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Impacts of Emissions Trading on Energy Intensive Industries (EII) and Industrial Restructuring – Lessons learned from EU ETS for South Korea

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Abstract

In this paper we discuss experiences of the European Union (EU) with respect to the introduction of the EU Emissions Trading System. We focus our attention on the implications of the system for the risk of carbon leakage, that is, the risk of losing industrial production to third countries, by discussing the history of the EU ETS in Europe and its impact on the international competiveness of the EU manufacturing sector over time

EU ETS – A Brief History

The European framework for trade in greenhouse gas (GHG) emission allowances – the European Union emissions trading system, or EU ETS – lies at the center of EU climate policy. It was launched in 2005 and since then has been perceived by many as the economically most efficient tool for reducing GHG emissions, promising not only to deliver substantial environmental gains in the form of cost efficient emission abatement, but also to spur innovation and reduce aggregate energy consumption in Europe. This expectation is based on theoretical assumptions suggesting that trading systems provide incentives for private enterprises to invest in technologies and industrial processes that over time reduce emissions in the most cost efficient way. As of 2013, the EU ETS operates in 31 countries: all 28 EU Member States and the three EFTA countries (Iceland, Liechtenstein and Norway). It currently covers 45% of the EU's greenhouse gas emissions and encompasses more than 11,000 installations in power generation and manufacturing. From 2012 onwards, moreover, the EU ETS incorporates GHG emissions from air traffic to and from the EU and EFTA territory. To date, it is not only the first, but also by far the largest international CO2 trading system in the world, although its planned counterparts in Asia may outgrow it in the medium term with respect to the volume of emissions traded and market size.

Economic incentives delivered by the EU ETS on the level of individual installations stem from its "cap and trade" design. A "cap" is a limit on the total amount of GHGs that may be emitted by all included installations. This cap is expected to shrink over time, leading to a reduction in emissions volume. In 2020, emissions from sectors covered by the EU ETS should be 21% lower than in 2005. The "trading" element arises from the existence of emission allowances that are, in accordance with specified rules, distributed among installations either through free allocation offered by the regulator or through sale at auctions on a dedicated primary market. If this requirement is not met and part of the emissions is not covered by the acquired allowances, severe penalties ensue. Those companies that are able to reduce their GHG production sufficiently to avoid having to surrender all their allowances can either bank allowances for the future or sell them to other market participants for a price determined by laws of supply and demand. In principle, the total number of available allowances should ensure that they not only have a value and thus a price, but also that the price signal provides an incentive for investments in low-carbon technologies. At the same time, however, the price should not be too high to undermine the international competitiveness of the European industry.

It must be underlined that the EU ETS is not yet fully mature. In fact, during the first three years of its operation (2005-2007), it was in a pilot phase (the "First Phase"), when only CO2 emissions from power generators and energy-intensive industrial sectors were included, and almost all allowances were grandfathered for free, therefore limiting the economic burden imposed by the carbon price on European industry. The primary goal of this phase was to build the necessary infrastructure for monitoring, reporting and verifying actual emissions from covered entities as well as launching the market as such. In practice, the latter was harder than expected, as the total number of allowances provided by national governments to their businesses significantly exceeded actual emissions and thereby aggregate demand, resulting in their price falling to zero in 2007. This effect was strengthened by the absence of allowances banking and the fact that they became invalid after the end of 2007. Still, the duty to report emissions and surrender allowances yielded more accurate data on emission levels and enabled Member States to set the national caps at a more reasonable level going forward.

In the Second Phase (2008-2012), significant changes were introduced to the system. First, nitrous oxide emissions from the production of nitric acid were incorporated. Second, the EU ETS was extended to the three EFTA states – Iceland, Liechtenstein and Norway. And third, the number of freely distributed allowances fell slightly, whereas the penalty for non-compliance more than doubled to €100 per tonne. At the same time, however, the purchase of offset credits from the Clean Development Mechanism (CDM) and Joint Implementation (JI) was allowed, significantly lowering the demand for emission allowances and creating demand for international carbon credits, which in turn provided an incentive for clean energy investment in developing countries and transition economies. Because the cap was tightened by 6.5% compared to the First Phase, the European Commission expected that the price of allowances should grow. Given the unexpected onset of the economic and financial crisis which began in 2008, however, and resulted in a collapse of European economic output and energy demand, further reducing GHG emissions due to a rapid decline in industrial production, this price increase never occurred. Instead, a clear downward trend in the carbon price has been observed, meaning that the role of the EU ETS as a driver of low-carbon investments in heavy industry or power sector has probably been negligible. Moreover, the ability to bank allowances enabled European firms to carry over unused allowances, causing a substantial oversupply in the market in early 2013.

As of 2013, the EU ETS is in its Third Phase, which will last until 2020. Substantial changes have been implemented relative to the previous two phases as a logical consequence of the experiences gathered and the evolving policy goals. First of all, a single, EU-wide cap on emissions has replaced the previous system of national caps. Moreover, auctioning has substituted grandfathering as the default allocation method, with an intention to remove a political incentive to shield certain industries from the costs of climate policy. In 2013, more than 40% of allowances will be auctioned, and this share will rise progressively over the next years. All of these measures have not caused the desired increase in the carbon price, however, as demand for allowances remains relatively low due to the sluggish recovery of the European economy from the 2008 crisis and because their supply was determined in the pre-crisis period, when policy makers assessed economic growth prospects much more optimistically.

Observers and market participants are therefore currently engaged in a controversial discussion about whether there is a need to accelerate the steady decline in emission allowances in upcoming years. Proponents of this solution (Neuhoff and Shopp, 2013) claim that the current price of carbon provides almost no incentive for low-carbon investments and eco-innovations. Opponents (see among others the Member of European Parlament Eija Rita Korcholla, 2013, or Zachmann, 2013) reject this argument, maintaining that prices are rather an outcome of market forces, and should therefore not be manipulated by regulators. They point to the fact that it would be problematic to undertake such a decision in the middle of an economic slowdown because of the risk that any intervention will be reversed when, hopefully, the European economy returns to its previous growth dynamics. One of the most popular claims of critics, presented by many industrial associations (e.g. CEMBUREAU, 2013, or EURELECTRIC, 2013) and some governments in Europe (e.g. Poland, see Sartor and Specer, 2013), argues that policy makers should not underestimate the risk of carbon leakage that could materialize when European climate policy replaces market instruments with discretionary steering.

Carbon Leakage: A Spectre in the EU ETS System

Carbon leakage describes the hypothetical situation when certain business models became uncompetitive in a given country due to the rising costs of CO2 emissions and, because of that, relocate to another country with less stringent environmental constraints. Carbon leakage is likely if climate change policies heavily impact prices of goods manufactured in one country while international prices remain steady. In a world of mobile goods and capital, such disparities will either lead to an increase in imports or relocation of production to a third country. It is widely accepted (see Carbon Trust, 2007 and 2010; Reinaud, 2008; Alexeeva-Talebi, 2010; Bruyn et al., 2013; Sato et al., 2013) that this risk may be especially high in industries with particularly high energy consumption or in those that directly emit large amounts of GHG. In both cases, exposure to the negative consequences of an increasing carbon price is non-negligible.

The most exposed sectors include organic chemistry and the steel, glass, cement and paper industries. The EU ETS may potentially result in carbon leakage if its impact on the operational costs of these sectors is large enough to undermine their international competitiveness. Three types of carbon leakage are mentioned in the literature (Bruyn et. al., 2013; Carbon Trust 2010). First, leakage may occur through shifting trade patterns, when EU production loses its competitive advantage on international markets and thus market share because of the rising costs of manufacturing in Europe due to the EU ETS. Second, carbon leakage may be induced by the capital markets when investments begin favoring countries without stringent climate policies over those that have introduced carbon pricing. Last but not least, an indirect effect may play a role when the reduced energy demand in the EU will lead to a lower price of fossil fuels worldwide and encourage their larger consumption in other countries.

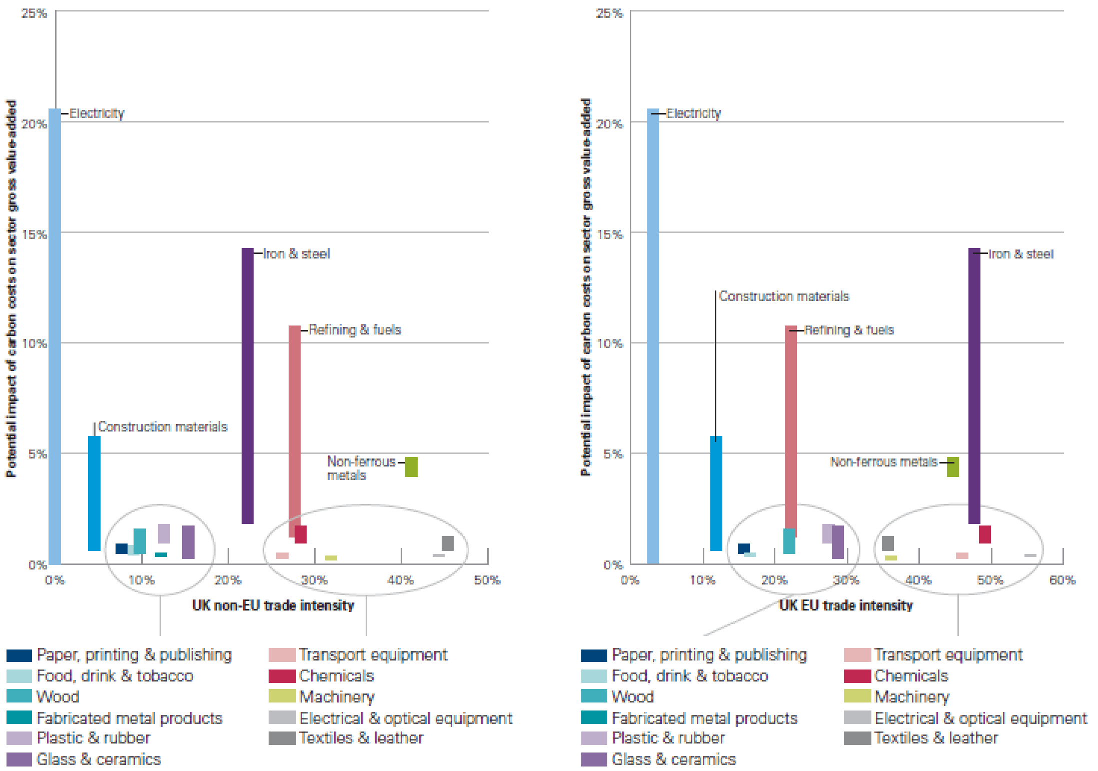
As highlighted by Climate Strategies (2009), unilateral carbon pricing can affect corporate operations and investment decisions through its impact on international energy markets, production costs and the dynamics of technological innovation and policy diffusion. Although the net effect of this impact was a priori unknown at the time the EU ETS was launched, energy intensive industries in Europe successfully pushed for a risk-averse approach towards carbon pricing of industrial emissions. They argued that strong exposure to global competition in the cement, steel or aluminum industry does not allow European producers to pass through the nominal costs of carbon to consumers. In the absence of free allocation, they would need to displace their operations to countries with no comparable regulations. Such claims contributed to the decision to allocate a vast majority of allowances for free in the First and Second Trading Phases. Concerns about the reality of carbon leakage as a consequence of climate policy resurged when the carbon market in Europe entered its Third Phase, however.

Whereas in the First and Second Phases between 2005 and 2012 most, if not all, of the potentially endangered industries received free allocation of emission allowances, the third phase of the EU ETS has introduced auctioning as the default method of allowance allocation. For sectors at risk of carbon leakage, however, free allocation is still the rule. The EU ETS Directive foresees a benchmarking approach under which the most efficient 10 per cent of installations – those with the lowest emissions – receive 100 per cent of the allowances they require for free, while all other installations receive less, according to their actual technological performance. The potential impact of carbon pricing on production costs and international competitiveness is not uniformly distributed across sectors and countries.

Relatively more endangered are those companies that emit large amounts of GHG directly and have to acquire emission allowances on the carbon market. If, at the same time, they operate in a very competitive international environment with small operating margins and high demand elasticity in prices, their ability to pass through carbon costs to their customers is small, if not zero. If a sector can absorb additional prices of carbon by reducing other outlays such as wage or energy bills, chances are much higher that industry can keep up its profits and market share. However, if the carbon intensity of power production in a country is large enough, the carbon price can also affect the operating costs of industry through increased energy prices. Therefore, ceteris paribus, some European countries can be more endangered by the risk of carbon leakage than others. States with a significant share of heavy industry in the manufacturing sector, as well as those with a large share of coal in the energy mix, are more likely to be confronted with the risk of carbon leakage than those with less carbon intensive economies

The relative importance of the EU ETS for the internal and external competiveness of selected industries further depends on such factors as transportation costs, trade regulations, market structure (e.g. monopoly) or sectoral competition (dominated by multinationals or domestic producers), and so on. The complexity of this

Chart 1. Value added at stake and UK trade intensity



Source: Carbon Trust (2007)

picture is only partially reflected in the EU ETS Directive, which defines the threshold for sectors exposed to a significant risk of carbon leakage. It is defined as (a) sectors which have a cost impact, calculated as a proportion of the Gross Value Added, of at least 5%, in combination with a trade intensity of 10% or more; (b) sectors with a cost impact of at least 30%; (c) sectors which have a trade intensity of at least 30%.

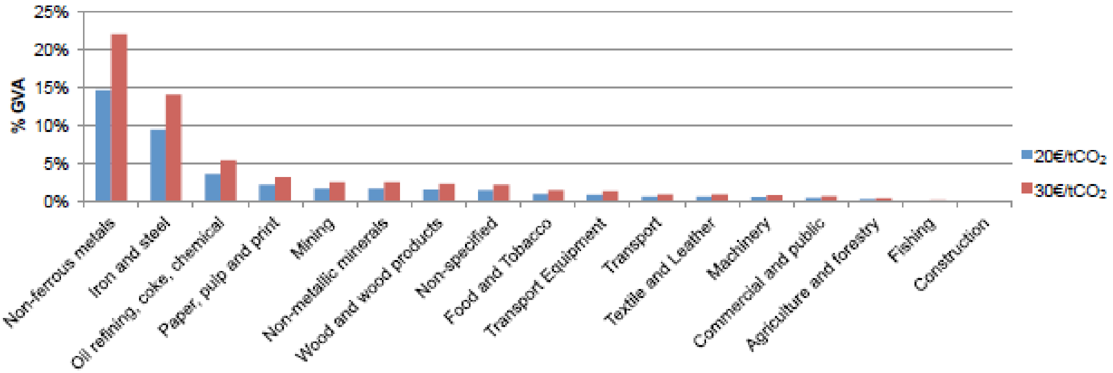
All European manufacturers who fulfill the enumerated criteria are protected from the effects of carbon pricing under the EU ETS by receiving free allocation of allowances. All other sectors receive 80% of the allowances they need for free in 2013, but over time this share declines to 30% in 2020. In order to identify industries that are entitled to such protection, the European Commission, "on the basis of clearly defined criteria and after extensive consultation with stakeholders", publishes every five years the official list that enumerates sectors and subsectors entitled to free allocation. As of 2013, the list contains about 170 sectors, covering a large segment of industrial emissions in the EU. The large number of sectors thus protected reflects the fact that the "trade-intensity" criterion has proven an efficient door opener for many industries, allowing a majority of them to find inclusion in the "carbon leakage list". Based on the cost criterion alone, only cement and lime would have been included in the list (Cooper and Droege, 2010).

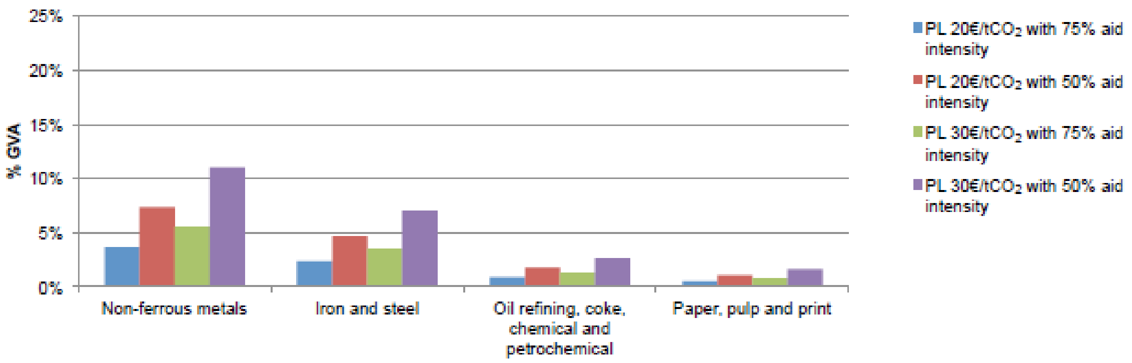
From a theoretical perspective, industrialists' reluctance to accept the necessity to pay for emission allowances seems to be relatively weak. On the one hand, the simulations of Oxford Economics (2007) argue that full auctioning would cut EU GDP by 0.5% in the medium term, provided that the increase in carbon price would be €25/ton.

On the other hand, the IPCC (2007) report presents the position that carbon leakage will only have minimal effects on macroeconomic performance, comparable to exchange rate fluctuations. Many authors point out that certain sectors are more exposed than others to the risk of carbon leakage. Among others, an analysis by the Carbon Trust (2010) concludes that only cement, steel and aluminum should be concerned about this risk. By contrast, Alexeeva-Talebi (2010) has shown that cement companies can pass through a majority of the additional costs to their customers. As a result, the estimated level of cost pass-through, and therefore the potential negative impact of the EU ETS, is very diversified across sectors (i.e. 0% to 75%). A conflicting view is held by Oberndorfer et al. (2010), who show that with the exception of ceramic goods, most sectors are capable to pass through only parts of their costs into output prices. This would mean that many European industries should take into account the possibility of serious carbon leakage in their sector.

Still, only sectors with unequivocally low pass-through potential are really exposed to the carbon leakage risk per se. For instance, Reinaud (2008) finds no EU ETS impact resulting in carbon leakage. Different studies show different carbon leakage likelihoods for different sectors, which can either reflect different methodologies applied (econometric or CGE modeling) or different data sets used (source data or lengths of time series). In particular, ex-post and ex-ante studies generally seem to have different views on the problem. Whereas the first group typically comprises studies that point to a relatively large risk of carbon leakage, the second category is dominated by studies that do not identify any real leakage phenomena in the historical data.

Chart 2. Indirect EU ETS costs on Polish industry without (top) and with (bottom)





Source: Sartor and Spencer (2013)

Ex-ante CGE modeling exercises estimate the risk to be up to even 75% (Aichele and Felbermayr 2010) for sectors included in the EU ETS, but this number should be treated as an upper boundary conditional on a relatively high carbon price and no counteracting measures like border taxation (Ponssard and Walker, 2008); assuming the cost of allowances oscillates between 5 and 15 euros per tonne and European governments adopt measures to protect vulnerable sectors, the risk estimated with CGE modeling techniques is much smaller (2-10%), see Paltsev (2001), Sijm et al. (2004) and IPCC (2007). Moreover, ex-post modeling, usually done with econometric models, generally does not agree with the high estimates from the ex-ante studies. For instance, Sartor (2012) in his analysis of the aluminum industry argues that we cannot say conclusively whether the European carbon price has caused an increase in imports during the first six and a half years of the EU ETS. This type of econometric analysis is rather limited, however, due to the lack of suitable data and relatively short time series available. Consequently, conclusions derived through this method should be treated with care. In fact, Kuik and Gerlagh (2007) rightfully underline that carbon leakage may be offset in the data by another effect: the transfer and diffusion of environmentally sound technologies, which would cancel out the leakage pressure at the macroeconomic level.

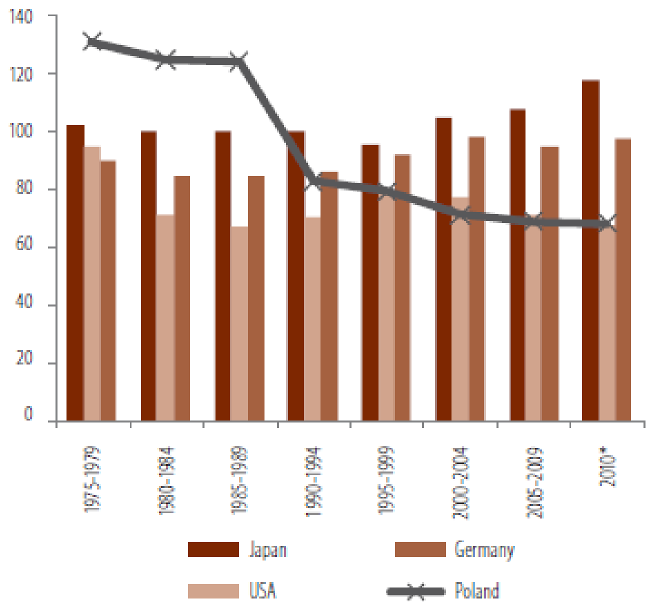
Deindustrialization or Carbon Leakage Risk and its Consequences

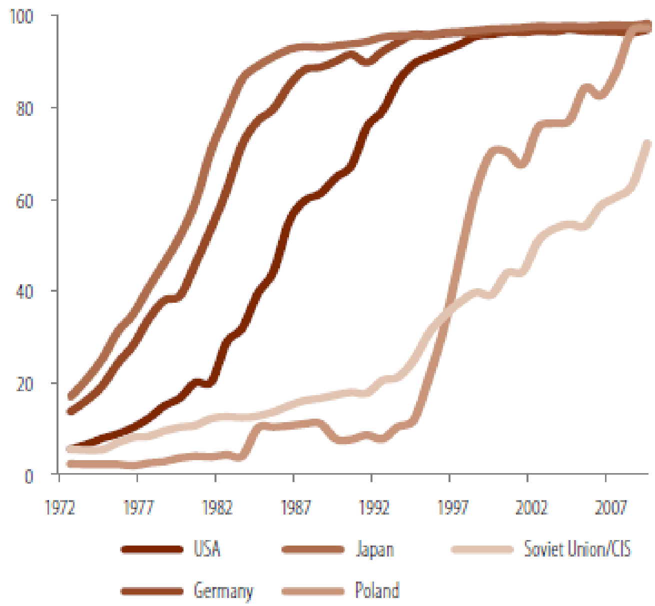
Carbon leakage is undesirable from the point of view of both industrial and climate policies. In the first case, policy makers fear the loss of jobs and GDP, in the second case they are concerned that the expected decrease in European GHG emissions is offset by a net increase benefiting climate 'freeriders' at the expense of EU members who have invested in long-term and sustainable development. Concerns related to loss of jobs, value added and taxes – although understandable from the perspective of policy makers – are not necessarily obvious from an economist's point of view. In fact, changes in the structure of production towards more environmentally sustainable products, improvements in the efficiency of resource use, as well as relying more on capital and skills than on labor, constitute dominant trends in the contemporary economy. In other words, all OECD countries have for some time observed trends in their sectoral compositions leading to declining employment in manufacturing and reallocation of employment to services, but also to much greater energy efficiency (Bukowski et. al. 2013).

At the same time, most industries do not automatically reduce the volume of their production. German steel industry serves as a good example, where, between 1970 and 2010, employment fell by 76 percent, while crude steel production remained at a more or less stable level and the production of rolled steel rose by 25%. The relative shift from labor and energy to more capital-intensive models of economic activity illustrates the rational behavior of managers that tend to prefer reducing labor expenditure than reallocating production to third countries with lower costs.

As explained by Bukowski and Sniegocki (2011), this phenomenon was particularly evident after the oil crisis in the mid-1970s, which sparked a major effort among heavy industries in the OECD countries to reduce their operating costs and keep their yields competitive on constantly changing global markets. In the context of the EU ETS, a major question relates to whether the expected rise in energy prices in the near future is going to spark a similar chain of economic restructuring and technological innovation in European industry as

Chart 3: Steel production (in tonnes, left) and share of energy efficient continious casting in steel production in selected coutries (1970-2010)





Source: Bukowski, Sniegocki (2011)

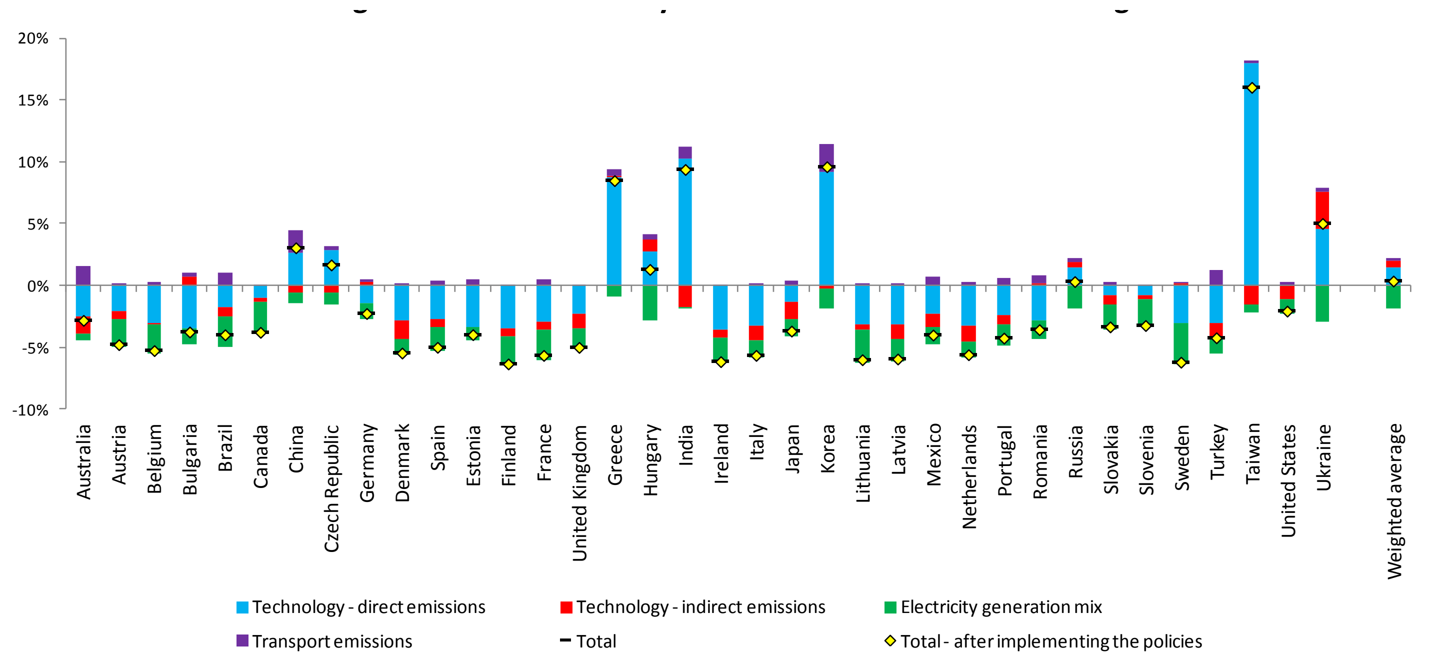
that observed in the 1970s. If so, the risk of carbon leakage would be small; if not, the challenge to reconstruct industry fundamentals will be larger.

In this context, one should mention the so called ‘shale gas revolution’ that originated fairly recently in the United States. The unprecedented collapse of natural gas prices that occurred after 2008 has inspired many commentators to herald the dawn of a new era for American industry. This enthusiasm has not been reflected in economic reality, however. Although a small number of industries that heavily depend on gas prices have experienced a significant incentive to relocate their production to the U.S., the rest have not. In fact, most of the economic reasons behind the long-term de-industrialization trend in the U.S. – such as rapid total factor productivity (TFP) growth in manufacturing, globalization, and an economic incentive to specialize in highly valued services – have not

establishments. If they prove to be more productive than before, the total level of wealth in the EU is likely to grow. If this is not the case, than limited growth dynamics in the new sectors would undermine the overall potential of the EU’s productivity increase. Because operating margins in the industries that are the most likely to be at risk of carbon leakage are rather small, one can expect that any carbon leakage will at least be neutral for economic growth in Europe, if not even a catalyst of growth. This is not necessarily the case for emissions. Even if the European economy does not lose its global economic position due to carbon leakage, it may be confronted with larger global emissions.

This would occur if any relocation leads to a shift in production to countries with a less sustainable energy mix and poorer dominant production technology. Still, the risk of carbon leakage should

Chart 4. Change of emission intensity from a given secor due to the hypothetical realocation of production from Poland to the third country



Source: CLEAN (Carbon Leakage Analysis) model developed by Aleksander Sniegocki (2012)

changed. In consequence, the gap between the relative role of industrial employment for Europe (in particular for Germany) and for the U.S. has even widened. Experiences gained during the last 40 years, when energy prices in Europe or Japan have regularly exceeded levels in the U.S., suggest that the factors underlying the international division of labor are very complex and should not be reduced to individual dimensions such as differences in the relative price of gas or oil on the regional markets.

Moreover, even if a given sector relocates outside the EU in order to avoid the burdens of climate policy, an overall economic evaluation of the macroeconomic consequences of the EU ETS will be difficult, given the relocation of labor and other production factors from closed factories to new

be negatively correlated with the chance of a global increase in emission as a consequence of such a move. In fact, if the power sector of a given country is dominated by coal, then the carbon price introduced by the EU ETS may generate a relatively strong relocation incentive. In such a case, however, the likelihood that the destination country will prove less favorable with respect to the share of coal in the energy mix is very small. In consequence, a large increase in global GHG emissions as a result of the European decision to unilaterally introduce an ETS is fairly unlikely. Carbon leakage therefore primarily poses an economic rather than an environmental risk. In Europe, two cases serve as useful examples: France and Poland. France’s power sector is dominated by nuclear generation, and therefore a carbon leakage risk induced by rising energy prices under the EU ETS is very unlikely. One the other hand, there is Poland, which is a global outlier with a 90% share of coal in the energy mix. Any hypothetical production relocation between these two countries should lead to a decline in global emissions, if anything.

Conclusions

Summing up, we should underline that EU ETS is yet under development. It is therefore too early for policy makers and market participants to draw final conclusions from the experiences to date under the EU ETS regarding its impact on European industry and international competitiveness. In particular, ex-post econometric techniques are not very informative so far as the available datasets are rather small and the entire economy has witnessed a relatively slow evolution of the power system towards greater use of market instruments. The same can be said about ex-ante modeling exercises, which often try to base their conclusions on simplified assumptions that do not adequately reflect the real complexity of industrial processes and economic relations.

As the reasoning laid out in this briefing shows, however, the risk of carbon leakage arising from the EU ETS is probably limited for the time being, at least as long as energy prices remain low; it may rise gradually as energy intensive industries are increasingly exposed to the economic consequences of carbon pricing in the European Union. Member States that, like France or Sweden, have decarbonized their energy mixes in the past few decades have shielded their economies from potential negative impacts of the EU ETS on their economies. At the same time, EU Members such as Poland, which seem to be more exposed to the risk of carbon leakage due to their unfavorable industrial structure, can still shield themselves from that risk relatively cheaply if they concentrate any policy efforts on the small group of most vulnerable manufacturing sectors while at the same time gradually adjusting the role of coal in the power generation mix in line with European climate policy goals.

Other industrial nations that are considering the introduction of an emission trading system as part of their climate policy should, however, observe the current Third Phase of the EU ETS carefully in order to understand the consequences of its near-term evolution. In particular, the ability of the ETS to trigger innovation and investments in energy efficiency in the most carbon- and energy-intensive industries should be observed. Also, the forthcoming revision of the list of European sectors that are exposed to the risk of carbon leakage may provide useful insights about the dominant competiveness concerns in Europe with respect to its climate policy targets.

Probably the most interesting questions that can be raised at the current outset of the Third Phase of the EU ETS relate to the perception of the system among EU Member States. If, in the near future, its evolving design takes into account the relatively large regional disparities within Europe with respect to the economic importance of carbon intensive sectors, this perception will probably improve and the experiences of the EU ETS will offer more useful insights to the rest of the world than it does at present, being – as it is – still an unfinished, and not fully mature, instrument of European climate policy.

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