

README

Artuc and Ortega (2026)

"International Trade Policy and Quantitative Models: A Practitioner's Guide"

World Bank Policy Research Working Paper Series

Overview:

This replication package consists of the code to run the example models in the paper, the code to process data, the code to produce figure/tables, and the processed data.

The model solution scripts and required processed data are located in the “**model_code**” folder. The scripts are provided in Python, Julia, Matlab and R. To solve the simple model, use one of the “**EK_Simple.py**”, “**EK_Simple.jl**”, “**EK_Simple.m**”, or “**EK_Simple.R**” scripts. To solve the extended model, use one of the “**AO_Extended.py**”, “**AO_Extended.jl**”, “**AO_Extended.m**”, or “**AO_Extended.R**” scripts. You can also run the extended model using our online tool “**Trade Policy Simulator: Tariffs**” from a web browser. The web based tool is available at: <https://www.worldbank.org/en/data/interactive/2025/12/15/trade-simulator-tariffs>

Please follow the instructions below to replicate the figures and tables of the paper. The whole replication process should take less than 15 minutes in most cases. Processed data from 2022 to quantify the model is already provided, you can skip the data processing steps if you wish.

Folder Structure and Files:

- **model_code** (folder): Main codes and processed data are here. Use the scripts here to study the example models in the paper and their solution codes. Most users will only need the files in this folder.
 - AO_Extended.py → Code for the extended model [Python]
 - AO_Extended.jl → Code for the extended model [Julia]
 - AO_Extended.m → Code for the extended model [Matlab]
 - AO_Extended.R → Code for the extended model [R]
 - EK_Simple.py → Code for the textbook model [Python]
 - EK_Simple.jl → Code for the textbook model [Julia]
 - EK_Simple.m → Code for the textbook model [Matlab]
 - EK_Simple.R → Code for the textbook model [R]
 - data_tiva25_tar.mat → Data for extended model generated by the scripts below. **You need this data to quantify the extended model.** You can either use the data file we provide, or generate following the instructions below.
 - data_tiva25_simplest_ek.mat → Data for simple model generated by the scripts below. **You need this data to quantify the textbook model.** You can either use the data file we provide, or generate following the instructions below.
 - TIVA25_Sectors_Aggregated.csv → List of sectors for reference
 - TIVA25_Countries.csv → List of countries for reference
 - results_ae.csv → Results for AO generated by scripts above
 - results_ea.csv → Results for EK generated by scripts above

- **data_processing** (folder): Data processing files are here.
 - data_extract1.jl → Run this first in Julia
 - data_extract2.py → Run this second first in Python
 - data_extract3.m → Run this third in Matlab for simple model data above
 - data_extract4.m → Run this fourth in Matlab for extended model data above
 - data1_intermediate_trade.mat → intermediate data produced by data_extract1.jl
 - data2_intermediate_tariffs.mat → intermediate data produced by data_extract2.py
 - Other files used in various stages: concord.txt, countries_81.txt, country_names_81.txt, sectors_50.txt, sector_names_50.txt, high.txt
- **figures_tables** (folder): The scripts to generate figures and tables.
 - Exhibits.py → Run this in Python to generate figures and tables
 - Various files for figures and tables will appear in this folder
- **data_raw** (folder): Please copy and paste raw data in here, the expected files are “2022_SML.csv” from ICIO-TIVA 2025 edition, and “tariff_tiva25_2022.dta” from Constantinescu (2025). “R1_Nomenclature.do” and “R1_Aggregations.do” collapse her main data into the “tariff_tiva25_2022.dta”. See below for details.

Data Availability Statement:

1. Inter-Country Input-Output tables (ICIO)

Source: OECD

Year: 2025

URL: <https://www.oecd.org/en/data/datasets/inter-country-input-output-tables.html>

Access Date (Month-Year): March 2026

Note: There are two versions of ICIO: regular ICIO and extended ICIO. We use 2025 edition (January 2026 update of regular ICIO). For this analysis we use latest year available: 2022.

Access Type: Accessible

Citation: OECD. 2025. "Inter-Country Input-Output tables (ICIO)". OECD TiVA database. [dataset]. <https://www.oecd.org/en/data/datasets/inter-country-input-output-tables.html>. Accessed March 2026.

2. Processing Raw Tariffs into Comparable Tariff Indicators: A Methodological Note

Source: World Bank

Year: 2025

URL: N/A

Access Date (Month-Year): November 2025

Note: The data comes from UNCTAD TRAINS (via WITS) and cover 199 countries. They include MFN and applied tariffs at the HS 6-digit level, with both ad valorem and specific rates. The raw data is available in WITS. We collapsed the master data by running “data_raw/R1_Nomenclature.do” and “data_raw/R2_Aggregations.do” in Stata.

Access Type: Full data accessible for WB staff on a server with permission from the author (Cristina Constantinescu). The author kindly allowed us to publicly distribute a collapsed version covering 2022 (“data_raw/tariff_tiva25_2022.dta”).

Citation: Constantinescu. 2025. "Processing Raw Tariffs into Comparable Tariff Indicators: A Methodological Note" Mimeo: World Bank [dataset]. Accessed November 2025

Statement about Rights:

We certify that the authors of the manuscript have legitimate access to and permission to use the data used in this manuscript.

Instructions for Replicators:

Run the following scripts in the exactly given order, and the results will appear in the “figure_tables” folder. Please change the working directory as needed.

1. Change the working directory to “data_processing” then run “data_extract1.jl” in Julia [takes less than 5 minutes, see known bugs below if you get an error] → Expects the input file “data_raw/2022_SML.csv” from OECD-ICIO Regular 2025 edition. January 2026 Update. Download this file from their website (<https://www.oecd.org/en/data/datasets/inter-country-input-output-tables.html>).
2. Keep the working directory as “data_processing” and run “data_extract2.py” in Python [takes less than 1 minute] → Expects the input file “data_raw/tariff_tiva25_2022.dta” from Constantinescu 2025. This file is already included in the replication package.
3. Keep the working directory as “data_processing” and run “data_extract3.m” in Matlab [takes less than 1 minute]
4. Keep working directory as “data_processing” and run “data_extract4.m” in Matlab [takes less than 1 minute]
4. Change the working directory to “model_code” then run “AO_Extended.x” in Python, Julia, Matlab or R (whichever you prefer, where x is the extension for the chosen language). You just need to run just one of them, they will give identical results subject to some minor precision loss. If you decide to use R, remember to change the line with working directory to the current path. [takes less than 10 minutes in R, and less than 3 minutes in others]
5. Change the working directory to “figures_tables” then run “Exhibits.py” in Python and outputs will appear in the same folder [takes less than 2 minutes]

Known Bugs:

With Julia, if you get a file permission error (either when processing the data or when solving the model) and if you are running the script in a cloud-synced folder, please try running it from a local folder instead.

You can use the freely available GNU Octave instead of Matlab, as they are highly compatible. But they are not 100%, so you might need to make small changes in the code.

List of Exhibits

Exhibit Name	Output file name	Source
Figure 1: Top and Bottom Performers Analysis	01_top_bottom_performers.png	Exhibits.py
Figure 2: Real GDP vs.	02_gdp_vs_income_by_level.png	Exhibits.py

Disposable Income by Income Level		
Figure 3: Distributions of Economic Impacts	03_distributions.png	Exhibits.py
Figure 4: Distribution of Disposable Income Changes by Region	04_violin_income_by_region.png	Exhibits.py
Figure 5: Distribution of GDP Changes by Region	05_violin_gdp_by_region.png	Exhibits.py
Table 1: Results for High Income Countries	latex_high_income_table.tex	Exhibits.py
Table 2: Results for Non- High Income Countries	latex_non_high_income_table.tex	Exhibits.py

Software Requirements

Any software below to solve the model (tested on the versions indicated):

- Matlab 2025b with Optimization Toolbox
- Python 3.13.1 with Numpy, SciPy, Pandas, matplotlib and xarray
- Julia 1.11.8 with MAT, LinearAlgebra, DataFrames, DelimitedFiles, CSV and Printf
- R 4.3.3 with R.matlab

To replicate the results in the paper and process the data, you will need Julia, Matlab and Python (all three). You will need only one of the above just to solve the model, if you don't wish to process the data.