



Aalto University
School of Business

How much climate policy has cost the OECD countries?

Timo Kuosmanen, Xun Zhou, Sheng Dai

Outline

- Motivation: economic cost of the Kyoto Protocol
- Estimation strategy: marginal abatement cost estimation by convex quantile regression
- Empirical results of abatement cost per capita for OECD countries

Further details: Kuosmanen, Zhou, Dai (2018)

<https://www.researchgate.net/publication/329829940> How much climate policy has cost for OECD countries

Milestones of climate policy

1992 Rio de Janeiro, Brazil: United Nations Framework Convention on Climate Change (UNFCCC)

1995 Berlin, Germany: Conference of Parties (COP)

1997 Kyoto, Japan: **Kyoto Protocol**

2008-2012 1st commitment period

2013-2020 2nd commitment period (Doha Amendment)

2015 Paris, France: Paris Agreement

Cost of Kyoto Protocol

Stanford Energy Modeling Forum (EMF)

- 14 studies published as a special issue of *The Energy Journal* (see Weyant and Hill, 1999, for introduction and overview)

Range of EMF estimates for the predicted loss of GDP per capita in year 2010

“No trading” scenario (€²⁰¹⁰ per capita)

Region	min	max
USA	155	742
EU	130	708
Japan	99	811
Canada-Australia-New Zealand	167	729

Cost of Kyoto Protocol

Murkowski (2000) The Kyoto Protocol is not the Answer to Climate Change, *Harvard Journal on Legislation*

- Average cost in the US: \$2,728 per household per year
- Eradicate 2.4 million jobs

20 years after Kyoto: what happened?

- USA signed but never ratified
- Australia signed but did not ratify until 2007
- Canada withdrew in 2012
- Almost all European countries have complied to their Kyoto targets

How large is the burden of climate policy on European economy?

Challenges in empirical cost assessment

- What is the counterfactual?
 - Which countries should be included in the *treatment group* vs the *control group*?
 - Countries that commit to targets do not always comply
 - Countries that do not commit also abate
 - GHG emissions depend on many other factors (e.g., economic growth, business cycle)

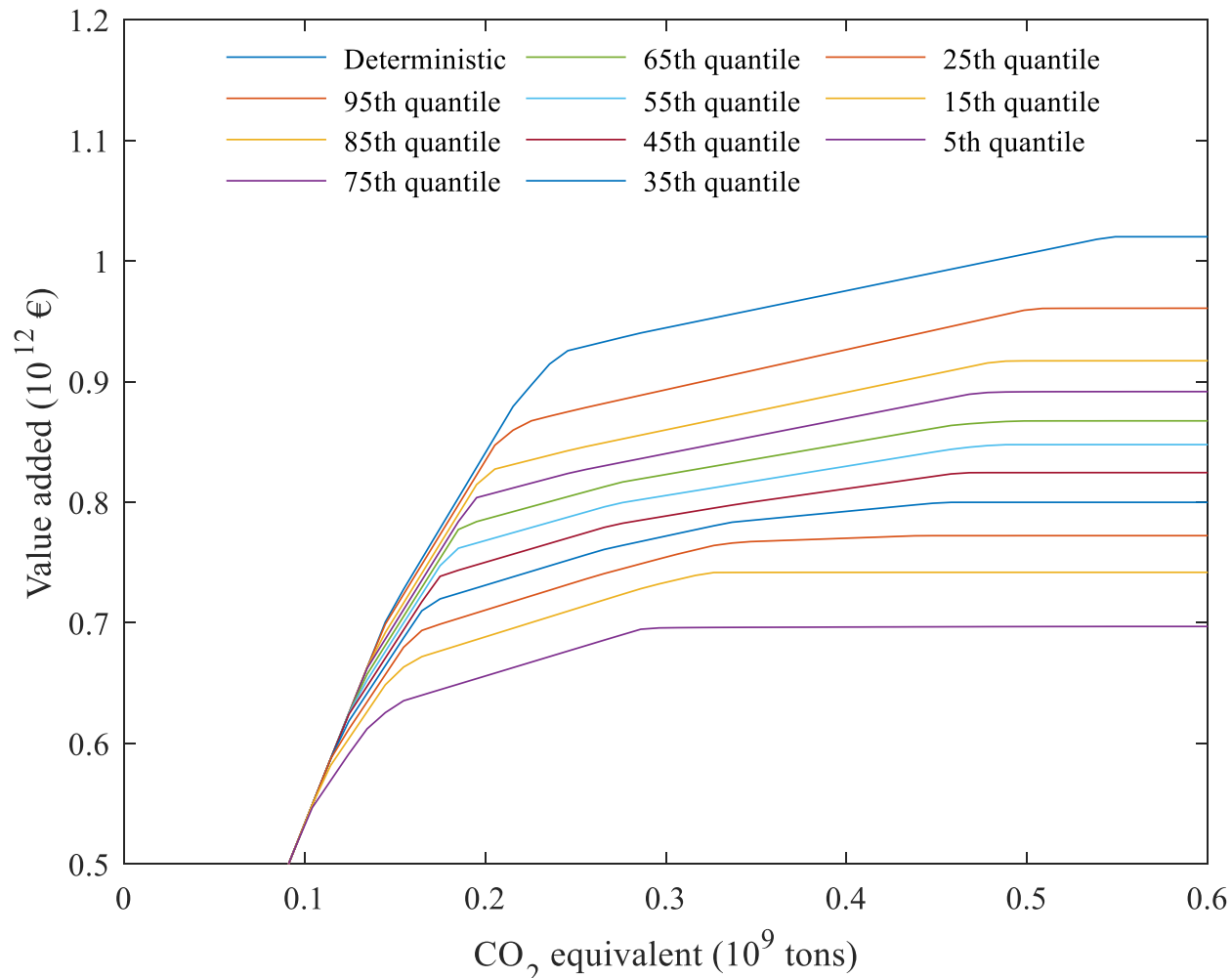
Our approach

- Estimate the abatement cost in country i in year t based on the **actual change of GHG** emissions from year $t-1$.
- The abatement cost is estimated using **tangent line approximation**:

$$AC_{it} = (GHG_{it} - GHG_{i,t-1}) \cdot (MAC_{it} + MAC_{i,t-1})/2.$$

where marginal abatement cost (MAC) is estimated using *convex quantile regression*

Convex quantile regression



Data

- Yearly data of 28 OECD countries
- Source: OECD STAN database
- Time period: 1990-2015
- Inputs:
 - Labor (total hours)
 - Capital (net capital stock)
- Outputs:
 - Value added (constant prices of 2010)
 - GHG, CO₂ equivalents

Table 2: Marginal abatement cost by country (€²⁰¹⁰ / ton), average of 1990-2015

(interquartile range in parenthesis).

EU-15 (Annex II)			EU transition economies (Annex I)		
Sweden	507	(207)	Estonia	189	(116)
Luxembourg	431	(64)	Slovenia	189	(71)
United Kingdom	421	(50)	Poland	129	(43)
Ireland	406	(11)	Hungary	121	(34)
Italy	349	(103)	Latvia	119	(16)
Belgium	340	(69)	Czech Republic	119	(43)
Greece	324	(59)	Slovakia	116	(43)
Netherlands	309	(94)			
Germany	289	(71)	Non-European OECD		
France	289	(181)	Canada	404	(1)
Finland	268	(112)	Israel*	396	(1)
Denmark	262	(190)	United States	318	(59)
Austria	182	(13)	Australia	311	(17)
			New Zealand	300	(69)
			South Korea*	217	(14)
EFTA (Annex II)					
Norway	435	(82)			
Iceland	198	(57)			

* Non-Annex I countries. All other countries are listed in Annex I of the Kyoto Protocol.

Table 3: Abatement cost per capita per year (€²⁰¹⁰ / person), average of 1990-2015

(interquartile range in parenthesis).

EU-15 (Annex II)			EU transition economies (Annex I)		
Luxembourg	112	(874)	Czech Republic	30	(75)
United Kingdom	83	(150)	Slovakia	15	(58)
Denmark	67	(293)	Hungary	15	(29)
Sweden	57	(165)	Poland	12	(40)
Germany	48	(107)	Slovenia	11	(53)
Finland	48	(345)	Estonia	3	(191)
Belgium	42	(169)	Latvia	3	(53)
Netherlands	23	(115)			
France	22	(73)	Non-European OECD		
Italy	14	(97)	United States	-9	(178)
Austria	2	(105)	Israel*	-30	(31)
Greece	-2	(161)	New Zealand	-48	(164)
Ireland	-8	(219)	Canada	-61	(296)
			South Korea*	-75	(122)
			Australia	-76	(101)
EFTA (Annex II)					
Norway	-6	(175)			
Iceland	-36	(101)			

* Non-Annex I countries. All other non-European countries are Annex II parties of the Kyoto Protocol.

Thank you for your attention!

Questions, comments:

- timo.kuosmanen@aalto.fi