Chaire Développement Durable-Environnement, Energie et Société

Marchés de CO2 et fuites de carbone: le rôle des allocations gratuites

17 Novembre 2015

J-P Ponssard (CNRS and Ecole Polytechnique)

Agenda

- Motivation
- Empirical analysis of the role of free allocations in the EU-ETS 2013-2018
- Another implementation issue: OBA in a multisector setting
- Concluding comments

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Motivation

- Unilateral ETS → risk of (sectoral) leakage for EITE→Options to limit leakage → free allocations
- A well studied topic in the literature
  - BTA > OBA > pure grandfathering or auction

    Sterner and Höglund-Isaksson (2006), Quirion (2009); Fisher and Fox (2007, 2012); Monjon and Quirion (2011), Böhringer et al (2012), Burtraw et al. (2015)…
- In practice
  - EU-ETS 2008-2012 selected grandfathering
  - CA-ETS 2012-2020 selected OBA (ex-post adustment of free allocations)
  - EU-ETS 2013-2020 selected an hybrid scheme (grandfathering with partial ex-post adjustments)
- The design issue is again on the table for the next EU-ETS 2020-2030

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Motivation: OBA 101

Profit

$$\pi(q, u) = P\,q - c(u)\,q - \sigma uq + \sigma u^{\circ} q$$

in which σuq is the cost of carbon when producing q with an emission rate at u and a CO2 price at σ and $u^{\circ}q$ the output based allocations with benchmark u°

The optimal abatment is u^* such that

$$c'(u^*) = \sigma$$

The competitive market equilibrium increases to

$$P = c(u^*) + \sigma u^* - \sigma u^{\circ}$$

→ If $u^{\circ} = 0$ the pass through rate is 100%: the market price increases by the same amount as the cost increase due to the CO2 price

→ If $u^{\circ} = u^*$ the pass through rate is 0%: the market price is not affected

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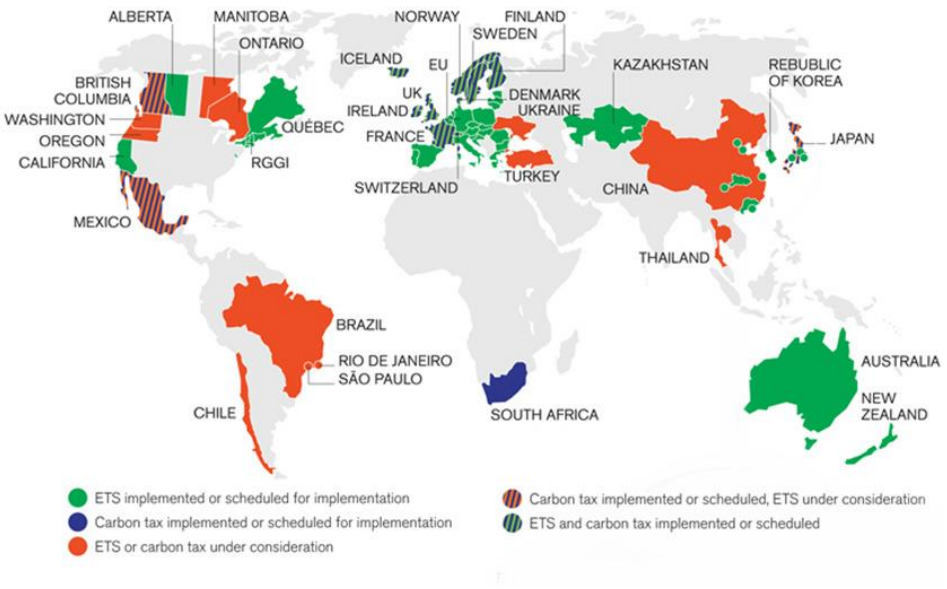
State of Carbon Pricing (World Bank)



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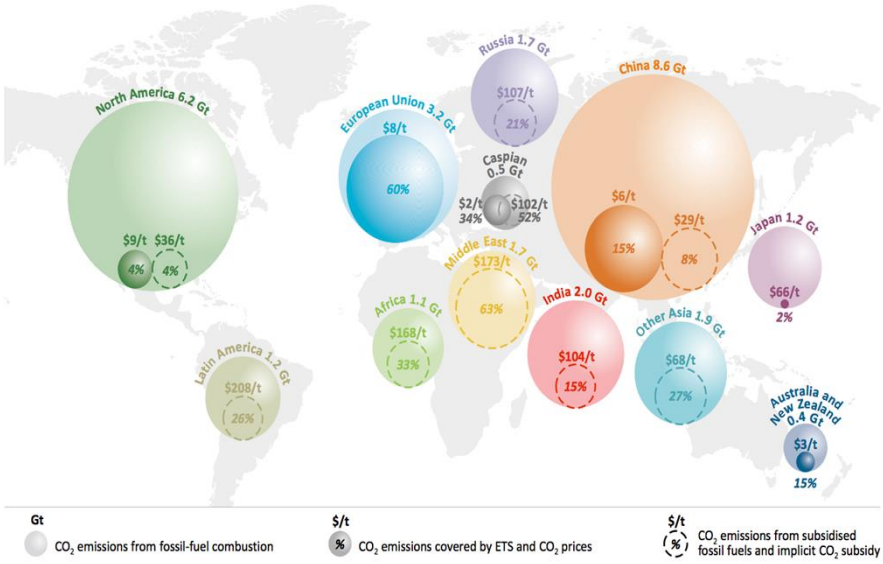
ETS in the world



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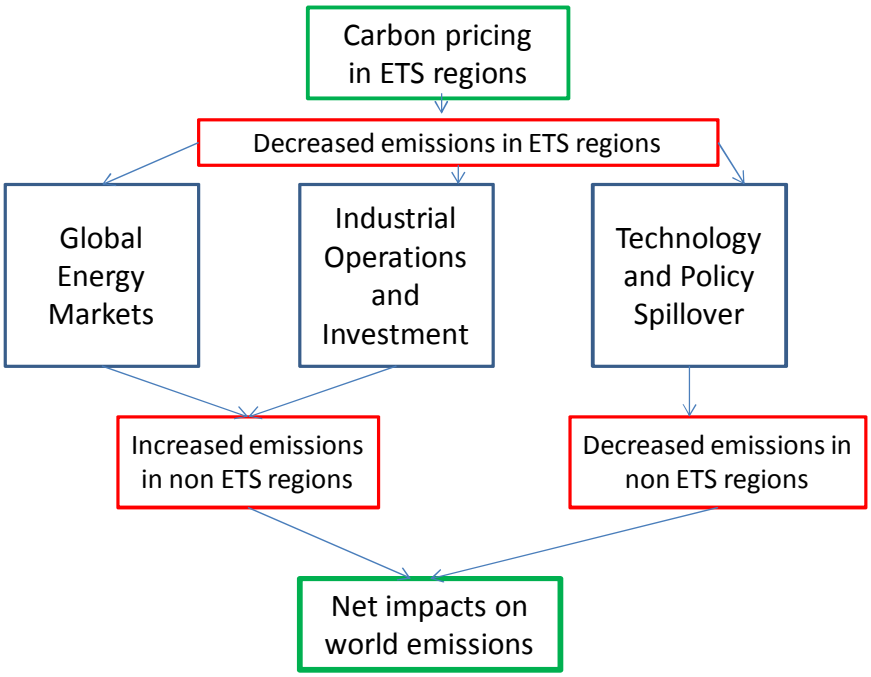
Empirical Analysis of Leakage

Susanne Dröge Tacklingleakage in a world of unequal carbon prices, Climate Strategies 2009



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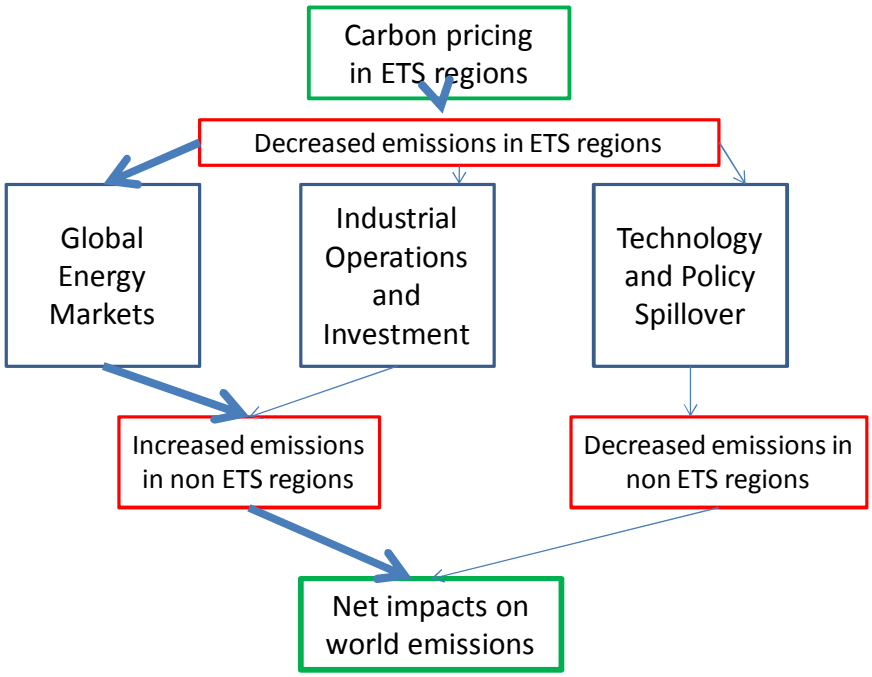
Global energy market: the energy channel effect



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Global energy market: the energy channel effect

- Carbon prices in ETS
- Demand for fossil fuels in ETS decreases
- World price for fossil fuels decreases
- Consumption of fossil fuels in non ETS increases
- CO2 emissions in non ETS increase…

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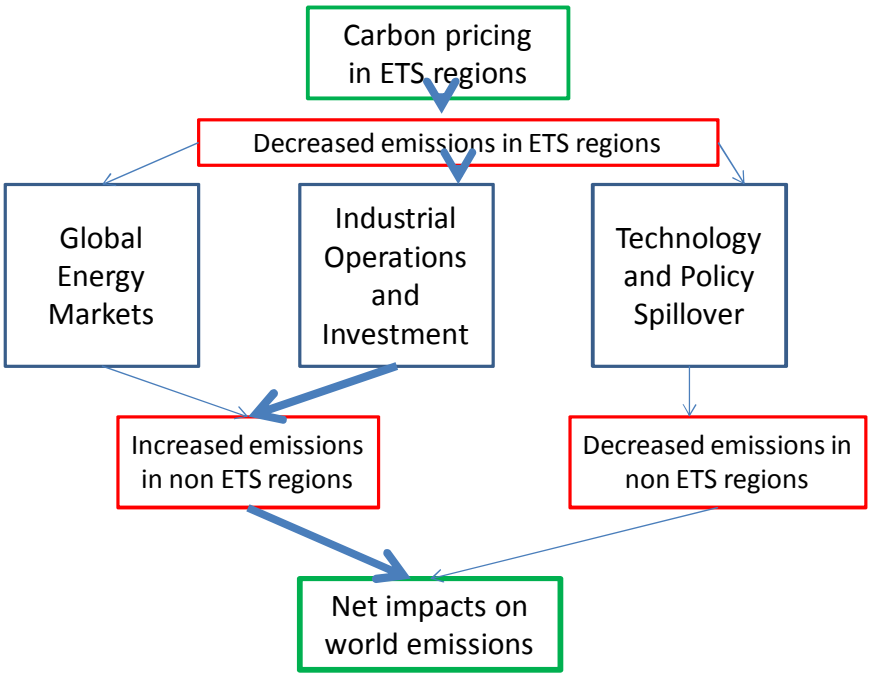
Industrial Operations and Investment Effects
The competitiveness effect



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Industrial Operations and Investment Effects
The competitiveness effect

- Industries in ETS implement abatement policies
- The unit cost for these industries increases wrt non ETS industries
- Imports increase and relocation of ETS industries
- Emissions in non ETS increase

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Definition of leakage indicators

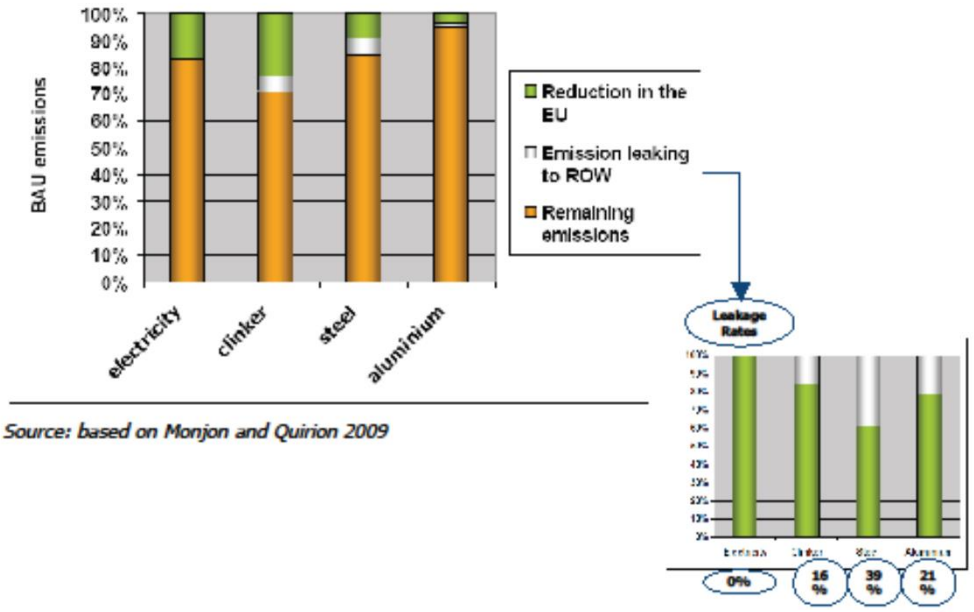
Kuik, O. J., 2001. "The effect of trade liberalization on carbon leakage under the Kyoto protocol: Experiments with GTAP-E". In 4th annual conference on global economic analysis. West Lafayette: Purdue University.

Change in emissions	Annex 1 Countries	Non-Annex 1 Countries
Competitiveness effect	-74.2	+31.5
Energy effect 1 (energy intensity)	-3303.6	+361.0
Energy effect 2 (household revenue)	-466.2	+43.5
Total effect	-3844.0	+436.0

NB The global leakage rate is 11.3% (=436/3844).
The competitiveness effect induces a leakage rate of 42.5% (=31.5/74.5).

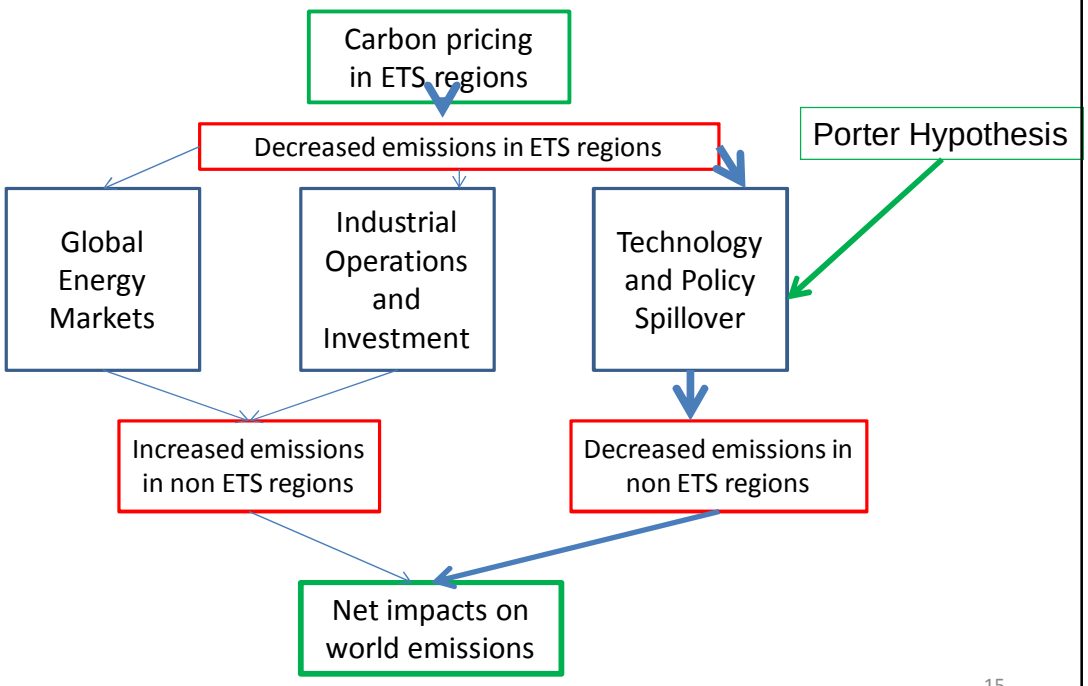
The leakage rate as estimated in economic models

Figure 13 Emission reduction in the electricity, clinker, steel, aluminium industry in 2016 under 100% auctioning



Source: based on Monjon and Quirion 2009

Innovation effect and spillover



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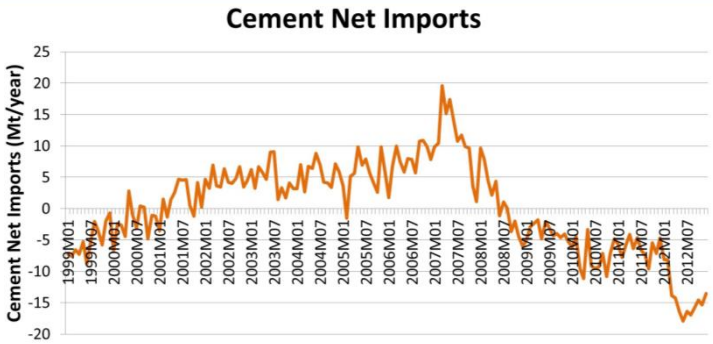
Empirical analysis of leakage

Frédéric Branger , Philippe Quirion, Julien Chevallier. Carbon leakage and competitiveness of cement and steel industries under the EU ETS : much ado about nothing. CIRED Working Paper, 2013. http://ideas.repec.org/s/hal/ciredw.html



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Policies for risk mitigation of direct emissions EU phase 3 (2013-2020) versus California(2012-2020)

Same basic principle: free allocation to each eligible entity

Product*technology localized within the installation

Free allocation=carbon leakage exposure*benchmark*activity level*adjustment factor

leakage risk for the sector to which the entity belongs

For the sector

For ongoing and new entities

Cross sectoral correction

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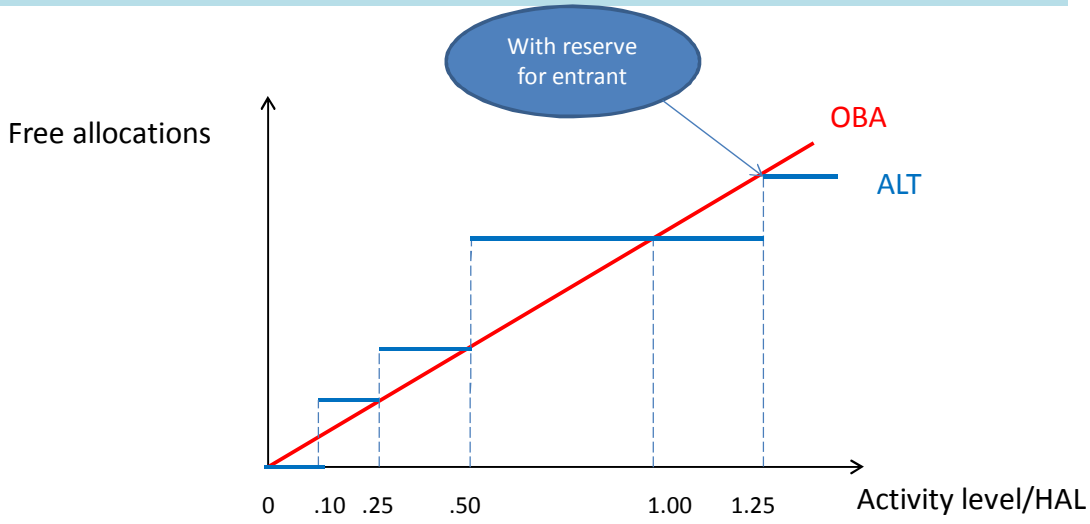
The hybrid scheme adopted by the EU for 2013-2020



With OBA free allocations are equal to emissions
The EU-ETS scheme – « ALT » – is an approximation of OBA based on actual production relative to an historic activity level (HAL) and capacity for new entrant

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Previous literature on hybrid schemes

- Reserve for new entrants may generate over-investment
  - relative to auctionning for electricity: Neuhoff et al. (2006), Ellerman (2008), Pahle et al. (2011), Golombek et al. (2011)
  - Relative to OBA: Meunier et al. (2014)
- Grandfathering (with updating and closure rule) achieve more in dynamic than in static settings
  - Fowlie et al. (2012)
- Our study is an ***ex-post*** study
  - Cement sector
  - A context of significant decline in demand
  - An outgrowth of the CS cement report

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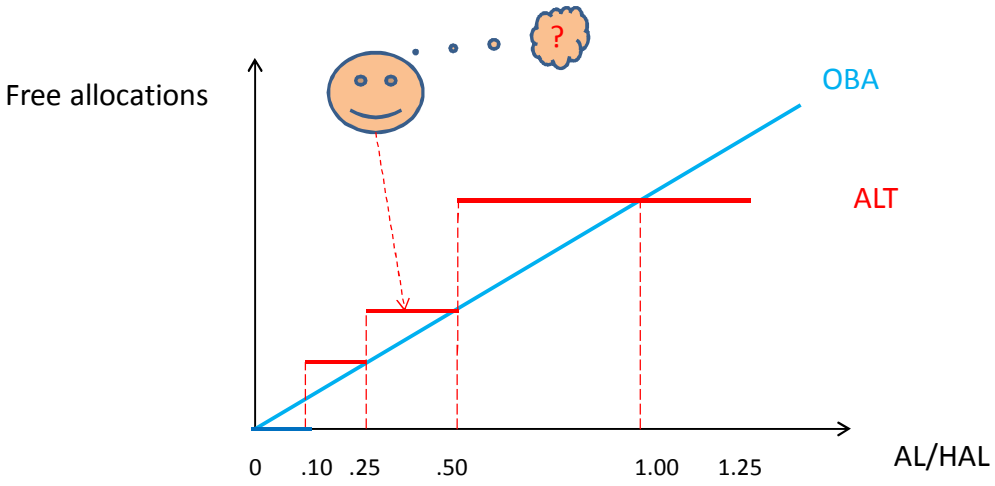
Agenda detailed

- Rationale for gaming
- Structural characteristics of the cement industry
- Methodology
- Results

Rationale for gaming in a context of declining activity

Jensen 2001 *Paying people to lie*



There is an incentive to increase the activity to benefit from the increased level of free allocations

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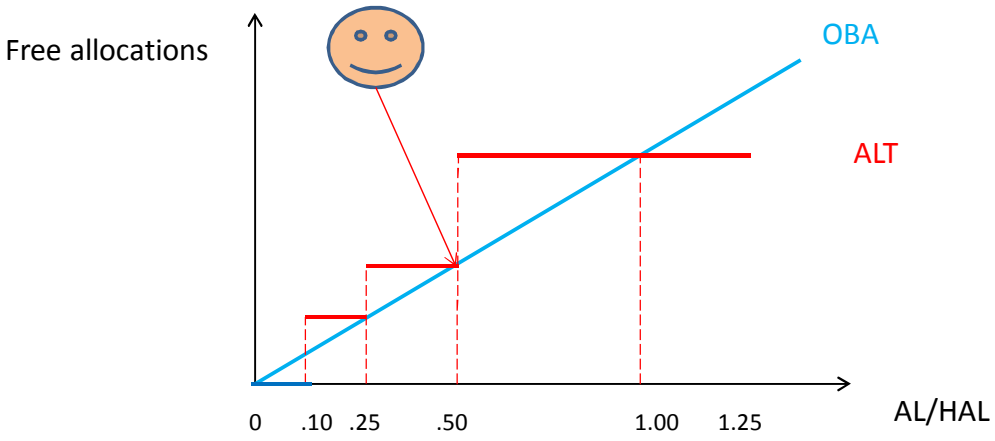
Rationale for gaming in a context of declining activity

Jensen 2001 *Paying people to lie*



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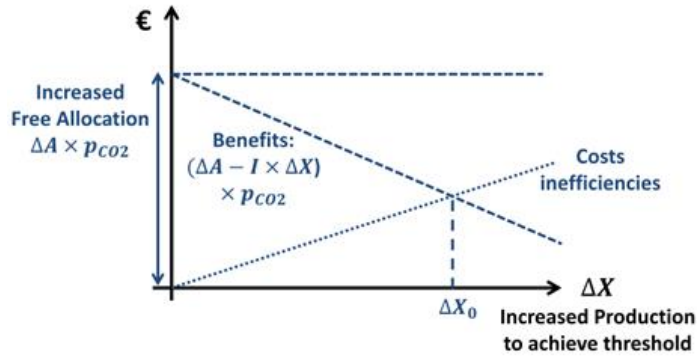
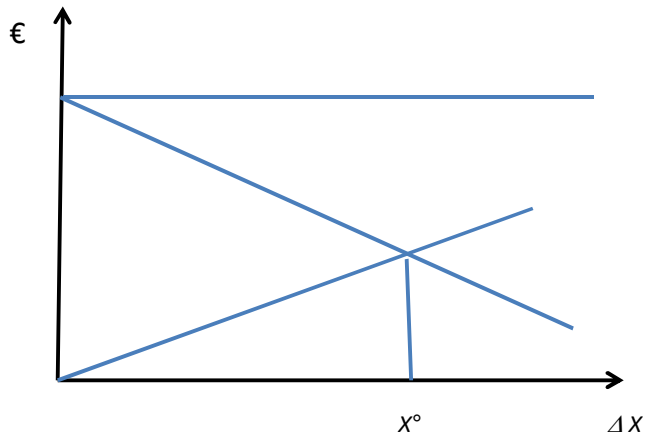
Rationale for gaming



The installation engages in gaming when $\Delta X < \Delta X_0$. I refers to the carbon intensity of the plant. Benefits are increased free allocations minus extra emissions. Costs inefficiencies refers to the various ways to dispatch the excess clinker

The higher the CO2 price the larger the opportunity for profitable gaming



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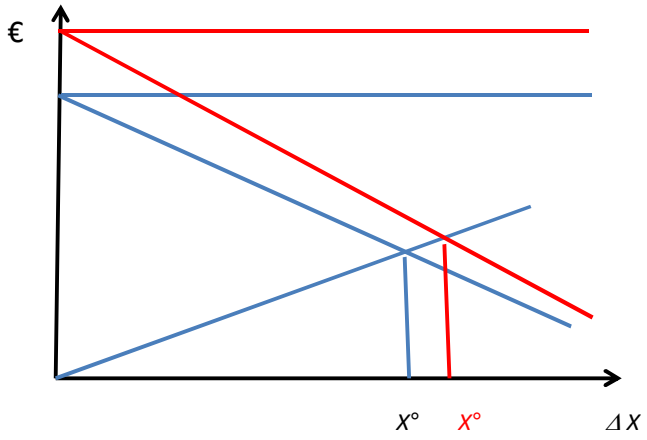

Cement Industry

- Cement markets are regional and possibly subject to leakage
- Demand is variable and cyclical (mainly dependent on the construction sector)
- Producing cement is carbon intensive
- Three limited ways to reduce cement carbon intensity
  - Change the fuel mix
  - Increase energy efficiency in kiln
  - Reduce clinker-to cement ratio
- Climate Strategies report limited evidence that CO2 price influenced the pace of improvement in carbon intensity

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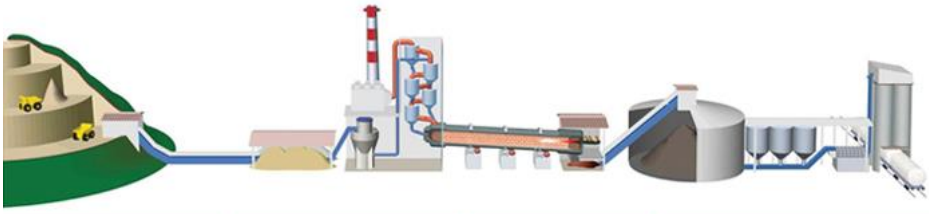
The production of cement



QUARRYING	RAW MATERIALS PREPARATION	CLINKER PRODUCTION	CEMENT GRINDING AND DISTRIBUTION
Limestone and small amounts of sand and clay are extracted, usually from a quarry located near the cement manufacturing plant.	The extracted materials are analyzed, blended with additional mineral components depending on the type of limestone available, and finely ground for further processing.	The materials are heated in a kiln reaching a temperature of 1,470ºC. The heat transforms the materials into a molten product called clinker, which is then rapidly cooled.	The clinker is stored and then finely ground. Gypsum is added to control setting time, along with supplementary cementing materials, such as fly ash or slag, to obtain a fine powder called cement, with the desired properties of strength and chemical resistance.

1 ton clinker = ,85 ton CO2

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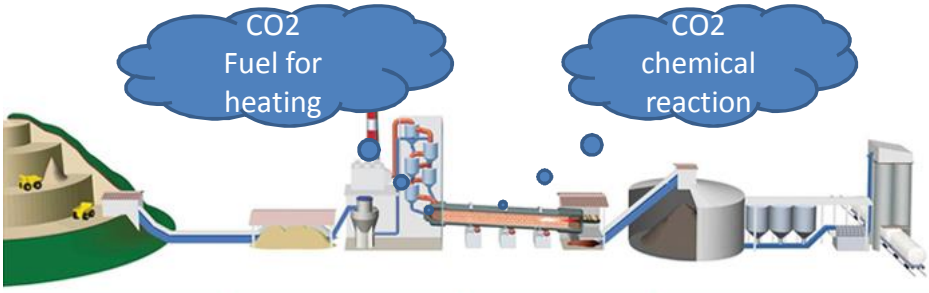
The production of cement



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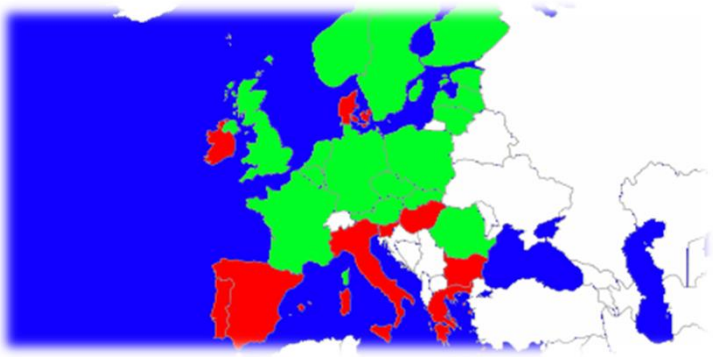
The EU cement market

- We separate countries in low demand (LD) and moderate demand (MD):
- LD if consumption 2012-2011 < 70% consumption 2007
- Approximately 50% of EU consumption in 2007
- 246 plants of which 117 in LD
- A downfall of 22% (6%) in cement consumption in LD (MD) from 2011 to 2012

LD countries
Ireland (21%)
Spain (30%)
Greece (36%)
Bulgaria (48%)
Hungary (62%)
Denmark (63%)
Portugal (63%)
Italy (65%)
Slovenia (66%)



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Methodology for the counterfactual

- A counterfactual for 2012 is constructed at the country and plant levels
  - Counterfactual clinker production and net exports at the country level are inferred from country consumption
  - The clinker production at plant level is inferred from plant emissions adjusted for the country demand change and two correction factors (coastal and low activity plants)
- Major assumptions: the allocation scheme has no influence
  - on cement consumption
  - On EU market shares

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Main findings

- Companies have « gamed » the rules to increase the windfall profits generated by the hybrid scheme
  - Production shifting among plants
  - Increase clinker production
    - exports of clinker and cement outside the EU
    - Increase the clinker to cement ratio
- Windfall profits have somewhat declined but at the expense of the credibility of EU ETS

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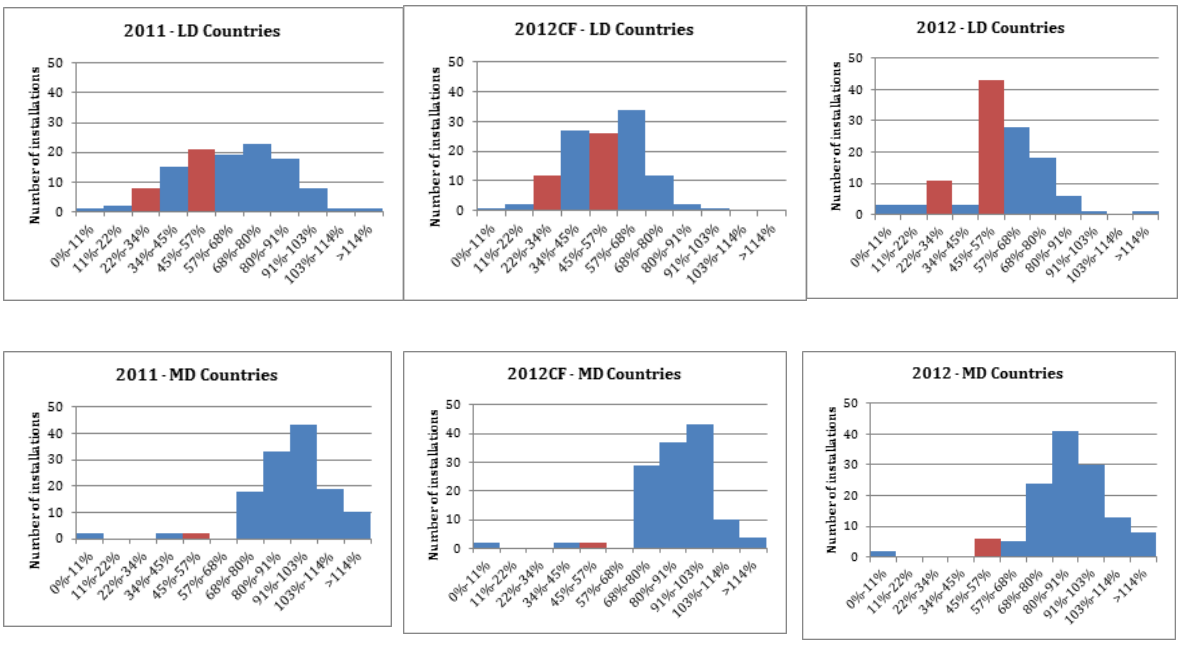
Evidence of gaming at the plant level: distribution of AL/HAL

20 plants instead of 40 over 117 received reduced allocations



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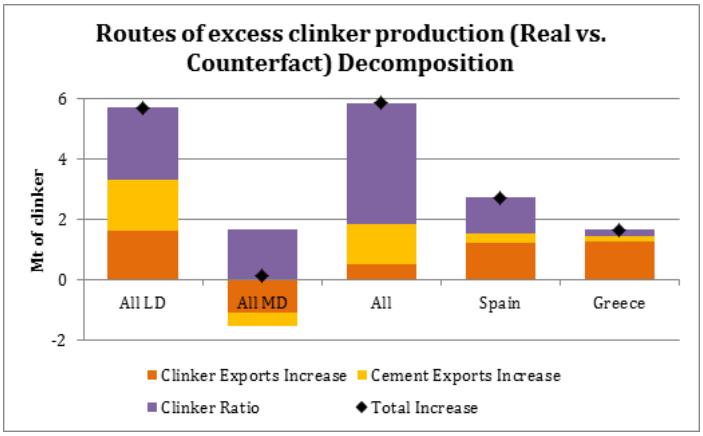
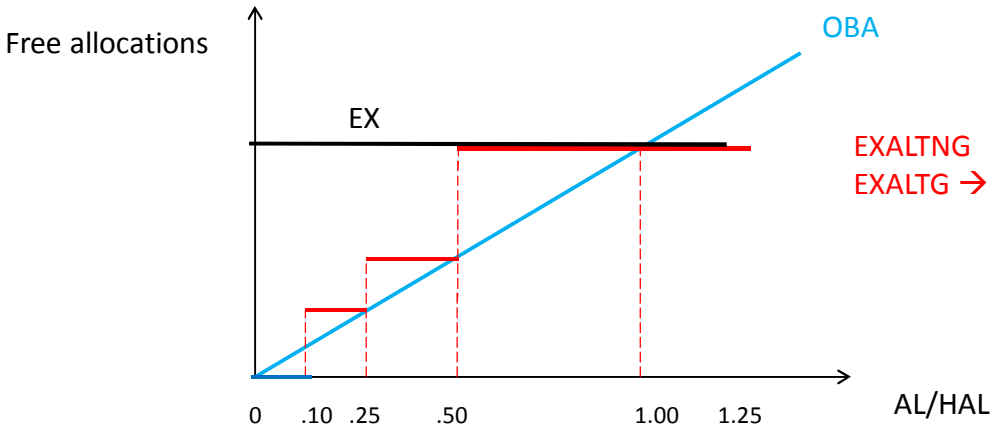
Evidence of production shifting among plants of the same company

Country-Company	Installation	E/HEL 2011	E/HEL 2012
Greece-W	1	34%	49%
Greece-W	2	77%	66%
Greece-W	3	11%	0%
Spain-X	1	42%	50%
Spain-X	2	57%	46%
Spain-X	3	68%	56%
Hungary-Y	1	41%	46%
Hungary-Y	2	68%	50%
Portugal-Z	1	34%	64%
Portugal-Z	2	55%	51%
Portugal-Z	3	71%	60%

Quantification of excess clinker production



Quantification of windfall profits



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Quantification windfall profits with a CO2 price at 8€/ton

Millions of € relative to OBA	LD	MD	All	Spain	Greece
EX	297	68	365	109	46
EXALTNG	172	57	228	47	14
EXALTG	208	64	272	67	23

Windfall profits have somewhat declined in low demand countries (30% instead of 42%)

In Spain and Greece 56% vs 38% and 70% vs 50% respectively

With a higher CO2 price gaming would have been worse and reduction less

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Implementing OBA in a multisector setting

- Leakage risk is sector dependent
  - OBA in sectors at risk (EITE)
  - Auction in sectors not at risk (electricity)
- Question: should the flexible free allocations for sectors at risk be « in » or « out » of the global cap?
  - In current ETS's they are « in »
- What implication for the induced carbon price (and the MSR)?

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The « in » option exacerbates the volatility of the carbon price

Å Illustration

- ï Assume demand uncertainty and no leakage
- ï Suppose the regulator may select a combination of auction and OBA
- ï Key result: the higher the uncertainty the higher the OBA rate

Å Numerical illustration

- ï two (equal size) sectors
- ï Sector 1 no uncertainty → no OBA
- ï Sector 2 uncertainty → OBA

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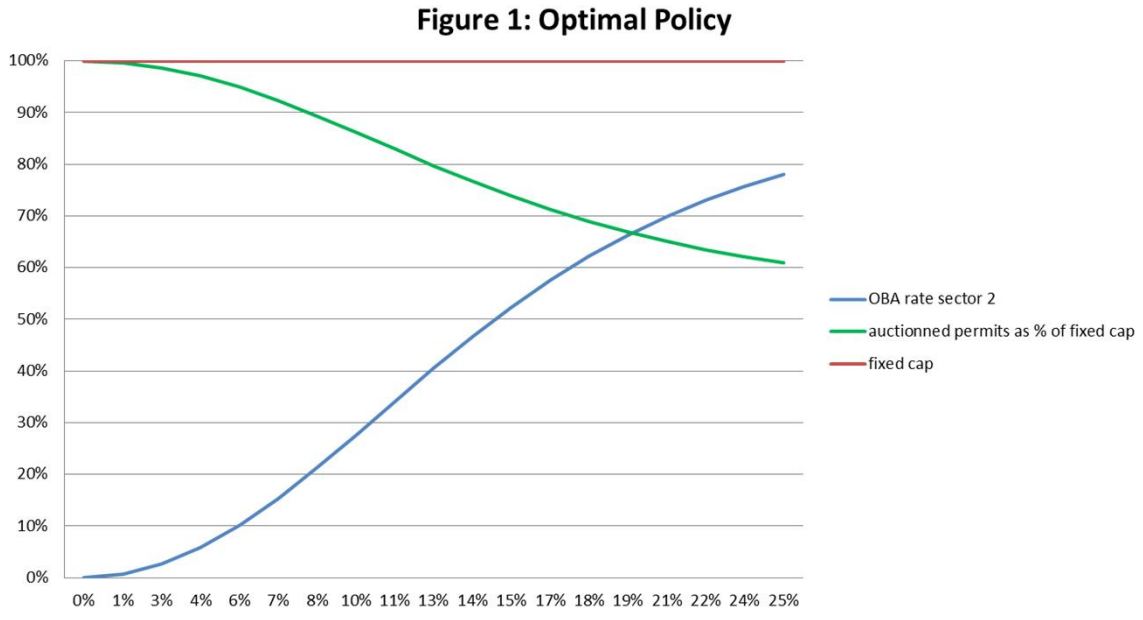
The optimal scheme as a function of uncertainty in sector 2 (cement – 40%, steel -17%, refineries – 10%)



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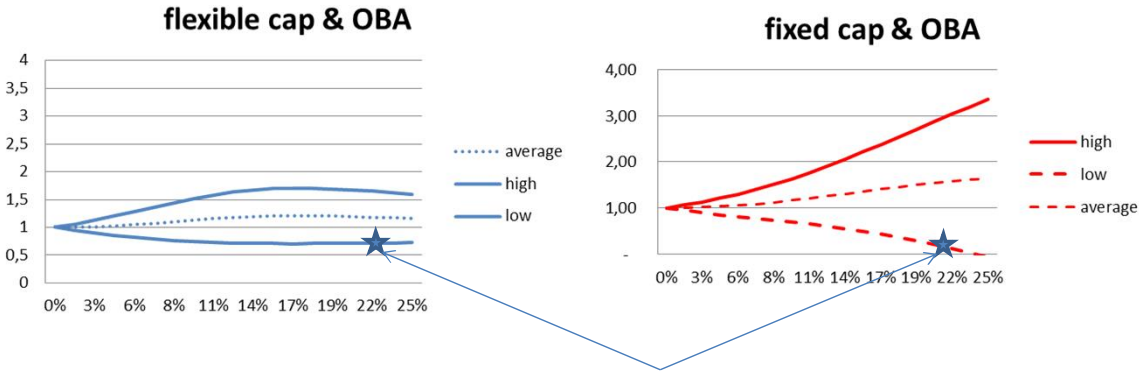
the volatility of the carbon price as a function of demand uncertainty

Important to embed the flexibility of the free OBA allocations into the total cap



2012 # 20%

the volatility of the carbon price when the activity level varies

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Discussion for the EU ETS

- ETS policy 2013-2020 appears as a bounded rationality decision to balance two conflicting goals
  - maintaining a global cap (interpreted as undifferentiated sector gaps)
  - the limitations of windfall profit
- At the cost of perverse incentives (even with a low CO2 price)
- Similar perverse incentives with reserve for new entrants in case of high demand?

- A number of proposals have been made promoting OBA
  - Ecofys feasibility study (2014)
  - CEPS (2014, 2015)
  - Climate Strategies (2014) OBA with inclusion of consumption in ETS for energy intensive products

→ This study delivers an empirical analysis that supports these proposals + flexible cap

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Discussion

What about COP 21

- The global cement market
  - Cement « most used man-made material of the world » with limited substitutes
  - Accounts for 5% of world's anthropic emissions
  - China has the Lion's share of production (57%) followed by India (7%) and EU 27 (5%)
  - In the EU, emissions are covered by the EU ETS
- Abatement in carbon intensity in cement is 1% per year while market growth is 2,5% …
- Kyoto CO2 versus Montreal protocol CFC
  - Cooperation between governments and industry on a long term road map
  - By-pass the antagonism between antitrust and climate policies
  - Lafarge-Holcim deal: a missed opportunity

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References

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Thank you!

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