MEASURING EXPOSURE AND VULNERABILITY TO INTERNATIONAL TRADE SHOCKS REPLICATION PACKAGE

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Overview

The code in this replication package allows the computation of the indicators presented in Arvis et al. (2025). It contains four separate replication packages in four zip folders. Packages 1-2 and 4 can be run separately. For Package 3, data from Package 4 is needed (see instructions for detail).

- Packages 1 & 2: Direct and indirect exposure indicators using respectively OECD ICIO and EORA data (Section 2 of the paper)
  EORA GVC Indicators package
  ICIO GVC Indicators package

- Package 3: Exposure and vulnerability indicators at product level using CEPII BACI data (Sections 3.1 to 3.2.2 of the paper)
  Product exposure and vulnerability package 0925

- Package 4: Logistics vulnerability indicator (Section 3.2.3 of the paper)
  Supply Chain Complexity indicators package

- Code for the replication of the tables and figures presented in the paper (using the data generated by packages 1-4)
  Replication of tables and figures.do

Data Availability Statement & Provenance Statements

☐ This paper does not involve analysis of external data (i.e., no data are used or the only data are generated by the authors via simulation in their code).

Statement about Rights

☒ I certify that the author(s) of the manuscript have legitimate access to and permission to use the data used in this manuscript.

☐ I certify that the author(s) of the manuscript have documented permission to redistribute/publish the data contained within this replication package.

Summary of Availability

- ☐ All data are publicly available.

- ☒ Some data cannot be made publicly available (see last column of table below).

- ☐ No data can be made publicly available.

EORA data was purchased under license from KGM & Associates Pty Ltd.

Details on each Data Source

Data.Name	Data.Files	Location	Provided	Citation	Confidentiality
Eora	Eora26_1990_bp.zip to Eora26_2022_bp.zip	\EORA GVC Indicators package\data	FALSE	Lenzen et al. (2012) and Lenzen et al. (2013)	For licensed use only
OECD Inter-Country Input-Output tables	1995.csv to 2020.csv	\ICIO GVC Indicators package\data\ICIO_2023	FALSE	Yamano et al. (2023)	
BACI Version: 202501	BACI_HS17_Y2017_V202501.csv to BACI_HS17_Y2023_V202501.csv	\Product GVC Indicators package\Data\Raw\BACI_HS17_V202501\	TRUE	Gaulier and Zingano (2010)	
HS concordance tables	HS2017toHS2012ConversionAndCorrelationTables.xlsx	\Product GVC Indicators package\Data\Support	TRUE	WITS https://wits.worldbank.org/	
	Concordance_HS_to_H0.CSV				
	HS 2012 to HS 1992 Correlation and conversion tables (1).xls				
Value Chain list of codes	GreenValueChains\Mapping_HS6\new_GVC_dataset.dta	\Product exposure and vulnerability package.zip\Data\ValueChains	TRUE	Mealy and Rosenow (2024)	
	HS_GVC_ProductGroup.xlsx			Ferrantino and Schmidt (2018)	
	Semiconductors/List of Products SemiConductors.xlsx			OECD (2019)	
Liner shipping bilateral connectivity index, quarterly	us_lsbci_21181766005401.xlsx	sc_complexity\	TRUE	UNCTAD	
Travel time and distance	results Travel Time and geo distance.csv	sc_complexity\	FALSE	Mathematica, Wolfram	For licensed use only
Country codes	unctad codes.csv	sc_complexity\	TRUE	UNCTAD	
Country WB region mapping	WB_Country_Classification_FY_25.dta	\Product GVC Indicators package\Data\Support	TRUE	World Bank WDI	
Country codes for heuristic indicator	just heuristic countries.csv	sc_complexity\	TRUE		
International LPI	c2c minus myanmar (calcs).xlsx	sc_complexity\	TRUE	World Bank (2023)	

Listed below are details about data availability and use:

- Full Eora data for the years 1990-2022 was purchased under license from KGM & Associates Pty Ltd. Note that data for year 2023 is also available but was not purchased for this paper. Access to the data and description of the structure of the data is available here: https://worldmrio.com/eora/ (accessed 10 September 2024)
- ICIO data 2023 release for the years 1995-2020. Note that a more recent release of ICIO is now available. The data is publicly available from the OECD at: https://www.oecd.org/en/data/datasets/inter-country-input-output-tables.html (accessed 23 September 2024)

- CEPII BACI balanced trade dataset for the years 2017-2023 using HS17 classification is publicly available from CEPII under open license Etalab 2.0 at https://www.cepii.fr/CEPII/en/bdd_modele/bdd_modele_item.asp?id=37 (accessed 12 February 2025)
- Harmonized system concordance tables were obtained from World Bank WITS database https://wits.worldbank.org/ (accessed 24 September 2025).
- Semiconductor value chain list of products was extracted from https://www.oecd.org/content/dam/oecd/en/publications/reports/2019/12/measuring-distortions-in-international-markets-the-semiconductor-value-chain_bf9aafd6/8fe4491d-en.pdf Annex A (accessed 24 September 2025)
- Green value chain list of products was extracted from https://openknowledge.worldbank.org/server/api/core/bitstreams/ab61d67f-f13f-4b11-b85b-6bfca62fae9a/content Table A3 (accessed 24 September 2025)
- Archetypical GVCs Value chains (Apparel, Autos, Electronic, Footwear, and Textiles) extracted from Ferrantino and Schmidt (2018), available at (accessed 29 September 2025): https://wits.worldbank.org/data/public/HS_GVC_ProductGroup.xlsx
- World Bank country groupings https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups (accessed 24 September 2025)

- International LPI overall score for 2022. If not available for 2022, the simple average of scores of previous years (2007-2018) is used. Data can be accessed at: https://lpi.worldbank.org/international/global (accessed 24 September 2025)
- Liner shipping bilateral connectivity index, quarterly for Q1 2021. https://unctadstat.unctad.org/datacentre/reportInfo/US.LSBCI (accessed 24 September 2025)
- Travel time and distance estimates data were downloaded from Wolfram Mathematica https://www.wolfram.com/language/11/geo-computation/travel-time-and-distance.html (accessed 13 May 2025)

Computational requirements

Software Requirements

- Stata (code was last run with version 18). The master do file contain instructions for installing the additional Stata packages (gtools, ftools, moremata, iefieldkit) required to run the code.

- Python 3.11.4 (Environment: conda on Windows 11)

  Libraries needed (use conda-forge channel):

  - pandas 2.0.3
  - numpy 1.26.4
  - matplotlib 3.7.2
  - openpyxl 3.1.2
  - IPython 8.14.0
  - ipykernel 6.25.1
  - jupyter_client 8.3.0
  - jupyter_core 5.3.1
  - jupyter_server 2.14.1
  - jupyterlab 4.3.4
  - nbclient 0.8.0
  - nbconvert 7.7.4
  - nbformat 5.9.2
  - notebook 7.3.2
  - qtconsole 5.4.3
  - traitlets 5.9.0

Memory, Runtime, Storage Requirements

Summary

Approximate time needed to reproduce the analyses:

- ☒ 2-8 hours

Approximate storage space needed:

- ☒ 2 GB - 25 GB

Details

The code was last run on an Intel(R) Xeon(R) Platinum 8462Y+ @2.80 GHz with 32 GB RAM with 64-bit Windows 2022 Server edition.

Description of programs/code

The replication package is divided into 4 distinct packages:

1. "EORA GVC Indicators package"

2. "ICIO GVC Indicators package"

3. "Product GVC Indicators package"

4. "Supply Chain Complexity Indicator package"

Packages 1-3 are replicated using Stata18. Package 4 is replicated using Python. Please note that package 4 is needed to run package 3.

Package 1 will replicate the direct and indirect exposure indicators FPEX, FPEX direct, FPEX indirect, FPEM, FPEM direct and FPEM indirect using EORA data.

Package 2 will replicate the direct and indirect exposure indicators FPEX, FPEX direct, FPEX indirect, FPEM, FPEM direct and FPEM indirect using OECD ICIO data.

Package 3 will replicate the exposure and vulnerability indicators at product level: revealed comparative advantage index, revealed comparative dependency index, imports relative to exports, import concentration index, export concentration index, import growth volatility, export growth volatility, and product level logistics complexity indicator (see Instructions below).

Package 4 will replicate the logistics complexity index indicator at the bilateral country level. Package 4 should be run before running package 3.

Instructions to Replicators

For detailed instructions, please refer to the file readme.txt for each package.

Unzip the files in the desired working directory

If needed pre-install the required packages indicated in the readme.txt or comments in the code.

Please make sure that Stata do files in the Code folder are run in correct order.

Package 1 & 2

[0.0] master.do – installs necessary Stata packages and sets working directories and runs [1.0] data.do and [2.0] indicators.do command files.

[1.0] data.do – uploads EORA or ICIO data and prepares dataset for the computation of indicators. In the case of EORA data, it also computes a balanced EORA dataset.

[2.0] indicators.do – computes exposure indicators.

Package 3

If not already available: run package 4 and copy "sc complexity output - bilateral weighted averages (REDUCED).csv" in Data/Raw folder

[0.0] master.do – sets the working file directory paths, uploads the source data and runs the do files [1.0] to [4.0].

Note: A cleaned BACI dataset is included in the package "Product exposure and vulnerability package 0925/Data/Clean/BACII_HS17_Bilateral.dta". If using a different BACI dataset, please remove the comment before line 41 in the code to execute "2_Data_Cleaning_Trade_Data.do"

[1.0] programs.do – calculates the dependency, market concentration and supply chain complexity indicators at the product level

[2.0] concordances.do – loads the harmonized system concordance tables needed for the consolidation of data in [3.0]

[3.0] data_preparation_heuristic_indicators_GVC_exposure.do – consolidates datasets trade, market structure, reliability, and supply chain complexity indicators.

[4.0] data_consolidation_GVC exposure.do - consolidates and classifies products into value chain groupings (Green Technologies, Archetypal GVCs, Semiconductors, and HS Section groupings) for the GVC exposure analysis.

Package 4

bilateral sc complexity.ipynb – master code with detailed comments in Jupyter notebook file:

bilateral sc complexity.pdf – copy of the master code and output in pdf readable format

bilateral sc complexity.html – copy of the master code and output in html readable format

List of tables and programs

The provided code reproduces:

- ☐ All numbers provided in text in the paper

- ☒ All tables and figures in the paper

- ☐ Selected tables and figures in the paper, as explained and justified below.

You will find below the name of the code that can be run separately to produce the tables and the charts included in the paper.

Figure Table #	Program	Output file	Note
Table 1	"Replication of tables and Figures.do"	Table 1_exposure_tables.xlsx	Run Package 1 if file "indicators_c_csgroup_1990 _2022.dta" not available
Table 2	"Replication of tables and Figures.do"	Table 2_exposure_tables.xlsx	Run Package 1 if file "indicators_ csgroup_c_1990_2022.dta" not available
Figure 2	"Replication of tables and Figures.do"	Figures 2-6.xlsx, sheet Figure_2	Run Package 3 if file "GVC_Exposure_Indicators.d ta" not available
Figure 3	"Replication of tables and Figures.do"	Figures 2-6.xlsx, sheet Figure_3	Run Package 3 if file "GVC_Exposure_Indicators.d ta" not available

Figure 4	"Replication of tables and Figures.do"	Figures 2-6.xlsx, sheet Figure_4	Run Package 3 if file "GVC_Exposure_Indicators.dta" not available
Figure 5	"Replication of tables and Figures.do"	Figures 2-6.xlsx, sheet Figure_5	Run Package 3 if file "GVC_Exposure_Indicators.dta" not available
Figure 6	"Replication of tables and Figures.do"	Figures 2-6.xlsx, sheet Figure_6	Run Package 1 if file "indicators_c_csgroup_1990_2022.dta" not available

References

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