C.I.R.E.D.
Centre International de Recherche sur l'Environnement et le Développement

Unilateral climate policies and carbon leakage
4-5 September 2008, Berlin

Free allocation to address leakage: comparison with border adjustments and differences between output-based and capacity-based allocation

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Free allocation in the EU ETS

- The 2003 directive:
  - Neither grandfathering allocation (as in the US SO_2 scheme) nor pure output-based allocation; rather capacity-based
  - Various motives for free allocation
    1. maintain profits in the covered sectors
    2. address leakage
- The current revision:
  - Free allocation only in sectors at risk of leakage
  - Unclear how the free allowances will be distributed
- Economic analysis:
  - Grandfathering cannot address leakage
  - Output-based allocation can, but is less efficient at least in a closed economy (e.g. Fischer, 2001; Haites, 2003; Demailly & Quirion, 2006)

Five proposals for the review of the EU ETS

1. **Grandfathering – GF**
Free allowances proportional to data *prior to the ETS*

2. **Auctioning – AU**
Allowances auctioned off – lump-sum revenue recycling

3. **Output-Based Allocation – OB**
Free allowances proportional to firms *current output level*

4. **Auctioning + Border Adjustments – AU-BA**
Exports from the EU to RoW exempted from the ETS; importers surrender allowances for embedded emissions

5. **Hybrid allocation – OB-AU**
OB for trade-exposed sectors & AU for sheltered sectors

Overview of the CASE model

The CASE model (1/2)

4 sectors:

- **C**ement
- **A**luminium
- **S**teel
- **E**lectricity

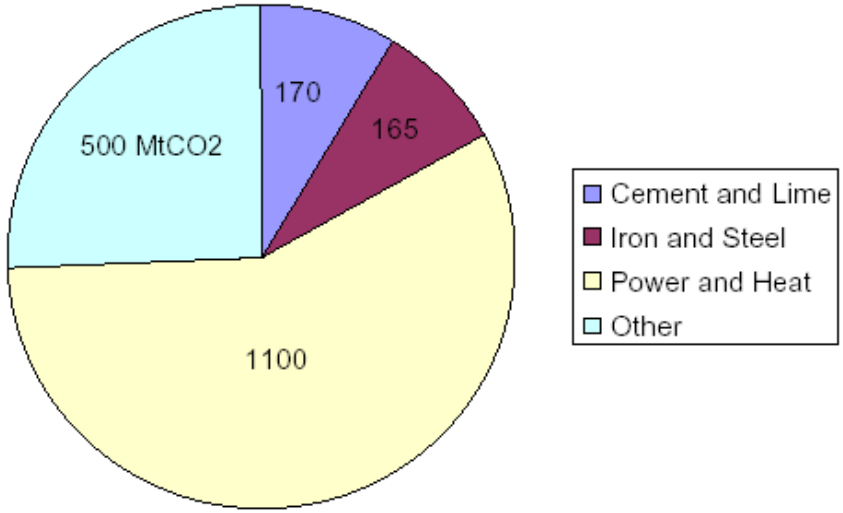
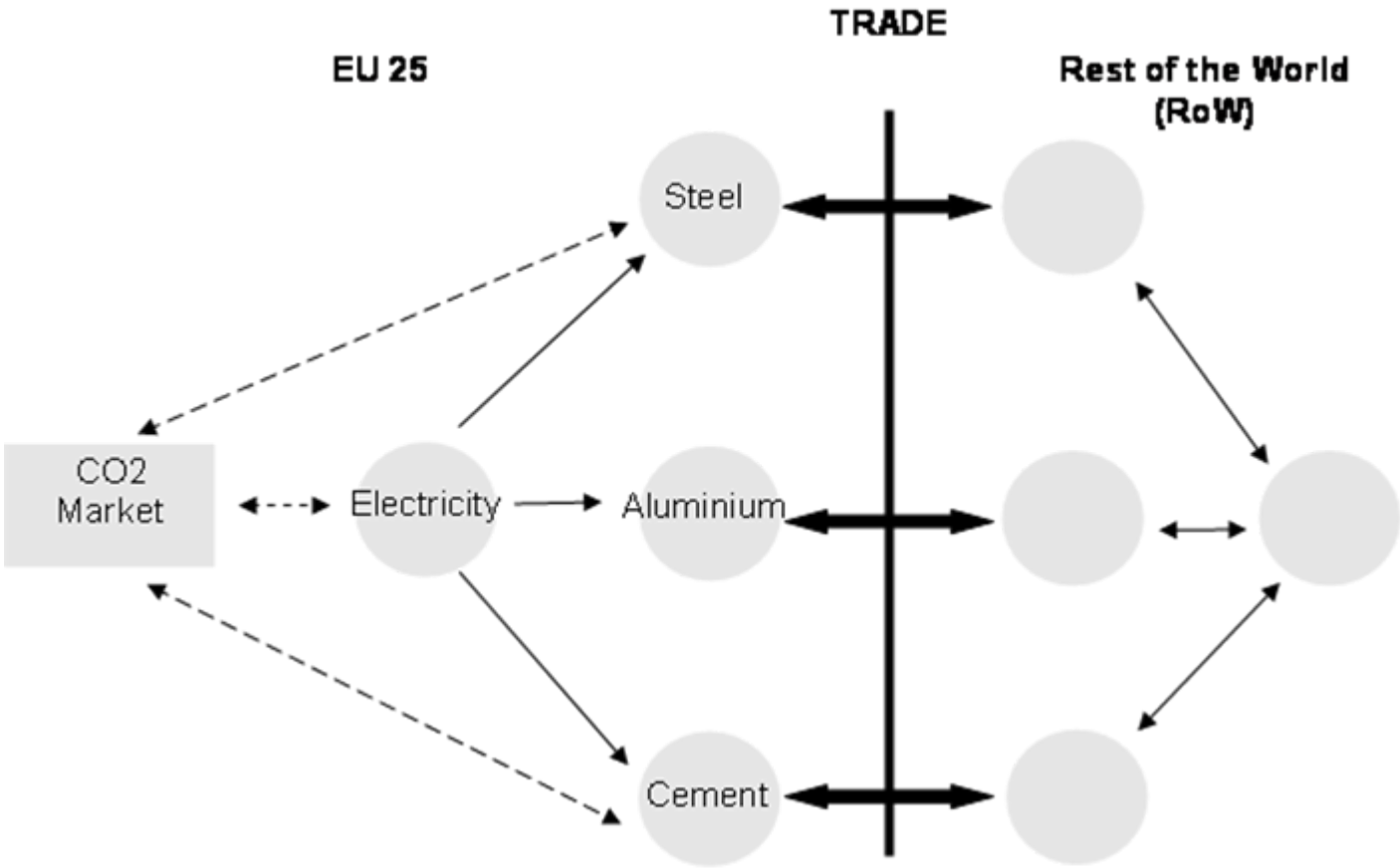


Figure 1. 2005 ETS emissions (source: Kettner et al., 2007)

2 zones : EU 25 vs. Rest of the World

The CASE model (2/2)



Numerical results

CO_2 prices

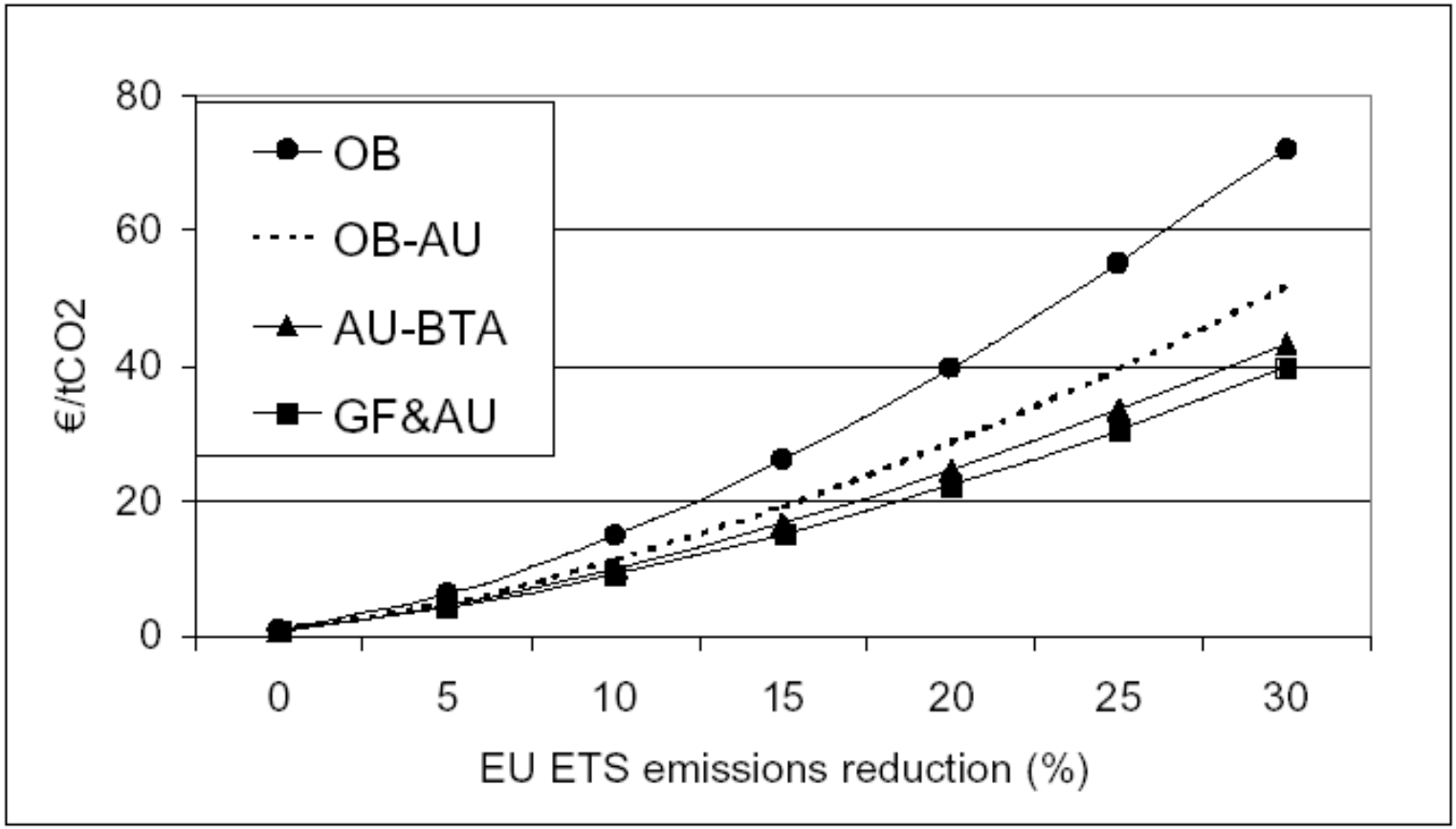


Figure 4: CO_2 price for the five policy options

Production losses

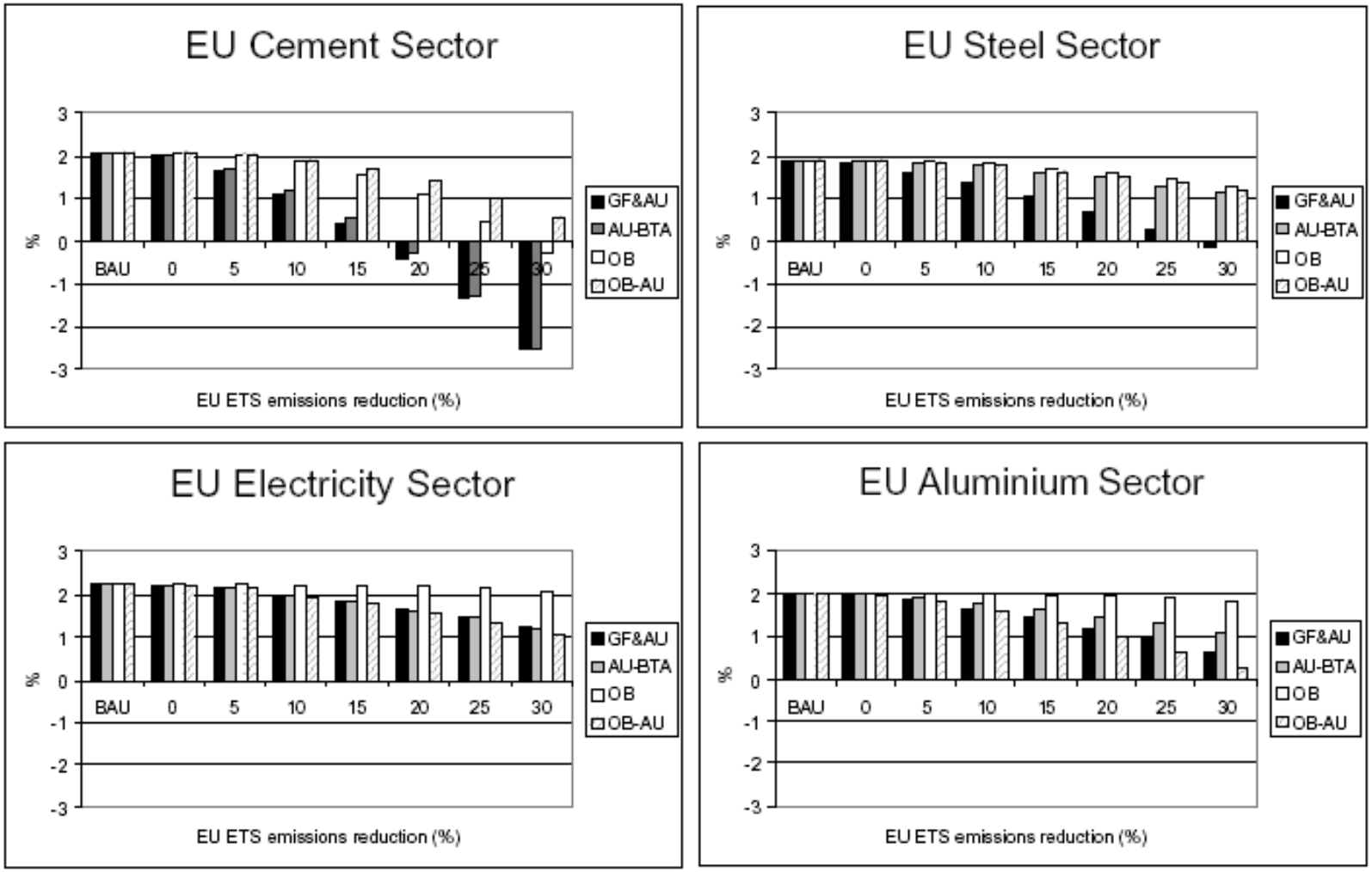


Figure 5: Average annual production growth ratio from 2005 to 2015

CO_2 leakage ratio $= \dfrac{\Delta E_{RoW}}{-\Delta E_{UE}}$

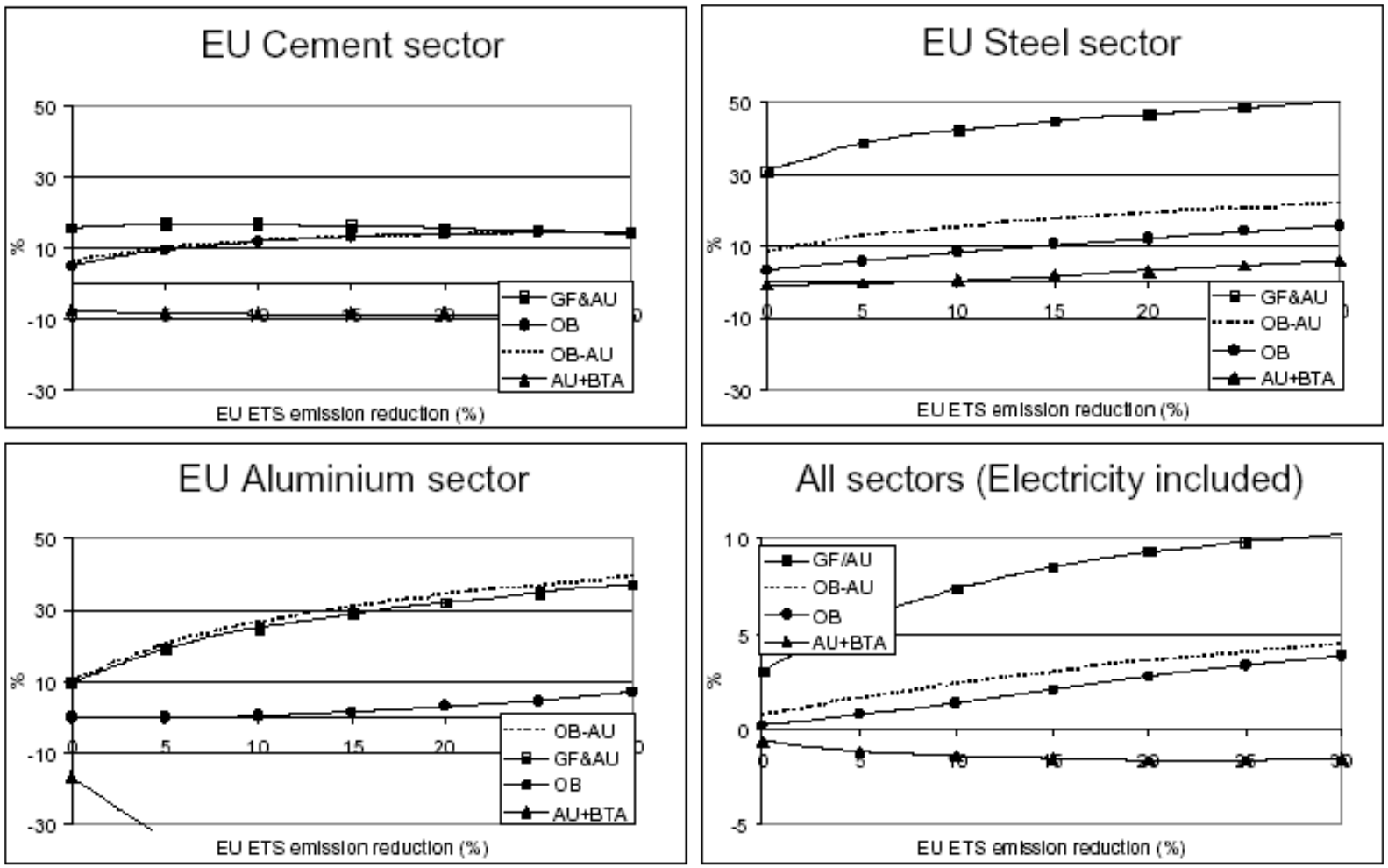
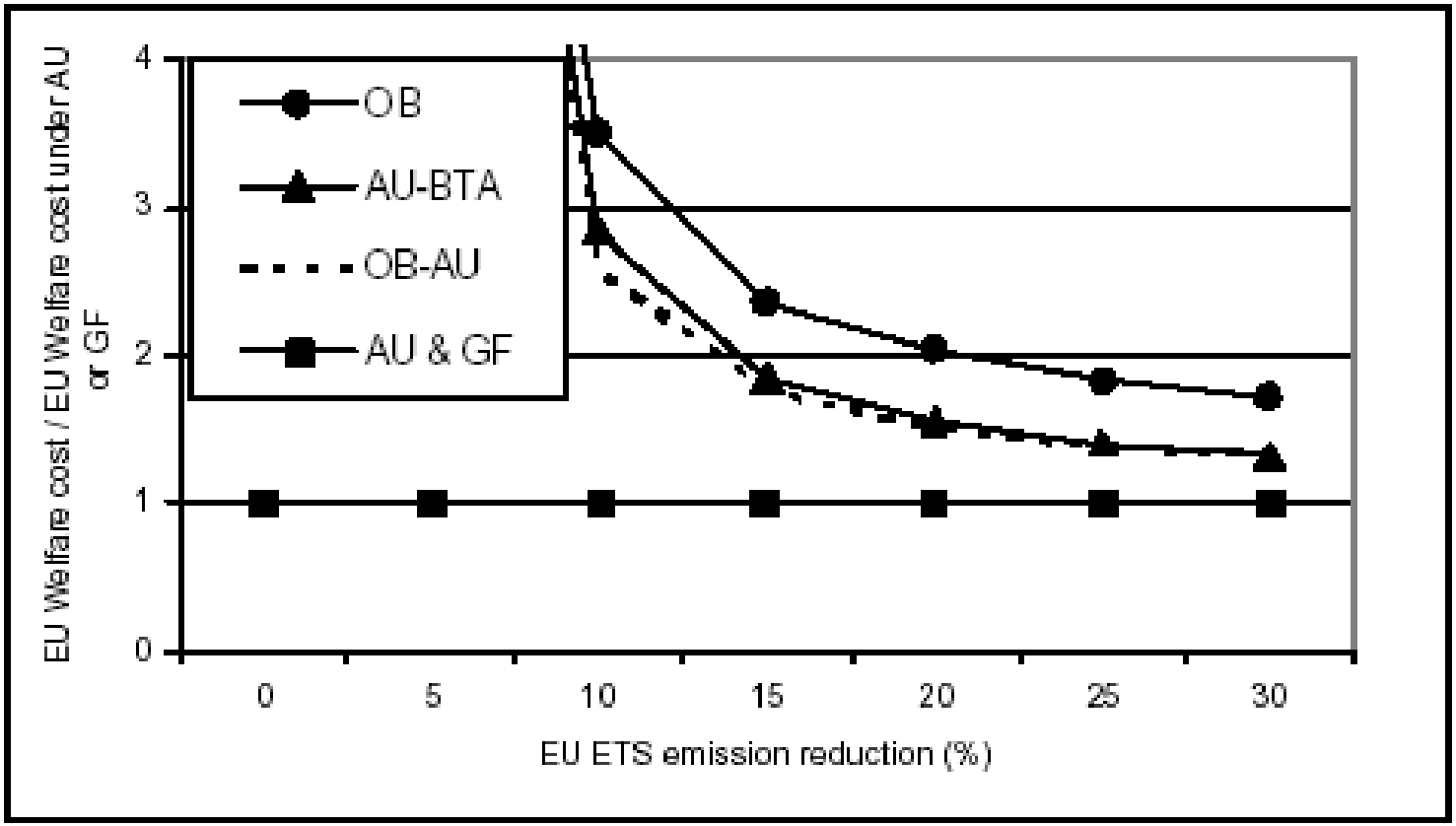


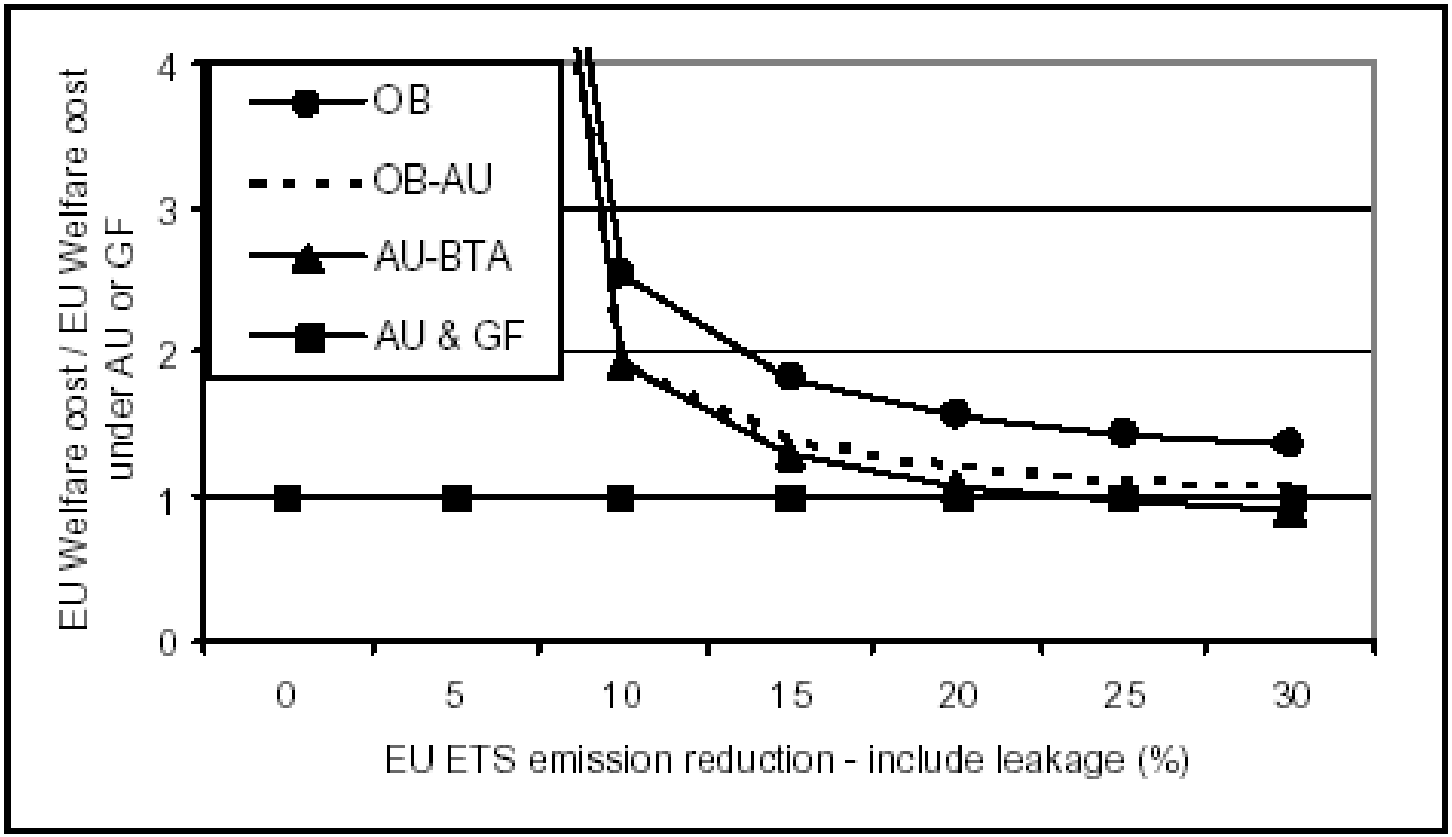
Figure 6: CO_2 leakage

EU Welfare losses (1/3)



EU welfare losses (2/3)

Accounting for leakage



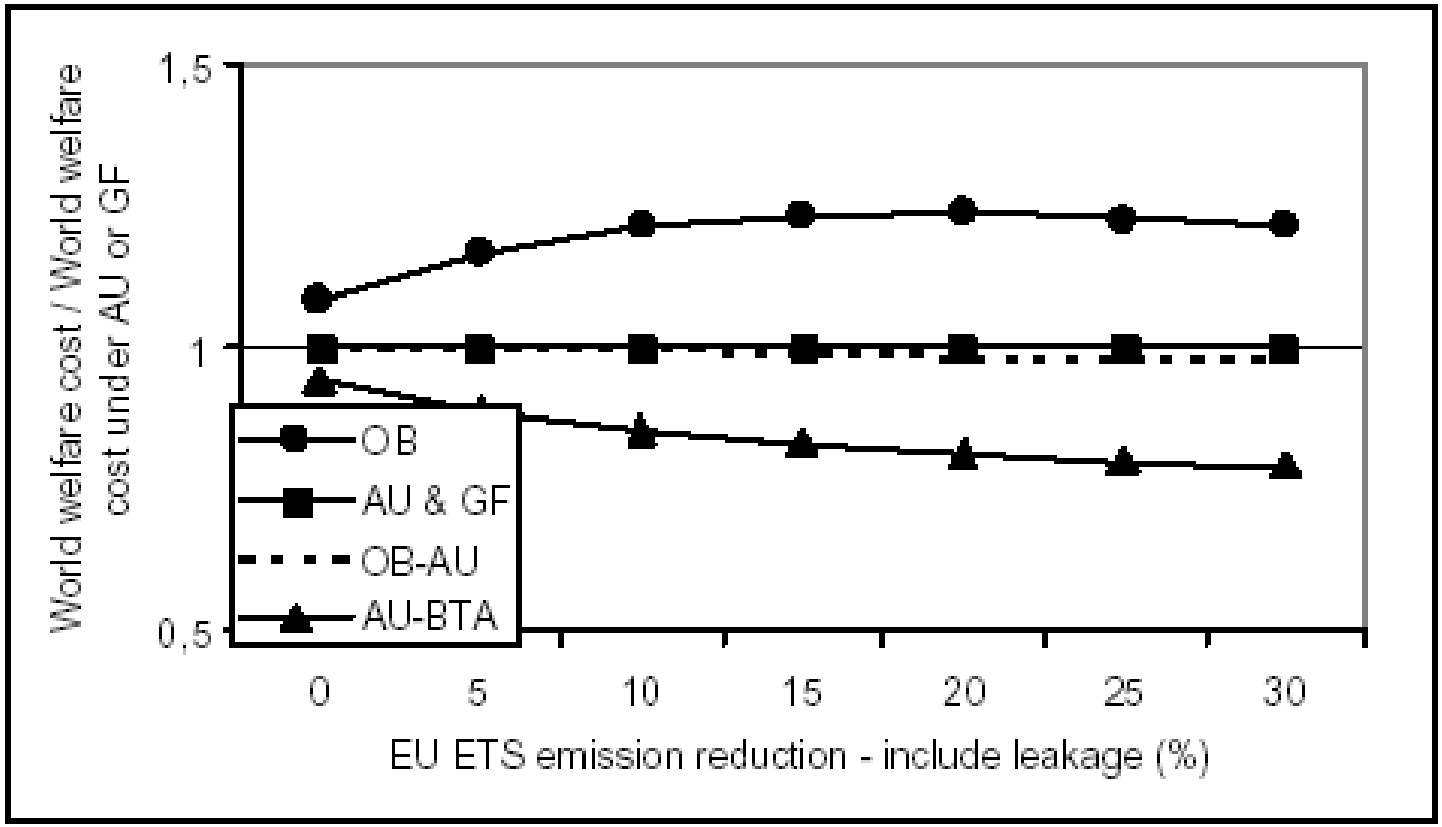
Terms of trade effect

AU or GF:
Increase in prices for goods exported by the EU → wealth transfer from foreign consumers to EU firms (GF) or EU public budget (AU)

OB, AU-OB and AU-BA:
Prices for EU exported goods rise much less → Effect much lower

EU welfare losses

Accounting for leakage and foreign welfare losses



Conclusions on free allocation vs. border adjustment (1/2)

For the level of emission reduction envisioned, **production** still increases from 2005 to 2015 for all sectors and policy options

CO_2 leakage small: around 5-10% for GF or AU; -2% for AU-BA

Economic efficiency:

- OB performs *poorly* compared with the other policies
- GF performs well but:
    - huge windfall profits
    - pre-existing distorting taxes raise the cost of GF compared to the other options (Bovenberg, Goulder et al.).

Conclusions on free allocation vs. border adjustment (2/2): AU, OB-AU or AU-BA?

Economic efficiency ranking depends on the welfare definition. **The choice may be based more on political acceptability and feasibility considerations**

- AU obviously fiercely opposed by industry, especially in trade exposed sectors

- OB-AU endorsed by some industry groups, but:
  - Different benchmarks likely → inefficiencies
  - WTO compatible?

- AU-BA endorsed by some stakeholders, but:
  - Impact on the likelihood of a global agreement?
  - WTO compatible?

Some insights on various free allocation methods

Free allocation methods: what impact on productive decisions?

Compared to auctioning	Grand-fathering	Capacity-based	Output-based	
More new investments		X	X	Long run
Less closures		X	X	
Higher utilization rate			X	Short run

Free allocation methods: can they address leakage?

	Capacity-based	Output-based
Long run	Yes	Yes
Short run, high demand state	Little leakage risk	Little leakage risk
Short run, low demand state	No	Yes

Free allocation methods: other differences

Pros of output-based:

→ BAU emissions ~ proportional to output ➔ Abatement level & compliance cost less uncertain

→ Higher utilisation rate ➔ less job losses

→ Lower product price ➔ less windfall profits

Cons of output-based:

→ Less products substitution

→ End of the "insurance effect"

→ Need for information on firms' output level

→ ETS emissions uncertain ➔ government may have to buy AAUs to comply with KP

Thank you!

Presentation based on two papers:

D. Demailly et P. Quirion. *Changing the allocation rules for EU greenhouse gas allowances: Impact on competitiveness and economic efficiency*, European Association of Environmental and Resource Economics, Thessalonica, June 2007

P. Quirion "Comment faut-il distribuer les quotas échangeables de gaz à effet de serre ?", *Revue française d'économie*, 2007, XXII(2) pp. 129 à 164 (English translation available)

To get the papers (comments welcome):

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Complementary material

(not to be displayed)

Optimal policy

Benevolent planner programme: $$\begin{cases} \underset{ua,Q}{Max}\, W = \int_0^Q P[q]dq - C[ua]Q \\ s.t.(ue_0 - ua)Q \leq E \end{cases}$$

- *P[q] :* Inverse demand function
- *Q* : Production level
- C : Long run production cost (assumed constant with production and increasing with unitary abatement *ua*)
- ue_0 *:* baseline unitary emissions
- *E* : Emission target

First-order conditions: $$\begin{cases} C'[ua] = \lambda \\ P = C[ua] + \lambda(ue_0 - ua) \end{cases}$$

→ the output and the unitary abatement channels

Grandfathering and Auctioning

Programme of a representative firm :

$$\underset{ua,Q}{Max}\,\Pi^{GF/AU} = \left(P - C\left[ua\right]\right)Q - P_{CO_2}\left(\left(ue_0 - ua\right)Q - GF\right)$$

- P_{CO2} the CO2 price
- *GF* the amount of free allowances (*GF*=0 under full auctioning)

First-order conditions:

$$\begin{cases} C'\left[ua\right] = P_{CO_2} \\ P = C\left[ua\right] + P_{CO_2}\left(ue_0 - ua\right) \end{cases}$$

= **Optimal policy with $P_{CO2}=\lambda$**

→ Equalization of the marginal abatement cost with the CO2 price
→ « Internalisation » of the emission cost in output price
→ *GF* does not appear in first-order conditions

Output-Based Allocation

Programme of a representative firm :

$$\underset{ua,Q}{Max}\,\Pi^{OB} = \left(P - C\left[ua\right]\right)Q - P_{CO_2}\left(ue_0 - ua - OB\right)Q$$

- *OB* the unitary allocation

First-order conditions:

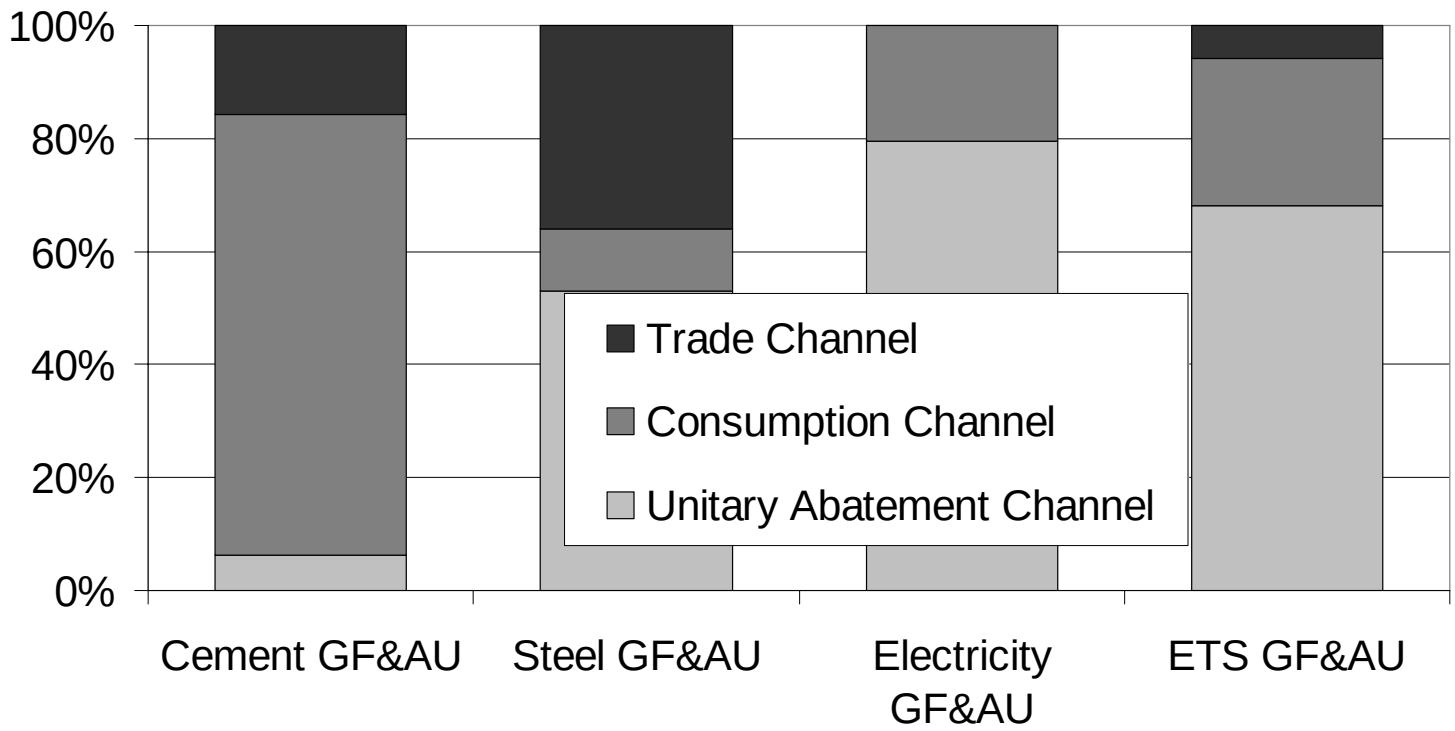
$$\begin{cases} C'\left[ua\right] = P_{CO_2} \\ P = C\left[ua\right] + P_{CO_2}\left(ue_0 - ua - OB\right) \end{cases}$$

Emissions = Allowances implies: $OB = ue_0 - ua \Rightarrow P = C\left[ua\right]$

Compared with the Optimal policy:
→ No use of the output channel to reduce emissions
→ Emission reduction through unitary abatement
→ Higher CO2 price, higher unitary abatement

Emission reduction channels

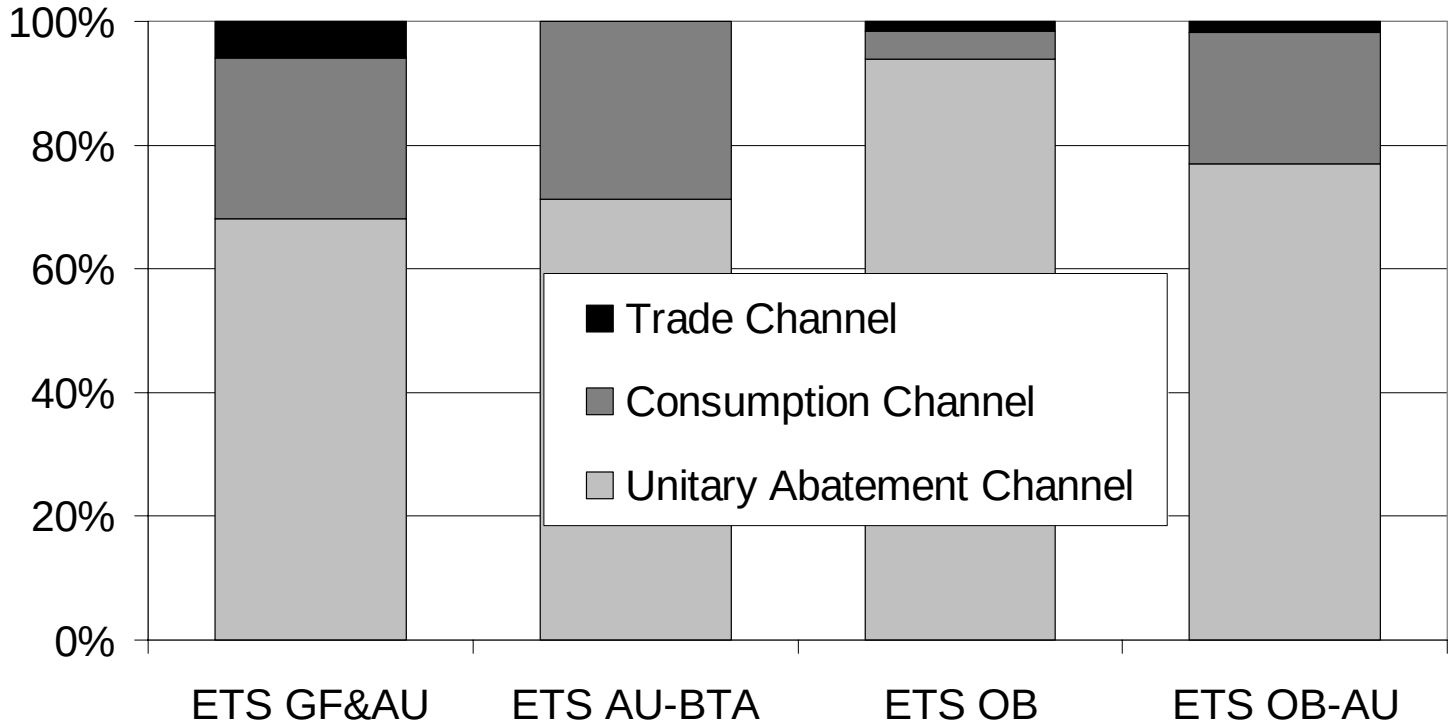
Sectoral comparison for GF or AU



Share of the channels to reduce the emissions covered by the EU ETS by 15% compared with 2005

Emission reduction channels

Sectors aggregated for all policies



Share of the channels to reduce the emissions covered by the EU ETS by 15% compared with 2005