

# The impact of carbon pricing on industrial competitiveness

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Project convened by:



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1. Introduction: basic analytics
2. Which (sub) sectors are affected?
3. Can we model market share impacts?
4. Better understanding the process chain..

**Part 1**

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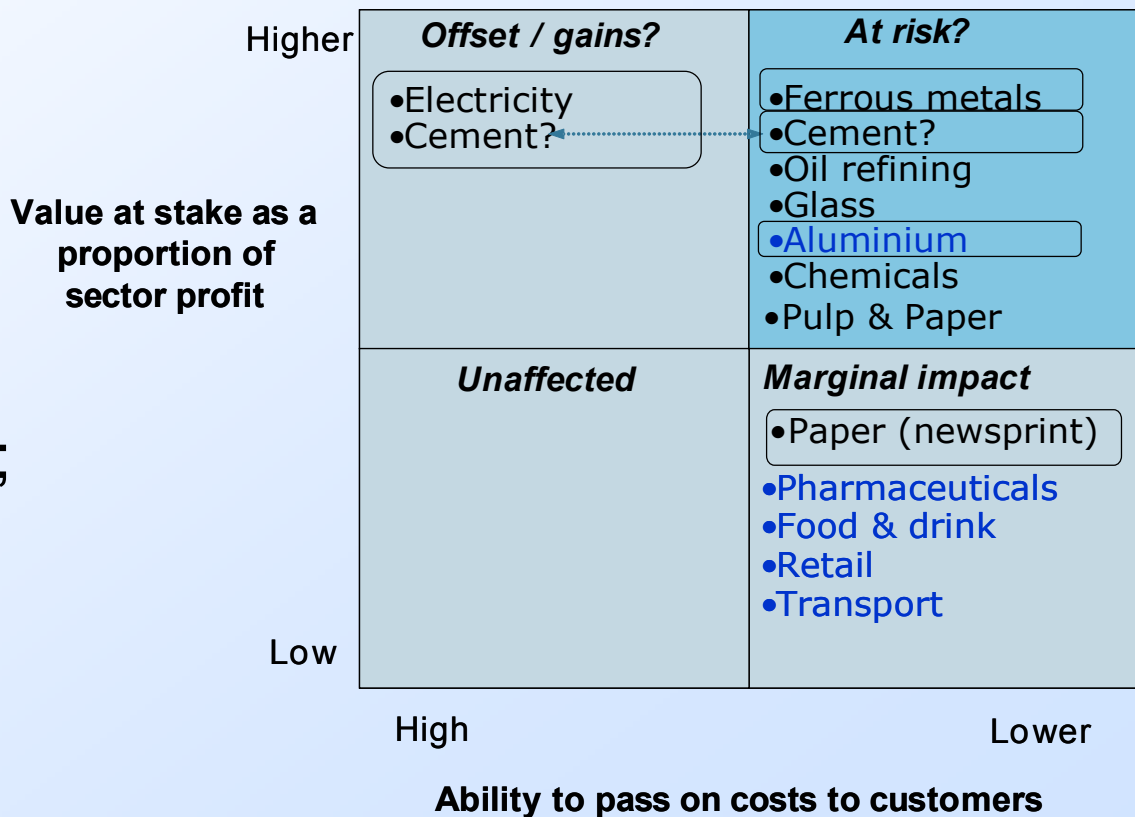
# **Basic analytics**

## ***A sector's cost is potentially impacted by ETS via 3 channels:***

1. Cost of the emissions
2. Costs of abatement
3. Increased electricity prices

## ***In turn there are 3 key determinants of competitiveness exposure***

1. Energy intensity of production;
2. Ability to pass through cost increases to prices;
3. Abatement opportunities

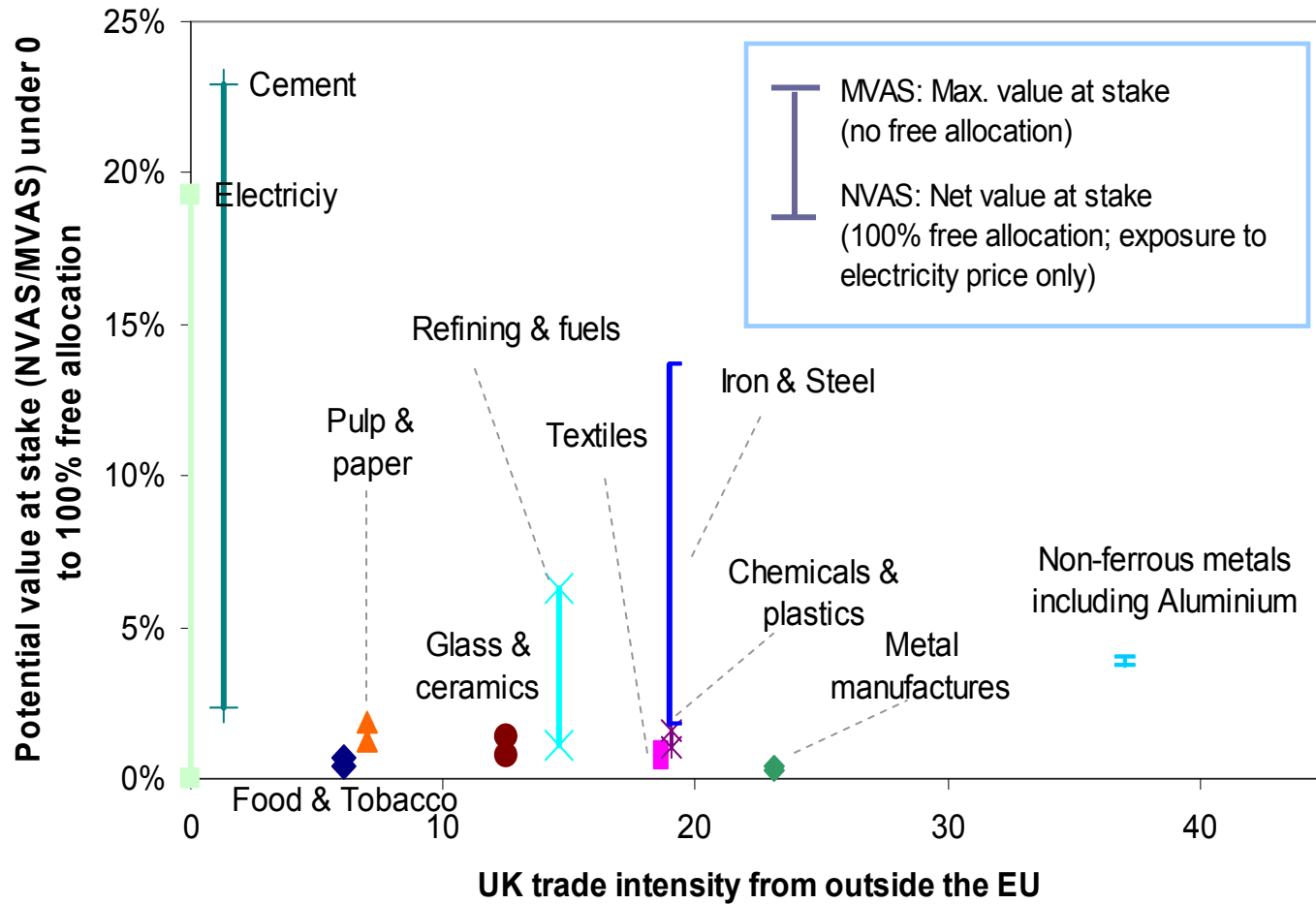


**Part 2**

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**Who is affected?**

# Using 4 digit (SIC 92) representation of the sectors...



Vertical range gives insights on:

- Marginal cost increase (top end of bar)
- Impact of electricity price pass through

Combined with horizontal axis gives insights on:

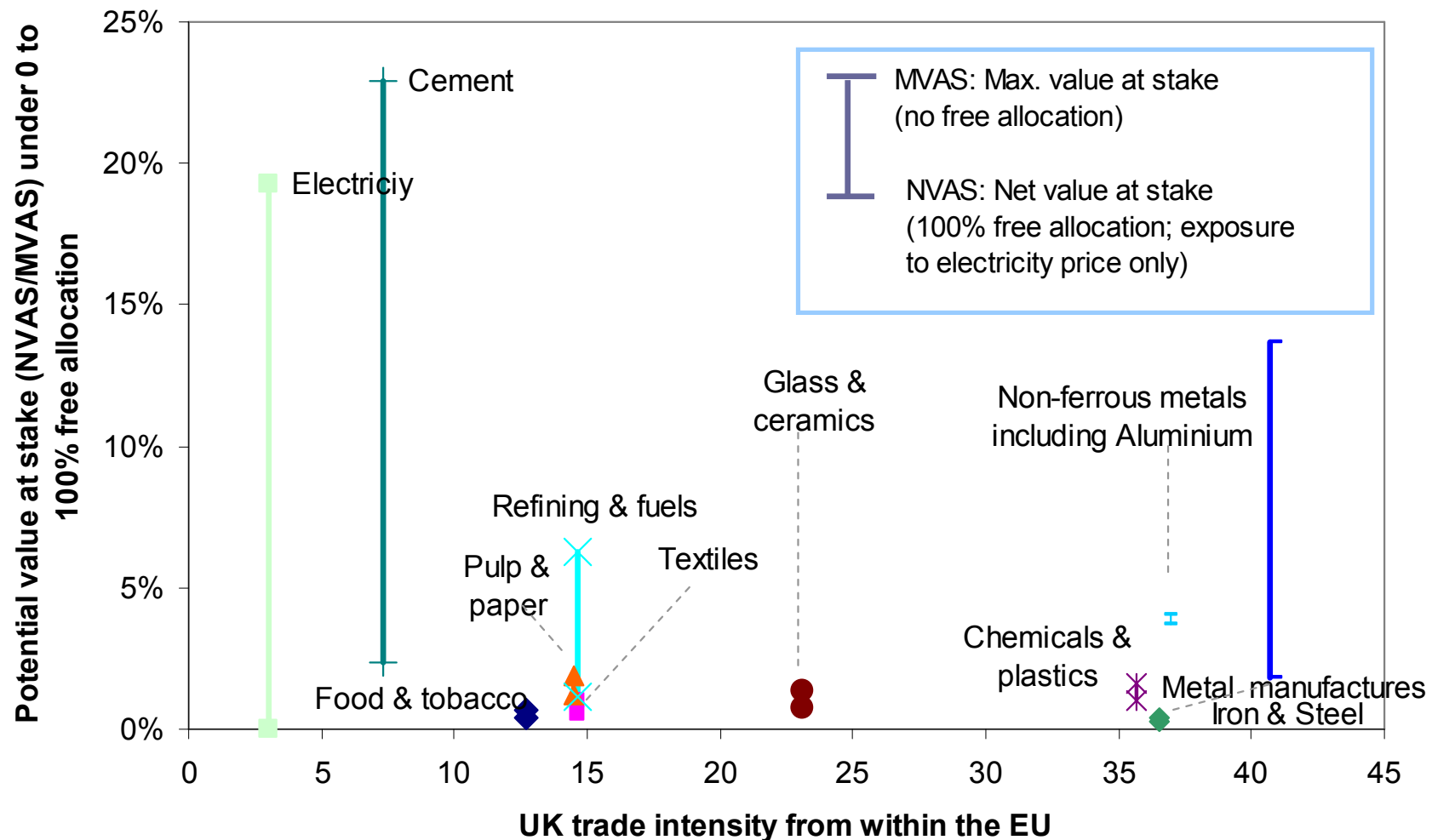
- Scope of auctioning
- dynamics of impacts

Upper end of range: zero free allocation

Lower end of range: 100% free allocation

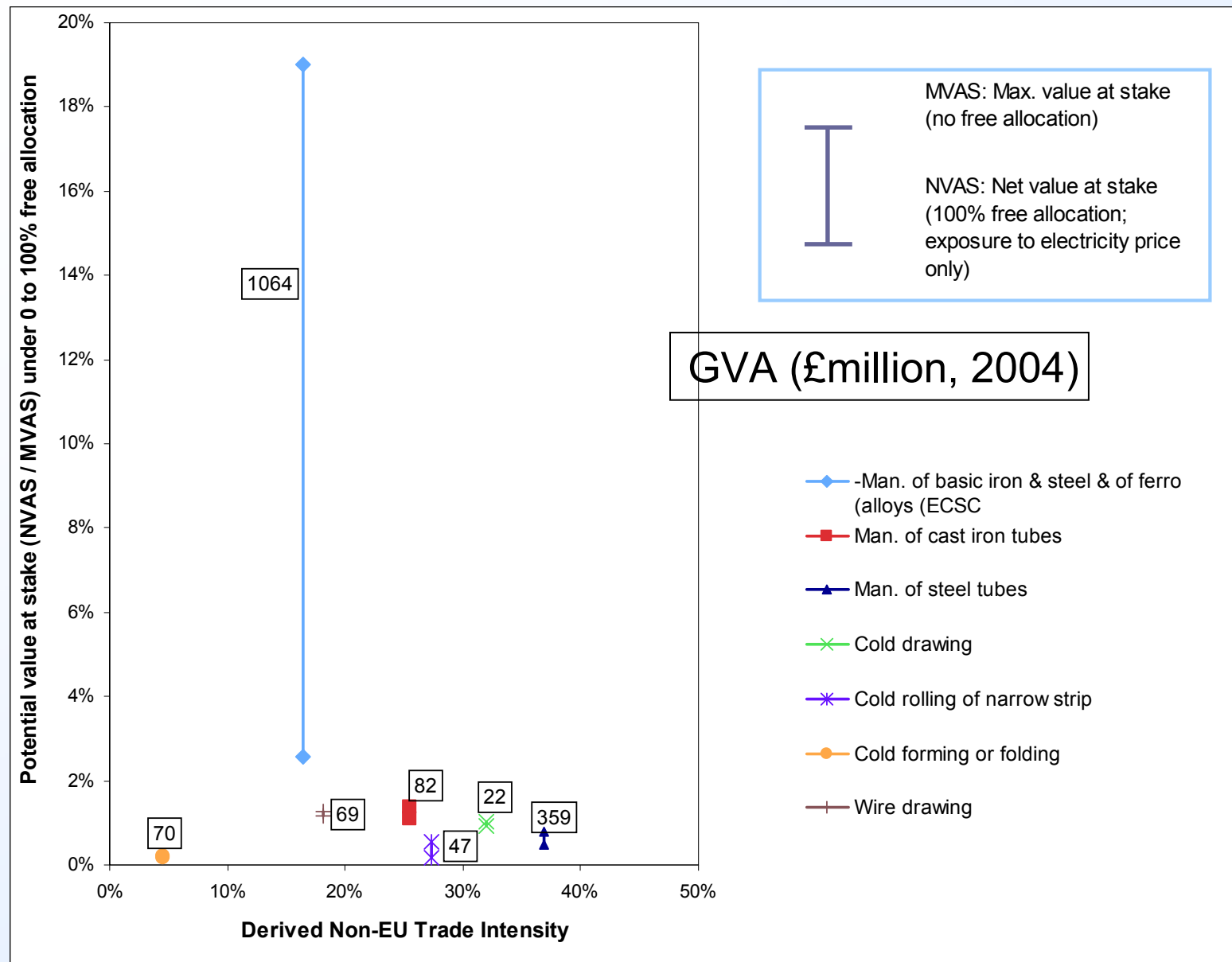
Assumptions: CO2 price=€15/tCO2; Pass through in electricity = €10/mwh

Setting against the *trade intensity from other EU countries* gives insight into the potential degree of concern about differential allocation between Member States.



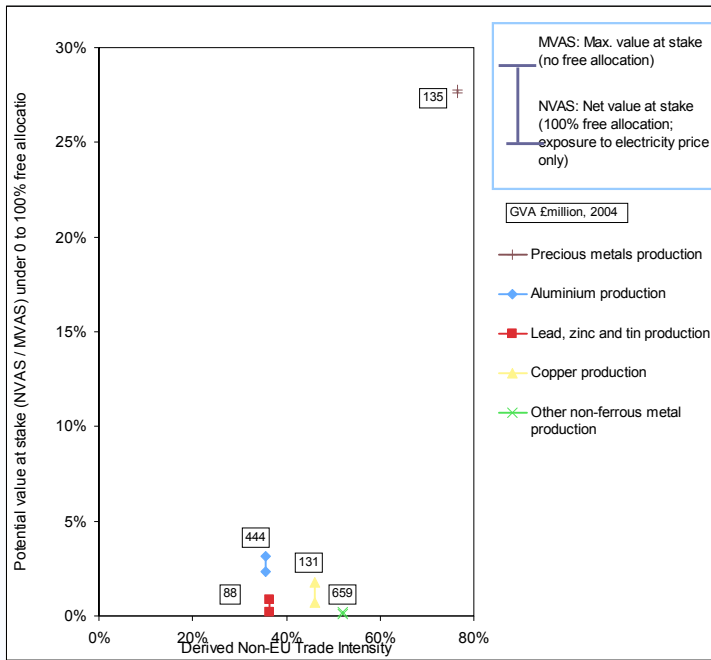
Upper end of range: zero free allocation ; Lower end of range: 100% free allocation  
 Assumptions: CO2 price=€15/tCO2; Pass through in electricity = €10/mwh

# Moving from a 3 digit to a 4 digit (SIC 92) representation of the sector e.g. break-down of Iron & Steel sector (non-EU trade)

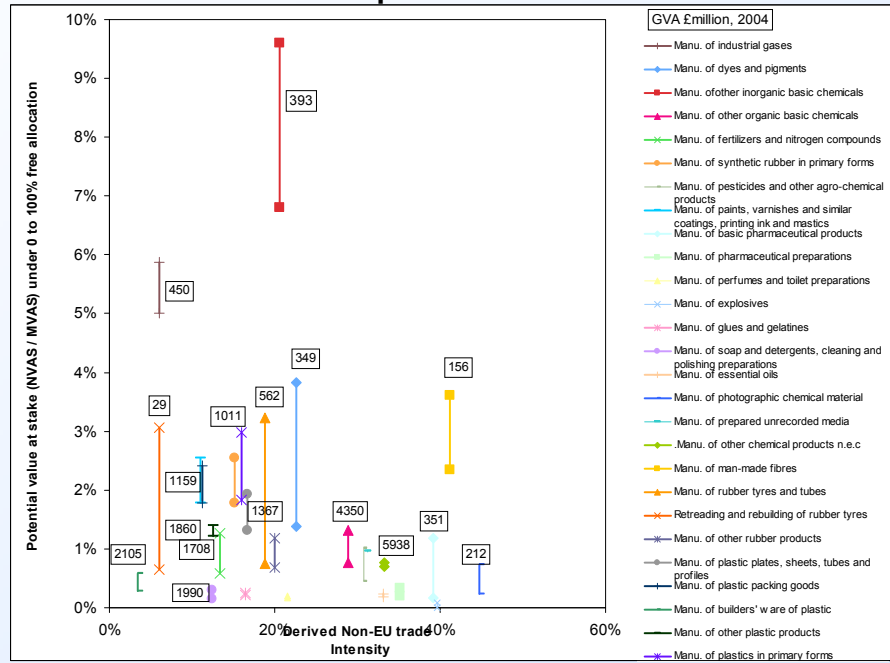




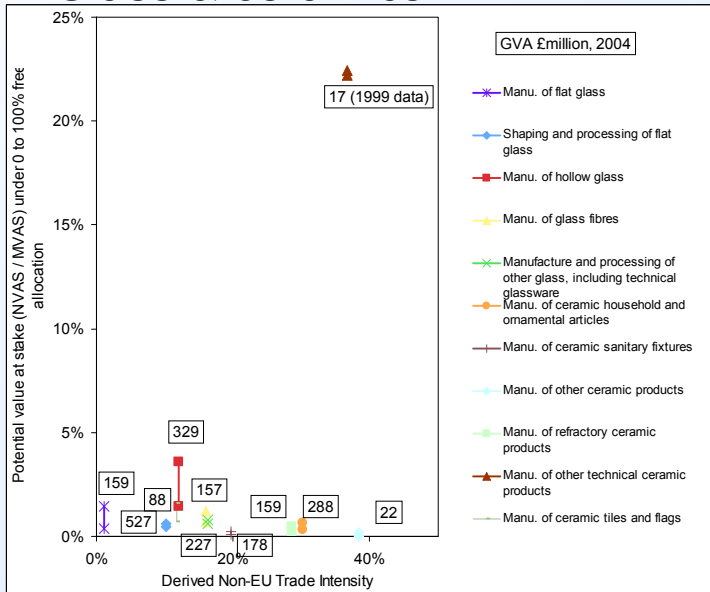
# Non-ferrous metals



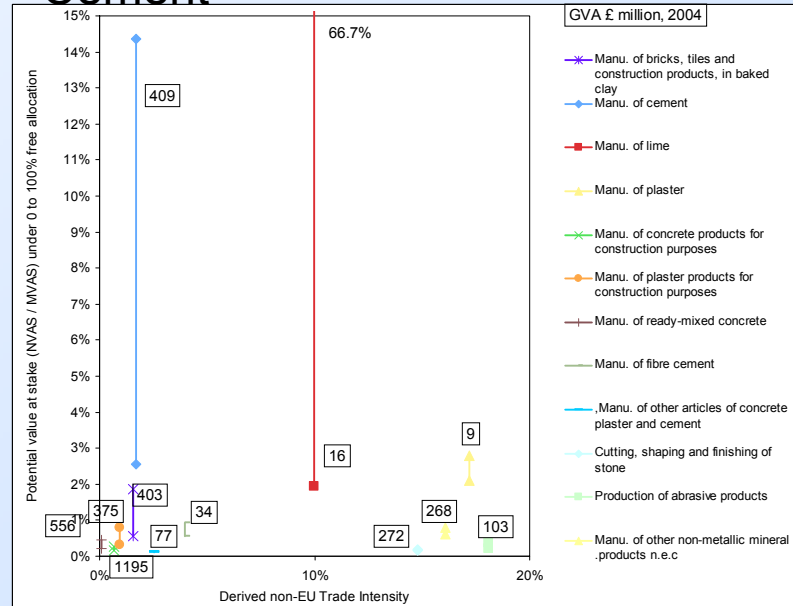
# Chemicals & plastic



# Glass & ceramics



# Cement



## Conclusion 1.

The analysis at 4-digit level identifies 2 groups of potentially exposed sub-sectors, with some overlap:

A) Indirectly exposed (electricity intensive production):

*Top 5: production of precious metals; manufacture of industrial gases; other inorganic basic chemicals; other technical ceramic products; household and sanitary goods;*

B) Potentially directly exposed (carbon intensive production)

*Top 5: manufacturing of lime; production of precious metals; other technical ceramic products; basic iron & steel; manufacturing of cement.*

➔ *significant impact of ETS on competitiveness concentrates on a far smaller fraction of industrial activities than suggested by aggregate figures.*

## Conclusion 2.

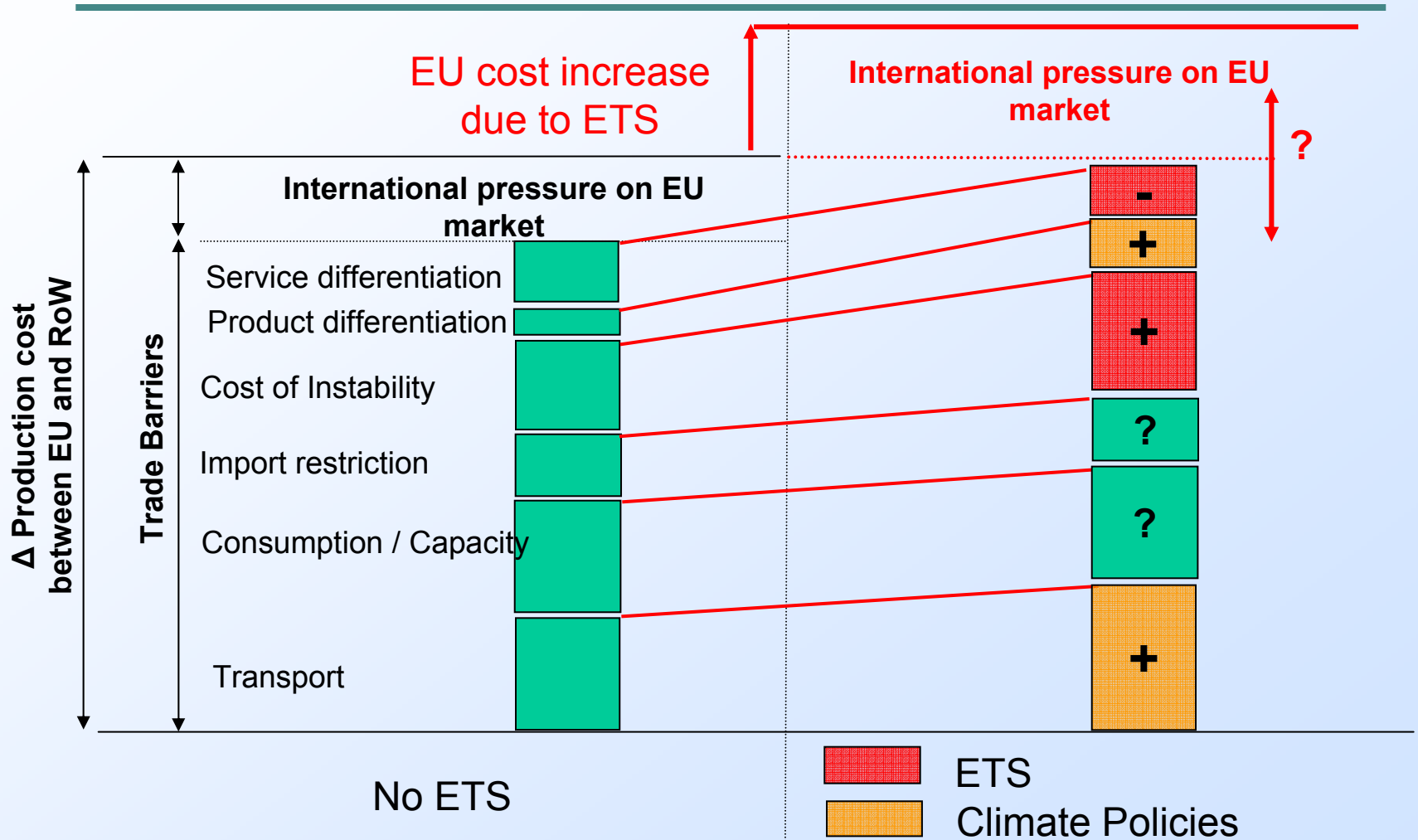
- Overall, 20 out of 92 sub-sectors fall under either/both:  
A) >1.5% electricity impacts at €15/t CO<sub>2</sub>;  
B) > 3% Maximum potential NVAS  
(i.e.CO<sub>2</sub> price of €50/t CO<sub>2</sub>, would therefore correspond to exposure of 5% and 10% respectively. )
- For the UK, the combined Gross Value Added of the top 20 potentially exposed is small (around 1% of total UK GVA).
- *low overall impact on total GVA of economy → implies low political obstacles towards finding international solutions to address competitiveness concerns for these sectors*

**Part 3**

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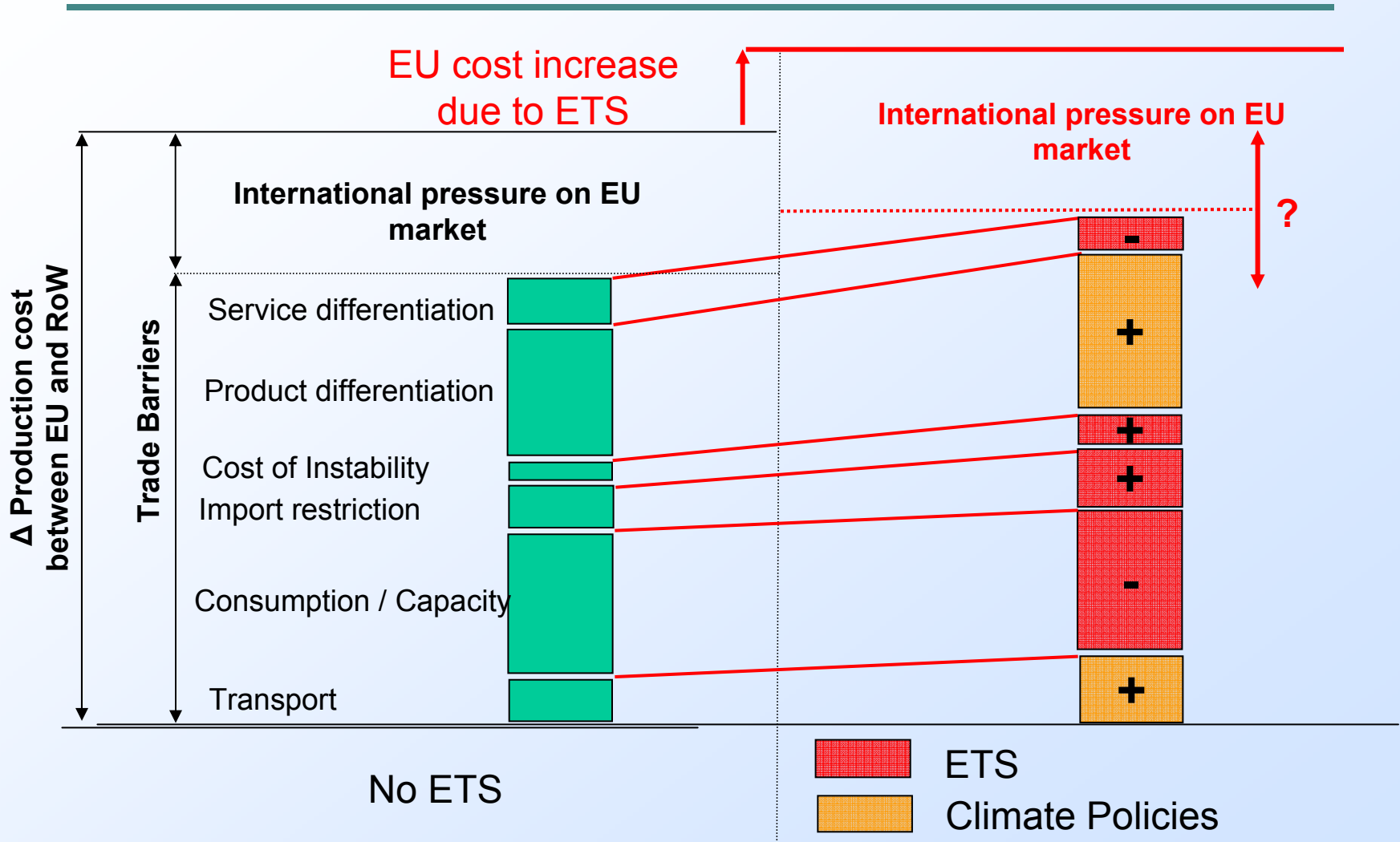
**Can we model EU ETS impacts on  
market share?**

# How will climate policies impact the RIP? Cement



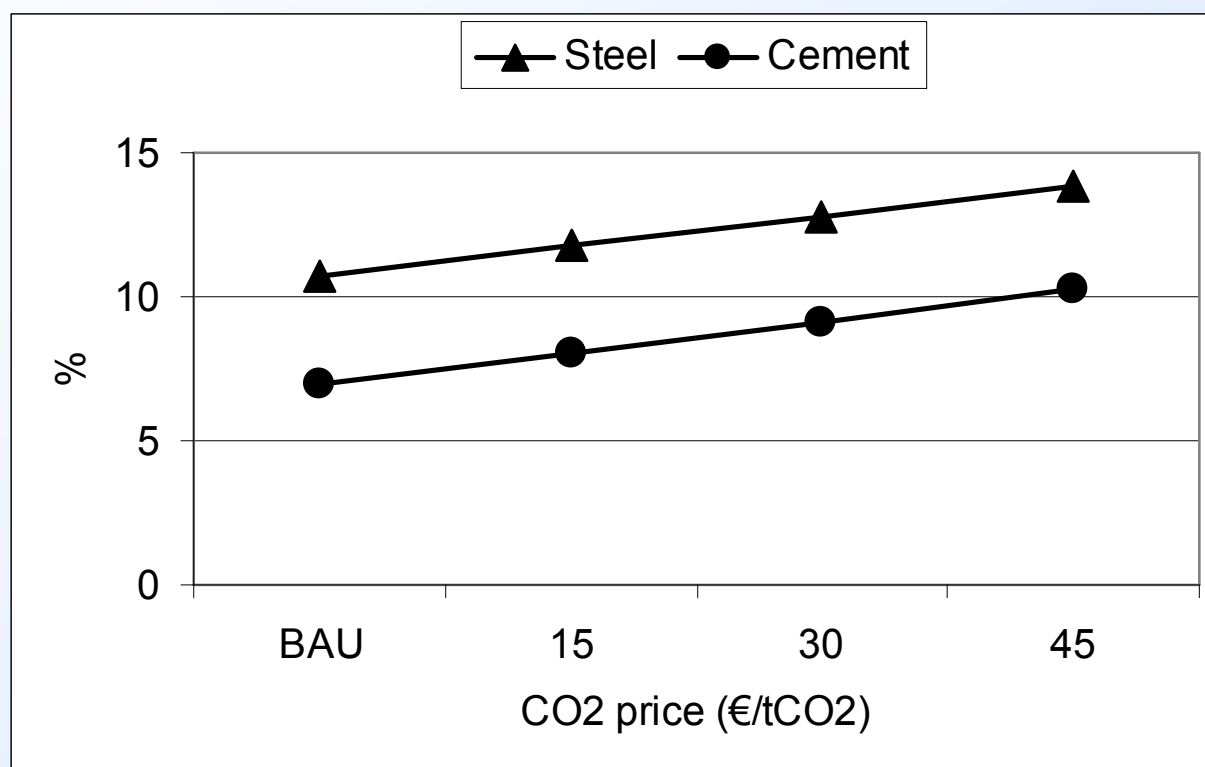
# How will climate policies impact the RIP?

## Steel



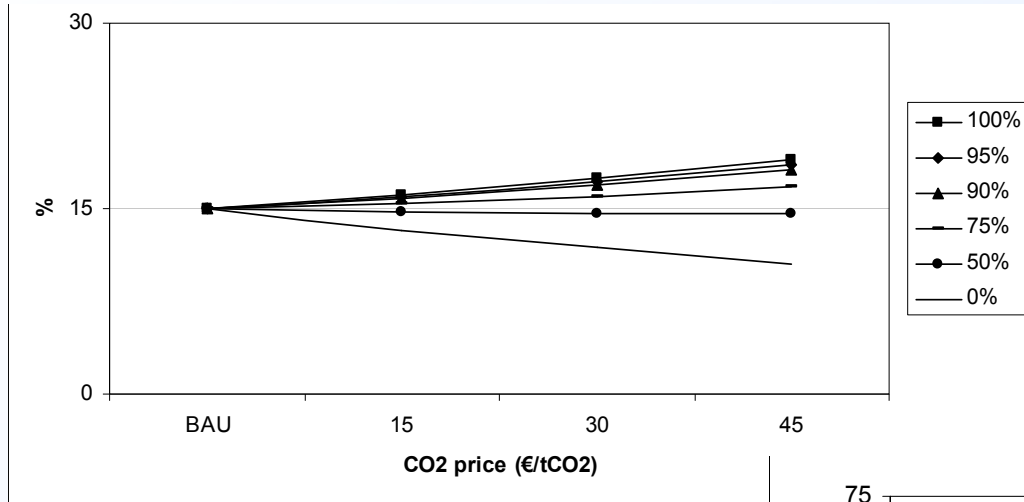
## Central scenario

### EU Import ratio



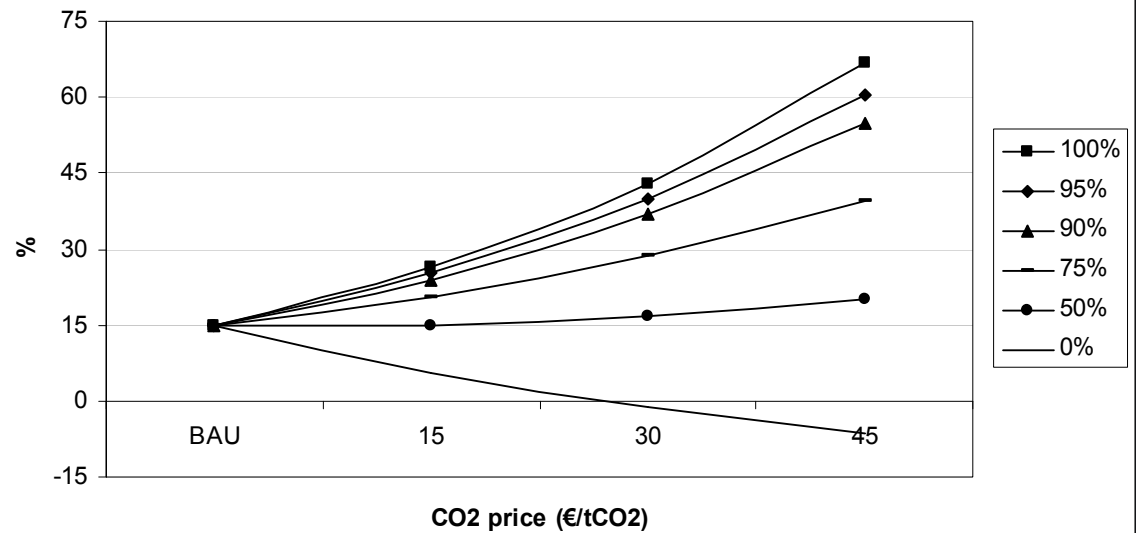
Central scenario

# Gross Profit margin for various Rates of Free Allocation (RFA)



**CEMENT**

**STEEL**

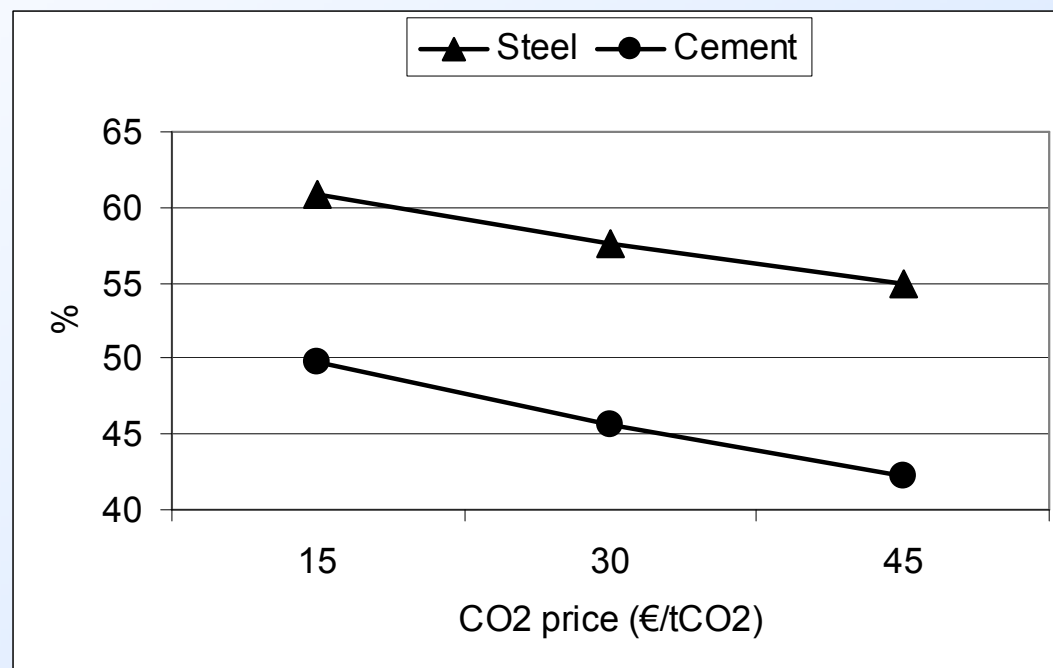




## Central scenario

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# Compensating Rate of Free Allocation



## Conclusions

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According to the econometric estimates of key parameters, and given their uncertainty:

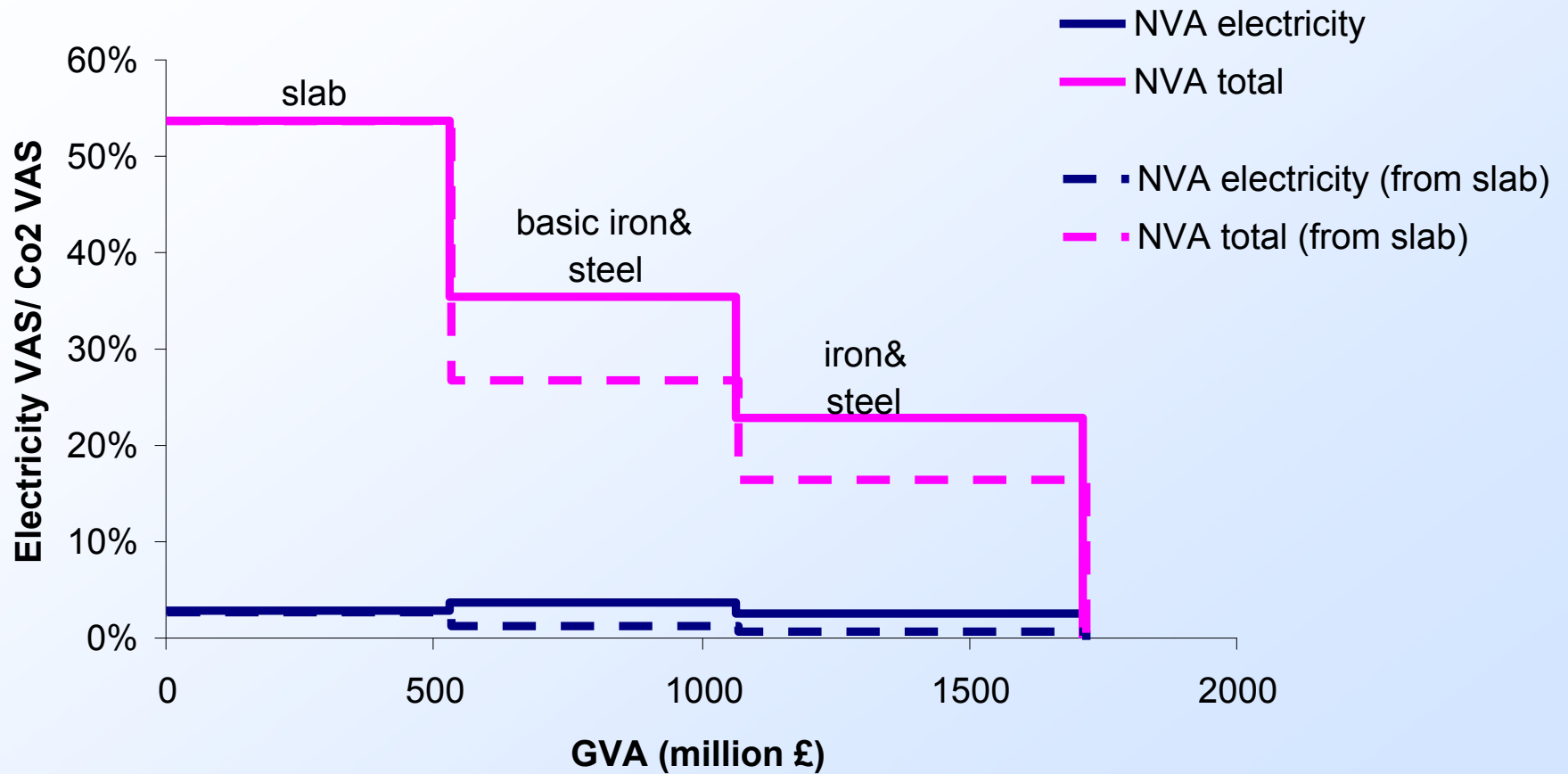
- Market share losses are likely to remain modest
- Market share losses in the cement sector are of the same order of magnitude than in the steel sector, the high CO<sub>2</sub>-intensity of the former offsetting its lower trade sensitivity
- The CRFA : it is all about the rate of cost pass through (PT)... Hence, huge uncertainty.
- A “wrong” CRFA has drastic impact on the cement sector’s profitability, much less for the steel sector
- Finally, what RFA? It is all about your risk aversion...

**Part 4**

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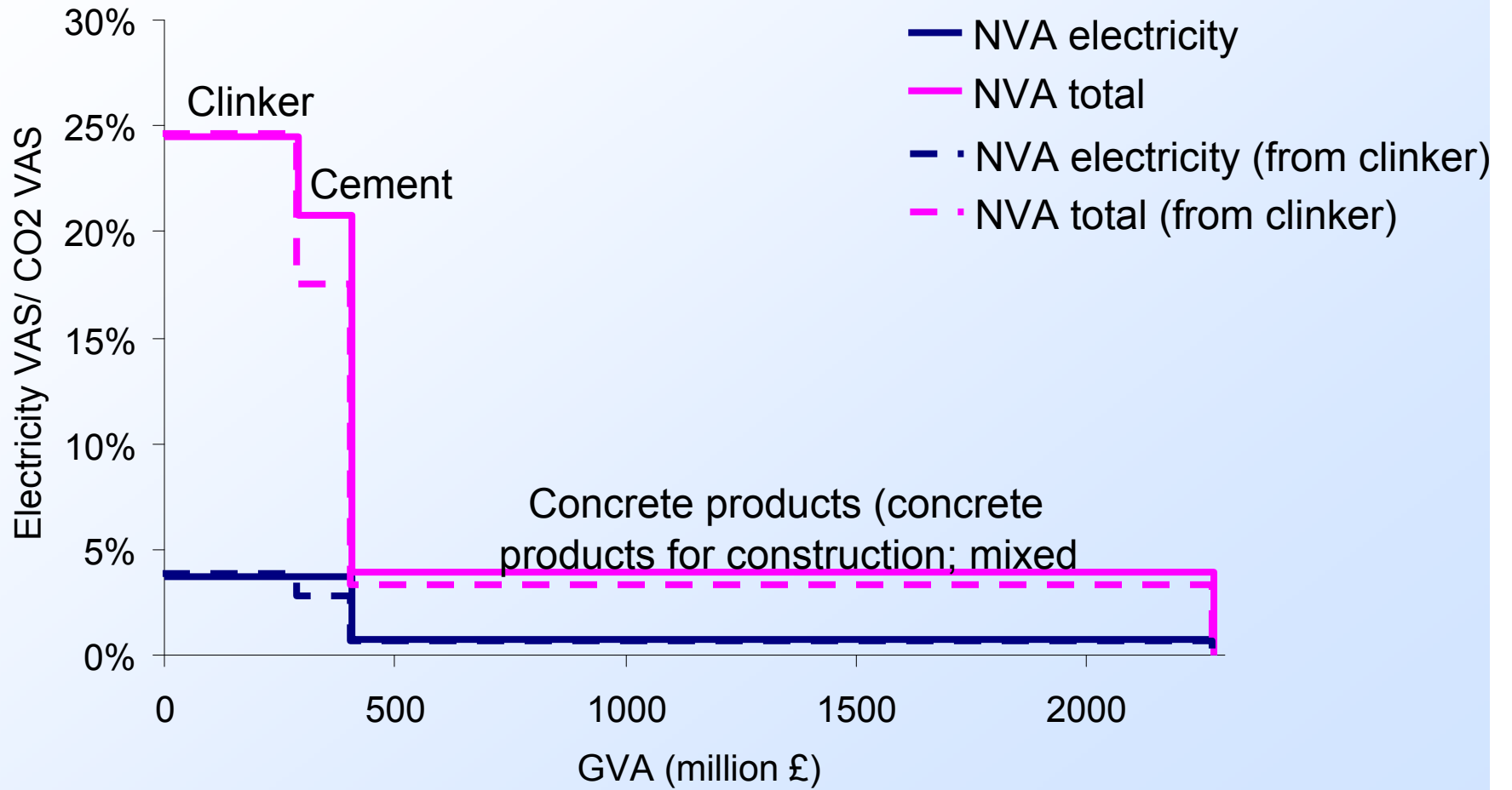
# **Towards better understanding the Production Chain:**

# Basic Oxygen Furnace production



Note – preliminary results – particularly GVA slab pure guess.  
This has implications for VAS estimations for slab.

# Cement



Note – preliminary results – particularly electricity split clinker/cement pure guess

**Part 5**

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# **Annex**

## 4 digit analysis : new approach to defining trade intensity

For the 3 digit analysis, we define UK trade intensity from the EU as:

$$= \frac{\text{value of imports from EU} + \text{value of Exports to EU}}{\text{value of total UK market value}}$$

For market value we use total supply=total demand from Input Output tables

Due to data constraints at 4 digit level, in this analysis we use:

$$= \frac{\text{Value derived EU exports} + \text{Value derived EU imports}}{\text{annual turnover} + \text{val. total imports} - \text{val. total exports}}$$

Where we define:

$$\text{Value derived EU exports} = \text{Total exports at 4 digit} \times \frac{\text{Exports to EU 3 digit}}{\text{Total export 3 digit}}$$

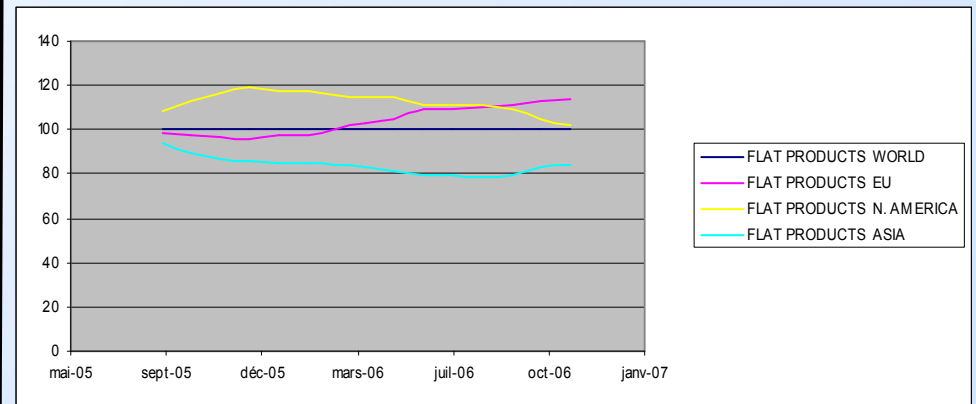
## International pressure on the EU Steel sector

### Long products

- Low value added products and differentiation (?)
  - High transportation cost for scrap steel
- Local market: EU Import ratio ~ 10%

### Flat products

- High product differentiation
- Three Regional markets (Asia, North America and Europe) partially linked
- EU Import ratio remains modest (~10%)
- Price differences maintain



Is this situation sustainable?

A possible new scheme: slab production in low cost countries, product differentiation close to consumers



## Modelling assumptions

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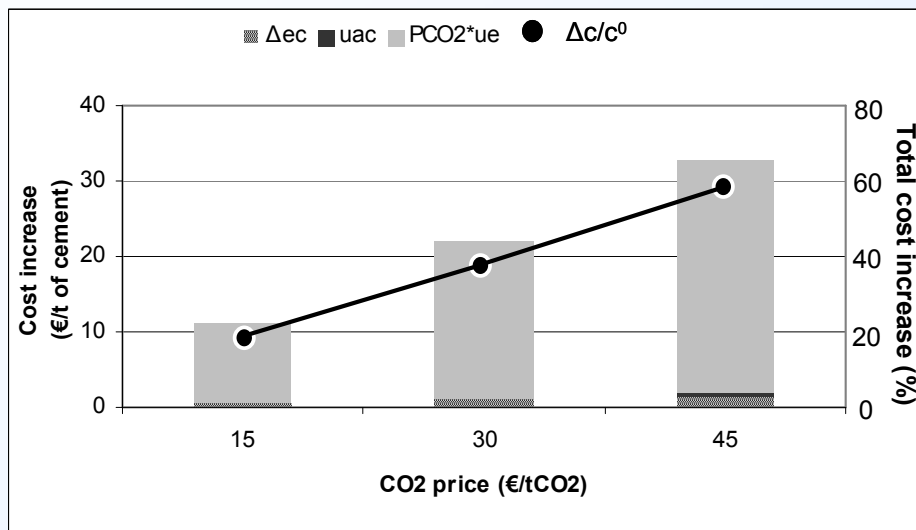
- Time Horizon: 2015
- Geographical aggregation : EU 27
- Products: flat and long steel products are aggregated
- For a given CO2 price, 3 elements in the cost increase due to the ETS:
  - Electricity cost increase (full pass-through in the electricity sector)
  - Abatement cost: depends on the **Marginal Abatement Cost Curve (MACC)**
  - Emission cost: free allowances (if any) are purely grandfathered
- Price increase: depends on the **Pass Through (PT)**
- Market share loss: depends on the **trade elasticity ( $\sigma$ )**
- Demand drop: depends on the **demand elasticity ( $\epsilon$ )**

**KEY  
PARAMETERS**

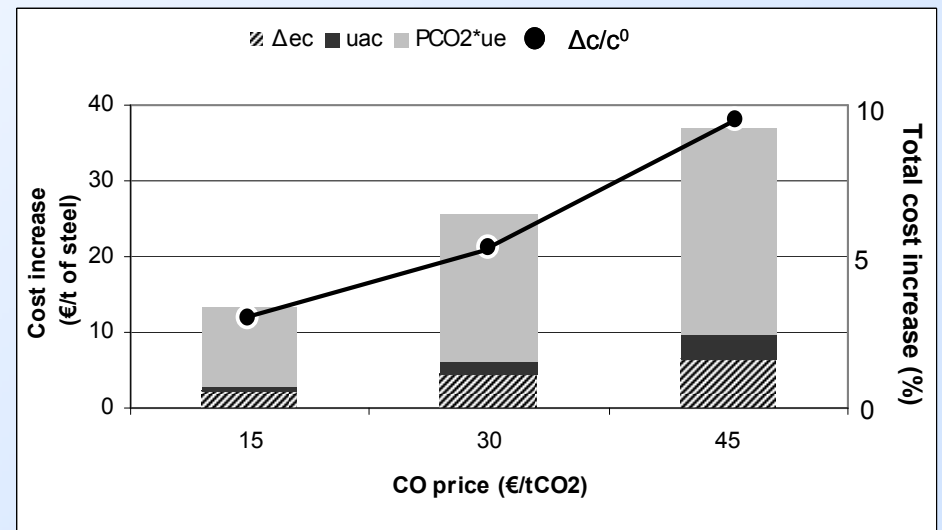
## Central scenario

Values for key parameters = the range mean

### Cost Impact



Cement

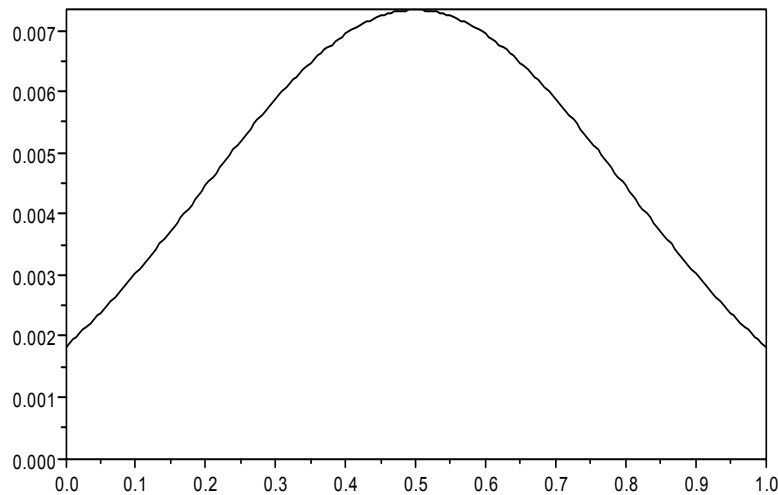


Steel

## CAVEATS

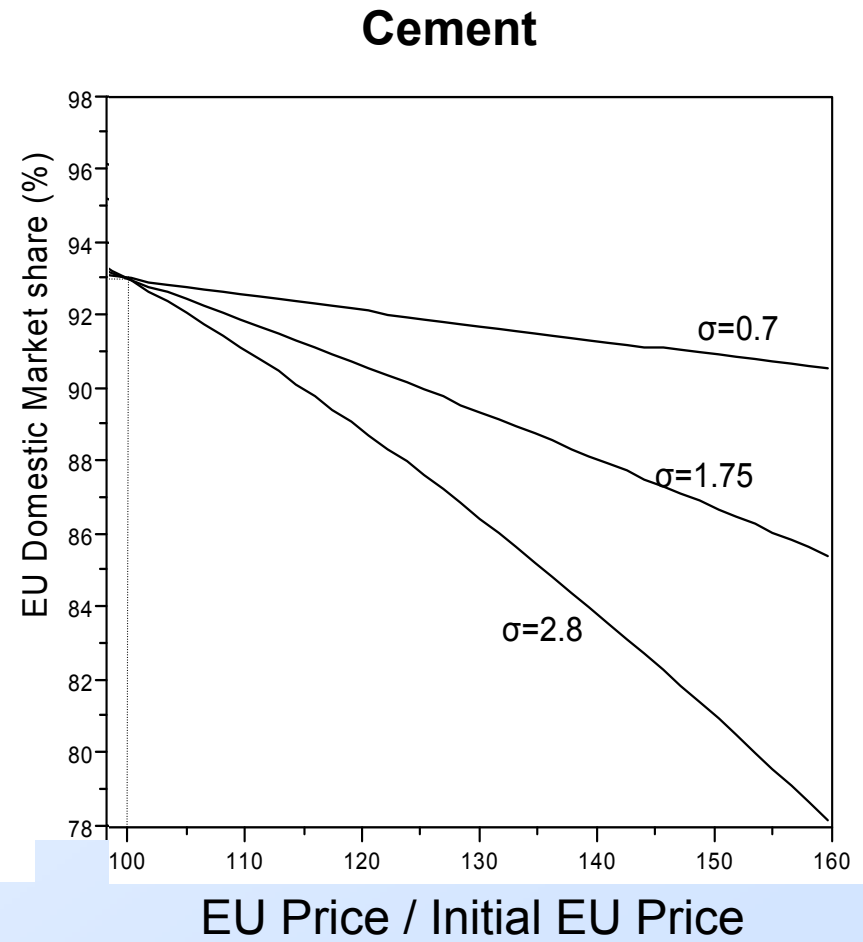
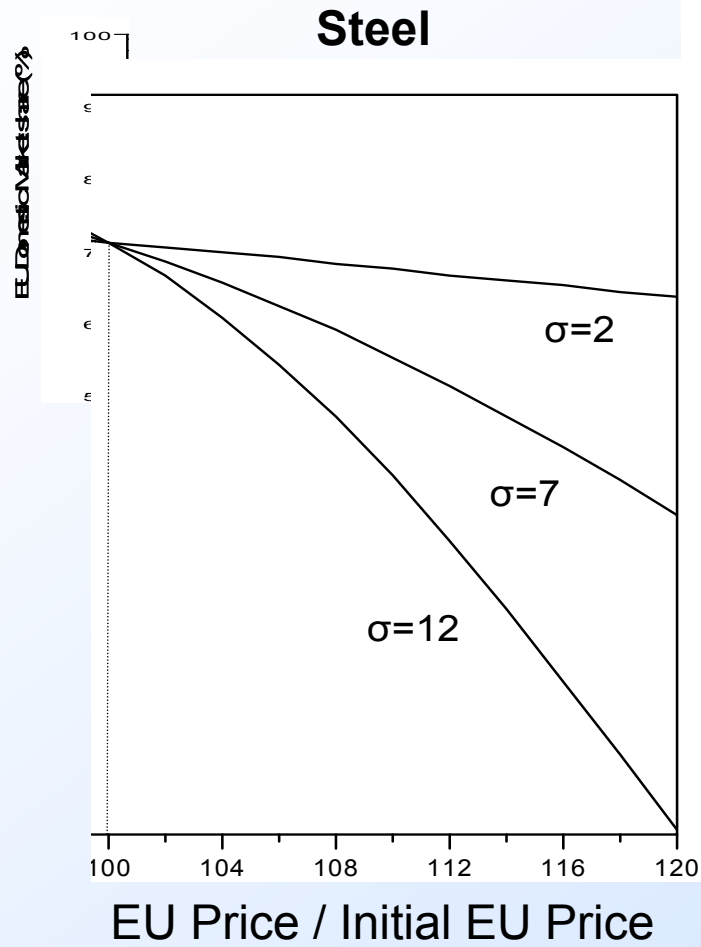
### Caveat N° 1 : Uncertainty surrounding these parameters

→ For every parameter, we test a range of values (from economics literature) and define a density of probability



	Cement		Steel	
PT	0	full	0	full
Trade elasticity	0.5	2.8	2	12
Demand elasticity	0.2	1.5	0	1
MACC	PRIMES +/- 33%			

# Uncertainty on the trade elasticity



## Uncertainty on the pass through

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### **A controversial issue...**

Theoretical Literature enhances the paradoxical role of market power  
→ Trade exposure is not the only PT determinant

Empirical literature:

- Ex-ante studies use a wide range of estimates
- Econometric works claim for significant PT:
  - Walker: PT of the CO<sub>2</sub> opportunity cost in 2005 from 10 to 40% in the cement sector
  - Literature on exchange rate → PT on export markets from 20 to 70% for these two sectors

## CAVEATS

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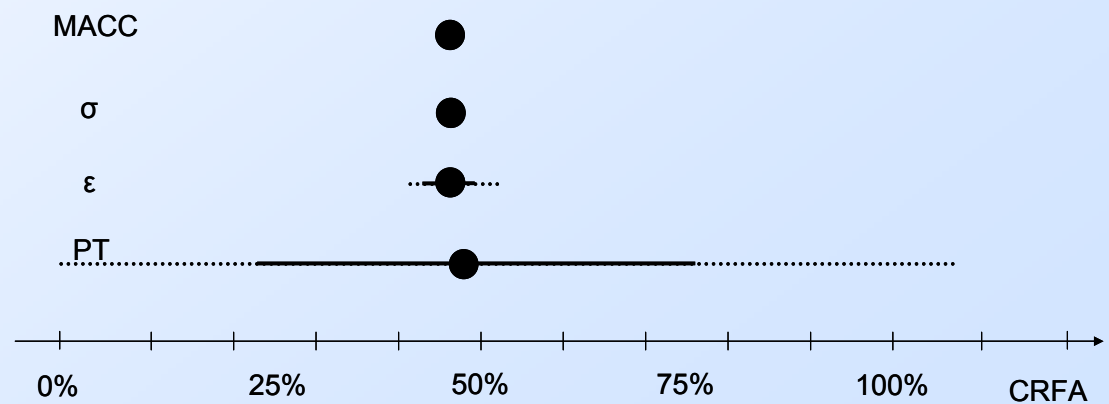
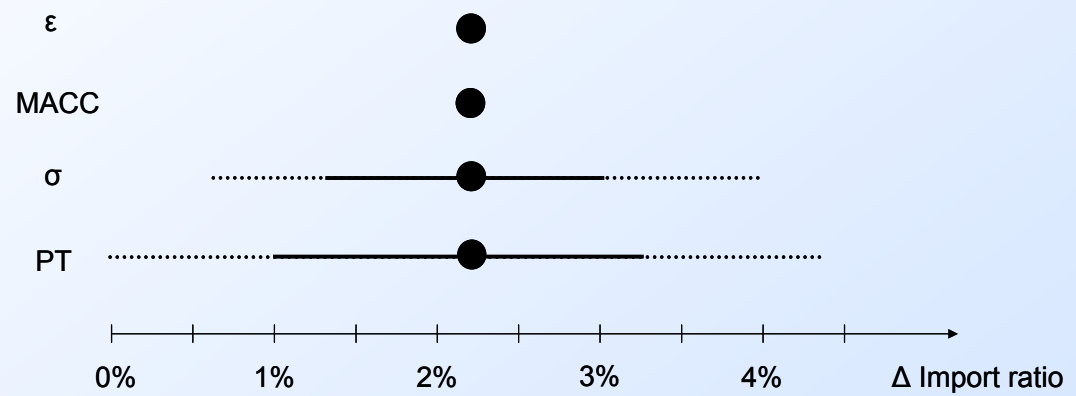
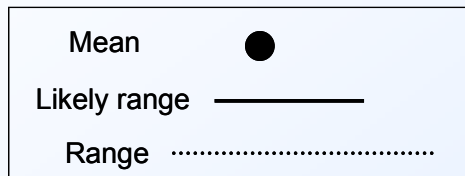
### Problem N° 2 : reliability of econometric estimates

- Poor estimates availability for the EU
- Estimates based on *small* shocks
- Estimates based on past data, whereas the determinants of trade evolve (e.g. slab trade)
- No distinction between trade barriers (all mixed) whereas they will evolve differently over time
- Do not take into account the impact of climate policies on trade barriers

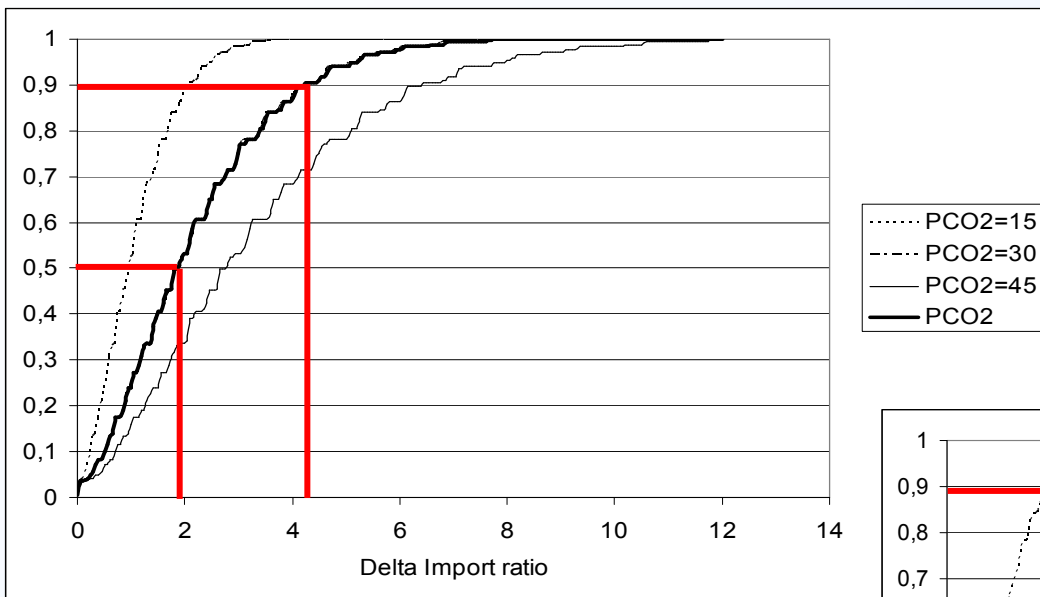
**Nevertheless...**

# Sensitivity Analysis

## CEMENT



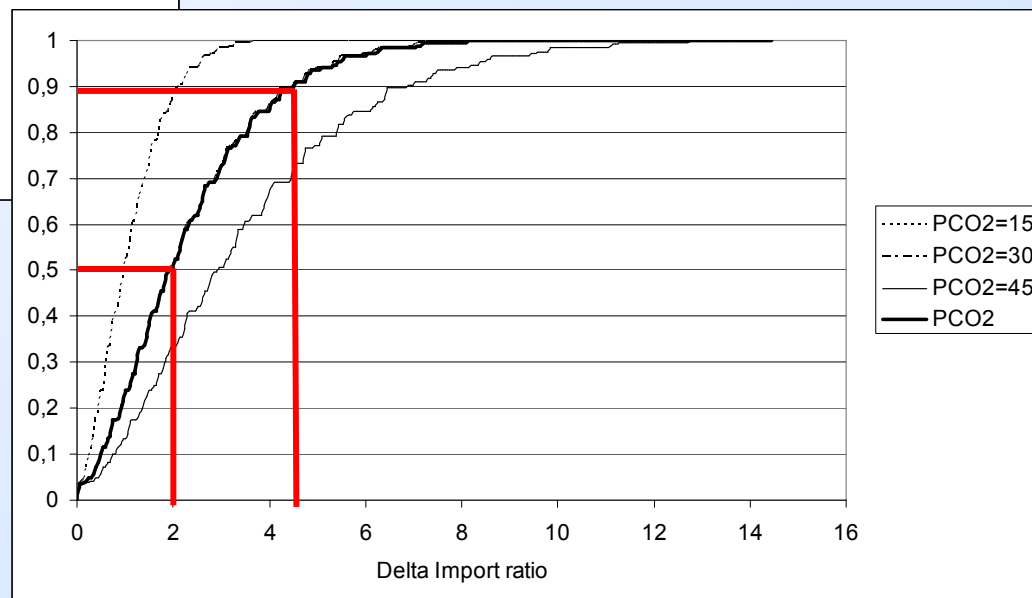
# Multi-sensitivity Analysis



**STEEL**  
Mean: -2%

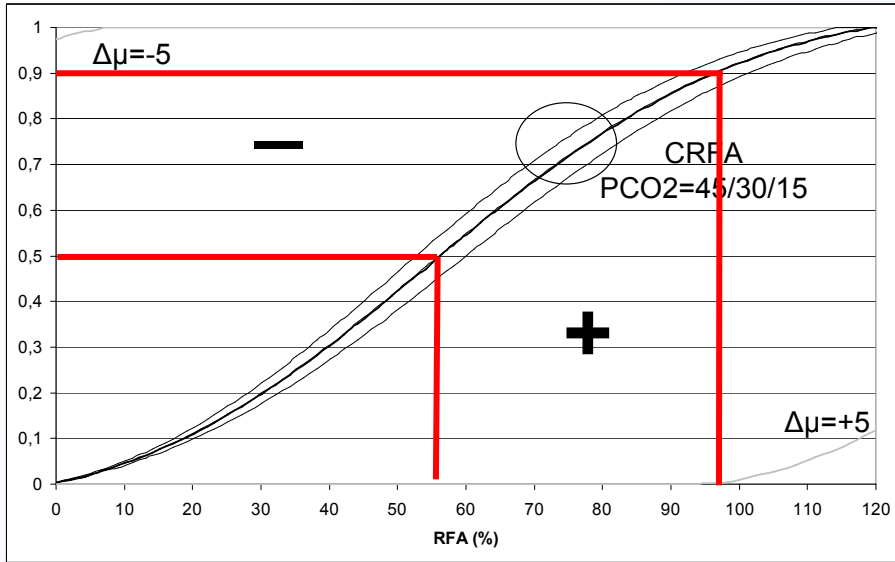
## $\Delta$ EU Import ratio *Repartition function*

**CEMENT**  
Mean: -2%





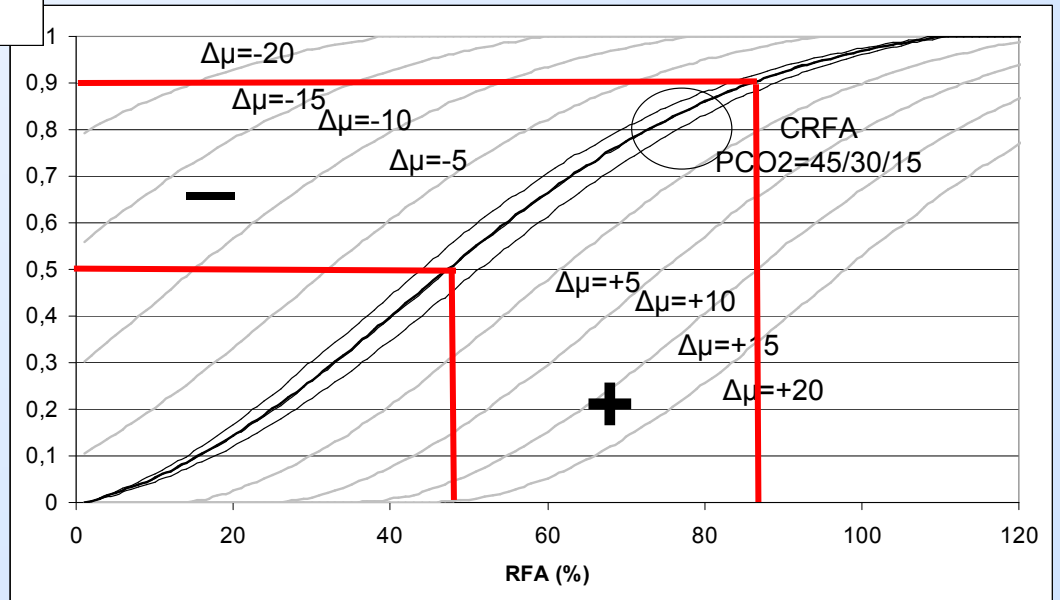
# Multi-sensitivity Analysis



**STEEL**  
Mean CRFA: ~60%

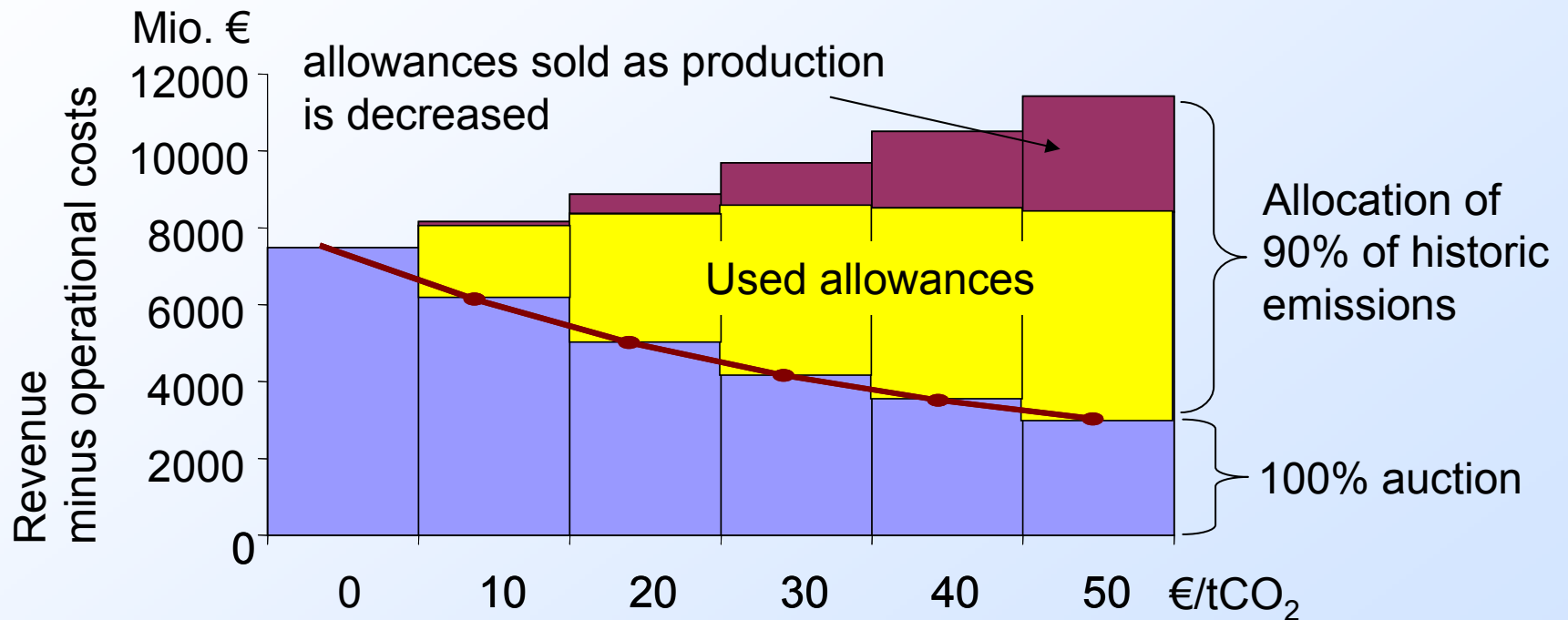
**CRFA**  
*Repartition function*

**CEMENT**  
Mean CRFA: ~50%



# The current approach of free allocation shields profits, not the production of effected sectors

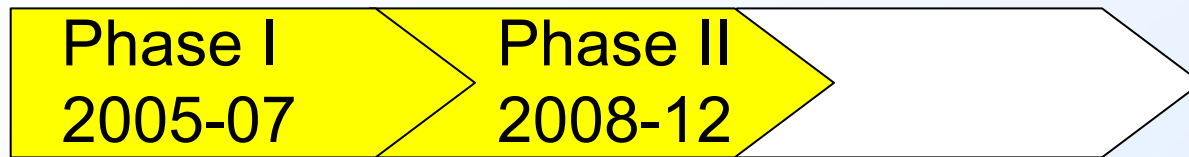
Example: Cournot model of the European cement sector



- energy intensive industry has usually high fixed costs
- relocating production is a strategic (long-term) decision
- competitiveness is affected by post 2012 perspective

Assumptions: For 20€/tCO<sub>2</sub>, extended cost: +14€/t cement ~200km by road

# Robust solutions for post 2012 exist



Continued international cost differences effect energy intensive industry.

Global or sectoral agreements

Compensation of Exports/imports

Allocation proportional to output

	Efficient production	Environmental costs reflected in price	Fair competition
Global or sectoral agreements	✓	✓	✓
Compensation of Exports/imports	✓	✓	✓
Allocation proportional to output	✓		✓

We will find the best solution in an international dialogue.