

Readme File for Replication Package for  
**Trade and the Climate Emergency: Policy Priorities for  
Developing Countries**

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## Data Source

The data used in this paper is sourced from numerous literatures, which are publicly available. Emission intensity data is commercially available. GVC exposure indicator is confidential. The details are as follows:

- CBAM Exposure Index:
  - o Exports at 6 digit HS code employed for calculating the index are obtained from the World Bank's World Integrated Trade Solution, <https://wits.worldbank.org/WITS/WITS/Restricted/Login.aspx>. We use mirror data in 2019 to mitigate data inconsistency from the reporting countries. The trade of countries can be reconstructed on the basis of data reported by partner countries. The data obtained in this way is called mirror data. The list of CBAM-related products at HS 6-digit level is provided in the Annex 1 of the EU CBAM legislation, <https://data.consilium.europa.eu/doc/document/PE-7-2023-INIT/en/pdf>. Following this practice, we use iron and steel, aluminum, cement, fertilizer and electricity.
  - o Carbon emissions intensity are collected from Chepeliev and Corong (2022) and Chepeliev et al. (2022). We use the carbon emission intensity from both Scope 1 (direct emissions from production) for iron and steel and aluminum, and Scope 2 (indirect emissions produced from electricity generation) for cement, fertilizer and electricity.
- Renewable: exports at 6 digit HS code employed for calculating renewable products are collected from the World Bank's World Integrated Trade Solution and Rosenow and Mealy (2024). We use mirror data in 2022 to mitigate data inconsistency from the reporting countries.
- EV: exports at 6 digit HS code employed for calculating renewable products are collected from the World Bank's World Integrated Trade Solution. We use mirror data in 2022 to mitigate data inconsistency from the reporting countries.
- Critical minerals: exports at 6 digit HS code employed for calculating critical minerals are collected from the World Bank's World Integrated Trade Solution. We use mirror data in 2022 to mitigate data inconsistency from the reporting countries.
- EUDR: exports at 6 digit HS code employed for calculating EUDR affecte products are collected from the World Bank's World Integrated Trade Solution. We use mirror data in 2022 to mitigate data inconsistency from the reporting countries.
- GHG and CO2 emission intensity: export, greenhouse gas and carbon emission intensity are collected from Chepeliev and Corong (2022) and Chepeliev et al. (2022).
- GVC exposure indicator: Constructed using methodology from Baldwin, Freeman and Theodorakopoulos, (2023) and the commercially available data from EORA.

The complete list of papers, including author, publication years, and corresponding values, is available in Excel and the Appendix of the paper.

In excel files below, tab color in yellow indicates raw data. Tab color in red indicates confidential raw data that is not allowed to redistribute.

## Evolution of the number of preferential trade agreements with environmental-related provisions (Figure 6):

This chart is drawn from Espitia et al (forthcoming). This paper is not published, yet.

## CBAM (Figure 7a and 7b)

Raw data: emission intensity is from Chepeliev and Corong (2022) and Chepeliev et al. (2022). This data is shared by authors of paper with the team. Exports of CBAM affected products is from World Bank's WITS.

*TC2\_CBAM exposure index.xlsx* comprises three sheets: emission intensity, export, EU, calculation, and chart. *The Emission Intensity sheet* illustrates carbon emissions of each CBAM products in scope 1 and 2, which serves to calculate potential embodied carbon payment at USD 100 per CO<sub>2</sub> ton.

*The Export sheet* displays exports of each CBAM products to EU and world in 2019, which produces EU share in exports of CBAM affected products to world. The unit of value is USD 1000.

*The EU sheet* provides calculation of EU average potential carbon payment of each CBAM products, which is used to calculate trade weighted average relative potential carbon payments and aggregate relative CBAM exposure index. The unit of value is USD 1000.

*The Calculation sheet* contains a comprehensive list of values gathered from various sources, with the final variable such as CBAM exposure index and relative CBAM exposure index in scope 1 and 2.

For a given sector, CBAM exposure index is measured as the mathematical product of two main elements:

The share of a country's exports of the CBAM related product to the EU is calculated as follows:  $X_{cs}^{EU} / X_{cs}^{World}$ , where  $X$  denotes exports and  $c$  and  $s$  represent the country and the sector, respectively.

The potential embodied carbon payment per dollar of CBAM product exports to the EU is based on the emissions intensity of production ( $EI_{cs}$  for country  $c$  and sector  $s$ ) at an assumed carbon emissions price of \$100/ton CO<sub>2</sub>e. The unit of emission intensity is kilogram of CO<sub>2</sub> per dollar of export. It is divided into scope 1 and 2.

The **aggregate CBAM exposure index** results from multiplying the exports of all covered sectors of the products to EU by the sum of the total embodied carbon payments (the assumed carbon price USD100/ton multiplied by the exporter's emission intensity of all covered sectors of the product), divided by the sum of the country's total value of exports of CBAM products to the world. The index is disaggregated into scope 1 and 2.

$$\text{Aggregate CBAM exposure index} = \frac{\sum_{s \in \text{CBAM}} X_{cs}^{EU} \cdot EI_{cs} \cdot \$100 \text{ per ton}}{\sum_{s \in \text{CBAM}} X_{cs}^{World}}$$

The **aggregate relative CBAM exposure index** calculates the sum of the total excess embodied carbon payments (the assumed price times the sum across all covered sectors of the product of exports to the EU multiplied by the difference between their own emissions intensity and the EU average intensity), divided by the sum of the country's total value of exports of CBAM products to the world. The index is disaggregated into scope 1 and 2.

$$\text{Aggregate relative CBAM exposure index} = \frac{\sum_{s \in \text{CBAM}} X_{CS}^{EU} \cdot (EI_{CS} - EI_{EU_s}) \cdot \$100 \text{ per ton}}{\sum_{s \in \text{CBAM}} X_{CS}^{World}}$$

The **relative CBAM exposure index** is measured by multiplying the same export share by the difference between the exporter's emissions intensity and the EU average emissions intensity for the CBAM product, scaled by the assumed CBAM price (\$100 per ton).

*The figure 7a sheet* provides the visualization of both aggregate CBAM exposure index in absolute and relative term and scope 1 and 2, selecting top 20 countries by aggregate CBAM exposure index (drawn from the Columns AU-AX in the *Calculation sheet*). In this visualization, EU members, EFTA countries (Switzerland and Norway), and countries with less than USD 1 million exports of CBAM products to EU are excluded.

*The figure 7b sheet* provides the visualization of relative CBAM exposure index by products. For aluminum and iron and steel, the index is visualized with scope 1 and 2. For cement and fertilizer, the index is visualized with sum of scope 1 and 2. Top 10 countries are selected in each product except cement after excluding EU members, EFTA countries (Switzerland and Norway), and countries with less than USD 1 million exports of CBAM products to EU. For cement, top 5 and bottom 5 are selected.

*The country sheet* provides a list of country and ISO3 classified by region and income group defined by the World Bank's WITS.

*The HS code sheet* provides a list of HS codes of the EU CBAM products.

## Renewable (Figure 8)

*TC2\_Renewable.xlsx* comprises three sheets: list, exp, and chart. *The list sheet* illustrates 6 digit HS codes of solar and wind related components, which serves to collect export data (mirror data) from the World Bank WITS database. *The exp sheet* shows country's export to China, EU27, US and Rest of World in 2022. The unit of value is USD 1000. *The figure 8 sheet* displays top 10 countries with largest exports to three major markets, excluding high income countries, EU member states and China. The unit of value is converted into USD billion in the chart.

## EV (Figure 9)

*TC2\_EV.xlsx* comprises three sheets: exp, and chart. *The exp sheet* illustrate country's EV export to China, EU27, US and Rest of World in 2022. HS code 870380 was used to extract mirror data. The unit of value is USD 1000. *The figure 9 sheet* visualizes top 10 countries with the aggregate exports to three major markets, excluding high income countries, China and Mexico. The unit of value is converted into USD million in the chart.

## Critical minerals (Figure 10)

*TC2\_CM.xlsx* comprises three sheets: exp, chart and product list. *The exp sheet* illustrate country's critical mineral export to China, EU27, US and Rest of World in 2022. We extract mirror data from the

WITS. The unit of value is USD 1000. **The figure 10 sheet** visualizes top 20 countries with the aggregate exports to three major markets, excluding high income countries. The unit of value is converted into USD billion in the chart. The list sheet shows the HS codes identified as critical minerals.

### Chinese Belt and Road Initiative engagements in metals and mining (Figure 11)

This chart is drawn from Wang (2023), China Belt and Road Initiative (BRI) Investment Report 2023 H1. <https://greenfdc.org/china-belt-and-road-initiative-bri-investment-report-2023-h1/>

### EUDR (Figure 12)

**TC2\_EUDR.xlsx** comprises three sheets: exp, chart and product list. **The exp sheet** illustrate country's exports of EUDR products to EU and World in 2022. We extract mirror data from the WITS. The unit of value is USD 1000. **The figure 11 sheet** visualizes top 20 countries in the column 'share of EUDR products exports to the EU in total EUDR products exports to the world'. We exclude countries exporting less than USD 10 million. The list sheet shows the HS codes subject to the EUDR.

### Global Textile value chain exposure to the EU (Figure 13)

**GVC Exposure Indicator.do** provides calculation to group importers into the EU and non-EU group.

**GVC Exposure Indicator.dta** provides raw data of GVC exposure indicator in textile.

**TC2\_GVC Exposure Indicator\_textile.xlsx** comprises 3 sheets: gvc, country classification, and chart. **The gvc sheet** illustrate textile exporters' GVC exposure to EU market. This is a subset of GVC exposure indicator that was constructed by using EORA data and methodology (Baldwin, Freeman and Theodorakopoulos, 2023). The entire dataset is confidential. **The figure 13 sheet** visualizes top 20 countries whose textile GVC is highly exposed to the EU. We exclude high income countries.

### The intersection between CBAM exposure index and carbon pricing (Figure 14)

The map is a screenshot of Relative CBAM Exposure Index, deselecting the countries that have carbon pricing. The aggregate relative CBAM exposure index is found in the dashboard,

<https://www.worldbank.org/en/data/interactive/2023/06/15/relative-cbam-exposure-index#3>

**TC2\_price\_us.xlsx** provides a list of countries that have their carbon pricing mechanism.

### Impact on emissions of Simple Emission Intensity Improvement Scenario (Figure 15)

**TC2\_Emission Scenario.xlsx** comprises 2 sheets: raw and figure 15. **The raw sheet** displays all emission data by country. **The figure 15 sheet** displays the results of simulations on the emission changes by four income groups.

### GHG and CO2 emissions intensity (Figure 16)

**TC2\_GTAP Sectors Exports and Emissions.xlsx** comprises 9 sheets: Exports 2019, CO2 all scopes, N2O all scopes, Methane all scopes, Emissions CO2, Emissions N2O, Emissions Methane, Emissions All and chart.

The **Exports 2019 sheet** displays export values (USD1000) in 2019 by 120 countries and 45 sectors. The column EA shows the total exports of world by sector.

The **CO2 all scopes sheet** contains CO2 emission intensity (kg/USD) by sector and country.

The **N2O all scopes sheet** contains N2O emission intensity (kg/USD) by sector and country.

The **Methane all scopes sheet** contains Methane emission intensity (kg/USD) by sector and country.

The **Emissions CO2 sheet** contains calculations used to derive the trade-weighted global CO2 emission intensity. This is accomplished by multiplying the export values from the **Export 2019 sheet** by the CO2 emission intensities found in the **CO2 all scopes sheet**. We then divide the aggregate of these multiplied values across all countries by the total exports of all countries, resulting in the trade-weighted global CO2 emission intensity, which is detailed in column EC.

The **Emissions N2O** and **Emissions Methane sheets** both display the same calculation of the **Emissions CO2 sheet**.

The **Emissions All sheet** provides the methodology for calculating the trade-weighted global greenhouse gas (GHG) emissions intensity. We aggregate the multiplied values across all countries in **Emissions CO2, Emission N2O and Emissions Methane sheets**, and then divide it by the total exports of all countries, resulting in the trade-weighted global GHG emissions intensity. The final result of this calculation is displayed in column EC.

*The figure 13 sheet* displays the figure selecting top 10 most carbon and GHG intensive sectors globally.

### CGE simulation results (Figure 2,3,4)

*TC2\_CGE results.xlsx* comprises 5 sheets: *xp\_hic* (chart), *xp\_lmy*, *exp\_LMY* (chart), *exp\_HIC*, and *GVC\_electronics* (chart).

The **xp\_hic (chart) sheet** displays the results of CGE simulations on the output by sector for all high income countries. It also contains the chart that is based on this data, and the data from **xp\_lmy** sheet, which contains the CGE simulations results on the output by sector for all low and medium income countries.

The **exp\_LMY (chart) sheet** displays the results of CGE simulations on the exports by sector for all high income countries. It also contains the chart that is based on this data, and the data from **exp\_HIC** sheet, which contains the CGE simulations results on the exports by sector for all low and medium income countries.

The **GVC\_electronics (chart) sheet** displays the chart on the percentage change in GVC participation for selected countries in electronics sector.

All these results are also reported in the background paper by Chepeliev et. al (2024) available at <https://www.gtap.agecon.purdue.edu/uploads/resources/download/12384.pdf>

The simulations have been performed by the GTAP center. The spreadsheets with the results and charts are a part of consultant's deliverables. The access to the code for CGE requires subscription/ payment.

## Data Availability Statement for Trade and the Climate Emergency: Policy Priorities for Developing Countries

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Exports at HS 6-digit level are obtained from the World Bank's World Integrated Trade Solution, <https://wits.worldbank.org/WITS/WITS/Restricted/Login.aspx>.

The list of CBAM-related products at HS 6-digit level is provided in the Annex 1 of the EU CBAM legislation, <https://data.consilium.europa.eu/doc/document/PE-7-2023-INIT/en/pdf>.

The list of renewable energy components at HS 6-digit level is provided in the Appendix 3 of Rosenow and Mealy (2024). <https://documents1.worldbank.org/curated/en/099936402072438837/pdf/IDU127b390ef1155014bd91aea9110575d799ce6.pdf>

Emissions intensity data is collected from Chepeliev and Corong (2022) and Chepeliev et al. (2022). It is commercially available.

GVC exposure indicator has been constructed using methodology from Baldwin, Freeman and Theodorakopoulos, (2023) and the commercially available data from EORA. The indicator data is confidential.

CGE simulation results and methodology are documented in the background paper by Chepeliev et. al (2024) <https://www.gtap.agecon.purdue.edu/uploads/resources/download/12384.pdf>

## References

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World Bank World Integrated Trade Solution.  
<https://wits.worldbank.org/WITS/WITS/Restricted/Login.aspx>.