



# **UNREVEALING PUBLIC PREFERENCES FOR CLIMATE CHANGE POLICIES**

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# Introduction

- Importance of citizen's views in policy making:
  - Global public good
  - Budget restriction and financial crisis
  - Distributive aspects
  - Uncertainties
- **Have Americans' Views on Global Warming Changed? A New Look at Public Opinion**
  - ***By Jon Krosnick***

<http://woods.stanford.edu/research/surveys.html>

# Introduction

- Spain:
  - Strong growth in emissions
  - Climate vulnerability
  - Concerned population
  - Little use of economic Instruments...



# Introduction

- Climate policies
  - A goal and many instruments (taxes, etc.)
  - An instrument and many goals (energetic security, etc.)
- Policy instruments
  - Prices vs conventional regulations
  - Infraestructure & investments
  - **Adaptation and mitigation**

# Concerns about Climate Change in Spain

	BBVA (2008)	MAPFRE (2009)
Awareness level	90,7%.	95,6%
Understanding of climate change	El 46,5% lo entiende por completo y el 41,0% lo entiende en parte.	5 de cada 10 encuestados manifiesta entender el fenómeno.
CC linked to human activity	64,8%	6/10
CC is given less importance than what actually it has	44.1% believe so	63.3% believe so
Degree of pessimism toward irreversibility of the process	70.1% irreversible	6/10 believe still can be reversable

# Objectives

- We expect to contribute to the literature on **latent constructs and valuation studies**
- Earlier studies (Boxall and Adamowicz, 2002; Morey et al. (2006, 2008) have put forward the importance of latent variables in willingness to pay studies.
- Recent techniques try to estimate latent constructs instead of employing responses to indicator variables as direct explanatory variables.
  - We will compare a binary choice with the results from a hybrid mixture model.

# Contribution to Related Literature

- Growing international literature on mitigation and adaptation valuation studies.
  - Hoyos, Longo and Markandya, 2009. “Concienciación Pública y aceptabilidad de medidas para la reducción de emisión de gases de efecto invernadero: el caso del País Vasco.” (132,62 euros to reduce by 16% current CO2 emissions ).
  - Spanish case: Hanemann, Michael, Labandeira, Xavier; Loureiro, Maria L. “*Climate change, energy and social preferences on policies: exploratory evidence for Spain*”. ***Climate Research***, 48: 343–348, 2011.

# Survey structure

- Structure shares features with others previously used successfully:
  1. Opinions about current issues.
  2. Knowledge and attitude towards climate change.
  3. Valuation scenario about different policies for action against climate change:



Electricity



Transport

4. Questions about **attitudes** towards different issues.
5. Questions about habits and customs.
6. Socio-economical questions.



# Survey application

- Carried out by independent company Sondaxe in spanish territory.
- Face-to-face surveys, using quotas for age and gender.
- May and June 2010.
- Number of final surveys: 750.
- Multistage sampling (recommended by INE)

# Survey results



***P.1 Please, ¿could you tell me how important is for you (if it is important) ....***

	Nothing important	Not very important	Somewhat important	Very importante	Extremely important	DK/No answer
Reducing violence and crime	0.14%	0.43%	4.72%	37.63%	56.51%	0.57%
Increase public health	0.29%	0.57%	6.87%	40.63%	50.79%	0.86%
Polution reduction	0%	0.43%	8.3%	42.78%	47.78%	0.72%
Fight economic crisis	0%	0.57%	2.15%	25.32%	70.82%	1.14%



## ***P.2. In your opinion, what are the most important environmental issues nowadays in Spain?***

• Pollution in general	18.60%
• Air pollution	12.45%
• Climate change, global warming	13.45%
• Excessive number of vehicles	3.29%
• Water shortage	3.58%
• Occupation of natural areas by urbanizations	1.43%
• Forest fires	5.01%
• Dirtiness/garbage	2.29%
• Noise pollution	1.86%
• Industrial pollution	2.72%
• Pollution of coastal areas and rivers	5.44%
• Absence of environmental education	0.57%
• Absence of the development of clean energies	2.43%
• Failure to execute the international regulations	0.14%
• Energy waste	0.72%
• Recycling	3.58%
• Deforestation	2.29%
• Other	14.45%
• None	0.00%
• Doesn't know	5.72%
• No answer	0.00%

### ***P.3. Have you heard about climate change?***

Yes	No
98,28%	1,72%

### ***P.4. Taking into account your level of information about climate change, would you say....***

Very informed	Well informed	Not much informed	Uninformed	I could not appreciate it
10,01%	45,06%	39,10%	5,01%	0,82%



***P.5. In your opinion, is climate change a real problem or not?***

<b>It is real</b>	<b>It is real, but exaggerated</b>	<b>It is not a real/serious problem</b>	<b>D.K./No answer</b>
77,25%	17,17%	3,15%	2,43%

***P.6. For you and your immediate relatives, climate change could be good or bad?***

<b>Good</b>	<b>Bad</b>	<b>Neither</b>
1,57%	90,99%	7,44%



**VALUATION  
SECTION:  
ELECTRICITY**



# Electricity

- 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.....** This program includes to require **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.**



# Valuation Questions

***P.9. In principle, would you agree or disagree with these actions?***

Agree	63,10%
Disagree	29,75%
D.K./No answer	7,15%

# Basics results of willingness to pay

- Accounting of protest responses.
- The responses “don’t know” or “no answer” have been classified as negative responses.
- Used method: **Turbull’s nonparametric method**
  - It doesn’t require any functional form of error term.
  - It considers that responses given at the dichotomous questions may be used to estimate the ranges where the individual’s WTP falls.
  - It is assumed that individuals show a willingness to pay  $W$ , comprised between the intervals  $t_j$  and  $t_{j+1}$ .

# WTP: green electricity (monthly)

Electricity	Yes	No	Cdf	Pdf	(WTP)
5	67	49	0,4224	0,4224	0,0000
10	45	72	0,6154	0,1930	0,9649
20	22	95	0,8120	0,1966	1,9658
35	16	101	0,8632	0,0513	1,0256
40	13	102	0,8870	0,0237	0,8298
60	10	107	0,9145	0,0276	1,1029
			1,0000	0,0855	5,1282
				<b>WTP</b>	<b>11,0173</b>
	<b>Confidence interval</b>			<b>(9,32; 12,71)</b>	

# Questions about attitudes



## ***A.1. What level of responsibility should Spanish households take to reduce air pollution?***

<b>No responsab.</b>	<b>Little responsab.</b>	<b>Great responsab.</b>	<b>Total responsab.</b>	<b>D.K./No answer</b>
5,15%	25,32%	51,50%	17,74%	0,29%

## ***A.2. And companies/industries?***

<b>No responsab</b>	<b>Little responsab.</b>	<b>Great responsab</b>	<b>Total responsab.</b>	<b>D.K./No answer</b>
1,29%	3,00%	32,47%	62,23%	1,00%

***A.3. Do you think that scientist will likely find technology solutions that allow us to avoid the negative effects of the climate change?***

Very likely	Likely	Neither likely nor unlikely	Little likely	Unlikley	D.K./No answer
18,88%	44,78%	14,02%	14,74%	7,44%	0,14%

***A.4. ¿How necessary is it to take actions to control greenhouse gas emissions today?***

Absolutely necessary	Somewhat necessary	Somewhat unnecessary	Absolutely unnecessary	D.K./No answer
41,77%	46,78%	7,44%	2,15%	1,86%

## ***A.5. ¿Should the Spanish government do something to control greenhouse gas emissions?***

Only if developing countries cooperate and control their emissions.	29,04%
Regardless if developing countries cooperate or not	62,09%
No, Spain shouldn't do anything	4,29%
D.K./No answer	4,58%

***A.10. Households with very high consumption of energy should pay a much higher price for energy than households with low consumption.***

<b>Strongly agree</b>	<b>Agree</b>	<b>Neither agree nor disagree</b>	<b>Disagree</b>	<b>Strongly disagree</b>	<b>D.K./No answer</b>
32,19%	31,63%	16,45%	8,73%	10,01%	1,00%

***A.11. Fuel taxes already are high enough.***

<b>Strongly agree</b>	<b>Agree</b>	<b>Neither agree nor disagree</b>	<b>Disagree</b>	<b>Strongly disagree</b>	<b>D.K./No answer</b>
53,51%	28,04%	10,01%	3,43%	1,43%	3,58%



***A.12. Even if it makes new homes are a bit more expensive, should be required that they are more energy efficient.***

Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	D.K./No answer
29,18%	31,76%	14,88%	14,88%	7,15%	2,15%

***A.13. Nuclear energy is a valid way to face the climate change.***

Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	D.K./No answer
17,02%	21,17%	43,20%	5,87%	9,73%	3,00%

***A.14. Should not be encouraged putting large solar panels fields in protected natural areas.***

Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	D.K./No answer
26,47%	30,47%	19,74%	9,30%	8,15%	5,87%

***A.15. The best way to face climate change is to educate our children to live differently***

Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	D.K./No answer
52,50%	33,05%	7,15%	3,29%	3,15%	0,86%



***A.16. There are many other environmental problems in Spain and the government should use resources to solve them instead of allocating them to climate change.***

<b>Strongly agree</b>	<b>Agree</b>	<b>Neither agree nor disagree</b>	<b>Disagree</b>	<b>Strongly disagree</b>	<b>D.K./No answer</b>
18,45%	31,90%	31,33%	7,44%	5,58%	5,29%

***A.17. Would you be willing to pay an environmental tax to fight against climate change?***

Very willing	Somewhat willing	I don't know, I'm not sure	Somewhat unwilling	Very unwilling	D.K./No answer
6,01%	25,46%	22,32%	14,31%	28,61%	3,29%

***A.18. If environmental taxes were enforced to reduce climate change emissions, other taxes payed for the citizens and companies should be reduced.***

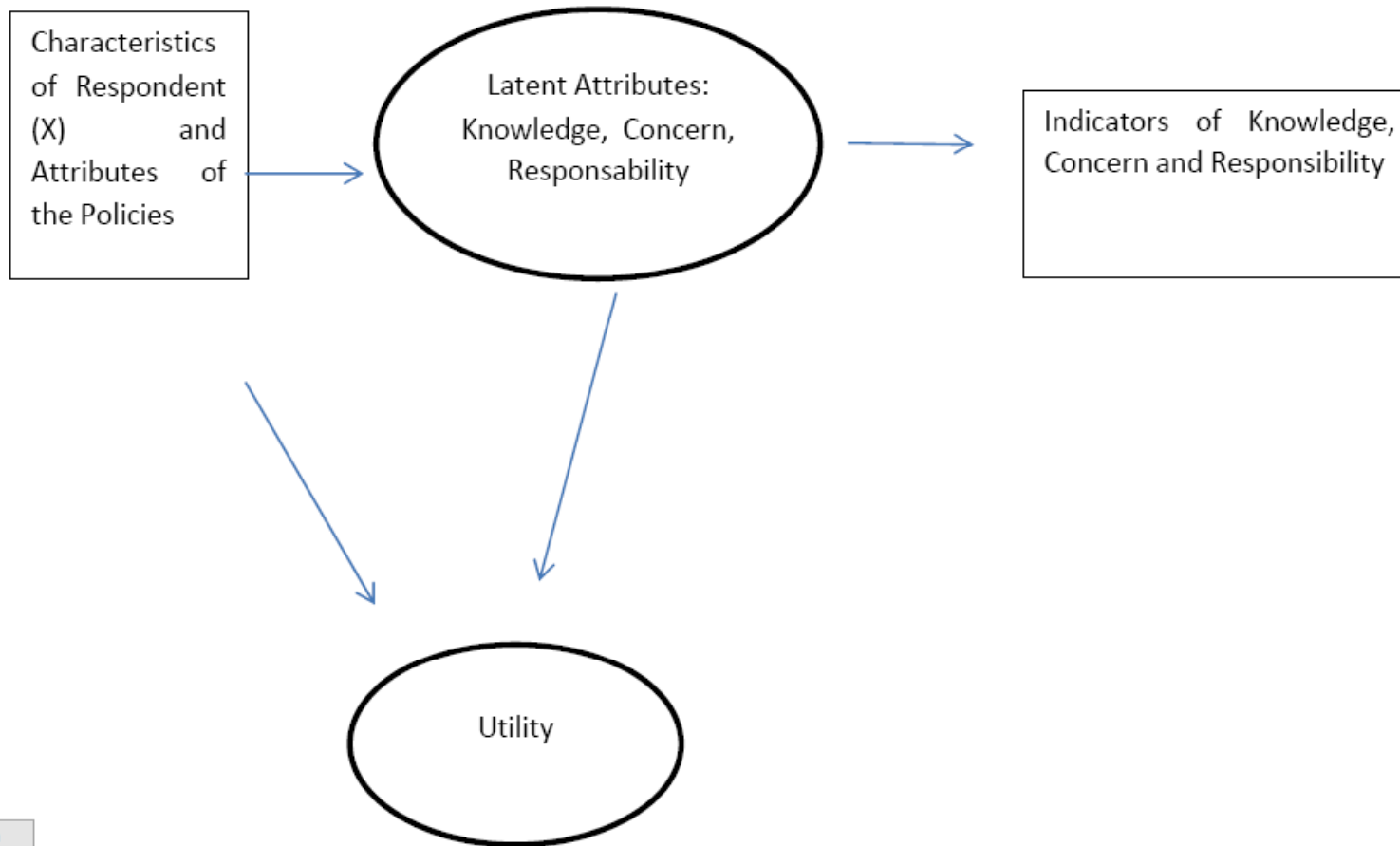
Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	D.K./No answer
40,92%	36,77%	14,02%	3,43%	2,72%	2,15%



# Empirical Modeling



# Modeling Latent Attitudes



# Ben-Akiva Hybrid Choice Model

- Structural Model

$$Z_i^* = X_i \delta + \eta_i$$

(latent equation, can be n of them)

$$U_i = X_i \beta_1 + Z_i^* \beta_2 + \varepsilon_i$$

(choice model)

$\chi^2$ Table 3: Binary Choice Models						
Variable	WTP 1			WTP 2		
	Coefficients	Std. Err.	P> z	Coefficients	Std. Err.	P> z
Constant	-1.329	0.407	0.001	-4.840	1.366	0.000
Bid	-0.053	0.007	0.000	-0.054	0.008	0.000
Income	0.274	0.071	0.000	0.204	0.082	0.013
Education				0.063	0.089	0.483
North				0.122	0.322	0.704
South				0.037	0.266	0.890
Age				-0.019	0.008	0.015
Info climate				0.007	0.174	0.966
Climate problem				0.698	0.336	0.038
Degree own responsibility				0.218	0.170	0.199
Degree firm responsibility				0.199	0.235	0.397
Need for action				0.420	0.184	0.023
Spain should do something				-0.103	0.224	0.646
Log-likelihood	-273.318			-234.818		
LR	88.750			113.550		



# Hybrid Choice Model: Results

- 1: Socio-Economic Variables behind Latent Construct

		coef	s.e.	z-value	p-value	Wald(0)
<b>LatentFactor</b>	north	0,2513	0,0874	2,8753	0,0040	8,2674
	south	0,1334	0,0599	2,2278	0,026	4,9631
	education	0,0185	0,0193	0,9588	0,34	0,9192
	income	0,0785	0,0270	2,9135	0,0036	8,4887

# Structural Latent Equations

degree_own_resp onsability(1)	1	-0,6226	0,2445	-2,5463	0,011
degree_own_resp onsability(2)	1	0,6851	0,1337	5,1226	3,00E-07
degree_own_resp onsability(3)	1	0,8819	0,0929	9,4898	2,30E-21
degree_own_resp onsability(4)	1	-0,9444	0,2572	-3,6715	0,00024
degree_own_resp onsability	CFactor1	1,1534	0,4322	2,6686	0,0076
degree_firms_resp onsability(1)	1	-1,3613	0,4289	-3,1742	0,0015
degree_firms_resp onsability(2)	1	-0,5638	0,2359	-2,3901	0,017
degree_firms_resp onsability(3)	1	1,1742	0,1929	6,0882	1,10E-09
degree_firms_resp onsability(4)	1	0,7509	0,3157	2,3787	0,017
degree_firms_resp onsability	CFactor1	2,1201	0,8153	2,6005	0,0094

# WTP with Latent Constructs

Constant	-0,8835	0,2479	-3,5646	0,00036
LatentFactor	0,9966	0,352	2,8312	0,0047
Bid	-0,0278	0,0039	-7,0887	1,40E-12
Income	0,0664	0,0446	1,4886	0,14

# Willingness to Pay Results

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**95% Confidence**

**Mean**

**Interval**

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**WTP 1**

1.215€

0.559

1.872

**WTP 2**

3.073€

1.702

4.445

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# Conclusion

- A possible explanation for the 'Spanish anomaly': reconcile statements on climate change with positive WTP
- Margin for application of public policies in the field of transport and electricity
- Another favorable sign for a Green Tax Reform
- Useful information for policy design

- Comments and questions are appreciated!

**–Thank you!**