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Carbon Leakage: Options for the EU

Andrei Marcu, Project Leader
Christian Egenhofer
Susanna Roth[1]
Wijnand Stoefs

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This is a

"DRAFT for Discussion" paper

It will be presented in five workshops in EU Members States and the input received will be incorporated in a "Final" version

[1] Susanna Roth is a Fellow at CEPS, funded by Mistra.

Abstract

This paper builds on the first deliverable of the project entitled "Carbon leakage: Options for the EU". It identifies carbon costs, and the ability to pass through carbon costs, as the main risk factors that could lead from asymmetrical carbon policies to carbon leakage. It also outlines and evaluates, based on criteria discussed in the paper, options for detecting and mitigating the risk of carbon leakage in three jurisdictions, with special attention to the EU ETS (Emissions Trading Scheme).

Based on the analysis of approaches currently used in a number of existing carbon pricing systems, it identifies the balance between the number of sectors identified as being at risk, and the amount of compensation provided as a risk mitigation measure, as the critical element in providing an optimum approach to address carbon leakage risks. It also identifies a risk-based approach to identifying sectors at risk as allowing for a better reflection of reality in a counterfactual argument. Finally, the paper concludes that while, with some exceptions, there has been limited carbon leakage until now, the past may not be a good reflection of the future and that measures need to be put in place for the post-2020 period.

While examining a number of approaches, it identifies free allocation as the most likely way forward for mitigating the risk of carbon leakage. While other approaches may provide interesting options, they also present challenges for implementation, from a market functioning, to international trade and relations, points of view. A number of challenges will need to be addressed in the post-2020 period, with many of them part of the EU ETS structural reform package. Some of these challenges include, among others, the need to recognise, and provide for individual sectoral characteristics, as well as for changes in production patterns, due to economic cycles, and other factors. Finally, the paper emphasises the need for an open dialogue regarding the post-2020 provisions for carbon leakage as no overall Energy and Climate Package is likely to be agreed on until this matter is addressed.

CEPS Carbon Market Forum
Centre for European Policy Studies
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The objective of the Carbon Leakage Project is to prepare policy options that can be used to address concerns regarding carbon leakage in the context of EU internal discussions, international negotiations and bilateral discussions (see the back cover for more information about the project).
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Centre for European Policy Studies
Place du Congrès 1, B-1000 Brussels
Tel: 32 (0) 2 229.39.11 Fax: 32 (0) 2 219.41.51
e-mail: info@ceps.eu
website: www.ceps.eu

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1. Introduction

This paper, entitled "Carbon Leakage: Options for the EU" is the second deliverable of the CEPS project of the same name. It aims to outline possible options to address the issue of carbon leakage from the EU Emissions Trading Scheme (ETS) and draw conclusions for policy-makers, politicians, regulators and industry. It does not intend, however, to make recommendations.

The present paper builds on the first deliverable of the project – a paper entitled "Carbon Leakage: An Overview"[2] – which outlined the concept and economics of carbon leakage and highlighted the main elements of the current debate on this topic. A short summary of the findings of the latter paper, including the causes of carbon leakage, channels of leakage, state of play in the debate, etc. can be found in Annex 1.

The analysis and findings of this research paper are organised in the form of responses to three key questions related to carbon leakage and are presented as outlined below:

1. Which factors determine carbon leakage risk? (chapter 2)

    a. Carbon costs
    b. Ability to pass through costs

2. How to determine if a sector is at risk of carbon leakage? (chapter 3)

    a. What are the options to determine if a sector is at risk of carbon leakage? What are the tests that could be used?
    b. What are the criteria to assess the tests for carbon leakage risk?

3. What are the options to mitigate the risk of carbon leakage for sectors that are found to be at risk? (chapter 4)

    a. What are the options that could be used to mitigate risk of carbon leakage?
    b. What are criteria to assess the mitigation options?

We then review and assess how existing systems handle the tasks both of identifying and mitigating leakage risk (chapter 5) with detailed reference to the measures in place in three important jurisdictions: the EU, California and Australia. A final chapter outlines the outstanding issues that need to be addressed in the context of the EU ETS and possible conclusions are offered on:

a. Overall direction
b. Tests for carbon leakage risk (Focused coverage)
c. Policies for risk mitigation (compensation for direct and indirect emissions)

[2] See Marcu et al. (2013).

Setting the scene

Carbon leakage could, in everyday language, be defined as the displacement of emissions from a jurisdiction to another jurisdiction, due **to asymmetrical climate policies**, resulting in same, or higher, volume of global emissions. Asymmetrical climate policies are understood as policies that impose carbon constraints in one jurisdiction, while other jurisdictions have less stringent, or no, carbon constraints.

'Carbon leakage' refers primarily to an environmental impact. However, the relocation of emissions is caused by economic impacts that result, broadly speaking, in changes in trade and investment patterns. This link between environmental and economic issues resonates with the UNFCCC discussion on Response Measures. It must be emphasized that this paper focuses on the economic impacts of carbon leakage.

A couple of caveats must be made to fully understand the scope of this study:

- Measures to address carbon leakage are handled in a narrow way in this paper; these measures are meant to address the impact of carbon pricing on competitiveness, not to deal with broader competitiveness concerns and industrial policy.
- A number of the issues addressed in this paper could fall under the heading of EU ETS structural reform. However, EU ETS structural reform is a broad topic and includes many important issues (such as fragmentation within the EU ETS) which are not within the scope of this study.

2. Carbon leakage risk factors

Carbon leakage risk factors may provide the trigger that could lead from an asymmetry in carbon policies to carbon leakage. Two risk factors are considered in this paper:

- ***carbon costs*** and
- ***ability to pass through*** carbon costs to other sectors or consumers.

If a sector faces carbon costs, then it could be at risk of carbon leakage. Its ability to pass those costs down the value chain or to end-consumers, will have a significant impact on whether it results in carbon leakage. However, it is also important to mention that the willingness and ability to pass costs through are linked to price-setting power, and are also dependent on the strategic behaviour of firms and the choices they make.

Carbon leakage risk factors do not necessarily act independently of each other, and may reinforce or minimise their overall impact on asymmetrical climate change policies.

2.1. Carbon costs

A number of issues can be grouped together under the risk factor category called "carbon costs". They may include sector and product characteristics that will influence the likelihood of carbon leakage.

1) **Carbon costs relative to total costs of production**. The impact of carbon costs will differ significantly depending on their relative weight in the total production costs. The indirect costs for primary aluminium producers during phase 2 of the EU ETS, for example, amounted to more than 3.5% of total production costs (Renda et al., 2013a). However the sum of direct, indirect and administrative costs for steel producers was around 0.6% of total production costs over phase 1 and 2 (yearly averages) (Renda et al., 2013b).
2) **Carbon price level**. The level of the carbon price is the principal determinant of carbon costs.
3) **CO_2 intensity** (of a sector or product). CO_2 intensity (tonnes/unit of production) will impact compliance costs. For example, the production of one tonne of steel using the blast oxygen furnace (BOF) technology releases anywhere between 1.5 and 2 tonnes of CO_2 (JRC, 2012). In the case of primary aluminium production, direct emissions are between 1.5 and 2.55 tonnes of CO_2 per tonne of aluminium. However aluminium remelting plants emit far less: between 150 and 350 kg of CO_2 per tonne of secondary aluminium (Ecofys et al., 2009).
4) **Costs passed on from other sectors.** The use of inputs that internalise carbon costs, and pass carbon costs through, increase the production costs for the sector. These inputs can take two forms:
   a) **electricity and**
   b) **components or semi-finished products** that internalise carbon costs.
5) **Sectoral margins.** The level of margins can make a difference with respect to the ability and willingness of enterprises to absorb additional costs from the carbon price, direct and indirect.
6) **Abatement potential and the cost of abatement** can affect the impact of carbon costs in the future and influence investment decisions. Managerial responses might be dominant in reducing emissions in the short run, but abatement efforts in the medium or long run are more closely related to technology and investments.
7) **Long-term reduction targets.** Costs could increase with more stringent long-term targets.

2.2. The ability to pass through carbon costs

The ability to pass through carbon costs is influenced by both industry-specific and economy-wide characteristics (Reinaud, 2008 and Droege & Cooper, 2010). This risk factor is more difficult to quantify, and therefore more qualitative in nature.

1) **Trade intensity**. If the product is heavily traded, cost differentials introduced by carbon prices could prove decisive in terms of market share and investment decisions.

2) **Price-setting mechanism**. How and where product prices are set has a strong link with the ability of a sector to pass through incremental, locally added costs. Industry players that cannot set prices for their products ('price-takers'), are less likely to be able to pass through carbon costs. For example, if there is a global price-setting mechanism, this reduces the ability of domestic producers to set prices and pass through additional costs that are local in nature.
3) **Risk for other parts of the value chain**. If parts of the value chain, either upstream or downstream are at risk of moving out of the jurisdiction, this can exacerbate carbon leakage risk in two ways:
    a) **Transport costs** within the value chain might increase to levels that make a geographic split within the value chain unsustainable and
    b) **Positive externalities** of clustered activities disappear, for instance integration of recycling, R&D and production.
4) **Product heterogeneity.** An increased level of specialisation and differentiation may allow a higher pass-through rate and reduces the risk of carbon leakage. Commodities in general have a lower ability to pass through costs.
5) **Exchange-rate risks.** The potential cost of moving production away from demand centres is a function, among others, of the stability of exchange rates.
6) **Price elasticity of demand** will determine the reaction of customers to price increases. This is linked to issues such as vertical integration of the industry, quality issues and long-term contracting. This is a variable that is extremely difficult to quantify.

3. How to identify risk of carbon leakage

Both quantitative and qualitative tests are used to assess the risk of carbon leakage for different sectors. This section examines the options available to test whether the risk factors are in a range that would indicate a risk of carbon leakage.

Sectors that are found to be at risk from carbon leakage are recognised in different ways by different jurisdictions. For example, the EU Emissions Trading System (ETS) places such sectors on a Carbon Leakage List (CCL).

3.1. Tests for carbon leakage risk

As mentioned above, two main types of tests are used to check if the carbon leakage risk factors of a particular sector are in a range that would indicate leakage risk:

- **Quantitative tests** use factors, or surrogates, that can be quantified and result in a number that can be tested against benchmarks. Two main categories of quantitative tests are currently identified (but others could be imagined):
    - **Carbon-related** risk tests **and**
    - **Trade exposure-**related risk tests.

Each of these two categories can be further divided into approaches with different characteristics.

- **Qualitative tests** are used to cover criteria that are deemed representative, but for which figures, or surrogates, cannot easily be calculated, or for which there are no readily available data. Qualitative tests are seen as more flexible than quantitative tests, but they are inherently subjective in nature.

These risk tests can be used alone or in a combination (i.e. multiple tests bundled together). Risk tests for carbon and trade intensity have often been combined to provide for better coverage and capture the combined effects of carbon leakage risk factors. When risk tests are used in combinations, the thresholds are usually lower, as the tests are multidimensional and are intended to capture multiple conditions. Quantitative and qualitative risk tests can be also combined.

In some systems, the risk tests are also used as stand-alone tests, e.g. only testing for carbon costs. For stand-alone tests, the thresholds have higher values, as they are intended to capture extremes and outliers.

There are several **design features** of risk tests that must also be taken into account when assessing risk tests. One design feature is whether the carbon leakage risk test employs an **in/out** (i.e. a sector is either at risk, or not at all), or a **tiered** approach. An in/out approach determines which sectors are or are not at risk and results in some sectors not receiving any compensation, if the sector falls under the threshold. With a tiered approach several risk levels are defined and compensation could be distributed in proportion to the risk level.

Another design feature that needs to be considered is the **flexibility of** the mechanism to adapt to changes in key parameters, including how it is updated. In general, mechanisms can be reviewed periodically and/or be triggered by market participants. This must be balanced with the need for stability for investment purposes.

Lastly, **data availability** and **data aggregation** are other important design features used in assessing risk tests. The underlying data for the risk tests may not always be publicly available, which creates problems with transparency. Moreover, data aggregation for sectors could be done at different levels and therefore sectors and risk tests may not be comparable across schemes.

The remaining parts of this section will discuss the different risk tests that can be used, illustrated with examples drawn from existing carbon pricing mechanisms.

3.1.1. Quantitative risk tests

Table 1 provides an overview of the quantitative risk tests currently used in various operational and proposed schemes.

Table 1. Quantitative risk tests used in the EU ETS, Australia CPR, California, the US Waxman-Markey Bill and New Zealand

	Formulas	Stand-alone test	Combined tests
EU ETS	**Carbon costs** $\frac{(Direct\ emissions\ tCO_2 + Indirect\ emissions\ tCO_2) * €30/tCO_2}{Gross\ value\ added}$ **Trade intensity** $\frac{(Imports + Exports)}{(Turnover + Imports)}$	• Carbon costs over 30% • Trade intensity over 30%	• Carbon costs above 5% • Trade intensity above 10%

Australia CPR	**Emissions intensity**
	$\frac{Tonnes\ CO_2e}{Million\ AUD\ revenue}$ ***or*** $\frac{Tonnes\ CO_2e}{Million\ AUD\ value\ added}$
	Trade intensity
	$\frac{(Annual\ value\ of\ imports + annual\ value\ of\ exports)}{Annual\ value\ of\ production}$
			• Emissions intensity
			  ○ Highly emissions-intensive: At least 2,000 tCO_2e emissions per million AUD revenue, or 6,000 tCO_2e per million AUD value added
			  ○ Moderately emissions-intensive: 1,000 tCO_2e emissions per million AUD revenue, or 3,000 tCO_2e per million AUD value added
			• Trade intensity above 10%

California Cap-and-Trade	**Emissions intensity**
	$\frac{Tonnes\ CO_2e}{Million\ USD\ value\ added}$
	Trade intensity
	$\frac{(Imports + Exports)}{(Shipments + Imports)}$
			• Emissions intensity
			  ○ High: > 5,000
			  ○ Medium: 1,000-4,999
			  ○ Low: 100-999
			  ○ Very low: less than 100, **and**
			• Trade intensity
			  ○ High: > 19%
			  ○ Medium: 10-19%
			  ○ Low: less than 10%

US Waxman-Markey Bill	**Carbon costs** $\frac{Cost\ of\ electricity + fuel\ costs}{Shipments}$ ***or*** $\frac{(Direct + indirect\ emissions) tCO_2 * \$20/tCO_2}{Shipments}$ **Trade intensity** $\frac{(Imports + Exports)}{(Shipments + Imports)}$	• Carbon costs over 20%	• Carbon costs over 5%, **and;** • Trade intensity of at least 15%

New Zealand	**Emissions intensity:**
	$\frac{Tonnes\ CO_2e}{Million\ NZD\ revenue}$
	Trade intensity: Assumes all sectors are trade exposed unless they obviously are not
		• Emissions intensity
		  ○ High: 1,600 (or 4% of revenue)
		  ○ Moderate: 800 (or 2% or revenue)	

Sources: Australian Department of Climate Change and Energy Efficiency (2011a), California Air Resources Board (2006 and 2012), European Council and Parliament (2003)

Carbon-related risk tests

These tests check for the impact of carbon cost, or carbon emissions, relative to a measure of financial performance. Currently two approaches can be identified:

- **Emissions intensity** – carbon emissions intensity (tonnes) relative to revenue (monetary value) and
- **Carbon costs** – impact of carbon costs (monetary value) relative to gross value added (monetary value).

Emissions intensity tests are currently used in California, New Zealand and Australia (see Table 1) and can be looked upon, in a more general way, as an indicator of carbon intensity relative to financial performance. This could also be extrapolated to the carbon intensity of GDP. While emissions-intensity tests can be seen as less targeted than carbon cost tests (discussed below), there remains a relationship between emissions intensity of an installation and its compliance costs.

For these tests, the approach used is that emissions intensity thresholds are defined, which then determine the risk level. It must be emphasised that the data used for these tests are historical, not a forecast.

In California, different tiers (high, medium, low and very low) of emissions intensity are defined (see Table 1). This risk test is not used alone, but in conjunction with trade intensity (discussed below). The combination of the two thresholds is also used to determine the level of compensation. In the case of California, this currently results in 15 sectors classified as high-risk, 14 as medium-risk, and 3 sectors as low-risk.

Table 2 illustrates a selection of sectors in California and their emissions-intensity classification.

Table 2. Selected sectors in California and their emissions intensity (tonnes CO_2e/$ million value added) and emissions intensity classification

Emissions-intensity classification	**Sector**	**Emissions intensity**
High (2)	Lime manufacturing	29,398
	Cement manufacturing	13,744
Medium (12)	Iron and steel mill	4,148
	All Other Basic Inorganic Chemical Manufacturing	2,636
Low (7)	Steel and aluminium processing	645
	Pesticide and other agricultural chemical mfg	232
Very Low (3)	Pharmaceutical and Medicine Manufacturing	64
	Aircraft Manufacturing	37

Note: Number in between brackets states total number of sectors in that classification.

Source: California Air Resources Board (2006).

In the case of New Zealand, emissions intensity is classified as either high or moderately (see Table 1).

In Australia, emissions intensity is divided into three levels: high, medium and not emissions-intensive (see Table 1). Prior to testing for emissions intensity, a trade intensity test is used to assess if the activity is trade exposed. If the emissions intensity is below the trade intensity threshold, the activity is not eligible.

Currently, 35 activities on the list are highly emissions-intense, and 16 sectors are moderately emissions-intensive. Table 3 illustrates a selection of activities in Australia and their emissions intensity.

Table 3. Selection of activities in Australia and their emissions intensity (tCO_2e/$ million revenue)

Activity	**Emissions intensity classification**	**Emissions intensity**
Production of clinker	H	15,600-15,699
Production of lime	H	12,100-12,199
Aluminium smelting	H	5,700–5,799
Integrated iron and steel manufacturing	H	3,200-3,299
Production of bulk flat glass	H	2,100-2,199
Production of ceramic floor and wall tiles	M	1,100-1,199

Note: H = Highly emissions intensive and M =Moderately emissions intensive

Source: Australian Department of Climate Change and Energy Efficiency (2012).

Carbon costs relative to value added, is the second approach currently used in the EU, and which was also included in the proposed Waxman Markey Bill (American Clean Energy and Security Act), approved by the US House of Representatives in June 2009 but defeated by the Senate in the US.

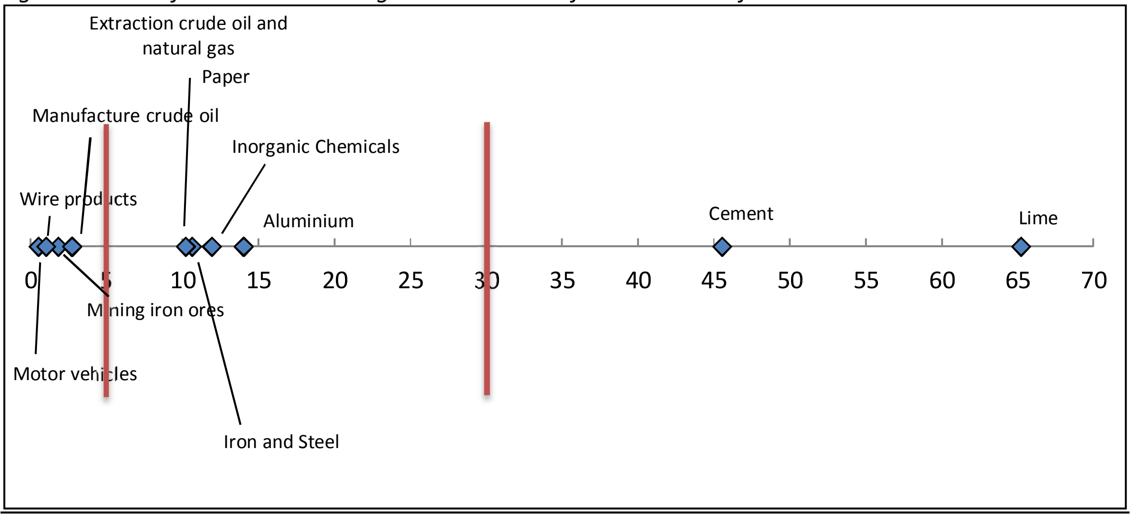
This test is currently used as a stand-alone, or in combination with another test. In the EU ETS, two thresholds are defined for this test. A price of €30/tonne is used in calculating carbon costs.

When used as a stand-alone test, the threshold is 30%. This figure was adopted in order to include outlying sectors with high carbon costs that needed to be included. The two sectors that qualify based on this criterion are cement and lime.

When used in conjunction with the other quantitative criteria (on trade intensity), the threshold is 5% (see Table 1). In total, 13 sectors qualified based on the combined test (described in Table 1), covering 36% of the total emissions from industrial sectors in the EU ETS. Figure 1 shows a selection of EU sectors (NACE 4-level[3]) and their carbon cost over value added.

[3] The Statistical classification of economic activities in the European Community, abbreviated as NACE, is a four-digit classification providing the framework for collecting and presenting a large range of statistical data according to economic activity in the fields of economic statistics (e.g. production, employment and national accounts).

Figure 1. Ratio of carbon costs over gross value added for a selection of EU ETS sectors



Note: The vertical lines in the figure illustrate the threshold values 5% and 30%.

Source: European Commission (2009c).

The proposed Waxman-Markey Bill also included tests for the impact of carbon costs. If either the carbon cost or the energy cost would be higher than 20% when used alone, or 5% when combined with trade intensity, the sector would be considered as being exposed to carbon leakage. In this case, an allowance price of $20 was assumed.

Trade-related risk tests

Trade intensity or trade exposure takes different forms depending on the jurisdictions, as outline in Table 1.

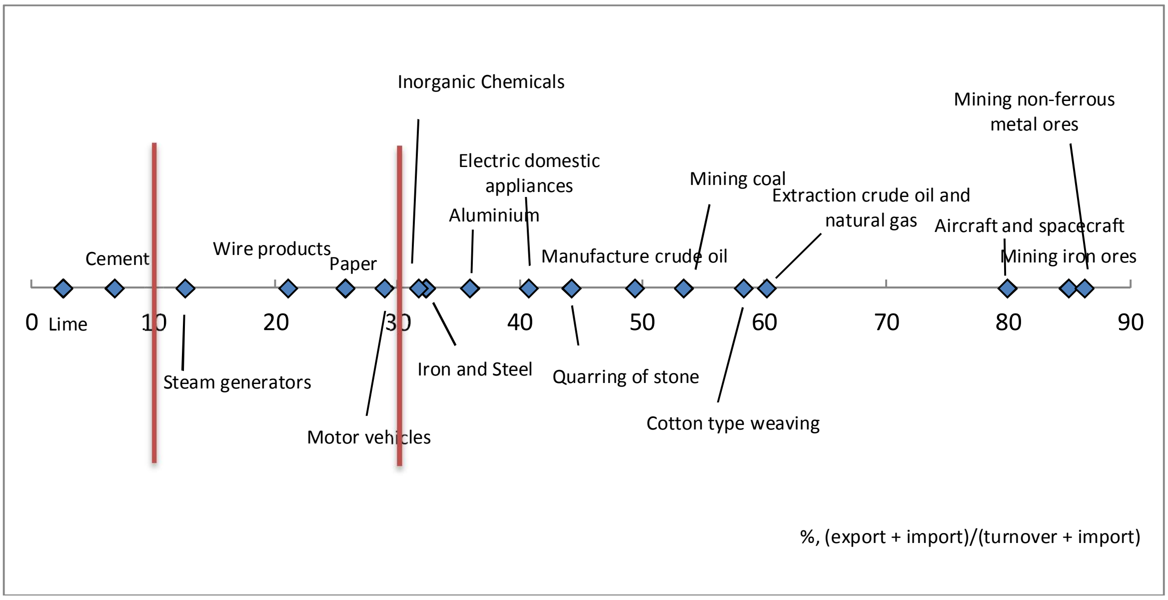
In the case of the EU ETS, sectors are considered to be exposed to carbon leakage risk if trade intensity is over 30% (as a stand-alone). A 10% threshold is used if the trade intensity test is combined with another test (carbon cost).

The outcome is that 133 sectors in the EU ETS have a trade intensity over 30%, covering a total of 26% of the industrial emissions in the EU ETS (de Bruyn et al., 2013).[4]

[4] Out of these 133 sectors, 117 qualified for the CLL based on the criteria of trade intensity over 30% alone.%. The remaining 19 sectors would also have qualified for the combined test since they also have an estimated carbon cost over gross value added over 5%.

Figure 2 shows a selection of EU sectors (NACE 4-level) and their trade intensity.

Figure 2. Trade intensity for selected sectors in the EU ETS.



Note: The vertical lines in the figure illustrate the threshold values 10% and 30%.

Source: European Commission (2009c).

California has a similar approach to the EU, but trade exposure is categorised as low, medium and high risk (see Table 1). The trade-intensity test is combined with an emissions-intensity test to assess sectors' carbon leakage risk. Table 4 shows a selection of different sectors and their trade intensity in the California ETS.

Table 4. Trade intensities of selected sectors in California

Trade exposure classification	Sector Classification	Trade share
High, >19% (16)	Oil and gas extraction	65%
	Aircraft manufacturing	61%
	Flat glass manufacturing	46%
	Steel and aluminium processing	37%
	Pesticide and other agricultural chemical manufacturing	20%
Medium, 10-19% (6)	Cement manufacturing	16%
	Petroleum products manufacturing	13%
Low, <10% (2)	Lime manufacturing	3%

Note: The number in between brackets states the total number of sectors in that classification.

Source: California Air Resources Board (2006).

A slight variation was employed in the Australian ETS where trade intensity is calculated as a ratio over domestic production. If the ratio is higher than 10% in any of the financial years 2004-05, 2005-06 or 2007-08, the sector is considered to be trade exposed. This is then combined with a test on emissions intensity in order to determine the level of compensation. Table *5* gives examples of trade intensity for different activities in Australia.

Table 5. Examples of trade intensity for eligible Australian activities

Activity	Trade intensity
Production of sodium carbonate (soda ash) and sodium bicarbonate	105-240%
Production of coke oven	94-227%
Production of bulk flat glass	65%
Aluminium smelting	55%
Integrated iron and steel manufacturing	20%
Production of lime	Less than 10%

Source: Australian Department of Climate Change and Energy Efficiency (2012).

New Zealand has not included any formal measure of trade exposure. Instead it is assumed that all sectors are trade exposed unless it is obvious that they are not, i.e. if it is not a traded commodity (e.g. electricity production or consumption of liquid fuels).

It must be mentioned that the EU ETS is the only system that is using the trade-intensity threshold as a stand-alone test. The other schemes combine trade intensity with either emissions intensity or carbon costs to determine if the sector is at risk for carbon leakage. It is therefore difficult to compare the impact of the trade-intensity thresholds used in the EU ETS, with those used in other jurisdictions.

Other potential quantitative risk tests

Other quantitative tests or indicators could be considered. Risk indicators could be calculated and used as a guideline to signal that abnormal trends are being observed, and that a sector could merit special attention and analysis. Markets may move faster than the review cycle of the EU ETS CLL.

Examples of such indicators could be the jurisdiction's market share of consumption or production over the total world market. This could indicate the market power of the certain sector, and thereby its ability to pass through costs. Assessing changes in import/export patterns could be another indicator of the vulnerability of the sector to trade. Any abrupt or sustained changes in the trade patterns could provide a warning signal.

Additional quantitative approaches that have been mentioned are the ratio of carbon cost over profit. This would provide the impact of the carbon cost over profitability, which may be more relevant than gross value added. Alternatively, carbon costs over EBITDA (Earnings before interest, taxes, depreciation and amortisation), could be another quantitative test to be considered.

3.1.2. Qualitative risk tests

Qualitative risk tests are used to cover some of the carbon-leakage risk factors that are deemed representative, but for which figures, or surrogates, cannot easily be calculated, or for which there are no readily available data.

Currently the EU ETS uses qualitative risk tests. Eight sectors, representing 3% of industrial emissions in the EU ETS, qualified for the CLL with the qualitative assessment (de Bruyn et al., 2013).[5] If the sector has borderline values on the quantitative criteria discussed above, then the assessment is based on:

- emissions levels and electricity consumption reduction potential of individual installations in the sector,
- current and projected market characteristics and
- profit margins as an indicator of long-term investment or relocation decisions.

In Australia, sectors that do not pass the trade-intensity threshold can submit an application for a qualitative assessment. Four sectors in Australia qualified through the qualitative assessment. This qualitative test is meant to assess whether there is a demonstrated lack of capacity to pass through costs due to international competition. The lack of ability to pass through costs can be demonstrated using one of the following:

- historical trade shares above 10%,
- high correlation between the prices received by domestic producers and a transparent international price or
- existence of international producers who trade in the product that is a substitute for the domestically produced good.

3.2. Criteria to assess carbon leakage risk tests

Risk tests are used alone, or can be combined and used as a package. As such, the criteria used to assess their effectiveness ought to be able to ensure that regardless of the package used, it captures the sectors truly at risk – i.e. it does not allow sectors to be at a competitive disadvantage, but also does not over compensate.

In addition, a distinction must be made between the test and the level of the threshold. It may be that the test is appropriate, but the level of the threshold provides the wrong outcome.

Based on the above discussion of risk tests in use so far, the following criteria could be considered:

1. Does the risk test cover a credible/significant/critical proportion of risk factors?
2. Is it focused?
3. Is the risk test flexible?
4. Is the risk test simple, both to understand as well as to administer?
5. Are data available and credible?

[5] Based on the 2009 CLL, where only six sectors qualified after the qualitative assessment.

Does the risk test cover a significant proportion of the risk factors?

It is important that a risk test captures components that fall into the two main categories: carbon costs and the ability to pass cost through. While no test or grouping of tests will capture all risk factors under these two major categories, it is important that it provides credible coverage to determine if the sector is at risk, given the sectoral and broad economic circumstances.

The question that needs to be asked is:

- Does the risk test cover risk factors associated with carbon cost and the ability to pass costs through?

Is the risk test focused?

- What percentage of the emissions does it cover? How many sectors does it cover? This may become increasingly important if there are a limited number of free allowances available, and there is a decision to focus on those sectors in need of real assistance.
- Does it provide for outliers and extremes? Some tests capture the 'middle' of the distribution but fail to capture extremes – those that are totally exposed in one dimension but do not show any risks on other dimensions tested. However, we currently see examples of tests that capture a very large number of sectors – which may lead to questions of how well it is calibrated.

Is the risk test flexible in the way it is designed?

There are several areas related to flexibility, which need to be part of the assessment criteria. It is also important to recognise that different shades of grey exist in what is, to a large degree, a counterfactual world – determining carbon leakage risk is largely a counterfactual process.

It is unlikely that we can determine with precision if a sector is at risk or not – in an in/out type of decision. As such, one important design element that we need to focus on as part of the criteria is the flexibility these tests provide to recognise different levels of risk.

Determining sectors at risk from carbon leakage could be compared to another well-known climate change and carbon pricing element, namely that of additionality under the CDM. A CDM project is considered additional if emissions are reduced below what would have occurred in the absence of the project. The problem is to prove this additionality. The experience of the CDM cannot be discarded, where the in/out approach on additionality does not have a good record. A general observation is that the CDM, and carbon markets, are moving more and more towards a graduated/risk-based approach, which seems to account much more for the level of uncertainty that exists and is in line with the practices of the financial industry that has used ratings for many years to address risk.

A number of observations can be made regarding how risk levels are applied. We observe a number of choices:

- EU ETS/Waxman-Markey type, in which there is in/out outcome (or moving towards one). This will also result in a (full) compensation/no (full) compensation outcome.
- Australia/NZ, where one test is in/out, while a second is graduated – creating a number of options/levels of compensation.
- California, where both tests are graduated, resulting in different levels of compensation.
- A logical progression, which we have not observed so far, is an increase in the number of thresholds, possibly to the level of a continuum. Alternatively, it is also possible to consider as an option an increase in the number of tests that are combined – that is, beyond the two that we have seen so far.

Several questions need to be asked with respect to risk test flexibility:

- Is compensation distributed in proportion to the level of risk?
- Does it recognise that for some risk factors there cannot be quantitative tests?
- Does it recognise different shades of grey when it comes to risk exposure? An in/out approach could create absolute winners and losers and lead to higher pressures and a more politicised approach. Thresholds in a tiered approach will still be politically motivated, but possibly with less at stake for the sectors.
- Are sector-specific statistics and the underlying system variables updated, including adjustment to changes in key parameters? These system variables include the criteria that are used, the levels at which the criteria-specific thresholds are set and other parameters (such as the carbon price used to determine the leakage list in the EU). It must be taken into account that carbon leakage measures target long-term decisions, while at the same time recognise that realities change in the marketplace at an increasingly rapid pace.
- Is the risk assessment updated in regular intervals to adapt to changing market conditions?

Is the risk test simple, both to understand and to administer?

Understanding how tests are constructed and whether the risk tests are easy to administer are other important features of the risk tests. Two essential questions are:

- Are risk tests, including threshold values, well justified and understandable?
- Are the risk tests simple to administer?

Are data available and credible?

To assess risk test and to compare risk tests across jurisdictions, data availability and data credibility are important. A number of questions must be asked:

- Are the data available or does new data need to be collected?
- Is data collection based on existing statistical aggregation or does it create a new level of aggregation and require cross-referencing?
- How reliable and credible are the data – are they historical or forecast? Risk tests that rely on forecasts introduce uncertainty in the assessment compared to using historical data.

The criteria discussed above will be used in Chapter 5 in the assessment of the overall approaches in the EU, California and Australia.

4. How to mitigate carbon leakage risk

This chapter describes and assesses different options to mitigate carbon leakage risk. While the criteria and options are presented in a theoretical and generic manner, the discussion is illustrated with examples drawn from existing carbon pricing mechanisms in operation mainly, but not only, in the EU ETS.

4.1. Criteria for risk mitigation measures

The criteria to assess risk mitigation provisions can be divided into four broad groups, which are elaborated below and illustrated with a number of examples and issues.

These criteria, in some cases, may not be self-standing, that is, a number of them may need to be combined to result in a credible approach.

1. Does the provision address the carbon leakage risk?
2. Does it undermine the environmental integrity of the climate change policy/carbon pricing mechanism?
3. Does it allow for the good functioning of the carbon market?
4. Does the provision meet the general goals and criteria of any sound policy?

Does the provision address the carbon leakage risk factors?

Risk mitigation provisions should tackle the carbon leakage risk and not its impacts and effects. The main risk factors examined in section 2 (carbon costs and the ability to pass through costs) are the issues that should be addressed, not the symptoms. For illustration purposes, a number of examples are provided below:

- Can the provision be used alone? If that is not the case, complementary policies might be necessary to ensure that the carbon leakage risk factors and both direct and indirect costs are sufficiently addressed, as well as any side effects (e.g. breaking the cap).

- Provisions should be targeted at those sectors deemed to be at risk and not over or under compensate.
- Does it address both imports and exports? An importer should be placed on the same level as domestic carbon-constrained industries. However, it is equally important that exporters should not be burdened with additional costs that hinder their ability to compete in the international arena.
- Are all channels of leakage addressed? Not only production leakage needs to be addressed, but also other forms and channels of leakage – most notably, investment avoidance and investment reallocation.
- Are polices adaptable to changes in the carbon market, such as changes in the carbon price? There is a trade-off between giving a long-term investment signal by adopting an inflexible provision and the short-term adaptability of a flexible provision that follows changes in the carbon market. One item for discussion is whether any changes in short-term price levels are relevant and need to be recognised.
- Is the provision neutral to the functioning of the underlying market, e.g. does it take rising/decreasing production levels into account?
- Can the provision be applied broadly across all necessary sectors or is it restricted to a limited coverage? It might not be administratively feasible to implement the provision for a broad range of sectors.

Does it undermine the environmental integrity of the climate change policy?

It is important to ensure that a risk mitigation measure does not affect the ability of the climate policy to address the climate change objectives. Some of the questions to be asked are:

- Does the measure impact on the environmental effectiveness of the carbon price signal? Provisions should not affect incentives to reduce emissions. In the EU ETS the price signal is the tool to drive emissions reductions, not only for sectors that are at risk of leakage, but for all covered sectors. The cost of carbon for those that are deemed at risk of carbon leakage needs to be targeted, not the carbon price.
- Would it provide incentives for convergence in climate change policies internationally, especially with major trading partners and competitors? For example, the EU pursues the dual goals of moving competitors and major trade partners to a model that prices carbon and seeking linkages with other carbon pricing mechanisms. Both would reduce or eliminate asymmetries. However, in the absence of global linking, risk mitigation provisions will remain necessary. The introduction, or continuation, of comparable risk mitigation measures in

various jurisdictions will be seen as a plus, as they enhance the chances of negotiating a linking agreement.

- Does the risk mitigation measure require additional interventions to safeguard environmental integrity, such as ensuring the quality of offsets accepted, and protection of the integrity of the cap?

Does it provide for good market functioning?

Good market functioning entails that the carbon market itself should have adequate liquidity. If a carbon market is not functioning well, it might not deliver on its environmental goal in a cost-effective manner.

Price collars are one type of provision that could potentially disrupt the good functioning of the market by forcing a minimum and a maximum carbon price.

Additionally one needs to consider how risk mitigation measures will interact with other measures that are introduced to ensure good market functioning. It is possible that if additional free allowances are distributed in the EU, this may increase liquidity in the market to the extent that it could trigger the proposed volume-based flexibility mechanism, which is outlined in the EC legislative proposal (European Commission, 2014b). As such, the triggers and functioning of the proposed flexibility mechanisms would need to be informed by and coordinated with risk mitigation measures.

Does the provision meet the general goals of any sound policy?

Any policy needs to meet a set of criteria that would include:

- **Is the provision feasible and implementable**? This encompasses all administrative, political and legal constraints that could arise for any provision.
    - Is it generally acceptable within the framework of international political and trade relations (e.g. WTO rules)?
    - Does it lead to distortion of competition? This is applicable not only within sectors or between sectors, but also between member states. The EU’s single market is one of the core principles underlying the EU. Provisions need to take this into account by ensuring that the same rules are applied throughout the EU. The current approach to indirect costs for instance does not fulfil this criterion, as member states decide independently on the existence and level of compensation. This could lead to distortions in the single market.
    - Provisions must be politically acceptable within the EU; otherwise they will not be passed.
    - Provisions must be practical, feasible and administratively implementable.
    - Can the provision be implemented unilaterally or is it based on cooperation with other international actor?

- **Cost factors**. What are the cost implications and economic efficiency of the measure being implemented, both in terms of administrative as well as implementation costs? One particular dimension is the lost revenue resulting from the provision of additional free allowances. However, this is a political decision.

4.2. Options

Risk mitigation provisions can be discussed from a number of different points of view. One way is to focus the discussion on how narrow or how broad these measures are. From this point of view, they can be either:

a) **Targeted measures,** which focus only on the sectors deemed to be at risk.
b) **Cost-containment measures**, which lower the compliance cost for all entities covered by the carbon pricing mechanism. They also impact the risk of leakage, but at the same time also address a number of other issues. Such measures may include:
    i. Broad access to international offsets (currently lower priced than EUAs)
    ii. Linking with other carbon trading
    iii. Transitional funding to aid investments in reducing emissions
    iv. Funding of research and deployment of less carbon-intensive technologies

While the broad measures included in this latter category are recognised as potentially important, they are not the focus of this paper.

Many of the risk mitigation measures (discussed below) are what one could call 'add-ons', which is the case in the EU ETS, Australia and California. These are measures specifying compensation for carbon costs, under certain circumstances, in order to alleviate the impact on competitiveness. However, they do not attempt to provide a solution that would prevent carbon costs from occurring in the first place.

In this context, another way to approach carbon leakage is to keep the final objective in mind: providing incentives to reduce emissions through the introduction of a carbon price. However, rather than provide add-on measures, we may want to think of ways to design the carbon pricing mechanism that recognise and incorporate concerns related to carbon leakage.

The options to address carbon leakage are presented below. As mentioned, it is possible that none of them will individually meet the criteria above, and that elements may need to be combined. Moreover, some of the options will have implications for the effectiveness and/or integrity of the climate change policy, which will need to be addressed through additional policies and measures.

The leakage options examined in this section are:

a. Free allocation for direct emissions
b. Compensation for the cost of indirect emissions
c. ETS in different speeds
d. Border adjustments
e. Targeted access to international offsets

4.2.1. Free allocation for direct emissions

Free allocation for direct emissions is the main carbon leakage risk mitigation measure currently in place throughout the world. The EU, Australia, California, Quebec and New Zealand all use varying forms of free allocation.

The common element is that emissions permits are provided, free of charge, to participants covered by the carbon pricing mechanism and which are deemed eligible. Eligibility for being at risk of carbon leakage is determined using the risk tests described in section 3.1.

While the emissions permits received free of charge can be used for compliance purposes, the incentive to reduce emissions is still present. Any surplus permits resulting from actions to reduce emissions in a given installation can be sold in the market, and provide additional revenue.

What needs to be kept in mind is that the goal is to mitigate the risk of carbon leakage arising from the need to purchase emissions permits in order to meet compliance obligations from direct emissions.

Taking into account the experience acquired so far, as well as the issues discussed above, we can identify a number of axes along which free allocation for direct emissions can be operationalised, as discussed below:

Timing (ex-ante vs. ex-post)

Ex-ante allocation. In this case, the level of free allocation for a given period is determined **before** the actual emissions or production levels of the installation are known. Historical data are used to establish the number of permits the installation receives. The EU ETS uses historical data to calculate how many allowances installations receive.

One issue with this approach is that allowances are not a function of the actual level of production. This brings certainty for the installation on the volume of allowances but could discourage production increases as installations face the full cost of the emissions for all production above historical levels. On the other hand, it could also act as a perverse incentive to limit production (and the linked emissions), in order to sell permits received for free.

Ex-post allocation. In this case the level of allowances for a given period is determined at the end of the compliance period – after the actual emissions and production are known. In this case, allocation can be a function of the actual level of production or emissions.

New Zealand uses an interesting model for combining ex-ante and ex-post allocation. The annual allocation is done in two steps. First, during the 'provisional allocation', an advance payment of allowances is made, based on production data from the previous year. When the actual output becomes known, the second step (the 'reconciliation mechanism') seeks to correct possible errors caused by changes in production levels.

The California ETS has a system that provides production-based free allocation for direct emissions. More details are provided in the assessment of the measures to mitigate carbon leakage risk in the California ETS (see chapter 5.3.2). The Australian CPM also provides assistance for eligible activities based on previous year's level of production, with a true up, to account for actual production (see chapter 5.2.3).

Ex-ante and ex-post may refer both to the time when the level of the (free) allocation is determined, as well as to the time when the allocation is distributed to operators. While the latter may have an effect on market functioning, this section is concerned with the former.

Benchmark-based vs. grandfathering-based

Benchmark-based allocation uses data on product- or sector-based emissions intensity to determine allocation to all producers in that sector. This rewards installations that are less emissions-intensive, and motivates the more emissions-intensive installations to catch up.

Benchmarking in Phase 3 of the EU ETS is done predominantly on the basis of product-specific benchmarks. These product benchmarks are expressed as a number of allowances per unit of production that the installation receives. In general, this number is calculated as the average emissions intensity of production of the top 10% least emissions-intensive installations producing a certain product.

Installations that emit at the benchmark level receive 100% free allocation (if on the leakage list, and discounting the cross-sectoral correction factor). Those who are less emissions-intensive than the benchmark receive more allowances than they need to surrender. Installations that emit more per unit of production than the benchmark are not allocated enough EUAs to cover their obligations, and must undertake a residual effort.

That effort and the impact on those that need to make it will vary significantly with:

- The threshold benchmark used (benchmark at 30%, 10%, average)

- The distribution of installations within the sector around the benchmark
- Technology
- Abatement opportunities

Grandfathering implies that free allocation to an installation is determined based on its past levels of emissions. The EU used grandfathering during the first two phases. For the first (pilot) phase (2005-08), estimates of emissions were employed to allocate allowances. For phase 2, data generated during the pilot phase were used to set up an ex-ante fixed emissions-based system, in which more than 90% of all EUAs were distributed for free.

Fixed allocation vs. dynamic allocation

Fixed allocation. Free allocation can be provided at a fixed level determined by the regulator, based either on benchmarking or on grandfathering. Both are generally based on historical data.

Dynamic Allocation. In this case, allocation is based on benchmarks, which are regularly reviewed and updated and can be:.

- **Production-based**. In this case the allocation is calculated as the number of units produced multiplied by a level of compensation. Consequently, this may not cover the entire actual obligation of the installation, resulting in a shortfall, which must be made up by the installation. The impact on the sector will depend on the same factors outlined above. There continues to be an incentive to increase the carbon efficiency of production, as any allowances freed in that way could be available for sale in the market.
- **Emissions-based**. In this method, the compensation would match the actual emissions (or share of) the installation. There is thus little incentive to increase the carbon efficiency of the installation and no possibility of accumulating allowances for sale in the market.

Binary (in/out) vs. graduated allocation

In the **binary model**, a sector is judged as being either at risk or not – it is either black or white, there are no shades of grey. In this case, there is intense pressure to be deemed at risk.

As mentioned, jurisdictions can use an in/out system (or are moving in that direction) to determine whether a sector is at risk or not, while others use a tiered approach.

The EU ETS is not, for the moment, a pure in/out system. In this phase, installations that do not make it on the CLL receive some level of free allocation, but one that is declining to 2020.

In a **graduated system**, a risk-based system of free allocation is used. This system assigns each sector a level of risk, determined by an algorithm. The carbon pricing systems in California and Australia illustrate how such a system works and assign different levels of free allocation.

One 'extreme' way would be to forgo bandwidths and thresholds, use a discrete number as an outcome for each risk test and assign a numerical risk level. This approach may then be used to determine a discrete/linear 'risk-based' free allocation system.

Assessment

The assessment of "free allocation for direct emissions" as a carbon leakage risk mitigation measure must recognise that it is the most commonly used, accepted and well understood approach.

It must be noted, however, that it cannot be used alone, as it addresses only part of the problem, namely, the cost for direct emissions. Costs for indirect emissions are not covered, and the relative weight of direct and indirect costs can vary significantly from sector to sector, as well as within the sector.

In addition, how the amount of free allowances is determined will also signal whether it covers all costs or leaves some effort to be made by covered installations. For illustration purposes, an approach that uses free allocation may not cover all emissions from an installation if it is ex ante, not dynamic and based on a benchmark, with a significant deviation from the benchmark for many installations.

In general, this approach is adaptable and can recognise changes in market conditions for the underlying product (through dynamic, ex-post allocation). However, this may require additional measures to ensure that it does not imperil the environmental integrity of the climate policy. Also, dynamic allocation, currently implemented in other jurisdictions (Australia and California), requires new levels of effort and resources to implement.

If additional free allowances are provided to recognise real levels of production or emissions, these allowances must come from somewhere – and they either impose additional burdens on other ETS sectors, put more burden on the non-ETS sectors of the economy, or the public authority assumes the risk through international purchases for sovereign compliance.

This approach can be considered focused to the extent that the risk tests are well calibrated. Since it reimburses the additional costs of those sectors deemed at risk, it will cover both exports and imports.

Market functioning and dynamics will be affected and those implementing these measures must be aware of this. The proportion of free allocation and auctioning under a given cap will have an impact on market behaviour and attract different participants. A larger proportion of auctioning is likely to attract more financial participants and ensure better liquidity. Other needs, such as hedging needs, must also be recognised in minimum levels of auctioning.

Auctioning will have a clear impact on government revenue, which is a function of the amount of free allocation. However, as mentioned before, this is a purely political issue.

In terms of WTO compliance, free allocation does not seem to create compliance problems for the EU. However, if coupled with border adjustments (described below), it will need to ensure that there is no double-dipping. Finally, for the EU, free allocation is not likely to impact the single market since it is done at the EU level.

4.2.2. Compensation for the cost of indirect emissions

Carbon costs resulting from emissions embedded in electricity or other production inputs could be passed through.

Indirect costs can be as important as direct costs, and to some degree are even more controversial, as they are more difficult to evaluate. For some industries, especially electricity-intensive industries, these costs can be significant, e.g. for the aluminium industry. It follows that the level of compensation for indirect costs may not only be challenging to evaluate, but it can be also, in some cases, be very significant.

Most of the debate on indirect costs results from the pass through of carbon costs in electricity prices. An analysis of the second category, costs embedded in other inputs, would require a daunting effort and is outside the scope of this paper.

The formula for calculating the indirect cost of carbon (in the EU ETS) is:

Indirect cost of carbon (Euro) = Price of allowances (Euro/tonne) x (Pass-through factor) x Carbon intensity of electricity (tonne/Kwh) x Electricity intensity of production (Kwh/unit produced)

Much of the data that needs to be plugged in the above formula is difficult to obtain and verify. The most contentious part is the pass-through rate, which many, especially in industry, regard as logically being one, given, in their view, the fact that the electricity market uses marginal pricing, with fossil-fuel generation taking place most likely on the margin.

For most exercises, however, the pass-through costs for the electricity sector is generally considered to be between 0.5 and 1. There is currently no authoritative study that can provide guidance on this matter.

CEPS has concluded several studies[6] that looked at (among other things) the indirect costs of carbon faced by a number of sectors within the EU: steel, aluminium, ceramics, chemicals and glass. A lack of data for several of the elements above was addressed by using proxies.

The controversy surrounding the pass-on rate of indirect costs was overcome by a simple sensitivity analysis with three pass-on rates (0.6, 0.8 and 1).

The carbon intensity of electricity generation also proved challenging to verify. The maximum regional carbon intensity of electricity provided by the Commission's Guidelines on state aid measures was used.[7] Note that member states that are highly interconnected or have electricity prices with very low divergences are regarded as being part of a wider electricity market and so have the same maximum intensity of generation (for example, Spain and Portugal). This raised the issue of the lack of differentiation between member states.

Indirect costs per tonne of product for the sectors reviewed are presented in Table 6.

Table 6. Indirect cost ranges for selected sectors

Sector	Indirect cost ranges per tonne of product
Steel (BOF) (2005-12)	€0.261 – 0.409
Steel (EAF) (2005-12)	€3.633 – 6.544
Primary Aluminium (2005-12)	€0* – 127.46
Secondary Aluminium (2005-212)	€0 – 2.44
Bricks and roof tiles (2010-12)	€0.29 – 0.93
Wall and floor tiles (2010-12)	€0.70 – 2.72
Flat glass (2010-12)	€0.41 – 2.37
Ammonia (2010-12)	€0.65 – 2.68
Chlorine (2010-12)	€16.78 – 43.64

Notes: Costs refer to actual plants and relate to the scenario with a pass-on rate of 1.
* The indirect costs for some plants was equal to 0 euros per tonne, because these plants either had long-term contracts that predated the ETS or used carbon-neutral generation.
Sources: Renda et al. (2013a and 2013b), Egenhofer et al. (2014)

Assessment

There are three important questions to consider when discussing compensation for indirect costs:

- Who compensates, at what level of government?
- What form does compensation take?
- How stable is that compensation?

The EU ETS currently allows for compensation for indirect costs in line with state aid rules to take place at the member-state level. This makes compensation potentially uneven across the EU, as some member states have the ability and resources to provide

[6] See Renda et al. (2013a and 2013b), and Egenhofer et al. (2014).
[7] Communication from the Commission; Guidelines on certain State aid measures in the context of the greenhouse gas emission allowance trading scheme post-2012 (2012/C 158/04)

this compensation, while others do not. It is understood that at least five member states and Norway provide this compensation (UK, Germany, Netherlands, Spain and Belgium (Flanders region) (DG Comp, 2014)).

An alternative would be for monetary compensation to take place at the EU level, but that would require funds to be available and would raise issues of fiscal sovereignty for member states. Revenues from EUA auctioning are currently going to member states.

Compensation could be provided at EU level, just as for direct emissions, in free EUAs. This in itself would raise a substantial number of questions, some politically challenging:

- How to calculate the level of EUAs assigned to each sector?
- Will installations not covered by the EU ETS also be compensated with allowances?
- Where would these additional free EUAs come from? From the amount currently auctioned?
- How would member states' auctioning revenues be affected?
- Would it imply the introduction of additional EUAs with implications for the integrity of the cap and who would carry that risk?

California implements a different approach to compensating indirect costs. Private electricity distribution utilities (EDU) are granted free allocation at 90% of 2008 emissions. From 2013 onwards, all these allowances must be auctioned and the proceeds of those auctions are earmarked to compensate each EDU's customer for any price increase caused by the cap-and-trade system. A proposal by the California Public Utilities Commission would limit the compensation scheme to households and small businesses (consuming less than 20 kWh) to keep motivating large electricity consumers to increase their electricity efficiency.

The effectiveness of the measures to compensate for cost from indirect emissions is critical, especially for those industries that are electricity-intensive (as was illustrated in Table 6).

Compensation for indirect emissions cannot be used in isolation, unless the industry is not covered by the ETS. Since the aluminium industry was not covered in Phase 2, coverage for indirect emissions from electricity would have provided enough compensation for that time period.

In the EU ETS, the compensation for indirect emissions is done in financial terms, not in permits. As such the value/price of permits is relevant and the compensation needs to be adjusted for price.

The ability to use a realistic carbon price is important but will pose problems if there are significant variations in production, or the carbon price, during the year. Similarly, calculations based on the availability of data such as carbon intensity of electricity or electricity intensity of production may be more challenging than one would expect.

Indirect compensation at the EU level could be more feasible if permits (EUAs) are used for compensation. The calculation would be de facto the same, without the price of carbon, and would imply the same difficulties in obtaining the data.

However, if the compensation for indirect emissions is done through permits, then the possibility of challenging the environmental aspects of carbon pricing schemes would also be a concern, and provisions must be made to avoid that. This was discussed in other sections above.

Two issues need to also be considered. Firstly, is whether this would be as important an issue under the scenario whereby auctioning revenue for member states would be much more significant. Secondly, the different impact of carbon on electricity prices in different EU members states.

4.2.3. One ETS, different speeds

This approach, which has not been debated in depth, could take different forms. While some in industry have floated it, it was never clearly articulated or detailed. One thing that needs to be made clear is that it still implies an overall cap for the whole ETS.

In the EU ETS, the linear reduction factor defines one cap for all ETS sectors. Free allocation alleviates part of the effort, up to the benchmark level for sectors on the CLL. The residual effort borne by each sector may not be proportional to its ability to deliver it.

It is fundamental to recall that we are trying to find ways to address carbon leakage risk by making sure that carbon costs are borne in a realistic way for those deemed at risk. Another way of expressing this notion may be to say that carbon costs that cannot be passed through are a burden that must have some relationship to the characteristics of the sector. This fact can be attributed to:

- different margins that allow for different capacities to absorb costs that cannot be passed through,
- different technological pathways or
- different distribution in terms of carbon intensity.

Therefore one could imagine carbon-pricing mechanisms in which there are different speeds, or residual efforts, with respect to a number of aspects, depending on the sector, such as:

- different caps
- reduction factors
- different benchmark rule settings, for instance by taking sectoral spreads around the benchmark into account.

Is it already happening?

One way to look at this approach is to examine whether it is already happening. In fact, the EU and some other jurisdictions discussed in this project currently have different speeds with regard to the method of free allocation.

In principle, all sectors and installations in the EU ETS are subject to the same market price for EUAs. In fact we can identify within the EU ETS:

- Installations in the electricity sector that obtain their permits by purchasing them on the secondary market or through auctions, and can pass carbon costs through;
- Installations in the electricity sector that receive free EUAs for a period of transition;
- Industry sectors on the CLL that are compensated based on historical production to the level of the benchmark – and as such their effort and costs are based on the distribution within the sector; and
- Industry sectors that are not on the CLL and are compensated based on historical production up to a gradually decreasing part of the benchmark.

As such, one could say that there are different speeds when it comes to the EU ETS. There are many ways to think of a multi-speed ETS, as discussed below.

One ETS with burden sized to sector characteristics

One way to operationalise this concept may be to recognise that each sector is different, can carry different burdens, and then integrate leakage protection in the ETS itself through the ETS allocation system.

It may be worth considering the fact that currently the benchmark in the EU ETS is common – average of top 10% performers. This implies that depending on the distribution of carbon intensity inside each sector, some sectors may have to do more than others, as the residual effort is a function of how far one is from the benchmark. While for some sectors this is perfectly feasible, it may require much more effort for other sectors, and be too expensive to contemplate without being materially at risk of leakage.

There may be some ways that could be considered to address this difference in efforts between sectors to reach the benchmark. One may be to consider the possibility of using a different way to define the benchmark altogether, or to have different benchmarks more adapted to the realities of the sector.

More than one ETS?

Dividing the ETS into more than one, but linked, ETSs is another solution that has been floated by some industrial stakeholders.

One could split sectors into those that can pass through costs and those that cannot. This may lead to the temptation to have one ETS for the power sector and one for industry, implying different caps, carbon units and prices for each of the two ETSs.

A more sophisticated, or complex approach could see a number of ETS grouping sectors with the same residual effort, the same carbon leakage risk rating or a combination thereof. Moving sectors between ETSs would certainly raise interesting questions.

Assessment

This is a difficult approach politically, with a significant new layer of complexity in implementation. Depending on the extent to which it departed from the current EU ETS, it would require significant research, deep 'surgery' and a substantial effort to sell to stakeholders in Brussels and around the EU.

What is more important is the fact that different speeds within the ETS might jeopardise the fundamental merit of the ETS: its imposition of a single cap across all the sectors, which allows the cheapest emissions reductions to take place first. It would require assumptions (inevitably inaccurate) about the emissions reduction potential in different sectors, therefore reducing the economic efficiency of the system.

Any solutions related to the creation of more than one ETS, sectoral in nature, and linked, would also raise questions of good market functioning, especially as it relates to market liquidity. It is likely that few, if any, sectoral ETSs would be liquid enough to survive since it is the variety of interests and natural positions that makes the market liquid.

In a 'one ETS, multiple speeds'-approach, liquidity may be less of a problem, but the result would certainly be excessively high complexity, which may put off some liquidity providers. In addition, administrative costs would logically increase, raising questions about the efficiency of the system. In addition, having different speeds for different sectors, by itself, does not guarantee that all carbon costs will be covered.

The advantage of this system is that it would provide an approach that is more in line with the different capabilities of sectors. This is positive, as it would ensure that under different scenarios the burdens placed on individual sectors are consistent with the characteristics and realities of those sectors.

The degree to which it compensates for carbon costs will depend on other characteristics of the approach used: whether it is fixed or dynamic, whether it is ex post or ex ante and whether it is based on production or emissions. These approaches are not unique to a multi-speed ETS.

An ETS in different speeds may be seen as an intriguing solution, as it incorporates ways to recognise the diversity of the EU sectors with the ETS allocation structure. However, it must also be recognised that it might depend on the introduction of other measures to maintain the environmental integrity of the system. Measures would need to be put in place that would address any potential breach of the cap. This implies an added burden for other ETS sectors and/or non-ETS sectors of the economy. Alternatively, the public authority may need to guarantee the environmental risk by committing to buy international credits.

Is a 'one ETS, different speeds' approach a feasible way forward? As mentioned, in our view it will require substantial amounts of effort and political capital to be expended and a level of complexity in implementation that is not likely to be currently well appreciated by proponents.

4.2.4. Border carbon adjustments

The discussion around border carbon adjustments (BCAs) centres on their efficacy and impact, their pluses and minuses, but also on their compliance with WTO provisions. Stiglitz (2006) argues that not pricing the global externalities of carbon emissions through carbon prices is a de-facto subsidy and would justify the imposition of countervailing duties.

Carbon leakage risk factors can impact the ability to compete in internal markets as well as external ones. A BCA can target imports, exports or both. By targeting both imports and exports, a BCA ensures that producers at risk of carbon leakage will not suffer a competitive disadvantage in their domestic market, or when exporting.

BCAs can take various forms and it is important to note that being classified as a tax or tariff can make an important difference in terms of their compliance with WTO rules. It must also be noted that treatment of imports and exports under the WTO can be very particular. As such, very specific technicalities become important and actual testing under different dispute resolution mechanisms becomes unavoidable for a BCA to be declared as WTO-fit, and therefore implementable.

A BCA for **imports** (from a less-or-not-carbon constrained jurisdiction) can be expressed as a tax, or the requirement to hold/purchase allowances. When we address **exports**, a rebate for the cost of carbon needs to be implemented.

In California there is a provision for electricity importers (for all out of state) to hold allowances. Some would see this as an extension of the AB 32 bill provision to out-of-state electricity producers, while some would see many similarities to a BCA.

Also in California, the California Air Resources Board (CARB) has recently started to analyse the feasibility and form of a BCA for the cement sector (see Annex 2). Cement is seen, by some, as a good candidate for such a mechanism, since the carbon cost component is important, and it is to a large degree a homogenous product for which emissions can be calculated.

The Waxman-Markey Bill, contained a provision that required the Executive to establish a mechanism that would require importers to obtain emissions credits from an international reserve allowance programme if no international agreement was reached by 2018. The Bingaman-Specter Bill included a form of BCA that would be triggered for trading partners if they had not adopted comparable efforts to reduce emissions. One of the solutions examined by CARB would see the creation of an independent allowance pool for importers (like a mini-ETS).

The EU ETS Directive refers to a potential BCA in Art 10b by raising the possibility of "inclusion in the Community scheme of importers of products" of which the domestic counterparts are already covered by the EU ETS. In addition, the incorporation of international aviation and maritime transportation in the EU ETS also represented a form of BCA to ensure that EU companies were not placed at a disadvantage.

A BCA, whether in the form of a holding obligation or a tax, needs to be regarded as addressing an environmental balance and not as putting up trade defences in the name of the environment. As such, in our view, the amount of carbon that is embedded in the product that is imported (or exported) should be the prime focus of the discussion.

Assessment

BCAs are seen as having both positive and negative effects, and that debate will continue. But it is important to point out that BCAs will act as an alarm system for, but not only, developing countries, which will be suspicious of these measures as being 'green protectionism'.

This may lead to the threat – or even the start – of a trade war. The Chinese and Indian governments have raised that spectre in the context of the UNFCCC in the case of EU ETS and international aviation. As a result, BCAs may become entangled in a long, drawn-out WTO dispute, with the accompanying uncertainty.

But will BCAs address the causes of carbon leakage? The short answer is: it "depends" on how the particular BCA in question is designed. It would need to address both imports and exports. Addressing imports only will leave exporters vulnerable and certainly encourage several channels of leakage: production, new investments, maintenance and upgrading.

How the amount of carbon is calculated becomes extremely important. It clearly needs to include both direct and indirect emissions and include provisions to adjust for the free allocation that may be received by sectors, as in the case of the US bills. However, obtaining the data may be a major implementing challenge for a BCA.

Data to assess the carbon content of exports may be possible to come by, given the sophistication of collection that is possible in developed countries, such as the EU member states and the US. However, recent sectoral studies undertaken by CEPS have highlighted the complexity of such data collection, and the number of assumptions and approximations that need to be introduced. As such, the cost of collecting and administering such as system may be significant.

When extrapolated to imports, this will pose a greater challenge, as the cost may increase exponentially to the extent that it may only be feasible to apply the BCA to a limited number of products or sectors. The precision of such data may also suffer and it may be impossible to verify according to the same standards. This also assumes a certain level of cooperation from authorities in other jurisdictions, which is not guaranteed at best. There could be surrogates and approximation used such as the industry-wide emissions baseline from the country of origin (Monjon & Quiron, 2011) or the characteristics of BAT (Godard, 2007).

If the BCA is tax-based as opposed to permit-based, then the price of carbon that needs to be considered is also an issue and some approximation (such as yearly average of daily closing on exchanges) may need to be used. Disputes will inevitably arise, however, especially in a fragmented global market where prices may differ.

Depending on how compensation for exports is provided, it may be that there could be little incentive to reduce the carbon intensity of production. This may be the case if the compensation is allowance-based and related to the amount of emissions for the whole production (adjusted ex post).

Other issues related to environmental integrity could be seen as generic. Whether the ETS cap could be breached in such a situation by increasing the number of allowances under the cap, and/or the quality of the units used to compensate are also valid questions, but will ultimately depend on the BCA design.

Therefore, clearly, the major concern must be WTO compliance, as well as the impact on international trade, international relations and the prospect for an international climate change agreement. A BCA does not seem to impact the EU internal market as it is oriented outwardly.

BCA will continue to be an option, and so far has not been eliminated as an alternative. It is difficult to see it as an option that will be applied by a single jurisdiction against a majority. However, the emergence of such approaches in different parts of the world (starting with a significant economy such as California) may make it more 'implementable' in other jurisdictions. Given the difficulty of calculating emissions for imports, its application is likely to be limited to products (such as cement) where the emissions are easier to calculate, as opposed to complex ones, with a multitude of sub-components.

4.2.5. Targeted use of international offsets

International offsets are meant to lower the cost of compliance and as such provide a cost-containment option. In Phases 1 and 2 of the EU ETS, offsets from CDM and JI were hailed as saviours. In addition they had a strong positive impact on capacity development around the world in preparing other jurisdictions for converging climate change policies, especially the introduction of carbon pricing mechanisms.

They were also seen as having negative impacts by contributing to the current surplus in the EU ETS with approximately 549 million international credits having been surrendered by the end of 2011 (European Commission, 2012a), even though this volume is well below the offsets use rights under the ETS Directive at this point in time. Some have called part of these reductions of questionable environmental integrity.

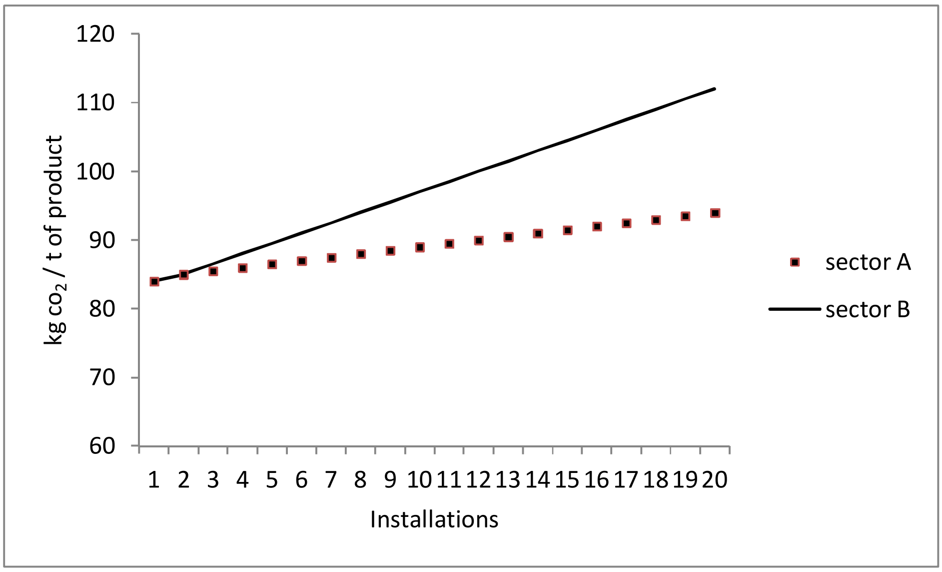
One option that ought to be open for discussion is the “targeted use of international credits”. This would allow sectors that are at risk of carbon leakage to use international offsets, which are cheaper than EUAs, for compliance.

It must be clear that this is not meant to replace free allocation. It must be seen as an additional tool, and help ease the burden for that remaining part of the effort (if any), which is not covered by free allocation.

Installations that are in sectors included on the CLL may face two types of situations:

1) Scarcity of free allowances. The amount of free allowances available for free distribution will be increasingly affected by the stress of the linear reduction factor, through the cross-sectoral correction factor as well as through the need to maintain a minimum level of liquidity at auctions, and in the market. This will pose a growing problem for sectors on the CLL, as the effort required by each sector and the impact on their competitiveness will be increasingly felt in spite of the free allowance system.
2) Unequal distribution of effort required. Given the same benchmarking methodology (average of 10% best) that is used for free allocation in all sectors, as discussed above, some sectors will be called upon to make a bigger effort than others. For illustration, Figure 3 depicts two sectors of 20 installations each and where the best two installations (top 10%) in each sector have the same emissions performance; emissions reduction requested of sector B is significantly higher than that requested of sector A.

Figure 3. Illustration of two sectors with same benchmark, but different distributions around the benchmark



To alleviate but not eliminate these additional burdens, one may consider allowing targeted use of international offsets by sectors that are on the CLL to meet the incremental part of the obligation. Consideration could be given to pegging the level of access to offsets to the level of risk for the sector. Consideration should also be given to managing the use of the credits within a fixed cap.

Assessment

This is not a stand-alone measure and addresses the problem only partially, as costs will still be incurred and not passed through. The benefit is also highly dependent on the price of international credits. Interestingly, the price of international credits may be expected to mirror the level of commitment of the major competitors to EU in the fight against climate change.

This measure can be seen as an intermediate step between status quo (and an ever-increasing level of effort for those on the CLL) and direct increased free compensation. I

Such a measure could be used in conjunction with free allocation as well as with an ETS at multi-speeds. Such an approach would not affect the internal market or violate WTO rules and would be cost neutral for the EU member states.

It would not break the cap and commitment at the international level as the units are expected to be recognised as “good for international compliance”. However, it would reduce demand internally within the ETS and impact prices. It would also be seen by some stakeholders as a way to ‘deflate’ the domestic commitment by allowing offsets under the cap, provoking some controversy.

Such an approach would have a positive impact in connecting the EU ETS with the international market but in a very limited way and without providing trading competitors with incentives to align climate change policies.

The utility of this measure also depends on how the international carbon market could evolve post-2020. Consideration should be given to the wider context of decisions about offsetting/credit access in the EU Climate and Energy Package as a whole.

5. Assessing current risk mitigation measures

5.1. EU ETS

5.1.1. Assessing carbon leakage risk tests

In the EU ETS both quantitative and qualitative risk tests are used to determine which sectors are at risk of carbon leakage and therefore qualify for inclusion on the CLL.

Quantitative tests

The quantitative risk tests focus on carbon costs and trade intensity (see Table 1). They are used as a stand alone, but also combined with one another.

The **carbon costs** test provides a good indication of the impact of the carbon on the overall cost structure. Other approaches should be tried (e.g. costs over margins, or over EBIDTA). It is however clearer, more relevant and easier to understand than other financial-type tests used in other jurisdictions (e.g. carbon intensity over revenue). While other risk factors in the carbon-cost risk category are not captured with this test (e.g. abatement potential and the cost of abatement), there is a sense that carbon costs provide credible coverage.

There are significant approximations associated with this carbon-cost risk test. An EUA price forecast (€30/tonne) is used, which is being criticised for being far above the current (and forecast to 2020) market price. However, it must be considered that €30/tonne is a price that is put forward for an investment decision time frame, as the CLL addresses all channels of carbon leakage, including investment. From this point of view, a long-term price of €30/tonne cannot be seen as unrealistic, and could in fact be considered conservative. However, this needs to be specified and clarified in the Directive itself.

Two sectors qualify for the CLL with a carbon cost over 30%. Admittedly, the threshold was set to capture certain sectors, but it can be argued that is focused, as it captures two sectors only, which are outliers on this dimension (high costs, but not high trade intensity).

The ability to pass through additional costs from carbon pricing is captured with the surrogate test on trade intensity. While this clearly captures heavily traded products, it does not capture all risk factors associated with pass-through ability, such as price-setting power and market concentration.

In symmetry with carbon costs, the stand-alone threshold for trade intensity was set also at 30%, resulting in 117 sectors being captured by this test (see also Table 7). This outcome cannot be seen as focused. The test itself is questionable as a stand-alone, but it might be less questionable if the threshold is significantly revised upwards.

Moreover, 16 sectors have trade intensity above 30%, but they also qualify on the combined criteria. The sectors with trade intensity over 30% represent 26% of total EU ETS industrial emissions (de Bruyn et al., 2013).

When used in combination, trade intensity and carbon costs are certainly relevant for the EU ETS, and they capture 36% of emissions and around 5% of the sectors, which does seem to cover the "middle", and also not excessive number of sectors.

In general, the outcome of the test for carbon leakage risk seems to be a very broad list, with almost everyone included. There are currently 156 sectors on the CLL, out of a total of 258 industrial sectors, covering approximately 95% of total industrial emissions in EU ETS (de Bruyn et al., 2013).

Table 7 describes the number of sectors on the CLL for each qualifying criteria. According to one study, commissioned by the Australian Trade and Industry Alliance, the number of sectors on the CLL translates into 42% of jobs and 48% of turnover being compensated for carbon leakage in the EU (SFS Economics, 2011).

Table 7. Number of sectors on the EU ETS CLL

Qualifying criteria	**Nr of sectors**
Combined test (carbon cost 5%, trade intensity 10%)	13
Carbon cost over 30%	2
Trade intensity over 30%	117
Both trade intensity over 30% and combined tests (carbon cost 5%, trade intensity 10%)	16
Qualitative test	8
Sectors beyond NACE-4*	20
Industrial sectors not covered	93
Total	258

Source: European Commission (2009b, Amendments included).

* For some sectors an additional 6-digit analysis have been performed.

In general, the quantitative risk tests seem to make sense and are understandable. However, some complexities exist, e.g. the risk tests in the EU ETS provide no information on the compensation provided, since free allocation is allocated on the basis of benchmarks.

Qualitative tests

The EU ETS complements the quantitative tests with qualitative tests. Through these qualitative tests, the EU ETS has some flexibility when it comes to detecting the risk of carbon leakage.

There are eight sectors included in the CLL through the qualitative assessment approach. The European Commission's impact assessment gives no information on how the criteria were applied.

Qualitative tests are therefore seen as more susceptible to being politicised. They may also be more complex and time-intensive to administer. Qualitative factors may also result in excessive measures being implemented, with the resulting diminished ability to address the sectors truly at risk.

With regards to **data collection** and sector aggregation, the EU ETS is complex. Emissions data at the NACE-4 level are not publicly available. To make the carbon leakage risk assessment, the Commission collected data from the Community Independent Transaction Log (CITL) and from member states.

To re-create emissions data at the NACE-4 level is a complicated and time-consuming task, since the CITL (and the EU Transaction Log, its successor) does not provide a cross-reference to which NACE sector each installation belongs. This lack of transparency makes further analysis and comparison of EU ETS risk tests with other jurisdictions' tests, as well as the ability to test for other approaches, much more complex.

5.1.2. Assessing mitigation measures

The EU ETS has risk-mitigation provisions for those sectors found to be at risk, and thus included in the CLL. For **direct emissions** they receive free allocation (to the level of the benchmark) at the EU level, while compensation for **indirect emissions** is determined and awarded at the member state level (subject to EU state-aid rules). The amount of free allocation for sectors not on the CLL decreases until 2020. Note that it decreases at a higher rate than the free allocation for CLL sectors.

Free allocation in the EU ETS is calculated according to the following formula[8]:

Allocation= Benchmark x Historic Activity Level x Carbon leakage exposure factor x Cross-sectoral correction factor

The benchmarks are defined at the product level, and are generally the average emissions intensity of production of the top 10% of installations. The historical activity

[8] Ecofys, Entec and Frauhofer ISI (2011).

level is based on the average annual production levels during the years 2005-08 or 2009-10 (whichever is highest).

The carbon leakage exposure factor is 1 for sectors on the CLL. For installations not on the list, it was 0.80 in 2013, but it will decline yearly till it reaches 0.30 in 2020.

The cross-sectoral correction factor reconciles the sum of free allocation to the installations (as proposed by the member states) with the total cap for free allocation, and will reach 0.82 by 2020 (European Commission, 2011a). This will lead to a significant reduction in free allowances available, and if it continues on this slope will reach levels that may make this approach untenable in the longer term. At the moment there is no clarity on how both factors will decline after 2020.

Therefore the EU ETS model can be described as ex-ante and fixed with allocation based on benchmark methodology for all sectors. It may lead to a significant amount of costs not being covered, depending on the sector's characteristics (spread around the benchmark). In addition, it does not compensate for any carbon costs related to increased production levels as it is based on historical levels of production and could be seen as not encouraging investment and/or increased production.

Another issue that needs to be highlighted is that the rules determining free allocation to installations that reduce production leave room for perverse incentives. That is due to ex-post production threshold checks, currently set at 50% and 75%.

For example, an installation that produces at 51% of historical levels receives 100% free allocation. On the other hand if that installation produces between 25% and 50% of the historical level, it receives 50% of its original allocation (European Commission, 2011b). This may motivate some sectors to try to game the system and spread the production around, with the economic justification coming from free allocation.

As discussed, for the EU ETS, free allocation is not a totally binary system, but it certainly is not graduated and risk-based. This system produces a high level of rigidity, leads to a very large CLL, and possibly contributes to the oversupply in the market, as it is unlikely that all sectors on the CLL face the same level of risk.

It is difficult to quantify the effect that free allocation has had on EU ETS market functioning. The large amount of excess EUAs currently in the market (estimated at between 1.5 and 2 billion EUAs at the beginning of 2013 (European Commissions, 2012a)) was caused by many factors, including historically-based free allocation that ended up being overly generous, international credits and the economic downturn.

Indirect costs (from electricity prices) are not compensated at the EU level, but are left to the discretion of member states. This makes it a very uncertain and uneven approach with only a handful of member states compensating for indirect costs, which also distorts the single market.

The CLL cannot be deemed very targeted, given its 95% industrial emissions coverage. In 2011 the 156 (NACE-4 level) sectors on the list accounted for a large swath of the EU manufacturing industry; SFS Economics (2011) reported that 48% of the EU's manufacturing value added were covered by the leakage list (as opposed to 22% in Australia).

This issue is very important since, under Phase 3, free allocation is based on emissions-intensity benchmarks. The environmental goals of the EU ETS are kept whole through the cross-sectoral correction factor, which ensures that the number of free allowances is not superior to historical.

One additional element that needs to be mentioned is the fact that changes in the market place take place, and can alter conditions, at a faster speed than the CLL may be able to provide through its periodical review (currently set at 5-year intervals). It must be stressed that products and sectors can be added (but not subtracted) on a yearly basis.

The EU ETS Directive does recognise the necessity of more international action on climate change and works in that direction. However, its current provisions do not provide incentives for convergence in climate change policies with other jurisdictions. The planned inclusion of aviation in the EU ETS in 2012 worked in that direction, but free allocation provides no incentives for others to adopt carbon-pricing mechanisms.

The EU ETS still exhibits good market functioning and has considerable liquidity. However, we have seen a significant reduction in the number of participants as many liquidity providers have departed the market for this, as well as other unrelated reasons. Recent developments, including the adoption of back-loading, seem to have brought volumes up again.

There are two main costs associated with the EU ETS carbon leakage risk mitigation measures. The first one is the administrative cost associated with setting up the system and the ongoing administrative burden. Both of them are not significant (Renda et al, 2013a and Renda et al, 2013b). The second cost category relates to the opportunity cost of free allowances, which decrease auctioning revenue. While a purely political consideration, it must still be acknowledged.

Finally, data acquisition and provision in the EU ETS in general, and in addressing carbon leakage in particular, are problematic. As discussed above, data on the information to address carbon leakage are aggregated according to NACE 4 or 6, while emissions data are aggregated by sectors that have a different definition. This constitutes a real barrier to cross-referencing and analysing the impacts of financial and emissions information.

5.2. Australia

This analysis is based on the Carbon Pricing Mechanism (CPM) as it was proposed and implemented before the Australian general election of 7 September 2013. The new

Conservative government has indicated that it will attempt to repeal the CPM. Draft repeal legislation was released for public comment on 14 October 2013, but it may not be passed until changes in the composition of the Senate take place on July 1st 2014.

It is more difficult to assess the risk mitigation provisions in Australia as they have been in operation for a very short period of time, and the system may not survive beyond 2014.

5.2.1. Assessing risk tests

Australia has both quantitative and qualitative carbon leakage risk tests. The quantitative test is a combination of trade exposure (for ability to pass through) and emissions intensity (carbon-related).

For those activities that meet the threshold of 10% **trade exposure**, the risk exposure is determined through **emissions intensity** thresholds (highly emissions-intensive activities and moderately emissions-intensive), creating a number of levels of compensation (Table 1). Eligible emissions include direct emissions and electricity emissions (Australian Government, 2011b).

The trade exposure test is a quantitative in/out test and can, under certain circumstances, be complemented with a qualitative test (if there is a demonstrated lack of capacity to pass through costs).

Under the Australian Jobs and Competitiveness Programme, activities that demonstrated the potential to meet the carbon leakage criteria were initially assessed. The plan was to update the assessment in the third year of operation of the CPM (2014-15) and thereafter, at regular intervals. Firms could also petition the Government to assess the carbon leakage risk of their activity.

Trade intensity is used as a proxy to test for the ability to pass through carbon costs. This quantitative test captures heavily-traded products, but not all risk factors associated with pass-through ability. Moreover, the trade intensity criterion in Australia is calculated as imports and exports over domestic production, i.e. not over the sum of domestic production and imports (as in the EU and in California). This means that trade share could be overstated for activities with high levels of import. This risk test on trade intensity does not provide a threshold for outliers.

If the activity does not reach the trade-intensity threshold, there is a complementary qualitative test to determine pass-through ability. The basis for the qualitative assessments are described and justified for each activity that is eligible, which makes the Australian system flexible and transparent, and covers many of the risk factors associated with pass-through ability.

With respect to carbon-related risk tests, the Australian emissions intensity approach is less direct than the carbon costs test, which is used in the EU ETS. It gives a measure of carbon intensity but does not cover carbon-related risk factors to the same extent.

Intuitively, thresholds for emissions intensity over revenue and value added are not easy to capture. The thresholds are absolute numbers and as such are difficult to interpret. For example, the thresholds for highly emissions-intensive activities is 2,000 tonnes CO_2-eq over 1 million AUD of revenue, or 6,000 tonnes CO_2-eq over 1 million AUD of value added. As an observer, it is difficult to value the relevance of these thresholds.

As a plus, emissions intensity uses historical data on emissions, and as such does not rely on carbon price forecasts the way the EU ETS does. The emissions-intensity test is flexible in the way that it recognizes different levels of risk. The graduated structure and its link to the level of assistance are also clear and straightforward.

Regarding the coverage of the eligible activities in Australia, the study by SFS Economics (2011), referred to above, concluded that all but one of the eligible activities in Australia would qualify for the EU CLL, while 126 of the EU ETS sectors (from the original CLL in 2009) would not receive assistance in Australia.

This study also compares the economic implications of the risk tests in Australia with the situation in EU. While the sectors in the EU ETS that are on the CLL cover 42% of employment, the corresponding figure for eligible activities in Australia is 9%. For turnover, the EU CLL covers 48%, while the number in Australia is 29%. As such, the risk tests in Australia seem to be more focused than in the EU – the study concludes with an appeal for broader Australian coverage.

The Australian risk identification focuses on 'manufacturing activities', whose definition, in general, is similar to the sector definitions used in the EU and California, but not for all sectors. For example, the different segments of the steel and paper/pulp sectors are kept separate in the EU while in Australia, the value chains, starting from raw material processing, are kept together when assessing leakage and providing compensation.

Australia's method has both pros and cons. The definition of activities is not always clearly described, but compared to sector classifications, the focus on activities ensures that assistance is well targeted, and therefore could be more logical to use than sector classification. This way, compensation is targeted towards the most emissions-intensive trade-exposed processes in the economy.

Since the activities do not translate into standard sector classification, data collection is complicated. It is also difficult to correlate the available data for activities with other variables such as financial indicators. Moreover, data for activities that are not eligible are lacking, which makes further analysis complicated, if not impossible.

5.2.2. Assessing mitigation measures

Australia uses free allocation as risk mitigation under the Jobs and Competitiveness Program. If the activity passes the trade exposure criteria, free allocation is provided in a graduated manner, based on the activities' emissions intensity. Free allocation in Australia is done ex-ante, and based on the entity's previous year's level of production, with a true up to account for actual production in the previous period.

Moderately emissions-intensive activities receive 66% free allocation and highly emissions-intensive activities receive 94.5% free allocation. Allocation for both categories declines by 1.3% per year.

The existing provisions cover direct emissions and indirect emissions from electricity use. Ensuring that the playing field remains level for importers and exporters can be considered as addressed, as the trade-exposure test includes both imports and exports. The risk-based allocation in Australia is flexible as it addresses leakage risk differences between sectors in a more realistic way than an 'in/out' approach.

With respect to market functioning, according to estimates by the Department of Climate Change and Energy Efficiency in Australia, around 63.5% of the permits would be offered in the first auctioning, while 28% are allocated to EITE activities (Betz et al., 2010). As such, it does not seem that free allocation could hinder the good functioning of the carbon market.

5.3. California

5.3.1. Assessing carbon leakage risk

The California cap-and-trade scheme uses only quantitative risk tests to determine if sectors are at risk from carbon leakage. The test used is a combination of emissions intensity and trade intensity. This combined test covers both risk factors – carbon costs and ability to pass through.

The outcome is a classification of sectors as being at high, medium or low risk (as shown in Table 8). The formulas and thresholds are described in Table 1.

Table 8. Classification of leakage risk in the California cap-and-trade system

Leakage Risk	Emissions Intensity	Trade Exposure
High	High	High
		Medium
		Low
	Medium	High
Medium	Medium	Medium
		Low
	Low	High
		Medium
Low	Low	Low
	Very Low	High
		Medium
		Low

Source: California Air Resource Board (2012).

With respect to the impact of carbon costs, emissions intensity was chosen in order to avoid using carbon price forecasts (CARB, 2006). As in the case of Australia, one could argue that this is a less representative way to capture risk factors related to carbon costs. It captures the importance of GHG emissions, but not, at least not to the same extent, the weight of carbon costs relative to the cost of production or sectoral margins.

The **ability to pass** through additional costs from carbon pricing is captured through the trade-intensity test. This approach provides some information regarding the sectors' ability to pass through costs, but many aspects are not covered. In contrast to other jurisdictions, there are no qualitative tests that would inject some flexibility and which could be useful to provide more information on the ability of the sector to pass costs through.

Neither test is used on a stand-alone basis, which is usually used to capture outliers. The California risk-based approach reduces (possibly eliminates) the need to cover for outliers, as every sector is covered in some way. This risk-based approach, based on Table 8, seems to assign a higher value to emissions intensity compared to trade intensity.[9] This may also seem to confirm the suggestion that trade intensity may cast too broad a net in the EU ETS.

All sectors are classified as low, medium or high, and there is no 'no risk' category. This tiered approach provides a flexible way of recognising that carbon leakage risk is almost impossible to define with precision. The risk rating resulted in 15 high-risk sectors, 14

[9] This is a result of a sensitivity analysis that showed that the cost pass-through capacity is amplified as emissions intensity rises. Hence, industries with higher emissions intensity are more sensitive to the effects of cost pass-through ability, so emissions intensity should be given greater weight in the leakage classification.

medium-risk sectors and 3 low-risk sectors. In addition, the risk rating gives information about the level of compensation for different tiers.

5.3.2. Assessing mitigation measures

The main Californian carbon leakage risk mitigation provision is an output based free allocation system,, based on benchmarks, and which allocates to sectors according to the risk level classification.

There are two types of output-based allocation: product-based or energy-based. Product-based benchmarks are preferred since it can recognize early action and enhance leakage protection. In some sectors, however, benchmarks can be difficult to develop due to e.g. high variation among facilities. If so, energy-based benchmarks are applied.

The benchmarks are generally set at close to 90% of average sectoral emissions or energy consumption. The formula for product-based allocation is:

Allocation = Initial Output x Benchmark x Assistance Factor x Adjustment Factor
+ Trueup Output x Benchmark x Assistance Factor x Adjustment Factor

There are a number of factors in the Californian allocation that require a discussion. Firstly, adjustments to the allocation are done based on the *Initial Output* and the *Trueup Output*.

Secondly, there is the *Adjustment Factor*, i.e. the decreasing total level of available allowances differs between sectors. For example a number of sectors with process emissions greater than 50% have a higher *Adjustment Factor*, e.g. cement manufacturing, where the factor is 0.991 in 2013, compared to 0.981 for the other sectors. Lastly, the *Assistance Factor* differs from sector to sector, depending on their risk level (1, .75 and .5).

Initially all sectors received allowances at 100% of the benchmark, but while high-risk industries do not experience a decrease in free allocation, those at medium and low risk do (up to respectively 50% and 30% of the benchmark in 2020).

The graduated approach that is used is more suited to sectoral differences with regards to emissions intensity and/or trade exposure. In practice, most sectors are listed as at either high or medium risk of carbon leakage (29 out of a total of 32 sectors).

Costs from indirect emissions are provided for as electricity providers are obligated to auction the allowances they receive, and use the revenues to compensate their customers for increases in electricity prices. However a proposal has been put forward by the California Public Utilities Commission to limit compensation to households and small businesses, in order to continue motivating large electricity consumers to improve their energy efficiency.

There are also potential impacts on US inter-state commerce clauses, as well as WTO provisions. This can be an important element considering the inclusion of electricity imports in the pricing mechanism. Utilities selling electricity generated outside of California are obligated to surrender allowances to cover the emissions linked to the generation of that electricity. This can, to some degree, be regarded as BCA. CARB is further examining the applicability of BCA to other sectors, with cement as the first sector examined for applicability of a BCA (see Annex 2).

The California cap-and-trade is a sub-national scheme and therefore its impact on international negotiations is perhaps limited. But as a member of the Western Climate Initiative and more specifically through the link with the Quebec ETS it is showcasing how carbon-pricing mechanisms could work together. It is too soon, however, to evaluate the full link between California and Quebec as it only entered action at the start of 2014.

The effect of free allocation on the price signal in California (the impact of the ETS) is not clearly understood, but there are provisions and interactions that need to be monitored. It must be recalled that the position of the ETS in the California climate change approach is very different from that of the EU ETS. The EU ETS price is meant as the main signal for decarbonisation, while California relies heavily on complementary measures, with the ETS having a safety role.

There are price floors as well as an Allowance Price Containment Reserve, which sells allowances at fixed prices. The interaction of carbon leakage mitigation provisions with the Reserve, with complementary measures as well as with the BCA is not well understood, but it can provide valuable lessons for the EU ETS, which is currently examining a reserve of its own. The methodology for output based allocation in California can also provide important lessons for the EU ETS.

6. Conclusions

This chapter tries to draw conclusions for the EU ETS, based on the two papers that have been prepared as deliverables for this project (the present paper and the earlier overview).

Competitiveness and the impact that carbon costs have on competitiveness are issues that are at the forefront of preoccupations for policy-makers and industrialists. It is clear that carbon costs, which can lead to carbon leakage, are but one element in the general make-up of the competition landscape. Also important and related to carbon leakage risks, but not always well understood, is the difference between carbon price and carbon costs.

Based on outcomes from Phases 1 and 2 of the EU ETS, it is clear that the ex-ante projections of potentially significant carbon leakage did not always materialise. This is not uniform, as in some sectors, especially the electricity-intensive sectors, the impact of carbon costs was material (Renda et al., 2013b).

It is unclear what this discrepancy is attributable to, but there have been significant changes in the conditions and assumptions under which the EU ETS was constructed (e.g. economic forecasts and interaction with other polices), and they may have played an important role.

However, the past may, or may not, be a good reflection of the future and therefore serious consideration needs to be given to how to ensure that measures are in place to address the risk of carbon leakage in the long term, post-2020. There is currently no clarity on how it will be treated. Some of the issues highlighted below, and which represent conclusions related to carbon leakage post 2020, are structural changes to the EU ETS and will need to be considered in that broader discussion.

Based on the two studies that CEPS has carried out as part of this project on carbon leakage, the following conclusions seem to emerge:

- The measures put in place have, so far, broadly delivered, with the caveats listed above
- There are new approaches that are being tested in other jurisdictions and the EU needs to monitor them, and learn from them.
- A number of issues/features/provisions are emerging as being in need of examination and possible action:
    1) The number of allowances available for free allocation is decreasing (due to the cross-sectoral correction factor). This will impact the current attitude of entitlement to carbon risk mitigation measures.
    2) Unfocused coverage – too many sectors covered
    3) Likely increase in EUA prices, due to a number of ETS provisions planned, as well as possible different economic circumstances
    4) Recognition of increase/decrease in production
    5) Coverage of carbon costs from indirect emissions
    6) Uneven effort required from different sectors due to different sectoral spread around one benchmark
    7) All sectors are treated the same, but are not the same
        i. Different margins
        ii. Varying abilities to pass through
        iii. Sectoral distribution around the benchmark
    8) The likely emergence of a new global climate change regime which will impact risk mitigation measures

9) Interaction
    i. Within the EU ETS (e.g. carbon leakage mitigation measures and carbon reserve)
    ii. Between the EU ETS and other policies

Overall direction

- BCA, from a theoretical point of view, meets many of the criteria considered. However, its implementation faces tremendous trade, political and administrative barriers and will not be a viable approach and will face challenges (e.g. aviation in EU ETS) if applied by a small number of jurisdictions. However in California, BCA is currently being implemented for one input (electricity) and is being considered (cement) for homogenous products. These developments need to be closely monitored and lessons learned internalized.
- The use of free allowances is likely to continue to remain the centrepiece of carbon leakage risk-mitigation measures, albeit with modifications.
- The continuation of free allocation is positive if there is an opportunity to negotiate linking agreements with other ETSs, as carbon leakage provisions will be somewhat similar between systems. On the other hand, free allocation provides neither carrot nor stick to eliminate asymmetry in climate change policies.
- There is no silver bullet or one ‘simple’ solution; a menu of approaches will have to be used.
- The directions that seem available, if we are to refer to the issues mentioned above, potentially imply a balance between the breadth and the depth of the coverage of carbon risk mitigation measures.
    - Increase the focus. This implies focusing on those sectors that are a bigger risk, and provide them with as many free allowances as the available free allocation allows (i.e. those at high risk will receive what they need).
    - Increase coverage, without focusing. This implies the introduction of measures that will provide enhanced risk coverage to all those at risk – this may result in an increase in the number of free allowances (i.e. all those at risk will receive what they need).
    - Increase coverage. This implies providing allowances to those deemed at risk to the level of free allocation allowable under the cap. This implies that there will be an increasing effort for those on the CLL (i.e. all sectors at risk will receive something, but likely not enough).
- The options above imply that the two levers available are the risk tests (their design and thresholds) and the form and level of compensation, once a sector is deemed to be at risk.
- Many of the conclusions point to the fact that the changes that may need to be considered are inextricably linked to the process of EU ETS structural reform.

Tests for carbon leakage risks (focused coverage)

- Focusing the CLL can be accomplished, but the result will have strong political undertones and affect the sense of entitlement that currently exists in the carbon leakage discussions.
- Moving away from a binary (in/out) model of detecting the risk of carbon leakage to a risk-adjusted model could contribute to this approach. A multi-level, or even linear risk-rating system seems like an option that needs to be examined, as it could provide a more realistic way to measure, identify and communicate the risk of carbon leakage, as well as handing out free allowances.
- One approach is to adjust the leakage risk tests and/or the thresholds, limiting the coverage of the CLL to those really at risk and in great need. Other options may include:
    - Less use of qualitative tests,
    - Additional use of quantitative tests directly related to the impact of carbon costs, such as a ratio of cost of carbon relative to margins and
    - Revisiting the trade-intensity criteria, which have added a substantial number of sectors to the CLL.

Policies for risk mitigation

Compensation for direct emissions

- We can conclude that using the current free allocation model may be challenging under future potential circumstances. An examination of how to address the different problems is certainly required, including an impact of plusses and minuses of using a dynamic, production-based, allocation system. The adoption of such an approach will need to take into account market functioning and the relationship with the flexibility mechanism, which has also been proposed as part of the package. In this, the EU will need to learn from other jurisdictions that are experimenting with approaches that are different from the currently used in the EU (such as California and Australia).
- Such an approach (if not combined with increased focus) could also lead to a risk to the overall EU ETS cap. This risk needs to be addressed, which can be done in a number of ways:
    - Place a greater burden on other ETS sectors,
    - Place a greater burden on non-ETS sectors and
    - Make the public authority for sovereign compliance and purchases of credits in the international market.
- The current imbalance in the market also points to the need to consider dynamic free allocation.
- Also, dynamic allocation, currently implemented in other jurisdictions (Australia and California), requires new levels of effort and resources to implement.
- Other tools than can be considered include

- Targeted availability of ‘cheaper-than-EUA’ international offsets, for compliance purposes, only for those sectors that are at a certain carbon leakage-risk level. This would also include consideration of the sector’s structure and distribution around the benchmark, and allow access for those sectors that must make a significant additional effort as a result of benchmark distribution. There is a choice between free EUAs and cheaper than EUA offsets.

Compensation for indirect emissions

- The current approach to compensation for indirect costs is causing serious concerns. Addressing these concerns, just like for direct costs, could be done at the EU level through free allocation, instead of monetary compensation. Other models exist, such as the ones in Australia and California.
- This approach would ensure that there is equal treatment across all member states and at the same time provide compensation for what can be significant carbon costs for some sectors, especially those whose inputs or processes are electricity-intensive.

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Annex 1. Background on Carbon Leakage

Definition of carbon leakage

The issue of carbon leakage has been addressed in many jurisdictions, but most of the experience has emerged from the EU, where the EU Emissions Trading Scheme (ETS) has been in operation since 2005. The following definition from the EU ETS Directive (recital 24) is used throughout the paper:

> In the event that other developed countries and other major emitters of greenhouse gases do not participate in this international agreement, this could lead to an increase in greenhouse gas emissions in third countries where industry would not be subject to comparable carbon constraints (carbon leakage), and at the same time could put certain energy-intensive sectors and subsectors in the Community which are subject to international competition at an economic disadvantage. This could undermine the environmental integrity and benefit of actions by the Community.

There is a strong feeling among some stakeholders that the EU ETS definition is too narrow and refers primarily to shifts in production and trade patterns, but does not touch upon decreased maintenance, upgrading and new investments. However the text does not seem to exclude any leakage channel explicitly, but if the definition is not complete, any assessment of whether carbon leakage has taken place or not, based on that definition, may not give the right signals.

Carbon leakage: Causes and impacts

Carbon leakage is a possible outcome of ***asymmetrical climate policies***, e.g. imposing carbon constraints in one jurisdiction while other jurisdictions have less-stringent or no carbon constraints. Competitiveness is affected by a wide variety of factors, of which asymmetrical climate policy is only one. It is difficult to assess the impact that climate policies and resulting carbon costs may have on competitiveness, when compared to other factors that come into play, such as labour and energy costs.[10]

There are a number of factors that may enable asymmetric carbon policies to result in carbon leakage. These so-called ***'carbon leakage risk factors'*** determine whether climate policies increase the carbon leakage risk for a product or a sector on the basis of two criteria: the size of the ***carbon cost*** and the ***ability of the sector to pass through*** carbon costs to other sectors or consumers.

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[10] The IEA quotes "high energy prices, relatively high wages in the European Union as well as longer shipment distances to the major consumption centres in Asia" as the main factors putting EU exports at a comparative disadvantage (IEA, 2013). The IEA's chief economist, Fatih Birol, has estimated that the projected 10% loss of the EU's share of the global export market for EU energy-intensive goods would only be reduced to 9% if carbon pricing was abolished (Harvey, 2013).

Measures to prevent carbon leakage centre on identifying and targeting products and sectors that might face carbon leakage risk (and mitigating that risk) before any carbon leakage has occurred. It is important to also note that as long as there is no global climate change agreement (or a global price for carbon), it is virtually impossible to have total symmetry, and therefore there will always be a risk of carbon leakage.

The most prominent example of climate policies that may lead to carbon leakage risk is the introduction of carbon pricing, which can take different forms:

- 'Visible' carbon pricing, from different market instruments, including cap-and-trade schemes or taxation that could result in:
    - Direct costs (e.g. cost of compliance for direct emissions)
    - Indirect costs (e.g. carbon prices embedded in the price of inputs, most notably electricity)
- 'Shadow' carbon pricing that could also result from policies without a visible price on carbon, such as renewable energy targets and plant standards.

However, a second matter that also needs to be factored in is that most jurisdictions will implement some form of climate policy. Many may not result in an explicit carbon price, but they may result in a 'shadow' carbon price (see Marcu et al., 2013, for more information). When searching for asymmetry in climate policies, a thorough investigation needs to be undertaken.

The impacts of carbon leakage can be divided into environmental, social and economic. The environmental impacts are the result of emissions migrating to a jurisdiction without any or with lower levels of carbon constraints. Environmental leakage can reduce, and even reverse, the environmental outcomes (e.g. emissions reductions) that the EU seeks through the imposition of a carbon price.

Besides environmental leakage, there are two other aspects that can impact the sustainability of policies that introduce carbon pricing: social and economic/competitive aspects. Economic impacts include investment avoidance, investment relocation and shifting of production (including impacts on the value chain) outside the jurisdiction imposing the carbon constraints. The social impacts, closely linked to the economic impacts, are due to job losses and the resulting changes to livelihoods and communities. Note that carbon leakage can also lead to social benefits, such as improvements in air quality through the reduction of local pollution and the linked public health benefits.

At the moment, there are two distinctive debates going on related to the prevention of carbon leakage.

The first debate relates to how to address the risk factors that enable or trigger carbon leakage, which is the focus of this paper and should be seen as an ex-ante action and preventive in nature. Ideally, if measures to address carbon leakage risks are successful, it can be expected that carbon leakage would be significantly reduced. It is unlikely, however, that the risk can be reduced to zero.

Perversely, successful risk mitigation measures may create difficulties in evaluating the effectiveness of measures to address carbon leakage risks. This leads to debates on the contribution of different intervening factors: Was carbon leakage avoided due to the measures introduced, or due to other factors?

An additional issue linked to ex-ante and risk-reducing measures is the possibility of mis-targeted and/or unnecessary measures, which could have a negative effect on economic efficiency and the environmental goals of carbon pricing.

There is also a second debate, which is also very important, that focuses on how to address the impacts of carbon leakage, such as ex-post measures to address social displacement or loss of investment. This is not addressed in the present paper.

Current debate

While ex-ante studies have presented the potential for carbon leakage, ex-post analyses show little evidence of this having taken place in the EU during Phases 1 and 2 of the EU ETS (Ecorys, 2013). However, this may not be uniform across all sectors as some sectors were impacted due to high indirect costs

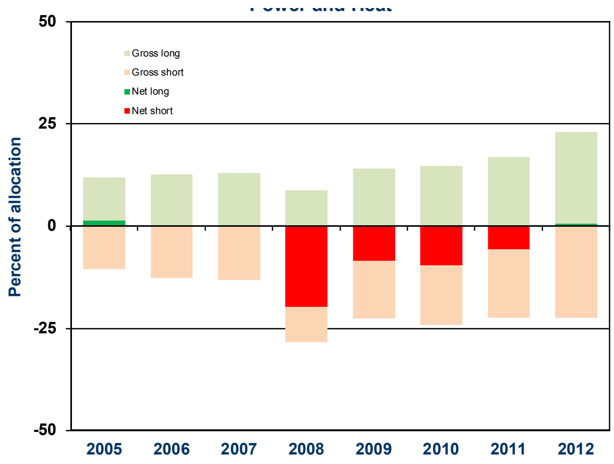
Related to these findings is the net position of installations – defined as the difference between free allowances and actual emissions, expressed as a percentage of those emissions – which shows the stringency of allocation. The net position can be looked at from a sectoral level or a country level.

Figure A1 indicates the net positions of the power and heat sectors. The net positions are shown as short (less allowances than emissions, red colour) or long (vice versa, green colour). The net position is the balance between the sum of long and short positions of the installations of a sector (green and red shades, respectively).

Obviously the power and heat sector was ,at least in the second trading period (2008-12),short every year.. We obtain completely different evidence for the non-power and non-heat sectors in Figure A2. These sectors exhibit surpluses of their free allocations for the years in the second trading period in the range between 15 and 40% of their emissions.

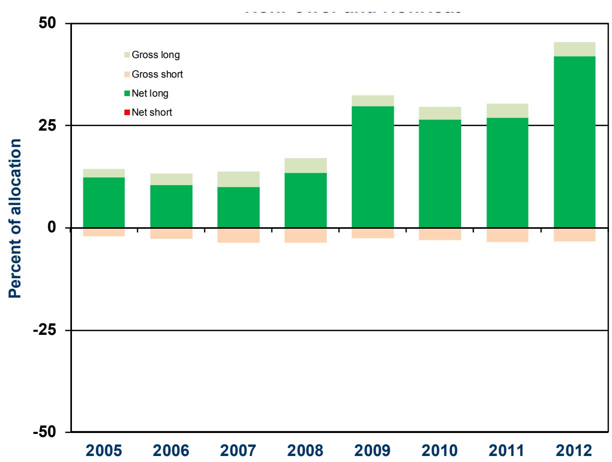
This stringency analysis can also be done with respect to the member states. This can be seen in Figure A3, which reveals that in the second trading period the total market was about 5% long but with a wide variation of the net positions of the member states. Only Germany, the United Kingdom and Estonia, together with Norway, remained short during this period.

Figure A1 Net position of power and heat sectors in the EU



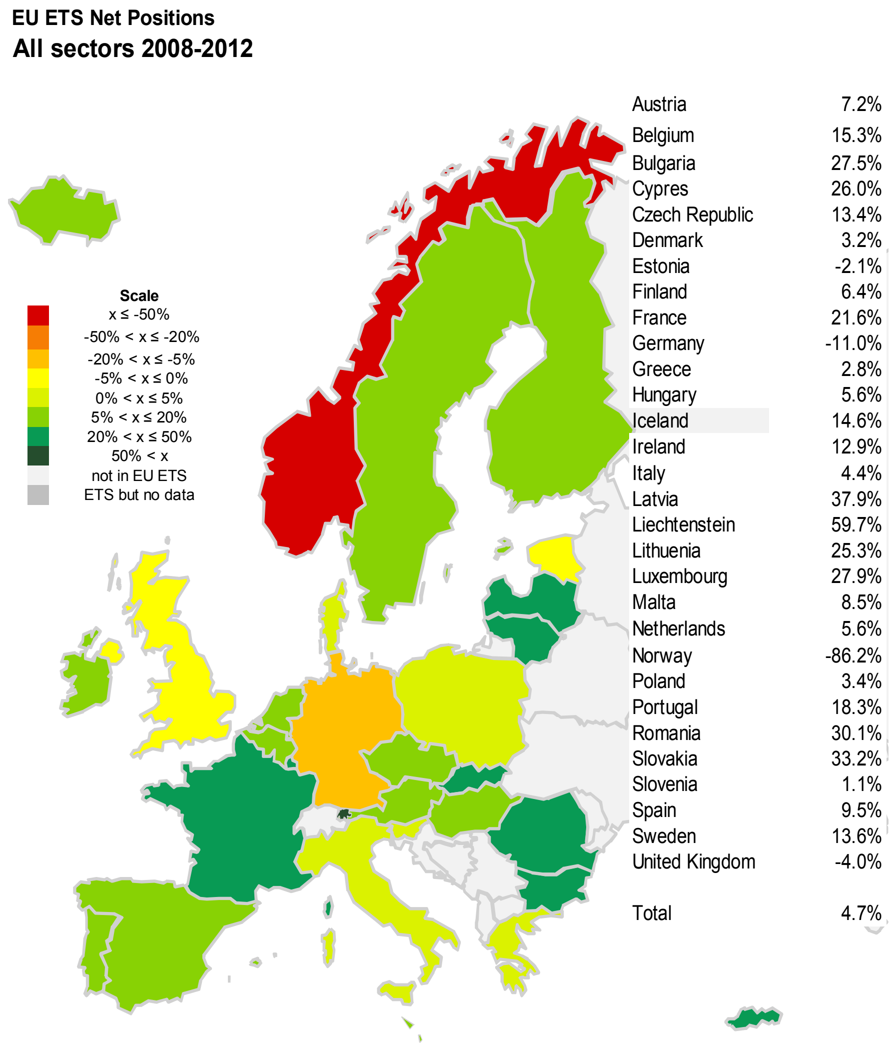
Source: Schleicher & Zeitlberger (2013).

Figure A2. Net position of non-power and non-heat sectors in the EU



Source: Schleicher & Zeitlberger (2013).

Figure A3. Net position of EU member states and selected other countries



Source: Schleicher & Zeitlberger (2013).

It is difficult to definitively identify the causes of the discrepancies between ex-ante forecasts and ex-post studies, although it is likely that this outcome could be attributed, among other factors, to:

- effectiveness of measures in the EU ETS to address the risk of carbon leakage (free allocation in Phases 1 and 2 of the EU ETS),
- economic and financial crises that have resulted in much lower emissions and corresponding lower EUA prices, and
- barriers to trade not captured in models used for ex-ante forecasts, such as product heterogeneity.

Part of the current debate focuses on Phase 3 (post-2012) and the development of a new Carbon Leakage List (CLL) (by the end of 2014). This debate now seems to have been clarified to some degree in the announcements that accompanied the proposals for the 2030 policy framework for climate and energy.

The Impact Assessment for the 2030 policy framework for climate and energy (European Commission, 2014a) mentions several design features of the current CLL methodology that will need to be reflected upon, if free allocation through benchmarking is preserved in the EU ETS:

- Recognition that carbon leakage risk may differ between sectors
- The relation between the length of validity of the CLL and trading periods
- Periodic revision of the benchmark values, to reflect technological developments
- Closer link between allocation and production data by using more recent data
- Amendment of the maximum amount of free allocation, to recognise different abatement potentials for those receiving free allocation and those not.

The focus of this study is on the post-2020 period, for which there is currently a lack of clarity, as there are no provisions in place to address carbon leakage. The Commission proposal clarifies, however, that leakage provisions will remain in place until 2030.

While the observed carbon leakage may not have been in line with the estimations in some of the ex-ante studies, the past may not be a good reflection of the future, as a number of important elements could potentially change significantly, such as:

- Increased economic activity including economic recovery and growth
- More stringent caps
- Increased carbon prices in the EU ETS and internationally
- Changes to free allocation rules for Phase 3 and a decreased number of free allowances available as confirmed by Phase 3 allocation and 2013 verified emissions data. The cap currently declines at a rate of 1.74% a year, resulting in lower free allocation for those that are on the CLL.
- A new international climate change regime with contributions from significant EU trading partners.
- Carbon pricing at the domestic level in different jurisdiction – Is this going to become a reality or a perpetual promise?
- Abatement measures in EU ETS sectors reducing the impact of carbon pricing
- Evolutions in energy markets and energy prices. Note that indirect costs can be alleviated by self-generation, contracts with carbon-neutral generators or long-term contracts. Long-term contracts are important for large baseline consumers (such as primary aluminium plants) and although these are allowed in the EU, there are strict conditions imposed by case law. Many long-term contracts are due to expire between 2014 and 2016, which will expose large industrial electricity consumers to the carbon price embedded in their electricity.

Annex 2. Border Carbon Adjustment in California

As directed by Resolution 10-42 of 2010, the California Air Resources Board (CARB) held on February 5, 2014 a workshop with various stakeholders to discuss the possibility of introducing a Border Carbon Adjustment (BCA) for the cement sector. In 2010 CARB directed its staff to review the technical and legal issues related to border adjustment for the cement sector. At the workshop, the staff presented a number of options for discussion.

According to CARB's presentation, in addition to free allocation provided to covered industrial sectors in the Cap-and-Trade Program, a BCA would further reduce the risk of emissions leakage. Three options were presented for discussion:

- Option 1. *Include importers in the Cap-and-Trade Program.* Importers are subject to full Cap-and-Trade requirements as covered entities. The drawback is that the current allowance budget under the Cap-and-Trade Program does not account for emissions associated with potential production outside of California due to leakage.
- Option 2. *'Linked cost' for importers with no market mechanism*. Importers are subject to a cost calculated based on (Emissions obligation x Cap-and-Trade allowance price(s)), but there is no provision for market flexibility.
- Option 3. *Create an independent allowance pool for importers with equivalent program stringency*. Two possibilities are related to this option:
    a. *Replicate a 'mini' Cap-and-Trade allowance pool with full market mechanism*. It sets a cap only for importers based on projected cumulative emissions through 2020 and quarterly auctions are to be conducted. The challenge is to set an appropriate allowance budget. Flexibility is ensured through banking, trading, access to offsets/other compliance instruments and access to price containment reserve. If designed properly, it would provide consistent requirements to California covered entities and importers.
    b. *Create a simplified purchase/ sales system with equivalent program stringency*. It sets an updating allowance limit instead of a permanent cap. The allowances are not fungible with the main Cap-and-Trade, hence the BCA does not affect the Cap-and-Trade allowance budget. It allows for market flexibility mechanisms such as access to offsets to provide comparable level of flexibility to comply, but there are some complexity and allowance budget uncertainties.

Options 1 and 2 seem to be easier to administer than option 3. One of the main concerns with Options 2 and 3b is that they do not guarantee consistent emissions reduction associated with imported cement. A BCA aims at consistency with the Cap-and-Trade Program.

Cement is regarded as a logical first sector for discussion for a BCA because it is in the high leakage risk category and is a homogenous product with a relatively small number of points of regulation.

Meetings with interested stakeholders are to take place in the following two months in order to clarify how to determine the emission factor(s) for compliance obligation and for allowance limit setting, how to establish a system with the equivalent scarcity relative to the main C&T and how to operationalise the programme.

About the Carbon Leakage Project

This paper is one of the two deliverables of the CEPS project entitled "Carbon Leakage: Options for the EU", which is co-funded by five EU member states (France, Germany, the Netherlands, Poland and the UK) and seven companies from different sectors of the economy (BP, EdF, ENI, Hydro, Lafarge, Solvay and ThyssenKrupp Steel Europe).

This paper builds on the first deliverable of this project, the paper entitled "Carbon Leakage: An Overview", which outlined the concept and economics of carbon leakage, and highlighted the main elements of the current debate on this topic.

The objective of the Carbon Leakage Project is to prepare policy options that can be considered by policy makers to address concerns regarding carbon leakage in the context of EU internal discussions, international negotiations and bilateral discussions. The aim of this paper is to review and analyze two main topics:

- How to detect the risk of carbon leakage risk?
- What options to address carbon leakage risk are available?

This project comes at an important moment in the carbon leakage debate. It is currently a hot topic due to a number of policy debates that are taking place, including the on-going review of the Carbon Leakage List (CLL) - to be completed by the end 2014 - and the European Commission's proposal for the 2030 policy framework for climate and energy. In that proposal the 2020 concept was clarified, but not the post-2030 carbon leakage framework.

It is not the intention of this project to provide a definitive answer, such as a proposed solution, but to identify Issues, develop Options to address carbon leakage, as well as Criteria to appraise the different approaches identified.

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