

# Political Economy of Carbon Pricing Policies: Insights from a Panel of Countries

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# Overview

Motivation

Research objective

Analysis

Conclusion

# Motivation

## The case for a carbon price

“A uniform global carbon price (and prices on other greenhouse gases in proportion to their warming potential), delivered either by carbon taxes or carbon trading, would be an ideal tool to reduce greenhouse gas emissions sharply in a cost-effective way, based on the principle that the ‘polluter pays’. [...]” – Bowen (2011)

↔ carbon price  $> 0$

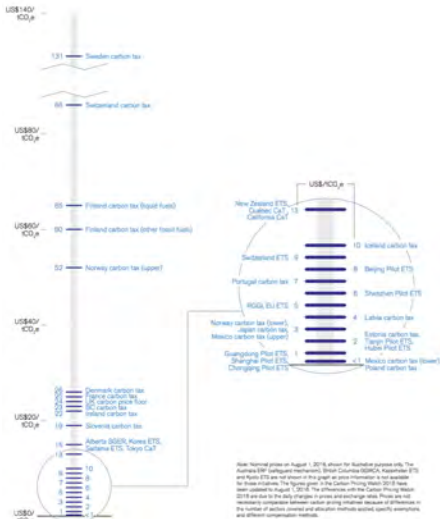
“[...] **In practice**, this will be difficult to achieve but the principle remains a vital yardstick with which to assess actual policy measures.” – Bowen (2011), cont.

↔ carbon price  $\ll$

## Carbon pricing policies at a glance



Source: State and Trends of Carbon Pricing (2016), The World Bank



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# Objective

## Research objective

- ▶ Provide a political economy perspective on (explicit) carbon pricing outcomes

## Questions addressed

- ▶ What drives implementation of carbon pricing policies?
  - ▶ Retrospectively
  - ▶ Prospectively
- ▶ **Corollary** Do political economy constraints constitute a valid rationale for overlapping policies?



# Analysis

# Taking stock

## Political economy – theory

- ▶ Olson (1965) – group size and group interest
- ▶ Stigler (1971) – regulatory capture
- ▶ Congleton (1992) – role of democracy

## Political economy – empirics

- ▶ Marques et al. (2010) – RE deployment and “conventional energy” lobby
- ▶ Chang and Berdiev (2011) – Political institutions and regulation
- ▶ van Beers and Strand (2015) – Fossil fuel taxation
- ▶ Fankhauser et al. (2015) – Climate Change policy drivers

# Analysis – What?

## Scope

- ▶ Explicit carbon prices
- ▶ 196 jurisdictions (137 national, 63 subnational, “world”)
- ▶ 1990-2012

## Two (policy) decisions

- ▶ Implementation
- ▶ Intensity

# Analysis – An Effective Carbon Price (ECP)

## Definition

- ▶ The Effective Carbon Price is an emissions-weighted price of carbon (2014 USD)

## Why an ECP?

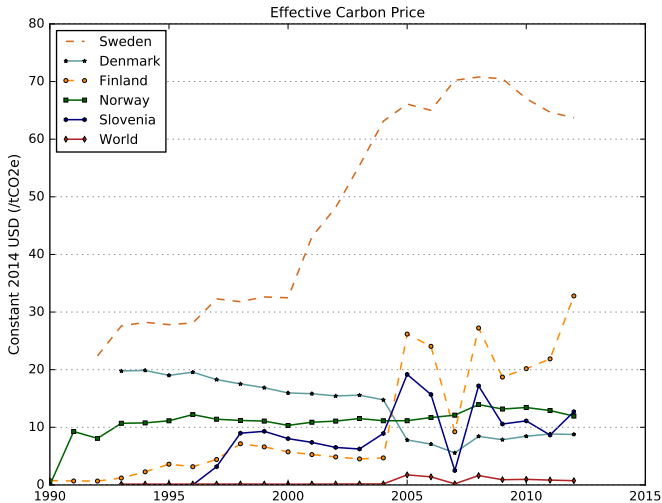
- ▶ Accurate measure of *intensity* of carbon pricing
- ▶ Multiple price signals within jurisdictions

## Construction

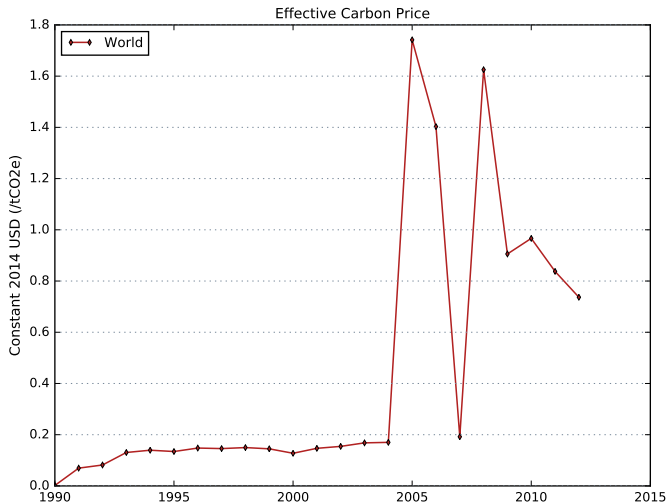
- ▶ Coverage: legislation and emissions data
- ▶ Price: market data (ETSs), legislation (Taxes)

Raw data

# Analysis – An Effective Carbon Price



## Analysis – An Effective Carbon Price: the World



## Analysis - Drivers ( $x'$ )

Table: Summary of variables

Category	Variable	Expected sign Carbon Price (Y/N)	Expected sign Carbon Price (Level)
Electricity sector & Industry	Elec. prod. from coal	-	-
	Elec. prod. from oil	-/0	-/0
	Elec. prod. from gas	-/0	-/0
	Industry, VA (% GDP)	-	-
-----			
Political envnt.	EU	+	+
	Annex-I	+	+
	Institutional capacity	+	n.a.
	Level of democracy	+	n.a.
	Government Ideology	+	+
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Economic envnmt.	GDP per capita	+	+
	Trade (% of GDP)	+/-	+/-

## Analysis – How?

### Two policy decisions ( $\mathbf{y}$ )

#### 1. Implementation

$$\text{Probability of implementation } (\pi_{it}) = \frac{\exp(\psi' \mathbf{x}_{it})}{1 + \exp(\psi' \mathbf{x}_{it})}$$

where  $\pi_{it} = P(Y_{it} = 1)$

#### 2. Strength (price level – coverage)

$$\text{Effective Carbon Price } (ECP_{it}) = \phi_i + \gamma' \mathbf{x}_{it} + \epsilon_{it}$$



# Results

## Implementation

- ▶ Higher share of electricity from fossil fuel associated with lower odds of carbon pricing (-)
- ▶ Industry (-)
- ▶ Institutional capacity (-\*), Level of democracy (+), EU (+)
- ▶ GDP per capita (+), Trade Openness (+)

### Regression results 1

## Strength (2014 USD/tCO<sub>2</sub>e)

- ▶ Electricity production from coal (-0.045)
- ▶ Industry (-0.04)
- ▶ GDP per capita – \$1000 (0.23), Trade (not significant),
- ▶ EU (5.344), no effect of institutional variables

# Conclusion

- ▶ This study offers a political economy perspective on carbon pricing policies' development. . .
- ▶ . . . which remains (politically) constrained
  - ▶ Fossil fuel generation of electricity negatively affects the odds of implementation (oil & coal) and the effective carbon price (coal)
  - ▶ Institutional environment affects implementation, not the level.
  - ▶ Strong EU effect (implementation and price level). . . [but not quite the only effect].
- ▶ Policy implication:
  - ▶ timing and context matter
  - ▶ support for a policy-mix (rather than a single instrument)

Thank you for your attention

- Bowen, A. (2011). The case for carbon pricing. Technical report, Grantham Research Institute on Climate Change and the Environment.
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- Congleton, R. (1992). Political institutions and pollution control. *The Review of Economics and Statistics*, 74(3):412–421.
- Fankhauser, S., Gennaioli, C., and Collins, M. (2015). The political economy of passing climate change legislation: Evidence from a survey. *Global Environmental Change*, 35:52–61.
- Marques, A., Fuinhas, J., and Manso, J. P. (2010). Motivations driving renewable energy in european countries. *Energy Policy*, 38:6877–6885.
- Olson, M. (1965). *The Logic of Collective Action*. Harvard Univeristy Press, Cambridge, Massachussetts.
- Stigler, G. (1971). The theory of economic regulation. *The Bell Journal of Economics and Management*, 2(1).
- van Beers, C. and Strand, J. (2015). *Political determinants of Fossil fuel pricing*, chapter 5. The MIT Press, Cambridge, Massachussetts and London, England.

► Jurisdictions with carbon pricing (60)

**Table:** Sectoral coverage – # of jurisdictions (2015)

	Carbon tax schemes (total: 17)	ETSs (total: 57)
Industry	14	47
Power	12	54
(Road) Transport	12	5
Aviation	4	31
Buildings (res. and com.)	12	8
Agriculture or Forestry	11	2
Waste	12	1

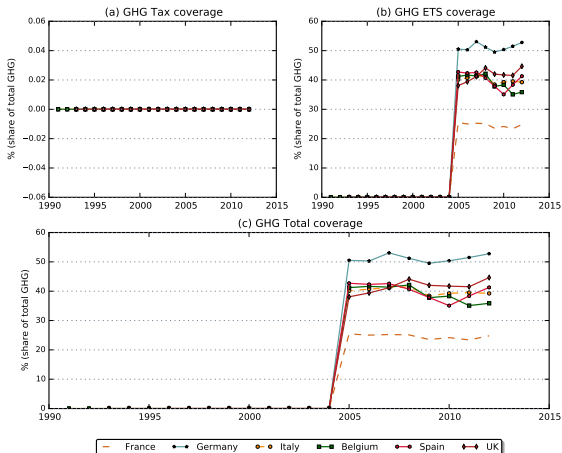
Back to [Map](#)

## Social Cost of Carbon

Table: US EPA - Social Cost of CO<sub>2</sub>, 2010-2050 (2014 USD/tCO<sub>2</sub>)

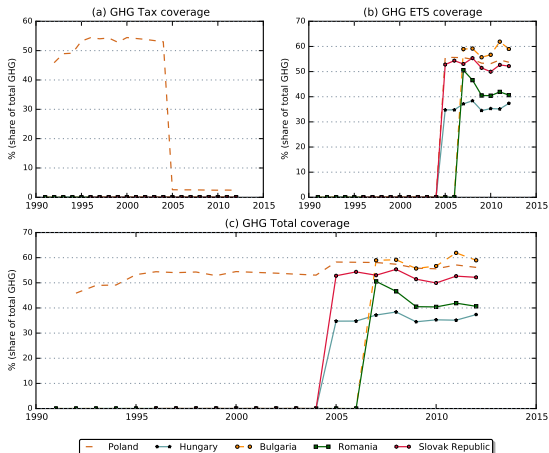
Discount Rate	5%	3%	2.5%	3%
Year	Avg	Avg	Avg	95th
2010	11	35	57	98
2015	13	41	64	120
2020	14	48	71	140
2025	16	53	78	158
2030	18	57	83	173
2035	21	63	89	192
2040	24	69	96	209
2045	26	74	102	225
2050	30	79	108	242

# Coverage – Western Europe



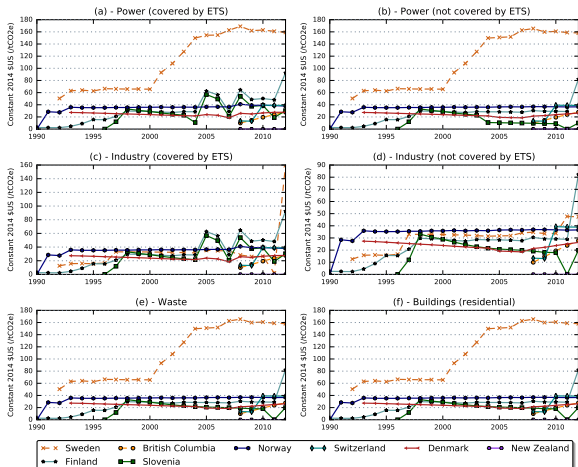


# Coverage – Eastern Europe

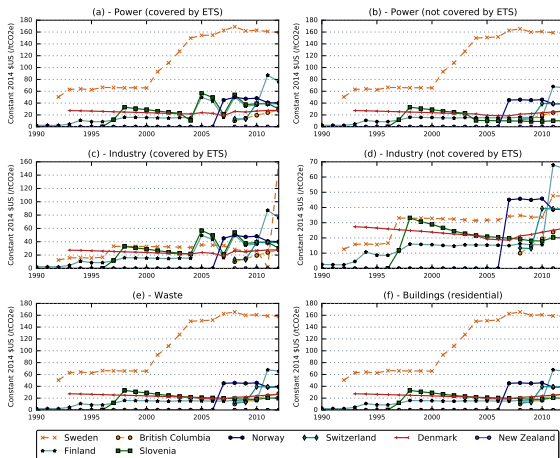


# Analysis (III) – The ECP: price

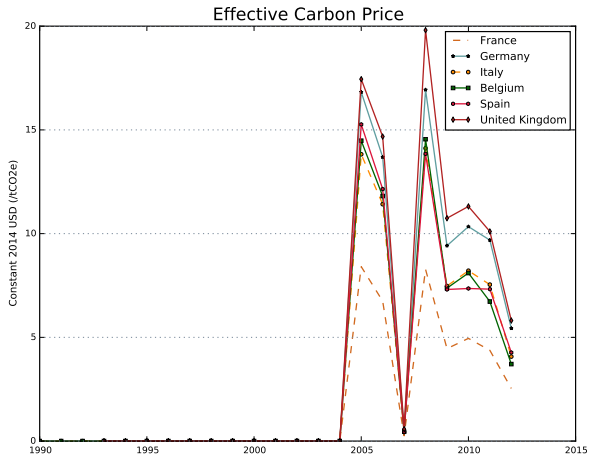
Figure: Total carbon price – oil



### Figure: Total carbon price – natural gas



# ECP – Western Europe



## ECP – Eastern Europe

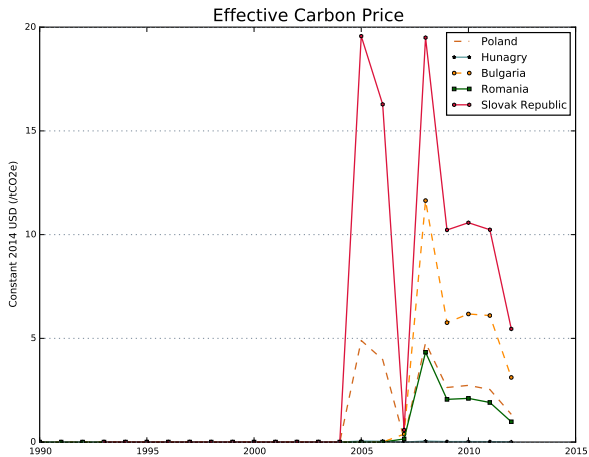


Table: Raw data

Design feature	ETS	Tax
Scheme coverage	x	x
Fuel coverage - coal	n.a.	x
Fuel coverage - oil	n.a.	x
Fuel coverage - gas	n.a.	x
Price - ETS	x	n.a.
Rate (all)	n.a.	x
Rate (coal)	n.a.	x
Rate (oil)	n.a.	x
Rate (nat gas)	n.a.	x
Sector coverage - industry ETS	x	x
Sector coverage - industry non-ETS		x
Sector coverage - power ETS	x	x
Sector coverage - power non-ETS		x
Sector coverage - transport (road)	x	x
Sector coverage - aviation	x	x
Sector coverage - waste	x	x
Sector coverage - forestry	x	x
Sector coverage - agriculture	x	x
Gas coverage - CO2	x	n.a.
Gas coverage - CH4	x	n.a.
Gas coverage - N2O	x	n.a.
Gas coverage - PFCs	x	n.a.
Gas coverage - HFCs	x	n.a.
Gas coverage - SF6	x	n.a.
Share - jurisdiction	x	x
Share - world	x	x
Revenue Recycling	x	x
Exemptions	x	x
Free Allocation	x	n.a.
Currency	x	x

## Results – Implementation (Logit)

Pricing (1=yes,0=no)	(1)	(2)	(3)	(4)
Elec. Prod - coal (% of total)	-0.134*** (0.0269)	-0.171*** (0.0308)	-0.115*** (0.0320)	-0.128*** (0.0347)
Elec. Prod - gas (% of total)	-0.000160 (0.0287)	-0.0250 (0.0540)	0.0548* (0.0238)	0.0419 (0.0395)
Elec. Prod - oil (% of total)	-0.246** (0.0797)	-0.305** (0.100)	-0.270*** (0.0560)	-0.248*** (0.0268)
GDP per cap. (thousand 2011 \$US)	0.355*** (0.0439)	0.683*** (0.0861)		0.547*** (0.0573)
Industry, value added (% of GDP)	-0.604*** (0.0846)	-0.711*** (0.188)	-0.809*** (0.0789)	-0.648*** (0.105)
Trade Openness (% of GDP)	0.0716*** (0.0111)	0.0539** (0.0191)	0.0928*** (0.00953)	0.135*** (0.0153)
EU	14.17*** (1.932)	5.570** (1.896)	20.79*** (1.805)	
Level of Democracy	1.381*** (0.337)	1.203* (0.569)		1.833*** (0.452)
Left		-0.546 (0.584)		
Institutional capacity			0.478 (0.775)	
Annex-I				8.581*** (2.606)
Constant	-25.18*** (4.409)	-18.84* (7.812)	-0.701 (2.107)	-50.44*** (5.971)
Observations	2938	1615	2163	2938

Standard errors in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

# Results – Intensity

## Table: GLS – Fixed effects

ECP (2014 \$US/tCO <sub>2e</sub> )	(1)	(2)	(3)	(4)
Elec. Prod - coal (% of total)	-0.0463** (0.0170)	-0.0715* (0.0341)	-0.0495 (0.0256)	-0.0458* (0.0177)
Elec. Prod - gas (% of total)	-0.00893 (0.0147)	-0.00720 (0.0249)	0.0104 (0.0145)	-0.0196 (0.0162)
Elec. Prod - oil (% of total)	0.00249 (0.00946)	-0.0104 (0.0145)	-0.0122 (0.0121)	0.00322 (0.00977)
GDP per cap. (thousand 2011 \$US)	0.238** (0.0789)	0.392** (0.137)		0.312** (0.0974)
Industry, value added (% of GDP)	-0.0446** (0.0154)	-0.0574* (0.0266)	-0.0809*** (0.0241)	-0.0486** (0.0164)
Trade Openness (% of GDP)	0.00112 (0.00456)	-0.00475 (0.00750)	0.0164* (0.00806)	0.00770 (0.00577)
EU	5.411** (1.649)	4.964* (2.044)	5.313*** (1.443)	
Level of Democracy	-0.0141 (0.0148)	-0.106** (0.0393)		-0.0120 (0.0171)
Left		-0.624 (0.498)		
Institutional capacity			-0.153 (0.560)	
Annex-I				2.728 (1.505)
Constant	-2.190 (1.472)	-1.042 (2.138)	2.872** (0.968)	-4.283 (2.266)
Observations	2938	1615	2163	2938
R <sup>2</sup>	0.203	0.245	0.110	0.149

Standard errors in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$



# Results – Intensity

Table: GLS – Random-effects

ECP (2014 USD/tCO <sub>2</sub> e)	(1)	(2)	(3)	(4)
Elec. Prod - coal (% of total)	-0.0339** (0.0124)	-0.0447** (0.0169)	-0.0327 (0.0171)	-0.0386** (0.0139)
Elec. Prod - gas (% of total)	-0.00811 (0.0130)	-0.0105 (0.0153)	-0.0133 (0.0147)	-0.0139 (0.0148)
Elec. Prod - oil (% of total)	-0.00900 (0.00742)	-0.00932 (0.00823)	-0.0171 (0.0106)	-0.00844 (0.00705)
GDP per cap. (thousand 2011 USD)	0.0770** (0.0285)	0.134* (0.0540)	0.0915** (0.0293)	0.0999** (0.0367)
Industry, value added (% of GDP)	-0.0337** (0.0125)	-0.0406** (0.0152)	-0.0616** (0.0202)	-0.0400** (0.0137)
Trade Openness (% of GDP)	0.00751 (0.00494)	0.00112 (0.00489)	0.0109 (0.00651)	0.0216* (0.00858)
EU	6.274*** (1.753)	5.834*** (1.654)	4.999*** (1.208)	
Level of Democracy	-0.0190 (0.0159)	-0.000156 (0.0137)	0.0145 (0.0174)	-0.0275 (0.0211)
Government ideology		-0.0367 (0.130)		
Institutional capacity			-0.845* (0.399)	
Annex-I				2.150* (1.094)
Constant	-0.128 (0.431)	0.400 (0.485)	0.797 (0.593)	-1.647 (0.893)
Observations	2814	2404	1939	2814
R <sup>2</sup>	0.19	0.19	0.19	0.08

Standard errors in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$