The impact of carbon pricing on industrial competitiveness

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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

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Part 2

Who is affected?
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

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
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)

- Man. of basic iron & steel & of ferro (alloys (ECSC
- Man. of cast iron tubes
- Man. of steel tubes
- Cold drawing
- Cold rolling of narrow strip
- Cold forming or folding
- Wire drawing

GVA (£million, 2004)

MVAS: Max. value at stake (no free allocation)
NVAS: Net value at stake (100% free allocation; exposure to electricity price only)
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 CO2;
  B) > 3% Maximum potential NVAS
  (i.e. CO2 price of €50/t CO2, 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
Can we model EU ETS impacts on market share?
How will climate policies impact the RIP? Cement

- Production cost difference between EU and RoW
- Transport
- Consumption / Capacity
- Import restriction
- Cost of Instability
- Service differentiation
- Product differentiation

International pressure on EU market:
- No ETS
- ETS
- Climate Policies

EU cost increase due to ETS

International pressure on EU market?
How will climate policies impact the RIP? Steel

ETS Climate Policies

International pressure on EU market

△ Production cost between EU and RoW

Trade Barriers

Service differentiation

Product differentiation

Cost of Instability

Import restriction

Consumption / Capacity

Transport

EU cost increase due to ETS

International pressure on EU market

No ETS

ETS

Climate Policies

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Central scenario

EU Import ratio

![Graph showing EU Import ratio with CO2 price (€/tCO2) on the x-axis and % on the y-axis, with two lines representing Steel and Cement.]
Central scenario

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

STEEL

CEMENT
Central scenario

Compensating Rate of Free Allocation

![Graph showing the compensating rate of free allocation for Steel and Cement against CO2 price (€/tCO2). The graph demonstrates a downward trend for both industries as the CO2 price increases.]
Conclusions

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 CO2-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

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.
Note – preliminary results – particularly electricity split clinker/cement pure guess
Annex
4 digit analysis: new approach to defining trade intensity

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

\[
\text{UK trade intensity from EU} = \frac{\text{value of imports from EU} + \text{value of Exports to EU}}{\text{value of total UK market value}}
\]

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:

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

Where we define:

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

• 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 ($\varepsilon$)
Central scenario

Values for key parameters = the range mean

Cost Impact

Cement

Steel
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

<table>
<thead>
<tr>
<th></th>
<th>Cement</th>
<th>Steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>PT</td>
<td>0</td>
<td>full</td>
</tr>
<tr>
<td>Trade elasticity</td>
<td>0.5</td>
<td>2.8</td>
</tr>
<tr>
<td>Demand elasticity</td>
<td>0.2</td>
<td>1.5</td>
</tr>
<tr>
<td>MACC</td>
<td></td>
<td>PRIMES +/- 33%</td>
</tr>
</tbody>
</table>

For every parameter, we test a range of values (from economics literature) and define a density of probability.
Uncertainty on the trade elasticity

Steel

Cement

EU Price / Initial EU Price

EU Domestic Market share (%)
Uncertainty on the pass through

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 CO2 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

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

Mean  
Likely range  
Range  

ε
MACC
σ
PT

CRFA

0% 1% 2% 3% 4% Δ Import ratio

0% 25% 50% 75% 100% CRFA

MACC
σ
ε
PT
Multi-sensitivity Analysis

Δ EU Import ratio
Repartition function

CEMENT
Mean: -2%

STEEL
Mean: -2%
Multi-sensitivity Analysis

**STEEL**
Mean CRFA: ~60%

**CEMENT**
Mean CRFA: ~50%

**CRFA**
Repartition function

![Graph showing CRFA repartition function for STEEL and CEMENT with different mean CRFA values.](image-url)
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€/tCO2, extended cost: +14€/t cement ~200km by road
Robust solutions for post 2012 exist

- Phase I: 2005-07
- Phase II: 2008-12
- Continued international cost differences effect energy intensive industry.

- Efficiencies in 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.