Price and competitiveness implications of the EU ETS:

modeling in the context of imperfect markets

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Making business sense of climate change

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Carbon Trust study on implications of the EU ETS for industrial competitiveness: outline

Introduction & Overview

- Background to the study
- Main determinants of competitiveness impacts (qualitative)
- Approach to study: interviews and modeling analysis of price pass-through issues

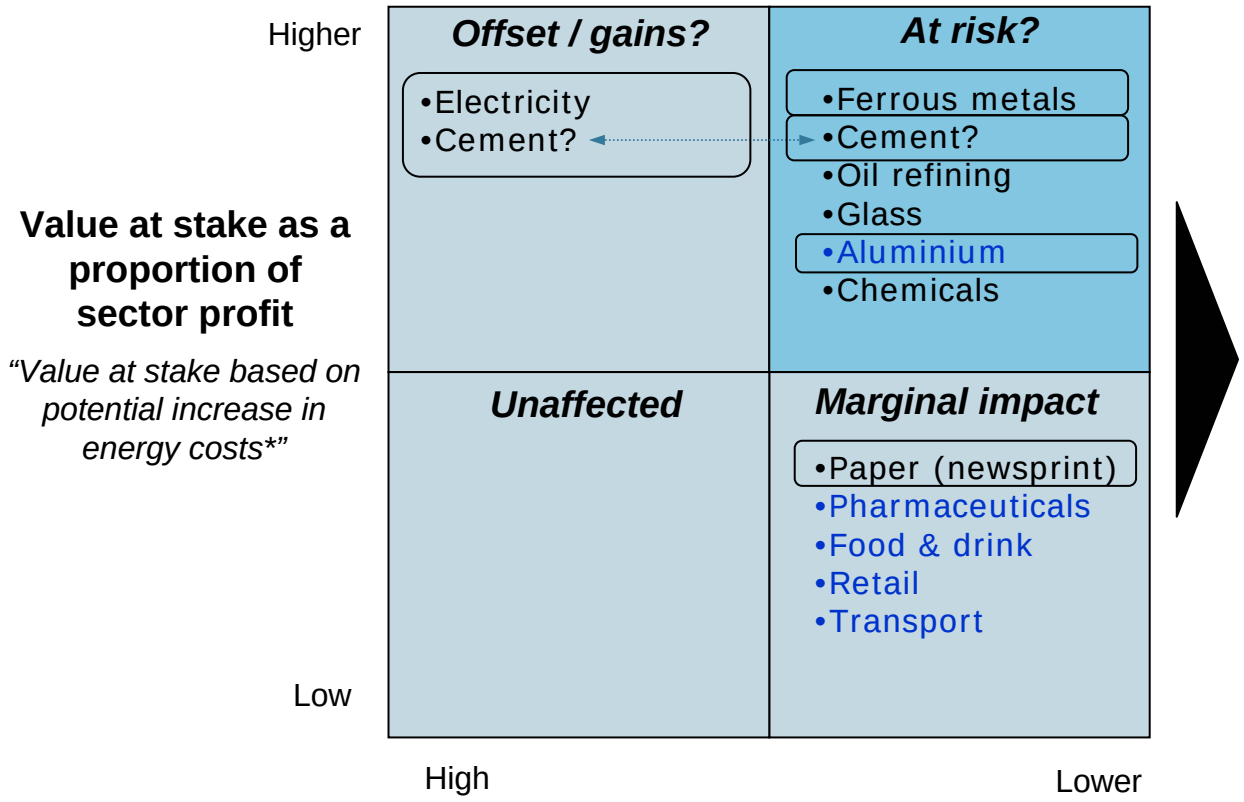
Results for the five focus sectors

- Electricity
- Cement
- Paper
- Aluminium
- Steel
- Each analysed according to appropriate market scale (UK / EU)

A broader quantitative look at competitive-ness issues

- Indices of net value at stake and exposure
- EU vs non-EU trade
- Sensitivity to allocations

Carbon Trust Competitiveness study identified *value at stake* and *cost pass through* as key issues- the study examines a mix of sectors in depth



•EU ETS sectors
•Non- EU ETS sectors

Sectors analysed

5 sectors selected for detailed analysis, illustrating range of possible effects

1. **Electricity**
2. **Cement**
3. **Paper**
4. **Steel**
5. **Aluminium**

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Note: *e.g. cost increase driven by uplift in electricity price and need to purchase allowances

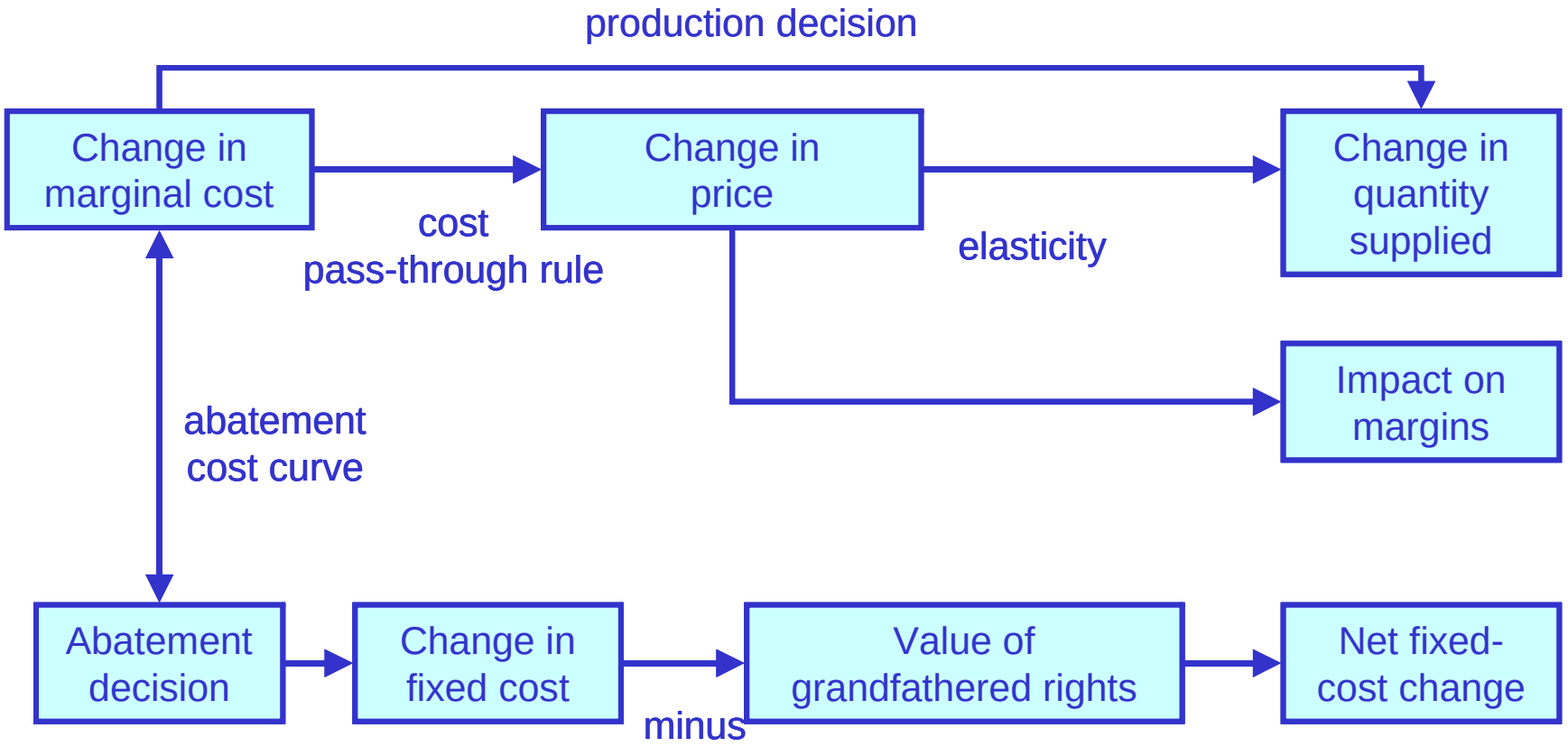
Previous studies had not examined the price pass-through issue seriously

- Most studies and claims have been based (implicitly or explicitly) on combination of
  - 100% price pass through for electricity producers
  - 0% price pass through for electricity consuming sectors

- This extreme combination maximises perceived adverse impacts on energy consuming industries

- Reality will be more complex; so is modeling it!

Structure of modeling analysis



All analysis is for a ‘typical firm’.

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Cournot Modelling Summary

- Market structure determined by the ratio of fixed and operating costs, demand elasticities, and degree of foreign competition
- Limited number of firms, seeking to maximise operating profits to cover fixed costs and to generate surplus
- Simplified model assumes all firms 'typical' of the sector average, and market is homogenous
- Model represents 'geographical market' in question – UK for electricity and cement, Europe for paper and aluminium
- Degree of price pass-through is determined by firm profit-maximising behaviour, *not* as an a-priori assumption
- Model allows firm entry and exit (though in cases we study this only happens for Aluminium)
- Results are reported for the *aggregate sector* not individual firms

With data obtained and single parameter adjustment, the model adequately mimics current observed market outcomes I.e. price, quantities and number of firms

Cost Pass-through Rule for simplified Cournot modeling with linear elasticity

Proportion of cost increase passed through, $P = x/(n + 1)$

- x is the number of companies affected by the cost change
- n is the total number of companies operating in the market

For example, for a monopolist, $x = 1$, $n = 1$, $P = 50\%$

For 10 players, 8 in the EU, $x = 8$, $n = 10$, $P = 73\%$

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Scenarios

Phase	Allowance price (€ / tCO_2)	Allowance allocation as a proportion of projected emissions (%)
1 (2005–07)	5	100 (98.8 electricity)
2 (2008–12)	10	100 (71.7 electricity)
3 (2012 onwards)	25	70

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Quantitative results for focus sectors - electricity

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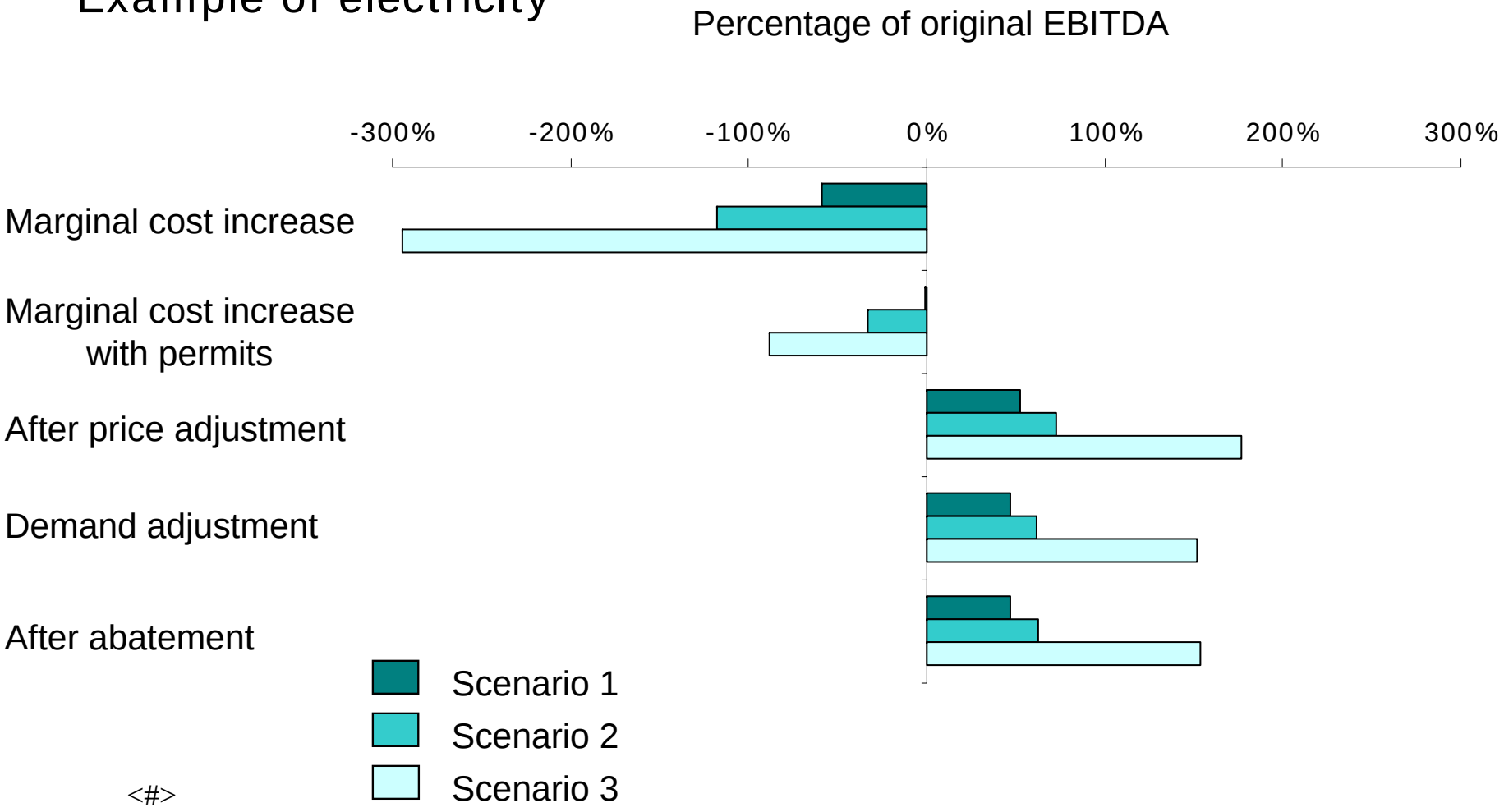
Impact on a sector, defined in terms of impact on earnings before interest, tax & depreciation (EBITDA) can be 'built up' in terms of five *analytic* stages

Example of electricity



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Electricity: even with large allocation cutbacks, sector can gain if it can pass through > 30% marginal cost increase

	Increase in marginal production cost, %	Cost pass-through required to maintain sector operating profits: Proportion of increase in marginal cost passed through to prices, %	Cost pass-through required to maintain sector operating profits: Increase in wholesale electricity price, %
Phase 1 €5/tCO_2	12%	0.9%	0.1%
Phase 2 €10/tCO_2	23%	28.9%	4.9%
Long term €25/tCO_2	58%	25.3%	10.6%

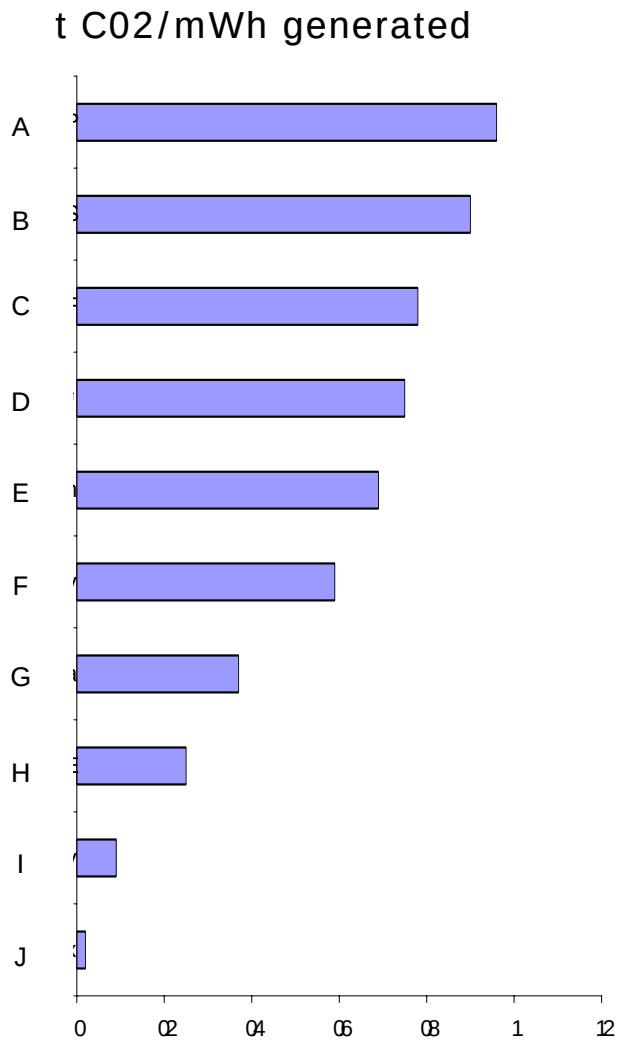
Minimal value at stake in phase 1 as allocation is close to total cost uplift;
required cost pass through in phase 2 & long term scenarios increase as c. 30% allocation cut back

Profit-maximising pass through predicted by market modeling: c.90%

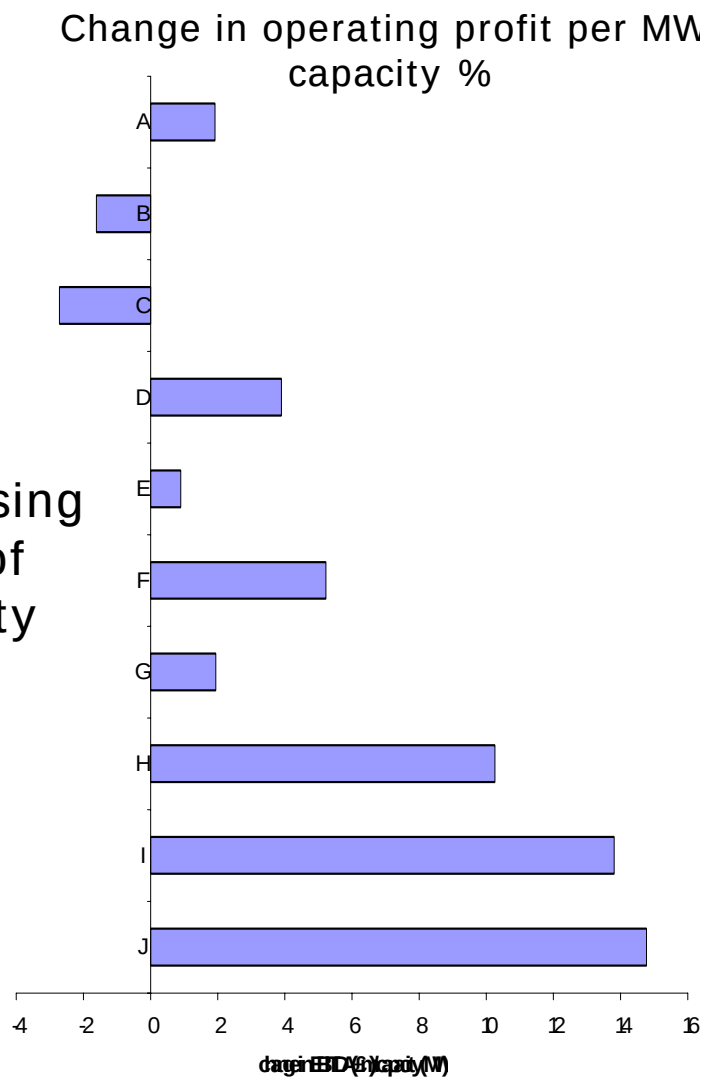
… but individual company impact is diverse and depends upon carbon intensity

[Oxera sector model, Central (Phase II) scenario, 90% pass-through]

UK generators



Coal increasing as % of capacity



Source: Oxera modelling

Six key questions for electricity sector real-world cost pass-through

- How far do companies really just seek short-term profit maximisation, as opposed to eg. market-building?
- How does diversity of power company carbon intensity affect cost pass-through?
- How much may transitional and political considerations constrain cost pass-through?
- How does 'new entrant' reserve constrain cost pass-through? In theory? In reality (uncertainty and timelag in new entrant investments)?
- To extent that power companies profit from trading, how quickly might new entrants compete away the margins?
- What is the influence of future allocation expectations on power system optimisation and emissions (Neuhoff et al., 2005)

A brief look at other sectors

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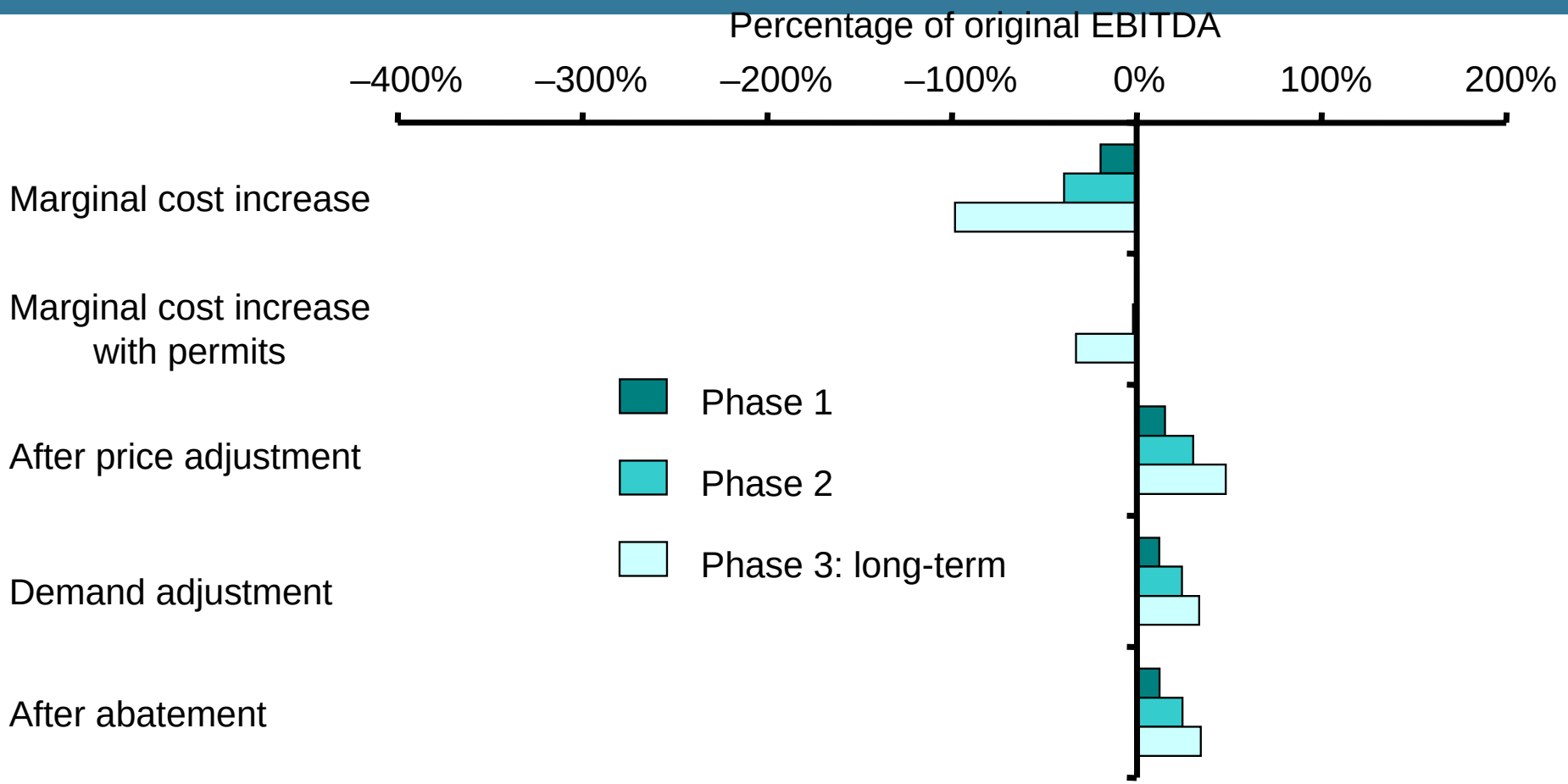
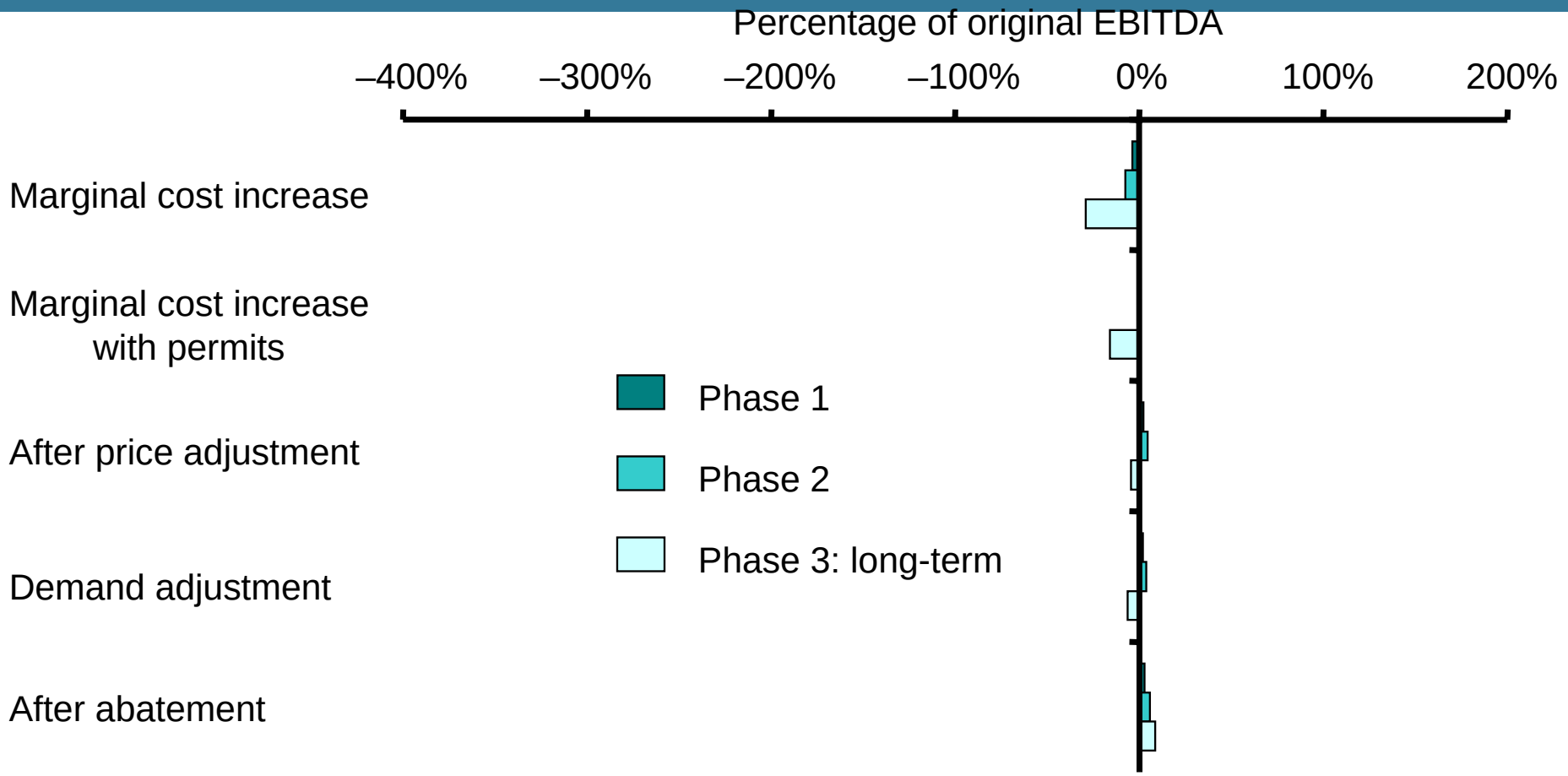
Cement



Source: OXERA.

Newsprint



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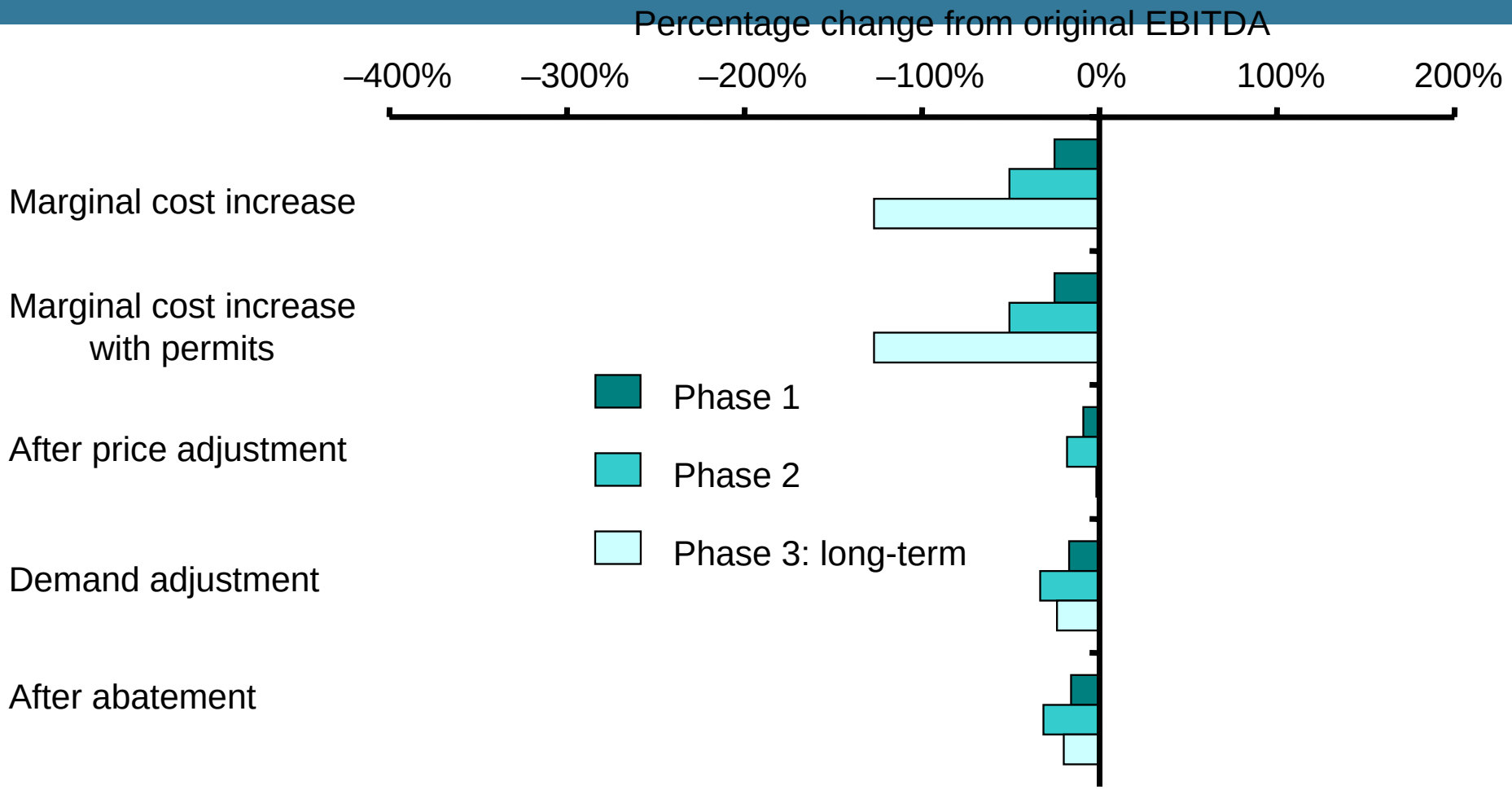
Source: OXERA.

Aluminium



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Source: OXERA.

Cold-rolled steel: sector will struggle to maintain current level of profits in long term scenario

	Increase in marginal production cost, %	Cost pass-through required to maintain sector profits (EBITDA)	
		Proportion of increase in marginal cost passed through to prices, %	Increase in price of cold-rolled steel, %
Scenario 1 €5/tCO_2	3.2%	33.0%	0.8%
Scenario 2 €10/tCO_2	6.3%	31.6%	1.5%
Scenario 3 €25/tCO_2	15.9%	63.3%	7.0%

Profit-maximising pass through predicted by market modeling: c.66%

Allocation changes do not feed through to other sectors and results not too sensitive to allocation:

Relative change in operating profit with optimal price pass-through

Phase II NAP extrap-olation

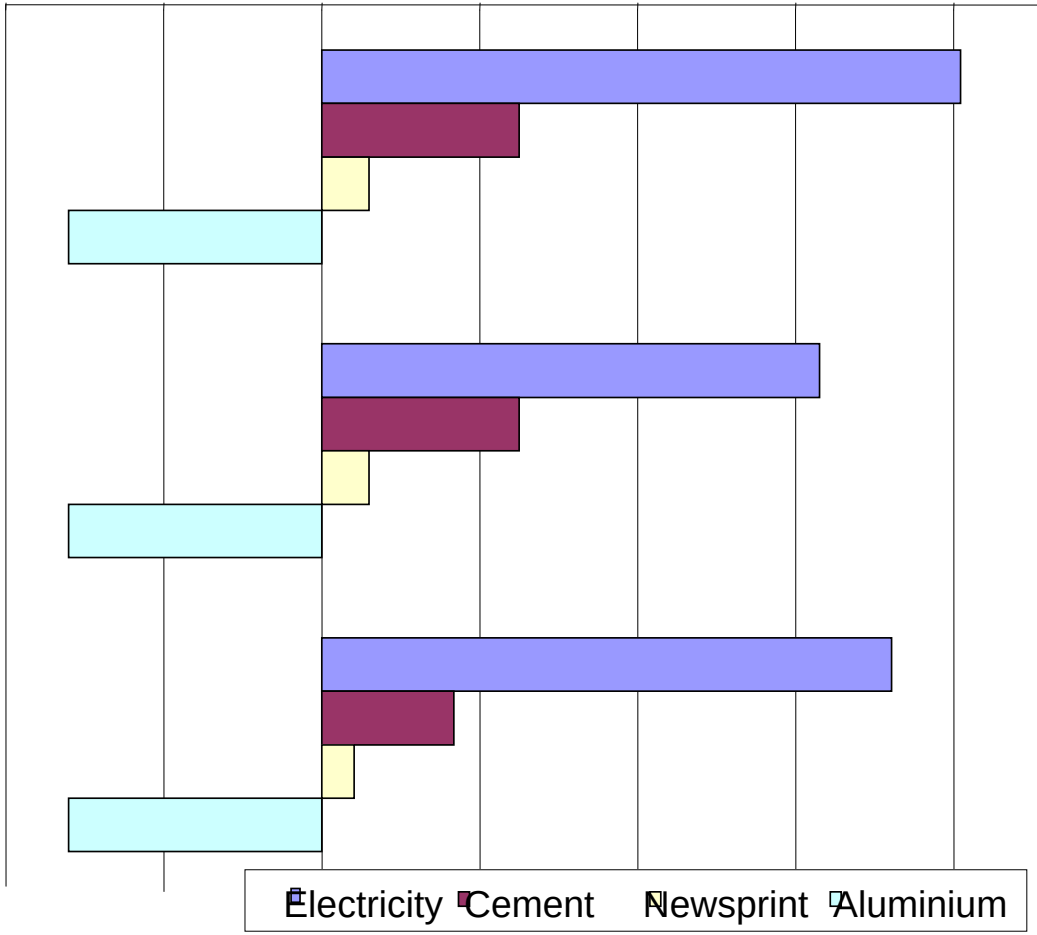
- Electricity allocation* 3.8% below projection
- Other sector allocation* equal to projection / CCA+

Phase II 20% UK, electricity leads cutback

- Electricity allocation* 28.8% below projection
- Other sectors allocation* equal to projection / CCA+

Phase II 20% UK, even allocation

- Electricity and other sectors allocation* 21.2% below projection / CCA+



* Allocation = allowances granted freely, additional emissions to be covered by auctioning or trading

CCA+ = revised climate change agreement targets

Source: Oxera modelling

A wider view on competitiveness issues

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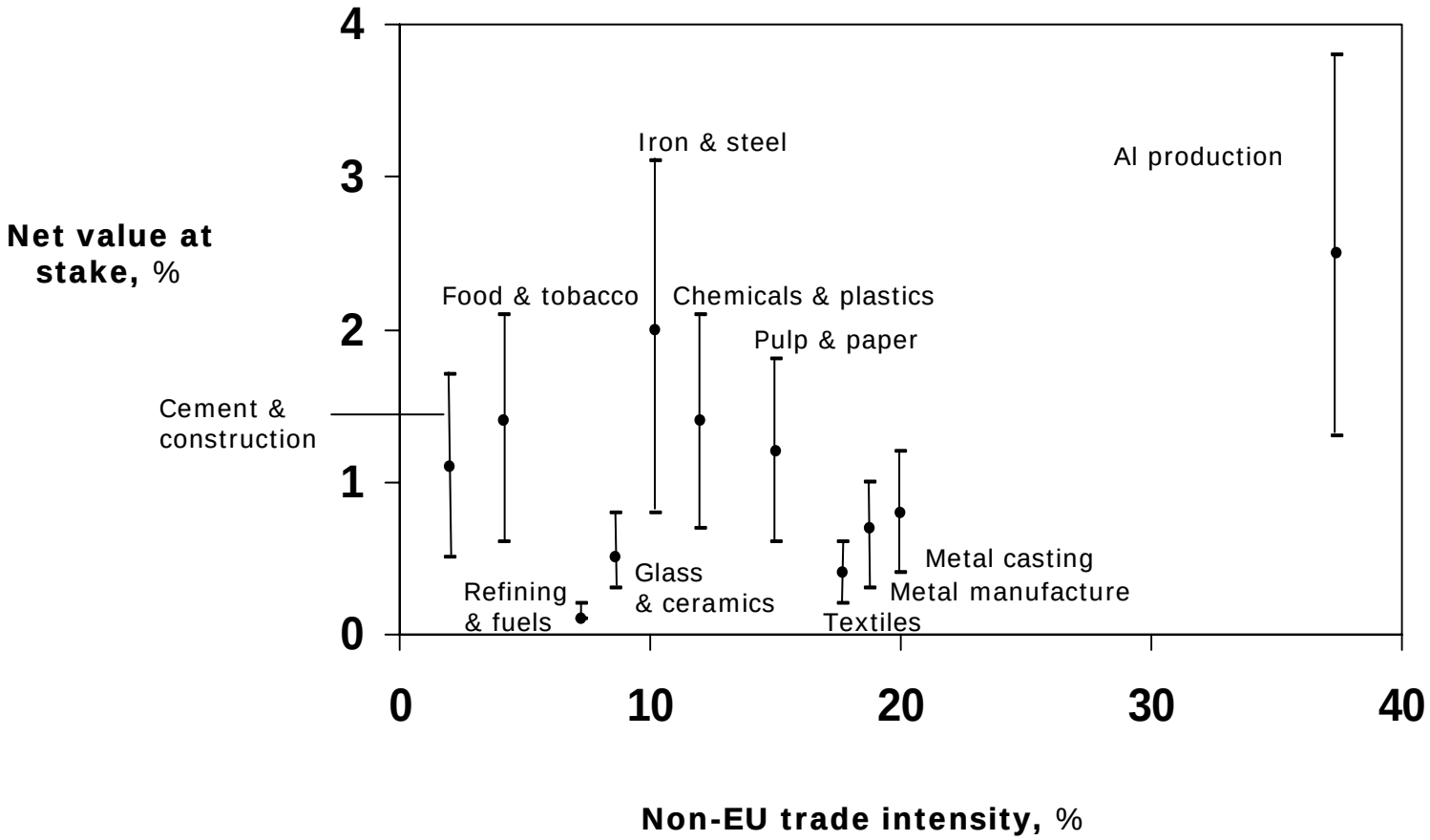
Power sector pass-through uncertainties dominate but for many industries, ETS unlikely to have significant adverse impact: *Al uniquely exposed (if it buys from grid)*



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Price impacts of EU ETS (with 60% cost pass-through in energy industries)

	% increase in final price, at carbon price €10/tCO2	
	Large industry	Domestic consumer
Electricity	10%	4%
Fuel oil	0.85%	0.56%
Petrol and diesel		0.1%
Natural gas	0.2%	0.1%
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Conclusions: EU ETS competitiveness implications

Not adverse impacts for most sectors, some profit

- Electricity not only sector likely to gain
- For others, value of free allocations in ELC principles, plus some cost pass-through, can outweigh cost increases except for sectors and firms that are both *electricity-intensive* and *internationally exposed*
- Firms can increase profits at margin through abatement action and lobbying on allocation, but cost pass-through is biggest determinant

Cost pass-through is a key and complex issue

- For some sectors (eg. cement), model results show profits whereas industry fears loss - inconsistencies need to be explored further
- Previous studies have used extreme combination of assumptions, but modeling also very simplified: reality may lie between the two

Transition issues need to be considered

- Market prices and targets uncertain and pass-through may take time
- Elec companies could defer operating profits strategically to increase market share –reducing impact on elec consuming sectors
- Potential operating profits may also be tapped to fund investment including emissions abatement

Impact mitigation possible for the few, highly exposed sectors

- The most exposed sectors can be affected *whether or not in the EU ETS* (through electricity price effects)
- These are sectors with high concentration – often only one or two firms
- Aluminium smelting probably most exposed – self generation a key?
- Potential impact will increase as price rises and special elec contracts expire
- Phase I and probably Kyoto period impacts appear manageable, later phases may raise more complex mitigation and protection issues

$$Q = \sum_{i=1}^{N} q_i$$

$$P(Q) = a - bQ$$

$$C_i = c_i q_i + F_i$$

$$P(Q) - c_i - bq_i = 0$$

$$NP(Q) - bQ = \sum_{i=1}^{N} c_i$$

$$P(Q) - bQ/N = \bar{c}, \text{ where } \bar{c} = \left(\sum_{i=1}^{N} c_i\right)/N$$

$$Q = \frac{\frac{N}{N+1}(a - \bar{c})}{b}$$

$$P = \frac{1}{N+1}a + \frac{N}{N+1}\bar{c}$$

$$q_i = \frac{\frac{a + \sum_{i=1}^{N} c_i}{n+1} - c_i}{b}$$

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