must use all available tools that we have now and improve them as we get smarter |
| R_0BCs0KygOCai7XX | 8/18/2021 15:39 | its a good survey and i like it. |
| R_3iURekFOz4MVXB | 8/18/2021 17:25 | I think this survey has good points on why we need carbon emission reductions in the world because of how climate change is effective humans, animals and many other forms of life on earth. We should all do something right now rather than later on. |
| R_2QrE4QLo5tPXLKS | 8/18/2021 1:29 | I have both worked at a survey call center and don"t a lot of surveys. This was one of the best I have ever seen. It was professional, informative, and unbiased. |
| R_Xoo8vWeUokuELeN | 8/18/2021 2:04 | It was really informative and I like the layout too see definitions of the topics. |
| R_2bIuam2u6GxJnYV | 8/19/2021 13:07 | great survey, very informative |
| R_0pjcO4m0PsjW6Qx | 8/19/2021 15:27 | Presenting each program separately was good; however, it would have also been useful to have them presented together to compare aspects within a singular "picture" as opposed to each individually. Similar to when you are shopping various products online, how you"re capable of doing side-by-side comparisons of features. |
| R_3EbWYLeZpDCtcEw | 8/19/2021 20:09 | Great survey. |
| R_27H8uGBIWTz4e3C | 8/19/2021 6:28 | Climate change is real we must all step up to the challenge to reverse the effects. |
| R_3hyhuFxdpE1glhx | 8/19/2021 7:37 | I did learn a lot |

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| | | |
|--------------------|-----------------|---|
| R_CfzGCoxgcT9LCeZ | 8/20/2021 18:48 | Very nice. Very very fresh my friends. Lovr the survey! |
| R_2aM6UvgK5UYhTEy | 8/20/2021 21:51 | Global warming is real. We should do our part. |
| R_utb7sTe9hmgbma5 | 8/21/2021 10:03 | Free the workers from responsibility and hold corporations accountable for their actions which is resulting in the death and destruction of our planet. That"s all, thanks |
| R_1FDHRaJTqpRDqaF | 8/21/2021 15:43 | No thanks |
| R_1dlVxhtsp92UzWU | 8/21/2021 17:15 | I learned a lot taking this survey! |
| R_RELvBGchLm23SJH | 8/21/2021 17:43 | Thank you for letting me be a part of this survey! |
| R_ulUK65dPaNfw9Hj | 8/21/2021 17:54 | best survey yet. Keep up the good work |
| R_1IN6Xs2EWVrTpy5 | 8/21/2021 17:54 | Great survey subject |
| R_2QtHMSCW219ziUI | 8/21/2021 18:03 | None at this time |
| R_WkTzOzYvWGI9TP3 | 8/21/2021 9:03 | It much more great survey. |
| R_3p8TMOVBEUNdOUa | 8/21/2021 9:51 | This was very easy to follow and i appreciate the level of detail and the easy to understand graphics that were put into the information sections of this |
| R_22zUeCmjYYexDNv | 8/22/2021 0:56 | none |
| R_27QIK5ymKDQh6eN | 8/22/2021 0:57 | Very interesting survey |
| R_3GfD6XAsnU2RpdY | 8/22/2021 11:25 | Thank You! |
| R_2amkwSuiAE7r6gY | 8/22/2021 11:36 | The monthly household costs all seemed pretty exorbitant to someone on SSI – even the lowest amount was more than 10% of my income. Whatever the chosen program, a good share of the auction money will have to be spent on relief for low-income households or we"ll be in a pretty bad situation. (If you do another survey on this in the future, perhaps you could take that into account.) |
| R_1pGd52hzj1XUabz | 8/22/2021 12:38 | Ok |
| R_3ssMVntxm8nVEZF | 8/22/2021 13:34 | Good Survey! |
| R_3qksrBMXDkAwkvz | 8/22/2021 16:24 | No |
| R_2XiLXXjJTieeLM | 8/22/2021 16:32 | Global warming is real please reach out to the right people to stop it before we all fry!!!! |
| R_1gIyWwALvmkoNnj | 8/22/2021 17:44 | This survey was fascinating and educational yet did not portray a bias one way or the other on a very controversial topic. Thank you for the chance to learn and participate in my views as a contribution to the thought process. |
| R_5cEKsQWPA3GO0Kt | 8/22/2021 19:07 | No thank you |
| R_1r7Gt6d6cZLQYyO | 8/22/2021 23:08 | Thank you |
| R_87JYb2V5m6d0Mrn | 8/22/2021 5:11 | Oregon has money in reserve to use instead of taxing citizens. |
| R_1gpx5dJ9x9aPZMs | 8/23/2021 12:37 | Thank you so very much for the great opportunity to participate in this important survey! ðð½ |
| R_2VEyFFuk2tjKWxB | 8/23/2021 13:25 | I learned something today, that I will carry with me into the future. Thanks. |
| R_3G8RgZsLTtoZW9Iq | 8/23/2021 13:26 | it is exciting |
| R_29aGT58Dc9yWYv4 | 8/23/2021 14:01 | Very interesting survey |
| R_tKWfL9ibDuqZxzX | 8/23/2021 14:48 | Good survey. Learned something. |

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Table G1 – continued from previous page

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| R_pMni1dmiUI0CiR3 | 8/23/2021 15:00 | Carbon cap-and-trade programs are nothing more than the Progressive's way of oppressing business and controlling the common man. Another method of the Progressive's to move the country further to the left. I do not believe they really care about carbon emissions. It's just another way to elevate their elite status and cause the rest of the population to become more dependent on the government handout. |
| R_3iHXCYYVFATa6AH4 | 8/23/2021 17:11 | I am not a believer in any kind of Federal or State government legislating in the marketplace. If you want the proof of that just check Amtrak or off track betting in N.Y. Government and politicians screw up everything they touch. |
| R_81c5h1QoHnnjkuB | 8/23/2021 18:59 | Thanks for survey |
| R_1LUSy3Wb6eRjrHL | 8/23/2021 21:18 | Great survey, very salient questions and problems. |
| R_OxHPGQp4NLhndDj | 8/23/2021 21:42 | I like the survey. I learned alot |
| R_bpwVVnsk6ygteRb | 8/23/2021 22:52 | This was a cool survey and it's really informative |
| R_1kNPcz8zK1s8kRZ | 8/23/2021 23:01 | I really appreciate the blue text that provided additional context for the issues presented |
| R_2VCjZF4nMHu6cUP | 8/23/2021 3:21 | Ok |
| R_1g7KIM8xaBhLCKu | 8/23/2021 4:32 | Would have liked a better understanding where monthly household cost were coming from, I.E. fuel ,food,electric utilities or natural gas, groceries ect, a breakdown of percentage? |
| R_1CqdYkOnN85zbaH | 8/23/2021 6:45 | The weather is changing day by day. We are facing a lot of calamities these days. It's very important to save our environment. We need to take proper steps to reduce green house gas from our environment and we have to plant more and more trees. Thank you for asking. |
| R_2PhdDMZHZjeLL3 | 8/23/2021 8:42 | I think as a resident I want to make sure others in these industries can find a new trade. I know they hear this type of thing and get scared and automatically flip out and shoot it down. But if these specific people could be encouraged or incentivized to move to a green sector that could help? Or I'm dreaming haha. I appreciate Oregon for trying to do this. Historically we have been progressive. I'd vote for a plan that YES limits other pollutants, limits future pollution, and does not cost the household more than \$200 or so |
| R_2QIBIHmfZ4GZtl8 | 8/23/2021 8:53 | I enjoyed this survey and actually learned some |
| R_2434emmPsyuhy6n | 8/23/2021 9:10 | I think not al citizens having to bear costs for climate change are very high when businesses should pay the highest amount. |
| R_3dWjRKsvK1dn502 | 8/24/2021 0:01 | Nothing additional |
| R_3nGY5gnaMS7ySUL | 8/24/2021 0:52 | Very informative survey. Didn't know the Oregon government was considering a cap on carbon emissions |
| R_3NCibWGOuxEgawn | 8/24/2021 13:40 | Great information, although I did see some inconsistencies of information. Also, a very strong bias opinion on the topic |
| R_2xQnrCATEqx6BWw | 8/24/2021 15:16 | nice! |
| R_2v0pNLU6lmfi6L | 8/24/2021 17:06 | Great survey! Educational + easy to complete. I do wish I had the option to go back & save my place as I wanted to revisit the previous Programs & since I couldn't, I had to refill the survey; but it was worth it. |
| R_cvuUb7qvW8dkAjn | 8/24/2021 23:25 | Carbon caps aren't enough. |
| R_27EhxlMB6zigEAH | 8/24/2021 23:49 | Thanks |
| R_bpJzm92n9aeEtbP | 8/24/2021 2:26 | Liked this survey. Different very thought provoking |
| R_li8MugFQhBHc09G | 8/24/2021 4:34 | Superlative survey. A win/win as it provided excellent feedback to you and provided an excellent education to the survey participant re the particularities of the cap-and-trade initiative. |

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Table G1 – continued from previous page

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| R_2TRgLv12h5h5mL | 8/25/2021 12:08 | Thank you for the information |
| R_3qkZozmqfwCsbu7 | 8/25/2021 19:52 | I wish more was explained about the household cost estimated. Is that just the elevated cost for goods and services provided by merchandisers? I would have voted much more in favor of those costs then; seems expected. Or is that amount an estimated out of pocket cost or tax paid directly by myself to the government or other committee in charge of this plan? I am living leanly as it is and would prefer the costs go to the companies instead of me. Or I need to know how much of my money is going where exactly; ie not to campaign costs and overhead. |
| R_yloMsGuzSfTGikh | 8/25/2021 19:57 | Thanks for increasing my awareness! |
| R_2aS30I0kL3v28Xy | 8/25/2021 23:44 | I like the survey I have taken for where I live in Clackamas Oregon |
| R_1JXFNHzS8vNzI8l | 8/26/2021 10:03 | I got lots of information about carbon cap. |
| R_2YFKXhUPx3z5Gy4 | 8/26/2021 12:41 | This survey was really nice |
| R_31AjNrGPlezXNcq | 8/26/2021 18:40 | I think the survey was informative but may not be the most understandable to the typical audience, especially those with little schooling. A video may be more effective in breaking down what was included here. |
| R_2RaeVUUQ0tI8co4 | 8/26/2021 19:47 | I was thoughtful in my answers but feel I could of understood the charts more. I started to feel tired and became impatient. I wonder if I would vote differently tomorrow, after a study session. |
| R_1eWwN6JlhkvWEpF | 8/26/2021 22:10 | Please do your part to save the planet. |
| R_urmnJYF2Fpe5WUx | 8/26/2021 23:25 | I can say its really good to know about our mather earth. And do what is good for everyone. And take good care of it. The cost reflects . Thanks |
| R_1PRzAHmAnQ86kC2 | 8/27/2021 11:04 | Good survey |
| R_2TtmePKLLHAHQf | 8/27/2021 18:02 | None of the above |
| R_22MtjhbGK7IHGHO | 8/27/2021 21:14 | This is a very vital problem we are facing and the more information, the better! |
| R_3oBEs09sdZnVpH | 8/27/2021 21:41 | nothing I can think of, Have a nice day! |
| R_3HhS3OVyoSatq1S | 8/27/2021 2:11 | I don"t know |
| R_WvIntSFZv3ZCQh3 | 8/27/2021 2:38 | This was a good and informative survey. I enjoyed it. Thanks for asking. |
| R_22tBKKTZwupggql | 8/28/2021 12:12 | I like this survey so much and I know so things which I don"t know before. |
| R_1eKTbwlKUVeDTCY | 8/28/2021 13:47 | It"s a bs program |
| R_3Vsqa4LYhQ94fsZ | 8/28/2021 16:14 | No thank you |
| R_1PTyLvsWmK4mPFL | 8/28/2021 16:29 | I felt that all of the proposals fell short in the amount of the emission reduction for a 30 year period. At my age, 30 years is not relevant, but it is for my children and grandchildren. |
| R_3FJPKcA3wAsZuJ9 | 8/28/2021 16:36 | It was informative and quick |
| R_5sSAIXBx0nxKvMI | 8/28/2021 17:38 | Decent |
| R_1jq4gnQ3K833N0M | 8/28/2021 17:44 | I would like to know more where can I find the info |
| R_PUNPGQJ2Uf9f9cJ | 8/28/2021 1:53 | Maybe show a video instead of making people read the important info |
| R_DI4007GAyrc39v3 | 8/28/2021 20:41 | Before participating in this survey I had no idea that this was a thing that was being talked about. Thank you for giving me something to think about and research further! |
| R_9yN8jZKUqyri48h | 8/28/2021 21:44 | It was very informal to learn about climate change and maybe make a impact on the climates |

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Table G1 – continued from previous page

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| R_2e4FYotxYpGtXGE | 8/28/2021 22:19 | None |
| R_1C9gU5xorp19Ytr | 8/29/2021 0:29 | i loved this survey because it was informative and i was able to learn a few things that i didn't even know about |
| R_2OH0akuSC6stxLA | 8/29/2021 10:20 | Your choices of political affiliation did not include Libertatian which it should have. It appears that several of the current issues are missed by you, such as a political class that will not do their job such as desalinazion plants and population control. Without stopping countries from poluting the oceans and without China and India being accountable a more serious peoblem will confront us soon, no fish in the oceans. Lack of clean water. |
| R_2xEGwY5Np0w8hWJ | 8/29/2021 13:45 | Reducing emissions will be expensive & maybe even painful to some, BUT if we don't do something it will only get worse. We need to starting doing something |
| R_2QM6g9SV0BiKy9P | 8/29/2021 16:01 | Don't want to |
| R_2AGxYbEbb2zGuMm | 8/29/2021 16:23 | Very interesting questions |
| R_2AFpxYZspWdOvA5 | 8/29/2021 16:29 | no additional feedback |
| R_31dfMDx97IWScWP | 8/29/2021 16:55 | Had no idea this was coming. Something does need to be done. I guess we will all feel pain of some sort |
| R_2uEXmaqTLtsisx1 | 8/29/2021 16:58 | Try to minimize household cost would be better idea. Somewhere \$150 would be reasonable. |
| R_xu6GvKWuUqBQOC5 | 8/29/2021 17:02 | Let those who can afford it most pay the most/lose the least from this plan. Money returned to the state should be disbursed to lower income households to offset the greater costs to them. Worker and communities who lose income should get the most support. |
| R_3si7yvyDy8pWwlQ | 8/29/2021 17:35 | I appreciate this informative survey |
| R_3EA5haEeqTUtjuZ | 8/29/2021 18:05 | Thank you |
| R_1nO39Ldj3YAxxdB | 8/29/2021 18:47 | No |
| R_11jRxMZzOfYx1Hi | 8/29/2021 18:58 | The surgery was really nice i loved how it talked about climate change |
| R_004u2AnIoYRAURb | 8/29/2021 19:19 | I understand what cap and trade is all about now - thanks! |
| R_1Qae2GKfy2deaUt | 8/29/2021 20:59 | No |
| R_2rJHAOgVgJ1gSpH | 8/29/2021 21:02 | I think the majority of people are coming to the realization that climate change is real; however, Americans are so slow to implement change and those who would oppose these changes do so for mostly political and financial reasons. |
| R_2E0hLr8Pt1UAglD | 8/29/2021 21:18 | Whatever we do, in 50 years it will be wrong |
| R_2z5Vlx5k5L838Te | 8/29/2021 21:37 | We support 3 generations, 5 people total, from a small family business. As much as we wish to help solve pollution, we would really suffer with monthly costs over about \$100, and even that would effect our family future |
| R_3sCLEosJSvKd23n | 8/29/2021 5:09 | No thanks |
| R_1dy8WlpSahToNwL | 8/29/2021 5:21 | No fight the fight. |
| R_1MX29jrgGCAHIHH | 8/29/2021 7:31 | I'm all good |
| R_2ZDoHjBTn1k8Gtv | 8/29/2021 8:55 | I enjoyed the new information. |
| R_2sYk3dCvoN4AyT | 8/29/2021 9:51 | I really found this survey informative. |
| R_BXugEo4drrtnx3X | 8/30/2021 11:10 | Please consider how many homeless people and how many low income families are already struggling. We are the little guys nobody considers, and we are your neighbors, family, and friends. We deserve to live a meaningful life too |

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Table G1 – continued from previous page

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| R_12hx62VZvIcrqUY | 8/30/2021 12:22 | Thankyou for the information , it was very enlightening. |
| R_3PIgQBWqwUq2i6 | 8/30/2021 12:33 | It is interesting to talk about this topic since we ourselves are destroying the planet and nobody does anything, it is good to be informed and know what is trying to do something |
| R_27DTVzcAqZjyFPo | 8/30/2021 14:31 | Technology is available today that could be used without the economic downsides to the cap-and-trade. For example, there is a company called Bloom Energy that produces fuel cells, which convert Natural Gas, Propane, Methane, Bio-fuels, which virtually no carbon emissions. Imagine not electric batteries for cars (very costly and environmentally unsound) or solar panel batteries, no longer being required. It's the emissions we are after and Bloom energy provides a reasonable alternative. Also, just because Oregon does a cap and trade policy does not mean that our efforts would affect the global climate change. China, Russia, Europe, etc. must all get in or the changes will not be effected. |
| R_1IMnQv4Nup7yzpa | 8/30/2021 15:23 | I loved this surgery ! |
| R_1rp2akHEWE9XuGW | 8/30/2021 15:27 | Would people living on just social security, below the federal poverty level, still have to pay the same amount for household costs or is it based on household income? I didn't see any explanation as to how this figure was established. If it was proportionate to your income I would have been more favorable to voting yes on the various scenarios. |
| R_27l4a3fUQhp8NIR | 8/30/2021 15:40 | Thought provoking. |
| R_1f40lj32taj8YU9 | 8/30/2021 16:10 | poor study |
| R_4HDwcKqvTEGOCat | 8/30/2021 16:44 | I enjoyed reading the explanations of any future vote we'll need to make. |
| R_1MvRAODsIPkesA2 | 8/30/2021 16:59 | The information we have about the earth in general is not that very old. We cannot justify climate change we we know so little about the cycles of our planet over vast periods of time. Carbon dating is what we rely upon for our information but carbon dating to see in the past is not reliable. You can lab reproduce a specimen that can carbon date to 30,000 to 50,000 years old in a matter of hours in a laboratory. We know so little about the earth's cycles. |
| R_2rubJXps8WHTXf2 | 8/30/2021 17:25 | These programs won't make a difference in my opinion if Countries like China, and India don't reduce their pollution. |
| R_2lhmIgiKHGJ2DwD | 8/30/2021 17:31 | Climate change exists. The earth's climate changes. Humans have an influence. Total cause? No. A brook flows, things get in the way, this causes change like speed/idle,. Humans put things in the brook, more changes, I.e. direction, flow. If humans can put less stuff in the brook, less changes, but there will be changes. This is climateâalways changing. Can humans help the change. I hope so. Thank you for your work. Amazing stuff you provided. |
| R_12QmJ0MgUYR6DGy | 8/30/2021 18:25 | The idea that cap and trade would pass off expenses to individual households makes the concept unappealing. Corporations are already milking us for everything they can, avoid taxes, grossly underpay their workers, and make exorbitant profits at the expense of the people and the earth. It is unfair to plan a way to further drain us when so many are already barely getting by and now would be expected to absorb the costs of corporations that must change some of their industrial practices to mitigate climate change that they caused by those same greedy short sighted practices. They out source to foreign countries with no labor or environmental regulations because THEY DON'T CARE ABOUT ANYTHING BESIDES THEIR BOTTOM LINE. Now they want the people to absorb the costs accrued from changing a few of their greedy practices? NO corporations need to be held accountable and they can absorb these costs from their profits and bonuses. |

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| R_3CW1004SOeZJNko | 8/30/2021 18:38 | We here a lot about climate change in the mid 70's we were told a new ice age was coming than in the 90's they started saying global warming was happening. The models they produced had no bearing on reality showing incredible increased in heat in a very short time. None of those model's came close to what has actually transpired. I live on the Oregon coast and if the ocean level's are rising it must be very slowly because I have walked on these beaches since 1965 and they look no different now in 2021. The last 3 summers I have noticed that fall has started in the month of July with leaves changing color early not waiting for more traditional time like September. The sun is the largest driver of our climate and with the low sun activity we may be seeing a cooling trend over the next few years so spending a lot of time and money on trying to stop climate change maybe we should try to understand why our models do not register reality. Florida and New York City were supposed to be underwater 10 years ago. Far as Green jobs go just exactly what would those be...installing solar cells to generate power...I live on the Oregon coast and I have news for you we have fog all summer long and you can not generate a lot of power from the sun when it's foggy now you could set up solar cells inland a ways and get some sunlight but than you would have to have power lines to bring the power where it's needed and what would be the cost and benefit to do that. |
| R_WccPqH2XGIsAD73 | 8/30/2021 19:05 | I just turned 71. and have seen how the world has changed and from carbon gas has affected are air. the world needs to do some thing to improved the air. |
| R_3qTZEkALvURB6Vi | 8/30/2021 21:13 | thank you |
| R_2rC4eEghAQwbd5B | 8/30/2021 21:20 | My low score on "informative" is because this is a long-time area of interest for me. I cannot use solar power without destroying magnificent oaks. I believe that carbon pricing may be a fairer system than cap-and-trade. THE main problem is that our military runs on oil, and so we protect our interests abroad in terms of oil acquisition, as well as US\$ hegemony for oil purchase and global loans. |
| R_bEmmlOCVHVEbIad | 8/30/2021 22:24 | Thank you |
| R_1CHMIxXjI6Kdzd3 | 8/30/2021 22:27 | Doing this survey made me more informed about the carbon cap-and-trade programs. One is never too old to learn. |
| R_qxq4nJOeWAP5iO5 | 8/30/2021 3:50 | No thank you |
| R_1H7FKF8f14GOCf0 | 8/30/2021 4:54 | I really don't have any opinion but if it's going to help us all in general and why not go for it |
| R_12EYzfTrdOs6phW | 8/30/2021 9:03 | When you ask why I voted against a certain Program, it would have helped if you showed the program alongside my possible choices so I could recall what I liked or disliked about the Program I voted down. |
| R_CmlEr96Bcd6pqvf | 8/31/2021 0:06 | good/helpful explanation of carbon cap and trade program |
| R_VInZyRufBWZkVod | 8/31/2021 0:07 | This survey is very educational amd a great way to make people take time to think about subjects they most likely never think about . And it's important for these discussions to take place |
| R_6FOtjMi5c9n5fz | 8/31/2021 10:55 | I didn't like the amount of job loss, and cap and trade seems like it would need A LOT of oversight to manage. |
| R_3ltwBoNyAQ9Gi7i | 8/31/2021 12:20 | Thank you for inviting me to indeed my input on your survey. For such a complex subject, this survey was as simplified as much as possible, it seemed to me. |
| R_3D5DldDmiBYtAV8 | 8/31/2021 14:19 | Great information |
| R_2378QzL2If1K2aI | 8/31/2021 16:08 | This survey was a little bit interesting, but also pretty boring unfortunately. |

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| R_ZE0C31QpP4dLE2Z | 8/31/2021 1:32 | One thing surveys apply to are people who are married or live with someone and who have children/grandchildren. I have none of those areas. I think adding something like unmarried or single would be good. God has not blessed me with any of that. This whole "title" is completely new to me, but the subject matter is partially new and partially known. I found it interesting that you covered everything from households to small and conglomerate businesses and the employment side. This is exactly what happened in going from moonshine to alcohol being legalized AND from manual to electronic means in homes and businesses like horses/buggies to vehicles. All are massive and global changes. As a point, I try to buy from companies that have a footprint in Oregon even if buying is online. Example is that Amazon has a warehouse in Hillsboro, OR so our Oregonians are employed there. Keeping the spending dollars in Oregon for our folks is important to help to keep our economy more robust now and in the future. |
| R_1Ii0cbkzBf8FNkM | 8/31/2021 3:15 | Keep oregon green with a place for wildlife and country folk without taxing their animals. They people life off the land as much as they can and let their neighbors Contribute to think nuggets grown on chickens as chocolate milk comes from brown cows. And when you look for land to developers don't take the middle of a hay field needed for horses. You may not Think it hurts, there isn't enough money to buy the hearths and memories of our ansestors. |
| R_1QLbYXMGUr2GnZx | 8/31/2021 5:45 | I hope the world becomes a better place. |
| R_1dHnjxyJHlhJMgm | 8/31/2021 7:36 | I saw only one option, I thought I was going to see 6. |
| R_2R2IituFfuwsYzR | 8/5/2021 14:11 | None |
| R_2E5CS03arySfC7y | 8/5/2021 14:26 | None |
| R_ZJyGULqLrB7MSB | 8/5/2021 14:37 | I've never taken a survey like this before. Thankyou for giving me the opportunity to learn a little more from this survey. |
| R_12MGwe4xCekwKEC | 8/5/2021 14:44 | I don't have any feedback to provide at this time. |
| R_2Cj1h6ounyN3kuP | 8/5/2021 15:32 | Very detailed |
| R_1DUdJdrzWz1exSI | 8/5/2021 15:36 | Hi |
| R_3EsC8ioOKhara0p | 8/5/2021 15:41 | Thank you for an opportunity to learn about types of carbon cap-and-trade programs. Its very helpful to knowledge more depth of emissions we need to take a control to reduce climate drastic changes from now on and in the future. |
| R_85HCxPAzksPVUOd | 8/5/2021 16:24 | I believe there should be a cap and trade program. Just work out the details to not pass so much on to thr households and make it fair to all. |
| R_1GH9ImZBsEZYrT9 | 8/5/2021 16:46 | Love the information I received taking this survey. |
| R_PMNbKjuP6c3d5cJ | 8/5/2021 19:22 | Very interesting and informative survey |
| R_DBpkCj8kMpqa08x | 8/5/2021 20:20 | I have none |
| R_2qCKIjuQuWZibG6 | 8/6/2021 0:10 | Thank you for the concise explanations. It really helped guide my choices for votes! |
| R_3ff3wJu978G3agc | 8/6/2021 11:36 | Too much reading. Not interested in this enough to be able to keep my attention easily |
| R_8Aoy3JkceGu7KMN | 8/6/2021 12:20 | As a former research assistant at the UO, I'm interested in the non-neutral phrasing you used in this survey. |
| R_2ZihERL3zY3XAoG | 8/6/2021 17:24 | Carbon tax isn't going to help. Has anyone ever heard of the ice age? The dinosaurs lived in a time in the planet's history when the earth was much warmer on a global scale. Then the ice age happened. About 32000 years ago the earth started moving back to where it was. Nothing humans did reversed the ice age and nothing is related to carbon, that'sa lie perpetrated on people to part them from their money and freedom. |
| R_110n4ok530bomVH | 8/6/2021 19:59 | No feedback to provide |
| R_23Wtm3yTF8Et2c0 | 8/9/2021 21:50 | The less time the democrats are around in politics is better for the earth and population. |

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Table G1 – continued from previous page

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| R_3exckSvKotu1enA | 9/1/2021 10:06 | Educational outreach explaining the benefits of Cap and Trade may aid in changing minds of the resistors. |
| R_2AWPyhnyjkTG7vE | 9/1/2021 11:37 | Excellent survey truly providing you with information which I need for a better understanding of such subject |
| R_2PcDo25kzomXtuL | 9/1/2021 14:41 | I am 89 yo. I returned to Oregon where I was born, after a lifetime doing research. Much of this activity was in atmospheric physics. As a result, I can find no evidence of global climate change, and I believe there is no such thing as a "greenhouse gas". So, who benefits from Cap and Trade? Well, Al Gore embarked on this when his personal wealth was approx. \$2 million. he is now worth \$200 million according to WSJ. Other Super wealthy Californians have been promoting this scheme for years. We also have to consider profoundly corrupt politicians. Consider the fact that Oregon built a nuclear power plant, and decided to demolish it a few years later. I don't think we want to entrust such a huge program to profoundly corrupt politicians. |
| R_1Q0AB2YuTnORvCu | 9/1/2021 19:12 | I might have changed my vote if options were different order but minimally. |
| R_3PS2BcRnmT0EJVf | 9/1/2021 19:39 | All of us must work together to solve Climate Change concerns. I think Oregon's Cap and Trade initiative to be more fair than other alternatives, and represents a creative means of addressing this very serious issue of attempting to cool the planet down as well as curtail green gas emissions. The cost to individual households in some of the scenarios seem prohibitive. Local and national legislators from both sides of the aisle must work together to creatively pay for Cap and Trade schemes to spread the cost. Poor people simply cannot afford to pay for industry's greed. |
| R_yQHeSxqDJjPjVYd | 9/1/2021 20:23 | It's was boring and I wish it was something more interesting. |
| R_3MxHXel5TufumY9 | 9/1/2021 20:58 | Since the industrial revolution began, we are just experimenting. |
| R_r78NcDpPdvGT3eV | 9/1/2021 21:10 | Interesting survey |
| R_3NLjZzj6hjynwsH | 9/1/2021 22:22 | I like to know |
| R_2YmFeRxNsbNRxp4 | 9/1/2021 22:38 | none |
| R_1Ke7t6XCfEBSZ4k | 9/1/2021 2:51 | Be good to natur |
| R_1g6pmezq0nRzGoR | 9/10/2021 14:53 | I like F the best! |
| R_1NxAKIWEoMasQmp | 9/10/2021 3:02 | Very interesting and learned a lot. |
| R_24dsZPPIf2twh1i | 9/11/2021 10:32 | Great articles made .e.want to vote |
| R_1rH9tM9VikRAL2t | 9/11/2021 12:38 | Very in informative, but a little too lengthy. |
| R_10IuuHdTVbWlQsd | 9/11/2021 13:25 | Nothing to add |
| R_2OVH4TYbb7ig4Hw | 9/11/2021 13:40 | Good survey. Hope the points are there too |
| R_2zOVDOaakbUb0Iq | 9/11/2021 14:35 | Stay healthy, stay safe! |
| R_URwDa8CGkD1YBzj | 9/11/2021 18:08 | No matter which way the issues go, the consumer will ultimately pay the price. If companies pay more to operate their businesses, consumers will pay more. |
| R_3pqXN0Maht6QUyL | 9/11/2021 18:09 | It was a decent survey |
| R_Xudk6RuHYEkqhSF | 9/11/2021 18:12 | all good |
| R_XhSTIBnfhItbbz | 9/11/2021 18:36 | None |
| R_2WNcZITD3WtbA0m | 9/11/2021 18:40 | Tbh idk |
| R_3PpFeNIG3xuUsFO | 9/11/2021 18:44 | A lot of info |

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Table G1 – continued from previous page

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|-------------------|-----------------|---|
| R_1f0YQHxNMJ3IVOs | 9/11/2021 18:56 | Climate change sucks |
| R_3nPfyzMTuNaiobs | 9/11/2021 19:02 | I dont understand why not allowing other pollutants isnt in every plan . It also does mot make sense to me that if a company sells their permits they would be allowed to pollute more |
| R_1OCrFH4Ivi9NZhc | 9/11/2021 19:08 | we as a people need to makes changes before it's to late. |
| R_2xyD2PJHI0J62MZ | 9/11/2021 19:27 | you pay now or you pay later with you"re life. Tax corporations and manufacturers who never pay the fair share of taxes. |
| R_2QLguR76QsHrTbD | 9/11/2021 19:29 | I really appreciated how the information was broken down and easy for me to understand about a subject i had previously known very little about. |
| R_zeDTVB0neIV8aTD | 9/11/2021 19:32 | I don"t disagree about climate change. But I don"t believe it"s all human caused. I think it"s just part of the normal cycle the earth goes through. |
| R_3nwrTwSLDOGHSWb | 9/11/2021 19:35 | In this area government making rules that hurt more than help. We have forest fires,bad forest management,and air is not heathly to breathe. |
| R_1msfcUWF8tjTvIT | 9/11/2021 19:37 | Thank you for doing this! |
| R_24pbIwzkKunGd76 | 9/11/2021 19:43 | The survey was very interesting and contained very good information. |
| R_1GCeTM4Wg170YxP | 9/11/2021 20:22 | N/A |
| R_1NC8FhS0MeNkdY1 | 9/11/2021 20:37 | None |
| R_daIB0wptYpuA0OR | 9/11/2021 20:58 | Thank you for this survey. It was very informative and helps much more to understand the terminology. I definitely agree that climate change is real and change needs to happen. However, it is also very scary to me as I live on less than \$1,000 a month. My apartment is heated with natural gas...if it changes, housing costs are going to rise. They are already high in this area, and so is homelessness. My vehicle is gas powered...if these changes happen, I will have to buy a hybrid...I can"t afford to buy a new car. If we don"t abide by the new changes, insurance and fuel costs will most likely rise. Worst of all, because this is unaffordable, me and people like me will still be part of the problem rather than the solution! |
| R_a4sbRdSFABCyLqV | 9/11/2021 21:01 | No |
| R_33cYLbpj83Txeg2 | 9/11/2021 21:10 | I enjoyed this survey and hope more people get to see it! |
| R_2uNFnCZhO4d5Qtg | 9/11/2021 21:26 | keep giving the information more and more are realizing the thruth. |
| R_3PoZBHNwPzT6DbM | 9/11/2021 21:48 | I am scared for the future of my generation and the generations that follow. The threat of climate change is imminent and existential, all action that can be taken to slow it should be taken. |
| R_tYW3BFp5EgYHXDH | 9/11/2021 22:06 | Thank you for sharing the knowledge and including me on this survey! |
| R_1ILeHcSACyNHGVA | 9/11/2021 22:32 | Thank you for letting me share my opinion |
| R_1JUSgwPKpMkCQLw | 9/11/2021 22:32 | Good survey and can be very helpful for Oregonians who have no idea on what"s happening today in our world. |
| R_1oEYM3hpTCeongW | 9/11/2021 23:29 | It really is scary these times we live in, something has to give. I don"t think for Oregon a personal income tax is fair or right or will solve Climate change. |
| R_1OC8NbrKq9TaGF0 | 9/12/2021 0:10 | Nothing. Thank you. |
| R_3dNihX6j8Y5o0Co | 9/12/2021 0:22 | I like that they care about the environment |
| R_CdL4MunODwnwwIp | 9/12/2021 22:24 | No |

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Table G1 – continued from previous page

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|-------------------|-----------------|---|
| R_3CnTPfYkTd6hVzr | 9/12/2021 3:18 | I could talk about this quite a bit. But I don't believe climate change is a problem for us. Okay maybe not that it's not a problem. But I don't believe that it's because of humans. I think it's just another topic to discuss to make a problem to divide us Americans mostly. If globally warming were real how come planets in our solar system have experienced global warming issues with no people living on them. I think after thousands of years the world planets etc are going to slowly make huge impacts on it's structure. If this was an issue why is it only been talked about now I feel it's just another reason to get people to argue with each other to divide us. It's another reason to shut down businesses it's another reason to charge more money to live here it's another reason to destroy America it's all political |
| R_2QSYdD8eAp5XZKX | 9/12/2021 4:10 | I believe the carbon tax is a good idea. Teaching and educating the public on better ways to reduce the carbon imprint and effective ways to do it would help. |
| R_2y7ODnHVas12eA7 | 9/12/2021 4:48 | thank you for using larger text |
| R_3J4sY0psGCIMm3G | 9/12/2021 4:54 | its very good |
| R_3Jsjfu5CEBr5h4I | 9/12/2021 5:00 | none |
| R_22Y0Es6EB2CIQZS | 9/12/2021 5:58 | no |
| R_1gME3xUE2FIDKU3 | 9/12/2021 6:43 | Took longer than expected |
| R_1QnBGivsGVTBPqc | 9/12/2021 6:51 | When you show a screen asking why I voted for or against the program you showed on the previous screen, why not have that program displayed on the side so I can easily remember what I liked or disliked about it? |
| R_1pVFxwDvZx7CvRd | 9/12/2021 7:47 | someone will be making a ton of money from these programs and I guarantee that it won't be we the people. |
| R_2YaHSK7tG5V3xnw | 9/12/2021 8:16 | As I stated climate change is a serious issue and I cannot get passed what the leaders of this country and of Oregon has done to our America and for that reason I would vote against anything they try to pass without believing they are doing it for their own political gain. As of today I will never stand by anything our government is in favor of. The leaders of Oregon do not do what is best for communities only what is best for them. |
| R_3HM23LmPmDdrxUI | 9/12/2021 8:56 | We all need to take part in reducing our own carbon footprint. Everyone needs to pay their fair share. I need to pay my share for using natural gas and electricity, gasoline for my car. Companies that have more carbon emissions need to pay for what they are polluting. I say auction all permits and every year increase those costs. We will need to force a replacement for or build governmental industries. God made us highly intelligent and even though we knew it was wrong we have taken shortcuts to improve our bottom line when we knew it affected our environment. Time to stop it and I believe the government could have prevented most of this had we not allowed certain industries in our country. |
| R_2AHfoycVmeePqvE | 9/12/2021 9:06 | \$215 more money per household will just make it harder for the average long-time Oregonian. Our state is so wrongly taxed in so many ways. Make takes equitable—whomever uses it, pays for it. I'm a lifelong Oregonian and instead of this idea, charge people to drive like the DOT has brought up. More and more people and cars is a real problem—start charging people auto taxes for the amount of miles they drive. Whomever drives the most, pays the most!!! This would also reduce traffic on our roads. I work full time and drive less than 5000 miles/yr in my auto and always have for 40+ years. Most people drive like 25,000 miles or more. Charge them by the mile!! That will reduce a great amount of Carbon Dioxide. Charge the autos coming across our boarder of Oregon a toll coming in—just to pass through, etc. |
| R_3IYPIQFDFPB56PZ | 9/12/2021 9:33 | I'm not sure any of this will work we don't have control over the world |
| R_1rwDgn5RmqKumGR | 9/12/2021 9:37 | I will not support any kind of legislation that doesn't allow me to vote on it. |
| R_3szXx1cJ0PUv9eV | 9/12/2021 9:41 | nothing in particular |
| R_3LXbAc7jfdody0 | 9/13/2021 15:54 | The survey was very informative |
| R_210Ucx2ibaWuSad | 9/13/2021 20:35 | I learned a lot, and appreciate the education. |

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| R_1pSWnPYIVwNryaO | 9/14/2021 10:06 | nothing to add |
| R_1n0faYTbDoN1gLj | 9/15/2021 20:43 | Thank you for an educational and bias free delight of a survey |
| R_cGtCHA9oTFvGG2d | 9/15/2021 7:14 | None |
| R_3qJ784TDNlpAvwo | 9/16/2021 22:47 | Gfsk |
| R_vrf7Xr7FQSSHV7j | 9/17/2021 10:50 | If this is going to be coming soon, I would love to see more information advertised to the public. This is the first I heard of this. |
| R_2Bhbp15dgrnFjg | 9/17/2021 13:43 | Fantastic Survey! Thank for all of the knowledge! |
| R_1OUUnXuidmAVogLj | 9/17/2021 15:54 | n/A |
| R_1mVrzLkA1TXmjZM | 9/17/2021 16:02 | thx |
| R_30tPCDNGnPqLudG | 9/17/2021 19:50 | nope |
| R_0wDwXruSMOQyGo9 | 9/17/2021 8:53 | Thank you |
| R_3vXW4rq4MC1ZXtn | 9/18/2021 0:54 | Great survey thanks |
| R_2S6yP1EmPMvq7a9 | 9/18/2021 11:01 | I like how people start to know more about the climate change |
| R_1q1CGARVCS4LzDo | 9/18/2021 11:30 | Raising taxes doesn't change the climate. |
| R_ON06GR2PJTE3qbn | 9/18/2021 14:15 | Very good |
| R_1C91E8CWsQO9Zmj | 9/18/2021 14:59 | Thank You! |
| R_2SH9o6smP4At0kO | 9/18/2021 16:33 | The most informative survey I have ever taken. The survey had more information that could be absorbed in a few minutes that I have read. Very well done. |
| R_3FQYNyEjh7C1MAA | 9/18/2021 1:52 | Try to reduce the use of disposable products and drive as little as possible |
| R_Y9NeH2ZSy5TP4rv | 9/18/2021 20:32 | Fun survey |
| R_4NqpU8jHkdQsRP3 | 9/18/2021 20:41 | I am very active in the CUT-OUT of Pollution in our environment due to the fossil fuels and I personally ride my electric longboard to and from every single location that I have to visit each day. I STRONGLY SUPPORT the TRANSITION to GREEN, Electric and non pollution causing ways to cut out any unnecessary waste and trash on Earth |
| R_2sTIURbPq13cPAs | 9/18/2021 22:28 | Thanks for the quick surveys |
| R_3HMr1AGpWDAhzBD | 9/18/2021 8:27 | we all have to act before it's too late |
| R_33dkQZ44qH7r4KG | 9/19/2021 0:23 | I really like the subject that this survey was on. I wasn't sure what content you guys were going to offer at first. I live in Eugene Oregon and gaining awareness on Climate change is very relevant in the community. Carbon emissions are one of the main culprits of climate change |
| R_Og9CNpHkegKuiQx | 9/19/2021 11:09 | U should give some available answers that u don't agree with so people can tell more of there truth |
| R_ZqSFF09fbx9UEk9 | 9/19/2021 17:21 | Hey this was propaganda to scare people about climate change to force them to vote on cap and trade. |
| R_1FnT4sMVd7Xhlm7 | 9/19/2021 22:17 | I definitely liked the survey. I just wish it was a little bit more informative but it really is relevant to today's life |

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Table G1 – continued from previous page

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|-------------------|-----------------|---|
| R_3pi12WtTSC0GMs9 | 9/19/2021 2:24 | I think we as humans need to not take away the jobs that built the society we all live in and enjoy and actually develop new ways to do those jobs that are actually not creating emissions and as humans we need to start thinking about how to relocate because the planet is already ruined and we all have made our way of life so important to our lives that it's not going to change easily and we should put our energy and efforts elsewhere |
| R_0BXMBnN4C2COmgF | 9/2/2021 0:24 | it is very important to talk about this topic and climate change |
| R_bNtmqSu2RXya7vz | 9/2/2021 10:28 | No opinions that you would care to hear about. |
| R_2dnBHjewMtXF81W | 9/2/2021 11:29 | Grubhub hun |
| R_2qgi2piRy6g5CbD | 9/2/2021 12:57 | I know climate change is a big problem but this bill if passed would hurt a lot of small businesses |
| R_25BMUa2aAH24eXS | 9/2/2021 13:37 | Thank you so very much for the opportunity and letting me do this survey. It was very informational very thought-provoking and I enjoyed it very much thanks again! ð |
| R_2tsqy2shEdJeigp | 9/2/2021 14:43 | Wish there's more surveys like this was interesting to more more about carbon caps |
| R_exJbLTDOxI7PvdT | 9/2/2021 16:27 | Nothing more to add at this time |
| R_3k4wvcx7JcdXz1R | 9/2/2021 18:24 | No thanks. |
| R_28LJHAU4y0Um3Yx | 9/2/2021 1:07 | None |
| R_22QuiTZaD7PkK6v | 9/2/2021 20:04 | No thank you |
| R_3NHSEsLNtXrEwDi | 9/2/2021 20:56 | Cape and trade is horrible. And horrible for the people of Oregon. |
| R_20Zmsyfw6mTryob | 9/2/2021 23:31 | Great |
| R_3g2bjgudbB3Fw0D | 9/2/2021 4:11 | Thank you for the information. |
| R_2rSgneCyYAy9FWT | 9/2/2021 9:04 | Really interesting survey. This topic has been on my mind lately. |
| R_21v5CzBxkyQYMuQ | 9/20/2021 17:02 | great survey |
| R_ah2gOSIdV3pOBuV | 9/20/2021 18:45 | I live it everyday and never give up. Oregon is the best. |
| R_zVe4VQQDwvAoVXz | 9/20/2021 9:11 | Feedback |
| R_3qeNTMCWI5qLe1c | 9/21/2021 19:01 | It was a good survey |
| R_11XeHjGAwY1BN3Q | 9/23/2021 8:50 | Not at this time. |
| R_3g8icvurnMqZDpl | 9/24/2021 10:39 | Thank you. |
| R_3knCXD2QwWTvChi | 9/24/2021 14:15 | Great survey, thank you for the neutrality. |
| R_9pHs6JsJitUyJwJ | 9/24/2021 19:51 | Sounds like a beneficial plan to lower carbon emissions. |
| R_2eXAJ6nNzLG4y0t | 9/24/2021 8:45 | Thank you |
| R_1Iddg9kNrIbafRX | 9/25/2021 22:08 | Great |
| R_1rBPzFS1dlhdAIa | 9/25/2021 3:29 | No thanks. |
| R_2TXmXgzL7XaXM5h | 9/26/2021 20:54 | I seriously doubt that ANY carbon regulation in the US will have any impact so long as China continues to outpace everyone on gas emissions and the global community does nothing to stop them. |
| R_1kSsjEFIFB2Rseh | 9/28/2021 16:33 | It's always nice |

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Table G1 – continued from previous page

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|-------------------|-----------------|--|
| R_ezfeHKQ9IHQwtnb | 9/28/2021 21:41 | N/A |
| R_2QPq1KimVM9xgay | 9/28/2021 23:26 | The survey was great |
| R_3HFvfCGLNLgkm7i | 9/28/2021 2:28 | Environmental protection does not affect the work and rest of Americans all the time, and carbon emission is a major factor affecting the environment. We should pay attention to this matter, jointly improve the ecological environment and protect our home |
| R_1LUzbnVzYIDFIKr | 9/3/2021 0:11 | Perhaps if you lowered my taxes I could afford \$3000 per year higher expenses for your carbon dream. Portland is becoming so expensive, we really can't afford paying more! Our sewer bill just went up, our water bill is more expensive this year, electric, nat gas... Now oil and gasoline are going up. When does the little guy get a break? When do tax paying citizens benefit from all the liberal programs Oregon government puts into place? You build the Max that no one rides and that I continue to subsidize. Why not charge people the actual cost of a max ride and let me keep my money? Until you can figure out a way that your idea will financially benefit me, I'll always vote no on a new government tax. |
| R_3NEwJ2fuKArf8y6 | 9/3/2021 10:32 | Es interesante |
| R_3pJRXtB9DILX7a | 9/3/2021 10:55 | Well thought out and easy to navigate survey. Best I've seen on the platform |
| R_eyNohCmYbAWhsaZ | 9/3/2021 11:07 | Great survey |
| R_3qTLc0OSSpd9cO3 | 9/3/2021 11:40 | Thank you for informative and educating information! This is very relevant to me and my community! |
| R_vDjTixxhBkxgkyl | 9/3/2021 12:20 | This survey was really cool |
| R_1f46DI4TVYyXuBE | 9/3/2021 17:10 | This was an intense survey, with a lot of information. I wondered about the use of images (like the first image of fire, or the images of polluted sky or protests), as it seems like they really push the cap-and-trade/pro-climate change viewpoint (which I agree with) and make the survey less objective, or possibly make people more on the conservative side of things less likely to complete it. |
| R_27QcxYRCuH797pM | 9/3/2021 19:00 | I'm very interested in the program and support it if it is affordable for us or our home. We are on a limited income, and can't really afford the fees per home or the possible expenses of the plans. The \$90.00 was really pushing it. |
| R_2fjrJozpXM4LffD | 9/3/2021 21:08 | I love surveys like this! |
| R_3CKs7r7G3yD6RQb | 9/3/2021 22:25 | This was a great survey! I loved all the information that was given |
| R_2rITLkclG15ZBkR | 9/3/2021 23:14 | Offer a company solutions, or make the new company have a permit before even building. Make economic electric cars more affordable. |
| R_1OT8EgOXDKb8rGH | 9/3/2021 8:52 | It was very informative |
| R_25sXmYBvd5NGnzC | 9/4/2021 12:13 | Thank you |
| R_qX9HtSBY8YQUsZX | 9/4/2021 14:12 | None |
| R_24uXB9bRVnJMTnB | 9/4/2021 15:14 | Interesting and relevant |
| R_5uQCQ3ZLRTSmSFr | 9/4/2021 16:37 | The biggest thing glossed over by the green energy proponents is the additional cost of the greatly larger number of jobs required to make the same amount of output. Seems pretty stupid from a practical standpoint to not highlight this context. It is always sold as a good thing to create additional jobs, while ignoring the inefficiency. |
| R_3JIMlssvr2DwVki | 9/4/2021 18:03 | Cap and trade is a scam by Democrats to Try to control and take more money from people. |
| R_2TNPCFRSQoYrvZI | 9/4/2021 18:36 | Program F would be the best choice. |

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|-------------------|----------------|--|
| R_RPq2lwsGGUzKImJ | 9/4/2021 19:09 | 1) Letting companies but sell or trade these permits is a bad idea. Why, because the bigger polluters are the biggest cash makers. at 2 to 2.5 percent a year reducing pollution. It will be five to ten years before we see much locally so why give the worst a way to prolong this level of pollution. 2) The areas in industry that pollute the most and the stuff we consume of these needs to be looked into with the of removing say plastic wrap for plastic bottles. 3) Everything the household does daily when being ecological is by choice, so why can't we not work on cutting down on what will go to the dump. |
| R_330V6RVSQA9UTVb | 9/4/2021 19:16 | So many families are truly struggling in my community. While we ALL should be concerned about our planet and take responsibility for our part in caring for it. It is hard to support something that could make it even harder for people to survive. I do not want to see even more people lose their jobs, and possibly homes. |
| R_0UuPWpNIXIhuWUV | 9/4/2021 19:49 | Cap and trade in any form is horrible. And wrong for Oregon. Govt cant manage money they have now, you think they'd actually give back with any of this money?!?! So what if you add jobs, what do you tell the peoples who's livlyhood you took away?! |
| R_2dfNuYPLIJak4G | 9/4/2021 23:26 | Oregon gets something like 70% of its power from Hydro. Why are you whining about carbon credits?? Just convert to electric and build more hydroelectric dams..... |
| R_3EGzsy7bX1StmIa | 9/4/2021 8:52 | Interesting made me think |
| R_1lmJdPBli7oWPmG | 9/4/2021 9:59 | great, fun survey |
| R_3O3A5jOo82C2EhT | 9/5/2021 0:47 | The information was well-explained to where I was able to understand it, but in a way that kept it short and sweet. It was unbiased and allowed me to feel free to be able to think and vote for myself, and really stressed and pushed that, which I greatly appreciated. It was really informative, too, and I learned about something new that is important and relevant to me, and I had some fun learning it! Great little survey, and thank you for letting me be a part of it! Keep up the good work! |
| R_2qvw5FKBuKUS6Ys | 9/5/2021 12:59 | No feedback |
| R_1DYAH7I5j05q2AP | 9/5/2021 13:26 | This survey was really good |
| R_21mFgeaDQR1Y3pl | 9/5/2021 13:52 | Great survey, I think students across Oregon would benefit from doing this! |
| R_3Nwwf2wIt1X2MgG | 9/5/2021 15:45 | Love it. Let's do something. |
| R_3jTgNtd18whjiQt | 9/5/2021 15:57 | It is horribly offensive to ask someone what their gender is. I do not have a gender. It's like asking someone what kind of soul they have. I not only do not believe in gender identity, but the idea of having a gender is traumatic and oppressive to me. Ask for a person's sex, not their gender. Not everyone has a gender, but everyone has a sex. |
| R_1LksNedMrRIXHJI | 9/5/2021 16:02 | i loved this survey because i learned so much |
| R_ptUj6kNFcHfJ7nr | 9/5/2021 16:30 | Nothing to add |
| R_Du9qKOpKxIk84Uh | 9/5/2021 16:57 | I am all for being more green but it shouldnt cost more prices are already way too high natural should cost less. |
| R_egmfq0XcmXyPqP7 | 9/5/2021 17:28 | Carbon cap is being placed in the wrong area. Oregon has gone down in pollution, maybe not much but we have by something like 1% or more where russia and china has gone way up. Force them to make a change and stop punishing the ones who are doing something already about it! We can not make up for someone elses failures all the time! |
| R_2TZPmYmuBzj09O0 | 9/5/2021 17:53 | My beliefs are the earth is going thru a heat cycle. Accelerated by humans. We have only been keeping record of temps and climate for such a short time compared to the age of the earth. There have been several Ice ages and I dont believe SUVs melted that ice. |
| R_0BcSOTqNTUM0RGN | 9/5/2021 18:06 | This was very informative. |
| R_28P2Re1hXI7HH99 | 9/5/2021 18:22 | Great survey and information. |
| R_26gtTGfkKC29Gta | 9/5/2021 18:25 | Thank you that was very interesting, i actually never thought about a cap and trade program |

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|-------------------|----------------|---|
| R_29ib5QsxH9i0wsi | 9/5/2021 18:57 | Carbon cap seems like good idea although I think there are too many variables to get it done |
| R_2Bqv6w7gE6cK7WZ | 9/5/2021 19:07 | thank you for this very important work! |
| R_1gS0e0EHMxJO0MV | 9/5/2021 20:21 | I love it hope we get more like this |
| R_3iDyvfJpYmIQYBm | 9/5/2021 20:49 | Thank you so much for sharing learned alot |
| R_OvSrQNT5vE2Ua6R | 9/5/2021 21:30 | I think equipment purchase assistance for small businesses is really important. Also not related to this exactly but towns like Eugene need to stop allowing healthy trees to be cut down. Also it seems that usable buildings are allowed to be demolished to building apartments. Seems so wasteful. Institutions are short sighted. |
| R_5zQWU4Q4mTaId1v | 9/5/2021 8:58 | Thanks for this vital research. |
| R_3RzKSqJAWASVPx | 9/6/2021 0:52 | In general I am in favor of caps but not so much the trade portions. I can see big business who is polluting the most affording the extra permits to allow them to continue business as usual. |
| R_3sBsskYLokFTnru | 9/6/2021 11:03 | No feedback at this time |
| R_w1NRVJLsxkga0gx | 9/6/2021 12:32 | It was great |
| R_1pA8ZoTe4CtgilE | 9/6/2021 14:10 | Good survey |
| R_yD6H7PA8coV6uU9 | 9/6/2021 15:05 | Thank you for the information |
| R_VOspZbegC8uQWfD | 9/6/2021 17:10 | Thank you |
| R_3PHPv1C3YX9HqvL | 9/6/2021 17:43 | N/A |
| R_6X8JGrU2ko6qcrD | 9/6/2021 19:24 | Good stuff bud |
| R_sETUVATtYiL7f57 | 9/6/2021 7:01 | C & T is another government scam to fleece more revenue \$\$ to alleviate their addiction to tax & spend stream. Special interests have lobbied our elected officials into their pocket. The âScam-demicâ was planned and is rolling along. |
| R_2bT9RprI1Db9roi | 9/6/2021 9:00 | I am very surprised that this survey was the work of only ONE graduate student & ONE professor. This was quite a lengthy & complex series of statements that were WELL ILLUSTRATED and with copyright credits for every photograph! The optional pop-up explanations were very helpful to me, particularly since I had not heard of some of these nuances of CAP & TRADE before today. I felt that the competitive plans that I was asked to review & vote on were NOT trying to shift my opinion, but were rather objective, each in their own standing! I personally have previous experience, decades ago, in survey design, implementing surveys & survey tabulation, so I have a fair understanding of what sort of work the Economics student & professor still have waiting ahead of them, as you collect response from this very interesting survey. I wish you a lot of success on this project, and I honestly hope that Oregon's legislators of BOTH political parties read & absorb the results of this survey. [...self identification omitted...] |
| R_2IOJCSp3OVluzrr | 9/7/2021 14:13 | I'm glad I could do something that might be useful in the decision making |
| R_2vZCnNj2UzXj5zP | 9/7/2021 16:06 | Survey worked great very enjoyable to fill out and complete. |
| R_3qsMa7ckN5ffKrD | 9/7/2021 7:41 | Carbon cap sounds like a great idea. Trying to implement it would be had to do. |
| R_3m7CuDV0LNlWafS | 9/8/2021 16:39 | Thank you for taking action. Any of these plans is better than none. One wonders about the morality of allowing an undereducated electorate vote on the existance of the species. |
| R_2qsFN8eN4CXd432 | 9/8/2021 21:44 | Fun time with the Surveys |
| R_2B8VbeyewZu3mpR | 9/9/2021 10:00 | Liked how much info there was to learn |
| R_2PnStK3FSehCubT | 9/9/2021 10:59 | wow - I sure learned - and understood a lot of information. This will be a VERY hard problem to solve - and it will sure NOT be able to please everyone!!! |

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