

Readme File for Replication Package for
Global Ripple Effects: Knock-on effects of EU, US, and China Climate Policies on Developing Countries' Trade¹

Enrique Aldaz-Carroll, Euijin Jung, Maryla Maliszewska, and Iryna Sikora

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.
- **GVC exposure indicator:** Arvis, Jean-Francois, Alvaro Raul Espitia Rueda, Jean Christophe Maur, Nadia Rocha and Daria Ulybina (forthcoming). GVCs Foreign Exposure and Vulnerability Heuristic Indicators was constructed using methodology from Baldwin, Freeman and Theodorakopoulos, 2023) and the commercially available data from EORA.
- **World Development Indicators [GDP \(current US\\$\)](#)**
- **Energy Transition Minerals (ETM)** was shared directly by the Africa team. The data used in the paper includes reserve information for six critical minerals essential for the energy transition: cobalt, copper, graphite, lithium, manganese, and nickel.
- **World Bank Country and Lending Groups.** Available [here](#).
- All other data (Environmental Goods Imports, Product Dashboard Data) are from the World Bank's World Integrated Trade Solution, using mirror data.

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Data description

The complete list of papers, including author, publication years, and corresponding values, is available in Excel. In excel files below, tab color in **yellow** indicates raw data. Tab color in **red** indicates confidential raw data that is not allowed to publish. We do not have an agreement with the WITS, so the package should be published without the raw data from the WITS.

Table 1 is created by authors.

Table 1 is created by authors based on references.

Figure 1 is drawn from Wang (2024).

Figure 2 is created by authors.

Instructions

The figures in this analysis are generated using a combination of Stata do-files and manual Excel manipulation. The following steps outline how each figure is produced:

1. Run the data for figures.do file:

This will generate the input data needed to manually create Figures 3, 7, 9, 10, 11, 12, and 13 in Excel.

2. Run the GVC.do file:

This will produce the input data required to manually create Figures 4, 6, and 8 in Excel.

3. Manually Created Figures and Tables:

The remaining figures and tables are created entirely through manual processes in Excel. Detailed instructions for these are provided below.

Note: The raw data required to run the Stata do-files is not included in the package due to licensing restrictions. Additional details on figure creation and data sources are provided in the sections below.

Figure 3, 7, 9, 10, 11, 12, and 13

Dashboard_rawdata.xlsx comprises 8 sheets: eudr (EUDR related products), battery (Battery), ff (fossil fuels), cm (critical minerals), ev (EV), ev comp (EV components), renewable (renewable products & components) and list. Each sheet provides raw data of products. **The list sheet** provides HS codes of fossil fuels, critical minerals, EV, EV components, battery, renewable products & components, and EUDR related products. **data for figures_v1.xlsx** comprises 8 sheets: eudr, battery, ff, cm, ev, ev comp, renewable and all. Each sheet provides data economic and sector indicator of top 10 countries by economic exposure. Sector exposure and economic exposure are 100 times export of products to three economies divided by exports of products to world and by GDP, respectively. **data for figures_final.xlsx** comprises 8 sheets: eudr, battery, ff, cm, ev, ev comp, renewable and all. Each sheet provides charts using sector and economic exposure. Sector exposure and economic exposure are 100 times export of products to three economies divided by exports of products to world and by GDP, respectively. The unit of value is percent in the chart. **data for figures.do file** provides the coding to calculate economic and sector exposure of countries in eudr, battery, ff, cm, ev, ev comp, renewable. **GDP.dta** provides GDP in latest available year (2021 and 2022). **ISO_Region_Income.dta** provides the latest Country ISO, region and income group classified by the World Bank in 2024.

Figure 4, 6 and 8

GVC Exposure Indicator.xlsx comprises four sheets: GVC, figure4_petroleum, figure7_metal and figure10_textile. **GVC sector sheet** illustrates GVC exposure to the EU – direct and indirect – in three sectors such as textile, petroleum and metal products. The **figure4_petroleum, figure6_metal and figure8_textile** display top 10 developing countries of Direct export to EU and Indirect export to EU. This is a subset of GVC exposure indicator by Arvis, Jean-Francois, Alvaro Raul Espitia Rueda, Jean Christophe Maur, Nadia Rocha and Daria Ulybina (forthcoming). “GVCs Foreign Exposure and Vulnerability Heuristic Indicators. They constructed GVC exposure indicator by using EORA data and methodology (Baldwin, Freeman and Theodorakopoulos, 2023). *GVC.do file* provides the coding to calculate GVC exposure to the EU directly and indirectly, using three dta files. *GVC.dta* provides a subset of raw data provide by Arvis et al. *ISO_Region_Income.dta* provides the latest Country ISO, region and income group classified by the World Bank in 2024. *Sec_des.dta* provides the sectoral description. When Arvis et al (forthcoming) is published, the data will be updated.

Figure 5

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 CO₂ 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 CO₂e. The unit of emission intensity is kilogram of CO₂ 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.

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

The fig5 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 HS code sheet provides a list of HS codes of the EU CBAM products.

Table 2 is drawn from Carrara et al. (2023).

Table 3.

CM reserve.xlsx comprises two sheets: raw and table4. *The raw sheet* illustrates country's mineral reserves as % of global mineral reserves. *The table4 sheet* provides top 10 countries with reserves in 6 critical minerals.

Figure 14.

EG imports from China.xlsx comprises three sheets: list, exp, and fig 16. *The list sheet* illustrates 6 digit HS codes of environmental goods, which serves to collect export data (mirror data) from the World Bank WITS database. *The exp sheet* illustrate country's environmental goods imports from China in 2022. The unit of value is USD 1000. *The fig14* visualizes top 10 countries with environmental goods imports from China by value. The unit of value is converted into USD billion in the chart.

Data Availability Statement for
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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 EV components, and renewable 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>

The list of EUDR related products at HS 6 digit level is provided in the Annex of the EU Deforestation Regulation legislation, <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32023R1115>

The list of battery products at HS 6 digit level is drawn from the draft list of critical supply chains prepared by the US International Trade Administration. <https://www.trade.gov/data-visualization/draft-list-critical-supply-chains> and Rosenow and Mealy (2024).

The list of critical mineral products at HS 6 digit level is drawn from the draft list of critical supply chains prepared by the US International Trade Administration. <https://www.trade.gov/data-visualization/draft-list-critical-supply-chains>

The list of critical minerals at HS 6 digit level is provided in "DRAFT LIST OF CRITICAL SUPPLY CHAINS ITA Federal Register Notice on Draft List of EO 14017 Critical Supply Chains", <https://www.trade.gov/data-visualization/draft-list-critical-supply-chains>

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 by ETIRI team using methodology from Baldwin, Freeman and Theodorakopoulos, (2023) and the commercially available data from EORA. The indicator data is confidential.

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