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Carbon pricing of basic materials: Incentives and risks for the value chain and consumers

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EXTENDED ABSTRACT

The Council of the European Union (EU) has recently agreed on a carbon border adjustment mechanism (CBAM) on imports of carbon-intensive products in the sectors cement, iron and steel, aluminium, fertilisers and electric energy production.[1] The aim is to avoid carbon leakage, while allowing to phase out free allocation in these sectors. This paper quantifies carbon leakage risks, distributional implications and additional revenues associated with an import-only border carbon adjustment (BCA) as agreed by the EU, a symmetric (import and export) BCA, and an excise for embodied emissions at a fixed benchmark level in combination with continued free allocation. We find significant carbon leakage risks along the value chain, as well as for exporters even at a relatively modest carbon price of 30 EUR/t.

Introduction / background

The shift to climate neutrality envisaged by the EU by mid-century will require the decarbonisation of production of basic materials such as cement, steel, and aluminium. These materials account for around 25% of global CO_2 emissions[2]. Carbon pricing could result in carbon leakage if higher domestic carbon costs lead to a replacement of domestic production and emissions with foreign production and emissions. Historically, carbon leakage risks within the EU Emissions Trading System have been successfully addressed with free allocation of allowances to the energy intensive and trade-exposed (EITE) producers of steel, cement, aluminium, or plastics.[3] However, as a result of international tradability of materials and free allocation, only a fraction of the carbon costs is passed on along the value chain to basic material products, components and final products and the incentives for material efficiency and recycling at the demand side are muted.[4] Alternatives to the current free allocation regime discussed in the literature are border carbon adjustments or excises for embodied emissions in combination with continued free allocation.

[1] https://www.consilium.europa.eu/en/press/press-releases/2022/03/15/carbon-border-adjustment-mechanism-cbam-council-agrees-its-negotiating-mandate/.
[2] IEA, 2017. Energy Technology Perspectives 2017. International Energy Agency.
[3] See e.g. Martin, R. Martin, R., Muûls, M., Wagner, U.J. 2014. *Industry compensation under relocation risk: A firm-level analysis of the EU emissions trading scheme*. American Economic Review 104, 2482–2508; Branger, F., Quirion, P., Chevallier, J., 2016. *Carbon Leakage and Competitiveness of Cement and Steel Industries Under the EU ETS: Much Ado About Nothing*. Energy Journal 37, 109–135.
[4] See e.g. Branger, F., Ponssard, J.-P., Sartor, O., Sato, M. 2015. *EU ETS, free allocations, and activity level thresholds: the devil lies in the details*. Journal of the Association of Environmental and Resource Economics 2, 401–437; Martin, R., Muûls, M., Wagner, U.J. 2016. *The impact of the European Union Emissions Trading Scheme on regulated firms: what is the evidence after ten years?* Review of Environmental Economics and Policy 10, 129–148.

Substantial existing literature has attempted to quantify the effects of these instruments on carbon leakage risks for basic material producers.[5] However, apart from the leakage risk exposure for EITE industries, the existing literature typically does not look at implications of a border carbon adjustment substituting free allowance allocation for the (downstream) manufacturing sector.[6] Our paper fills this gap.

Methodology

Based on EU-ETS benchmarks, we estimate product-level carbon intensities (embodied emissions) for 4,400 commodity groups in the PRODCOM database of production and trade (basic materials, basic material products, components and final products).[7]. Assuming full cost pass-through along the value chain, we compute maximal implied price changes due to full carbon pricing. We calculate cost increases relative to gross value added as an indicator for the scale of carbon leakage risks.[8] We also compute the distributional consequences of full carbon pricing, and approximate potential fiscal revenues, taking into account a stylised demand response to increased carbon prices.

Results

We show, first, that around 10% of EU exports (190 billion euros) and 5% of all domestic manufacturing sales (240 billion euros) may be at risk of carbon leakage under an incomplete import-only BCA covering only basic materials and basic material products at an EU-ETS carbon price of 30 EUR/t (see Figure 1 for domestic sales). This number increases for higher carbon prices, rising to 15% of domestic sales and 23% of exports at a carbon price of 75 EUR/t. Compared to cement, a higher number of aluminium and steel products are at risk of carbon leakage due to a combination of a larger number of manufactured products not covered by the CBAM and a higher export intensity. Second, the distributional implications of consistent carbon pricing of basic materials – illustrated for German households – are small and progressive: The price signal due to the carbon charge levied on basic material production both in the EU27 and the supply chain of imported material commodities is below 0.2% and increases by about one third with disposable income across all income groups. Finally, an excise could generate revenues of around 20 billion euros that may be used towards climate action.

[5] See e.g. Branger, F., Quirion, P., 2014. Would border carbon adjustments prevent carbon leakage and heavy industry competitiveness losses? Insights from a meta-analysis of recent economic studies. Ecological Economics 99, 29–39; Fischer, C., Fox, A.K., 2018. How Trade Sensitive Are Energy-Intensive Sectors? AEA Papers and Proceedings, 108, pp. 130–135.

[6] The CBAM as proposed by the EU Commission is devised as a substitute for free allocation and will apply only to the proportion of emissions that does not benefit from free allowances under the EU ETS. See https://ec.europa.eu/commission/presscorner/detail/en/qanda_21_3661.

[7] We do this by using simplified supply chains of commodities, EU-ETS process and electricity benchmarks, and data from life cycle databases such as ecoinvent, assigning EU-ETS benchmarks to the relevant processes to calculate and sum up the different emissions contributions. For more details on the methodology, see Stede, J., Pauliuk, S., Hardadi, G., Neuhoff, K. 2021. *Carbon pricing of basic materials: Incentives and risks for the value chain and consumers.* Ecological Economics 189, 107168. https://doi.org/10.1016/j.ecolecon.2021.107168.

[8] In line with the indicator used to assess carbon leakage risk under the EU ETS until 2020 for primary material producers, a value of at least five percent is used as a threshold for carbon leakage risks (see Directive 2003/87/EC).

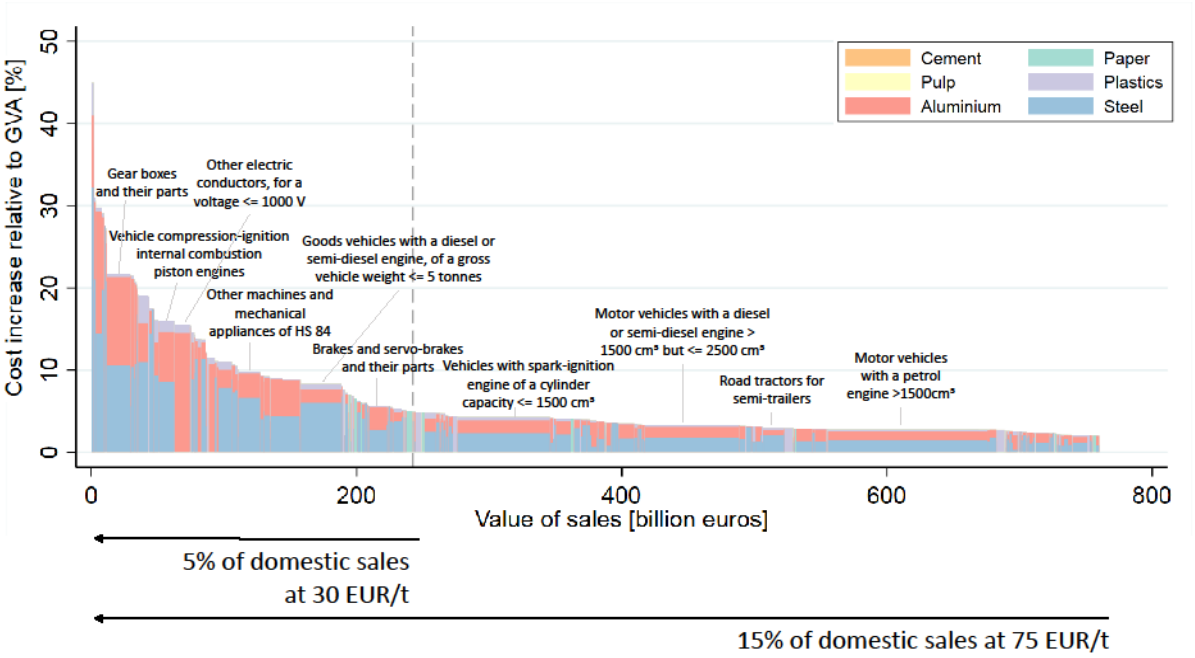

Figure 1. Components and final products in domestic markets potentially at risk of carbon leakage under a BCA that covers only basic materials and basic material products. *Source:* Stede et al. (2021).[9]

Conclusion & discussions

Our results show two disadvantages of implementing border carbon adjustment if administrative and WTO constraints put limitations on their scope. We demonstrate that if products further down the value chain are not covered, for example to limit complexity of monitoring and verification of incurred carbon emissions, increased prices for basic material and basic material products triggered by the EU-ETS price and the CBAM on imports of basic materials could imply significant cost increases for domestic producers of intermediary and final products competing in domestic markets with international imports not subject to a border adjustment. If exports are not refunded for their carbon costs, which could be difficult to implement in a WTO compatible manner, then domestic producers may face higher costs and lose market shares to foreign producers in export markets, resulting in a relocation of production and emissions (carbon leakage). These disadvantages can be avoided if instead the reform of EU ETS involves the introduction of an excise charge levied on the production of basic materials in combination with continued free allowances. Our results can therefore inform responsible policy making to shape the EU pathway towards climate neutrality.

Reference to full paper

This extended abstract is based on the following paper (open access):
Stede, J., Pauliuk, S., Hardadi, G., Neuhoff, K. 2021. *Carbon pricing of basic materials: Incentives and risks for the value chain and consumers.* Ecological Economics 189, 107168. https://doi.org/10.1016/j.ecolecon.2021.107168.

[9] Stede, J., Pauliuk, S., Hardadi, G., Neuhoff, K. 2021. *Carbon pricing of basic materials: Incentives and risks for the value chain and consumers.* Ecological Economics 189, 107168. https://doi.org/10.1016/j.ecolecon.2021.107168.