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# The short-run impact of US tariffs on an interconnected world

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# The short-run impact of US tariffs on an interconnected world*

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**Abstract**

We quantify the short-run impact of U.S. tariffs with a 77-country, 11-sector input–output model calibrated to OECD's ICIOs. All intermediate inputs are locked in fixed Leontief proportions, so relative prices—not quantities—absorb the shock. A uniform 10% duty trims world GDP by 0.73% and U.S. GDP by 0.83%; ratcheting the schedule to 25% on NAFTA, to 15% on EU partners, and to 145% on China deepens those losses to 3.38% and 3.78%, respectively. Global trade flows in value, measured as exports plus imports over GDP, drop by 4.60% on average, but the U.S. is the biggest loser as its trade flows drop by -2.40% with a uniform duty, but drops can be as large as -11.60%.

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# 1 Introduction

The World is experiencing a new wave of protectionism, initiated by the United States in 2018 during President Trump's first term, following disputes over China's alleged trade dumping and currency manipulation. This protectionist shift has intensified and broadened since the beginning of his non-consecutive second term, reaching levels not seen since the Smoot-Hawley Tariff Act of 1930. This paper aims to quantify the short-run effects of tariffs on real GDP in international dollars[1], and global trade flows in a world that is more interconnected than ever before, where retooling production lines is costly and time-consuming.

To this end, we develop a static computable general equilibrium model (CGE) of the global economy, comprising 76 countries and 11 sectors. The model is calibrated using Inter-Country Input-Output tables curated by the Organization for Economic Co-operation and Development (OECD). In our calibration, we abstract from differences in factor intensities across sectors and countries, as well as from variation in capital-to-labor ratios. We assume perfect complementarity between intermediate goods. These simplifications allow us to isolate the short-run, first-order effects of tariffs on real quantities—specifically, GDP, and trade flow intensity.

Given that the United States accounted for 25% of the World's GDP in 2019, its tariff policies have significant global effects that are worth examining in isolation to understand their magnitude before any retaliation, which yields a sort of upper-bound to the effect of tariffs on GDP and trade openness. Our assumption of a world with one bully also delivers a stark message to the American public. Even with no retaliation, the US economy suffers considerably more than most countries, including China, Canada, and Mexico.

[1] We use the methodology of Geary (1958) and Khamis (1972) to compute purchasing power parities, and a brief description is included in Appendix 6.

We model five such scenarios. In all the scenarios, we are assuming that there is no retaliation. In the first one, the US imposes a 10% tariff on all goods from all countries. Then, it raises tariffs to 25%, targeting NAFTA partners, and China, and imposes a 15% tariff on the European Union that will be held fixed across the next scenarios. In the remaining three, the U.S. increases tariffs on Chinese goods to 54%, 125%, and 145%, respectively. These rates reflect tariffs that have either been agreed, enacted, or publicly proposed by the U.S. administration, and provide ready-to-use estimates of the short-run impacts of tariffs on GDP and global trade flows over GDP in a tightly interconnected world.

A uniform 10% tariff reduces the World's GDP in international dollars by 0.73%. The losses are broadly distributed around the World, but the U.S. suffers a bigger GDP loss, measured in international dollars, of 0.83%, whereas Canada suffers losses of 0.67%, China 0.64%, Mexico 0.45%, and the average EU country suffers losses of 0.72%, with little variance. France loses 0.70%, Germany and Portugal 0.72%, and Spain loses 0.74% of its GDP, measured in international dollars. Everybody shares similar losses because fixed input-output linkages propagate price distortions well beyond the initially targeted bilateral trade flows.

Escalation to the extreme 145% tariff schedule significantly deepens the contraction: GDP falls by 3.38%, with the U.S. losing 3.78%, Canada 3.14%, China 2.93%, Mexico 2.40%, and the European Union 3.38%. The geographical dispersion of trade costs in terms of international GDP increases across their members, which highlights how rigid global supply chains amplify tariffs into first-order real shocks.

Global trade flows drop by 0.33% in the baseline 10% tariff only. Even in the worst case scenario, the trade openness index for the World, including the US, drops by 1.46%. These small, short-run drops in trade openness across scenarios hide a considerable redistribution across countries, where the U.S. turns out to be the biggest loser. In the baseline scenario, it loses 2.40% of trade flows, but ratcheting the schedule to 25% on NAFTA, to 15% on EU partners, and to 145% on China, increases the loss to 11.60%.

The emptiness left by the U.S. as a trade actor is partially filled by other countries that reroute trade value through the network. In particular, Mexico increases its trade flows by 2.84% in the baseline scenario, up to 7.80% if the U.S. imposed a 145% tariff on China. Therefore, Mexico absorbs two-thirds of the trade volume that the U.S. relinquishes, constituting one of the biggest shots to the foot of a country in recent economic history. The EU index barely changes, showing the resilience of a sub-network that is a trade and monetary union.

These results position our paper at the intersection of several strands of the trade literature. Early work in CGE models already showed that even a narrow tariff wedge reverberates through the whole economy: Johansen (1960) calibrated a multi-sector model for Norway, Harberger (1962) traced incidence across factors, and the applied CGE wave that followed—exemplified by Shoven and Whalley (1984) and the GTAP synthesis of Hertel (1997)—quantified the Kennedy- and Tokyo-round reforms. Historical episodes were dissected in the same spirit: Magee and Young (1987) revisited Smoot–Hawley in an Armington CGE, while Eichengreen and Irwin (2010) mapped the 1930's beggar-thy-neighbor spiral.

Mitchener et al. (2022) constructs a monthly bilateral trade panel to study how retaliatory behavior impacted U.S. imports during the Smoot-Hawley war. Another strand revisits tariff incidence using scanner-level evidence, which shows near-unit pass-through into landed costs as in Amiti et al. (2019) or Cavallo et al. (2021), that use pricing information at the border, or (Bown and Kolb, 2023) that explore how firms use third-country detours (Bown and Kolb, 2023) to reduce tax incidence.

A new generation of Armington and Ricardian CGEs with flexible sourcing finds far smaller welfare losses once suppliers can be re-optimized—Fajgelbaum et al. (2020) and Caliendo and Parro (2015, 2021) cut U.S. losses to well under one-half of one percent—yet their equilibrium is explicitly long-run. We find larger upper bounds when we assume that countries and industries, are densely interconnected, which has been explored by yet another strand of the trade literature.

This network-based strand restores short-run rigidity: non-parametric formulas in Baqaee and Farhi (2020), or Baqaee and Farhi (2024), predict higher-order spillovers that plant-level data confirm as in (Atalay, 2017; Carvalho et al., 2021). Pandemic and prospective trade-war simulations by Bonadio et al. (2021) and Almazán-Gómez et al. (2025) reveal losses of an order of magnitude once input–output links are fixed.

Evidence on the network origins of business cycle asymmetries (Miranda-Pinto et al., 2023) and game-theoretic work on optimal retaliation (Fajgelbaum and Khandelwal, 2021) further motivate our dense bilateral IO framework with zero substitution, which provides an operational *upper bound* for the short-run cost of tariffs in terms of GDP, and complements the lower-bound estimates from elastic-sourcing models.

Taken together, our paper incorporates recent findings from trade literature and points to three insights: tariffs of even 10% have first-order real effects when contracts are rigid. Escalation multiplies GDP losses, although marginal damage tapers once critical links snap. Trade balances redistribute immediately, not without a net loss, but with a redistribution of the value of trade to countries that the US had in the spotlight. The remainder of the paper details the data, the model, the calibration, and the policy implications of these findings.

## 2 Data

Measuring the short-run effect of tariffs requires detailed information on transactions of goods and services across sectors and countries, including destinations. Inter-country input-output databases (ICIOs) serve that purpose. Still, only the OECD's ICIO contains information for the most significant number of countries in 2019, right before the pandemic, but capturing the beginning of the trade dispute between China and the United States. We use the 2023 edition, a release that records bilateral flows of intermediate and final goods for 45 industries across 76 sovereign economies, plus a residual "Rest of the World" aggregate.

In its raw form, the matrix contains more than 150k non-zero cells. The sheer granularity would sink the numerical simulations of our model through near collinearity. Thus, we aggregate the data into 11 sectors that are listed in Appendix A so that it preserves the cross-country-sector fabric, while respecting the pragmatic limits of a static computable general equilibrium model.

After aggregation, each national block of the matrix spans 11 rows of inputs and 11 columns of outputs, while the global Leontief inverse—the object we ultimately feed to the model—bloats to $836 \times 836$ once all bilateral permutations are enumerated, which makes it still tractable. Every entry in ICIO is denominated in billions of current US dollars, which will allow us to compute magnitudes in international US dollars within the model.

**A** $2 \times 2$ **example**. To illustrate how we deal with 77 countries and 11 sectors, we shrink the economy into the U.S. and the rest of the World, and we collapse sectors into manufacturing and services. The US represents 25% of the worlds GDP in nominal $ US, and it is the instigator of this unfolding trade war, so it makes sense to track these two blocks to explain the structure of ICIO and national accounts, and the statistical imputations that need to done to make both congruent.

Table 1: A $2 \times 2$ illustration.

| | | RoW | | US | | RoW | | | US | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MAN | SER | MAN | SER | C | I | $C_x$ | C | I | $C_x$ |
| RoW | MAN | 213.2 | 94.6 | 4.2 | 3.0 | 96.6 | 39.5 | 0.0 | 5.1 | 2.9 | 0.1 |
| | SER | 86.0 | 215.1 | 1.0 | 2.7 | 299.9 | 112.6 | 0.0 | 2.3 | 1.1 | 0.4 |
| US | MAN | 3.1 | 1.3 | 15.9 | 10.6 | 1.7 | 1.2 | 0.0 | 16.7 | 7.9 | 0.0 |
| | SER | 2.0 | 3.7 | 13.5 | 85.6 | 2.4 | 1.1 | 0.6 | 123.3 | 30.1 | 0.0 |
| T | | 8.2 | 11.7 | 0.7 | 1.4 | 21.5 | 7.4 | 0.0 | 4.1 | 0.8 | 0.0 |
| K | | 48.9 | 131.6 | 7.7 | 53.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| L | | 97.8 | 263.1 | 15.5 | 106.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

Note: We aggregate the economy into a two country: the US and The World, and two sectors: manufacturing, into which we drop agriculture, and services. This way we can easily explain the imputations that need to be done to homogenize input-output information, from that of national accounts. Nevertheless, it is only a useful illustration of our more complicated $77 \times 11$ model.

Table 1 contains information on intermediate use across countries and industries, final destination of goods, taxes, capital income, and labor income. The first upper left quadrant is the cross-intermediate use matrix, which will turn into the Leontief matrix in the calibration. Letting $x_{ij}^{cc'}$ denote the monetary flow from sector $i$ in country $c'$ to sector $j$ in country $c$, the ICIO provides

$$y_{cj} = \sum_{c',i} x_{ij}^{cc'} + T_{cj} + VAB_{cj},$$

so that dividing each intermediate entry by $y_{cj}$ yields the Leontief coefficient $a_{ij}^{cc'}$. Once intermediate consumption is subtracted from output, we have $GDP$, which has to be equal to taxes on products net of subsidies $T$, capital income $K$ net of depreciation, and labor income $L$.

The upper right quadrant of Table 1 captures the expenditure side of value added, produces the coefficients $a_{fj}^{cc'}$ and $a_{Ij}^{cc'}$ that will allow us to characterize parameters in a household's utility problem. Conceptually, we interpret these ratios as short-run contracts: they are locked in until physical retooling or renegotiation takes place. A version of this table for Canada, China, the European Union, Mexico, the U.S., and the Rest of the World is spliced in tables 9 and 10 in Appendix A.

Table 2: Imports and Exports % National Accounts

Imports and Exports

| | RW | USA |
|---|---|---|
| M (intermediate inputs) | 10.16 | 10.90 |
| X (intermediate inputs) | 10.90 | 10.16 |
| X (final demand) | 11.93 | 6.92 |
| M (final demand) | 6.92 | 11.93 |
| X total | 22.83 | 17.08 |
| M total | 17.08 | 22.83 |
| XN | 5.75 | -5.75 |

National Accounts

| | RW | USA |
|---|---|---|
| Consump. | 422.07 | 151.44 |
| Consump. abroad | 0.65 | 0.53 |
| Investment | 161.71 | 42.84 |
| GDP | 590.18 | 189.06 |

**Reconciling national accounts.** While the ICIO embeds capital formation and changes in inventories in its final-demand block, those series occasionally diverge from the System of National Accounts when statistical agencies revise investment upstream. We smooth the mismatch by proportionally scaling each country's investment column so that $C + I + G + XN$ matches GDP, where $XN$ is the net-export vector derived from the bilateral matrix. In the United States, the adjustment is less than 0.3 percent of baseline GDP, whereas in Singapore—an archetypal entrepot economy—it reaches 1.7 percent. These adjustments are also needed so we can take the data to the model that we present in the next section.

# 3 Model economy

There are $C$ countries in the world. Each country $c$ has $J$ sectors that produce local varieties of goods that are traded globally. These goods are bought by all industries across all countries that are integrated into the global value chain, and by importers that combine local and foreign varieties into investment and final consumption goods. This section describes the basic features of the model and its equilibrium and relegates algebraic details to Appendix A.

**Sectoral technology**. We assume that there is a price-taking representative firm in each country that produces $y_{cj}$ using a combination of varieties $x_{ij}^{cc'}$ from different sectors and countries, capital $k_{cj}$, and labor $l_{cj}$ with the technologies:

$$y_{cj} = \min \left\{ \left( \frac{x_{ij}^{cc'}}{a_{ij}^{cc'}} \right)_{(c',i) \in C \times J}, \beta_{cj} k_{cj}^{\alpha_{cj}} l_{cj}^{1-\alpha_{cj}} \right\}$$

We assume that sector good producers use intermediate goods in fixed combinations, given by the inverse coefficients of the Leontief matrix $a_{ij}^{cc'}$. The combination of capital and labor generates part of the value added through a Cobb-Douglas technology with a country-specific sectoral productivity $\beta_{cj}$.

These firms minimize the costs of renting capital and labor from the representative household and purchasing intermediate goods from different sectors around the world, at international prices $p_j$ for $j \in J$. Intermediate goods from abroad $c' \neq c$ must pay a product and country-specific tariff $\tau_{cc'}^{j}$. These firms pay a production tax $t_{cj}$ net of subsidies, and operate under free entry. We demonstrate that this zero-profit condition enables us to establish an equilibrium relationship between local prices $p_{cj}$ and international prices $p_j$.

$$(1+t_{cj})p_{cj} = \frac{1}{\beta_{cj}}\left[\left(\frac{r_c}{\alpha_{cj}}\right)^{\alpha_j}\left(\frac{w_c}{1-\alpha_{cj}}\right)^{1-\alpha_{cj}}\right] + \sum_{i=1}^{J} p_i \sum_{c'=1}^{C}(1+\tau_{cc'}^{i})a_{ij}^{cc'}$$

which is a matrix equation with an analytic solution as a function of country-specific unit production costs.

**Final demand assemblers**. We assume that two firms operate a technology that combines the same variety from different countries to produce a final consumption good $u = f$

$$y_{uj}^{c} = \min\left\{\left(\frac{x_{uj}^{cc'}}{a_{uj}^{cc'}}\right)_{(c',j)\in C\times J}\right\}$$

or an investment good $u = I$, also in fixed combination with intensity given by the inverse coefficients of the input-output matrix for final demand $a_{uj}^{cc'}$ for $u \in \{f, I\}$. These firms are also price takers, operate under free entry, and must pay tariffs for imported goods.

They sell a final variety of goods $j$ to the representative household at price $p_{fj}^{c}$, and an investment composite at price $p_{cI}$. We show that their zero-profit conditions allow us to write prices for the final consumption of good $j$ as:

$$p_{fj}^{c} = p_j \sum_{c'=1}^{C}(1+\tau_{cc'}^{j})a_{fj}^{cc'}$$

and the final price of the investment good as

$$p_{cI} = \sum_{j=1}^{J} p_j \sum_{c'=1}^{C}(1+\tau_{cc'}^{j})a_{Ij}^{cc'}$$

**Representative households**. These final consumption $d_{cj}$ goods for $j \in J$ and investment goods $d_{cI}$ are valued by consumers around the world with country-specific utility:

$$U_c = \sum_{j=1}^{J} \theta_{cj} \log(d_{fj}^c) + \theta_{cI} \log(d_{cI})$$

These consumers maximize utility subject to a budget constraint.

$$\sum_{j=1}^{J} p_{fj}^c (1 + \tau_{fj}^j) d_{cj} + p_{cI} d_{cI} = w_c \bar{l}_c + r_c \bar{k}_c + T_c$$

where $\tau_{fj}^j$ are value-added taxes. These consumers receive the proceeds from the collection of government taxes $T_c$.

**Government**. The final important element in our model is a country-specific government that collects value-added taxes $\tau_{fj}^c$, production taxes $t_{cj}$, and tariffs $\tau_{cc'}^j$ such that budget balances:

$$T_c = \tau_{cf} p_{cf} d_{cf} + \sum_{j=1}^{J} \left[ p_{cj} t_{cj} y_{cj} + \sum_{c'=1}^{C} \sum_{i=1}^{J} p_i \tau_{cc'}^i x_{ij}^{cc'} \right]$$

These proceeds $T_c$ are rebated in lump sum to the representative consumer in each country. Therefore, three forces shape the equilibrium in our model: technological/contractual fixed trade relationships, tastes over consumption and investment goods, and trade policy that interact in a competitive general equilibrium, as we allow all markets to clear.

The world product markets are clear for all $j \in J$:

$$\sum_{c=1}^{C} y_{cj} = \sum_{c=1}^{C} \sum_{c'=1}^{C} \left( x_{fj}^{cc'} + x_{Ij}^{cc'} + \sum_{i=1}^{J} x_{ij}^{cc'} \right)$$

as well as local capital $\sum_{j=1}^{J} k_{cj} = \bar{k}_c$ and labor markets $\sum_{j=1}^{J} l_{cj} = \bar{l}_c$. The final product markets are also cleared, as the local supply of the final products $d_{cj} = y_{fj}^c = \sum_{c'=1}^{C} x_{fj}^{cc'}$ and $d_{cI} = y_{cI} = \sum_{c'=1}^{C} \sum_{j=1}^{J} x_{Ij}^{cc'}$.

This is a large nonlinear problem of $2 \times J \times C + 2 \times C + J$ equations and unknowns; for 77 countries and 11 sectors, it turns into 1859 equations and unknowns. We describe the algorithmic solution in the Appendix A.

# 4 Calibration

Following Kehoe and Kehoe (1995), we calibrate the model so that, in equilibrium, the agents' transactions in the model reproduce the baseline inter-country Input-Output tables (ICIO) for 11 industries and 76 countries. Our calibration pins down every parameter so that the model reproduces the 2019 benchmark economy exactly. Here we present a $2 \times 2$ example that we were using for illustrative purposes.

Table 3: Calibrated coefficients

| | | Technical $a_{ij}$ | | | | Utility $\theta$ | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | RoW | | USA | | RoW | | | USA | | |
| | | MAN | SER | MAN | SER | $C$ | $I$ | $C_x$ | $C$ | $I$ | $C_x$ |
| RoW | MAN | 46.42 | 13.12 | 7.17 | 1.14 | 17.25 | 7.27 | 0.00 | 2.78 | 1.36 | 0.03 |
| | SER | 18.73 | 29.83 | 1.69 | 1.05 | 53.53 | 20.70 | 0.00 | 1.24 | 0.52 | 0.25 |
| USA | MAN | 0.68 | 0.18 | 27.18 | 4.05 | 0.30 | 0.21 | 0.01 | 9.08 | 3.70 | 0.00 |
| | SER | 0.44 | 0.52 | 23.02 | 32.64 | 0.43 | 0.20 | 0.10 | 67.00 | 14.03 | 0.00 |
| Taxes $\tau$ | | 1.20 | 0.50 | 1.80 | 1.60 | 2.70 | 2.10 | 7.60 | 5.10 | 4.40 | 6.20 |
| Productivity $\beta$ | | 4.76 | 3.12 | 5.92 | 3.45 | | | | | | |

Table 3 presents a reduced version of the calibration inputs that we need for the 77 countries and 11 sectors in our model: the input-output coefficients, including those for final destination that are informative of utility weights, technological parameters, and taxes.

We begin with the technical coefficients of the Leontief matrix $a_{ij}^{cc'}$. Each dollar flow in the upper-left block of Table 1 is divided by the gross output of its destination sector.

For instance

$$a^{\text{US}\leftarrow\text{RoW}}_{\text{SER}\leftarrow\text{MAN}} = \frac{x^{\text{US}\leftarrow\text{RoW}}_{\text{SER}\leftarrow\text{MAN}}}{y_{\text{US,SER}}} = .0114$$

Similarly, we need to select the final demand shares of columns headed $C$, $I$, and $C_x$ normalized by their respective totals to give the consumption and investment coefficients that enter the household utility function $\theta$. With prices normalized to one, utility weights follow directly from observed expenditures. Such as the appetite in the U.S. for their own services.

$$\theta^{US}_{US,SER} = 123.3/189.1 = 0.67$$

We assume that capital shares $\alpha_{cj}$ are constant across sectors and countries and set to a third, which is a common value in the macro literature. We also assume that the endowment of capital relative to labor is the same across countries. This way we focus on the real effect of the price transmission of tariffs, instead of effects that arise in the presence of differential factor intensities and endowments, contained in the classical and seminal work of Heckscher (1919), Ohlin (1933), Stolper and Samuelson (1941) or Rybczynski (1955).

Sectoral productivity across countries $\beta_{cj}$ is obtained using standard growth accounting techniques, given $\alpha_{cj} = .33$, so that:

$$\beta_{cj} = \frac{y_{cj}}{k_{cj}^{\alpha_{cj}} l_{cj}^{1-\alpha_{cj}}}$$

Finally, we use row $T_{cj}$ of Table 9 over output $y_{cj}$ to compute tax rates on products $\tau_{cj} = T_{cj}/y_{cj}$. Endowed with these parameters we can simulate our model to study several U.S. trade policies that we undertake in the next section.

# 5 Results

We simulate the effect of five different unilateral trade policies on GDP in international dollars and trade flows, measured by the ratio of nominal imports plus exports to nominal GDP. In the baseline scenario (I), the U.S. sets a 10% tariff on every country and good. Next (II), the U.S. differentially raises tariffs to 25% on Canada, China, and Mexico, and imposes a 15% tariff to the European Union, that is held constant for the rest of the cases. In scenario (III) the U.S. imposes a 54% tariff to China, followed by an increase to (IV) 125% and (V) 145%. There is no retaliation as we want an upper bound of the cost of U.S. tariffs to the rest of the World, and to itself.

**The effect of U.S. tariffs on GDP growth**. Most papers that quantify U.S. tariff shocks work with real GDP in national prices or chain-weighted constant U.S. dollars, not international dollars. We can use the model to transform production in nominal US dollars into endogenously defined international prices, using the methodology described in (Geary, 1958) and (Khamis, 1972) to study how U.S. tariffs are transmitted through international prices to the rest of the world.

This twist seems to matter for policy decisions. Estimates from Yale's Budget Lab set $100 billion as the yearly costs of Trump tariffs in 2024, or 0.3% of their GDP. Our simulations in the mildest scenario set the costs of tariffs to 0.83%, almost three times the level found in the Yale study, and in large CGE and Armington models such as Fajgelbaum et al. (2020), or the GTAP updates.

Table 4 illustrates that the U.S. 0.83% drop in the mildest scenario is larger than the World's average loss, and certainly bigger than its targets in this trade war: NAFTA and EU partners, and China. They suffer smaller declines on the order of 0.45 to 0.67%. These fairly even losses reflect the fixed Leontief production structure, without scope for input substitution, a tariff-induced price wedge in any bilateral trade flow propagates downstream and across borders.

Table 4: GDP growth (%)

| | (I) | (II) | (III) | (IV) | (V) |
|---|---|---|---|---|---|
| USA | -0.83 | -1.48 | -1.99 | -3.35 | -3.78 |
| China | -0.64 | -1.14 | -1.53 | -2.59 | -2.93 |
| Mexico | -0.45 | -0.85 | -1.18 | -2.10 | -2.40 |
| Canada | -0.67 | -1.21 | -1.63 | -2.78 | -3.14 |
| United Kingdom | -0.75 | -1.35 | -1.82 | -3.10 | -3.51 |
| European Union | -0.72 | -1.30 | -1.76 | -3.00 | -3.38 |
| Spain | -0.74 | -1.34 | -1.80 | -3.06 | -3.46 |
| Germany | -0.72 | -1.30 | -1.75 | -2.98 | -3.36 |
| France | -0.70 | -1.27 | -1.71 | -2.92 | -3.31 |
| Italy | -0.75 | -1.35 | -1.82 | -3.10 | -3.50 |
| Portugal | -0.72 | -1.30 | -1.77 | -3.04 | -3.44 |
| World | -0.73 | -1.31 | -1.76 | -2.99 | -3.38 |

**Note:** Each entry reports the percentage change in GDP in international dollars relative to a no-tariff baseline in 2019. All scenarios are unilateral U.S. import duties with no foreign retaliation. All tariffs are homogeneous across the board. (I) applies a uniform 10% tariff to all countries. (II) from (I) raises tariffs to 25% on Canada, Mexico, and 15% to the EU. (III)–(V) retain the structure of (II) while escalating the rate on Chinese goods to 54%, 125%, and 145%, respectively. EU countries are listed in Table 8 in the Appendix. Groups of countries are weighted by their relative size in nominal GDP in $US.

GDP losses in international dollars are fairly similar across European countries. France loses 0.70%, Germany (0.72%), Italy (0.75%), Portugal (0.72%), and Spain (0.74%), below the self inflicted harm that the U.S. imposes upon itself, but above the costs experienced by its NAFTA partners or China.

Table 5: Change in openness

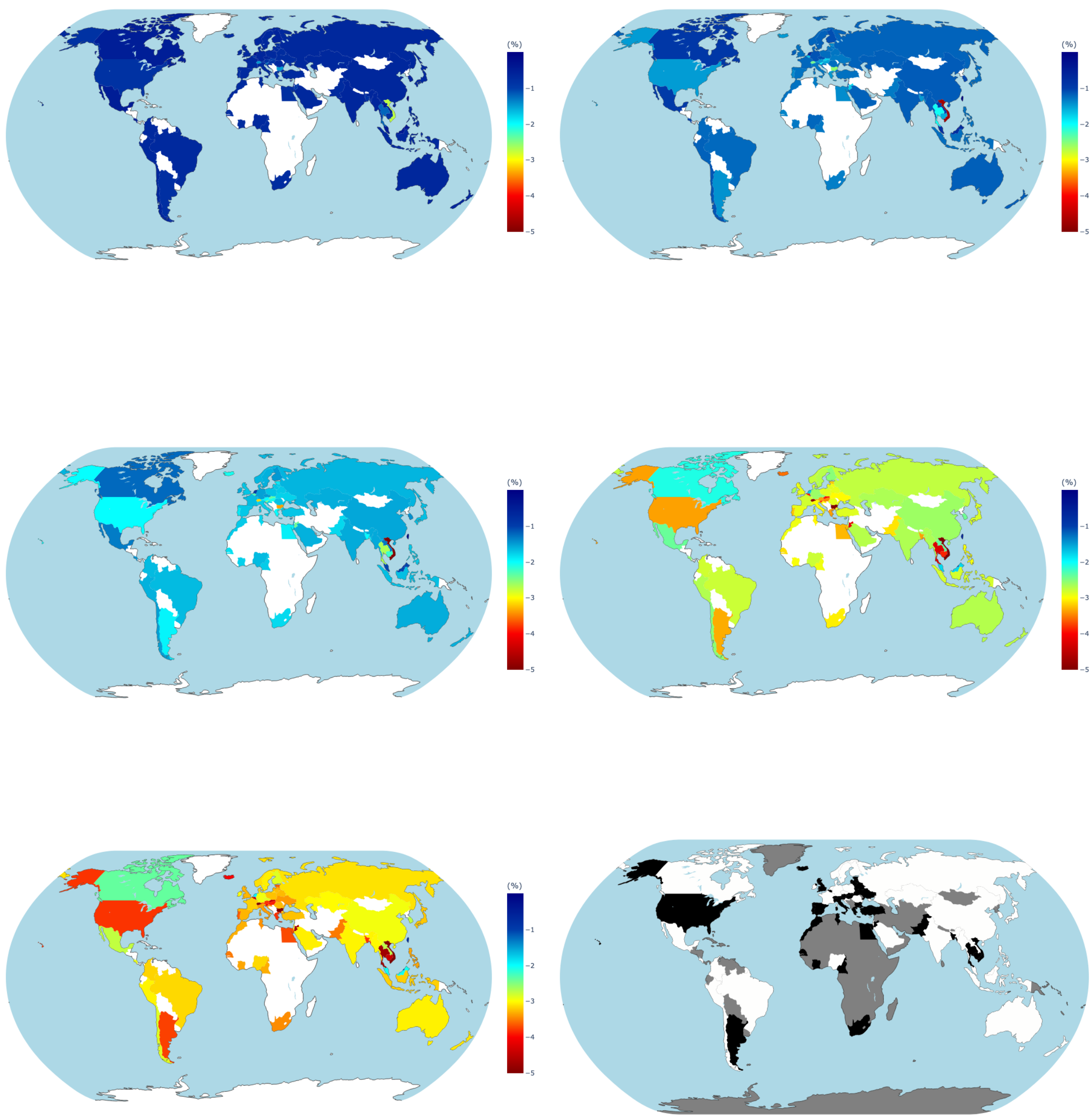
| | (I) | (II) | (III) | (IV) | (V) |
|---|---|---|---|---|---|
| USA | -2.40 | -4.36 | -5.93 | -10.23 | -11.60 |
| China | -0.08 | -0.14 | -0.20 | -0.35 | -0.40 |
| Mexico | 2.84 | 4.37 | 5.36 | 7.33 | 7.80 |
| Canada | -0.06 | -0.13 | -0.22 | -0.53 | -0.65 |
| United Kingdom | -0.05 | -0.09 | -0.12 | -0.19 | -0.21 |
| European Union | -0.03 | -0.04 | -0.05 | -0.04 | -0.04 |
| Spain | 0.04 | 0.07 | 0.09 | 0.14 | 0.16 |
| Germany | 0.04 | 0.06 | 0.08 | 0.12 | 0.13 |
| France | 0.07 | 0.12 | 0.17 | 0.29 | 0.33 |
| Italy | 0.09 | 0.16 | 0.22 | 0.38 | 0.43 |
| Portugal | -0.03 | -0.06 | -0.09 | -0.18 | -0.20 |
| World | -0.33 | -0.58 | -0.78 | -1.30 | -1.46 |

**Note:** Each entry reports the percentage change in a trade openness index, defined as exports plus imports over GDP, all in nominal terms, relative to a no-tariff baseline in 2019. All scenarios are unilateral U.S. import duties with no foreign retaliation. All tariffs are homogeneous across the board. (I) applies a uniform 10% tariff to all countries. (II) from (I) raises tariffs to 25% on Canada, Mexico, and 15% to the EU. (III)–(V) retain the structure of (II) while escalating the rate on Chinese goods to 54%, 125%, and 145%, respectively. EU countries are listed in Table 8 in the Appendix.

Escalation to scenario V paints a much starker picture. Here, the U.S. maintains its 10% general duty, but imposes a 25% tariff on Canada and Mexico, 15% on European countries, and imposes a tariff of 145% on China. In such a case, the World's GDP falls by 3.38%, more than four times the baseline loss. The U.S. now forfeits 3.78% of GDP, a considerably bigger fall than China 2.83%, Mexico 2.40%, or Canada 3.14%. This geographical fanning out of GDP losses in international dollars is displayed in Figure 1. As tariff raises for Canada, the European Union, Mexico, and particularly for China, color heterogeneity increases.

Fajgelbaum et al. (2020) and Caliendo and Parro (2015) find that the first Trump-era

Figure 1: The geographical fanning out effect of tariffs on GDP growth



**Notes:** Figure 1 shows the percent change of GDP in international dollars for each of the five U.S. tariff schedules analyzed in Section 5. Panels are shown in scenario order through rows. All panels use a diverging color scale centered at zero and symmetrically truncated at ±4% to sharpen visual contrast: warmer (red) colors indicate larger output declines, cooler (blue/green) colors indicate smaller losses or gains. The bottom-right panel recasts the same data into a categorical overlay: countries whose contraction exceeds the world-weighted mean appear in **black**; those whose contraction is smaller than the mean in **white**; economies not covered by the OECD ICIO remain in **gray**.

tariffs shaved at most 0.4% off U.S. real income, barely half the 0.82% percent contraction we measure under a uniform 15% percent tariff. The gap widens dramatically under escalation: our extreme scenario of a 3.78% U.S. GDP loss is almost four times larger than the 1 percent upper bound those elastic-sourcing models typically report, although previous works don't compute GDP in international dollars, which lay closer to a measure of welfare change.

Non-linear amplification is equally striking. Our four- to five-fold jump in global GDP losses between the baseline and the 145% China tariff mirrors the convex responses predicted by the network formulae of Baqaee and Farhi (2020, 2024). Their analytical wedges imply that once a critical edge in the production graph is severed, the marginal damage of additional wedges decays—a pattern that Table 4 confirms and that Figure 1 visualizes for its spatial dispersion.

Micro-data studies of tariff incidence offer a complementary lens. Near-unit pass-through at the border in Amiti et al. (2019) or Cavallo et al. (2021), and firm-level detours via third countries (Bown and Kolb, 2023) suggest that price wedges materialize quickly, yet firms start rerouting within months. Our short-run framework captures the immediate price shock but locks in intermediate inputs, thereby fixing an upper bound on the first-year welfare hit. In this sense, the 3.38% global GDP decline under the harshest schedule should be interpreted as a worst-case snapshot before strategic sourcing or capacity investment can unfold.

**The effect of U.S. tariffs on trade openness**. Table 5 shows the effect of the different scenarios of U.S. trade policy on the ratio of exports plus imports over GDP, which is a textbook measure of trade openness. It has the advantage that it is a very intuitive measure of trade disengagement, which has been overlooked in previous studies.

Bleaney and Tian (2023) point that trade openness is sensitive to geographical factors, unrelated to trade policies, and exchange rate swings. Whereas we can not change geography, its natural limitation is contained in the fixed IO coefficients in the short run. Given that we use international dollars in our model, our measure of trade openness is thus neutral to exchange rate swings. With that in mind, we can ask how far the U.S. tariff wall pushes economies toward autarky, or makes them trade more.

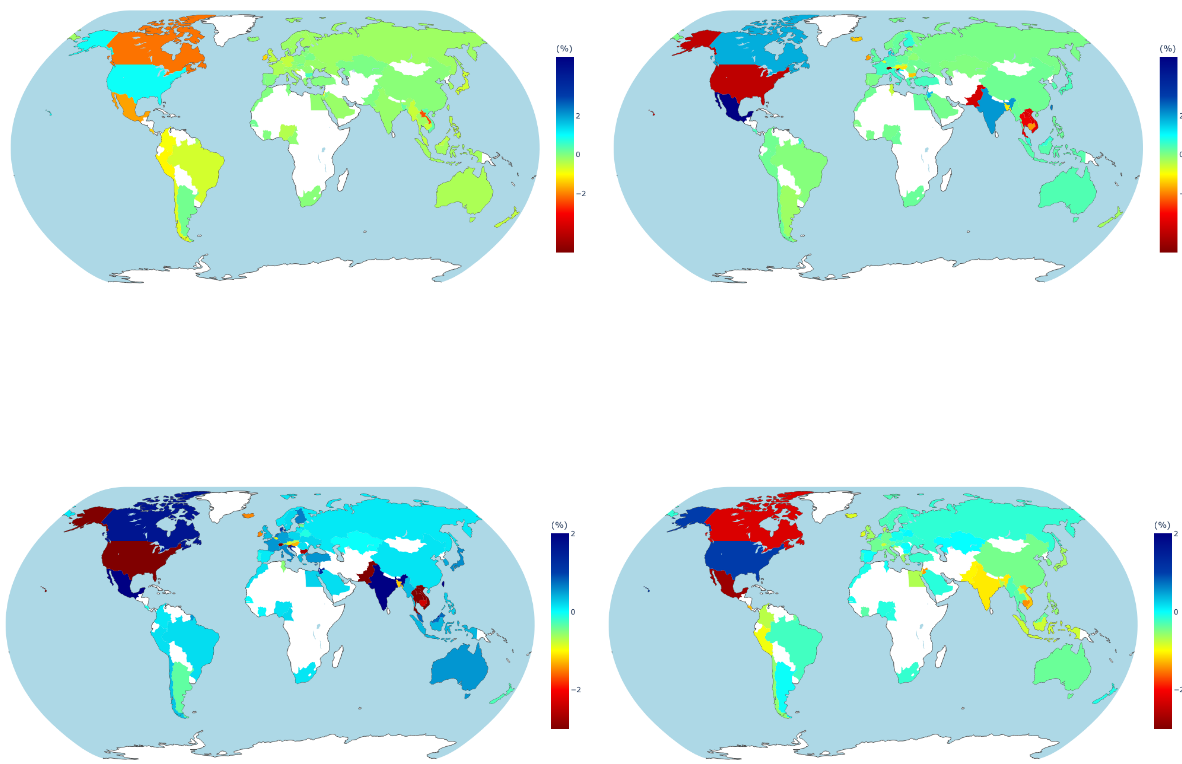
Table 5 shows how the U.S. is shooting itself in the foot. Even a mild homogeneous tariff increase to 10%, as in scenario (I), reduces the volume of trade relative to GDP by 2.40%. However, the World's trade openness only falls by 0.33%, and if we exclude the U.S., it increases. Therefore, other countries fill the emptiness left by the U.S. retreat from world trade through tariffs. Mexico increases its trade openness by 2.84%. China, despite being the primary foe in the U.S. policy narrative, barely suffers any change in trade openness, with a loss of only 0.08%. Trade openness in the EU barely changes as well, but there are winners and losers within the union.

As the U.S. escalates its tariff policy, it becomes more autarkic and poorer in the short run, and exacerbates the changes in the trade openness index. In the worst-case scenario, where the U.S. charges a 145% tariff on China, it loses 11.60% of it, and Mexico plays once more a pivotal role in the short-run rerouting of trade value, increasing its trade openness index by 7.80%.

The maps in Figure 2 reveal the short-run reordering of trade through imports and export flows for intermediate goods and final demand goods in the first scenario. The tariffs barely change the U.S. imports of intermediates, but the import of final goods drops substantially. Conversely the U.S. exports less intermediates and more final goods to the rest of the world. Spare parts are used by the rest of the world that buys more final-use products from the U.S..

Figure 3 shows the world redistribution of trade flows, as measured by the trade openness

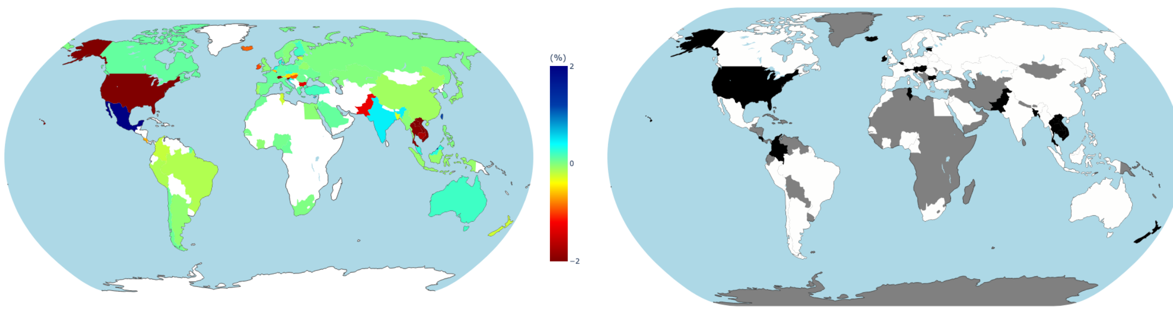
Figure 2: The effect of tariffs on exports and imports by use in Scenario I



**Notes:** Figure 2 parses the simulated change in bilateral trade flows under Scenario I. The four world maps are arranged as a $2 \times 2$ grid: the **top row** shows *imports* and the **bottom row** *exports*; within each row, the **left panel** records transactions of *intermediate inputs* while the **right panel** records flows destined for *final demand*. Colors measure the percentage deviation from the 2019 benchmark. The diverging scale is symmetrically truncated at $\pm 0.15\%$ to highlight cross-country contrasts. Warm (red) shades mark contractions in gross trade, cool (blue/green) shades mark expansions, and off-scale observations are capped at the boundary color. White land masses denote economies for which the OECD ICIO provides no sectoral breakdown.

index, in the first scenario. The trade openness index falls by 2.40% in the U.S.. However, the rest of the world does not de-globalize; other countries fill the space left by the U.S. retreat. Instead, Mexico gains 2.84% in its trade openness index, and the rest of the world absorbs the remainder, so there is barely a change in the trade openness index of a world without the U.S. trade partner.

Figure 3: Trade openness redistribution in scenario I



**Notes:** Figure 3 reports the simulated change in each country's trade-openness ratio—defined as $(X + M)/\mathrm{GDP}$ in current prices—in scenario I. The *upper panel* is a heat-map whose diverging color scale is truncated at $\pm 0.7\%$ to sharpen cross-country contrasts: warmer shades mark declines in openness, cooler shades gains. The *lower panel* re-bins the same data into a three-way classifier: economies whose openness contracts by more than the world-weighted mean appear in **black**; those whose openness rises (or falls by less than the mean) in **gray**; the remainder in **white**.

This pattern complements (Bleaney and Tian, 2023), warning that the headline openness ratio masks where transactions land. Openness changes little because fixed Leontief linkages keep total intermediate demand almost constant; what shifts is who clears the orders. The migration of flows to already-dense hubs echoes (Rodrik, 2000) insight that unilateral protection often enlarges third-country trade and aligns with the shock-propagation evidence of (Amiti et al., 2020).

Our simulations are also consistent with plant-level evidence from the Tōhoku earthquake used in (Carvalho et al., 2021) and pandemic disruptions studied by (Bonadio et al., 2021), both of which document that network centrality—not headline openness—predicts the depth of local output shortfalls. Therefore, the evidence shows that when a central buyer withdraws, peripheral suppliers pivot to the next-best central node instead of shrinking outright.

In sum, the baseline and extreme scenarios underscore three lessons. First of all, tariffs have first-order real effects when sourcing is rigid: a uniform 10% duty suffices to shave almost three-quarters of a per cent off world income. Second, escalation multiplies those losses non-linearly—output drops quadruple and trade–balance swings widen—even though the last increments of tariff rates add diminishing marginal harm once key links have already snapped. Third, tariffs act like a redistributive valve—they divert containers to the nearest viable hub instead of choking them off altogether. It seems that the rest of the world can sustain similar trade flows relative to its size, without the U.S. as a trading partner in the short run.

# 6 Conclusions

We build and solve a short-run, multi-country input–output model in which every sector sources intermediate goods at fixed Leontief proportions, and quantities are expressed in international dollars. The framework nests 77 economies and 11 industries, capturing not only bilateral trade in final products but also the cross-border supply links that amplify relative-price shocks—an amplification channel that recent empirical work has highlighted as central to understanding the effect of tariffs.

Tariffs behave in today's production network much less like a barrier, and much more like a valve that diverts value chains. In our baseline simulation, the United States erects a uniform 10% wall. Because all 77 economies are locked into fixed Leontief proportions, the price shock propagates instantly and trims world GDP by 0.73%; the U.S. itself loses 0.83%, while Mexico, Canada, and China record contractions between 0.45% and 0.67%. Escalating the schedule to 25% on NAFTA partners, 15% to EU countries, and 145% on China magnifies those numbers almost fourfold—global output falls by 3.38% and the U.S. output by 3.78%. The aggregate volume of trade falls by 1.46% across scenarios, yet the aggregate volume of trade does not decrease if we exclude the U.S. from the sample.

Instead, the geography of commerce is upended: Mexico's openness index jumps by 7.80%, while the U.S. ratio plunges by 11.60%. The pattern echoes (Johansen, 1960) early multi-sector warning that even narrow wedges reverberate across an economy, and it corroborates more recent network formulations by (Baqaee and Farhi, 2019) that predict convex amplification once a critical edge is severed. Network centrality, rather than headline openness, dictates exposure.

These findings complicate the benign view that long-run Armington or Ricardian models offer, because they make clear that the first year after a tariff hike is dominated by rigidity, not substitution. They also cut against the political argument that tariffs repatriate production: the American economy emerges less open, poorer in real terms, and surrounded by neighbors that trade more, not less, despite showing a trade surplus.

Only once contracts expire, capital is reallocated, and firms experiment with new suppliers will the losses move toward the smaller numbers reported by elastic-sourcing CGEs. Until that adjustment unfolds, protectionism remains a costly gamble whose immediate dividend is a reshuffling of container routes rather than a return of manufacturing jobs.

Future extensions that let coefficients drift, model retaliatory games, or incorporate intangible flows could trace the transition path from this upper-bound snapshot to longer-run equilibrium. For now, the evidence is unambiguous: in a densely wired world economy, even a seemingly moderate tariff shock leaves global trade volumes largely intact. Still, it hollows out the income of the country that fires the first shot. The lesson that emerges from our numbers, and from the historical record they echo, is that trade wars are not won; they are paid for.

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# A Appendix

## A.1. Data construction and code mappings

### A.1.1 Transformation pipeline

The raw 2023 edition of the OECD ICIO provides $\sim$150 000 non–zero cells: 45 ISIC Rev.4 industries $\times$ 76 countries + "Rest-of-World" (ROW). To keep the numerical Leontief inversion tractable we compress those data into the $77 \times 11$ structure used in the model. Table 6 summarizes the workflow; the `*.xlsx` scripts mentioned are supplied with the replication material.

Table 6: Automated pipeline that converts raw ICIO blocks into the model matrices

| **Step** | **Operation (see code_transformation.xlsx)** |
|---|---|
| 1. Import ICIO | Read the six inter-linked CSV files released by OECD (intermediate use, final demand, value added, taxes, etc.). |
| 2. Harmonize | Strip accents, force ISO–3 country codes, replace ICIO's mixed 4- and 2-digit ISIC labels by clean 2-digit codes. All mappings stored in `codeMap.xlsx`. |
| 3. J-merge | Left-join the 45 industries with the "11-sector key" in Table 7; aggregate by summation (matrix formula in `matrixCodes.xlsx`). |
| 4. C-merge | Merge each of the 27 EU-27 members into the synthetic region `EUR`, leaving 49 individual countries and `ROW`. Mapping in Table 8. |
| 5. Balancing | Re-scale investment so that $C + I + G + XN = GDP$ (national-account consistency), then recompute the Leontief inverse. |
| 6. X % M | Partition the balanced matrix into intermediate and final blocks, producing $X_{ij}^{cc'}$ and $X_{fj}^{cc'}$ used in Section 5. |

### A.1.2 Industry aggregation: the 11-sector key

Table 7 lists the correspondence between the 2-digit ISIC codes and the composite sectors (`AGRI` ... `OTHS`) employed in the simulations. The same mapping drives all three Excel helpers cited above.

### A.1.3 Regional aggregation: the EU-27 block

Following common practice in multi-regional IO work, all members of the European Union are collapsed into a single "`EUR`" economy. Table 8 lists the ISO-3 codes that are summed before

Table 7: Mapping from ISIC Rev.4 industries to the 11 composite sectors

| **Composite code** | **ISIC Rev.4 2-digit coverage** |
|---|---|
| `AGRI` | 01–03 (A) Agriculture, forestry % fishing |
| `MINQ` | 05–09 (B) Mining % quarrying |
| `MANU` | 10–33 (C) All manufacturing (food, textiles, ... machinery) |
| `ENEG` | 35–39 (D % E) Electricity, gas, water, waste |
| `CONS` | 41–43 (F) Construction |
| `TRAD` | 45–47 (G) Wholesale % retail trade |
| `TRAN` | 49–53 (H) Transport % storage |
| `INFO` | 58–63 (J) Information % communication |
| `FIN` | 64–68 (K, L) Financial % real-estate services |
| `GOV` | 84–88 (O, P, Q) Public admin., education, health |
| `OTHS` | 55–56, 68–82, 90–99 (I, M, N, R, S) Other services |

the Leontief inversion; bilateral flows between those members disappear from the final dataset, but intra-EU trade is preserved in the `EUR` row/column.

Table 8: Countries aggregated into the `EUR` region

| | | | | |
|---|---|---|---|---|
| AUT | BEL | BGR | HRV | CYP |
| CZE | DNK | EST | FIN | FRA |
| DEU | GRC | HUN | IRL | ITA |
| LVA | LTU | LUX | MLT | NLD |
| POL | PRT | ROU | SVK | SVN |
| ESP | SWE | | | |

Any country not enumerated above—or absent from OECD ICIO—is absorbed into the residual `ROW` entity to keep the global transaction matrix square.

Table 9: Intermediate transactions by origin and destination in 2019

| | | CAN | | CHN | | MEX | | EUR | | USA | | ROW | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | man | ser | man | ser | man | ser | man | ser | man | ser | man | ser |
| CAN | man | 17.41 | 12.45 | 0.88 | 0.16 | 0.28 | 0.05 | 0.49 | 0.18 | 8.43 | 3.53 | 1.74 | 0.76 |
| | serv | 11.72 | 57.72 | 0.28 | 0.16 | 0.11 | 0.03 | 0.24 | 0.92 | 1.89 | 2.70 | 0.55 | 1.41 |
| CHN | man | 0.98 | 1.64 | 934.24 | 334.74 | 3.60 | 0.65 | 9.87 | 5.16 | 6.09 | 7.81 | 38.97 | 23.24 |
| | serv | 0.14 | 0.33 | 256.39 | 354.86 | 0.41 | 0.12 | 1.24 | 2.44 | 0.80 | 1.98 | 5.03 | 9.74 |
| MEX | man | 0.28 | 0.33 | 0.71 | 0.16 | 16.11 | 4.77 | 0.40 | 0.16 | 6.09 | 3.20 | 1.52 | 0.68 |
| | serv | 0.15 | 0.11 | 0.15 | 0.04 | 13.01 | 14.58 | 0.14 | 0.14 | 1.53 | 1.23 | 0.51 | 0.30 |
| EUR | man | 0.80 | 0.74 | 9.16 | 2.92 | 1.21 | 0.29 | 224.60 | 121.01 | 5.82 | 4.34 | 25.72 | 16.51 |
| | serv | 0.28 | 0.87 | 3.65 | 3.26 | 0.34 | 0.17 | 176.50 | 635.92 | 1.91 | 6.85 | 12.37 | 30.20 |
| USA | man | 4.58 | 2.46 | 4.63 | 1.18 | 4.79 | 1.33 | 4.25 | 1.78 | 158.79 | 106.05 | 12.78 | 6.36 |
| | serv | 2.26 | 3.64 | 2.48 | 1.62 | 2.20 | 1.01 | 4.80 | 14.10 | 134.47 | 855.87 | 8.54 | 16.81 |
| ROW | man | 2.12 | 1.01 | 65.15 | 15.73 | 2.97 | 0.46 | 32.19 | 14.22 | 15.45 | 10.93 | 740.46 | 388.25 |
| | serv | 0.45 | 1.28 | 12.67 | 7.85 | 0.59 | 0.19 | 10.58 | 30.21 | 3.79 | 14.68 | 352.76 | 998.15 |
| T | | 0.84 | 1.92 | 35.99 | 29.08 | 1.05 | 0.82 | 14.44 | 30.99 | 6.86 | 13.53 | 29.81 | 54.15 |
| VAB | | 22.69 | 129.92 | 394.63 | 775.07 | 26.71 | 55.67 | 231.22 | 1018.69 | 216.28 | 1453.60 | 813.76 | 1907.74 |

Table 10: Consumption and investment by origin and destination in 2019

| | | CAN | | CHN | | MEX | | EUR | | USA | | ROW | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | C | I | C | I | C | I | C | I | C | I | C | I |
| CAN | man | 12.93 | 0.89 | 0.16 | 0.05 | 0.15 | 0.09 | 0.18 | 0.12 | 3.16 | 2.61 | 1.02 | 0.56 |
| | serv | 98.31 | 28.80 | 0.53 | 0.06 | 0.09 | 0.04 | 0.33 | 0.24 | 2.38 | 1.43 | 1.50 | 0.37 |
| CHN | man | 1.77 | 0.76 | 219.74 | 91.45 | 1.50 | 1.20 | 9.02 | 5.08 | 12.49 | 7.80 | 28.85 | 22.54 |
| | serv | 0.38 | 0.11 | 475.39 | 436.62 | 0.25 | 0.11 | 2.06 | 0.89 | 2.43 | 1.17 | 7.05 | 3.77 |
| MEX | man | 0.69 | 0.25 | 0.09 | 0.11 | 18.57 | 4.60 | 0.24 | 0.21 | 5.76 | 5.26 | 1.08 | 0.88 |
| | serv | 0.18 | 0.08 | 0.06 | 0.04 | 39.10 | 12.86 | 0.15 | 0.06 | 2.20 | 1.19 | 0.59 | 0.21 |
| EUR | man | 0.74 | 0.39 | 2.03 | 3.41 | 0.64 | 0.62 | 152.41 | 68.08 | 10.20 | 3.43 | 25.60 | 16.63 |
| | serv | 0.62 | 0.28 | 2.50 | 1.57 | 0.57 | 0.15 | 776.85 | 200.52 | 7.11 | 2.17 | 32.73 | 8.78 |
| USA | man | 3.30 | 1.08 | 1.08 | 0.88 | 2.57 | 1.29 | 2.19 | 2.11 | 167.08 | 79.38 | 7.98 | 6.24 |
| | serv | 3.08 | 0.89 | 2.83 | 0.69 | 2.49 | 0.48 | 3.90 | 4.11 | 1232.61 | 301.00 | 17.49 | 4.55 |
| ROW | man | 2.07 | 0.52 | 6.67 | 7.44 | 1.30 | 0.95 | 18.03 | 6.34 | 20.07 | 10.11 | 458.01 | 162.14 |
| | serv | 0.98 | 0.36 | 9.39 | 3.80 | 0.60 | 0.21 | 13.25 | 6.54 | 13.13 | 5.26 | 1535.09 | 419.03 |
| T | | 5.03 | 1.89 | 34.20 | 19.58 | 4.23 | 0.48 | 71.11 | 17.71 | 41.11 | 7.63 | 100.84 | 34.32 |
| VAB | | | | | | | | | | | | | |

## A.2. Model and solution algorithm

In this section, we provide details on the decision problems faced by participants in the global economy and how we aggregate them into the world's competitive equilibrium.

**Local producers problem**. There are $J$ local producers in each country that demand capital $k_{cj}$, labor $l_{cj}$ and intermediate products $x_{ij}^{cc'}$ from different sectors and countries, taking local cost of capital $r_c$ and labor $w_c$, and the international price of intermediates $p_i$ as given:

$$\min_{\{x_{ij}^{cc'}\}_{(c',i)\in S\times J},k_{cj},l_{cj}} r_c k_{cj} + w_c l_{cj} + \sum_{c'=1}^{C}\sum_{i=1}^{J} p_i(1+\tau_{cc'}^{i})x_{ij}^{cc'}$$

subject to:

$$\min\left\{\left(\frac{x_{ij}^{cc'}}{a_{ij}^{cc'}}\right)_{(c',i)\in C\times J}, \beta_{cj}k_{cj}^{\alpha_{cj}}l_{cj}^{1-\alpha_{cj}}\right\} \geq y_{cj}$$

The solution to this problem is a set of intermediate input demand functions:

$$x_{ij}^{cc'} = a_{ij}^{cc'}y_{cj}$$

and demands for capital

$$k_{cj} = \frac{1}{\beta_{cj}}\left[\frac{\alpha_{cj}w_c}{(1-\alpha_{cj})r_c}\right]^{1-\alpha_{cj}} y_{cj}$$

and labor

$$l_{cj} = \frac{1}{\beta_{cj}}\left[\frac{(1-\alpha_{cj})r_c}{\alpha_{cj}w_c}\right]^{\alpha_j} y_{cj}$$

These demands and those of intermediate inputs are homogeneous of degree 1 in industry production, so theoretically firms could be making profits in these sectors. We impose a zero profit condition in each sector, which allows us to define local prices as a function of international prices and the unit cost of production using capital and labor through the profit condition:

$$(1+t_{cj})p_{cj} = \frac{1}{\beta_{cj}}\left[\left(\frac{r_c}{\alpha_{cj}}\right)^{\alpha_j}\left(\frac{w_c}{1-\alpha_{cj}}\right)^{1-\alpha_{cj}}\right] + \sum_{i=1}^{J} p_i \sum_{c'=1}^{C}(1+\tau_{cc'}^{i})a_{ij}^{cc'}$$

**Final consumption producers problem**. There is a representative firm that buys products

$x_{fj}^{cc'}$ at international prices and supply final products $y_{fj}^{c}$ to local consumers at final domestic prices $p_{fj}^{c}$ to maximize profits:

$$\max \sum_{j=1}^{J} \left[ p_{fj}^{c} y_{fj}^{c} - \sum_{c'=1}^{C} (1+\tau_{cc'}^{j}) p_j x_{fj}^{cc'} \right]$$

subject to:

$$y_{fj}^{c} \leq \min \left\{ \left( \frac{x_{fj}^{cc'}}{a_{fj}^{cc'}} \right)_{c' \in C} \right\}$$

Following the same zero profit principle, we can write the prices that the final consumer faces in each country, for each product, as:

$$p_{fj}^{c} = p_j \sum_{c'=1}^{C} (1+\tau_{cc'}^{j}) a_{fj}^{cc'}$$

**Investment producers problem**. There is a representative firm that buys products $x_{Ij}^{cc'}$ at international prices and transforms them into sectoral investment goods $I_{cj}$ that have value to local consumers and buys them at final domestic prices $p_{Ij}^{c}$ to maximize profits:

$$\max \sum_{j=1}^{J} \left[ p_{Ij}^{c} I_{cj} - \sum_{c'=1}^{C} (1+\tau_{cc'}^{j}) p_j x_{Ij}^{cc'} \right]$$

subject to:

$$I_{cj} \leq \min \left\{ \left( \frac{x_{Ij}^{cc'}}{a_{Ij}^{cc'}} \right)_{c' \in C} \right\}$$

Relying, once again, on a zero profit condition, we can write the price of investment in each sector as:

$$p_{Ij}^{c} = p_j \sum_{c'=1}^{C} (1+\tau_{cc'}^{j}) a_{Ij}^{cc'}$$

**Representative household problem**. There is a representative household in each country that values the demand of goods for final consumption $d_{fj}^{c}$ and for investment $d_{Ij}^{c}$

$$\max_{d^c_{fj}, d^c_{Ij}} \sum_{j \in J} \left[\theta_{fj} \log(d^c_{fj}) + \theta_{Ij} \log(d^c_{Ij})\right]$$

subject to:

$$\sum_{j \in J} \left[p_{fj}(1+\tau^j_{cf}) d^c_{fj} + p_{Ij} d^c_{Ij}\right] = w_c l_c + r_c k_c + T_c$$

The solution of this problem results in a set of demands for final consumption:

$$d^c_{fj} = \frac{\theta_{fj}\left(w_c l_c + r_c k_c + T_c\right)}{p^c_{fj}(1+\tau^j_{cf})}$$

and investment:

$$d^c_{Ii} = \frac{\theta_{Ij}\left(w_c l_c + r_c k_c + T_c\right)}{p_{Ij}}$$

**Government**. There is a government that collect taxes on products $t_{cj}$, consumption $\tau^j_{cf}$, and tariffs $\tau^j_{cc'}$, so that tax proceeds $T_c$ are rebated in full to the representative household in each country:

$$T_c = \sum_{j=1}^{J} \left[p_{cj} t_{cj} y_{cj} + \tau^j_{cf} p^c_{fj} d^c_{fj} + \sum_{c'=1}^{C} \sum_{i=1}^{J} p_i \tau^i_{cc'} x^{cc'}_{ij}\right]$$

**Numerical solution**

We solve the equilibrium by following the following steps:

(i) Make a guess of international prices $\left\{p^{(0)}_j\right\}_{j \in J}$, productions $\left\{y^{(0)}_{cj}\right\}_{(c,j) \in C \times J}$, trade balances $\left\{XN^{(0)}_c\right\}_{c \in C}$ and tax proceeds $\left\{T^{(0)}_c\right\}_{c \in C}$ across countries

(ii) We compute $\{p_{cj}\}_{(c,j) \in C \times J}$ using international price and production guesses in (i) and free entry conditions of local good producers

(iii) We compute final prices $p_{cf}$ of final consumption, investment and foreign goods using the free entry conditions of the final goods assemblers

(iv) We obtain final demands $\{d_{cj}\}_{(c,j) \in C \times \{C_f, I, C_x\}}$ by solving the household's problems based on the guesses in (i)

(v) We compute tax proceeds $\{T_c\}_{c \in C}$ across countries

(vi) We compute demand of intermediate goods derived from local producer's minimization problem $\left\{x_{ij}^{cc'}\right\}_{(c,j),(c',i) \in CJ \times CJ}$

(vii) We compute exports $X_c$ and imports $M_c$ using final demands from (iv) and intermediate demands from (vi)

(viii) This recursion can be summarized by a newton algorithm applied to the following set of equations

$$\begin{aligned}
\sum_{c=1}^{C} y_{cj}^{(0)} &= \sum_{c=1}^{C} y_{cj} \sum_{c'=1}^{C} \sum_{i=1}^{J} a_{ij}^{cc'} + \sum_{c=1}^{C} y_{cj}^{f} + \sum_{c=1}^{C} y_{cj}^{I} & (1)\\
p_j &= p_j^{(0)} \ \forall\ j \in J & (2)\\
\sum_{j=1}^{J} l_{cj}(w_c, r_c) &= \bar{l}_c \text{ and } \sum_{j=1}^{J} k_{cj}(w_c, r_c) = \bar{k}_c \quad \forall\ c \in C & (3)\\
X_c &= XN_c^{(0)} \ \forall\ c \in C & (4)\\
T_c &= T_c^{(0)} \ \forall\ c \in C & (5)
\end{aligned}$$

## A.3. Impact by region, income level and country

In the scenarios (I)-(V), international prices

$$p_j = \sum_{c=1}^{C} (p_{cj}/\mathrm{PPP}_c) \frac{q_{ij}}{\sum_{j=1}^{J} q_{cj}}$$

are computed as the weighted average of international prices $p_{ij}$ using $PPP_c$ given by

$$\mathrm{PPP}_c = \frac{\sum_{j=1}^{J} p_{cj} q_{cj}}{\sum_{j=1}^{J} p_j q_{cj}}.$$

We use these international prices to compute GDP in Geary-Khamis dollars. Note that our calibration ($\forall p_{cj} = 1$) implies that international prices and $PPP_c$ are also equal to one in the baseline World.

Table 11: GDP growth by income group and region (%)

| | n | (I) | (II) | (III) | (IV) | (V) |
|---|---|---|---|---|---|---|
| High income | 46 | -0.71 | -1.28 | -1.73 | -2.95 | -3.33 |
| East Asia % Pacific | 8 | -0.71 | -1.27 | -1.71 | -2.91 | -3.29 |
| Europe % Central Asia | 31 | -0.71 | -1.29 | -1.74 | -2.96 | -3.35 |
| Latin America % Caribbean | 2 | -0.58 | -1.10 | -1.53 | -2.73 | -3.11 |
| Middle East. North Africa. Afghanistan % Pakistan | 3 | -0.72 | -1.30 | -1.76 | -2.99 | -3.37 |
| North America | 2 | -0.75 | -1.35 | -1.81 | -3.06 | -3.46 |
| | | | | | | |
| Upper middle income | 14 | -0.71 | -1.27 | -1.72 | -2.92 | -3.30 |
| East Asia % Pacific | 4 | -0.69 | -1.25 | -1.67 | -2.84 | -3.21 |
| Europe % Central Asia | 4 | -0.72 | -1.30 | -1.74 | -2.95 | -3.33 |
| Latin America % Caribbean | 5 | -0.69 | -1.25 | -1.69 | -2.90 | -3.28 |
| Sub-Saharan Africa | 1 | -0.78 | -1.41 | -1.90 | -3.24 | -3.66 |
| | | | | | | |
| Lower middle income | 16 | -0.69 | -1.25 | -1.69 | -2.88 | -3.26 |
| East Asia % Pacific | 5 | -0.66 | -1.19 | -1.61 | -2.74 | -3.10 |
| Middle East. North Africa. Afghanistan % Pakistan | 5 | -0.72 | -1.30 | -1.76 | -3.02 | -3.42 |
| South Asia | 2 | -0.66 | -1.19 | -1.60 | -2.71 | -3.06 |
| Sub-Saharan Africa | 4 | -0.73 | -1.31 | -1.75 | -2.97 | -3.36 |
| | | | | | | |
| Rest of The World | | -0.73 | -1.31 | -1.77 | -3.00 | -3.39 |
| | | | | | | |
| Total general | | -0.70 | -1.27 | -1.72 | -2.93 | -3.31 |

Table 12: Trade openness change by income group and region (%)

| | n | (I) | (II) | (III) | (IV) | (V) |
|---|---|---|---|---|---|---|
| East Asia % Pacific | 8 | 0.36 | 0.58 | 0.73 | 1.07 | 1.16 |
| Europe % Central Asia | 31 | -0.23 | -0.34 | -0.41 | -0.55 | -0.59 |
| Latin America % Caribbean | 2 | -0.30 | -0.65 | -1.01 | -2.01 | -2.33 |
| Middle East. North Africa. Afghanistan % Pakistan | 3 | 0.13 | 0.22 | 0.30 | 0.48 | 0.53 |
| North America | 2 | -1.18 | -2.16 | -2.96 | -5.19 | -5.92 |
| | | | | | | |
| Upper middle income | 14 | 0.04 | 0.05 | 0.05 | 0.02 | 0.01 |
| East Asia % Pacific | 4 | -0.46 | -0.71 | -0.89 | -1.28 | -1.39 |
| Europe % Central Asia | 4 | 0.05 | 0.08 | 0.11 | 0.18 | 0.20 |
| Latin America % Caribbean | 5 | 0.44 | 0.64 | 0.76 | 0.92 | 0.94 |
| Sub-Saharan Africa | 1 | 0.01 | 0.03 | 0.05 | 0.11 | 0.12 |
| | | | | | | |
| Lower middle income | 16 | -0.57 | -0.95 | -1.21 | -1.86 | -2.05 |
| East Asia % Pacific | 5 | -1.60 | -2.70 | -3.49 | -5.45 | -6.03 |
| Middle East. North Africa. Afghanistan % Pakistan | 5 | -0.28 | -0.41 | -0.48 | -0.64 | -0.68 |
| South Asia | 2 | 0.09 | 0.13 | 0.16 | 0.19 | 0.18 |
| Sub-Saharan Africa | 4 | 0.02 | 0.04 | 0.06 | 0.10 | 0.11 |
| | | | | | | |
| Rest of The World | | 0.30 | 0.53 | 0.71 | 1.17 | 1.30 |
| | | | | | | |
| Total general | | -0.19 | -0.32 | -0.41 | -0.65 | -0.72 |

Table 13: Change in GDP in Geary-Khamis dollars (%)

| code | GEO | INC | (I) | (II) | (III) | (IV) | (V) |
|---|---|---|---|---|---|---|---|
| ARG | Latin America & Caribbean | Upper middle income | -0.73 | -1.33 | -1.79 | -3.06 | -3.46 |
| AUS | East Asia & Pacific | High income | -0.75 | -1.35 | -1.82 | -3.10 | -3.50 |
| AUT | Europe & Central Asia | High income | -0.70 | -1.27 | -1.72 | -2.92 | -3.30 |
| BEL | Europe & Central Asia | High income | -0.75 | -1.36 | -1.83 | -3.12 | -3.52 |
| BGD | South Asia | Lower middle income | -0.68 | -1.21 | -1.62 | -2.74 | -3.09 |
| BGR | Europe & Central Asia | High income | -0.51 | -0.96 | -1.32 | -2.32 | -2.64 |
| BLR | Europe & Central Asia | Upper middle income | -0.71 | -1.28 | -1.72 | -2.92 | -3.30 |
| BRA | Latin America & Caribbean | Upper middle income | -0.77 | -1.39 | -1.87 | -3.18 | -3.59 |
| BRN | East Asia & Pacific | High income | -0.65 | -1.15 | -1.54 | -2.58 | -2.91 |
| CAN | North America | High income | -0.67 | -1.21 | -1.63 | -2.78 | -3.14 |
| CHE | Europe & Central Asia | High income | -0.81 | -1.41 | -1.88 | -3.12 | -3.50 |
| CHL | Latin America & Caribbean | High income | -0.75 | -1.34 | -1.81 | -3.06 | -3.46 |
| CHN | East Asia & Pacific | Upper middle income | -0.64 | -1.14 | -1.53 | -2.59 | -2.93 |
| CIV | Sub-Saharan Africa | Lower middle income | -0.74 | -1.34 | -1.79 | -3.04 | -3.43 |
| CMR | Sub-Saharan Africa | Lower middle income | -0.75 | -1.35 | -1.81 | -3.07 | -3.46 |
| COL | Latin America & Caribbean | Upper middle income | -0.73 | -1.32 | -1.78 | -3.04 | -3.44 |
| CRI | Latin America & Caribbean | High income | -0.41 | -0.85 | -1.26 | -2.41 | -2.77 |
| CYP | Europe & Central Asia | High income | -0.77 | -1.40 | -1.89 | -3.21 | -3.63 |
| CZE | Europe & Central Asia | High income | -0.71 | -1.28 | -1.73 | -2.94 | -3.32 |
| DEU | Europe & Central Asia | High income | -0.72 | -1.30 | -1.75 | -2.98 | -3.36 |
| DNK | Europe & Central Asia | High income | -0.72 | -1.29 | -1.74 | -2.95 | -3.33 |
| EGY | ME. NA. Af & Pa | Lower middle income | -0.74 | -1.35 | -1.83 | -3.13 | -3.54 |
| ESP | Europe & Central Asia | High income | -0.74 | -1.34 | -1.80 | -3.06 | -3.46 |
| EST | Europe & Central Asia | High income | -0.70 | -1.26 | -1.70 | -2.89 | -3.26 |
| FIN | Europe & Central Asia | High income | -0.70 | -1.27 | -1.70 | -2.89 | -3.27 |
| FRA | Europe & Central Asia | High income | -0.70 | -1.27 | -1.71 | -2.92 | -3.31 |
| GBR | Europe & Central Asia | High income | -0.75 | -1.35 | -1.82 | -3.10 | -3.51 |
| GRC | Europe & Central Asia | High income | -0.77 | -1.39 | -1.87 | -3.19 | -3.60 |
| HKG | East Asia & Pacific | High income | -0.75 | -1.35 | -1.83 | -3.11 | -3.51 |
| HRV | Europe & Central Asia | High income | -0.70 | -1.28 | -1.74 | -3.00 | -3.39 |
| HUN | Europe & Central Asia | High income | -0.68 | -1.23 | -1.66 | -2.83 | -3.20 |
| IDN | East Asia & Pacific | Upper middle income | -0.71 | -1.27 | -1.70 | -2.87 | -3.24 |
| IND | South Asia | Lower middle income | -0.65 | -1.17 | -1.58 | -2.68 | -3.03 |
| IRL | Europe & Central Asia | High income | -0.75 | -1.36 | -1.83 | -3.09 | -3.48 |
| ISL | Europe & Central Asia | High income | -0.63 | -1.18 | -1.63 | -2.87 | -3.26 |
| ISR | ME. NA. Af & Pa | High income | -0.68 | -1.22 | -1.65 | -2.80 | -3.17 |
| ITA | Europe & Central Asia | High income | -0.75 | -1.35 | -1.82 | -3.10 | -3.50 |

ME. NA. Af & Pa = Middle East, North Africa, Afghanistan & Pakistan

Table 14: Change in GDP in Geary-Khamis dollars (%) (cont)

| code | GEO | INC | (I) | (II) | (III) | (IV) | (V) |
|---|---|---|---|---|---|---|---|
| JOR | ME. NA. Af & Pa | Lower middle income | -0.62 | -1.16 | -1.59 | -2.79 | -3.16 |
| JPN | East Asia & Pacific | High income | -0.75 | -1.35 | -1.82 | -3.09 | -3.49 |
| KAZ | Europe & Central Asia | Upper middle income | -0.67 | -1.20 | -1.61 | -2.72 | -3.07 |
| KHM | East Asia & Pacific | Lower middle income | -0.51 | -0.96 | -1.35 | -2.39 | -2.72 |
| KOR | East Asia & Pacific | High income | -0.68 | -1.22 | -1.63 | -2.77 | -3.13 |
| LAO | East Asia & Pacific | Lower middle income | -0.91 | -1.61 | -2.14 | -3.57 | -4.01 |
| LTU | Europe & Central Asia | High income | -0.76 | -1.37 | -1.84 | -3.11 | -3.52 |
| LUX | Europe & Central Asia | High income | -0.45 | -0.85 | -1.17 | -2.06 | -2.33 |
| LVA | Europe & Central Asia | High income | -0.74 | -1.33 | -1.79 | -3.04 | -3.43 |
| MAR | ME. NA. Af & Pa | Lower middle income | -0.70 | -1.26 | -1.71 | -2.91 | -3.29 |
| MEX | Latin America & Caribbean | Upper middle income | -0.45 | -0.85 | -1.18 | -2.10 | -2.40 |
| MLT | ME. NA. Af & Pa | High income | -0.77 | -1.39 | -1.88 | -3.21 | -3.62 |
| MMR | East Asia & Pacific | Lower middle income | -0.72 | -1.30 | -1.75 | -2.98 | -3.37 |
| MYS | East Asia & Pacific | Upper middle income | -0.71 | -1.28 | -1.73 | -2.95 | -3.34 |
| NGA | Sub-Saharan Africa | Lower middle income | -0.69 | -1.24 | -1.67 | -2.83 | -3.19 |
| NLD | Europe & Central Asia | High income | -0.71 | -1.29 | -1.73 | -2.95 | -3.33 |
| NOR | Europe & Central Asia | High income | -0.71 | -1.28 | -1.71 | -2.90 | -3.28 |
| NZL | East Asia & Pacific | High income | -0.70 | -1.28 | -1.73 | -2.97 | -3.36 |
| PAK | ME. NA. Af & Pa | Lower middle income | -0.76 | -1.37 | -1.84 | -3.12 | -3.53 |
| PER | Latin America & Caribbean | Upper middle income | -0.75 | -1.36 | -1.83 | -3.11 | -3.51 |
| PHL | East Asia & Pacific | Lower middle income | -0.73 | -1.33 | -1.79 | -3.06 | -3.46 |
| POL | Europe & Central Asia | High income | -0.75 | -1.36 | -1.82 | -3.10 | -3.50 |
| PRT | Europe & Central Asia | High income | -0.72 | -1.30 | -1.77 | -3.04 | -3.44 |
| ROU | Europe & Central Asia | High income | -0.73 | -1.32 | -1.78 | -3.03 | -3.42 |
| RUS | Europe & Central Asia | High income | -0.73 | -1.31 | -1.76 | -2.98 | -3.37 |
| SAU | ME. NA. Af & Pa | High income | -0.72 | -1.29 | -1.74 | -2.95 | -3.33 |
| SEN | Sub-Saharan Africa | Lower middle income | -0.72 | -1.29 | -1.74 | -2.95 | -3.34 |
| SGP | East Asia & Pacific | High income | -0.70 | -1.26 | -1.69 | -2.88 | -3.25 |
| SVK | Europe & Central Asia | High income | -0.72 | -1.30 | -1.76 | -2.99 | -3.38 |
| SVN | Europe & Central Asia | High income | -0.83 | -1.45 | -1.93 | -3.22 | -3.63 |
| SWE | Europe & Central Asia | High income | -0.70 | -1.26 | -1.70 | -2.90 | -3.28 |
| THA | East Asia & Pacific | Upper middle income | -0.71 | -1.29 | -1.73 | -2.95 | -3.34 |
| TUN | ME. NA. Af & Pa | Lower middle income | -0.75 | -1.36 | -1.84 | -3.15 | -3.56 |
| TUR | Europe & Central Asia | Upper middle income | -0.70 | -1.26 | -1.69 | -2.86 | -3.23 |
| TWN | East Asia & Pacific | High income | -0.69 | -1.23 | -1.66 | -2.80 | -3.16 |
| UKR | Europe & Central Asia | Upper middle income | -0.79 | -1.44 | -1.94 | -3.30 | -3.73 |
| USA | North America | High income | -0.83 | -1.48 | -1.99 | -3.35 | -3.78 |
| VNM | East Asia & Pacific | Lower middle income | -0.43 | -0.77 | -1.03 | -1.72 | -1.94 |
| ZAF | Sub-Saharan Africa | Upper middle income | -0.78 | -1.41 | -1.90 | -3.24 | -3.66 |
| ROW | Rest of The World | | -0.73 | -1.31 | -1.77 | -3.00 | -3.39 |

ME. NA. Af & Pa = Middle East, North Africa, Afghanistan & Pakistan

Table 15: Trade openness change (%)

| code | GEO | INC | (I) | (II) | (III) | (IV) | (V) |
|---|---|---|---|---|---|---|---|
| ARG | Latin America & Caribbean | Upper middle income | -0.05 | -0.11 | -0.16 | -0.32 | -0.37 |
| AUS | East Asia & Pacific | High income | 0.22 | 0.37 | 0.50 | 0.82 | 0.92 |
| AUT | Europe & Central Asia | High income | -0.51 | -0.81 | -1.02 | -1.52 | -1.66 |
| BEL | Europe & Central Asia | High income | -0.60 | -1.03 | -1.35 | -2.13 | -2.37 |
| BGD | South Asia | Lower middle income | -0.28 | -0.50 | -0.66 | -1.09 | -1.23 |
| BGR | Europe & Central Asia | High income | -1.37 | -2.14 | -2.66 | -3.83 | -4.14 |
| BLR | Europe & Central Asia | Upper middle income | -0.06 | -0.07 | -0.07 | -0.05 | -0.04 |
| BRA | Latin America & Caribbean | Upper middle income | -0.15 | -0.27 | -0.37 | -0.63 | -0.72 |
| BRN | East Asia & Pacific | High income | 1.46 | 2.37 | 3.03 | 4.54 | 4.96 |
| CAN | North America | High income | 0.10 | 0.14 | 0.15 | 0.10 | 0.06 |
| CHE | Europe & Central Asia | High income | -3.50 | -5.40 | -6.66 | -9.56 | -10.37 |
| CHL | Latin America & Caribbean | High income | 0.07 | 0.12 | 0.16 | 0.26 | 0.29 |
| CHN | East Asia & Pacific | Upper middle income | -0.10 | -0.19 | -0.26 | -0.45 | -0.51 |
| CIV | Sub-Saharan Africa | Lower middle income | -0.04 | -0.07 | -0.09 | -0.15 | -0.16 |
| CMR | Sub-Saharan Africa | Lower middle income | 0.07 | 0.12 | 0.15 | 0.25 | 0.28 |
| COL | Latin America & Caribbean | Upper middle income | -0.21 | -0.37 | -0.48 | -0.79 | -0.88 |
| CRI | Latin America & Caribbean | High income | -0.67 | -1.42 | -2.17 | -4.27 | -4.95 |
| CYP | Europe & Central Asia | High income | 0.61 | 1.09 | 1.47 | 2.46 | 2.77 |
| CZE | Europe & Central Asia | High income | 0.25 | 0.39 | 0.49 | 0.73 | 0.80 |
| DEU | Europe & Central Asia | High income | 0.11 | 0.17 | 0.22 | 0.33 | 0.36 |
| DNK | Europe & Central Asia | High income | 0.31 | 0.56 | 0.74 | 1.19 | 1.33 |
| EGY | ME. NA. Af & Pa | Lower middle income | -0.03 | -0.02 | 0.03 | 0.14 | 0.18 |
| ESP | Europe & Central Asia | High income | 0.05 | 0.09 | 0.12 | 0.18 | 0.20 |
| EST | Europe & Central Asia | High income | -0.30 | -0.56 | -0.76 | -1.31 | -1.48 |
| FIN | Europe & Central Asia | High income | 0.21 | 0.30 | 0.36 | 0.48 | 0.52 |
| FRA | Europe & Central Asia | High income | 0.09 | 0.16 | 0.22 | 0.37 | 0.41 |
| GBR | Europe & Central Asia | High income | -0.03 | -0.05 | -0.07 | -0.10 | -0.11 |
| GRC | Europe & Central Asia | High income | 0.11 | 0.20 | 0.27 | 0.45 | 0.50 |
| HKG | East Asia & Pacific | High income | 0.93 | 1.49 | 1.88 | 2.78 | 3.03 |
| HRV | Europe & Central Asia | High income | 0.33 | 0.48 | 0.58 | 0.82 | 0.89 |
| HUN | Europe & Central Asia | High income | -0.93 | -1.49 | -1.91 | -2.90 | -3.19 |
| IDN | East Asia & Pacific | Upper middle income | -0.07 | -0.12 | -0.15 | -0.25 | -0.28 |
| IND | South Asia | Lower middle income | 0.46 | 0.75 | 0.97 | 1.46 | 1.59 |
| IRL | Europe & Central Asia | High income | -0.98 | -1.70 | -2.24 | -3.67 | -4.12 |
| ISL | Europe & Central Asia | High income | -0.89 | -1.85 | -2.70 | -4.67 | -5.23 |
| ISR | ME. NA. Af & Pa | High income | 0.13 | 0.21 | 0.28 | 0.44 | 0.48 |
| ITA | Europe & Central Asia | High income | 0.09 | 0.16 | 0.21 | 0.35 | 0.40 |

ME. NA. Af & Pa = Middle East, North Africa, Afghanistan & Pakistan

Table 16: Trade openness change (%) (cont)

| code | GEO | INC | (I) | (II) | (III) | (IV) | (V) |
|---|---|---|---|---|---|---|---|
| JOR | ME. NA. Af & Pa | Lower middle income | 0.11 | 0.28 | 0.47 | 0.92 | 1.05 |
| JPN | East Asia & Pacific | High income | -0.05 | -0.09 | -0.13 | -0.22 | -0.26 |
| KAZ | Europe & Central Asia | Upper middle income | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 |
| KHM | East Asia & Pacific | Lower middle income | -1.72 | -3.05 | -4.09 | -6.80 | -7.62 |
| KOR | East Asia & Pacific | High income | 0.06 | 0.09 | 0.12 | 0.17 | 0.19 |
| LAO | East Asia & Pacific | Lower middle income | -2.37 | -3.68 | -4.58 | -6.54 | -7.06 |
| LTU | Europe & Central Asia | High income | 0.08 | 0.14 | 0.19 | 0.33 | 0.38 |
| LUX | Europe & Central Asia | High income | 2.30 | 4.02 | 5.38 | 9.24 | 10.55 |
| LVA | Europe & Central Asia | High income | 0.06 | 0.10 | 0.14 | 0.22 | 0.25 |
| MAR | ME. NA. Af & Pa | Lower middle income | 0.06 | 0.14 | 0.23 | 0.49 | 0.57 |
| MEX | Latin America & Caribbean | Upper middle income | 2.76 | 4.19 | 5.12 | 6.88 | 7.28 |
| MLT | ME. NA. Af & Pa | High income | 0.17 | 0.31 | 0.43 | 0.70 | 0.78 |
| MMR | East Asia & Pacific | Lower middle income | -0.03 | -0.04 | -0.04 | -0.04 | -0.04 |
| MYS | East Asia & Pacific | Upper middle income | 0.29 | 0.52 | 0.70 | 1.18 | 1.32 |
| NGA | Sub-Saharan Africa | Lower middle income | 0.04 | 0.08 | 0.12 | 0.23 | 0.27 |
| NLD | Europe & Central Asia | High income | 0.32 | 0.52 | 0.67 | 1.04 | 1.14 |
| NOR | Europe & Central Asia | High income | 0.04 | 0.07 | 0.10 | 0.17 | 0.20 |
| NZL | East Asia & Pacific | High income | -0.24 | -0.32 | -0.30 | -0.23 | -0.21 |
| PAK | ME. NA. Af & Pa | Lower middle income | -1.30 | -2.04 | -2.54 | -3.70 | -4.03 |
| PER | Latin America & Caribbean | Upper middle income | -0.14 | -0.25 | -0.33 | -0.53 | -0.60 |
| PHL | East Asia & Pacific | Lower middle income | 0.00 | -0.01 | 0.00 | 0.02 | 0.03 |
| POL | Europe & Central Asia | High income | 0.12 | 0.19 | 0.23 | 0.33 | 0.35 |
| PRT | Europe & Central Asia | High income | -0.09 | -0.17 | -0.23 | -0.39 | -0.44 |
| ROU | Europe & Central Asia | High income | 0.06 | 0.06 | 0.05 | 0.01 | -0.01 |
| RUS | Europe & Central Asia | High income | 0.01 | 0.02 | 0.02 | 0.03 | 0.03 |
| SAU | ME. NA. Af & Pa | High income | 0.09 | 0.15 | 0.19 | 0.30 | 0.33 |
| SEN | Sub-Saharan Africa | Lower middle income | 0.02 | 0.03 | 0.04 | 0.06 | 0.06 |
| SGP | East Asia & Pacific | High income | -0.66 | -1.18 | -1.59 | -2.70 | -3.04 |
| SVK | Europe & Central Asia | High income | -0.47 | -0.79 | -1.02 | -1.59 | -1.75 |
| SVN | Europe & Central Asia | High income | -2.51 | -3.22 | -3.61 | -4.28 | -4.43 |
| SWE | Europe & Central Asia | High income | -0.01 | -0.02 | -0.01 | 0.03 | 0.04 |
| THA | East Asia & Pacific | Upper middle income | -1.96 | -3.06 | -3.85 | -5.61 | -6.09 |
| TUN | ME. NA. Af & Pa | Lower middle income | -0.25 | -0.44 | -0.61 | -1.05 | -1.18 |
| TUR | Europe & Central Asia | Upper middle income | 0.19 | 0.33 | 0.45 | 0.73 | 0.82 |
| TWN | East Asia & Pacific | High income | 1.17 | 1.87 | 2.34 | 3.40 | 3.68 |
| UKR | Europe & Central Asia | Upper middle income | 0.06 | 0.07 | 0.07 | 0.06 | 0.05 |
| USA | North America | High income | -2.47 | -4.47 | -6.08 | -10.49 | -11.89 |
| VNM | East Asia & Pacific | Lower middle income | -3.90 | -6.71 | -8.76 | -13.91 | -15.43 |
| ZAF | Sub-Saharan Africa | Upper middle income | 0.01 | 0.03 | 0.05 | 0.11 | 0.12 |
| ROW | Rest of The World | | 0.30 | 0.53 | 0.71 | 1.17 | 1.30 |

ME. NA. Af & Pa = Middle East, North Africa, Afghanistan & Pakistan