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Climate Change, Energy and Social Preferences on Policies: Exploratory Evidence for Spain

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Abstract

Spain faces a complex situation regarding its climate change policies. On the one hand, greenhouse gas emissions have shown an important increase since 1990, being far from the Kyoto commitments. On the other hand, Spain is likely to suffer important impacts from climate change. However, there has been a rather limited application of corrective policies, particularly in the field of energy prices. Indeed, although Spanish citizens generally show a large concern towards climate change, price increases in energy goods have been traditionally opposed. In this paper we try to offer an explanation to this phenomenon, and a possible hint for future policies in the field, by showing how Spanish households strongly favour the application of a green electricity program that makes electricity more expensive to reduce carbon dioxide emissions. In particular, with data from a phone survey representative of the Spanish population, the mean willingness to pay per month and household is 29.91€ over the current electric bill. Our results also show that younger individuals who live in the Mediterranean area are more likely to pay for this green electricity program.

Keywords: preferences, climate policy, renewables, Spain

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1. Context

Climate change has become a major concern for citizens across the world. The first worldwide pool on global warming, conducted by *World Wide Views* (2009), depicts a vast majority of people (close to 90%) favouring sizeable reductions in greenhouse gas (GHG) emissions for developed countries in the period 2020-1990. A similar proportion of citizens strongly supports keeping global warming within 2 degrees Celsius over pre-industrial levels. In Europe, the Eurobarometer Survey (2009) indicates that two thirds of the European population consider that global warming is among the most serious problems faced by humankind today. Although there are relevant geographical differences within Europe, Spain is among the countries well above the EU average in rating climate change as a very serious problem. At the same time, most Europeans (again, roughly two thirds) believe that governments and industries are not doing enough to fight the problem.

This is the general setting of the paper: intense social preferences for climate change abatement that are not fully materialized in actual policy-making. In this sense, Spain is probably the quintessential country, with a strong concern by citizens and even government (one of the three 'guiding issues' of the current Spanish government) but few implemented policies. In a way, Spain faces a complex situation regarding its climate change policies. On the one hand, greenhouse gas emissions have shown an important increase since 1990 (around 35% at the moment of writing, with a recent sharp reduction due to the recession), being far from the Kyoto commitment (15% increase). On the other hand, Spain is likely to suffer important impacts from climate change due to its geographical situation: important temperature increases and an exacerbation of water shortages are to be expected in few decades (Spanish Agency of

Meteorology, 2009). However, there has been a rather limited application of corrective policies, particularly in the field of energy prices, which are generally below European averages.

This contrasts with the traditional support of pricing instruments in climate policies by economists. Carbon prices, for instance, are seen as a necessary mechanism to achieve cost-effective abatement and to foster carbon-free technologies. Yet in Spain carbon pricing has been traditionally opposed by governments, actually against a growing positive evidence on its effects. Fear of loss of competitiveness led successive Spanish governments to block any attempt of setting a European carbon tax during the 1990s and early 2000s, despite empirical evidence showing that a Spanish green tax reform, based on carbon taxation, could lead to net economic gains (Labandeira, Labeaga and Rodríguez, 2004) and with limited distributional concerns (Labandeira and Labeaga, 1998).

Is there any reason for this phenomenon, despite the ex-ante positive effects from the policy and the underlying social preferences regarding climate change? The intense opposition of Spanish citizens to tax-related price increases of car fuels during this decade, or the strong pressure to keep electricity prices low (with a clear risk of sustainability for the system, which is now operating in deficit as prices do not reflect total costs), may provide an intuitive explanation for the lack of corrective carbon pricing. As indicated later, the focus groups used in the preliminary stages of this paper were consistent with this behaviour.

In this paper we intend to reconcile the strong Spanish social preferences on climate change abatement with a corrective policy that is acceptable to citizens. Our method relies on a contingent valuation (CV) application, based on a questionnaire that demand respondents to state their willingness to pay (WTP) for reducing GHG emissions. Indeed, there is an increasing

literature on WTP for climate change policies, with recent contributions by Berrens et al. (2004), Cameron (2005a, 2005b), Li et al. (2004), Lee and Cameron (2008), Leiserowitz (2006), and Stedman (2004). Those papers reflect the perceptions towards various climate change policies around the world, mostly through the use of CV methods. Other approaches include discrete choice experiments (Longo et al., 2008), ordinal responses to valuation scenarios (Diaz-Rainey and Ashton, 2007), and extrapolation from public opinion polls (Bohringer, 2004). The policy objectives, or environmental goods under consideration also vary considerably across the papers, including climate stabilizing measures, (Cameron, 2005), green energy investments (Diaz-Rainey, 2007; Wiser, 2007; Longo et al., 2008), decreased temperature changes (Viscusi and Zeckhauser, 2006), and sequestration mechanisms (Brouwer et al, 2008). For a comprehensive review of this field see Johnson and Nemet (2010).

Although the applications for Europe are still limited, they have experienced a considerable growth in recent years. For instance, Cole and Brännlund (2009) assess preferences for mitigation policies in Sweden, showing that citizens in Sweden support informational campaigns, as well as measures that carry positive effects on technological development. In Spain, Hoyos and Markandya (2009) investigate preferences for climate change measures in the Basque region, including global (as in previous studies) and ancillary benefits. They show that estimates are 40% higher when ancillary benefits are also included.

This paper contributes to the European and Spanish literature on this matter. And, although the CV method can and has been used to assess non-market values associated to climate change, our approach only deals with policy definition and design. We restrict our exercise to electricity consumption, as this is a major origin of Spanish GHG and has been subject to an intense debate on pricing in the last years. Moreover, during this century Spain has embarked in a very ambitious

and costly policy to promote renewable sources in the electricity sector (in part designed to abate GHG emissions), whose characteristics are probably well-known to citizens. Another reason for the policy considered in the paper is the European objectives in terms of renewable energy and greenhouse gas emissions for 2020, which will request measures similar to those simulated.

The paper is based on a phone survey, representative of the Spanish population, which was implemented in November and December 2009 (mostly during the Copenhagen summit). The results show that Spanish households strongly favour the application of an electricity program that makes electricity more expensive but uses extra revenues for the promotion of renewable sources to reduce carbon dioxide emissions. In particular, the mean willingness to pay per month and household is very large: 29.91€ over the current electric bill. Our results also show that younger individuals who live in the Mediterranean area are more likely to pay for this green electricity program. We feel that the evidence from this paper may provide a guide for future and successful pricing policies that are related to climate change control.

The article is organized in four sections, including this introduction. We next describe the questionnaire and valuation scenario. Section 3 deals with the sample and its econometric treatment. Finally, section 4 presents the results and policy implications.

2. Questionnaire and valuation scenario

Our research method relies on the construction of a questionnaire to assess preferences towards climate change mitigation policies in Spain. Several stages were required to produce a comprehensive and easy survey instrument. Once a first stage of preliminary data collection

concluded with respect the potential impacts of climate change in Spain, focus groups were carried out in different Spanish cities. Research developed in this first stage was the basis for designing a draft version of the questionnaire to be presented and extensively discussed in the focus groups. From ten to twelve individuals participated in each of the focus groups. These focus groups included individuals with different socio-economic profiles, who participated during two hours in organized discussion groups, providing their opinions and concerns towards several key questions related to the magnitude of the ongoing climate change and plausible solutions. Preliminary survey versions were extensively discussed in terms of clarity, accuracy of the information presented, etc. These focus groups have been crucial, since important suggestions were added in order to improve the survey instrument's comprehensiveness.

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). Responses and reactions obtained on each of the focus groups were progressively added into the questionnaire design, so that the final version of the questionnaire reflects each of the main comments and concerns obtained from the five different focus groups. The groups stressed the need for action against climate change, but were reluctant to accept tax or price increases related to carbon policies.

The questionnaire follows the basic structure from previous employed by Malka, Krosnick and Langer (2009), although adapted to the Spanish socio-economic context. In the introductory part, the questionnaire begins with warm-up questions, where respondents indicate their level of concern with respect to several social issues, such as taxes, unemployment, and pollution, among others. Next, specific questions about respondent's familiarity with the climate change process were presented, together with rankings of perceived damages. The questionnaire

continued by describing the various options the Spanish government is considering to fight climate change, and willingness to pay estimates were requested for the electricity program presented below[1]. In particular, it was stressed that the objective for this electricity program was to fulfil the Spanish 20/20/20 objectives with respect to emission levels in Spain (that is, 20% reduction in emissions, 20% renewable energies and 20% improvement in energy efficiency by 2020). So, our objective was to assess the social preferences towards those measures, and not to compute an estimate of willingness to pay to avoid all consequences linked to climate change. Follow up questions with respect to the various motives behind the given responses were also included. The questionnaire concluded with some attitudinal and socio-demographic questions.

Regarding the valuation scenario, the cost of the climate change mitigation program was described as a private cost linked to an "extra electricity price/per month": The verbatim employed in the survey was the following:

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

[1]Due to the large uncertainly, no information was provided with respect to the expected climate change avoidance effects linked to the fulfilment with respect to non-fulfilment of the 20/20/20 objectives. However, individuals stated through various questions the level of knowledge, concern, awareness and commitment to fight the climate change process in Spain.

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*

The previously described survey was implemented via phone in all Spanish territories, including Baleares and Canary islands. The sampling method employed was 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 dialling. In the following analysis all responses are included, even those that may be considered protest. This seems appropriate since in a real election their vote will count. The timing in which the questionnaire was collected coincided with the Copenhagen summit of climate change in order to learn about the awareness of climate change issues in Spain at the time of the summit. The average time to complete the survey was of 8 minutes.

3. Sample and econometric modelling

With respect to the characteristics of the sample, 48% of respondents are men, with an average age of 44.74 years. Most respondents are employed full-time (35.5%), while retired respondents, amount to 18.4%, and self-employed and working at home, represents 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. If we compare our data with the Census, we find that no significant differences emerging with respect to the basic education level, since 37.4% of Spanish adult population has completed elementary school. 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 Spanish households.

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

Responses to the WTP questions have been analyzed with a probit model, where, the empirical specification takes the following functional form:

$$(1)\quad Y^* = \beta_0 + \beta_1 Bid_i + \beta_2 Age_i + \beta_3 Mediterraneam_i + \beta_4 Inland_i + \beta_5 MidIncome_i + \beta_6 Highincome_i + \beta_7 ElectricBill_i + \varepsilon_i,$$

where the left hand site is the latent variable representing participants´ preferences towards the fulfilment of the 20/20/20 objectives; while the right hand site contains the explanatory variables and the error term which is supposed to follow a standard normal distribution.

The explanatory variables are: the *Bid*, that reflects the price increment asked to be paid for the evaluated electricity program; *Age* is a socio-demographic variable, reflecting the age of respondents; the variables *Mediterranean* and *Inland* that reflect that the respondent lives in the Mediterranean coast or in the interior of the country, with respect to the Cantabric Coast area, omitted variable). Additionally, the dummy variables *MidIncome* and *HighIncome*, represent household monthly income levels between 1500€-and 2999€, and above that, respectively; and lastly, the variable *ElectricBill* represents the current monthly household electricity payment. Table 2 contains the variable description and summary statistics of these explanatory variables, presenting their means and standard deviations. Table 3 presents estimated coefficients that will be employed to calculate the mean WTP estimate.

As reflected in Table 3, results from the probit model indicate that as economic theory predicts, the bid or amount respondents asked to be paid has a negative effect on the probability of supporting the electricity program. Further, those individuals living in the Mediterranean and South areas are more likely to pay for the green electricity program than those living in the Cantabric or Northern area. This may be related with the anticipation of larger impacts linked to climate change in the Mediterranean and Southern area. Additionally, individuals who are older are also less likely to pay for the program. The income variables are not statistically significant,

while on the contrary, the current monthly electricity bill does affect and in a negative and statistically significant way the willingness to pay for supporting the previous green electricity program. Thus, our results show that younger citizens without family obligations and with low electricity bills are the ones more likely to support the discussed abatement policy.

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

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

where $\tilde{\alpha}$ 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 $\tilde{\beta}$ being the coefficient associated with the bid amount.

4. Results and Policy Implications

The magnitude of WTP and the 95% confidence interval are presented in Table 4. Confidence intervals were estimated using the Jackknife technique. Mean/Median WTP per household is about 29.91€/month calculated from the probit model. This amount reflects the serious concerns perceived by the current process of climate change. It is also in consonance with those results shown by the recent Eurobarometer indicating that a wide majority of Europeans (70%), believe that alternative fuels should be used to reduce greenhouse gas emissions, and 56% believe that fighting climate change can have a positive effect on the European economy. Furthermore, the survey was conducted during the Copenhagen submit and climate change issues were recursive topics on the media. 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. 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 Southern areas are more likely to pay higher electricity prices to prevent climate change effects.

To calculate the total societal WTP for this green electricity program, the probit mean WTP is multiplied by the number of Spanish households. According to the last national statistics (INE, 2001), the number of Spanish households is 14187169. Given that our WTP question has been formulated employing electricity prices as the payment vehicle, and if each of the households pays on average 29.91€ of extra each month, mean social willingness to pay per month amounts to 425€ million per year for this green electricity program.

In summary, we believe that we have reconciled the strong Spanish social preferences on climate change abatement with a corrective policy that is acceptable to citizens. In a way, this piece of research may help Spanish policymakers to design adequate and effective princing policies that follow the recommendations of economists.

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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	2.88	7.64
€6,000-€11,999	11.54	20.72
€12,000-€17,999	29.81	25.06
€18,000-€23,999	18.27	19.89
€24,000-€29,999	11.54	13.00
€30,000-€35,999	11.54	6.31
€36,000-€59,999	13.46	6.12
More than €60,000	0.96	
Ocupation %		
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 for Probit Regression

	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	.47
Inland	=1 if region of residence does not have coast	.272	.446
Midincome	=1 if income level between 1500€-2999€	.169	.376
Highincome	=1 if income level above 3000€	.059	.236
ElectricBill	Monthly electricity bill	15.880	27.677

Table 3. WTP Regression: Probit Results

WTP	Coef.	Std. Err.	z	P>|z|
Bid	-.0247	.0088	-2.79	.005
Age	-.0153	.0060	-2.55	.011
Mediterraneam	.4270	.2087	2.05	.041
Inland	.2721	.2127	1.28	.201
Electricbill	-.0034	.0031	-1.10	.270
Constant	1.300	.3593	3.62	.000
N	233			
LR	19.61			
P-value	0.0065			

Table 4. WTP Estimate and Confidence Intervals (C.I.) (C.I. obtained via Jackknife estimation)

Estimate	Mean WTP (€)	Lower-Bound	Upper-Bound
Mean/median	29.91	28.43	31.40