EU ETS AND SECTORAL COMPETITIVENESS:
A REVIEW OF RECENT DEVELOPMENTS

Neil Walker
University College Dublin

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Department of Planning and Environmental Policy
University College Dublin
www.ucd.ie/pepweb
ABSTRACT

The main argument to support generous permit allocations to firms covered by ETS is the threat of competition from installations that are not capped by Kyoto, e.g. firms in the US and China. Under the aegis of the Lisbon process, making the EU a leading, innovation-led competitor in the global economy is a key Community objective. Reconciling the need to compete globally with the need to meet a Kyoto target poses a certain policy tension that emissions trading is designed to alleviate.

The free allocation of allowances created incentives for participants in the process that makes it difficult to disentangle what is substantive from what is the product of gaming behaviour. In this context, it is important to review and assess the models that have been designed and implemented to shed light on the insights and implications of emissions trading.

A review of research published in the last 18 months has identified a number of relevant studies in the areas of computable general equilibrium modelling, the analysis of electricity markets, and the estimation of profit impact assuming oligopoly competition. These are discussed in the context of continuing debate over the economic effects of the EU Emissions Trading Scheme.

Keywords: EU Emissions Trading Scheme, competitiveness effects

Correspondence to: Neil Walker, Department of Planning and Environmental Policy, University College Dublin, Richview, Clonskeagh, Dublin 14.
Telephone +353 87 969 0678.
Email: nwalker@ucd.ie

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1. INTRODUCTION AND OBJECTIVES.

Once the decision was made to provide free allowances to installations participating in the European Union Emissions Trading Scheme (EU ETS), a strong incentive was created on the part of the firms affected to lobby for a generous allocation. And their industry associations at national and European level had a strong incentive to maximise the size of the envelope of total allowances allocated to the trading sectors. The bigger the total envelope, the lower would be the equilibrium price per tonne. The bigger the allotment going to individual installations and the companies that own them, the less likely that such firms would see a fall in profits. Indeed, if the allocation were sufficiently generous relative to their options to abate or switch, participants might even see some profit gain. The incentives were different for those sectors not included in the trading scheme. Given that each Member State has a fixed total cap on emissions, and most of the EU15 envisage exceeding their national caps under ‘business as usual’, allocation gains by the trading sectors within a fixed overall envelope have implications for those not in the scheme, and efficiency and equity implications for the economy.

A key feature of the case-making from all quarters has been a preoccupation with international competitiveness in all its forms. Various measures of competitiveness have previously been discussed by Jenkins (1998), Klepper & Peterson (2003) and the OECD (2003).

Depending on the context, the word can be taken to mean quite different things. For example, the European Commission (2004) regards competitiveness as ‘a sustained rise in the standards of living of a nation, and as low a level of involuntary unemployment as possible’. The same publication defines competitiveness at the industry sector level as ‘the ability of an industrial sector to defend and/or gain market share in open international markets by relying on price and/or the quality of goods’, which is therefore related to the concept of Revealed Comparative Advantage (RCA). It may also be appropriate to consider competitive advantage at the level of individual firms, for whom the key measure is sustained profitability.

Shortly after the EU’s pilot Emission Trading Scheme came into effect on 1st January 2005, Carbon Market Europe magazine reported:

- that there were doubts as to whether the proposed level of free allowances in Poland’s National Allocation Plan would be approved by the European Commission;
- that several Member States had not yet submitted NAP’s for approval;
- that the UK Government was attempting to revise and obtain re-approval of its NAP in order to issue circa 20 million additional allowances; and

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that German energy utilities had gone public in their campaign to have the NAP revised upwards in their favour (an initiative which was evidently supported by the Economy Minister)

A few months previously, the same publication also noted the Irish Government’s decision not to proceed with a carbon tax applicable to the non-Traded sector. This policy measure, which had been signalled in the previous year’s budget, was supposed to be a key element in its National Climate Change Strategy. Although there was strong criticism in the media, and also from opposition parties, the announcement was welcomed by Ireland’s UNICE affiliate IBEC, which had consistently and vehemently argued against the tax.

Although the dust may finally be settling on the 2005-07 Pilot Scheme, plenty of further lobbying can be expected on the 2008-12 EU ETS itself, not to mention any new arrangements post-2012.

In a context where gaming at national, sector and firm level are pervasive, a number of efforts have been made to model or anticipate the effects of EU ETS on costs and thereby competitiveness at national and sector level. It is therefore important to understand key assumptions, design features and findings.

The remainder of this paper is organised as follows.

Section 2 identifies current research themes in respect of the impact of EU ETS on competitiveness, critically compares the different methods and models being used, and discusses the key findings in the context of previous research. Section 3 then assess the prospects for addressing outstanding discrepancies and certain points of disagreement. Finally Section 4 presents a preliminary template for advancing the intellectual frontier in the area.
2. A SELECTIVE REVIEW OF RECENTLY PUBLISHED RESEARCH.

A number of previous literature reviews have touched on the competitiveness issues which arise from climate change policy in the EU and elsewhere. The current review complements these by concentrating on research published during 2004. Appendix 1 gives a tabular summary of the various models discussed below.

2.1 Equilibrium Modelling.

A economic consultancy study by COWI (2004) was commissioned by Denmark’s UNICE affiliate in order to further the debate on environmental policy in the context of the EU’s Lisbon strategy.

COWI’s proprietary GTAP-ECAT computable general equilibrium model is configured to analyse emissions trading, using the GTAP\textsuperscript{2} dataset, with GTAP-EG\textsuperscript{3} energy substitution formulae.

It assumes perfect competition and constant returns to scale, so the differential economic burden on firms is not modelled. Rather, the calculated costs represent losses arising from structural changes in RCA which impact on the rate of GDP growth and sectoral trade patterns.

Two different rates of technological adaptation are modelled. The base case scenario reflects long lead times for replacing emissions-intensive generation plant, and hence substantial substitution costs. The results suggest an overall loss in production output of circa 0.5%, equivalent to Euro 52 Billion. Mainly due to income effects, the energy intensive sectors suffer a 4% reduction in non-EU exports.

The report’s findings are based on assumptions about a slow initial uptake of JI/CDM projects, and EU restrictions on purchases of ‘hot air’ from EU-10 Accession States. The emissions gap also depends on a hypothetical business-as-usual (BAU) baseline which assumes no climate policies enacted since 1997.

Subject to these caveats, UNICE (2004) makes reference to COWI’s findings in a recent submission to the European Commission. It argues that EU competitiveness is significantly damaged, primarily because of the unilateral nature of climate policies as currently designed.

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\textsuperscript{2} The Global Trade Analysis Project, administered by the Center for Global Trade Analysis, Purdue University, West Lafayette Indiana, USA. The economic data is provided (and used) by a network of researchers and policy makers conducting quantitative analysis of international policy issues. \hfill http://www.gtap.agecon.purdue.edu/

\textsuperscript{3} Rutherford, T F and Paltsev, SV, GTAP in GAMS and GTAP-EG. Global Datasets for economic research and illustrative models, Working Paper, University of Colorado \hfill http://debreu.colorado.edu/papers/gtaptex.html
A paper by Klepper and Peterson (2004) examines the range of likely National Allocation Plans, using Kiel's DART model. Two scenarios for allocation method, and two scenarios for hot air purchases are modelled. The model ignores JI/CDM flexibility mechanisms, and does not allow for inter-temporal banking, both of which would otherwise tend to reduce permit prices. Like the COWI study, it is based on the 1997 GTAP dataset, and assumes an efficient sharing of burden between the Traded and non-Traded sectors. In contrast to COWI's model, however, the BAU case includes various domestic climate policies enacted up to 2001.

The permit price in the 2012 central scenario, assuming that the EU-10 Accession States will be significant net exporters of permits, is Euro\textsubscript{2000} 11/Te. The price falls to Euro\textsubscript{2000} 7/Te if purchases of ‘hot air’ are also allowed. These estimates are somewhat lower than some of the market prices observed during the first year of the pilot emissions trading scheme, but this does not invalidate Klepper and Peterson’s results, which suggest that any competitiveness effects from ETS will be small. Total output in EU-15 states is reduced by just 0.3%, and a similar figure applies to those energy-intensive sectors covered by EU ETS, although local variations are noted. However, the adverse impact on energy intensive sectors not covered by ETS is circa 2.0%, indicating that such sectors might be better off outside the Scheme.

The estimates of welfare cost in the central scenario are 0.9%, although this figure rises sharply if the split between Traded and non-Traded sectors is not optimal. It is interesting to note that the EU Accession states, despite being expected net sellers of permits, actually suffer a small welfare loss as a result of ETS, partly because of the exposure of their energy intensive industries such as iron and steel, and partly due to indirect effects such as higher energy costs in the non-traded sector.

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A recent modelling study by Quirion and Hourcade (2004) suggests that the competitiveness impact of emissions permit purchases is likely to be small in comparison to the corresponding effect of, say, a 10% movement in exchange rates. This point seems highly topical in view of the sharp US$ depreciation experienced throughout 2004. The paper also includes a useful discussion of the difficulties in selecting appropriate elasticities, noting the wide gap between econometric estimates and the figures used in some studies.

Some of its conclusions about the power sector are based on an assumption of low openness to international trade. Although this is broadly correct where non-EU competition is considered, it may be less accurate in describing intra-EU trade.

\textsuperscript{4} However, a subsequent analysis by Peterson and Klepper (2005) does assess the role and implications of CDM and JI for EU ETS.
In this regard, Ilex (2004) makes the assertion that French wholesale prices closely correlate with those in Germany.

Similar effects can be seen in the Irish gas market, which is wholly determined by UK NBP market prices. Although electricity prices as yet show no such linkage, this situation might change with the construction of a proposed 1000MW interconnector to Britain in 2009. Such a quantum of transmission capacity, if added to existing capacity from Northern Ireland, would enable over 20% of the Republic's winter power requirement to be imported.

In this regard, the energy regulators in the Republic and Northern Ireland initiated a joint review during 2004 with the explicit objective of creating an all-island electricity market. The key issues identified included possible harmonisation of the treatment of emissions allocations to generators, and consistent treatment of CHP incentives, so as to avoid the creation of a 'necklace' of investments on one or other side of the border.

2.2 Electricity Market Pricing Models

Because of the commercial and regulatory interest in power price forecasts, a number of European consultancy firms have developed proprietary models of national power markets across the EU. Such models generally reflect closely the actual generation and transmission cost structure, dispatch patterns, and market structure.

A recent report by Ilex (2004) examines the impact of traded 2005/2006 permit prices on the forward price of electricity in those years. It finds no firm evidence that the forward curves in Germany, UK, Scandinavia Netherlands or France are reflective of CO$_2$ permit costs. However, it points out that the carbon market remained very illiquid during 2003-4.

The same study makes predictions about the impact on wholesale prices in each country arising from the pass through of an assumed €10/Te permit price. As might be expected, the largest impacts are in Germany, where the marginal generating plant (coal) is relatively emissions intensive.

It also makes informed guesses about the extent to which wholesale prices will be passed through to retail customers. Ilex identifies several factors which might cause this pass-through to be as high as 100% or as low as 2.5%.

- a vertically integrated incumbent may make a strategic decision to absorb opportunity costs in order to maintain its dominant market share and hence to preserve its retail trading margins.

- the stringency of NAP’s, the treatment of plant closures and the level of new entrant reserve are felt to be relevant, along with the implied production subsidy associated with any periodic re-basing of emissions allocations.
However, on balance Ilex takes the view that the level of windfall profits captured by generators will depend mainly on regulatory or political intervention. For example, Ireland’s Commission for Energy Regulation briefly considered imposing a Levy and Revenue Recycling scheme on ESB whereby wholesale power prices would reflect 100% pass through, but retail power prices would only factor in the cash cost of actual permit purchases. The extreme reluctance of ESB to accede to this proposal reflected the company’s strategic objective of maintaining the competitiveness of its ageing portfolio of coal-fired generation plant.

Karmali (2004) reports that ICF Consulting’s proprietary Integrated Power Model has been used to relate the impact of CO\textsubscript{2} permit prices on competition within the generation sector across Europe. It finds that the impacts depend on the treatment of plant closures and new entrant reserves. The main losers are expected to be mid-merit coal- and oil-fired generation plants, as well as certain industry sectors such as metals and chemicals. The competitive impact on other energy-intensive sectors such as paper, cement, lime, bricks, glass and ceramics is found to be less significant.

2.3 Modelling of Sectoral Costs and Potential for Price Pass-through

The UK’s Carbon Trust (2004) has published a summary of the conclusions of a study it had commissioned into the impact of EU ETS on competitiveness of UK firms. The consultant’s detailed report (Oxera, 2004) has also been published. The underlying theoretical model assumes oligopoly behaviour in each of the sectors, consistent with capital-intensive markets with a small number of players who compete on quantity. The report notes empirical evidence that competition is often on price rather than quantity but it cites prior research suggesting that this does not invalidate the results.

The level of marginal cost pass-through to customers is assumed to be a function of (i) the degree of non-EU competition, (ii) the number of domestic competitors in the relevant market (the geographic size of which is sector specific) and (iii) the product’s own-price elasticity of demand. Oxera suggests that the first of these factors is likely to be dominant.

The model assumes that, prior to EU ETS, there were a number of identical domestic players, and calculates whether the imposition of EU ETS costs would reduce the economic profit to the point where one or more firms would eventually exit. The percentage cost pass through is calculated from a formula involving the number of domestic players, and the level of non-EU imports. For example, the GB power market, modelled as having 9 players, with 80% cost pass through, is expected to make windfall profits.

Three combinations of permit price and allocation shortfall are examined. These notionally correspond to the pilot phase 2005-07, the first full trading period 2008-12, and a relatively tough post-Kyoto regime. The level of
competitive risk (‘net value at stake’) for each sector is presented as a scatter-diagram, one axis being the perceived exposure to direct and indirect cost increases, and the other axis being the sector’s ability to pass these costs on to customers.

Overall, the study concludes that no sector, apart from aluminium smelting, is seriously at risk, and that several sectors could actually be better off as a result of emissions trading. Dissenting comments from some industry representatives were, however, included in the discussion.

Oxera has cross-checked the predictions about electricity prices against its own proprietary power market model. It finds broad agreement about the aggregate outcome, but acknowledges that the firms are far from identical, due to different portfolios of generation type. In reality there will be both winners and losers.

Results for the cement sector are somewhat more ambiguous. The risk of imports into the UK is believed to limited by relatively high road freight cost, although the report does acknowledge that one other country (Spain) does have higher import penetration, and that UK market prices may be capped by the CIF price of seafreight imports. It concludes that the sector will be better off, or at least no worse off, due to emissions trading up to 2012.

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Reinaud et al (2004) have undertaken analysis to inform the debate among industrialists as to how much the direct and indirect costs of EU ETS will affect their competitiveness against non-EU rivals. Cost estimates have been derived from a variety of data sources, including industry. The focus is on three energy-intensive sectors covered by ETS (steel, paper and cement) as well as one which is not so covered (aluminium). Loss of competitiveness is measured in terms of lost output, whether from reduced domestic demand or increased non-EU imports. Price pass-through and carbon leakage are considered as functions of demand elasticity, market concentration, and international exposure.

The study examines the direct sectoral cost impact of a €10/te permit price, assuming 2% and 10% shortfalls between the requirement and the free allocation, as well as the indirect cost impact, assuming partial and 100% pass though of marginal costs into power prices. It also considers the impact on profit margins in the case where, due to the nature of competition, marginal costs cannot be fully passed through into prices.

It concludes that for a €20/Te permit price with generous free allocation, the carbon costs for sectors other than aluminium are generally outweighed by freight differentials when considering competition from non-EU imports. Nevertheless, it briefly considers various policy options for limiting the potential adverse effects of indirect (electricity price) costs. These include windfall levies, border taxes, and benchmarking. The first two options could involve practical or legal difficulties.
A follow-up report by Reinaud et al (2005) using the same methodology and assumptions as that described the 2004 study concluded that electricity was the only energy-intensive sector likely to pass on the all or part of the opportunity cost of grandfathered permits, because of its relatively low exposure to competition from outside the EU. However, it acknowledged the lack of empirical research into the actual rate of pass-through of such costs in different industry sectors.

The benchmarking approach suggested by Reinaud implies some form of output-based permit allocations (OBA). The advantages and disadvantages of OBA have previously been analysed by Böhringer and Lange (2004) for the EU ETS, and by Haites (2003) for a proposed scheme in Canada. More recently, Kuik and Gerlach (2005) have concluded that OBA does protect exposed sectors but that this may be achieved at the expense of overall economic welfare due to the implied production subsidy. Fischer and Fox (2005) have suggested that OBA may be preferable to grandfathering in a ‘second best’ world because it can offset the impact of other distortionary tax policies that would otherwise discourage production.
3. AREAS OF UNCERTAINTY

COWI’s report points out that its cost estimates are up to eight times higher than previous estimates from partial equilibrium analysis (eg. using Poles and Primes) undertaken by the EU Commission. However, this is not particularly surprising, given that GE models effectively capture opportunity costs, whereas PE models only attempt to measure direct costs.

Perhaps more significant is that COWI’s overall conclusions about competitiveness seem to be somewhat at variance with other recent CGE studies, for example Quirion & Hourcade (2004), and Klepper and Peterson, (2004). Indeed, it might also be argued that they run counter to the broad conclusions of several earlier literature surveys by Baron (2004), Convery et al (2004), Zhang and Baranzini (2004), Klepper & Peterson (2003), and Barker and Johnstone (1998).

Any meaningful comparison between models would need to use:
• a consistent baseline year
• a similar range of policies whose effects are measured
• similar growth scenarios.

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During the run-up to ETS being adopted, various industry groups lobbied successfully for a low level of auctioning. It has been argued by Fitzgerald (2004) and by others, that the equilibrium impact of emissions trading would be reduced if there was 100% auctioning and revenue recycling to offset distortionary labour taxes. If such an auction-based allocation policy had been adopted, it would probably have reduced the profits of firms engaged in emissions trading, while also mitigating the adverse GDP/welfare effects which concern UNICE. As suggested in Appendix 2, this may reflect a policy trade-off between the alternative measures of competitiveness derived from partial and general equilibrium analyses. However, it should be noted that Fischer and Fox (2005) have suggested that auctioning would not necessarily result in greater economic efficiency than other forms of allocation.

UNICE’s concern about the unilateral nature of climate policy begs the question of how the outcome of COWI’s modelling study would have been affected by a hypothetical US decision to ratify some variant of the Kyoto Protocol. The beneficial impact of a similar hypothetical scenario was previously considered in an earlier paper by Peterson (2003).
4. SUGGESTED FRAMEWORK FOR FURTHER RESEARCH

An interesting feature of some of the models assessed is the assumption that ‘do nothing’ is an option for the sectors involved, i.e. impacts of emissions trading are being estimated compared with the status quo. But this does not reflect the reality of policy choices.

It was to be expected that discrepancies would arise between some of the modelling predictions, and the views of industrialists interviewed. Similar comments from Irish businesses were reported by Indecon (2004) in respect of the perceived major impact of non-EU competition. Indeed, the concerns seemed to be extremely high even in those sectors characterised by high transport costs and low levels of export trade. The point being stressed was that even small volumes of imports can limit domestic prices at the margin. Depending on the transparency of market prices, such assertions may or may not be capable of independent verification.

A significant proportion of the income effect observed in CGE modelling is the result of electricity prices, so it would be helpful to assess the accuracy (or otherwise) of the 100% pass through of permit costs implied by perfect competition and constant returns to scale. A combination of Oxera’s theoretical approach, and Ilex’s qualitative approach would be appropriate.

Now that the pilot trading scheme is actually under way, it ought to be somewhat easier to make empirical assessments of the actual profit impact and revealed comparative advantage of energy-intensive firms. Commercial confidentiality, and the objectivity of data are likely to remain thorny issues. Also, firms will be cognisant of the fact that the process of making a new round of allocations for 2008-12 will commence in 2006. Their behaviour during 2005-06 may well be influenced by the degree to which they believe it might influence the eventual outcome of this new round. Nevertheless, an ongoing process of regular structured communication with a panel of industry representatives and regulatory authorities might allow researchers to make reasonable confident assessments of the medium term trade impacts. It could also prove to be a useful barometer of changes in industry’s attitude toward the scheme.

Econometric analysis of accounts and trade statistics would be one possible way of complementing the qualitative information provided by firms, although the relevant data would be subject to considerable time-lag.

A comparative review of the various CGE based studies, as outlined in the preceding section, may also be worth undertaking although it could well prove to be a lengthy and complex task without the co-operation of the parties directly concerned.
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## Appendix 1. Summary of Studies Reviewed

<table>
<thead>
<tr>
<th>Author/client</th>
<th>Model type</th>
<th>Key Assumptions</th>
<th>Scope</th>
<th>Findings</th>
</tr>
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<tbody>
<tr>
<td>COWI / UNICE</td>
<td>Static CGE featuring perfect competition and constant returns to scale</td>
<td>Business as usual case excludes all EU climate measures since 1997 Permit price up to €26/Te</td>
<td>Investigates the welfare RCA impacts of different rates of technological adaptation</td>
<td>Welfare is reduced Energy intensive sectors lose competitiveness as measured by exports</td>
</tr>
<tr>
<td>Klepper &amp; Peterson</td>
<td>Dynamic CGE</td>
<td>BAU excludes policy measures since 2001 Permit price €7-11/Te</td>
<td>Investigates the impact of different allocation methods and the treatment of hot air</td>
<td>Welfare is reduced, but sectoral competitiveness is only slightly affected</td>
</tr>
<tr>
<td>Quirion &amp; Hourcade</td>
<td>Partial equilibrium analysis of 12 industry sectors</td>
<td>GTAP 2001 dataset, three different sets of elasticities. €20/Te permit price</td>
<td>Estimates direct losses from unilateral implementation of EU ETS</td>
<td>Even for ‘worst case’ assumptions, the cost impact is far less than that of a 10% change in exchange rate</td>
</tr>
<tr>
<td>Ilex Consulting / UK Department of Trade and Industry</td>
<td>Proprietary software for multi-country analysis of power sector cost structures and generator dispatching</td>
<td>€10/Te permit price</td>
<td>Assesses, for several EU countries, the extent to which permit prices are factored into wholesale prices, and the likelihood of full pass through of the associated marginal cost.</td>
<td>No clear evidence from forward prices, probably due to illiquid market. Key issue for pass-through to retail prices is the regulatory regime rather than the market structure.</td>
</tr>
<tr>
<td>Oxera Consulting/ The Carbon Trust</td>
<td>Cournot oligopoly equilibrium for each of the industry sectors covered by EU ETS</td>
<td>Identical players facing the same permit costs and cost operating structures</td>
<td>Investigates the degree to which EU ETS will result in a loss in profits for UK industries</td>
<td>Energy sector expected to gain. Impact on most other industries in the traded sector is expected to be broadly neutral. Indirect adverse effects may arise in aluminium, which is not covered by ETS</td>
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<tr>
<td>Reinaud et al</td>
<td>Partial equilibrium analysis for steel, paper, cement and aluminium</td>
<td>Permit price €10-20/Te. Allocation shortfall of between 2% and 10%</td>
<td>Assesses the loss in output and level of carbon leakage under different cost-pass-through scenarios</td>
<td>Generally concludes that the impact of permit costs is outweighed by freight costs, but recognises the need to consider options for mitigation</td>
</tr>
</tbody>
</table>
Appendix 2. Indifference curves on the economic utility function?

The loss of welfare resulting from changes in comparative advantage is minimised when the abatement burden is shared efficiently between the sectors within ETS, and those not covered by emissions trading.

However, for reasons of political economy, the aggregate national allocations may be based on historic emissions rather than economic efficiency, in which case it is unlikely that Governments will achieve the optimal welfare impact.

Moreover, for any given level of aggregate allocation to the Traded sector, the welfare effect will vary as a function of the relative levels of grandfathering and auctioning. The optimal level probably depends on whether and how auction revenues can be recycled to reduce distortionary taxes. Member States have rather limited flexibility when setting the level of permit auctioning, but even allowing for such constraints, there is no guarantee that the best achievable welfare outcome will be chosen.

In the highly simplified model shown below, the vertical axis represents welfare costs of ETS (as estimated by general equilibrium models) while the horizontal axis represents only the direct cost of ETS (as measured by partial equilibrium models).

The concentric curves represent contours of constant utility to a hypothetical policy maker. For any given level of national abatement target, the ‘best’ policy mix lies at a point on the innermost indifference curve which is practically achievable. The shape of the indifference curve may vary between countries due to structural factors, and to political preferences.