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Economic under-determination: industrial competitiveness and free allowances in the European carbon market

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ABSTRACT

Tackling climate change has provided a key focus for the creation of what the editors of this special issue have termed 'environmental intangibles.' This paper focuses on the European Union Emissions Trading System (EUETS), a climate policy that revolves around the issuance and trading of environmental intangibles called emissions allowances. Set up in the mid-2000s, the cap and trade system has experienced many complications. We propose here to explore a particularly contentious issue: the allocation of free allowances. We will see that deciding on allocation rules leads to vivid debates about whether energy-intensive industries in Europe, such as the manufacturing of cement, can remain competitive in the global economy if climate policy is unilaterally enforced. These debates are focused on a phenomenon referred to as the risk of carbon leakage due to loss of competitiveness. Drawing on an empirical enquiry into the workings of policy-making, the paper examines the ways, in which this risk is framed and questioned through lobbying and evidential work. We suggest that the threat to competitiveness posed by the EUETS can neither be established, nor dismissed; a form of under-determination is maintained and carbon leakage as a never-quite-tangible possibility becomes a battleground for protecting European industry over the environment.

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Introduction

Tackling climate change has provided a key focus for the marketisation of environmental interventions, creating what the editors of this special issue have termed 'environmental intangibles' such as carbon footprints (Walenta 2021, unpublished manuscript) or conservation credits (Barral 2021, unpublished manuscript). The term points toward an issue recurrently discussed with regards to these new environmental markets: the numerical abstraction that underlies marketisation and by which 'intangibles,' such as carbon offsets and emissions allowances, are produced as dis-connected from the industrial activities to be regulated or the natural landscapes to be protected (Lohmann 2009, Roberston 2012, Dempsey 2016). Through this process of abstraction, exhaust gases released, for example, from burning limestone and clay to manufacture cement in a given location are expressed in tons of carbon dioxide (CO_2) and made commensurable to the emissions of other cement plants and industrial facilities (oil refineries, coal- powered facilities, blast furnaces, chemical plants etc.) located in distant places. Commensuration is needed to establish a market where permits to emit CO_2 can be traded among these sites (MacKenzie 2009a) and appear on balance sheets (Chiapello and Engels 2021, unpublished manuscript). Commensuration also brings into

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being new numerical aggregates (e.g. an industry's emissions level). Although it may appear less tangible than the noisy, dusty industrial plants from which it derives, and of which it provides an abstract representation, this numerical reality is the stuff of (market-based) policy; it can be put into relation with other aggregates (e.g. an industry's trade flows and gross added value) and used to make consequential decisions.

Our paper examines the ways, in which numerical abstraction becomes a policy battleground in the European Union Emissions Trading System (EUETS). Drawing on work in Science and Technology Studies on European regulation (Barry 2001, Laurent 2019) and carbon markets (MacKenzie 2009a, 2009b), we pay attention to the tools – formula, indicators, statistics etc. – used to discuss and decide on a particularly contentious aspect of the EUETS: how to regulate the CO_2 emissions of energy-intensive industries. Debates revolve around the notion of 'carbon leakage due to loss of competitiveness.' The term refers to the risk that, in a globalised world, climate policy in Europe might lead to domestic producers losing market share to foreign competitors and imports from regions where emissions are not regulated. We will see that, while in the EUETS this risk justifies an alleviation of the environmental constraint for energy-intensive sectors, such as the manufacturing of cement, its credibility is also actively questioned. Indeed, carbon leakage due to loss of competitiveness has not been observed, yet. Evidence suggests it might actually not be a real threat. But it is not possible either to assert with great certainty that it will never materialise. Therefore, we suggest that carbon leakage provides an opportunity to think about economic under-determination in climate policy and how this plays out in an intervention that seeks to achieve an environmental benefit (see Chiapello and Engels 2021 this issue) at the same time as maintaining industrial competitiveness.

Emissions trading, or cap and trade policy originated within economics. It operates by setting a limit on CO_2 emissions within a jurisdiction and through the issuance of a finite quantity of emissions allowances that can be traded among regulated entities (an allowance usually represents one tonne of CO_2). Economists and policy-makers consider that trading allows the cap to be met at the lowest aggregated cost: a company able to reduce its emissions at a low cost will do so, and keep or sell allowances it might have in excess, while a company facing high abatement costs will instead buy the cheaper allowances. In a cap and trade system, market agents choose whether or not, and how, they develop emissions reduction strategies or invest in cleaner technologies. The market is expected to stimulate a decentralised process of exploration and distribute the mitigation effort so that emissions decrease where it costs the least. Praised for its cost-efficiency, cap and trade is now a well-established climate policy (Lederer 2017). The EUETS was the first large-scale attempt to run such an economic experiment (Wettestad 2005), extending over 31 countries and regulating more than 11,000 'installations' (a regulated installation is defined by its ownership of a fuel combustion unit of a certain size).[1]

If the economics-inflected account sketched above appears straightforward, Europe's practical experience with cap and trade turned out to be more complicated. On-going problems have plagued the policy despite it being open to revision.[2] The EUETS was devised to operate in phases. In the first two phases (2005–2007 and 2008–2012), cap setting and the allocation of allowances were national prerogatives. Companies and their installations received allowances for free, based on their past emissions and within the limits of rather generous national caps (on the French case, see Godard 2005). Free allocation of relatively large quantities of allowances seemed to have been a political move to respond to early concerns about possible adverse effects on the competitiveness of European industry. The risk that some over-allocation may occur (too many allowances compared to emissions levels) was taken to ensure acceptance among affected businesses.[3] But the economic recession that followed the 2008 financial crisis dramatically increased the imbalance. A surplus of unneeded allowances began to accumulate in the market and the price paid for emitting CO_2 durably dropped (Chaffin 2012).[4] This surplus marked the second phase of the EUETS and continued growing after 2012. In preparation for phase 3 (2013–2020), the institutions of the European Union decided to further harmonise, and strengthen, the policy. The EUETS was restructured around a single EU-wide emissions cap decreasing annually and common allocation rules. But these changes did not address the problem of the surplus. The value of the cap was derived from an emissions reduction target that member states had agreed upon in 2007, before the economic recession occurred. Modelling had helped compute the cost-effective split of this broader reduction effort between sectors regulated by the EUETS (thus fixing the value of the cap), and other activities emitting greenhouse gases (agriculture, transport, etc.). The total quantity of allowances to be issued (that is the cap) was then divided up into auctioned allowances and free allowances that were only distributed to 'industrial installations' (all those that were not electricity producers – more on the reasons for this later). The European Commission was put in charge of supervising free allocation through complex calculations, taking into account the risk of 'carbon leakage due to loss of competitiveness.' Such a risk justified the distribution of free (surplus) allowances to many industrial sectors. For sections related to the construction industry, such as the manufacturing of steel and cement, this comprised a significant number of allowances given the enduring decline of production and CO_2 emissions in the aftermath of the recession. While free allocation was thus maintained in phase 3, the credibility of the threat it ought to mitigate (carbon leakage) started being contested. As we shall see, the situation has since been one of on-going under-determination.

Our focus here is on the elusive, yet enduring risk of carbon leakage, how it is assessed, contested, reframed, and with what consequences. We build on fieldwork carried out in Brussels, Paris and London in 2016 and 2017, where we conducted extensive documentary research, especially on the EUETS legislative process, and in-depth interviews with a range of stakeholders – from staff members of the European Commission, to national civil servants and parliamentary assistants, from academic economists, to environmental activists and industrial lobbyists. Our empirical account will be structured in three parts, each foregrounding a particular facet of the problem of/with carbon leakage. A first section will examine the criteria and data that were used in phase 3 to operationalise the distribution of free allowances to vulnerable sectors. We will then engage with the evidential work that was carried out ahead of revising the EUETS rules for phase 4 to assess the credibility of the threat of carbon leakage and decide on the future of free allowances. Thirdly, we will turn to a specific sector deemed vulnerable to carbon leakage, the manufacturing of cement, which has been singled out for having greatly benefitted from the surplus of free allowances. But before all this, we propose to further unpack the concept of competitiveness and discuss what an analysis of its under-determination can bring to the study of economic uncertainty in environmental policy.

Acting within conditions of under-determination

For economists, the notion of carbon leakage captures the idea that, in a globalised world where capital and goods freely flow across borders, CO_2 emissions can increase outside a jurisdiction as a result of climate action enforced in that jurisdiction (Hourcade *et al.* 2007, Dröge *et al.* 2009). This increase is expressed as a leakage rate counterbalancing the positive impact of the policy (here the emissions cap). Economists suggest that the relocation of emissions unfolds through two different dynamics. The first depends on the global fossil fuels market. If demand for polluting energy declines in the regulated space because cleaner sources are sought, the global price of fossil fuels will decrease, which might increase their consumption, and CO_2 emissions levels, in unregulated jurisdictions. The second means through which carbon leakage might occur is 'the competitiveness channel.' If domestic industries increase the price of their products in response to the additional cost imposed by the policy (the cost of buying allowances), they risk losing market share to cheaper, imported products. Activity and emissions will increase outside the regulated space, and in the long run, an entire industry may relocate to unregulated jurisdictions. In both cases, carbon leakage is an accidental consequence of unilateral climate action in an interconnected world where products, such as oil, steel, cement and aluminium, are (or can be) traded globally and production moves easily. To prevent loss of competitiveness, the environmental constraint can be alleviated for vulnerable sectors, which in a cap and trade system means, for example, giving some allowances for free to reduce the cost of compliance. The European Union being the first large jurisdiction to have a climate policy, this hypothetical dynamic was a preoccupation from the start. But the term carbon leakage really pervaded policy discussions when the EUETS entered its third, more centralised phase in 2013 when more persistent questions were raised regarding the free allocation of allowances that had been maintained until that point. Carbon leakage due to loss of competitiveness has, quite understandably, become a key theme when industrial associations argue for the continuation of free allowances.

Carbon leakage is a spatial and numerical problem. In her work on the energy sector in Baltic countries, Kama (2014) clearly shows its territorial aspect. She describes how the Estonian government managed to introduce in the EUETS a special measure for member states where national power grids were connected to networks outside the European Union (in Russia notably, a legacy from the Soviet Union). It was argued that carbon leakage could occur via cheaper imports of electricity produced by plants not subjected to any climate policy. In addition to the environmental harm, dependence on imports would weaken Europe's energy security. Hence it was decided that energy providers in these countries could benefit from free allocation (this measure derogates from the rule applying to the rest of the power sector – more on this later). Here we develop a similar spatial sensibility to explore the ways, in which the positioning of the European Union within the global economy is brought about in debates and decisions about the EUETS and carbon leakage (cf. Barry 2001). As we will see, statistics and other numerical abstractions are central to such an effect (Mitchell, 2002, Didier 2009). Delineating a statistical territory, creating classes and categories (sectors, sub-sectors, products), developing indicators and calculating ratios, all these practices aim to grasp the economic impact of the climate policy through relations between aggregates (emissions levels, imports, exports, gross added value etc.).

And yet, despite all these numbers, or maybe because of all these numbers, we argue that carbon leakage due to loss of competitiveness is characterised by a form of under-determination: the existence of such a risk keeps being called into question, but the possibility of the phenomenon cannot be entirely dismissed either. Two reasons can be put forward for why this may be so. Kama (2014) identifies a first reason in the forward-looking nature of carbon leakage. She suggests that it is 'a future threat of an event "that has not happened and may never happen"' and describes free allowances as 'a form of pre-emption' (p. 208). Carbon leakage is an uncertain risk. A second reason that might help us understand its on-going under-determination lies in the very idea of competitiveness. Competitiveness became a panacea in European governance in the 1990s. The notion works in a world where goods and capital are assumed to freely circulate, and these global movements appear unstoppable (and desirable). As stressed by Davies (2016), concerns about competitiveness fuse the economic and the political in a peculiar way. Nation-states (here the European Union) engage in a never-ending economic battle with the rest of the world and political communities become indebted to the business activities taking place within their borders. As it appears impossible to consider that an economy is competitive enough, the result is a 'sense of *anxiety* amongst political leaders' (Davies 2016, p 138). When she discusses benchmarking as a means to steer national policies and make a 'competitive Europe,' Bruno (2009) develops a similar point. Using a Foucauldian register, she talks about 'the "indefinite discipline" of competitiveness' (p. 277). It follows that the risk of being less competitiveness is nearly impossible to debunk. A policy like the EUETS that might undermine European industry by increasing the cost of its products logically exacerbates this competition-based anxiety.

What we call economic under-determination – a situation, in which processes that are economic in nature (carbon leakage and its non-existence) appear to be accounted for with less than the amount of evidence needed to satisfy key audiences that they can be firmly established – invites us to think about uncertainty in policy-making in new ways. The sociology of ignorance has shown that uncertainty can be strategically produced by powerful actors (companies and regulators alike) to deflect attention, evade responsibility or prevent regulation (McGoey 2007, 2012). Organised climate denial in the United States is a good example (Oreskes 2010). Given the vitality of business lobbying in Brussels (Laurens 2018), one might consider that carbon leakage is just another case of strategic maintenance of doubt and unknowns. But this would miss out the intractability of the phenomenon at stake. By arguing that economic under-determination here is unresolvable, we then also depart from another body of work, which sees uncertainty, and controversy, as fostering a new form of democracy (Callon *et al.* 2009). Initially developed with regards to decision making about technoscientific innovations, this argument was extended to carbon markets, at a time when these regulatory interventions were emerging and could be envisioned as sites for collective experimentation (Callon 2009, MacKenzie 2009b). A decade later, our inquiry into the EUETS nuances the optimistic vision that anticipated a learning by doing dynamic open to questioning. The slippery notion of competitiveness, for example, while it is so crucial in drawing the limits of the EUETS, has been left largely unquestioned. As we shall see now, carbon leakage due to loss of competitiveness too often amounts to an appeal to authority, foreclosing in-depth discussion of the future of European industry under an ambitious climate policy.

Defining exposure to the risk of carbon leakage

As mentioned, when the EUETS entered its third phase (2013–2020), it was further harmonised and common allocation rules were introduced. The Directive revised in 2009 aimed to better regulate the supply of free allowances and engage a transition from generous national allocations to a future regime (possibly in phase 4), in which all allowances might be auctioned. In the meantime, free allocation aimed ‘to address the risk of carbon leakage,’ according to a rigorous assessment (OJUE 2009). The amount of allowances given out for free was set at 43% of the cap so as to match the proportion of emissions from industrial installations (defined as not being electricity suppliers) in previous phases. It was decided that each eligible installation would, every year, receive a quantity based on the following formula: historic activity levels (specific to the installation), multiplied by a product benchmark (specific to the industrial product), multiplied by a carbon leakage factor (specific to the industrial sector), multiplied by a factor reflecting the annual decrease of the cap[5] (applied to all installations). For this formula to be implemented, the category of being at risk of carbon leakage needed to be delineated. How that was done is our focus here.

In order to operationalise free allocation and give a numerical value to the carbon leakage factor, the industrial activities regulated by the EUETS had, first of all, to be sorted out into sectors. The statistical apparatus and data infrastructure of the European Union proved essential here as it allows anyone in an office in Brussels to ‘grasp the economic activity’ and frame it for the workings of the policy, explained a staff member of the Commission involved in the process (interview DG CLIMA 1). A certain level of disaggregation was chosen in the Statistical Classification of Economic Activities in the European Union (NACE). It was known as NACE 4 and helped demarcate 250 sectors, ranging from the ‘manufacture of wallpaper’ and ‘of basic pharmaceutical products,’ to the ‘manufacture of fertilisers and nitrogen compounds’ and ‘of basic iron and steel and of ferro-alloys.’ The Commission used this classification to draw ‘a list of sectors and subsectors, which are deemed to be exposed to a significant risk of carbon leakage’ that it would regularly update.

To assess exposure to such a risk, two criteria were applied: ‘cost intensity’ and ‘trade intensity.’ These calculative tools worked as proxies to evaluate whether, or not, an industrial sector would be able to support the cost of buying allowances. The indicators captured if an activity could comply with the EUETS, without losing market share to cheaper products manufactured by foreign competitors and causing carbon leakage due to loss of competitiveness. As suggested by an economist (below), whose work fed into the conception of the two criteria used by the Commission, the ability to increase product prices is the best proof that an industry is not threatened by foreign competition.

> In terms of the carbon intensity [equivalent to cost intensity] of the sector, and measuring, ‘which are the industries that will really feel the carbon costs in their operating costs?’ this indicator is quite straightforward.

> But in terms of, 'how vulnerable, how exposed to international competition are these sectors?,' trade [intensity] is just one of many indicators that can be used. In fact, it's not a great one because trade fluctuates over time; it's just the most obvious. Ideally, if you could directly estimate the cost pass-through ability in these sectors, then that's what we're really interested in. If the sectors really can't pass through any of the carbon cost, then they're clearly exposed to competition. But if they're able to pass on 100%, or 120%, then they don't really need the free allocation. This is quite hard to do for sectors that are not … electricity basically. The electricity market, you know, they have high-frequency data, we know they adopt marginal-cost pricing, so it's a no-brainer. But when it comes to steel and cement, it's really hard to get product prices at a high frequency. (interview, economist 1)

The economist drew a contrast between the electricity sector and industries like cement and steel, regarding the simplicity, with which what she termed 'cost pass-through ability' could be assessed. Some of her colleagues had produced evidence that, in the early days of the EUETS, electricity prices were fluctuating with the price, at which allowances were being traded. The demonstration built on econometric tests using high-frequency data obtained from trading platforms where electricity contracts are exchanged (cf. Sijm *et al.* 2006). Although power companies had not paid for most of the allowances used for compliance (generous allocation from member states), they seemed to have factored in a carbon cost into their pricing strategies and were, therefore, passing on that cost. Their cost pass through ability relied on the physicality of electricity networks, preventing imports (except in Baltic countries, Kama 2014) and limiting consumer choices. Once made public, the behaviour of power companies triggered an outcry: they could be making 'windfall profits' environmental organisations argued.[6] It followed that under the harmonised allocation rules in phase 3, electricity suppliers could not get anything for free. Free allowances were maintained only for manufacturing industry, broadly conceived, and supposedly targeted towards the sectors deemed less able to pass on costs (OJEU 2009). Many industries seemed potentially concerned. With little publicly available information on their pricing strategies, an indirect approach was developed to evaluate their vulnerability based on the two indicators introduced above.

Drawing the contour of the sectors at risk of carbon leakage prompted a series of numerical abstractions. A sector was judged exposed, if its cost intensity was above 30%, or if its trade intensity was above 30%, or if its cost intensity was above 5% and its trade intensity above 10%. Cost intensity was defined as the ratio between the costs of the EUETS for the sector and the latter's gross value added. For economists, the criterion might be 'straightforward,' because it represents the dynamic leading to loss of competitiveness. Climate policy would increase production costs via the need to purchase allowances and higher electricity prices, assuming the power sector passed on its own cost of compliance. For a given sector, the effect of such a cost increase – how much it would be 'felt' – was considered to be relative to the sector's capacity to produce value in the economy, as captured by its gross value added.[7] But moving from theoretical considerations to actual numbers proved tricky. If gross value added is an indicator routinely computed by the statistical agency of the European Union (Eurostat), calculating the hypothetical costs involved more work for the Commission. Additional information needed to be collected (e.g. the emissions level of a sector had to be aggregated based on installation data retrieved from the EUETS database) and choices to be made to apply the counterfactual reasoning (e.g. what would be the cost pass through strategy of the power sector).

In contrast, trade intensity was easier to compute. It relied on one of Eurostat's databases that records the movements of manufactured products in and out of the 'statistical territory' of the European Union (European Commission 2009, p. 31). For a given sector, trade intensity was then defined as the ratio of the total value of imports and exports with non-European countries, against the total market size of the European Union (turnover and imports). But the problem here was that the indicator and its thresholds lacked focus. Along with industrial goods, like steel and aluminium, it also classified as being at risk of carbon leakage some surprising businesses, the competitiveness of which would clearly not be affected by having to pay for a few allowances: 'ice cream makers, imitation jewellery, clock making are on the list, because they're trade intensive,' summarised a civil servant of the European Commission (interview, DG CLIMA 2).

Assessing exposure to the risk of carbon leakage and establishing a list of sectors in need of protection was a 'heavy process,' recalled another staff member of the Commission (interview, DG CLIMA 1). It involved a lot of 'data crunching' and many adjustments (European Commission 2009). Industrial associations and manufacturers could make the case for being evaluated according to a product-specific classification if NACE 4 was thought inappropriate. Such *ad hoc* inclusion allowed, for example, the subsector of French fries – 'Frozen potatoes, prepared or preserved (including potatoes cooked or partly cooked in oil and then frozen; excluding by vinegar or acetic acid) – to be considered at risk, when the NACE 4 sector 'Processing and preserving of potatoes' was not (OJEU 2013). Furthermore, inclusion could also be argued via a 'qualitative assessment,' if the two indicators of the 'quantitative assessment' were missing out on certain features of an activity (European Commission 2009). As a result, in phase 3, almost every installation that was not a power station belonged to a (sub)sector deemed exposed to carbon leakage. This directly impacted the quantity of free allowances these installations were to receive. In the allocation formula, for activities deemed at risk, the carbon leakage factor was set at 1 throughout the phase, while for others, it was set at 0.8% in 2013 and decreased annually to reach 0.3% in 2020.

To address the possible threat of carbon leakage, evidence had to be collated and choices made. The formula for deciding how and to whom allowances could be given out for free, drew on indicators that conceive of carbon leakage as a risk, to which manufacturers residing within the economic, legal and statistical space of the European Union might be exposed. This definition of carbon leakage is an operational one. It aims to ensure that exposed sectors receive a higher share of free allowances than those not considered to be vulnerable. Business statistics, criteria, thresholds and a series of numerical abstractions helped the European Commission identify, which industrial activity was likely to suffer economically, if it had to bear the full cost associated with the EUETS. This indirect assessment of what economists call the 'cost pass through ability' of an industry seemed, however, to lack precision and, as we shall see now, has been called into question.

A contested but enduring threat with consequences

The criteria-based definition described above is not the only way the elusive process of carbon leakage due to loss of competitiveness has shaped the EUETS. The idea of carbon leakage first emerged within environmental economics. To continue exploring the question of economic under-determination, this section will examine some of the ways, in which economists have construed the phenomenon. We then turn to recent policy discussions about whether free allocation in the EUETS should be maintained after 2020. These discussions occurred in light of retrospective economic analyses suggesting the risk, as defined in phase 3, might have been overestimated.

As the EUETS entered phase 2 in 2008, a group of economists from British, French and German universities and research centers published a series of studies about carbon leakage due to loss of competitiveness. These studies used models, whereby various leakage rates could be calculated for key sectors (cement, steel, aluminium, etc.) under different scenarios (different allocation rules, such as free allowances or auction) (see Dröge *et al*. 2009). According to an economist involved in this work, the message was that leakage was possible, although the actual rates were not meant to be predictions (interview, economist 2). Modelling aimed to inform policy discussions on the allocation of allowances in the forthcoming third phase. But where it enabled economists to get a sense of the dynamics at stake, industrial associations saw in the possibility to calculate impressive leakage rates a lobbying technique. In a report that the European cement association commissioned from a consulting firm in 2008, one can read that, with a forecasted allowance price of 25 euros, more than 80% of European cement production 'will be at risk of offshoring' (BCG 2008). The statement is accompanied by a map of the European Union where a colour range represents the vulnerability to carbon leakage – the more vulnerable, the redder, with large areas in orange-red acting as a warning.

Five years later, as the EUETS moved into its third phase (2013–2020), the European Commission asked consultants to investigate 'whether there is factual evidence for the occurrence of carbon leakage over phases 1 and 2 of the EUETS (2005–2012)' (Bolscher *et al.* 2013).[8] Such retrospective analyses would help prepare for the revision of the policy beyond 2020 (phase 4). The report eventually concluded there was 'no evidence for any carbon leakage' (p. 11). The assessment had focused on specific sectors (e.g. steel, glass, pulp and paper, refined petroleum products), about which production and trade data were gathered, available literature reviewed, and industry consultations organised. Each sector (products, costs, prices, demand, trade flows, investments etc.) was documented in an attempt to identify the 'drivers' of a possible relocation of production. If we take the steel industry, which produces a range of materials (flat steel for cars and washing machines; long steel for rails and reinforced concrete) using manufacturing processes emitting large quantities of CO_2 emissions, the report stated that: 'changes in trade flows [of steel products] of the EU can mainly be attributed to changes in domestic demand (especially between 2006 and 2009) and in the development of China being able to satisfy both the rapidly increasing Asian demand and become a next exporter' (p. 23). The study pointed towards 'a shift of world demand' (p. 35) as the main explanation of changing trade flows. Given that blast furnaces and steel works had received (many) allowances for free, the authors could not exclude that free allocation might have prevented carbon leakage from occurring. But their analysis clearly cast doubt on the credibility of the climate policy being a major threat to European industry especially compared to recent macroeconomic shifts.

In order to further assess whether carbon leakage had occurred, and whether it was likely to occur in the future, more sophisticated approaches were also proposed in the academic literature, from which consultancies appointed by the Commission would later draw on. The implementation of the EUETS has been producing data (emission levels and allowances prices) that could be used to switch from modelling to econometrics. For example, economists showed that in the case of steel and cement, higher demand in Europe (respectively in the rest of the world) was associated with increasing (respectively decreasing) net imports, while the allowance price had 'no explanatory power on net imports' (Branger *et al.* 2013, p. 20). Econometric techniques apprehend carbon leakage as a statistical link, the robustness of which is testable. In the presence of leakage, high allowance price would imply higher production costs, a loss of market share vis-à-vis foreign producers, and an increase in net imports. As this numerical relationship could not be detected, the economists conducting these analyses suggested that carbon leakage had not been observed in the past. Changes in trade flows appeared (statistically) independent from the cost of CO_2, calling for nuancing the 'fear of competitiveness and carbon leakage' disseminated by industrial lobbies (Branger *et al.* 2013, p. 23).

In Brussels, the accumulation of reports and studies contributed to consolidate the idea that the risk of carbon leakage due to loss of competitiveness might have been overstated, making free allocation harder to justify. Perhaps policy debates could move from under-determination to evidential satisfaction that this was not a serious enough risk to exempt most industrial manufacturers from buying their allowances. Besides, arguments were made by environmental organisations that free allocation deprived member states from auction revenues and undermined the development of abatement technologies and strategies. A sign that even industrial lobbyists tended to agree that carbon leakage had not been observed (yet) was a discursive move to talk about 'investment leakage' instead. Investment leakage is 'when companies decide to invest less and less in a new capacity or invest less in maintaining and upgrading existing capacity,' explained a lobbyist (interview, Business Europe). This new risk was made visible through an opinion survey where industrial executives had been asked how they thought the price of allowances would develop in the future and what its impact would be on their investments in Europe.[9] Most respondents expected the price to increase and have negative consequences. The survey was released at an event gathering industrial representatives, officials of the European Commission and members of the European Parliament, at a time when discussions about phase 4 of the EUETS were on-going. Because investment decisions depend on perceptions of future constraints and opportunities, talking of investment leakage would make it harder to produce counter-evidence.

The allocation rules that would apply in phase 4, from 2021 to 2030, were under negotiation from 2015 to 2017. Based on its 'impact assessment,' the European Commission published in the summer of 2015 a Proposal for revising the Directive (European Commission 2015). Despite consensus around the absence of proof that carbon leakage occurred in the past, it did not suggest the termination of free allocation. The Proposal built on the conclusions of the European Council in March 2014, when the heads of states and governments had explicitly insisted on having measures to prevent potential carbon leakage (European Council 2014). The Proposal, therefore, introduced only a few changes in the allocation rules. To exclude from the carbon leakage list sectors that were only trade intensive (e.g. clock makers), it suggested a combined criterion that would be compared to different thresholds in a 'tiered approach.' Instead of a binary categorisation (at risk or not), four degrees of exposure (high risk, middle risk, low risk and no risk) were identified, leading to differentiated treatments to ensure that free allowances benefitted only the most vulnerable industries.

Carbon leakage was one of the most contentious topics debated as part of the revision of the EUETS Directive. Various industrial associations contested the tiered approach during consultations held at the Commission. Lobbying against a tighter allocation regime also targeted members of the European Parliament.[10] The Commission had handed out the Proposal to a subgroup of parliamentarians, the Committee on Environment, Public Health and Food Safety (ENVI), tasked with drafting a text that would be submitted to the whole assembly to vote on.[11] The draft of the ENVI Committee kept the tiered approach, but in the plenary session, further amendments were introduced and a majority eventually voted to return to the binary categorisation (at risk or not). Environmental organisations attributed this twist to the German steel industry.

> We heard from a German NGO that a very influential MEP [Members of the European Parliament] from Saarland had a lot of pressure from the steel lobby that sent out a letter five days before the vote. We tried to write a response and meet with the MEP and its assistants, we were also in touch with the socialist shadow rapporteur, but the pressure from the steel industry spread out, and they created an alliance with trade unions in Saarland. (interview, environmental organisation)

The environmental activist quoted above further reported that trade unions organised demonstrations in protest against an overly stringent EUETS, which would spell the end of the steel industry and increase unemployment.[12] And so, the vote in Strasbourg in February 2017 was shaped at a distance by the politics of steel in Germany.[13]

After being agreed by ministerial representatives, the rules of the EUETS for phase 4 eventually entered into force in April 2018 to be applied from January 2021. A single combined criterion substitutes the two indicators used so far (carbon and trade intensity) and only one threshold helps identify exposed sectors. The Directive still includes many routes for an industry failing the quantitative test to make the case for its inclusion (OJEU 2018). All this might cast doubt on the earnestness of the claim that 'auctioning of allowances remains the general rule, with free allocation as the exception' (ibid.). Rather what we see is a policy endorsing a form of 'regulatory precaution' where exception and exemption tend to be the norm (Laurent 2019).

Free allocation, whether it should be maintained, and for which sectors, seem an irreconcilable issue given the under-determined nature of carbon leakage due to loss of competitiveness. Carbon leakage first gained consistency as an economic calculation, based on hypothetical costs and assumptions about a friction-less global economy. Its realisation, however, was not statistically detected in the records of the European economy. But it might actually not be observable for quite some time, if, as business lobbyists more recently argued, the risk is better understood as gradual disinterest and disinvestment in European industry. Numerical abstractions have proliferated to assess the credibility of the threat, without resolving its under-determination. Compared to opinion surveys, lobbying and union politics, numbers appeared quite weak in shaping the latest revision of the policy.

Coming closer to industrial realities

In this last section, we move away from the legislative process to engage with an industry deemed vulnerable to loss of competitiveness. The focus will be on the 'manufacture of cement.' Based on the indicators and thresholds examined earlier, the 200 or so cement plants responsible for c 6% of total CO_2 emissions that the EUETS regulates, were at risk (Neuhoff *et al.* 2014).[14] Cement companies have thus received large quantities of free allowances throughout phase 3. In a similar fashion to the steel industry, their business association lobbied against the tightening of free allocation in phase 4. By asking how the policy applies to a specific sector, we can come closer to industrial realities and look at the on-going under-determination of carbon leakage from that angle.

The cement industry was identified as being exposed to carbon leakage due to loss of competitiveness solely based on its cost intensity. Early on, economists and their models had singled out cement production for that reason (Hourcade *et al.* 2007). The cost intensity ratio calculated by the European Commission indicated that the value at stake for the industry was well above the 30% threshold. Cement is a low added value material, the manufacturing of which generates large emissions. The key step in this process consists in heating ground limestone and clay, which releases large quantities of CO_2, both from fuel combustion and the chemical transformation itself. Sedimentary rocks are decarbonised to obtain a material called clinker able to harden with water. Mixed with sand and stones to produce concrete, cement is widely consumed due to its low cost and high versatility. With the material's physical properties and commercial qualities depending on emitting CO_2, it was anticipated that decreasing the sector's emissions would not be an easy task.

In contrast to cost intensity, trade intensity in the cement sector was actually quite low a decade ago, when all these calculations were performed. The reason is that, although European cement companies are often multinational, cement markets tend to be local, spread across 200 km around a plant and its quarry. This is due to high transportation costs, especially by road, relative to the low added value of the material. Along the seacoast, the situation slightly differs. Shipping bulk cement over long distances is technically feasible at reasonable costs (Dumez and Jeunemaître 1998). When carbon leakage was still a matter of *ex ante* analysis, some economists developed spatial models to calculate differentiated leakage rates showing that coastal regions, where the industry comes into contact with the global economy, might be more vulnerable than the hinterlands (Ponssard and Walker 2008).

Deemed at risk of loss of competitiveness, in the EUETS cement companies have accumulated a surplus of allowances, well beyond their needs, from the start of phase 2 and throughout phase 3. While in the mid-2000s, production of cement was high to satisfy high demand in the construction and housing sectors, these activities collapsed with the financial crisis, especially in Southern European countries. The period between 2008 and 2012 was marked by cement plants reporting emissions levels much lower than the quantities of allowances they were entitled to in the allocation plans of most member states (Branger and Quirion 2015). Large over-allocation to the sector further continued into phase 3. To understand why, two parameters of the allocation formula must be considered: 'historic activity levels' and 'product benchmark.' As the European Commission was working on the new allocation rules (assessing the carbon leakage risk), it also established 'benchmarks' for more than 50 'product categories' (e.g. 'tissue,' 'nitric acid,' 'cement clinker').[15] Benchmarks are expressed in tonnes of CO_2 emitted per tonne of product and calculated as the average emission efficiency of the 10 best installations. Industrial associations and manufacturers were involved in the calculation, because it required access to confidential production data and an agreement on the definition of the product category. In the cement sector, the benchmarking exercise amounted to a struggle for the distribution of free allowances among market competitors (like the setting of market standards, Laurens 2018). Indeed, multiplied by 'historic activity levels,' 'product benchmark' would reward the plants that had been chosen to set the value of the benchmark with a volume of allowances close to their future needs. More polluting installations would in contrast be short of allowances. This ought to provide an incentive to improve environmental performance across the sector. But the subtle incentivising effect was quickly swamped. Far too many allowances continued to be distributed in phase 3, as the Commission used the period between 2005 and 2008 to calculate the 'historic activity levels' used in the allocation formula for phase 3. Pre-crisis years constituted the baseline to allocate free allowances in times of recession.

The problematic accumulation of a surplus of allowances in the EUETS goes beyond the cement industry and free allocation.[16] Where free allocation comes in, is with regards to distributional issues. As an excess of allowances started developing in the system, an environmental organisation established a 'carbon rich list' by assigning the surplus to specific companies (Sandbag 2010). Cement manufacturers were high on that list. A few years later, the same organisation decided to further look into the cement industry, shaming five companies for having 'collectively received nearly €1 billion worth of spare EU allowances' (Sandbag 2016). These environmentalists sought to participate in the policy debate about the revision of the EUETS, advocating, with others, for a reform of free allocation (in favour of the tiered approach). Besides the surplus question, their enquiry into the cement industry also revealed a serious regulatory flaw. According to the allocation rules in place in phase 3, if an installation is operating below 50% of its production capacity, this must be reported to the relevant national authority, and a reduction of 50% applies to the amount of allowances distributed the following year. But, as long as industrial activity is above that threshold, full supply of allowances is secured. As a result, where the construction sector suffered most from the crisis, cement plants seemed to have kept production levels just above 50% of their capacity to secure full free allocation. A group of economists detected the 'gaming' pattern and environmental organisations relayed the findings (Neuhoff *et al.* 2014, Branger *et al.* 2015). The new Directive eventually modified the rule to mitigate this threshold effect in phase 4.

Evidence was being produced that carbon leakage protection had maintained cement production, and associated CO_2 emissions, possibly beyond what would have happened if allowances had not been freely allocated. The environmental organisation that publicised the problem, tried to trace the movements of this cement surplus through trade statistics. Gaming, it seems, allowed companies with assets in various European countries to optimise activities across the value chain (clinker production, grinding, concrete production) by transferring excess production from countries hit by the crisis, like Spain, to regions where the construction sector was still thriving, like the London area. In addition to these internal arrangements, trade flows suggested that gaming might have increased net non-EU exports. Clinker manufactured in European plants, where production costs ought to be higher because of the EUETS, had been exported to regions with no climate policy, to South America for example (interview, Sandbag). This was talked about as carbon leakage 'in reverse' (Sandbag 2016, p. 4), in that the EUETS led to 'a *net import* of emissions' (p. 7). The investigation also showed that 'the clinker ratio has risen from 76% in 2008 to 80% in 2013 in Spain' for example (Sandbag 2016, p. 27). The ratio refers to the percentage of clinker contained in cement products. It is an indicator of the product's environmental performance. The production of clinker is the manufacturing stage that generates most CO_2 emissions. Clinker can be partially compensated for with slag from blast furnaces or fly ash from coal plants. This is one of the easiest ways to reduce the emissions of commercialised cement. Information about the value of the clinker ratio per country is made available through a corporate sustainability initiative. According to this database, cement was manufactured with higher ratios in countries where there was excess capacity. This suggested that the regulatory loophole – the 50% capacity rule – might be seriously undermining the very purpose of climate policy.

Lack of evidence of carbon leakage and clear evidence of counter-productive effects have not stopped the European cement industry from arguing against the end of free allocation. As noted with the shift to investment leakage, conjuring up gloomy futures can be a lobbying tactic. For the executive of a cement multinational quoted below, in a future where the EUETS imposes additional costs on the industry, and in a world where jurisdictions are engaged in an economic battle (cf. Davies 2016), there is a real threat of cement dumping from abroad.

> In China, it's having over capacity of 600 m tonnes. They are going to close plants, but we don't know how much. They have an over capacity and you have seen what happened in the steel industry in Europe, due to the dumping this year. […] It might be that in 2020, we have to say, 'Okay, we will close all our plants in Europe, because there is no protection anymore.' […] At this moment, I have, from China, cement can be transported, is transported to Europe. The cost price of transport from China to Rotterdam is €7 per tonne. Do you know what the sale price of cement is? €60, €70, so it's 10% [which is not much]. (interview, cement executive)

The quote suggests that, if companies needed to pay for their allowances, once their surplus is used up, cement imports would become competitive. Credible or not, the risk of carbon leakage displays stubborn endurance, including through bad faith. In the same conversation, the cement executive condemned China subsidising steel exports and acknowledged that his company used the 50% capacity rule to maximise the amount of free allowances (a kind of subsidy) received by its installations.

The looming possibility of carbon leakage and fierce lobbying to prevent loss of competitiveness have made it difficult to imagine this energy-intensive industry could be required to buy its allowances. But free allocation is not convincing either, which is why economists have suggested replacing it with 'border adjustment.' A carbon tax, or charge, could be applied on industrial products entering the European Union. It would allow domestic manufacturers to pass on the cost of paying for their allowances, without risk of losing market share to foreign competitors whose prices would also increase. Domestic producers might even be rewarded. If they improved their environmental performance, they would buy fewer allowances and could market their products slightly below imports. Despite substantial literature on the economic rationale for border adjustment, the European Commission did not suggest it in its Proposals for the revision of the EUETS after 2020. The main reason is that it would conflict with the free trade principle of the World Trade Organisation, especially as more countries implement some form of climate policy. With the Paris Agreement, a carbon tax on imports is 'not the message that we want to give,' summarised a staff member of the Commission (interview, DG CLIMA 2). Border measures clearly are diplomatically sensitive. Yet, the draft of the ENVI Committee discussed in 2016 introduced the idea for the cement industry only. Together with the CEO of an eco-cement company, an environmental organisation (Carbon Market Watch) had lobbied the small group of parliamentarians with some success, before the plenary dropped the idea.[17] In a free-market world, trade barriers ought to be technological. The creation of an Innovation Fund to be operational in the fourth phase of the EUETS illustrates this logic. Auction revenues would finance demonstration projects to foster low-carbon innovations in energy-intensive sectors such as cement. Meant to 'boost growth and competitiveness by empowering EU companies with a first-mover advantage to become global technology leaders,'[18] the purpose of the Fund is justified again in the elusive and authoritative language of competitiveness.

Gaming, exports subsidised through free allowances, and less environmentally efficient products, have emerged as problematic consequences of trying to prevent carbon leakage in the cement sector. One might argue that these just confirm that companies are profit-seekers. But in this section, we also wanted to point out how difficult it may be for energy-intensive industries to adapt to the new environmental constraint. Cement derives its commercial properties (a cheap, versatile powder used in the most consumed manmade material in the world) from a manufacturing process that releases CO_2 into the atmosphere and has remained unchanged for decades. Pursuing our exploration of the under-determination of carbon leakage, we saw that the question could draw attention to specific facets of industrial realities, which do not get discussed if one stops at the anxiety-provoking concept of loss of competitiveness.

Conclusion

In this paper, we examined the European Union Emissions Trading System (EUETS) and the ways, in which it regulates energy-intensive industries. The cornerstone of European climate policy, the EUETS ought to reduce the CO_2 emissions of a variety of industrial activities, through the creation of tradeable environmental intangibles called emissions allowances. We examined the policy discussions arising around the distribution of the regulatory intangibles, in particular whether, to whom and under which conditions they should be allocated for free. Central to these debates was the hypothetical phenomenon of 'carbon leakage due to loss of competitiveness.' The idea is that, if a jurisdiction like the European Union unilaterally enforces climate policy, there is a risk that production in energy-intensive industries linked to global trade (e.g. steel, cement, aluminium, glass), and associated emissions, relocate to unregulated jurisdictions, via changes in trade flows (more imports) and investments. The paper explored how the possibility that the EUETS might cause carbon leakage has been brought about, contested and reframed. From exposure indicators and trade data to econometrics and benchmarks, we came across many numerical abstractions that are central to the working of such a market-based climate policy. We saw that the terms kept fluctuating for establishing whether or not the EUETS could lead to carbon leakage. Opinion surveys, demonstrations, lobbying and the stubborn endurance of the idea(l) of a friction-less global economy, constantly reactivated the possibility that environmental constraint poses a risk to European competitiveness. The possibility of carbon leakage could neither be established, nor entirely dismissed, and we used the term under-determination to capture such a state of affairs.

We suggested that what makes carbon leakage endure and have effects (free allocation of surplus allowances), despite its elusiveness, or because of it, might lie in the potency of any claims about competitiveness. The fear of industries becoming (even) less competitive than foreign manufacturers is so tenacious that it trumps the need to urgently decrease CO_2 emissions. As Chiapello and Engels (2021, this issue) suggest, environmental concerns are a focus for these elaborate interventions because they are considered important. But these interventions also often fail. Here we suggest that concerns for competitiveness continually challenge the direction and possibility of the climate policy in view leading to a form of under-determination that seems characteristic of the uncertain yet authoritative nature of economic claims. As a source of political anxiety, the competitiveness argument tends to evade the need for evidential clarification. Climate policy appears condemned to suffer from having the precautionary principle applied for the benefit of the economy instead of the environment.

One can argue that, when it comes to the accumulation of CO_2 into the atmosphere, the only element that matters in the EUETS is the emissions cap, which, as we pointed out, was too high for more than a decade. But the paper showed that the ways allowances are distributed can also be relevant to the environmental consequences of the policy. Companies in the cement sector were able to game the allocation rules to maximise the amount of allowances they received for free, thereby turning the climate policy into a production (and emissions) subsidy. Some kind of reverse carbon leakage might have even occurred. The policy turned out to have the opposite effect of that intended. It could, therefore, be tempting to talk about failure and blame the industry for it. What we argue here is slightly different. When a decade ago, the EUETS could be celebrated for its experimental approach, our account is clearly less optimistic. But it also suggests that the notion of failure misses the point (Neyland *et al*. 2019). We showed that in policy making related to the EUETS, there is not much room for a collective investigation into, and in-depth understanding of industrial realities. The legislative process, which aims to regulate a wide range of sectors at once, tends to foreclose discussions of the less polemical reasons why some industries emitting large quantities of CO_2 might lobby so hard against the policy (the structure of the sector, the nature of its products, etc.). In the ongoing carbon leakage debate, the competitiveness argument, too often used as an appeal to authority, might contribute to this foreclosure.

Notes

1. The 31 participants are the EU's 28 member states (before Brexit) plus Iceland, Lichtenstein and Norway.
2. For a technical overview of the problems and changes undergone by the policy until the mid-2010s, see Ellerman, Marcantonini, Zaklan (2014)
3. Although free allocation departed from the ideal market design recommended by the European Commission, namely the auctioning of allowances, it was argued that it would not undermine the economics of the EUETS: if an installation could reduce its emissions at a low cost, it would do so to derive revenues by selling its excess allowances (Ellerman, Convery, de Perthuis, 2010). In the first two phases of the policy, member states were then in charge of elaborating National Allocation Plans and had to submit it to the European Commission for evaluation (Mackenzie 2009b). The latter tried to exert some control over the total quantity of (free) allowances put into circulation, and more than once, downward adjustments were requested (Kama, 2014)..
4. Traded at around 25 euros in 2008, allowances saw their value decline in 2009 and become particularly low between 2012 and 2018 (well below 10 euros). See: https://sandbag.org.uk/carbon-price-viewer/.
5. This factor includes the 'cross-sectoral correction factor', which had to be introduced to solve the discrepancy between the calculation of the total amount of allowances handed for free (the so-called industry share) and the calculation of free allocation based on the carbon leakage list.
6. See, for example, the position of WWF: http://wwf.panda.org/?129881/eu-carbon-market-sets-upanother-round-of-windfall-profits-for-dirtiest-power-generators.
7. The gross value added is defined as the difference between output – the monetary value of all products disposed on the market – and intermediate consumption – the monetary value of all goods and services consumed by the process of production, except fixed assets.
8. The Commission also commissioned an 'ex post investigation of cost pass through in the EUETS', focused on six sectors, including steel and cement, that suggested that these industries might have actually increased the prices of their products (de Bruyn et al., 2015).
9. See: https://www.businesseurope.eu/publications/company-survey-reveals-risk-investment-leakage.
10. As Laurens (2018) notes, lobbyists for sectors like steel, cement, ceramic and glass, appear quite united on the issue of competitiveness in the EUETS.
11. The process is more complicated. Another Committee (Industry, Research and Energy – ITRE) was tasked with providing an opinion on the draft legislation.
12. In the early 2010s, Germany concentrated a quarter of the European steel production in terms of value and employment (Bolscher et al 2013).
13. The Parliament's vote dismissed what environmental organisations considered the most ambitious elements: the tiered approach and a lower emissions cap (Neyland, Ehrenstein, Milyaeva, 2019).
14. The ownership of cement plants in Europe tends to be concentrated, with a handful of multinationals, such as LafargeHolcim and HeidelbergCement, dominating the market. These multinationals also often own concrete plants. In aggregate the European Union ranks as the third producer of cement in the world, after China and India. See: https://cembureau.eu/cement-101/key-facts-figures/
15. Only a limited number of manufactured products (52) have a benchmark. These were chosen to include a maximum amount of emissions while keeping it manageable to establish benchmarks for each of them. For installations that did not manufacture such products, a fall-back approach was developed based on heat and fuel consumption.
16. Besides the recession, other elements have contributed to increase the surplus of allowances: the implementation of policy incentives for renewable energies and the import of offsets from project-based market mechanisms (MacKenzie, 2009a; Bryant, 2016)
17. For environmentalists, this was not a total failure, as the Directive mentions that border adjustment could be considered in the future (OJEU, 2018). They were recently proven right. The Green Deal for Europe of the new President of the European Commission has revived the idea of a border mechanism, which could be tried out first with simple products like cement and steel (Kahn, 2019). But then, concerns about potential retaliation have already been voiced by member states.
18. Available at: https://ec.europa.eu/clima/policies/innovation-fund_en.

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