PARIS REINFORCE

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Policy Brief

The EU Carbon Border Adjustment Mechanism towards net zero: mitigating adverse impacts on least developed countries

The brief in brief

- Implementation of the EU CBAM to support achieving climate neutrality by 2050 has raised concerns.
- As the mechanism aims to minimise leakage through equal fairness in global mitigation, imposing carbon tariffs on the EU's imports of energy-intensive goods could curtail the export of EU trading partners.
- This might be detrimental, especially to the LDCs, due to their high exposures and vulnerability risks.
- We quantified the implications of CBAM and analysed complementary measures to mitigate impacts on LDCs

- Implementing CBAM could **reduce the rate of carbon leakage in the EU by one-third by 2040**.
- However, LDCs could suffer **significant welfare loss**.
- Exempting LDCs would result in greater leakage.
- CBAM complementary measures could focus on **reinforcing climate action within LDCs**.
- Targeted **revenue redistribution** to promote clean and efficient use of energy in LDCs would improve the welfare of recipient countries, and substantially reducing leakage **at a low cost for the EU**.

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The EU Carbon Border Adjustment Mechanism towards net zero: eight measures to mitigate adverse impacts on least developed countries

Policy Challenge: As part of its ongoing efforts towards net zero by 2050, the European Parliament and the Council have reached an agreement on the implementation of the Carbon Border Adjustment Mechanism (CBAM), the EU's landmark tool to put a fair price on the carbon emitted during the production of carbon-intensive goods entering the EU and to encourage cleaner industrial production in non-EU countries. Achieving its updated climate ambition will require substantial and rapid reduction in the current emissions quota. Although the CBAM is expected to support the transition stopping free allowances under the EU-Emissions Trading System (ETS) and to reduce the risk of carbon leakage in the European market, there are different possible settings and a series of complementary measures to consider, each with different implications for the EU and the developing countries exporting their goods.

At the initial stage, the CBAM's scope refers to sectors currently covered by the EU-ETS, mostly energy-intensive industries (EIIs). The latest EU legislative proposal targets **the power sector, cement, steel, aluminium, and fertilisers** to be included in this mechanism, with the commencement plan in 2025. However, some countries (mostly the EU's trading partners) have communicated strong opposition to this new mechanism, including Brazil, China, India, and South Africa. At the same time, latest studies assessing the implications of the EU CBAM have concluded that the tool will pose different challenges to developing countries (Eicke et al., 2021).

This policy brief synthesises the results of a modelling study carried out in the context of the H2020 PARIS REINFORCE research project (see Perdana and Vielle, 2022), which provided an analytical overview of the implementation of CBAM and its effectiveness in reducing leakage and of the EU's competitiveness issue due to changes in production output. It also provides a holistic assessment of eight potential complementary policy options of the EU CBAM targeted to EU trading partners focusing on Least Developed Countries (LDCs), enabling to comprehensively contribute to understanding the concrete adoption scheme, transition, and political acceptability of the EU CBAM.

The **CBAM** could be implemented by a border charge on imports, **a border rebate for exports**, or **full border adjustment**. The tendency, however, goes to implementation of CBAM as a border charge on import to reduce complexities (Mehling et al., 2020) and ensure its consistency with the World Trade Organisation (WTO) rules (Evans et al., 2021). Implementing CBAM as an export subsidy may violate international trade law for its conditional compliance upon export classified as a prohibited subsidy under the Agreement on Subsidies and Countervailing Measures (Holzer, 2014).

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European Climate Policy under the CBAM

We first measured the impacts of a climate policy scenario under the CBAM relative to a reference scenario based on existing national policies. This reference scenario included a subset of the high-impact policies collected and analysed for 2015 to 2030, as documented in our previous work (see Giarola et al., 2021; and Sognnaes et al., 2021). We used the latest modification of GEMINI-E3, a multi-sectoral calibration model with dynamic global scope. For robustness, the scenario was projected until 2040 to fit the yet undefined climate policies post-2030 and the feasibility of policy implementation due to technological and sectoral granularity in the model.

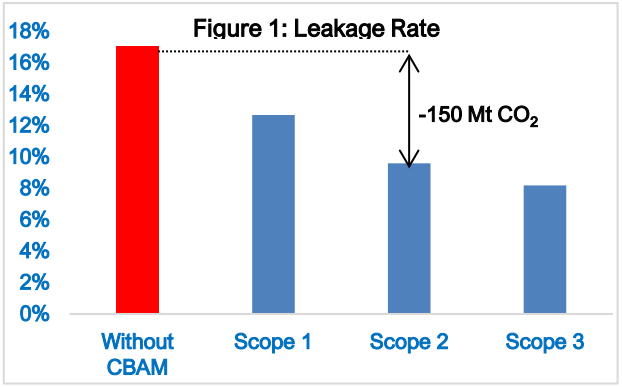
GEMINI-E3 *is a* ***Computable General Equilibrium*** *Model (CGE) designed for climate and energy policy analysis. It is a global, multi-sectoral model that encompasses international trade and emissions and addresses the impacts of production allocation, international trade, and emissions of Greenhouses Gases. The current version is built on the GTAP 10 Power database with the year 2014 as reference. The model aggregates the World into eleven regions. Sectors are also limited to eleven for a tractable and acceptable computation time. The* ***EU27+UK*** *are described by a single region, while the* ***EU ETS*** *market and the emissions integrated in the* ***Effort Sharing Regulation (ESR)*** *are detailed. More information on GEMINI-E3 can be found at the I2AM PARIS platform (link).*

We then integrated the "**Fit for 55"** package and incorporated a **net zero emissions** target in 2050 by adjusting the abatement target in precedent years. This new stringent policy resulted in a higher EU ETS price, reaching €127 in 2040. Significant leakage was found (at 17% for CO_2 and 12.1% for all GHG emissions).

*'**Carbon leakage**' refers to the transfer of activities to countries with laxer environmental/climate regulations.*

*There are three categories—or scopes—of calculating emissions contents in the CBAM. Carbon contents could be based on **direct emissions** from fuel combustion within the sector boundary (**Scope 1**), **direct emissions plus the CO_2 content of electricity** consumed by the sector or indirect emissions associated with energy use (**Scope 2**), or **direct emissions and any indirect production-related emissions** including all the CO_2 content of intermediate consumption by the sector (**Scope 3**).*

The scenario then introduced the CBAM as an import tariff to EIIs and electricity generation, based on the CO_2 content that includes **only direct emissions** (Scope 1). In this case, CO_2 leakage would decrease by approximately one-third, from **17% to 12.6% in 2040**, and the EU would **avoid a €90 billion output loss** in the EII sectors. Extending the CO_2 basis of CBAM to **include direct emissions and electricity used** (Scope 2) was found more effective in reducing leakage and output loss of EU EIIs: **the leakage rate would decline almost by a half (to 9.6%)** in 2040 (**Figure 1**), with a **more significant output loss avoided (€173 billion)** in the EII sector (**Figure 2**).



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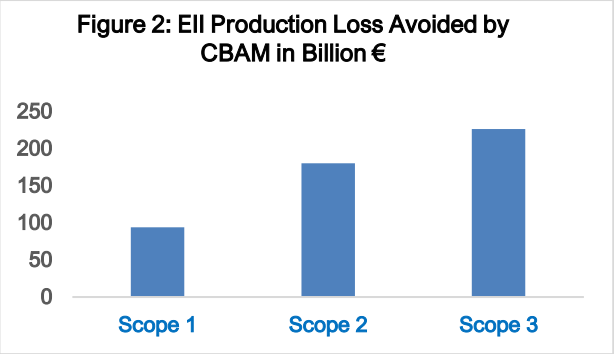

A further extension **to include indirect emissions** (Scope 3) was found not to provide substantial changes in leakage rate and avoided output loss (at 8.2% and €218 billion, respectively), instead creating more complexities and pointing to limited gains in an implementation of the EU CBAM including indirect emissions contents.

Focusing on least developed countries

Complementary measures to reduce the cost of CBAM implementation for least developed countries

We analysed eight complementary measures that cover options to exempt and to reallocate CBAM revenues to LDCs:

1. Exemption: Assuming that CBAM is not implemented on imports coming from LDCs (similar policy as the Generalised Scheme of Preferences (GSP) and GSP+).

An alternative includes rebating revenues from CBAM to LDCs through lump-sum transfer unconditionally to the use of the money. We analyse two options:

2. Per capita redistribution of all revenues to LDCs.

3. You Get What You Contribute: Limiting the transfer based on export contributions of LDCs

This scheme is likely more realistic, as it aligns with the proposal of ''most revenues generated by CBAM will go towards the EU budget''. All following measures follow this principle.

4. Money received on LDCs' exports is used to increase saving and induce additional investment without targeting any sector, technology, or economic agent.

5. Revenue is redirected to LDCs increase investment in the EIIs and stimulate additional investment and improve substitution of energy by more capital goods.

6. Revenue is invested in non-EII industry for diversifying the industries of LDCs.

7. Revenue is used to subsidy renewable electricity (i.e., solar and wind) in LDCs.

8. Revenue is used to increase household energy efficiency, by assigning it to LDCs' households to reduce fuel poverty by financing electric appliances.

The implementation of the EU CBAM tool could hurt LDCs, causing declines in their EIIs and leading to significant economic cost (€36 billion for Scope 1—i.e., for direct emissions contents only), negatively impacting LDCs and reducing their opportunities for export-led development. Thus, considering supplementary measures is critical and could produce fairer options than to expect LDCs to carry the same mitigation burden as developed countries by common but differentiated responsibilities.

EU imports from LDCs: Here, we define LDCs as recognised under the UNDP Human Development Index (HDI)—i.e., with an HDI value *of* below 0.8 in 2020: India, the rest of Asia, specific countries in Africa, and Central and South America. While the EU's EEI imports are still dominated by developed countries, up to US$16 billion of LDCs' exports to the EU could face an additional charge to the new CBAM levy. Some countries are highly exposed, as their share of EII-related export relative to total goods export to the EU is over 20%. Mozambique ranks at the top of this list, with more than 56%; it is followed by Zambia (47%), Tajikistan (28%), Armenia (24%), and Kyrgyzstan (21%).

For these reasons, we conducted further analysis based on the development of eight

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different CBAM scenarios with exemptions and revenue redistributions on targeted regions. Such analysis is critical for the political acceptability of the EU's CBAM to be potentially integrated into its future re-design. For robustness and consistency with the initial public consultation (European Commission, 2021) and the proposal of the European Parliament (2022) the complementary analysis was conducted based on imposing CBAM with direct emissions contents (under Scope 1). Results are compared to our previous scenario of climate policy with CBAM.

First, we analysed the impacts of LDC exemptions in the mechanism, on the basis that, should the exemption fully offset the cost of the CBAM for LDCs, it could create a significant advantage over developed countries, resulting in welfare improvement. ***Exemption was found to benefit LDCs by €32.4 billion, but the impact on leakage was critical (a rate of 15.6%—i.e., higher than the 12.6% found in the reference CBAM scenario).***

We then developed complementary measures based on rebating revenues principles. At first, all revenues collected from the CBAM was designed to be redistributed to LDCs per capita (regions with larger population get a higher share). This financial transfer would improve the LDCs' economies by €35.4 billion with leakage lower by 6 MtCO2 than the reference CBAM scenario. But when revenue was distributed based on LDCs' exports contribution ('You Get What You Contribute'), benefits would be more moderate compared to the per-capita rule, meaning that the leakage would be slightly reduced, with a small economic cost for the EU. Further complementary scenarios were developed using this approach. Among five extended distributive measures based on the 'You Get What You Contribute' principle, involving subsidising renewable electricity and financing electric appliances, showed a very positive effect on leakage reduction (see Figure 3).

If the revenues were returned and used to subsidise renewable electricity in LDCs, global emissions would be reduced by 79 $MtCO_2$, with the leakage rate also cut by 7.6%. The increase in renewable power would reduce CO_2 emissions from coal and gas power plants, while the effects on economics costs for EIIs' output would be comparable to the 'You Get What You Contribute' case. Likewise, returning revenues in the form of financing household efficient appliances was found equally impactful on leakage, yet with more significant economic benefit for LDCs, benefitting up to 107 million homes and saving 26 TWh of electricity (around −0.8% of electricity consumed by households) in 2040. This would have strong implications for the economy of LDCs by generating an increase of €35 billion and reducing their CO_2 emissions by 90 $MtCO_2$; the cumulative impacts of replacing equipment between 2020 to 2040 would be reflected in efficiency of final energy: the leakage rate would be reduced to 4.9% and electricity used in LDCs would be down by 209 TWh by 2040.

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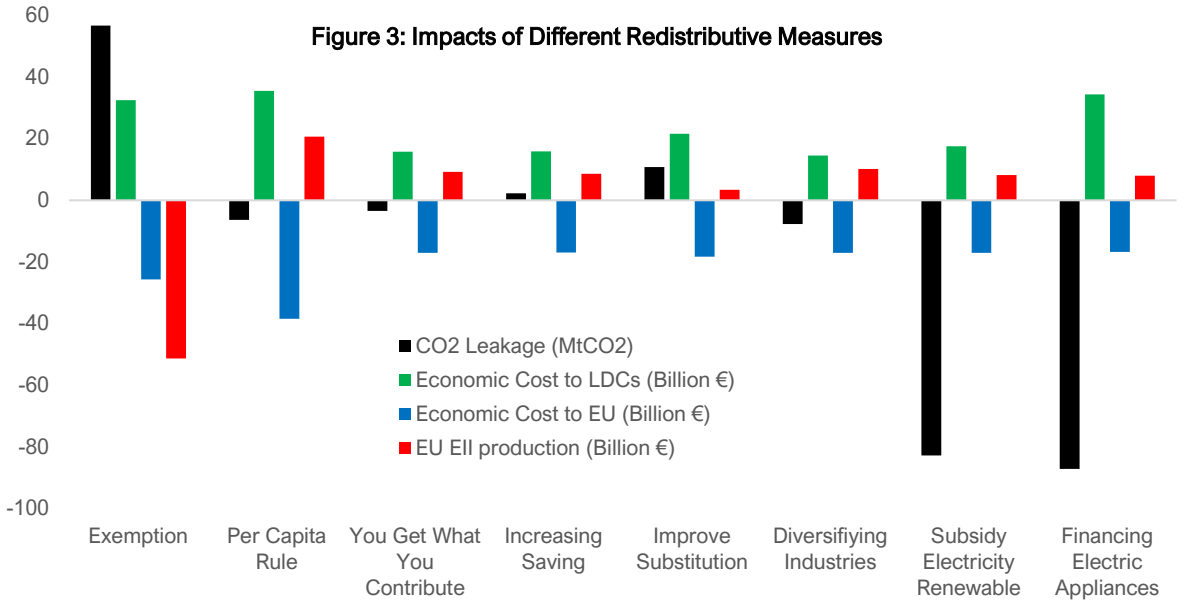

Figure 3: Impacts of Different Redistributive Measures

Policy takeaways

Assessing the implications of the new 'Fit for 55' package proposed by the European Commission and the introduction of the CBAM tool confirms that implementing the new mechanism limits loss of competitiveness and leakage. Leakage would be cut by one-third, if CBAM was imposed based on direct emissions contents (Scope 1) and almost by half if imposed to direct emissions and electricity used (Scope 2), although adding indirect emissions (Scope 3) would not provide significant gains while adding complexities and making the implementation more challenging.

On the other hand, CBAM implementation could prove detrimental to some developing countries: without complementary measures, CBAM could lead to significant losses for some countries. This raises questions of acceptability and highlights the importance of considering CBAM as part of a broader, more comprehensive policy package. If an exemption were prohibited, measures such as investments in renewable energy or energy efficiency in households could offer win-win solutions, by improving climate and welfare in least-developed countries that export their energy-intensively produced goods, at a limited cost for the EU.

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References

Eicke, L., Weko, S., Apergi, M., & Marian, A. (2021). Pulling up the carbon ladder? Decarbonization, dependence, and third-country risks from the European carbon border adjustment mechanism. *Energy Research & Social Science*, *80*, 102240.

Evans, S., Mehling, M. A., Ritz, R. A., & Sammon, P. (2021). Border carbon adjustments and industrial competitiveness in a European Green Deal. *Climate Policy*, 21(3), 307-317.

European Commission. (2021). Summary report: Public consultation on the carbon border adjustment mechanism (CBAM). URL https://ec.europa.eu/info/law/betterregulation/have-your-say/initiatives/12228-EU-Green-Deal-carbon-borderadjustment- mechanism-/public-consultation_en.

European Parliament. (2022). EU carbon border adjustment mechanism: Implications for climate and competitiveness. URL: https://www.europarl.europa.eu/RegData/etudes/BRIE/2022/698889/EPRS_BRI(2022)698889_EN.pdf

Giarola, S., Mittal, S., Vielle, M., Perdana, S., Campagnolo, L., Delpiazzo, E., ... & van de Ven, D. J. (2021). Challenges in the harmonisation of global integrated assessment models: A comprehensive methodology to reduce model response heterogeneity. *Science of the Total Environment*, *783*, 146861.

Holzer, K. (2014). *Carbon-related border adjustment and WTO law*. Edward Elgar Publishing.

Mehling, M. A., & Ritz, R. A. (2020). *Going beyond default intensities in an EU carbon border adjustment mechanism* (No. EPRG2026).

Perdana, S., & Vielle, M. (2022). Making the EU Carbon Border Adjustment Mechanism acceptable and climate friendly for least developed countries. *Energy Policy*, *170*, 113245.

Sognnaes, I., Gambhir, A., van de Ven, D. J., Nikas, A., Anger-Kraavi, A., Bui, H., ... & Peters, G. P. (2021). A multi-model analysis of long-term emissions and warming implications of current mitigation efforts. *Nature Climate Change*, *11*(12), 1055-1062.

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The project in a nutshell

PARIS REINFORCE developed a novel, demand-driven, IAM-oriented assessment framework for effectively supporting the design and assessment of climate policies in the European Union as well as in other major emitters and selected less emitting countries, in respect to the Paris Agreement. By engaging policymakers and scientists/modellers, PARIS REINFORCE created the open-access and transparent data exchange platform I²AM PARIS, in order to support the effective implementation of Nationally Determined Contributions (NDCs), the preparation of future action pledges, the development of 2050 decarbonisation strategies, and the reinforcement of the 2023 Global Stocktake. Finally, PARIS REINFORCE introduced innovative integrative processes, in which IAMs were further coupled with well-established methodological frameworks, to improve the robustness of modelling outcomes against different types of uncertainties.

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