

Climate Policy Measures: *What do people prefer ?*

Assessing attributes of CO₂ reduction policies

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Climate Policy Measures (Mitigation)

1. Regulations & Standards
2. Price Mechanism – Taxes/Charges
3. Price Mechanism – Tradable Permits
4. Financial Incentives (subsidies)
5. Voluntary Agreements
6. Information instruments
7. Public R&D

*Source: UN's Fourth Assessment Report (FAR) of the
Intergovernmental Panel on Climate Change*

Does the public have preferences ... if so, how do we measure them?

Purpose:

- Measure citizen preferences for *attributes* of policy measures
- Estimate WTP (implicit price) for different *attributes*

Our Method:

- Identified attributes that people might care about
- Developed a choice experiment survey
- Tested survey in focus groups
- Ran a small pilot study (230 surveys)
- Estimated a simple choice model

Previous Survey Research

- Hammar (2002) in Sweden
 - “green tax” vs. “green subsidy” comparison
 - no budget constraint consideration (!)
- Bannon & Krosnick 2007 in the U.S.
 - Preferences for specific measures *by name* (tax, permit system, regulation)
- Our focus: preferences for *attributes* of measures -- avoid using names (“tax”)
- To our knowledge, first CE approach to the issue

Possible Attributes

- Effectiveness of CO₂ reduction
- Future flexibility (to new knowledge)
- Regulatory flexibility (to unique circumstances)
- Effect on (net) government revenue
- Cost-effectiveness
- Enforcement mechanism
- Timing
- *Effect on environmentally-friendly technology*
- *Effect on environmental awareness*
- *Cost*
- *Distribution of Costs*

Selected Attributes

Attribute	Attribute Levels
<p>Effect on the development of <i>environmentally-friendly</i> technology [ENVIRO]</p>	<p>Positive No effect Negative</p>
<p>Has a positive effect on the Swedish citizens' <i>awareness of climate change</i> ? [AWARE]</p>	<p>Yes No</p>
<p>Distribution of costs across society [DIST]</p>	<p>All citizens pay the <u>same amount</u> All citizens pay the <u>same percentage</u> of income Higher income citizens pay a <u>higher percentage</u> of income</p>
<p>Monthly cost to you until 2010 [COST]</p>	<p>100 SEK (€10) 300 SEK (€30) 1000 SEK (€ 100)</p>

Which of the following measures, A or B, do you think should be used to reduce CO₂ emissions by 4 percent ?

(Note: both A and B, in fact, reduce emissions by 4 percent)

	Measure A	Measure B
Effect on the development of environmentally-friendly technologies	Positive	Negative
Has a positive effect on the Swedish populations' awareness of climate change	No	No
Social distribution of costs	All pay the <u>same amount</u> of their income	All pay the <u>same amount</u> of their income
Monthly cost to you until 2010	1000	100
Your choice	[]	[]

Focus Group Feedback

(4 focus groups (5-8 people each); free lunch; 60-75 min.)

- Defining the attributes
 - Interactive information is better than passive (e.g., table)

- “Distribution of costs” attribute
 - “regressive level” appeared to dominate...and
 - ... some people did not understand it.
 - Solution #1: interactive “warm-up” questions (next slide)
 - Solution #2: increased cost attribute

Question #6.

A reduction of CO₂ will cost you money. How this cost is divided among different people depends on what type of measure is used.

Alternative 1: All people pay the *same amount* which means that those with higher income pay a smaller percentage of their total income.

	Monthly Income	Percentage	<i>Same amount</i>
Björn	30 000 kr	5%	1 500 kr
Mattias	10 000 kr	15%	1 500 kr

Question #6.

A reduction of CO₂ will cost you money. How this cost is divided among different people depends on what type of measure is used.

Alternative 2: All people pay the *same percentage* of their income which means those with higher income pay a larger amount.

	Monthly Income	<i>Same Percentage</i>	Amount
Björn	30 000 kr	7.5%	2 250 kr
Mattias	10 000 kr	7.5%	750 kr

Question #6.

A reduction of CO₂ will cost you money. How this cost is divided among different people depends on what type of measure is used.

Alternative 3: People with higher incomes pay a *larger percentage* of their income than those with lower income.

	Monthly Income	<i>Larger Percentage</i>	Same amount
Björn	30 000 kr	8.3%	2 500 kr
Mattias	10 000 kr	5%	500 kr

Question #6.

A reduction of CO₂ will cost you money. How this cost is divided among different people depends on what type of measure is used.

- Which of these alternatives do you think is most consistent with the Swedish income tax system ?

Alternative 1

Alternative 2

Alternative 3

Don't know

Pilot Study

- Umeå: pop. 110,000 (25,000 students)
- 228 surveys distributed in urban/rural areas
- 75 surveys returned (33%)



Theoretical Model

$$U_m = \beta_{mk} f(X_{mk}) + \varepsilon$$

MNL

Multinomial Logit Model (MNL)

- Estimates probability of choosing a particular alternative (m)
- We assume individuals select alternative “m” that maximizes their utility (V_m).
- Individual’s utility is a function of:
 - X_{mk} -- The (k=4) attributes we use in the Choice Experiment
 - ε -- various sources of uncertainty (B, X, unobserved effects) collapsed into one term,

(Observable) Utility Function

$$V_m = \beta_0 + \beta_{\text{ENVIRO}}f(\text{enviro}) + \beta_{\text{AWARE}}f(\text{aware}) + \beta_{\text{DIST}}f(\text{dist}) + \beta_{\text{COST}}f(\text{cost})$$

- 4 Parameters (β) represent partial utility weights for attributes
- 1 Constant term (β_0) represents unobserved influences of utility
 - Used to measure a “base level” of utility from an opt-out or status quo
- Methodological question about β_0 :
 - Q#1: should one include β_0 in an unlabeled, experiment with two alternatives and no opt-out option ?
 - Q#2: If so, what does it mean ?

(Some literature suggests suppressing it in unlabeled experiments ... but our models perform better statistically with it)

Logit Model Results (Linear)

Attributes only (socioeconomic variables proved significant)

	With Constant			Without Constant			Price Change
	Coeff.	P-value	Conditional Implicit Price ¹	Coeffi.	P-value	Conditional Implicit Price ¹	
Constant	.760	99 %	380 SEK	-	-	0 SEK	-100%
ENVIRO	.340	99 %	170 SEK	.194	92 %	279 SEK	64%
AWARE	.717	99 %	359 SEK	.503	99 %	719 SEK	100%
DIST	.062**	55 %	n/a	-.019**	14 %	n/a	-
COST	-.002	99%	-	-.0007	99 %	-	-
Obs.	608			608			
Pseudo R ²	.08			.05			
LL Value	-385.62 (Restricted LL = - 421.44)			-400.22 (Restricted LL = - 421.44)			

** Not statistically significant at 10% level

Logit Model Results (Nonlinear)

- Two attributes specified as nonlinear dummy variables: ENVIRO & DIST

Variable	Dummy Variable	Marginal Change
ENVIRO	E_NEG	No effect → Negative effect
	E_POS	No effect → Positive effect
DIST	D_PROP	Regressive → Proportional
	D_PROG	Regressive → Progressive

Two attributes retained as linear: AWARE and COST

Logit Model Results (Nonlinear)

	With Constant			Without Constant			Price Change
	Coeff. (std error)	P-value	Conditional Implicit Price ¹	Coeff. (std error)	P-value	Conditional Implicit Price ¹	
Constant	.66	99 %	257 SEK	-	-	-	- 100 %
E_NEG	- .38	90 %	-147 SEK	.074 **	30 %	n/a	N/a
E_POS	.84	99 %	324 SEK	1.27	99 %	530 SEK	64%
AWARE	.78	99 %	300 SEK	.816	99 %	340 SEK	13%
D_PROP	.36	90 %	138 SEK	.577	99 %	240 SEK	74%
D_PROG	.10**	10 %	n/a	.338**	80 %	n/a	-
COST	-.0026	99 %	-	-.0024	99 %	-	-
Obs.	608			608			
Pseudo R ²	.100			.092			
LL Value	-377.57 (Restricted LL = - 421.44)			-382.75 (Restricted LL = - 421.44)			
** Not statistically significant at 10% level							

Conclusions From Pilot Study

(policy implications?)

- Respondents value measures that promote environmental awareness (300 - 720 SEK)
 - Respondents value measures that promote environmentally-friendly technologies (170 -530 SEK)
 - Cost distribution seems less important than anticipated (was it misunderstood ?)
 - Implication for Sweden's regressive CO₂ tax?
 - Should nationwide survey consider interviews ?
 - Missing attributes ? (China's CO₂ reduction?)
- ... paper available soon scott@eesweden.com