Factors affecting Americans' Reluctance to Support Renewable Energy Sources*

My subtitle if needed

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Using data from CES2020, we investigated the support for the question: "Require that each state use a minimum amount of renewable fuels in the generation of electricity even if electricity prices increase a little?". We found that support increased as a person's household income increased and also increased if a person lived in a rural area. We also found that the level of education a person has does not neccessarily inrease their support for using renewable fuels. These findings give an insight into areas where we may need to focus resources on promoting the benefits of switching to sustainable and renewable sources of energy.

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*Code and data are available at: https://github.com/RenfrewA/us-pop-env-stance

1 Introduction

Society is becoming increasing aware of the effects that humans have on the environment. To prevent this on a large scale, it is up to the governments of countries. One of the leading causes of pollution is the burning of fossil fuels to generate electricity (UN). To prevent this, a shift towards renewable energy sources has been on the rise. Harnessing renewable energy sources such as wind, solar, and hydroelectric will be needed if we are to reduce the harmful air pollution from the retrieval and use of sources such as coal, oil, and natural gas. The challenge is that the infrastructure has been in place for a long time and thus, we need to build new infrastructure for renewable energy sources such as building dams, wind turbines, and solar panels. This will come at a financial cost which will have to ultimately come from the citizens in the form of increased taxes or increased electricity payments.

From the CES 2020 dataset, we will analyze whether household income, education level, and type of area a person is living in affects their stance on reducing pollution and climate change prevention.

The scenario that was proposed in the survey was: Require that each state use a minimum amount of renewable fuels (wind, solar, and hydroelectric) in the generation of electricity even if electricity prices increase a little. Our estimand is the value of support for this proposition, either support or oppose. By analyzing this data, we can identify trends with the previously stated factors. This can be used to better understand people's stance on this issue and help develop different ways to increase support.

The structure of the paper is as follows: Data, Model, Results, and Discussion.

2 Data

3 Model

3.1 Model set-up

We want to model an American's stance on climate change, specifically their position on requiring that each state use a minimum amount of renewable fuels in the generation of electricity even if electricity prices increase a little. In our model, we consider a person's

political preference, education level, and type of area they are living in to predict their stance on this topic.

The model we are interested in is:

$$
\begin{aligned}
y_i|\pi_i &\sim \text{Bern}(\pi_i) && (1)\\
\text{logit}(\pi_i) &= \alpha + \beta \times \text{householdIncome}_i + \gamma \times \text{education}_i + \delta \times \text{livingArea}_i && (2)\\
\alpha &\sim \text{Normal}(0, 2.5) && (3)\\
\beta &\sim \text{Normal}(0, 2.5) && (4)\\
\gamma &\sim \text{Normal}(0, 2.5) && (5)\\
\delta &\sim \text{Normal}(0, 2.5) && (6)
\end{aligned}
$$

Where:

- y_i is the binary outcome variable, representing
- π_i is the probability that respondent
- $householdIncome_i$ is a predictor variable, representing the household income of the respondent i,
- $education_i$ is a predictor variable, representing the education level of the respondent
- $livingArea_i$ is a predictor variable, the residential area that the respondent is living in (urban, rural, suburban, etc.) i.

Since we have a binary outcome variable and multiple predictor/explanatory variables, we chose to use a logistic regression model fitted using a Bayesian framework. We utilized the package `rstanarm` (Goodrich et al. 2022) in R (R Core Team 2023) to achieve this.

3.1.1 Model justification

We chose householdIncome as a predictor variable because

4 Results

We performed logistic regression analysis on 3000 observations of the total 50788 observations in the cleaned dataset. We are interested in whether or not a person's household income, education, or area where they are living in will impact their stance towards switching to renewable energy sources at an increased price.

Table 1: Explanatory models of renewable energy support based on household income, education level, and land type of residence (n = 3000)

	Support renewable energy even at a higher monetary cost
(Intercept)	−0.802
	(0.286)
household_income$10,000 - $19,999	−0.235
	(0.226)
household_income$20,000 - $29,999	−0.195
	(0.205)
household_income$30,000 - $39,999	−0.004
	(0.212)
household_income$40,000 - $49,999	−0.143
	(0.213)
household_income$50,000 - $59,999	−0.245
	(0.217)
household_income$60,000 - $69,999	0.022
	(0.227)
household_income$70,000 - $79,999	0.208
	(0.218)
household_income$80,000 - $99,999	0.135
	(0.215)
household_income$100,000 - $119,999	0.207
	(0.233)
household_income$120,000 - $149,999	0.134
	(0.234)
household_income$150,000 - $199,999	0.127
	(0.259)
household_income$200,000 - $249,999	0.317
	(0.325)
household_income$250,000 - $349,999	0.265
	(0.417)
household_income$350,000 - $499,999	0.424
	(0.514)
household_income$500,000 or more	0.465
	(0.579)
educationHigh school graduate	0.031
	(0.266)
educationSome college	−0.189
	(0.264)
education2-year	−0.140
	(0.281)
education4-year	−0.620
	(0.273)
educationPost-grad	−0.691
	(0.286)
living_areaSuburb	0.274
	(0.108)
living_areaTown	0.535
	(0.133)
living_areaRural	0.711
	(0.114)
Num.Obs.	3000
R2	0.040
Log.Lik.	−1832.708
ELPD	−1857.3
ELPD s.e.	21.2
LOOIC	3714.6
LOOIC s.e.	42.5
WAIC	3714.5
RMSE	0.46

Table 2: Probability that an individual supports that each state requires a minimum amount of renewable fuels for energy generation even if it increases costs

rowid	estimate	conf.low	conf.high	env_stance	household_income	education	living_area
1	0.2653025	0.1940472	0.3489762	Support	$150,000 - $199,999	4-year	Suburb
2	0.2802627	0.2203808	0.3471261	Support	$100,000 - $119,999	4-year	Suburb
3	0.4192808	0.2904514	0.5638360	Oppose	$10,000 - $19,999	No HS	Rural
4	0.2567978	0.1128822	0.4731254	Support	$350,000 - $499,999	Post-grad	City
5	0.3772841	0.3098993	0.4472753	Support	$30,000 - $39,999	High school graduate	Suburb
6	0.3859065	0.2240998	0.5693295	Support	$250,000 - $349,999	Some college	Suburb

5 Discussion

5.1 Higher Household Income increases a person's willingness to contribute to renewable energy sources

When looking at [table] , we can see that as a person's household income increases, they are more likely to be willing to support renewable energy sources at a slightly higher cost. [Talk about the coefficients here].

This makes sense because as a person's income increases, they will be less affected by energy bill increases as someone who makes less money and is living paycheck to paycheck [insert stat about % of americans living p2p]. This could support the idea that a large majority of people are supportive of preventing climate change, however some will not support it with their votes if that means compromising their financial situation. Therefore, we need to think of a way to minimize impact on the population's financial situation to get more support and adoption of policies which will benefit the environment.

5.2 People living in more rural areas tend to have increased support

We can see from [table] that as the area a person is living in goes from urban to rural, there is an increase in support for states to have a minimum amount of renewable energy usage at a slightly higher cost. This is shown by [talk about the values/coefficients here].

This could be due to various reasons. One of the reasons could be because people who live in rural areas may be farmers or work in the agriculture industry. Climate change has an impact on agriculture as heat stress can lead to declining crop yields (UN). This could be a reason why people who live in these areas tend to support this proposition. Another reason could be that people who live in rural areas enjoy living in nature, away from cities and thus are more in tune with the environment. These people are more aware of the negative impacts that non-renewable fuels have on the earth.

5.3 People who have completed more years of education tend to have lower support

For the explanatory variable `education` which is the level of education the person has completed, the table shows that there doesn't seem to be an increase in support for requiring states have a minimum amount of renewable energy sources if there is a small increase in cost. [Talk about how the coefficients trend in a "V" shape or that both ends of the spectrum are higher than the middle].

This could be because having more years of education does not necessarily imply more knowledge about issues such as climate change. If it is outside of their field, a person may have the same opinion whether they have more education or less as that education did not include the topic at hand. However, we expected the trend to be higher support with higher education because we thought that more years of education leads to more years of critical thinking. We thought they would apply critical thinking to the proposition to see that support would provide a larger benefit for the future.

5.4 Weaknesses and next steps

Weakness in the question. It states "… even if electricity prices increase a little" but this is can mean something different to everyone. The wording leaves it up to the reader for interpretation on how much the price will increase. Thus, a person's decision may be different depending on if this question had a more concrete wording with a price range or percent.

References

Goodrich, Ben, Jonah Gabry, Imad Ali, and Sam Brilleman. 2022. "Rstanarm: Bayesian Applied Regression Modeling via Stan." https://mc-stan.org/rstanarm/.

R Core Team. 2023. *R: A Language and Environment for Statistical Computing*. Vienna, Austria: R Foundation for Statistical Computing. https://www.R-project.org/.

UN. "Causes and Effects of Climate Change." https://www.un.org/en/climatechange/science/causes-effects-climate-change.