

# **Energy Taxation and Renewable Energy: Testing for Incentives, Framing Effects and Perceptions of Justice in Experimental Settings**

**Roland Menges (Flensburg)**  
**Stefan Traub (Bremen)**

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## Political Background

- Germany's Law for the Support of Green Electricity (GE): Subsidization of GE
- Current share of GE in total production: ~13%
- Cost allocation:  
**Public pays principle:** forced private subsidisation (indirect tax on electricity consumption)

### Alternative cost allocation:

- 1. Polluter pays principle** (CO2 taxes, emission trading)
- 2. Benefitor pays principle** (market-driven GE)
  - Opens utilities chance to market own GE products
  - Not too successful so far (GE Market share <2%)

## Theoretical Background:

### (1) Why do people contribute?

### (2) Interaction of individual and public contributions

- GE consumption: *public good* due to CO<sub>2</sub>-Reduction
- Public subsidies vs. private contributions (benefit principle)
- Standard theory (Bergstrom et al. 1986): *neutrality hypothesis*
- Public subsidies *crowd out* private contributions completely
- Experimental/Empirical counter-evidence (e.g. charitable donations) *incomplete crowding-out*
- Andreoni (1989, 1990): “Warm glow of giving”
- Impure altruism  $U=U(x,G,c)$

## Methodological background:

### Values, Choices and Economic Experiments

- Models of individual choice (e.g. with regard to public goods) depend on assumptions about individual preferences
- Preferences are *inferred* from choices (valuation and choice as intertwined concepts)
- Two ways to measure environmental preferences (absence of markets) :

#### Stated preference

- **Contingent Valuation:** hypothetical bias

#### Revealed Preference

- **Experiments:** control for preferences
- set of rules, linked to a incentive mechanism (rewards for making “better” decisions)
- reveal “true” preferences

## Experimental investigation:

*Individual preferences for the consumption of GE under alternative payment vehicles for the promotion of GE*

Are individual contributions sensitive to certain treatment variables or attitudes?

- Public vs. individual choice scenarios
- Direct tax vs. indirect tax vehicles
- Attitudes towards: polluter, public, or benefitor pays
- Market vs state

## Research Questions

1. How large is the extent of **free-riding**?
  - Median-voter setup (WTP) vs. individual-choice setup (WTD)
  - *Hypothesis:  $WTP > WTD > 0$*
  
2. Is there evidence for **fiscal illusion**?
  - direct taxes (gain/loss) vs. indirect taxes
  - *Hypothesis:  $WTP_{indirect} > WTP_{direct} ; WTD_{indirect} > WTD_{direct}$*
  
3. **Crowding-out effects** are tested indirectly (questionnaire).  
 How do individual attitudes towards GE/state influence WTP/WTD?

**Questionnaire:**

**Knowledge, general attitudes**  
(e.g. liberalisation,  
GE quantities, tax-share)

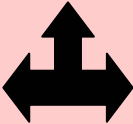


**Object of attitudes:**

**Public support for GE**

**Dimensions:**

**Financing  
mechanism**



**Support  
mechanism**



**Financial justice**  
• Who is responsible?  
(market, state, both)  
• Who should pay?  
(public, polluter or customer)

**„Efficiency“**  
• International harmonisation?  
• Differentiation of tariffs?  
(cost-covering tariffs)

## Experiment

- task: **Allocating household budget with respect to GE share in households electricity consumption**
- 6 Treatments (2x3 structure), between-subjects analysis
- T1-T3: Public Choice (Median-Voter) / T4-T6 Individual Choice

	WTP	WTD
Public pays, direct tax	1	4
Public pays, indirect tax	2	5
Polluter pays, direct subsidy	3	6

- Random lottery incentive-mechanism: showup-fee plus every 10th randomly selected for payoff, up to 250€
- no real electricity contracts, cheap-talk plus donations to environmentalists' organizations
- 348 subjects in 2 shopping malls (large variation of socio-demographics)





Bitte legen Sie nun mit dem Regler den allgemeinen Ökostromanteil fest

**Haushaltsgröße**

Haushaltsdaten

Personen

**Stromverbrauch**

kWh/Jahr

**Ihr Budget**

Kalkulation

€

**- Steuer**

€

**- Stromrechnung**

€

**Ihre Auszahlung**

€

**Umweltspende**

€

Ökostromanteil



**Ökostromanteil**

%

**Strompreis**

Cent/kWh

Weiter



## Results (I): Mean WTP and WTD

		Payment vehicle			
		<i>Direct tax</i>	<i>Indirect tax</i>	<i>Subsidy</i>	<i>All</i>
<b>Scenario</b>	<i>Public choice (WTP only)</i>	6.507 (0.673)	5.931 (0.629)	6.050 (0.605)	6.164 (0.366)
	<i>Individual choice (WTD only)</i>	1.189 (0.065)	1.200 (0.060)	0.916 (0.049)	1.102 (0.035)
	<i>All</i>	3.848 (0.418)	3.535 (0.380)	3.483 (0.385)	3.619 (0.227)

*Table Notes.* First row: WTP/WTD in cents of the Euro. Second row: standard errors.

## Results (II): Testing for Free Riding and Framing Effects

Test	Treatments	Mean difference	T	p
<i>Free riding</i>	<i>All</i>	<b>5.062</b>	13.777	<0.01
	<i>Direct tax</i>	<b>5.318</b>	7.863	<0.01
	<i>Indirect tax</i>	<b>4.730</b>	7.490	<0.01
	<i>Subsidy</i>	<b>5.134</b>	8.460	<0.01
<i>Fiscal Illusion</i>	<i>All</i>	-0.323	0.572	0.568
	<i>Public Choice</i>	0.576	0.625	0.533
	<i>Individual Choice</i>	-0.012	0.133	0.895
<i>Loss Aversion</i>	<i>All</i>	0.365	0.641	0.522
	<i>Public Choice</i>	0.456	0.504	0.615
	<i>Individual Choice</i>	<b>0.273</b>	3.337	<0.01

Table note: Significant mean differences (Welch-test) are given in boldface.

## Results (III): Crowding In – Correlation between WTP/WTD and Estimated Tax Share

		Payment vehicle			
		<i>Direct tax</i>	<i>Indirect tax</i>	<i>Subsidy</i>	<i>All</i>
Scenario	<i>Public choice (WTP only)</i>	<b>*0.230</b>	<b>**0.298</b>	0.128	<b>***0.209</b>
	<i>Individual choice (WTD only)</i>	0.179	-0.029	0.196	0.095
	<i>All</i>	0.019	0.147	-0.005	0.050

*Table notes.* Pearson's correlation. Significant correlations are marked with one (two, three) leading asterisk(s) if  $p \leq 0.10$  ( $p \leq 0.05$ ,  $p \leq 0.01$ ).

## Results (IV): Regression

Variable	Coefficient	T-value
<i>Constant</i>	4.647***	6.034
<i>Individual Choice Scenario</i>	-3.098***	5.088
<i>(Estimated Tax Share x Public Choice)</i>	0.356***	3.627
<i>(Estimated Tax Share x Public Choice) squared</i>	-6.672E-3**	2.545
<i>Household size</i>	-0.263**	2.156
<i>OECD equivalent income</i>	0.917E-3***	3.450
<i>Age squared</i>	-0.415E-3***	2.895
<i>No religion</i>	0.760*	1.707
<i>Support phasing out nuclear energy</i>	0.371**	2.579
<i>Support liberalization of electricity markets</i>	-0.318*	1.720
<i>Cost should be borne by green electricity customers</i>	-1.133*	1.863
F=24.419, p(F)<0.01, R=0.482		

*Table notes.* Dependent variable: average WTD/WTP per kW h of green electricity in cents of the Euro. Total n=348. Pairwise exclusion of missing values. Stepwise regression, an exogenous variable is included if  $p(F) \leq 0.1$ . Significant coefficients are marked with one (two, three) leading asterisk(s) if  $p \leq 0.10$  ( $p \leq 0.05$ ,  $p \leq 0.01$ ).

## Results

- OLS w/ sociodemographics, treatment effect, attitudes
- explains 48% of Variance
- WTP (Median Voter) >> WTD (Individual Choice), i.e. free riding
- weak evidence of fiscal illusion in the public choice case
- age (-), household income (+), religion (- !)
- abandoning nuclear electricity (+)
- fiscal attitudes: benefitor pays principle (-)
- estimation of tax share for GE in public choice case (+/-)
- Reverse effect: crowding-in becomes crowding-out at  $b=26,6\%$  !
- similar: see Menges, Schröder, Traub (ERE 2005)

## Conclusion

- *low chances* for private GE products (huge free-riding)
  - *market skepticism* of potential GE customers  
(refusing benefitor principle and market liberalisation)
  - sensitive to perception of tax-burden: *Crowding-in/out-effects*  
(fiscal illusion in the public choice case?)
- **GE support mainly seen as a public duty,  
to be financed from tax money**



## Fragebogen Fragen A1-A5 und B1-B3

### Bitte beantworten Sie die folgenden Fragen:

A1) Wie hoch schätzen Sie den gegenwärtigen Anteil von Steuern und Abgaben am Strompreis?

 %

A2) Wieviel Prozent dieser Steuern und Abgaben sind für die Ökostromförderung bestimmt?

 %

A3) Dem gegenwärtigen System der Förderung der erneuerbaren Energien ...

A4) Der Liberalisierung des Strommarktes ...

A5) Dem Ausstieg aus der Kernenergienutzung ...

B1) Die Kosten der erneuerbaren Energien sollten getragen werden, von:

B2) Die Verantwortung für den Ausbau des Ökostroms liegt beim

B3) Sollten energieintensive Unternehmen (z. B. Aluminiumwerke) von Umweltabgaben entlastet werden?





Weiter

Noch 16 Fragen.