Pre-analysis Plan: What drives support for inefficient corrective policies? Evidence from an energy ballot initiative

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Abstract

In this paper, I use an information provision experiment conducted about a vote on Nevada's Renewable Portfolio Standard (RPS) to understand how voter beliefs inform support for price versus performance-based policies. By modeling how voter's perception of policy attributes (cost, effectiveness, and equity) map to voting behavior, I will be able to decompose differences in policy support into mutable misperceptions of policy attributes versus differential aversion to certain policies (i.e., a general distaste for tax-based policy). These results have important implications for designing politically feasible corrective policies.

1 Introduction

In many cases, externalities are regulated with performance standards or quantity thresholds where economic theory suggests that price-based mechanisms offer a more cost-effective alternative. Examples include the US corporate average fuel economy standards, feed-in tariffs for renewable energy, and the US Clean Air Act. There are many explanations for voter's aversion to price-based regulation, including cost salience, equity concerns, lobbying, perceived efficacy, and fairness (Carattini, Carvalho, and Fankhauser, 2018). A robust voting literature demonstrates that these considerations matter: voters tend to prefer policies that they perceive as cheaper, fairer, and more effective (Healy, Persson, and Snowberg (2017), Huber, Wicki, and Bernauer (2020), Kuziemko, Norton, Saez, and Stantcheva (2015)).

Under these preferences, it is puzzling why voters routinely support performance standards over price-based policies: Given the cost-effectiveness of Pigouvian taxation and the ability of governments to pair these policies with redistribution, it should theoretically be possible to construct a price-based regulation that is superior to a performance-based regulation on at least one of the three dimensions of efficacy, fairness, or cost, holding fixed the others. One explanation for the tension between voter's stated preferences and policy attributes is that voters are misinformed. A growing literature has documented voter misperception of policy features (Sapienza and Zingales, 2013), lending credibility to early models of voter inattention proposed by Downs et al. (1957), Sims (2003), and others.

In this paper, I use an information provision experiment conducted about a vote on Nevada's Renewable Portfolio Standard (RPS) to test the hypothesis that voter misperception of policy attributes explains differences in support for corrective policies. This information provision experiment has three stages: First, I will survey a pool of Nevadans on their support for both a 50% RPS (which is on the ballot in Nevada in 2020), and for a hypothetical alternative price-based policy (a $25 dollar carbon tax). I will also record their initial perceptions of the cost, effectiveness, and fairness of these policies. Second, I will provide respondents with source-randomized information about these policies. And third, I will record voting behavior and posterior beliefs about both of these policies.

Using the results from this survey, I will build separate models of voter support for carbon taxation and for renewable portfolio standards. These models will allow me to answer three research questions. First, which policy attributes inform voter positions on corrective policies? Second, does the misperception of policy attributes erode support for emissions policies? And third, to what extent can the differences in support for renewable portfolio standards and carbon taxes be explained by differences in voter perceptions of policy attributes?

The results of this experiment have important implications for the design and communication of externality-correcting policies. The relevant question is whether policy preferences are mutable. If the factors that largely determine policy support are mutable (e.g. perceived cost), then providing voters with relevant information may lead to support for policies that would lead to welfare improvements relative to the uninformed policy counterfactual. Such a result would also lend credibility to works that point to the importance of advertising campaigns in determining

the results of climate policy votes (see Anderson, Marinescu, and Shor (2019), Meng and Rode (2019)). If preferences for policies are inflexible (e.g. 'tax aversion' or ideology), however, this implies a different objective function for policymakers. If neither policy attributes nor perceptions of those attributes do much to budge public opinion, then second-best corrective policies may in fact be the optimal policy given political constraints.

2 Setting: Nevada Question 6

Nevada's Question 6 is an instituted constitutional amendment about energy policy that will be decided by Nevada voters during the 2020 election. The ballot language for Quesiton 6 is as follows:

> ***Question 6***
>
> *Shall Article 4 of the Nevada Constitution be amended to require, beginning in calendar year 2022, that all providers of electric utility services who sell electricity to retail customers for consumption in Nevada generate or acquire incrementally larger percentages of electricity from renewable energy resources so that by calendar year 2030 not less than 50 percent of the total amount of electricity sold by each provider to its retail customers in Nevada comes from renewable energy resources?*

If passed, this initiative would increase Nevada's Renewable Portfolio Standard from requiring that 25% of the State's electricity come from renewable sources by 2030 to requiring 50% by 2030. Note that this initiative was also on the ballot in 2018, as initiated constitutional amendments in Nevada require passage in two consecutive even-year elections.

3 Information Provision Experiment

To understand how voter perceptions about policy attributes map into policy support, I will survey Nevadans about their views on Question 6 as well as on a hypothetical price-based alternative policy, and track how their preferences change in response to information about these policies.

3.1 Administration and Recruitment

This experiment will be hosted on Qualtrics and administered via CloudResearch, an online platform that allows researchers to distribute surveys through Amazon Mechanical Turk (mTurk). Survey participants will be US citizens, residents of Nevada, and aged 18 or older. Qualtrics and CloudResearch together include several safeguards against respondents falsely claiming to match survey qualifications. These safeguards include IP address location verification and filters for low-quality mTurk performers (e.g., accounts that fail attention tests) that are likely automated.

3.2 Survey Overview and Timeline

Prior Survey (Starting October 7th)

> Beginning October 7th (the day Nevada begins mailing ballots to voters) the prior survey will be posted on Amazon Mechanical Turk. The survey will be open until 1100 responses are recorded. Based on completion rates from mock surveys, this will likely roughly 5

days. The intuition for this start date is to ask voters about there preferences as close to the election date as possible, without surveying individuals who have already voted. This initial survey has three parts:

Part 1: Elicit priors. In this section, participants will be shown the official text from Nevada Ballot Question 6. They will be asked whether or not they support the bill, and asked to share their beliefs on three attributes of the bill: *cost, effectiveness, and regressivity*. These attribute questions will be performed in an incentive-compatible manner: participants who respond with cost, effectiveness, and regressivity estimates closest to the average figures reported in academic studies will be given additional compensation (a $10 amazon gift card) after they complete the survey.

After responding to these questions about Question 6, respondents will be shown a hypothetical alternative ballot initiative ("Question 7") that would impose a $25 carbon tax in Nevada and cut the state sales tax by 1.5%. They will be asked how they would vote on this policy, as well as the above questions about cost, effectiveness, and regressivity. See the Appendix for the language used in this hypothetical ballot initiative.

Part 2: Economic and Demographic Information In this section, respondents will provide information about their age, income, energy expenditure, and employment. This information will then be used to tailor the information they receive about the incidence of these policies.

Part 3: Information Provision. In this section, participants will receive information about the cost, effectiveness, and regressivity of each of these policies. Each respondent will receive 6 pieces of information, corresponding to the six attribute-policy pairs (e.g. the *cost* of the *carbon tax*). Within each attribute-policy pair the respondents will be randomly shown one of two possible academic information sources. This random, non-deceptive variation in information signals will provide the variation used to identify the parameters of interest in my preferred specification. See the Appendix for details on the possible information treatments.

Follow-up Survey (Starting November 4th)

Beginning on Wednesday, November 4th (the day after in-person voting for the 2020 General Election), I will open the follow up survey via CloudResearch. The survey will be open for 5 days, and will only be displayed to mTurk workers who completed the prior survey. This survey has two parts:

Part 1: Record Posteriors and Voting Behavior. I will record voting behavior on Nevada Question 6, and posterior support for the hypothetical carbon tax alternative ballot initiative,"Question 7". Additionally, I will collect posterior beliefs on cost, effectiveness, and regressivity for both initiatives.

Part 2: Record Additional Voter Information. The final stage of the survey includes collecting information that was not collected at an earlier stage because it may have 'primed' voters toward certain responses. This information includes political affiliation, voting method, and exposure to advertising.

4 Data Processing

Dropping observations

I will exclude observations from my analysis for three reasons. First, although I take several safeguards against individuals retaking either the posterior or prior survey, it is still possible that individuals could take either the prior or posterior survey more than once (e.g., by taking the survey on another device to circumvent cookies). All observations from mTurk workers who repeat the prior survey will be dropped, as they will likely receive conflicting information signals. If individuals repeat only the follow-up survey, I will keep their first response and discard any subsequent responses. Second, as a quality control measure I will discard surveys that were completed in less than one sixth of Qualtrics' estimated survey completion time. For reference, the cutoff rate is roughly three seconds per question. Lastly, I will use Qualtrics' *Expert Review* feature to identify and drop responses that were likely automated.

Winsorization

As a study that uses largely non-verifiable self-reported data on perceptions, the empirical exercises below are vulnerable to outliers in survey responses. In response to this concern, I will winsorize (at the 2.5% level) voter perceptions on all attributes. Intuitively, this exercise reflects taking outliers in reported perceptions *seriously* but not *literally*.

5 Empirical Strategy

The goal of this study is to estimate how beliefs about cost, effectiveness, and regressivity of climate policies influence voter choices. To that end, I will estimate models where policy support if a function of perceived policy attributes.

5.1 Variable definitions

Primary outcome variables

(1) *Support for renewable portfolio standards* (binary)

This variable will be collected twice – as a prospective question in the prior survey, and a retrospective question about voting behavior in the follow-up survey.

(2) *Support for carbon taxes* (binary)

This variable will also be collected twice for each participant. Note that because carbon taxes are not on the ballot, these variable reflects preferences and not reflect self-reported voting behavior, as in (1). In the specifications listed below both (1) and (2) are denoted $I(yes)$. I do not subscript these indicator variables by policy because each regression uses data from only one of the two policies (never both).

Secondary outcome variables

The following three variables will be used in regressions that characterize voter learning. Note that these variables serve as right hand side variables in Models (1) through (3) below.

(1) *perceived cost* ($c_{i,t}$)

This variable is defined as respondent's belief about the expected annual cost of a given policy $\in$ {*RPS, carbon tax*} to the respondent's household, reported at time $t \in$ {*prior, posterior*}. The difference between an individual's prior and posterior is Δc_i.

(2) *perceived effectiveness* ($e_{i,t}$)

This variable is defined as the respondent's expectation (at time $t \in$ {*prior, posterior*}) of state-level emissions reductions (in percent) that would result from the passage of a given policy $\in$ {*RPS, carbon tax*} by the year 2030. The difference between an individual's prior and posterior is Δe_i.

(3) *perceived regressivity* ($r_{i,t}$)

This variable is defined as the respondent's reported belief (at time $t \in$ {*prior, posterior*}) of the cost of a given policy $\in$ {*RPS, carbon tax*} to a 20th income percentile household in Nevada (a household making roughly $27,000 annually). The difference between an individual's prior and posterior is Δr_i.

Information treatment variables

Each of the following variables reflect the information provided to respondents. These variables will be used to isolate the exogenous variation in respondent beliefs that I use to identify the models below. Note that each individual will have two values for each of these variables, reflecting the two policies ($j \in$ {*RPS, carbon tax*}). For example, a given respondent will receive information about both the cost of an RPS ($c^{RPS}_{i,shown}$) and the cost of a carbon tax ($c^{tax}_{i,shown}$). I suppress the j notation in the specifications below for simplicity.

(1) *Information treatment* ($c^j_{i,shown}$, $e^j_{i,shown}$, $r^j_{i,shown}$)

This variable encodes the information shown to individual i about policy j.

(2) *Alternative treatment* ($c^j_{i,alt}$, $e^j_{i,alt}$, $r^j_{i,alt}$)

This variable encodes the information that would have been shown to individual i about policy j if they were randomized to a different branch.

(3) *Information Signal* ($\tau_i^{c,j}$,$\tau_i^{e,j}$, $\tau_i^{r,j}$)

This variable encodes the difference between the information shown to individual i about policy j, and that individual's prior about that attribute. For example, $\tau_i^{c,j} = c^j_{i,shown} - c^j_{i,prior}$.

(3) *Alternative Signal* ($\tau_i^{\prime c,j}$,$\tau_i^{\prime e,j}$, $\tau_i^{\prime r,j}$)

This variable encodes the difference between the information *not* shown to individual i about policy j (the alternative information treatment), and that individual's prior about that attribute. For example, $\tau_i^{\prime c,j} = c^j_{i,alt} - c^j_{i,prior}$.

5.2 Model Specifications

Model 1: Logit Model of Policy Support

$$I(yes_{i,t}) = I(\alpha + \beta_1 c_{i,t} + \beta_2 r_{i,t} + \beta_3 e_{i,t} + \Gamma_i + \theta_t + \xi X_i + \epsilon_{i,t} \geq 0) \tag{1}$$

The dependent variable in this regression is one of the two primary outcome variables outlined in section 5.1: (1) support for renewable portfolio standards, or (2) support for a carbon taxes. $c_{i,t}$ is individual i's perceived cost of the policy at time $t \in \{prior, post\}$. $r_{i,t}$ and $e_{i,t}$ are analogous measures for regressivity and effectiveness, respectively. Γ_i is a person fixed effect, θ_t is a time period fixed effect, and X_i is a vector of demographic variables.

Model 2: Information Provision as an Instrument for Perceptions

$$I(yes_{i,post}) = I(\alpha + \beta_1 \hat{c_{i,post}} + \beta_2 \hat{r_{i,post}} + \beta_3 \hat{e_{i,post}} + \xi X_i + \epsilon_i \geq 0) \tag{2}$$

$$\begin{aligned}
c_{i,post} &= \delta^1 + \gamma_1(c_{i,shown}) + \gamma_2(r_{i,shown}) + \gamma_3(e_{i,shown}) + \gamma_4 X_i + \nu^1_{i,post} \\
e_{i,post} &= \delta^2 + \gamma_5(c_{i,shown}) + \gamma_6(r_{i,shown}) + \gamma_7(e_{i,shown}) + \gamma_8 X_i + \nu^2_{i,post} \\
r_{i,post} &= \delta^3 + \gamma_9(c_{i,shown}) + \gamma_{10}(r_{i,shown}) + \gamma_{11}(e_{i,shown}) + \gamma_{12} X_i + \nu^3_{i,post}
\end{aligned}$$

This regression predicts posterior policy support, $I(yes_{i,post})$ as a function of posterior beliefs, using information provision as an instrument for these beliefs.

Model 3: Source Randomization as an Instrument for Perceptions (preferred specification)
In this model I instrument for changes in voter beliefs using the difference between the information signal they were shown (e.g. c_{shown}) and the information signal that individual i could have been shown (e.g, c_{alt}).

$$I(yes_{i,post}) = I(\alpha + \beta_1 \hat{c_{i,post}} + \beta_2 \hat{r_{i,post}} + \beta_3 \hat{e_{i,post}} + \xi X_i + \epsilon_i \geq 0) \tag{3}$$

$$\begin{aligned}
c_{i,post} &= \delta^1 + \gamma_1(c_{shown} - c_{alt}) + \gamma_2(r_{shown} - r_{alt}) + \gamma_3(e_{shown} - e_{alt}) + \gamma_4 X_i + \nu^1_{i,post} \\
r_{i,post} &= \delta^2 + \gamma_5(c_{shown} - c_{alt}) + \gamma_7(r_{shown} - r_{alt}) + \gamma_8(e_{shown} - e_{alt}) + \gamma_8 X_i + \nu^2_{i,post} \\
e_{i,post} &= \delta^3 + \gamma_9(c_{shown} - c_{alt}) + \gamma_{10}(r_{shown} - r_{alt}) + \gamma_{11}(e_{shown} - e_{alt}) + \gamma_{12} X_i + \nu^3_{i,post}
\end{aligned}$$

Model 4: Learning from Feedback

To study how individuals update their priors when provided with information about these policies, I will also estimate the following learning model, which is closely related to the first-stage equations above. Each of these regressions studies how individuals update their priors in response to information provision, while using the counterfactual information provision to control for spurious mean revision. For example, if Δc_i is the difference between an individual's posterior and prior perceptions of a policy's cost (i.e. their revision), I will estimate the following regression:

$$\Delta c_i = \alpha + \lambda_1^c \tau_i^c + \lambda_2^c \tau_i'^c + \epsilon_i$$

λ_1, the coefficient on the signal shown to individual i, captures the response of voters to information they receive. λ_2 captures spurious reversions to the mean. I will estimate 6 total learning equations, covering all combinations of attributes $\in \{c,\ e,\ r\}$ and policy options $\in \{$*RPS, carbon tax*$\}$.

Reweighting

I will re-weight each of the above regressions using exit polls to account for the differences between the demographics of the mTurk respondent pool and the Nevada electorate.

Heterogeneity Analysis

In addition to estimating the above specifications for the entire sample, I will also estimate each of the above specifications separately for Democratic and Republican Voters.

Robustness Checks

I will estimate linear probability model and Probit analogues to models (1) through (3) to test for sensitivity of my parameter estimates to the logit specification.

5.3 Statistical Tests

Can differences in policy support be explained by differences in policy attributes?

Here I use the estimated models of voter decision making to ask whether policy support would be statistically different between the carbon taxes and renewable portfolio standards if perceived attributes were the same across the two policies for all voters. This process has three steps:

(1) Take the empirical distribution of perceived attributes from one policy (each individuals perception of {*cost, effectiveness, regressivity*} for a $25 carbon tax).

(2) Use this distribution of perceived attributes to estimate vote probabilities under two logit models — one model estimated using RPS attributes and one model estimated using carbon tax attributes. This will yield two distributions, one representing predicted vote probabilities for a carbon tax and the other representing predicted vote probabilities for an RPS *if voters had perceived their attributes to be the same.*

(3) Test for a statistically significant difference in these distributions using a one-sided, two-sample t-test.

Differential Learning

To determine whether individuals respond differently to information about carbon taxes than they do information about renewable portfolio standards, I will test for the equality of learning parameters for each attribute across policy options. That is, for each attribute $j \in \{c, e, r\}$, I test the null hypothesis that λ_1^j is identical when I estimate Model (4) using support carbon taxes and support for renewable portfolio standards. I will test for differential learning across policies on three subgroups: *All respondents*, *Democratic voters* and *Republican Voters*. This is a total of 9 null hypotheses.

I will also test whether Republicans and Democrats respond differently to information: for each attribute $j \in \{c, e, r\}$ and each policy $p \in \{RPS, carbon\ tax\}$ I will text null hypothesis that $\lambda_1^{j,p}$ is equal for democrats and republicans.

Multiple Hypothesis Correction

Because my tests for differential learning constitute a large number of hypotheses (15), I will correct for the FWER using using the free step-down resampling method proposed by Westfall, Young, and Wright (1993). I will use two families for this analysis: *family 1* consists of the three tests for differential learning of voters between policy types. The remaining 12 tests constitute *family 2*. I do not use multiple hypothesis correction for my findings from models (1) through (3), as these specifications do not inform a large number of sharp test for which false positives would be concern.

5.4 Analysis and counterfactuals

In addition to the above empirical tests, I will use the models outlined in section 5.2 to perform the following descriptive exercises:

(1) **Oaxaca blinder decomposition:** After estimating separate logit models for the support for a carbon tax and the support for renewable portfolio standard, I will decompose the gap in policy support into the portion explained by differences in the average observable characteristics of the two policies, and the portion of the mean difference in support that is not explained by these characteristics. More specially, I will use Stata's `oaxaca` package, which includes an extension of the linear Oaxaca-Blinder decomposition to nonlinear models. This descriptive exercise acts as an extension of the first statistical test described above.

(2) **Carbon tax support under alternative tax cuts:** The hypothetical carbon tax ballot initiative shown to survey respondents features a sales tax cut to offset the revenue from the carbon tax. Using a different tax instrument (e.g. income or property taxes) would result in a policy with different incidence and regressivity properties. Using my estimated model of voter support for carbon taxation I will predict the estimated level of support under different redistribution mechanisms.

(3) **Carbon tax support under targeted information provision**: If I find that preferences for emissions policies are mutable, a natural question is how would support change if voters were fully informed, or if voters were exposed to targeted information campaigns. Using my models of voter behavior I will predict the estimated level of support for carbon taxation and renewable post folio standards under these counterfactual scenarios.

(4) **Marginal rates of substitution:** The ratio of coefficients will allow me to estimate willingness to pay for emissions reductions as well as the rate at which voters trade off their private tax incidence against tax incidence of low-income households.

6 Contingencies

Weak instruments: In the event that the source-randomized information provision is a weak instrument for posterior beliefs, I will use Model (2) as my main specification. I will rely on the formal tests developed by Stock and Yogo (2002) to test each of these specifications for weak instruments.

Insufficient sample size: It is possible that I will not reach 1100 responses from mTurk workers in Nevada. If it is clear that I will be unable to recruit a sufficiently large sample from mTurk, I will supplement my sample using respondents from *Prolific*, an online survey platform for social science research that has roughly 350 active users in Nevada.

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Appendix A: Ballot Initiative Language

The following is how Question 6 is presented to respondents:

The following initiative will be on the 2020 ballot in Nevada:

Question 6

Shall Article 4 of the Nevada Constitution be amended to require, beginning in calendar year 2022, that all providers of electric utility services who sell electricity to retail customers for consumption in Nevada generate or acquire incrementally larger percentages of electricity from renewable energy resources so that by calendar year 2030 not less than 50 percent of the total amount of electricity sold by each provider to its retail customers in Nevada comes from renewable energy resources?

How do you plan on voting for this initiative?

The following is how Question 7 is presented to respondents:

Question 6 is a policy that addresses state-level carbon emissions. As an alternative to requiring that a certain percent of energy be produced by renewable sources, some states and countries put a price on carbon emissions. Consider the following hypothetical alternative to Question 6:

Question 7

Shall Article 4 of the Nevada Constitution be amended to levy, beginning in calendar year 2022, a carbon emissions fee of $25 per metric ton of carbon on the sale or use of certain fossil fuels and fossil-fuel-generated electricity, and reduce the sales tax by 1.5 percentage points?

If this initiative were on the ballot instead of Question 6, how would you vote on this initiative?

Appendix B: Information Provision Treatments

The following are the sources for 12 possible information treatments that are randomized to survey participants. "Question 6" is Nevada's RPS; "Question 7" is the hypothetical carbon tax ballot initiative.

Question 6 cost high

Greenstone and Nath (2019)

Question 6 cost low

Galen (2018)

Question 6 regressivity high

Rausch and Karplus (2014)

Question 6 regressivity low

Rausch and Mowers (2014)

Question 6 effectiveness high

Greenstone and Nath (2019)

Question 6 effectiveness low

Sekar and Sohngen (2014)

Question 7 cost high

Cronin, Fullerton, and Sexton (2019)

Question 7 cost low

Marron, Toder, and Austin (2015)

Question 7 regressivity high

Grainger and Kolstad (2010)

Question 7 regressivity low

Marron, Toder, and Austin (2015)

Question 7 effectiveness high

Barron, Fawcett, Hafstead, McFarland, and Morris (2018)

Question 7 effectiveness low

The Congressional Budget Office (2016)