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BACKGROUND PAPER

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Climate change policy and competitiveness: a legitimate concern?

There are many reasons why rich developed countries are reluctant to take the lead in action against climate change. One emerging and perceived concern is "international competitiveness" which may be negatively impacted by individual climate policies.

Other reasons are a fear of domestic emissions caps, the relocation of production, job losses and carbon leakage. The energy- and carbon-intensive industrial lobby in developed countries continues to point to the "asymmetry" in climate actions internationally to delay governments from taking stringent control over industrial emissions.

However, the credibility of industry's threats and arguments are increasingly eroding, partly due to the growing volume of academic studies that have established the analytics and examined the empirics of the issues. Their evidence shows that the risk of relocation is small, and affects only a small fraction of the overall manufacturing industry – hence competitiveness risks can be handled with technical solutions. In Europe, Australia, and some states in the US, the recent debate on competitiveness has become notably focused. The question is no longer about whether industrial competitiveness issues have adverse impacts on countries. Rather, the discussions are about which specific industrial activities are of concern, how they differ, and what solutions best address potential emissions leakage and relocation concerns for each activity.

More generally, it is worth noting that there are also positive impacts of climate policies on industrial competitiveness through the creation of new markets – for example in energy efficiency and alternative energy. Early movers in these markets that drive technology innovation will enjoy a long-term competitive advantage as green markets grow[1]. The empirical evidence behind such positive impacts is also growing, as is the potential for tens of millions of "green jobs" in both developed and developing countries.

This paper examines a sequence of frequently asked questions about the impacts of climate policy on competitiveness, and summarises some of the insights that have been recently gained from empirical analysis of the issue in the economic literature.

QUESTION 1

Will developed countries lose their competitive advantage over developing countries by introducing a more stringent climate change policy at a faster rate?

It makes no sense to discuss the international competitiveness of countries. Rather, it is an issue of concern for particular sectors and companies. Specifically, the debate can be restricted to the competition between energy-intensive industries.

QUESTION 2

What are, in theory, the industrial competitiveness impacts of climate policies?

Climate policies may, in theory, lead to negative impacts on industrial competitiveness: profitability or market share losses, relocation and emission leakage. They may also have positive impacts such as higher profits in the short term, technology innovation and induced competitive advantage in the long term. Empirical evidence behind these positive impacts is growing.

QUESTION 3

Is the fear of relocation supported by empirical evidence? If not, why?

There is little empirical evidence to support the hypothesis that climate policy has led to the relocation of energy-intensive industry. Why? Put simply, the impact on production costs has remained moderate and the international trade is more complex than that depicted by lobbyists. International mobility for many industries is in fact restrained by trade "barriers" such as transport costs and risks. Environmental regulation is only one determinant of location and trade, among many others such as labour costs, which are usually more important.

QUESTION 4

Will more stringent climate policies drastically impact upon the production costs of CO_2-intensive industrial sectors?

To focus the debate, it is first important to identify which sectors actually experience notable increases in production costs. Recentstudies in Australia, Germany, the Netherlands, the UK and the US and have consistently shown that cost impacts from climate policy are generally low for the manufacturing industry. A handful of industrial activities are exceptions to this rule and cost impacts are focused on a few CO_2-intensive and low value-added upstream industrial activity.

QUESTION 5

If a sector experiences a sharp rise in production costs, does this imply a loss of competitiveness?

What matters is the ability to pass on the cost of CO_2 to product prices without losing any market share – therefore finding solutions to address competitiveness and the effects of emissions leakage is important. Careful assessment is required, particularly where a high cost impact is concerned. And although initial assessments already indicate that we should not worry too much, further studies are necessary.

These would inform *the design of specific measures for addressing industrial competitiveness and emissions leakage for key industrial activities.*

QUESTION 1

Will developed countries lose their competitive advantage over developing countries by introducing a more stringent climate change policy at a faster rate?

Contrary to what some politicians say, economists argue that discussing the competitiveness of a country makes little sense. Indeed, such competitiveness is maintained in the long term as exchange rates adjust. As the Nobel economics laureate Paul Krugman[2] put it, the concept of competitiveness of a country is "ill-defined in economics".

Were competitiveness an issue, this would be only at a company level or – more rarely – a sector level. Climate policies would reduce the competitive advantage of CO_2-intensive companies or sectors and shift advantage to less CO_2-intensive companies or sectors. In theory this would also shift advantage to the CO_2-intensive sectors in countries with less stringent climate policies, and may lead to carbon leakage – an environmental concern.

So what are the sectors to consider? By introducing a climate policy in the transport sector in the US, for example, people will not suddenly move to China in order to drive. Similarly, the concept of competitiveness doesn't make sense for sectors such as building, where consumption is intrinsically local. Power generation (the major target for climate policy) is also in large part a local sector, because inter-connection in power grids across international borders is limited.

However, for some of the energy-intensive industries, there is a degree of mobility of production. International trade may theoretically allow them to relocate production lines abroad and benefit from international differentials in factor outlays such as cost to the environment. Yet practice appears to be much more complex than theory.

To sum up*, it makes no sense to discuss the international competitiveness of countries. Rather, it is an issue of concern for particular sectors and companies. Specifically, the debate can be restricted to the competition between energy-intensive industries.*

QUESTION 2

What, in theory, are the industrial competitiveness impacts of climate policy?

The implication of international trade theory is that introducing climate policy at different speeds distorts competition in CO_2-intensive sectors that trade their products internationally, because their production costs are increased asymmetrically. In the short term, the primary concern is the loss of profitability and market share of domestic manufacturing, with imports gaining competitive advantage. In the long term, if some countries persistently fail to catch up with the global transition towards low carbon economies, there is concern that the CO_2 price differentials will induce some production lines to relocate to countries with little regulation, or "pollution heavens".

In both cases, this distortion may lead to a shift in emissions – emissions leakage. This refers to industrial emissions that are not reduced but simply displaced, as a result of introducing climate policy at different speeds. In the wider picture, it forms part of the debate around the *spillover effects* of climate policies. These policies can also induce positive *technology spillover effects* by providing incentives for low-carbon technology innovation – hence their diffusion across the world and further emission reductions. The empirical literature around spillover effects has found evidence behind the argument that emissions leakage effects are offset by technology spillover effects. For example, Barker et al (2007), using an econometric approach to examining leakage effects from environmental taxation in Europe between 1995 and 2005, finds very small and sometimes negative leakage rates due to technological spillover effects.

More generally, it is worth noting that climate policies also have positive impacts on industrial competitiveness through the creation of new markets – for example in energy efficiency and alternative energy. Early movers in these markets that drive technology innovation will enjoy a competitive advantage in the long term as green markets grow[3]. For example, the Dutch were early developers of wind turbine technology and now enjoy a competitive advantage as exporters in the technology. On the other hand, lax standards in vehicle fuel efficiency in the US are widely known to have had an adverse impact on General Motors' international competitiveness, as the demand for fuel-efficient cars increases throughout the world. The empirical evidence behind the Porter Hypothesis is growing[4], and a recent report by UNEP[5] also highlights the potential for tens of millions of "green jobs" in both developed and developing countries.

To sum up*, climate policies may, in theory, lead to negative impacts on industrial competitiveness: profitability or market share losses, relocation and emission leakage. They may also have positive impacts due to technology innovation and induced competitive advantage in the long term. Empirical evidence behind these positive impacts is growing.*

QUESTION 3

Is the fear of market share losses and relocation supported by empirical evidence? If not, why?

In general, the empirical economics literature on this topic finds little evidence to support this hypothesis.[6] A major report that surveys and compares the methods and results of existing studies on the empirics of the relocation of energy industries finds "no satisfactory explanation for the different outcomes between empirical studies"[7]. It concludes that if the relationship between climate policy and relocation did exist, it would be statistically weak and insufficient for policy-making. This is consistent with the consensus in the literature that examines "pollution heaven" – a hypothesis that increased environmental regulation in the economies of the North leads to a migration of dirty industries to the South.[8] An examination of historic data on trade patterns and foreign direct investment shows that there is little evidence that environmental regulation leads to the migration of pollution.

Why? One reason is that the increase in production costs due to climate policies is often moderate (see below). In addition, international trade is more complex than that depicted by corporate lobbyists.

What is undeniable is the fact that international mobility for many industries is restrained, as can be seen in many recent studies[9]. Trade barriers take various forms, as detailed in the report by Climate Strategies (2008). For example, transport costs are increasingly important for bulk products. Limited port facilities may also act as a barrier for imports. For products such as steel, product differentiation is also important (for example, German steel companies can afford to charge for specialist high-grade steel that meets specifications required by the vehicle industry). Customers also have preexisting relationships with local producers; proximity helps to build and maintain trust in business relationships and meeting delivery times. Trade barriers and their relative importance are usually specific to sectors, difficult to disentangle and quantify. Yet both anecdotal evidence and trade data confirm these barriers are at play.

Manufacturing plants cannot just pack up and leave – not least because of the high capital costs already invested upfront. Relocation often involves risks – for example in exchange rate fluctuations and their impact on production costs. For most industrial sectors these impacts are significantly higher than the potential cost effects of climate policy. Other risks are political in host countries due to local and regional governance, future increases in freight costs, and government policies.

In terms of the latter, climate policy may level internationally over the course of the investment pay-back period – thereby reducing the competitive advantage of investments in production capacities in countries taking slow climate action. Alternatively, the host countries may impose export tariffs. For example in early 2007, Egypt imposed an export duty on selected steel products which amounted to more than € 20/t CO_2.[10] Similarly, in the same year China increased export tariffs by 5 % on many finished and semi-finished steel products while scrapping or lowering a range of export rebates[11]. This was equivalent to a US$ 65/t CO_2 tax, and the Chinese export tax on cement was equivalent to a US$ 12/t CO_2 tax.

In addition, it is worth noting that the relative impact of carbon pricing on production costs is small when compared with the impact of exchange rate fluctuation. For example in Japan, exchange rate fluctuation between 1987 and 2001 was 8.2 %, far exceeding the fluctuation in energy prices of 1.9 %[12].

Finally, while differentials in environmental regulation may be part of the decision process for new investment location, other factors are usually more important, as stated in the Stern Review[13]. These include the quality of the workforce, infrastructure, access to technologies, raw materials and to emerging markets. This was highlighted by a further report[14] showing that labour costs in Japan are 32 times more than in China, and land and communication prices are 50 times more, whereas the energy difference is only 2 to 3 times. A recent company survey in Japan[15] also argues that the primary driver for relocation is to widen the market to emerging economies, then to shorten the delivery cost, and finally to save on labour costs.

The picture is much more complex than that depicted by the industry lobbyists. So complex, in fact, that according to a study published in the American Economic Review, a prominent scientific journal, globalisation had led to the displacement of polluting activities towards rich and more environmental-regulated countries[16].

***To sum up**, there is little empirical evidence to support the hypothesis that climate policy has led to the relocation of energy-intensive industry. Why? Put simply, the impact on production costs has remained moderate and the international trade is more complex than the one depicted by corporate lobbyists. International mobility for many industries is in fact restrained by trade "barriers" such as transport costs and risks. And environmental regulation is only one factor determining location and trade, among many others such as labour costs which are usually more important.*

QUESTION 4

Will more stringent climate policies drastically impact production costs of CO_2-intensive industrial sectors?

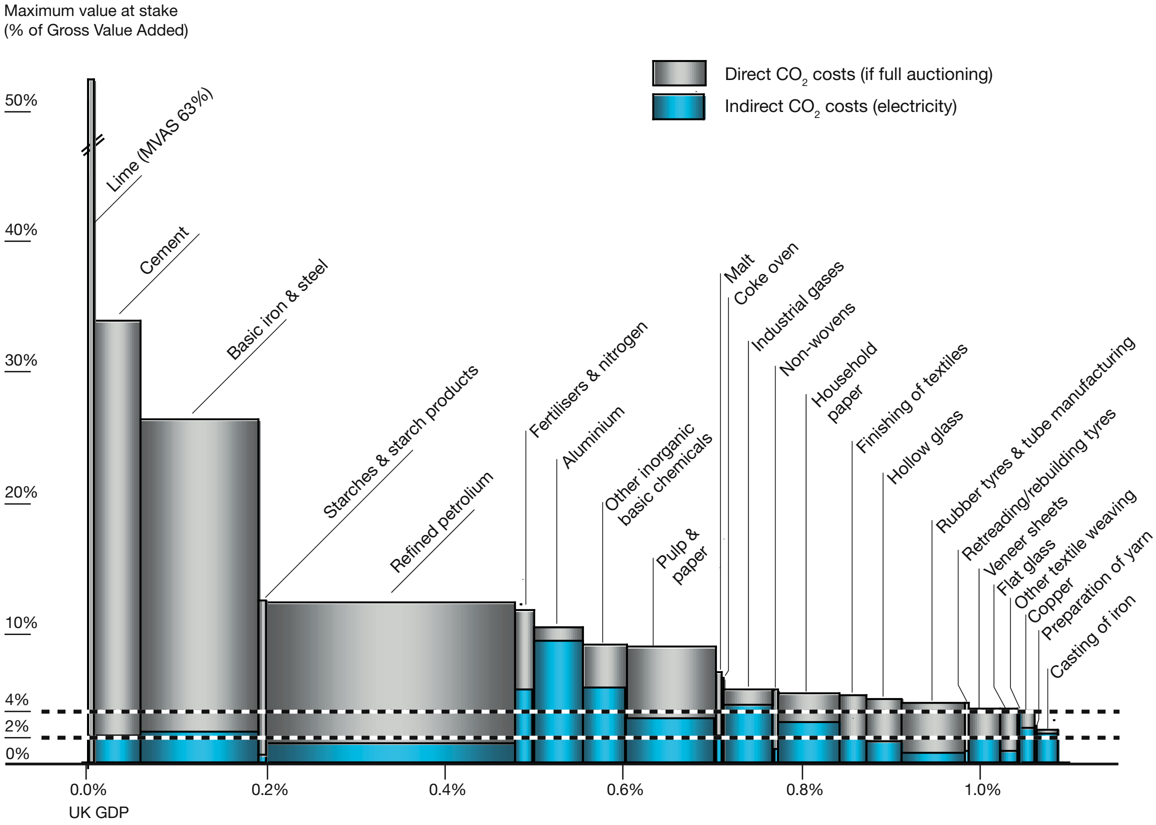
Several studies (including those in Australia, Germany, the Netherlands, the UK and the US) have quantified the potential impact of carbon pricing on production costs across sectors. They consistently show that cost impacts are highly differentiated across the wide range of manufacturing industry, and only a few specific industrial activities have the potential to be significantly impacted.

For example, Climate Strategies (2008) assesses the impact of a CO_2 price of €20/t CO_2 on 159 manufacturing sectors in the UK and Germany. The sectors are defined using the Standard Industry Classifications at 4-digit level – compared with previous examinations, this detailed sector classification allows a closer understanding of how within a sector such as steel, some processes or products are potentially more exposed to cost impact than others. This study quantifies both the cost impacts due to direct CO_2 emissions released during production (combustion and process) and indirect emissions that are emitted indirectly through their consumption of electricity.

Results are shown below. The height of the lower part of the bars depicts the indirect cost increase from anticipated electricity price increase with the ETS, relative to gross value added (GVA) of the sub-sector. The upper part of the bars reflects the direct cost increases relative to GVA, due to CO_2 emissions in combustion and process. The horizontal axis plots the relative contribution towards national GDP of these sub-sectors. This study shows that only 1-2 % of all economic activities face cost increases of over 2 %, relative to their value added. For the majority of manufacturing sub-sectors, the carbon price has less than 1 % impact.[17] Those with high potential impact are characterised by upstream position within a sector value-chain (e.g. cement within the concrete sector) that use high CO_2-intensive processes for the production of low value-added products.

FIGURE 1

CO_2 cost screen: sectors potentially exposed under unilateral CO_2 pricing, based on 2004 UK dat



Source: Data from German Statistical Office, calculations by Öko-Institut

In a study on the production cost impacts of carbon pricing for US manufacturing sectors, Morgenstern et al (2004) identify a similar set of sectors. A recent study on Dutch manufacturing (2008) also finds comparable results whereby lime, cement basic chemicals and basic steel stand out in terms of total cost impacts, and aluminium stands out in terms of indirect impact.

A recent study on the impacts of the Carbon Pollution Reduction Scheme on ASX100 companies, announced in Australia, quantifies potential impacts of an A$20/t carbon price at a company level. The study finds that for about three quarters of companies, the impact is below 2 % of value, and often well below 1 % of value.

***To sum up**, it is important to identify which sectors actually experience sizeable increases in production costs that may require similar increases in product prices. Recent studies in Australia, Germany, the Netherlands, the UK and the US have consistently shown that cost impacts from climate policy are generally low for the manufacturing industry. A handful of industrial activities are exceptions to this rule and cost impacts are focused on a few CO_2-intensive and low value-added upstream industrial activity.*

QUESTION 5

If a sector experiences a sharp rise in production costs, does this imply a loss of competitiveness?

No. As is demonstrated by the power sector's profits from the EU ETS, high cost impact does not directly translate into loss of competitiveness. It also depends on the degree to which the sector can pass on the CO_2 cost to consumers. If a sector is able to pass 100 % of the CO_2 cost on to consumers, its profits remain unaffected. Econometric studies[18] detected cost pass-on rates of between 40-120 % in the German and Dutch power sectors during Phase 1 of the EU ETS; companies were reported to have made windfall profits amounting to billions of euros from the scheme.

In addition, econometric analysis of the power sector has provided strong evidence of passing on costs in electricity prices. However, it is more difficult to assess this in relation to the manufacturing sector for a number of reasons – for example, prices may take longer to respond to production costs.

An alternative approach to measuring trade intensity is to test whether prices of the same commodity (e.g. cement) in different countries influence each other. According to a recent European project examining the evidence behind the competitiveness impact of EU environmental taxation since the 1990s[19], the US price has a strong and significant influence on basic metal prices in five EU countries. A stronger external price effect is found with German prices on EU countries. In contrast, only the German cement price has a statistically significant effect on cement prices in other EU countries. This suggests both are regional markets, but basic metals face more international competition than cement and are therefore restricted in their ability to pass costs on.

The biggest single constraint on the ability to pass CO_2-related costs on to customers is foreign competition. Several studies have found that most carbon-intensive sectors are shielded from international competition.

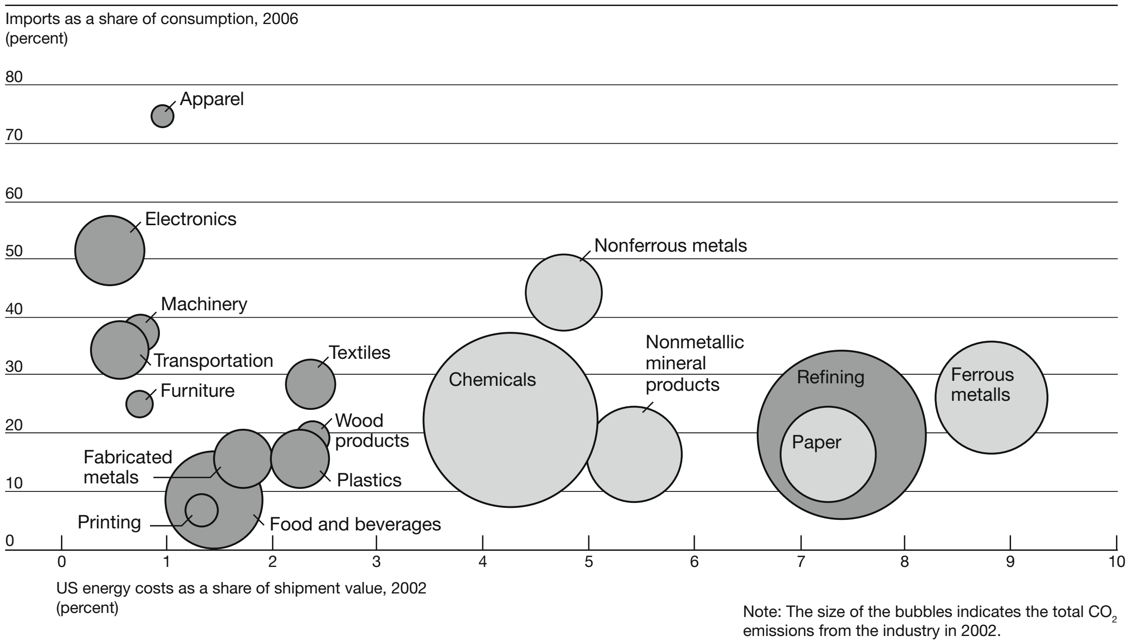
In the UK and Germany, the two outstanding manufacturing sub-sectors in terms of cost impacts – lime and cement – have very low exposure to international trade with non-EU countries. Trade intensity for basic iron is higher, but below 20 % in both countries. This seems in line with results from the study mentioned above; while steel is to a large degree a regional market and producers in Europe can maintain some premium on local sales, prices are also influenced by international prices. Hence there are some constraints on producers' ability to pass on CO_2 to product prices.

The study on the US (Figure 2) is less detailed in terms of sectoral disaggregation. Aggregating sectors masks the differences within sectors (e.g. the cost impact on cement is higher than glass, but is represented here in average terms for the aggregate non-metallic minerals sector). Nonetheless, it indicates that the energy-intensive sectors with high emissions levels such as chemicals, refining, paper and non-metallic mineral products are low in trade intensity (the vertical axis in this case). Ferrous (including aluminium) and non-ferrous metals (including basic iron and steel) are relatively more exposed to international trade.

Trade intensity is an imperfect indicator, and in response to large price differentials

FIGURE 2

US industry exposure to climate costs based on energy intensity and imports as a share of consumption



Source: Levelling the carbon playing field, WRI (2008).

could change substantially over time. However, the low trade intensity of some key sectors highlights the fact that important trade barriers that protect domestic markets are at play.

***To sum up**, what matters is the ability to pass on the cost of CO_2 to product prices without losing any market share – therefore finding solutions to address competitiveness and the effects of emissions leakage is important. Further sector-by-sector assessment of trade barriers is necessary to gauge their ability to pass on CO_2 costs. Doing so would inform the design of specific measures for addressing industrial competitiveness and emissions leakage for key industrial activities.*

Conclusion

Growing evidence on the impacts of industrial competitiveness undermines the threat of relocation put forward by the industry lobby against governments taking a lead in climate policy. These studies have shown that the cost of CO_2 has a small impact on production costs for the majority of the manufacturing industry. Furthermore, of the few manufacturing activities that have the potential to experience high cost impact with higher carbon prices, even fewer appear to have international production mobility.

To find solutions for the few manufacturing activities that are potentially exposed to competitiveness and leakage concerns, further detailed studies are required to assess the various trade barriers that determine their ability to pass on costs, and the determinants of location of new investments. Economic studies suggest that industrial competitiveness is a manageable issue that requires technical solutions, not a blurry political debate.

Finally, what is often neglected in the industrial competitiveness debate are the positive long-term economic effects of climate policy on industries by inducing technological progress.

NOTES

[1] For example see Porter, M., 1991, America's green strategy, Scientific American, p. 96.; Grubb, M., C. Hope, et al (2002) *Climatic Implications of the Kyoto Protocol: The* Contribution of International Spillover. Climatic Change 54, 11-28; Barker et al (2007) Carbon leakage from unilateral Environmental Tax Reforms in Europe, 1995–2005, Energy Policy, Volume 35, Issue 12, December 2007, Pages 6281-6292; Ekins (2007) in COMETR (WP4) 4 Available from www2.dmu.dk/cometr/

[2] Paul Krugman (1994) Competitiveness: A Dangerous Obsession In: Foreign Affairs, March/April 1994

[3] For example see Porter, M., 1991, America's green strategy, Scientific American, p. 96.; Grubb, M., C. Hope, et al (2002) *Climatic Implications of the Kyoto Protocol: The* Contribution of International Spillover. Climatic Change 54, 11-28; Barker et al (2007) Carbon leakage from unilateral Environmental Tax Reforms in Europe, 1995–2005, Energy Policy, Volume 35, Issue 12, December 2007, Pages 6281-6292; Ekins (2007) in COMETR (WP4) 4 Available from www2.dmu.dk/cometr/

[4] For example see COMETR report available from www2.dmu.dk/cometr/

[5] UNEP (2008) Green Jobs: Towards Decent work in a Sustainable, Low-Carbon World,< www.unep.org/Documents.Multilingual/Default.asp?DocumentID=545& ArticleID=5929&l=en>

[6] For example see IPCC (2001) Work Group 3 (Mitigation) Third Assessment Report; Oikonomou V., M. Patel and E. Worell (2006), Climate policy: Bucket or drainer? Energy Policy, Vol. 34, pp. 3656-3668.

[7] Sijm, JPM, Kuik OJ, et al. (2004). Spillovers of Climate Policy An assessment of the incidence of carbon leakage and induced technological change due to CO_2 abatement measures. Netherlands Research Programme on Climate Change Scientific Assessment and Policy Analysis, ECN.

[8] For example, see Christie E., 2003, Foreign Direct Investment in South East Europe, Working Paper No. 24, Vienna, Austria; Demekas D.G., B. Horváth, E. Ribakova and Yi Wu, 2005, Foreign Direct Investment in South-eastern Europe: How (and How Much) can Policies Help?, IMF Working Paper WP/05/110, Washington D.C.; Jeffe et al (1995) Environmental regulation and the competitiveness of US manufacturing: What does the evidence tell us? Journal of Economic Literature; Smarzynska B. and S-J. Wei, (2001), Pollutions Havens and Foreign Direct Investment Dirty Secret or Popular Myth? World Bank, Policy Research Working Paper 2673, Washington DC.

[9] These issue are studied in detail for the steel and cement industries in Climate Strategies (2008) Differentiation and dynamics of the EU ETS industrial competitiveness impacts. Available at www.climate-strategies.org. Also see Stern Review of Economics of Climate Change, Part 3 Chapter 11.

[10] Business Today (2007) *Steely Resolve* www.businesstodayegypt.com.

[11] IEA (2007), Sectoral Approaches to GHG mitigation. Exploring issues for heavy industry.

[12] Ministry of Environment Japan, report on the ratio of energy cost and climate tax (3400 yen/t-c) on total production cost, 26 March 2004

[13] Stern Review on the Economics of Climate Change, Part III The economics of stabilisation, Chapter 11 Structural change and competitiveness.

[14] "Wagakuni seizogyo no genjo to kadai (The current situation and challenges of Japan's manufacturing industry)" by the Development Bank of Japan, and pertaining to the fuels, "Energy Prices & Taxes Quarterly Statistics (Third Quarter 2003)" by IEA.

[15] Research and Statistics Department of Economic and Industrial Policy Bureau of METI (Ministry of Economy, Trade and Industry), & Trade Facilitation Division of Trade and Economic Cooperation Bureau of METI (2000). *Wagakuni kigyo no kaigai jigyo katsudo – Heisei 14 nen kaigai jigyo katsudo kihon chosa* (Overseas business activities by Japanese business entities: Survey of overseas business activities in 2002). Tokyo: National Printing Bureau.

[16] Antweiler et al., 2001. Is free trade good for the environment? American Economic Review.

[17] These results are in line with previous studies on cost impacts of CO_2 pricing in the literature, which in general have been found to be modest for energy-intensive industry. Baron and ECO Energy (1997) statistical analysis carried out on four energy-intensive sectors in nine OECD countries and estimate an average 3% increase in production costs from a CO_2 tax of ~US$30/tC$0_2$. Andersen (2007) in COMETR WP6 finds that the cost burden of environmental tax reform in eight energy-intensive sectors in Germany, Denmark and Sweden does not exceed 5% of gross operating service. When revenue recycling (e.g. recycling of employers' social security contributions) is taken into account, this figure falls to 2%.

[18] For example, J. Sijm,, K. Neuhoff and Y. Chen (2006) 'CO_2 cost pass through and windfall profits in the power sector', Climate Policy, Vol. 6, (2006); pp.49-72.

[19] Scott, S., Keeney, M. and Fitzgerald, J., 2006, The market: structure and vulnerability, COMETR (WP2). Available from www2.dmu.dk/cometr/