Carbon leakage: beyond competitiveness

Philippe Quirion
(CIRED and Öko-Institut)
Berlin Seminar on Energy and Climate Policy
2 July 2010

Synthesis

- The heavy industry (and policy-makers?) view:
  - Unilateral climate policy (in the EU, US or Annex I) would reduce industry competitiveness, hence create leakage
- My conclusions:
  - Influence of Annex I climate policies on non-Annex I emissions not to be neglected
  - Competitiveness not biggest leakage channel
  - Net leakage may well be negative (positive spillovers)
  - Leakage & spillovers depend on climate policy design

Outline

1. Competitiveness and leakage: definitions
2. How to minimise leakage & maximise positive spillovers
3. CCS & leakage: a CGE simulation
4. A significant leakage from coal?

1. Competitiveness and leakage: definitions

1. Competitiveness and carbon leakage: definitions (1)

- Carbon leakage: increase in emissions in the rest of the world following a climate policy in a part of the world (e.g. the EU), compared to a reference situation without climate policy
- Leakage ratio or (better) leakage-to-reduction ratio:

$$\Delta E_{RoW} / -\Delta E_{UE}$$

- Literature reviews by Gerlagh and Kuik (2007) & Dröge *et al*. (2009):

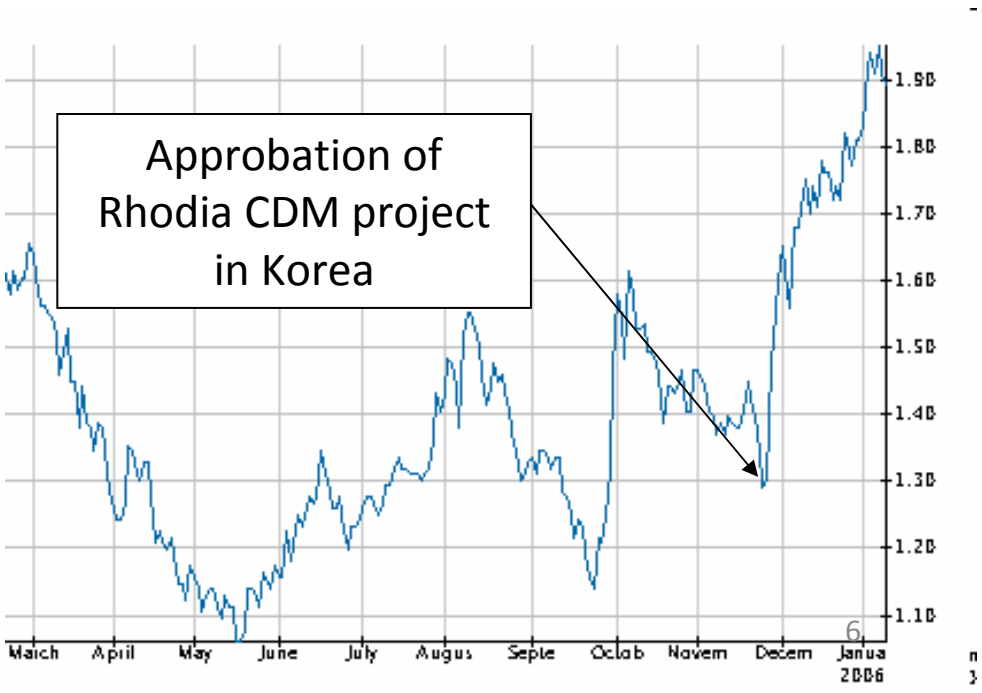
  2% to 23%, plus one outlier (Babiker, 2005): >100%

1. Competitiveness and carbon leakage: definitions (2)

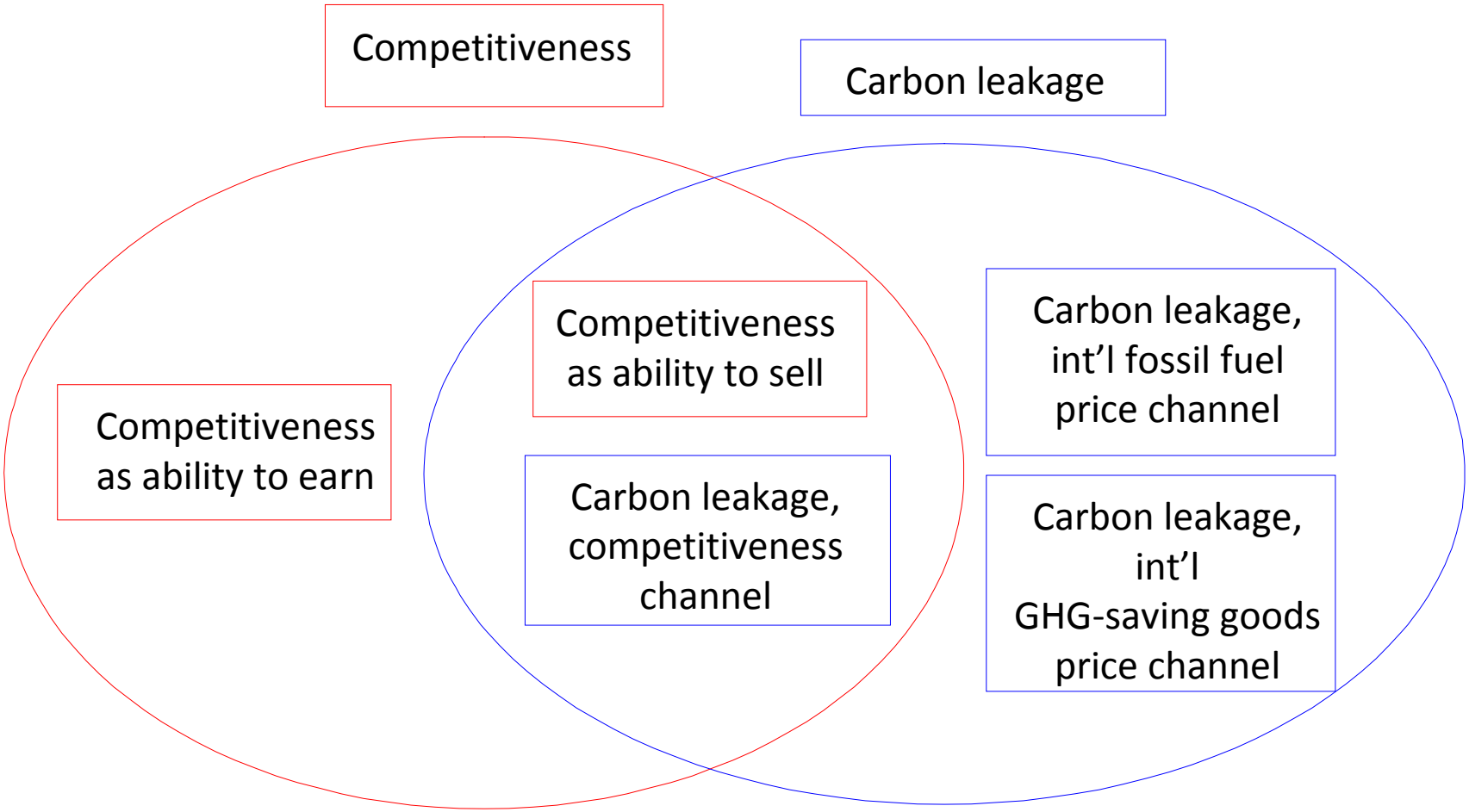
- For a sector or a firm, “competitiveness” has 2 main meanings (Alexeeva-Talebi et al., 2007) :
  - ability to sell → net imports (imports – exports) or variants (revealed comparative advantage…) → problem for workers + leakage
  - ability to earn → profits, firm value → problem for shareholders

“[...] operating rates for the last three months of 2008 will fall by between 30 and 50 % in the US and Europe [...]. Meanwhile, factories in Asia and Brazil, four of which will earn carbon credits, will keep production rates of above 80 % of capacity. "

Andrew Allan, "Carbon credits linked to product dumping", *Point Carbon*, 20 Nov 2008



Competitiveness and leakage: related but different



2. How to minimise leakage & maximise positive spillovers?

Options likely to generate leakage

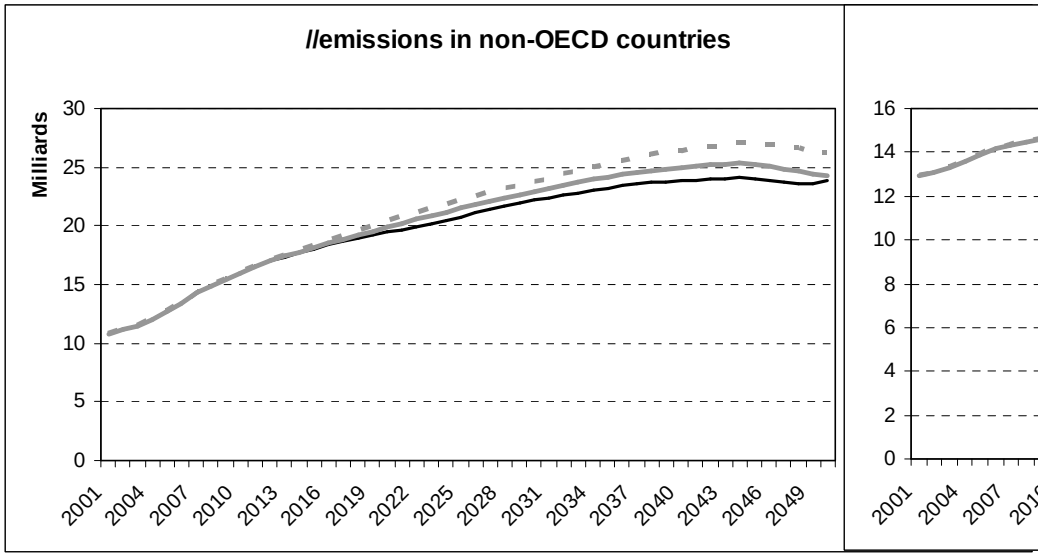
- CDM in manufacture of internationally traded goods
- Imports of biofuels, imports of steel and aluminium scrap
- Coal-to gas switch

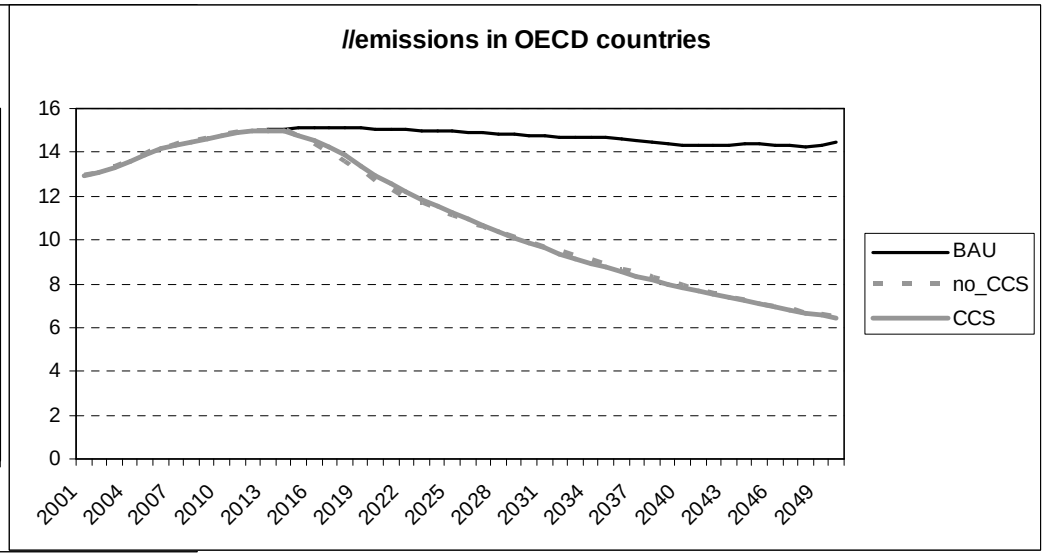
Options likely to generate spillovers

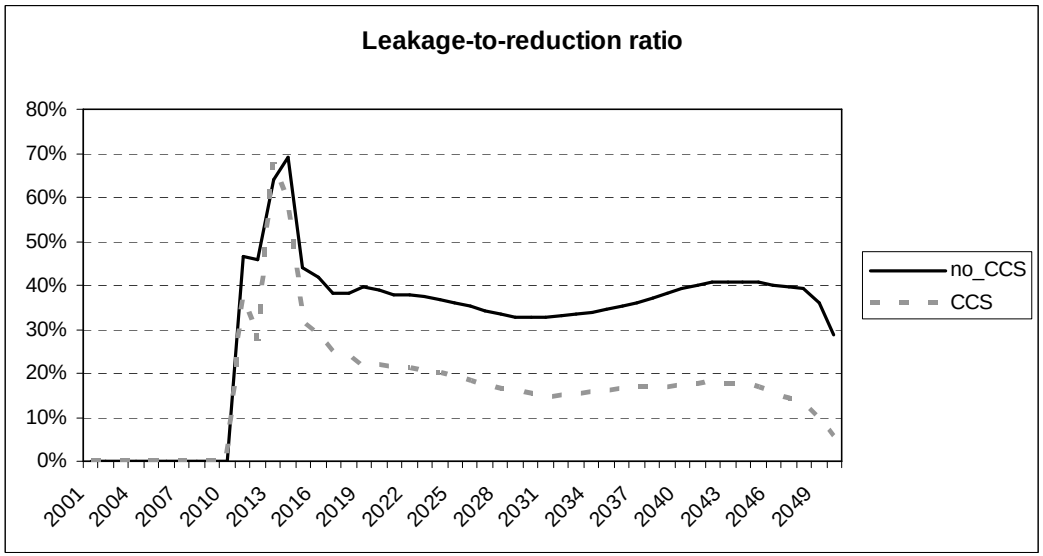
- Technical progress in GHG-saving techniques
  - Gerlagh & Kuik (2007): technology spillovers likely > leakage
- Examples of successful climate policies
  - E.g. European energy-efficiency label (A-G)
- Taxes on consumption of GHG-intensive goods
  - Similar to border adjustments
- Taxes on domestic extraction of fossil fuels
  - Reduces greatly the cost of climate policies in Annex I (Light, Kolstad & Rutherford, 1999)
- Limits on domestic extraction of fossil fuels
  - Offshore drilling, tar sands...
- Sectoral crediting mechanism
  - Especially if intensity targets for power generation in DCs (Hamdi-Cherif, Guivarch and Quirion, *Climate Policy*, forthcoming)
- CCS (energy penalty ~ 8%)

3. CCS & leakage: a CGE simulation

Leakage with & w/o CCS (1)





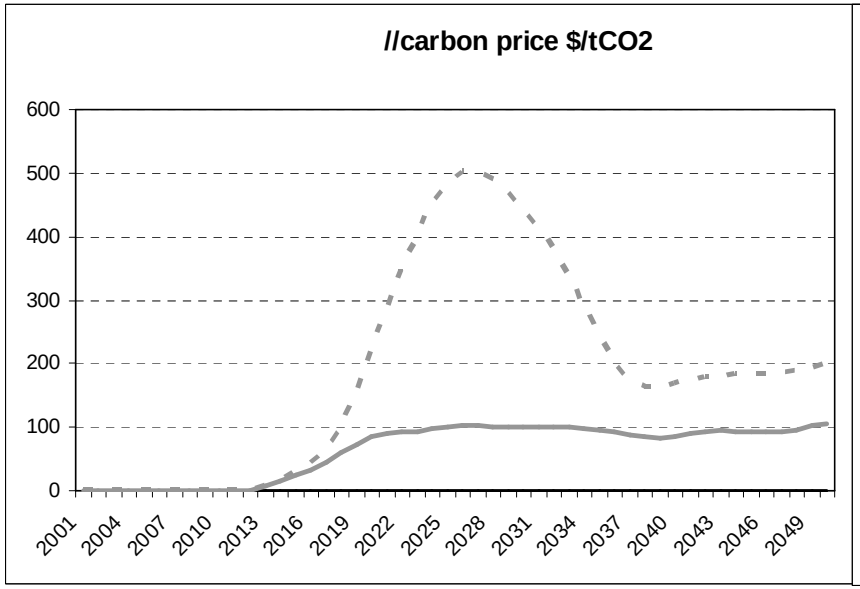


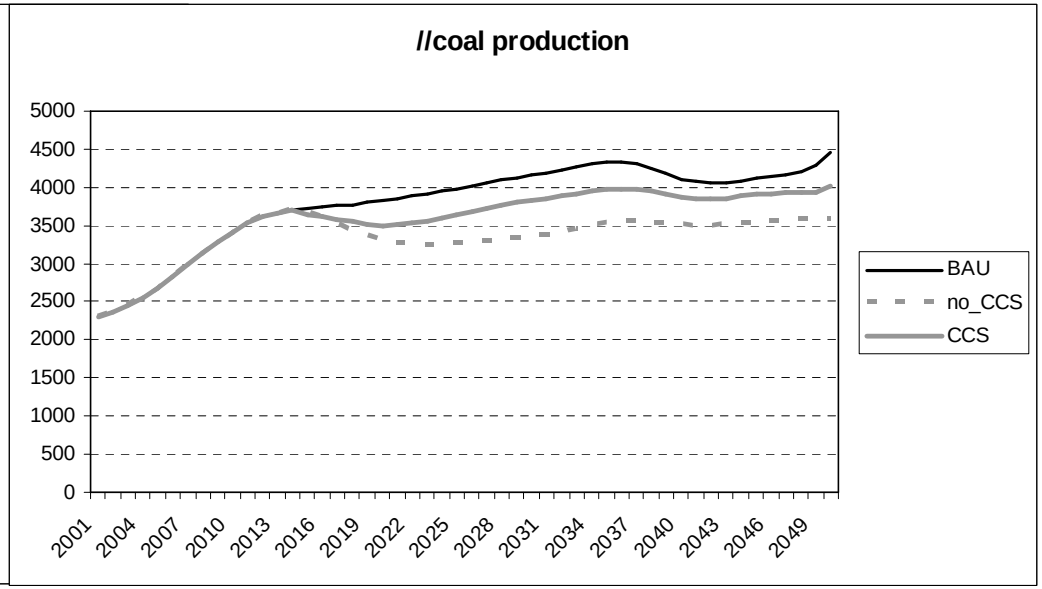
Scenario: climate policy only in OECD → 2050

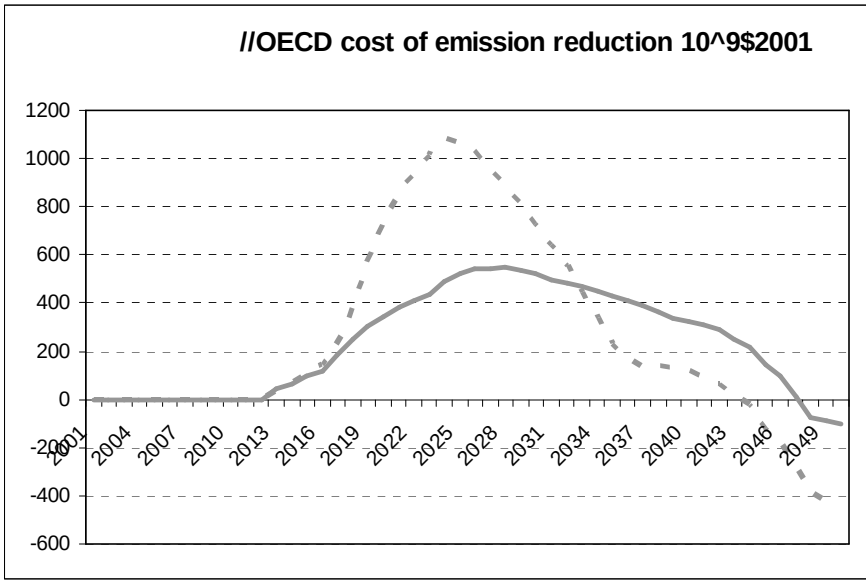
CCS halves leakage:
37% → 16% over 2011-2050

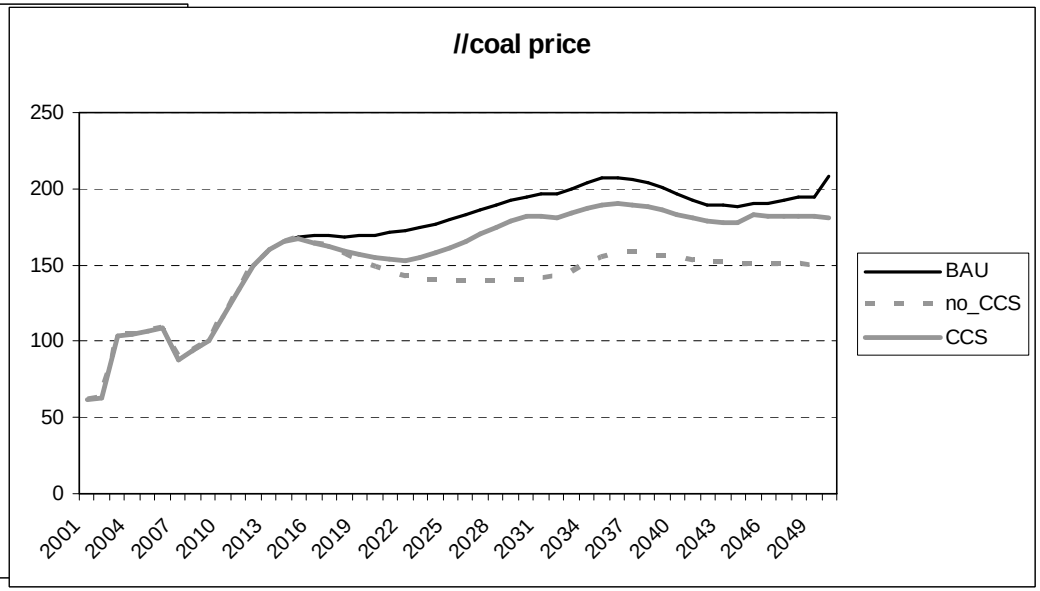
Source: Quirion, Rozenberg, Sassi & Vogt-Schlieb, work in progress, CIRED

Leakage with & w/o CCS (2)





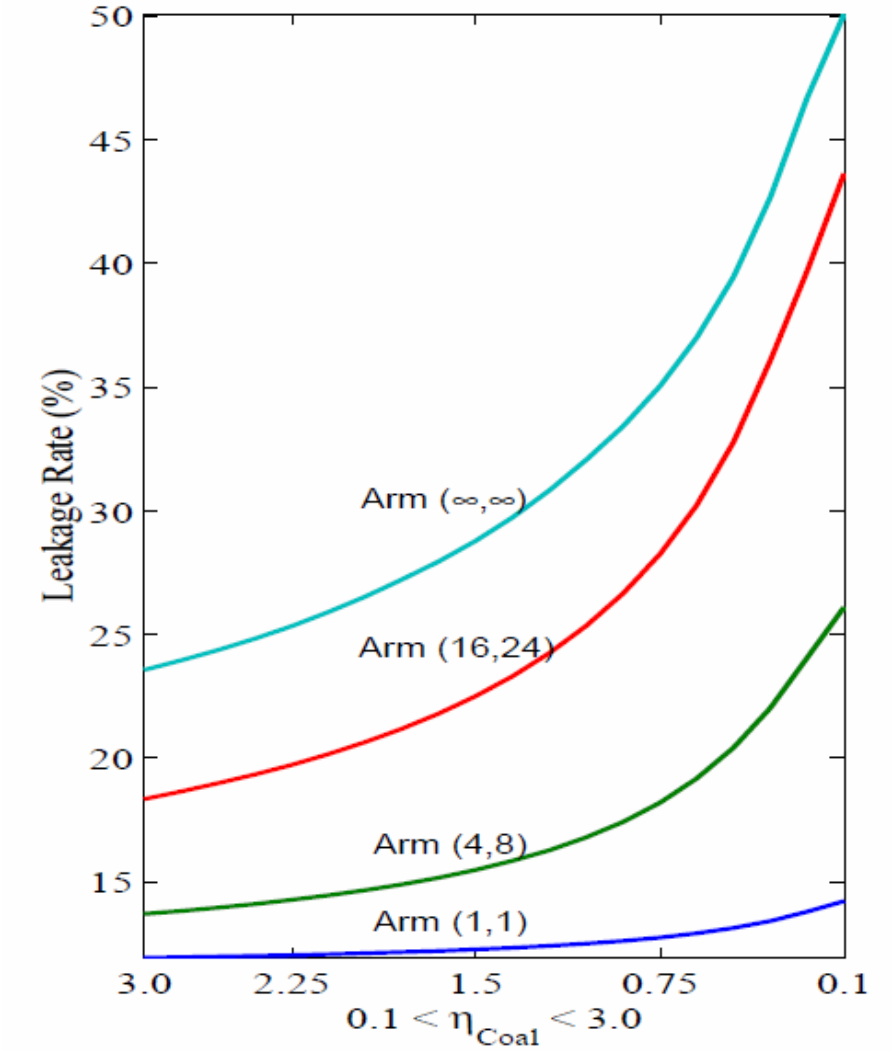




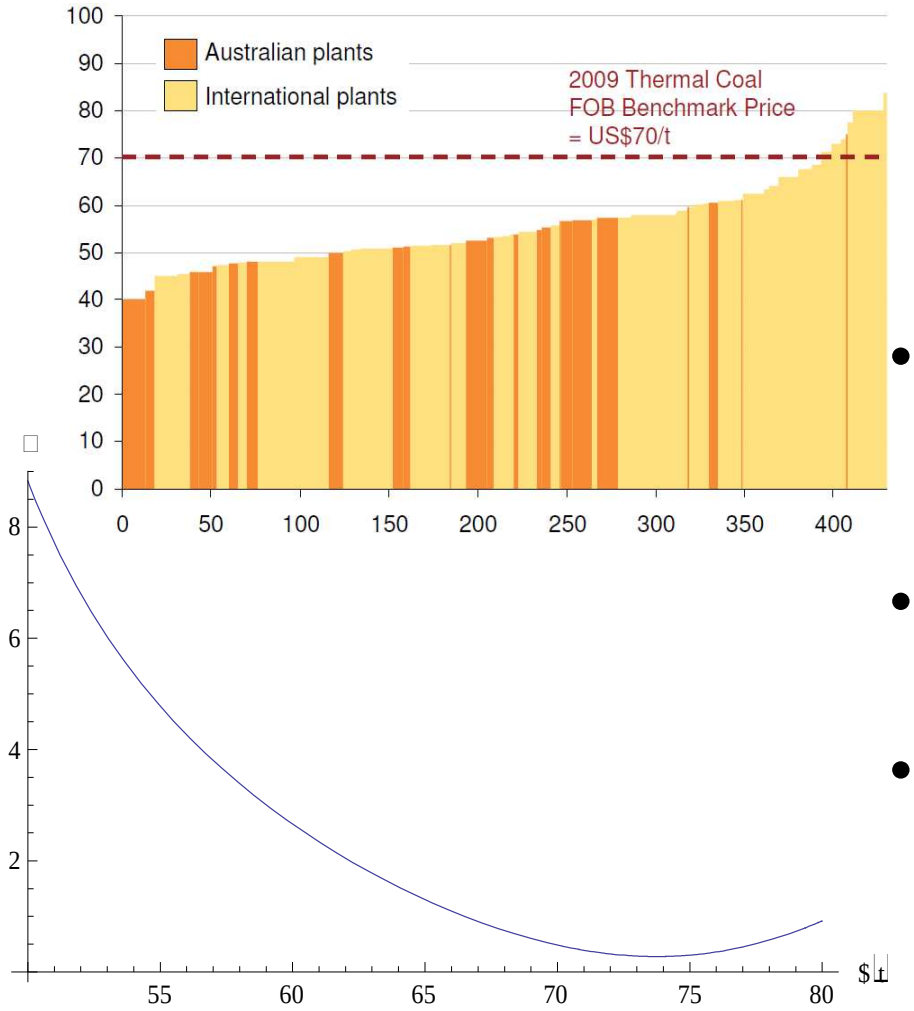
4. A significant leakage from coal?

Leakage depends on supply elasticity and substituability

- Light, Kolstad and Rutherford (1999): « a reasonable range for the coal supply elasticity is between 0.4 and 2.0 »
- International trade in coal = 16% of global production ➔ low Armington elasticity unlikely
- A fresh (and naive) look at the supply elasticity



A fresh (and naive) look at the supply elasticity



- Data: Edis (2010). *Cost curves produced by several energy analyst groups which have estimates of cost structure for each individual coal mine:*
  - *Wood Mackenzie (http://www.woodmacresearch.com)*
  - *AME Mineral Economics (http://www.ame.com.au)*
- Result of simple polynomial fits: Pacific-basin coal supply elasticity > 1 & < 8
- Supply elasticity increases with abatement
- Are models supply elasticity in this range?

Model and paper	*LR*	ψ	ν_e
DEEP (Kallbekken, 2006)	0.06	1	4
G-Cubed (McKibbin et al., 1999)	0.06	1	1
GEM-E3 (Bernard and Vielle, 2000)	0.13	1	6
GEM-E3 (Bernard and Vielle, 2000)	0.04	1	6
GREEN (Burniaux *et al*., 2000)	0.05	8	4
GREEN (Burniaux *et al*., 2000)	0.02	8	4
GTAP-E (Burniaux and Truong, 2002)	0.04	5	19
GTAP-E (Burniaux and Truong, 2002)	0.04	5	19
GTAP-E (Kuik and Gerlagh, 2003)	0.16	1	7
GTAP-E (Gerlagh and Kuik, this paper)	0.14	0.6	5
GTAP-EG (Paltsev, 2001)	0.11	1	4
Light (Light et al., 1999)	0.21	0.5	4
MIT-EPPA (Babiker and Jacoby, 1999)	0.06	2.9	3
MIT-EPPA (Babiker, 2005)	0.20	0.8	8
MIT-EPPA, Babiker, 2005)	1.15	0.8	∞
MS-MRT (Bernstein et al., 1999)	0.19	1.5	4
MS-MRT (Bernstein et al., 1999	0.16	1.5	4
WorldScan (Bollen, 2004)	0.17	3	10

- Gerlagh and Kuik (2007, p. 9)
  - *LR*: leakage rate
  - *psy*: supply elasticity of fossil fuels
  - v_e: Armington elasticity of energy goods
- Most models do not seem to overestimate leakage from coal price channel

Conclusions

- If the EU is serious about leakage, it should:
  - Take into account the other leakage channels, beyond competitiveness
  - Maximise spillovers from climate policies
- CCS reduces leakage greatly... but has many other pros and cons, possibly more important!

Comments and related references very welcome!

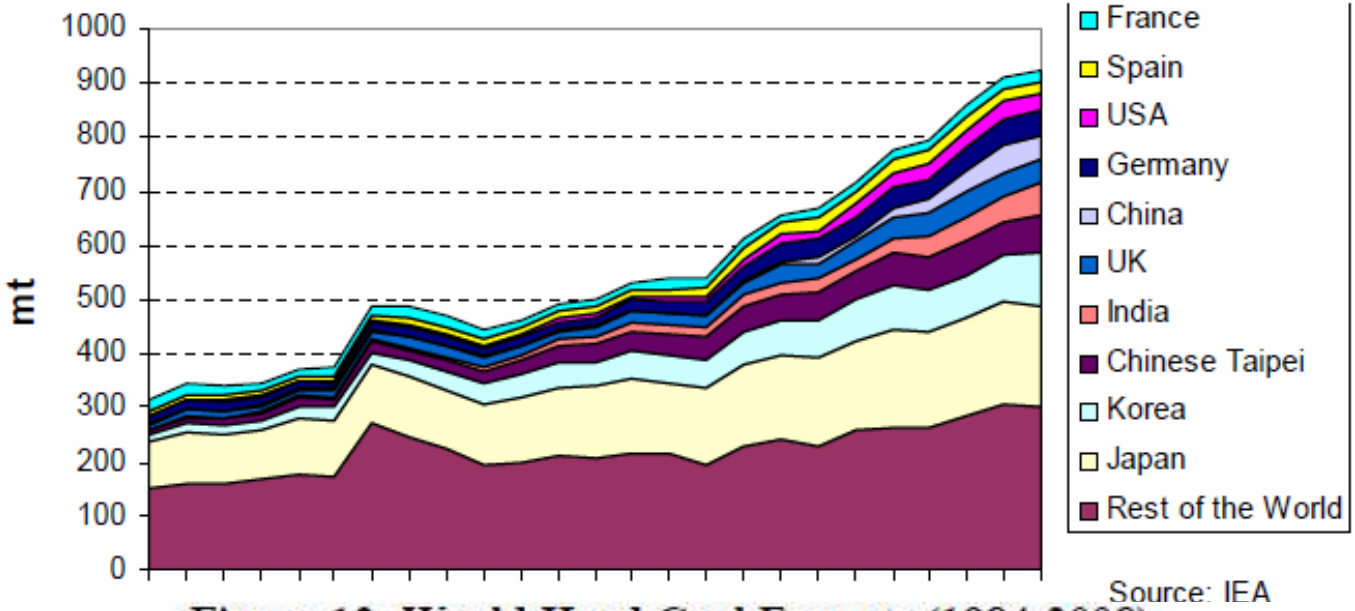
(I have to write the paper now)

quirion@centre-cired.fr

References

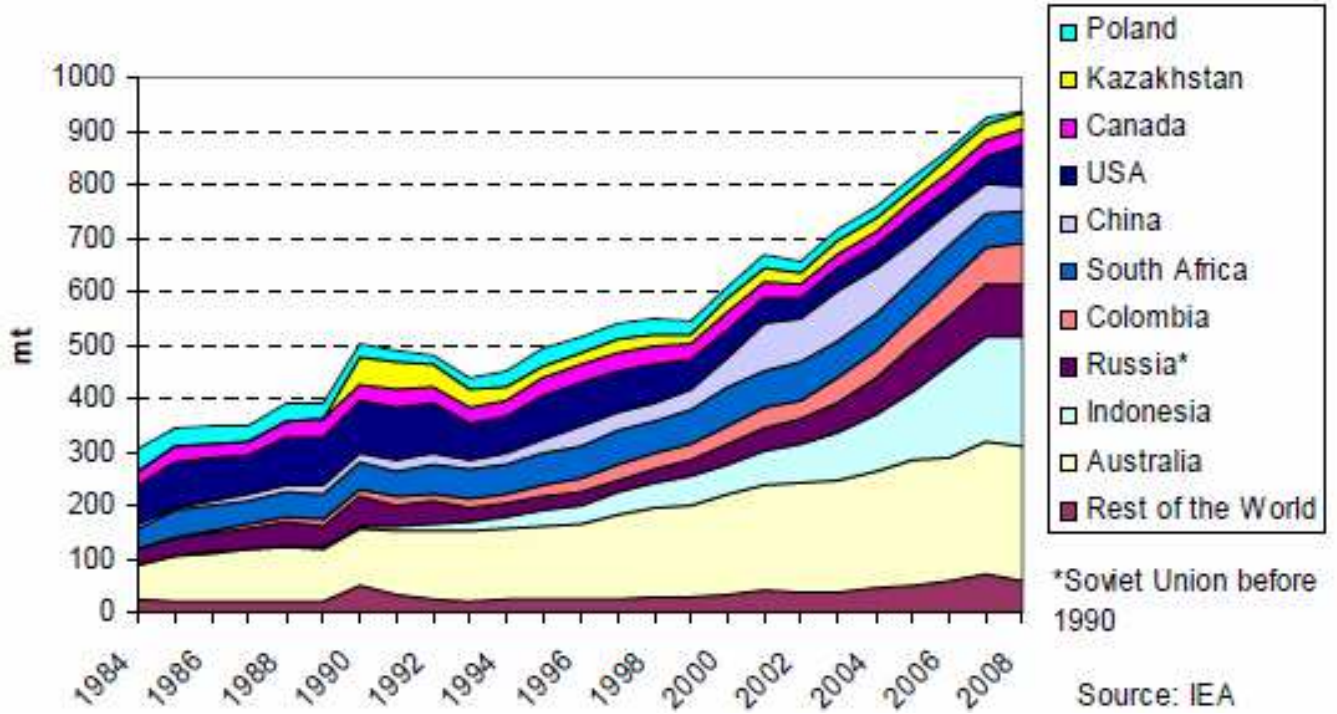
- Alexeeva-Talebi, V., C. Böhringer and U. Moslener, 2007. *Climate and competitiveness: an economic impact assessment of EU leadership in emission control policies*. Mannheim, ZEW.
- Babiker, M.H., 2005. "Climate change policy, market structure, and carbon leakage" *Journal of International Economics 65: 421-445.*
- Dröge, S., 2009. *Tackling Leakage in a World of Unequal Carbon Prices*. Climate Strategies.
- Edis, T., 2010. *Restructuring the Australian economy to emit less carbon*. Grattan Institute, May. Climate Strategies workshop, Berlin, 18 May.
- Gerlagh, R. and O. Kuik, 2007. *Carbon Leakage with International Technology Spillovers*. FEEM Nota Di Lavoro 33.2007.
- Hamdi-Cherif, M., C. Guivarch and P. Quirion, 2010. Sectoral targets for developing countries: Combining "Common but differentiated responsibilities" with "Meaningful participation", forthcoming in *Climate Policy*.
- Light, M.K., C.D. Kolstad and T.F. Rutherford, 1999. *Coal Markets, Carbon Leakage and the Kyoto Protocol*. Working Paper No. 99-23. Center for Economic Analysis. University of Colorado at Boulder.
- Quirion, P., Climate Change Policies, Competitiveness and Leakage. in Cerdá, E. and Labandeira, X. (eds.), 2010. *Climate Change Policies: Global Challenges and Future Prospects*. Edward Elgar

Figure 14: World Hard Coal Imports (1984-2008)



Source: IEA

Figure 13: World Hard Coal Exports (1984-2008)



*Soviet Union before 1990

Source: IEA