Universidade de Vigo
Departamento de Economía Aplicada

Documento de Traballo
1004

Public preferences for climate change policies: Exploratory evidence from Spain

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Documentos de Traballo

Xuño 2010

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Abstract

There is a body of evidence showing public attitudes towards climate change in various countries around the world. In this study, we employ a phone survey in order to assess attitudes towards climate change in Spain and preferences for a green electricity program that reduces CO2 emissions while making electricity more expensive. Results are similar to those obtained in other studies elsewhere, and complement them by showing a strong public support for implementing the green electricity program. In particular, we find that the mean willingness to pay per month and household is about 29.36€ over the current electric bill. Our results also show that younger individuals who live in the Mediterranean region of Spain are more likely to be willing to pay for this green electricity program.

Keywords: abatement policies, citizen preferences, contingent valuation, green electricity

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1. Introduction

Climate change has become a major concern for many people around the world. For example, in the first worldwide survey on global warming conducted by *World Wide Views (2009)*, 89 percent (87 percent in the U.S.) want to reduce 2020 greenhouse gas emissions for developed nations on 25-40 percent or more beneath 1990 levels. Globally, 88 percent (82 percent in the U.S.) are in favour of holding the increase in global average temperature to within 2 degrees Celsius of pre-industrial levels. Half the participants, especially in countries predicted to be hardest hit by climate change, want to maintain temperatures at the current level or bring them down to pre-industrial levels. There is a strong consensus for sharing the burdens of mitigating and adapting to climate change, with 76 percent favoring 2020 greenhouse gas (GHG) emissions reduction targets for fast-growing economies like India, China, and Brazil. Among the 38 countries represented in that study, Chinese respondents were the least inclined to accept 2020 targets for fast-growing economies; even so, 45 percent of those respondents support such reductions, another 52 percent support limiting growth in emissions in fast-growing economies, and none believed that there should be no commitment to control GHG emissions.

In Europe, views are even more homogenous, indicating a serious concern for climate change. The Eurobarometer Survey (2009) found that, while 68% think that "poverty, the lack of food and drinking water" is one of the most serious problems our world faces now, 62% feel that "global warming / climate change" also is among the most serious problems. There are, however, some noticeable geographical differences. At the country level, absolute majorities in nearly all countries regard "global warming/climate

change" as a serious problem, with the exception of citizens in the Czech Republic (only 45% consider this to be a serious problem), Italy and Portugal (both 47%). In Cyprus and Greece, 90% of respondents think that "global warming / climate change" is one of the most serious problems. Slovenia, Malta, Spain, France, Austria, Luxemburg and Hungary are also well above the EU average in rating climate change as very serious. About 62% of respondents believe that national governments are not doing enough to fight climate change. Even more (72%) believe that companies and firms are not doing enough to fight climate change.

Given the current debate about the need to establish GHG abatement policies, it seems useful to provide additional information to guide Spanish policymakers on the design of abatement policy in Spain. In this regard, the purpose of this research is to measure the public's attitude towards GHG abatement policies in a European country that is expected to be severely affected by global warming. We employ an attitude survey that includes a contingent valuation (CV) component which asks respondents to indicate their willingness to pay for preventing climate change. The results show a strong support towards a green electricity program that reduces GHG emissions in Spain although it raises electricity prices. Regional differences are also noticeable.

2. Previous Literature

Recent studies measuring willingness to pay (WTP) of the general public for climate change mitigation policies, include Berk and Fovell (1999), Berrens et al. (2004), Cameron (2005,a &b), Li et al. (2004), Lee and Cameron (2008), Leiserowitz (2006),

and Stedman (2004). All these studies analyze attitudes of North American households towards various climate change policies. There is a more limited European literature on this topic. Cole and Brännlund (2009) assess preferences for mitigation policies in Sweden, finding that the public in Sweden supports informational campaigns as well as measures that promote technological development. In Spain, Hoyos and Markandya (2009) investigate preferences for climate change measures in the Basque country, while accounting for both the global benefits of GHG mitigation (as in the other studies) and the ancillary regional benefits. They show that estimates are 40% higher when ancillary benefits are also included.

The current study goes beyond that of Hoyos and Markandya (2009) by evaluating preferences in Spain for a specific green electricity program in Spain that reduces GHG emissions while increasing electricity prices for an interim period.. Geographical differences are considered when assessing preferences for this climate change abatement policy.

3. Questionnaire

Our study employs an attitude survey to assess preferences towards climate change mitigation policies in Spain. To develop the survey focus groups were conducted in several Spanish cities. Focus groups were held first in two Galician cities, A Coruña and Santiago de Compostela. With the aim of comparing the different perceptions of Galician citizens and other residents in Spain, additional focus groups were held in Madrid (inland). These focus groups included individuals with different socio-economic profiles, who spent two hours in an organized discussion, providing their opinions and

concerns towards various questions related to the magnitude of the ongoing climate change and plausible solutions that might be adopted in Spain. The information from the five focus groups was used in developing and refining the survey instrument. Preliminary versions of the questionnaire were extensively discussed in terms of clarity, accuracy of the information presented, etc. The focus groups have been crucial, since they provided important suggestions for making the survey instrument more comprehensible and complete.

The questionnaire follows the basic structure from previous questionnaires employed by others including Malta and Krosnick (2009), while adapted to the Spanish socio-economic context. In the introductory part, the questionnaire begins with warm-up questions where respondents were asked about several social issues, including taxes, unemployment, and pollution. Next, there were some specific questions about respondent's familiarity with the climate change and the potential damages. The questionnaire continued by describing some options said to be considered by the Spanish government to reduce GHG emissions in Spain. Including a green electricity program, and willingness to pay was elicited to support the program. There were follow-up questions with respect to the various motives behind the CV responses and attitudinal questions regarding policy options for dealing with climate change both in Spain and internationally. The survey ended with some standard socio-demographic questions.

4. Valuation scenario

The cost of the climate change mitigation program was described as a private cost linked to a higher electricity price/per month: The specific text employed in the survey was as follows:

The electricity we use in our homes and factories is the single largest source of greenhouse gas emissions in Spain. This accounts for 28% of Spain's greenhouse gas emissions.

The Spanish government is considering taking action to reduce the greenhouse gas emissions caused by electricity generation and consumption. The Spanish government is considering a balanced program to reduce the energy we use in our homes and factories. This program includes requiring power companies to make electricity in ways that don't put out greenhouse gases, such as with renewable energy. Also, the government will require factories to use highly efficient energy equipment, and to make products which meet climate requirements. The government will continue to regulate the price of electricity for households, so that electricity companies cannot gain excess profits.

In the end, this program will make electricity less expensive to produce, but for an initial period of some years, the price of electricity will be higher. At the end, cleaner technologies and higher energy efficiency will make the cost of living lower and electricity less expensive.

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*If the government goes ahead with this program, the extra cost to your household is likely to be $**X** or per month (or **Y** per year) until about 2020. Would you be in favour of this program?*

☐ *YES*   ☐*NO*   ☐ *DON'T KNOW*

5. Sample

The survey was implemented via phone to a sample drawn from over Spain, including the Balearic Islands and the Canary islands. The sampling method involved a multi-stage method, firstly selecting different population areas in each region (Autonomous Community), including big, medium and small cities, and then using random digital dialing. In the following analysis all responses are included, even those that may be considered protest responses. This seems appropriate since in a real election these votes would count.

With respect to the characteristics of the sample, 48% of respondents are men, with an average age of 44.7 years. Most respondents are employed full-time (35.5%), while retired respondents amount to 18.4%, and self-employed and working at home, represent 10.7% and 10.5%, respectively. With respect to the number of income contributors to the household, 42.3% of the households have two income earners, while 34.7% have only one income earner. Given the large number of people in each Spanish household, 9.21% and 13.6% have three and four or more income earners, respectively.

The average education level in the sample is about the Census average, with 26.8% and 29.4% of the individuals having completed high school and elementary school, respectively. In addition, 13.9% of respondents have completed high school and 18.5% have a University degree, in comparison to 20.7% of Spanish Census that have completed high school, and 21.8% having University studies. Finally, with respect to the place of origin, both in our sample and in the Census, the population is concentrated along the coast (62.4%) instead of inland (37.5%). Thus on a number of social and demographic variables our sample reflects the Spanish population.

6. Econometric Modeling

In the following empirical application, WTP responses in the category of "do not know" or "no answer" have been recoded as "no" responses. This procedure was employed by Carson et al. (2003), and is one element making our WTP estimates conservative.

The responses to the WTP questions were analyzed with a logit model, where, the empirical specification takes the following functional form:

$$(1) \; \ln(Y_i / 1 - Y_i) = \beta_0 + \beta_1 Bid_i + \beta_2 Age_i + \beta_3 Mediterraneam_i + \beta_4 Inland,$$

where the right hand side is the log of odds ratio of an affirmative response over a negative response to the WTP question, the variable *Bid* reflects the price increment asked to be paid for the electricity program, *Age* is a socio-demographic variable, reflecting the age of respondents. The variables *Mediterranean* and *Inland* are dummy variables indicating that the respondent lives along the Mediterranean coast or in the

interior of the country, with location along the North Atlantic Coast area being the omitted dummy category. Table 2 contains the descriptions and summary statistics for the explanatory variables, including their means and standard deviations. Table 3 presents estimated coefficients that are used to calculate the estimate of mean WTP.

As shown in Table 3, the logit model estimates indicate that those individuals living in the Mediterranean coast are more likely to be willing to pay for the green electricity program than those living in the North Atlantic Coast. The cost of the program has a negative effect on the probability of supporting the program, as one would expect. Additionally, individuals who are older are also less likely to be willing to pay for the program, probably due to income restrictions. Thus, our results show that younger citizens without family obligations are the ones most likely to support the program.

The estimation of the mean and median WTP in a linear logit model is computed employing the formula (Hanemann, 1984):

$$(2) \quad WTP = \frac{-\tilde{\alpha}}{\tilde{\beta}},$$

where $\widehat{\alpha}$ represents the term known as the *grand constant,* being the sum of the products of the means of the explanatory variables times their associated coefficients, and $\widehat{\beta}$ being the coefficient associated with the bid amount. The magnitude of WTP and the 95% confidence interval are presented in Table 4. Confidence intervals were estimated using the Krinsky-Robb method with 2000 repetitions. Mean/Median WTP per household is about 29.36€/month calculated from the logit model. This amount

reflects the serious concerns perceived by the current process of climate change. It is also consistent with the findings of the recent Eurobarometer survey indicating that a wide majority of Europeans (70%) believe that alternative fuels should be used to reduce GHG emissions, and 56% believe that fighting climate change can have a positive effect on the European economy. Other factors that may explain this relatively high estimate are related to the fact that energy in the future may be cheaper, so that the current required payment may be seen as a profitable investment.

6.1. Estimating the Aggregate Spanish WTP

To calculate the total societal WTP for this green electricity program, the logit mean WTP is multiplied by the number of Spanish households. According to the last national statistics (INE, 2001), there are 14,187,169 Spanish households. Given that our WTP question has been formulated employing electricity prices as the payment vehicle, and if each of the households pays on average 29.36€ of extra each month, mean social willingness to pay amounts to 416,5€ million per year for this green electricity program.

7. Conclusions and Implications

In this paper, we have assessed the public's preferences towards climate change abatement policies in Spain. Our results corroborate other findings in the literature. They show a clear concern about climate change and a significant WTP to reduce GHG emissions. Our results show that on average, citizens willingness to pay for a green electricity program in Spain to reduce CO_2 emissions is about 30.45€ per month and household. We acknowledge that in addition to the concern about climate change that

justifies this WTP, there are also other factors that are influencing our findings. In particular, respondents were informed that the development of green technologies would facilitate energy supply at lower prices in the future, so that the current investment in green energies may encourage future savings. Our results also show clear geographical differences with respect to the support to this green electricity program. In particular, individuals residing in the Mediterranean and Andalucía areas are more likely to be willing to pay higher electricity prices to prevent climate change effects.

Table 1. Basic Sample Characteristics Compared with the Spanish Census

Variables	Average or %	Comparative Census (INE, 2005)
Gender= 1 if man	56.9	49.38
Age	47.47	
Education %		
Illiterate	2.76	
Elementary school	26.08	37.4 (elementary or lower)
High school/Professional Education	39.52	40.5
University Degree	28.85	21.8 (university or higher)
Postgraduate and PhD	1.58	
Annual Income (2005) %		
Until €5,999	1.18	7.64
€6,000-€11,999	4.74	20.72
€12,000-€17,999	12.25	25.06
€18,000-€23,999	7.50	19.89
€24,000-€29,999	4.74	13.00
€30,000-€35,999	4.74	6.31
€36,000-€59,999	5.53	6.12
More than €60,000	59.28	
Occupation %		
Self-employed/Full-time/Part-time employee	50.98	
Without job/looking for job	10.27	
Student	4.70	
Household work	11.46	
Retired	17.78	
Other	4.34	

Table 2. Explanatory Variables

	Description	Mean	Standard Deviation
Bid	Price increase requested	15.77	9.64
Age	Age of individual	47.47	14.82
Mediterranean	=1 if region of residence is Mediterranean or Andalucian coasts; 0 otherwise	.328	0.47
Inland	=1 if region of residence does not have coast	.272	.446
Constant	Constant term	.6424	3.78

Table 3. WTP Results

wtp	Coef.	Std. Err.	z	P>|z|
Bid	-.04034	.01445	-2.79	0.005
age	-.02327	.00964	-2.41	0.016
Mediterranean	.70366	.34018	2.07	0.039
Inland	.41365	.34427	1.20	0.230
_cons	1.9454	.55235	3.52	0.000

Table 4. WTP and Krinsky and Robb (95 %) Confidence Interval for WTP Measure (Nb of reps: 2000)

Estimate	WTP	Lower-Bound	Upper-Bound
Mean/median	29.36	21.60	63.96

References

Berrens RP, Bohara AK, Jenkins-Smith HC, Silva CL, Weimer DL (2004) Information and effort in contingent valuation surveys: application to global climate change using national internet samples. J Environ Econ and Manage 47:311-363.

Cameron T (2005, a) Updating subjective risks in the presence of conflicting information: an application to climate change. The Journal of Risk and Uncertainty 30: 63-97.

Cameron T (2005, b) Individual option prices for climate change mitigation Journal of Public Economics, 89: 283-301.

Cole S, Brännlund R (2009) Climate policy measures: what do people prefer? Mimeo, Umea University.

Eurobarometer (2009) European´s attitudes towards climate change. Available at: http://ec.europa.eu/public_opinion/archives/ebs/ebs_300_full_en.pdf

Hanemann M (1984) Welfare Evaluations in Contingent Valuation Experiments with Discrete Responses. Am J of Agric Econ 66: 332-341.

Hoyos D, Markandya A (2009) WTP for global and ancillary benefits of climate change mitigation: preliminary results. Paper presented at the 17th Annual Conference of the European Association of Environmental and Resource Economists (EAERE), Amsterdam.

Lee J, Cameron T (2008) Popular support for climate change mitigation: evidence from a general population mail survey. Environmental and Resource Economics 41: 223-248.

Leiserowitz A (2006) Climate change risk perception and policy preferences: the role of affect, imagery, and values. Climatic Change 77:45-72.

Li H, Berrens RP, Bohara AK, Jenkins-Smith HC, Silva CL, Weimer DL (2005) Testing for budget constraint effects in a National Advisory referendum survey on the Kyoto Protocol. Journal of Agricultural and Resource Economics 30:350-366.

Lorenzoni I, Nicholson-Cole S, Whitmarsh L (2007) Barriers perceived to engaging with climate change among the UK public and their policy implications. Global Environ Change 17: 445-459.

Malka A, Krosnick JA (2009)The association of knowledge with concern about global warming: Trusted information sources shape public thinking. Risk Analysis 29: 633-647.

Rabe B, Borick C (2008) The climate of opinion: state views on climate change and policy options. Issues in Governance Studies 19.

Stedman R (2004) Risk and climate change: Perceptions of key policy factors in Canada. Risk Analysis 24: 1395-1406.

World Wide News (2009) World Wide views on Global Warming. Policy Report available at:
http://www.wwviews.org/files/AUDIO/WWViews%20Policy%20Report%20FINAL%20-%20Web%20version.pdf

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