

Preliminary Analysis of the Implementation of an EU-Wide Permit Trading Scheme on CO₂ Emissions Abatement Costs Results from the POLES model

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1. Introduction

The purpose of this preliminary analysis is to quantify the likely impact of the implementation of an EU-wide CO₂ permit market. Only relatively simple and aggregate exercise was undertaken. For example, it was not possible to deepen the analysis to cover energy intensive sectors in isolation with eventually alternative portions opting in and out. Thus, this analysis involves only aggregate CO₂ emissions at the “national” and EU-wide level although the POLES model² contains sufficient detail in order to carry out meaningful analyses involving such schemes.

Only six country/regions of the European Union are currently identified in the POLES model: Germany, France, Italy the UK, the Rest of EU South (Spain, Portugal and Greece) and the Rest of EU North (Austria, Belgium, Denmark, Finland, Ireland, Luxembourg, Netherlands, and Sweden). Treating the two latter as blocks has been equivalent to creating two multinational trading bubbles and directly contradicting the premise of the “no trading” exercise which has been used for making comparisons to evaluate the impact of EU-wide permit trading.

In addition, it is assumed that the equivalent of a full flexibility system already existed within each Member State. This is an important proposition. Thus, the results of this preliminary analysis are somewhat biased and tend to underestimate systematically the benefits (in terms of cost reductions) derived from the introduction of an EU-wide emission trading scheme. It should be noted that the POLES model uses a concept of a “representative firm” so it does not capture the differences among firms within a sector. In this sense the reader is invited to treat the results cautiously as “lower bounds” on such economic benefits. On the other hand, an EU-wide emissions trading is analytically assumed to be cost free. In reality, transaction costs would raise the cost of compliance to some extent.

The presentation of the results has been organised as follows. First, some recent trends in emission growth are presented in order to give some indication of “distances” from the Kyoto objectives. Then EU-wide permit trading is presented and compared to a no-trading scenario in order to assess potential cost changes arising from the introduction of the market.

¹ Directorate-General Joint Research Centre. Opinions expressed in this report do not necessarily reflect those of the European Commission.

² POLES world energy model was developed by the Centre National de la Recherche Scientifique – Institute d’Economie et de Politique de l’Energie (CNRS-IEPE) through the support of DG Research non-nuclear energy programme. Opinions expressed in this report do not necessarily reflect those of the European Commission.

2. Recent trends in emission growth

Table 1 gives an overview of the recent evolution of CO₂ emissions for the regions as they are defined for the purpose of the current exercise. It also indicates the Kyoto target as a percentage of 1990 emissions as well as the ratio of 1998 emissions to that target as a crude measure of the effort that must be undertaken in the years to come.

Table 1: Index of CO₂ emissions for the POLES EU regions, 1970-1998

| Index 1990=100 | 1980 | 1990 | 1995 | 1996 | 1997 | 1998 | Kyoto % | 1998/Target % |
|-------------------|------|------|------|------|------|------|---------|------------------|
| Germany | 112 | 100 | 82 | 85 | 84 | 85 | 79 | 108 |
| France | 133 | 100 | 100 | 103 | 101 | 108 | 100 | 108 |
| UK | 102 | 100 | 97 | 101 | 99 | 101 | 88 | 115 |
| Italy | 93 | 100 | 103 | 102 | 103 | 107 | 94 | 114 |
| Rest EU North | 109 | 100 | 108 | 116 | 116 | 119 | 94 | 127 |
| Rest EU South | 83 | 100 | 113 | 110 | 115 | 124 | 119 | 105 |

Source: ENERDATA.

Germany, has achieved major reductions to 1995 mostly through the restructuring of the brown coal based industry, power generation and residential/commercial sectors in the former East Germany. In more recent years emissions have remained stable implying the need for renewed sustained efforts. France finds itself with a similar ratio to its objective as Germany after having undergone a single year emissions increase of 7 % in 1998. The UK, which has experienced virtually zero growth in emissions from 1990 to 1998, is faced with a tough target to achieve in the next decade. Italy has experienced some growth in emissions despite lower than historic average economic growth and relatively high energy prices.

The eight countries in the North of the Union have in aggregate a difficult task to perform as their emissions have grown very substantially during the nineties and the reduction options are limited as they are relying to a large extent on non-fossil sources for electricity production and natural gas for a large portion of their stationary demand. Furthermore, they have undertaken already major programmes in energy conservation over the last 25 years.

The three countries in the rest of EU Southern region, having obtained "softer" targets relative to the 1990 level mostly on the grounds of their development needs find themselves in a relatively easier situation in terms of distance from the objective but have experienced very strong emission growth since 1996.

3. Economic effects of EU-wide emissions trading scheme

Table 2 summarises trading activity and abatement cost as they emerge from unrestricted EU-wide permit trading and compare them to a situation where each Member State / grouping of Member States performs the full reduction within its borders. In other words, EU-wide trading is compared to a situation where Member States do not participate in any international trading scheme.

The first column contains the 2010 baseline emission forecasts as they are produced by the model assuming that there are no specific emission abatement measures undertaken by any country. This case serves as a reference against which the emission

reduction scenarios are evaluated. The second column contains the Kyoto targets and their distribution across countries within the framework of the burden sharing agreement. The third column gives the emission values as they stand for the EU-wide unrestricted trading scenario.

Table 2: Effect of unrestricted trade among all EU member States and all sectors

| | Emissions in 2010 MtCO ₂ | | | Emissions trading: Permit Price €49,0/tCO ₂ | | | | | No EU-wide trading | | | Cost savings from EU- wide trading In % of total cost with no EU-wide trading |
|-----------------|--|-----------------|-------------------------------|---|------------------------|-----------------------------|-----------------------|-------------|-------------------------------------|-----------------------|-------------|--|
| | Base- line | Kyoto target | Trad- ing sce- nario | Trade of CO ₂ | Trade Value (€b) | Cost With- in (€b) | Total Cost (€b) | % of GDP | Marg. Cost €/tCO ₂ | Total Cost (€b) | % of GDP | |
| France | 444 | 381 | 392 | 8,1 | -0,5 | 1,6 | 2,1 | 0,10 | 203,3 | 2,1 | 0,10 | 0 |
| Germany | 887 | 774 | 708 | -64,5 | 4,1 | 5,1 | 1,0 | 0,04 | 95,8 | 2,0 | 0,07 | 50 |
| Italy | 458 | 378 | 407 | 29,3 | -1,9 | 1,5 | 3,3 | 0,17 | 317,3 | 4,1 | 0,21 | 20 |
| UK | 623 | 517 | 488 | -28,6 | 1,8 | 3,5 | 1,7 | 0,09 | 117,9 | 2,0 | 0,11 | 15 |
| Rest EU North | 770 | 546 | 638 | 91,3 | -5,8 | 3,7 | 9,6 | 0,48 | 392,6 | 13,0 | 0,66 | 16 |
| Rest EU South | 466 | 411 | 378 | -35,2 | 2,2 | 2,5 | 0,3 | 0,02 | 88,4 | 0,8 | 0,06 | 62 |
| Total EU | 3648 | 3010 | 3010 | 0,0 | 0,0 | 18,0 | 18,0 | 0,15 | | 24,1 | 0,20 | 25 |

Note: All monetary figures are in 1999 euros. They were converted from the values used in POLES (\$US (1990)) using a GDP deflator (its value from 1990 to 1999 is 1,3) and the average exchange rate between \$ and € in 1999. This was 1,0653. Positive figures in the column “trade” indicate the Member State / region is a net buyer of permits, negative figures indicate a net seller position. *Source:* POLES

The next two columns contain data relating to net permit trade in physical (million tonnes of carbon dioxide) and value terms (billions of euros). The next three are the estimates of abatement costs. Under the heading “cost within”, the costs incurred on efforts within borders are given. They are calculated as the integral under the marginal abatement cost curve i.e. the sum of the costs of the actions undertaken within the country/region from the least expensive to the costliest (the latter in this case corresponding to the price of traded permits). To these costs are added the value of net permit purchases (net permit sales are obviously subtracted) to obtain the total cost which is also expressed in terms of percentage of GDP as projected to be in 2010.

The “no EU-wide trading” columns refer to the situation obtained in the scenario where no trading is permitted and each Member State / grouping of Member States undertook the totality of its abatement effort within its frontiers. The marginal abatement cost is given (i.e. the cost of the ultimate and most expensive step undertaken in order to conform to the target), together with the total cost in money terms and as a percentage of GDP. These are calculated in the same way as for the trade scenario and therefore directly comparable. Finally, the savings (i.e. gains from trading) arising from the flexibility offered by the EU-wide trading scheme relative to costs arising from no EU-wide trading are given in percentage terms.

The clearing price in an unrestricted permit market under the conditions of the scenario amounts to €49 per ton of carbon dioxide.

Germany emerges as the largest net seller of emission permits and this is not simply due to the relative weight of this country in the Union. A continuing dependence on fossil solid fuels and relatively low energy prices make for considerable abatement margins which are translated into deep reductions at reasonable carbon value levels

allowing for an exportable surplus. The UK is also estimated to be a net seller of permits though at a more modest scale. It also experiences only a very modest improvement in its overall abatement cost as a result of the implementation of the EU-wide permit market. Even more noticeably unaffected is France, a net importer at a very modest scale.

The region of “rest of EU North” is projected to be the major buyer absorbing almost the sales of Germany and the UK and effecting less than 60% of the reduction domestically. It also accounts for more than 55% of total EU cost gains resulting from the introduction of permit trading. Still the “rest of EU North” region has the highest compliance costs (almost 0,5% of its GDP compared to an EU average of 0,15%).

The “rest of EU South” region (Spain, Portugal and Greece) is also projected to benefit from an EU-wide emission trading scheme. Projected to emit about 8% less than its burden sharing quota, this region would free up close to 36 million tonnes of CO₂ for emission trading. It would also see its overall abatement costs slashed to about one third of their “no trading” level to become a virtually cost free 0,02% of GDP.

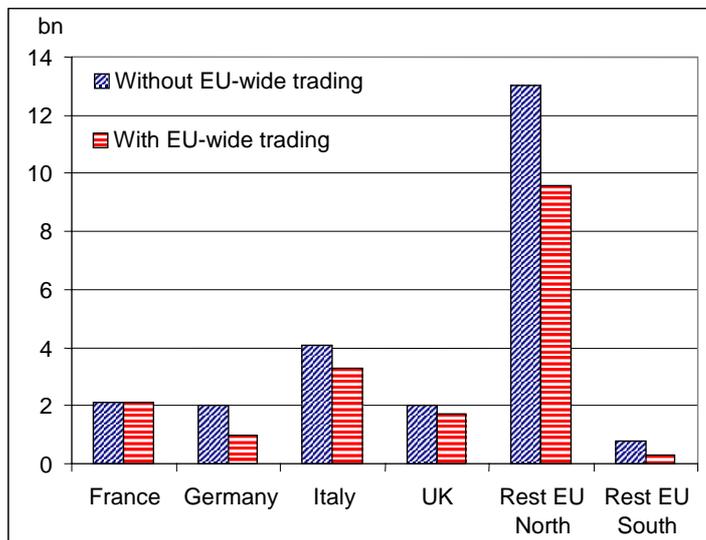


Figure 1 Welfare gains of EU-wide emissions trading

As shown in Figure 1 all countries are projected to gain from an EU-wide emissions trading scheme. In some cases the gains are fairly small, as the trading volume would be small. The overall EU abatement cost reduction is of the order of 0,05% of the Union's 2010 GDP. This would be equivalent to a 25% reduction in the cost burden. This should be considered as an underestimate, because the “no trading” case already assumes that the countries have undertaken reductions in greenhouse

gas emissions in an optimal manner. In practice, unless concrete and far reaching measures are undertaken, this optimal starting point is far from assured.