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LETTER

Public willingness to pay for a US carbon tax and preferences for spending the revenue

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Abstract

We provide evidence from a nationally representative survey on Americans' willingness to pay (WTP) for a carbon tax, and public preferences for how potential carbon-tax revenue should be spent. The average WTP for a tax on fossil fuels that increases household energy bills is US$177 per year. This translates into an average WTP of 14% more on average for households across the United States, where energy costs differ significantly across states. Regarding the tax revenues, Americans are most in support of using the money to invest in clean energy and infrastructure. There is relatively less support for reducing income or payroll taxes, returning dividends to households, and other expenditure categories. Finally, Americans support using the tax revenues to assist displaced workers in the coal industry enough to compensate each miner nearly US$146 000 upon passage of a carbon tax.

1. Introduction

In February 2017, an international research and advocacy organization referred to as the Climate Leadership Council released a report calling for the replacement of Obama-era climate regulations with a carbon tax. [1] The proposal starts with a carbon tax of US$40 per ton, with dividend payments rebated back to American households. The report is titled *The Conservative Case for Carbon Dividends*, and the initiative has received widespread attention because several prominent Republicans are advancing it. [2, 3] In addition to leading economists, these include several elder statesmen: James Baker III, former Secretary of State, the Treasury, and two-time White House Chief of Staff under Presidents Ronald Reagan and George H W Bush; Henry Paulson Jr, former Secretary of the Treasury under President George W Bush; and George Schultz, former Secretary of State and the Treasury under President Reagan. That these Republicans have come to support climate action in general—and a carbon tax in particular—has many advocates hoping the Trump administration and Republican Congress will consider the idea as a conservative solution to climate change. The Council's report emphasizes how, compared to command-and-control regulations, a carbon tax is more consistent with conservative principles of free-market solutions and small government. Indeed, the report has been referred to as the 'Republican climate jailbreak strategy,' an argument James Baker has made during meetings with Trump White House officials [4].

While Canada's province of British Columbia has imposed a carbon tax since 2008, a similar proposal failed in a 2016 ballot referendum in the State of Washington. More generally, however, does the American public support or oppose a carbon tax to address climate change? Specifically, how much are American households willing to pay for a carbon tax? And given flexibility about how carbon-tax revenue can be used, how would Americans prioritize among competing interests, including the possibility of direct payments in the form of carbon dividends? To answer these questions, we collected data through a nationally representative survey near the end of 2016. While the survey covered a range of topics [5], we focus here on several questions specifically related to carbon taxation.

2. Data collection

The data used in our analysis come from a nationally representative survey of 1226 American adults, aged 18 and older. The survey was conducted November 18 through December 1, 2016. The sample was drawn from GfK's KnowledgePanel, an online panel of members drawn using probability sampling methods. To ensure representativeness and address potential sample selection bias, key demographic variables were weighted, post survey, to match US Census Bureau norms. Data were weighted by gender, age, race/Hispanic ethnicity, education, census region, household income, home ownership status, and whether the respondent lives in a metropolitan or non-metropolitan area. We report summary statistics for the demographic variables in the supplementary information available at stacks.iop.org/ERL/12/094012/mmedia.

3. Preferences for spending potential carbon tax revenue

The first question informed respondents that Congress may consider a 'tax on fossil fuels (e.g. coal, oil, and natural gas) to help reduce global warming.' We refer to such a tax hereafter as a 'carbon tax.' We then asked respondents how they would like to see the revenue used if such a tax were implemented. Respondents were given ten different expenditure categories and asked to indicate whether they would support or oppose each one. In the supplementary information, we include the full text of this survey question and all others discussed herein. Table 1 reports the key results by expenditure category. Public support is greatest, at nearly 80%, for the development of clean energy (solar, wind) and for improvements to American infrastructure (roads, bridges, etc). More than 70% of Americans support using the money to assist displaced workers in the coal industry, and 66% support paying down the national debt. Between 45% and 60% support reducing federal income taxes, assisting low-income communities most vulnerable to climate change, paying a climate dividend to all households in equal amounts, and helping all communities prepare for and adapt to global warming. Fewer respondents support reductions in payroll taxes (44%) and reducing corporate taxes (24%).

A follow-up question asked respondents to allot revenue in percentage terms among the expenditure categories for which they had previously indicated support. We report the average percent allotted to each category (table 1), taking account of all respondents indicating zero by stating a lack of support for a category. That is, the percentage breakdown represents how much of the carbon-tax revenue Americans would prefer to see spent in each category on average. Note that the ordering among response categories need not (and does not) follow that of the percentage indicating support.

Americans would like to see the greatest proportion of revenue (17.3%) spent to further develop clean energy. Other categories receiving more than 10% of the revenue are improvements to America's infrastructure, paying down the national debt, and assisting displaced workers in the coal industry. Preferences are lower, though still quite high, for using the revenue to reduce federal income taxes (just under 10%) and paying carbon dividends to households in equal amounts (8.1%). We also find reasonably high levels of support for spending revenue on adaptation to climate change. The allocation is 7.8% when the focus is on assisting low-income communities that are most vulnerable, and 7.2% when targeted to help communities prepare for and adapt to global warming. These two categories combined, at 15%, are second to clean energy. The category where Americans would like to see the least revenue spent is a reduction in corporate income taxes (3.2%).

4. Willingness to pay for a carbon tax

The next survey question is used to estimate willingness to pay (WTP) in support of a carbon tax. We employ the contingent valuation method whereby respondents are asked directly about their WTP. While the method has been a source of debate over whether it yields unbiased estimates because the questions are hypothetical [6–8], stated-preference surveys of this type are the only way to estimate total economic value, and the technique is frequently used in regulatory impact analysis and to evaluate public opinion. [9, 10]

Respondents were asked a standard, referendum format, contingent valuation question about whether they would 'support' or 'oppose' a carbon tax. Specifically, the survey asked respondents to consider a 'tax on fossil fuels (coal, oil, natural gas) to help reduce global warming.' They were then asked to suppose the tax cost them more each year in higher energy bills. Using higher energy bills as the payment vehicle in the survey instrument serves as a salient cost measure. Each respondent was assigned a randomized amount that the carbon tax would cost his or her household in higher energy bills. Based on the 'support' or 'oppose' responses, we then estimate binary-choice models to determine how the probability of support depends not only on the cost to households, but also on standard demographic variables, political affiliation, and beliefs about climate change. The model also enables estimation of overall mean WTP in support of a carbon tax among Americans. Details about the model specification, estimation procedure, and a fuller set of results are included in the supplementary material.

Table 2 reports the main results of our multivariate logit regression analysis. We report the estimated marginal effects, which are interpreted as how a unit change in the explanatory variable affects the probability of support for the carbon tax. Most important,

Table 1. American preferences for the expenditure of revenues from a carbon tax.

Expenditure category	Percent indicating support	Percent of revenue allocation
Support the development of clean energy (solar, wind)	79.8	17.3
Fund improvements to America's infrastructure (roads, bridges, etc.)	77.4	14.5
Pay down the national debt	65.5	12.7
Assist workers in the coal industry that may lose their jobs as a result of the tax	71.9	10.4
Reduce Federal income taxes	59.3	9.9
Return the money to all American households in equal amounts	45.9	8.1
Assist low-income communities that are most vulnerable to the impacts of global warming	57.3	7.8
Fund programs to help American communities prepare for and adapt to global warming	54.6	7.2
Reduce Federal payroll taxes (Social Security and Medicare taxes that are deducted from paychecks)	44.2	7.2
Reduce corporate taxes	24.4	3.2
Other (please specify)	7.8	1.7

Reported as survey weighted summary statistics. Percent indicating support is the share of respondents that support using carbon tax revenue as indicated by the expenditure category. Percent of revenue allocation is the mean allocation, accounting for both those that do and do not support the expenditure category.

Table 2. Logit model marginal effects on the probability of support for the proposed carbon tax.

	Marginal effect	Standard error	*p* value
Cost to household energy bill	−0.001	0.000	0.045
Education (years)	0.010	0.007	0.136
Household size (# people)	−0.010	0.013	0.462
Age (years)	−0.001	0.001	0.328
Male	−0.033	0.036	0.357
Income ($10 000's)	0.009	0.004	0.014
White	0.074	0.042	0.078
Democrat	—	—	—
Republican	−0.112	0.044	0.010
Independent	−0.201	0.057	0.000
No party	−0.176	0.066	0.008
Global warming, don't know	—	—	—
Global warming, no	−0.254	0.069	0.000
Global warming, yes	0.352	0.044	0.000

The dependent variable is an indicator for whether the respondent supports the proposed carbon tax. The model includes 1220 observations. The estimation and reported variable means are survey weighted. Variable means for the indicator variables represent percentages. Marginal effects are evaluated at the mean for continuous variables and at the discrete change from zero to one for indicator variables.

we find a negative and statistically significant effect of cost: a US$10 increase in the annual household cost of the tax reduces the probability of support by 1 percentage point. We find statistically insignificant effects on the probability of support based on household size and the respondent's age, gender and years of education. We do, however, find statistically significant income and race effects. A US$10 000 increase in a household's annual income increases the likelihood of support by 1 percentage point. Not surprisingly, Republicans, Independents, and those having no party affiliation are significantly less likely than Democrats to support the carbon tax, with magnitudes of 11, 20, and 18 percentage points less, respectively.

The final set of results relate to beliefs about whether global warming is happening. A separate survey question asked respondents about whether or not they think global warming is happening. The omitted category of 'don't know' is compared against respondents answering either 'yes' or 'no.' We find statistically significant results for both. Those who believe global warming is happening are 35 percentage points more likely to support the carbon tax, whereas those who do not believe global warming is happening are 25 percentage points less likely to support the carbon tax.

The overall mean WTP is interpreted as the amount that Americans would, on average, be willing to pay in support of the described carbon tax. We use the logit model to derive estimates of the mean (equal to the median) WTP, along with the 95% confidence interval [11–14]. Our statistical approach conservatively admits the possibility for negative WTP; that is, respondents might be willing to pay a positive amount to avoid passing the carbon tax proposal. We find an overall mean WTP of US$177 per year, with a confidence interval ranging from US$101 to US$587. These estimates are reasonably close to the few somewhat comparable estimates in the literature. A recent survey, also in 2016, found that households have an additional WTP on electricity bills between US$15 and US$20 per month in support of a carbon tax [15, 16]. These numbers translate to between US$180 and US$240 per

year. Also based on a nationally representative survey, a study conducted in 2010 and 2011 found that American households are willing to pay US$85 per year for 10 years to reduce US emissions 17% by the year 2020 [17].

Given our nationally representative sample and survey design, an alternative way to analyze responses to the contingent valuation question is to estimate the average WTP for a percentage increase in electricity bills. Because average energy bills differ substantially by state (see the supplementary information), the same cost increase proposed in the survey question implies different average percentage changes in energy bills across states. Using data on state average energy bills [18], we are able to translate the WTP question into one about percentage increases in energy bills based on each respondent's state of residence. In parallel with the previous approach, we are then able to estimate a logit model focused on how percentage changes in energy bills affect support for a carbon tax (see the supplementary information). The model also produces a comparable WTP result: American households are, on average, willing to pay 14.4% more on their household energy bills in support of a carbon tax.

5. Conclusion

We conclude with a few observations about the implied magnitude of potential carbon-tax revenue. With just under 126 million households in the United States [19], our mean WTP estimate of US$177 implies an annual tax revenue of close to US$22.3 billion. While this is significantly less than that forecasted by Climate Leadership Council's proposal [1], it is worth keeping in mind that our survey asked about WTP through increased energy bills rather than all goods and services. We also ask about WTP for a tax on fossil fuels to help reduce global warming rather than using the words 'carbon tax.' Nevertheless, multiplying our revenue estimate by the allocation preferences (table 1) indicates significant levels of public expenditure in some categories. The implied US$3.9 billion per year in support for clean energy is close to the US$5.2 billion awarded in 2015 through preferences in the tax code favoring renewable energy [20]. Although federal agencies do not uniformly report expenditures related to climate adaptation, preparedness, and resilience, there is no question that the amounts implied by the two categories indicated in table 1, summing to US$3.3 billion, would be substantial.

Finally, we consider the expenditure category of aiding workers in the coal industry displaced because of the tax. The political economy of climate change is such that concerns about the coal industry, and its formidable influence, often inhibits policy. But what are the prospects for making compensation payments? There are currently about 15 900 employees working in extraction roles within the US coal mining sector, and the average wage rate is US$51 650 per year [21]. These individuals include many that would require retraining for transition to jobs in other sectors. The average WTP for a carbon tax, combined with public preferences about how to spend carbon-tax revenue, indicate a public willingness to allocate US$2.3 billion per year. This is enough to compensate all coal miners with nearly US$146 000 upon passage of the tax in the extreme (and highly unlikely) case that the entire industry shuts down. At the very least, our analysis indicates strong public support for using some portion of carbon-tax revenue to compensate coal miners who might lose their jobs.

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