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

Jorge Alonso-Ortiz José-María Da-Rocha

ITAM-CIE[†] Universidade de Vigo[‡]

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Abstract

We assess the short-run effects of U.S. tariffs using a multi-country-sector model with a fixed global Leontief matrix. A 25% tariff on Canada, China, Mexico, and the EU—and 15% on others—reduces U.S. GDP by 1.48%, while Canada's, China's, and Mexico's fall by 1.21%, 1.14%, and 0.85%, respectively. Rather than reducing the trade deficit, tariffs increase it by 5 trillion due to a J-curve effect and shift real trade flows to competitors.

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[†]Centro de Investigación Económica. E-mail: `jorge.alonso@itam.mx`.

[‡]Facultad de Comercio. E-mail: `jmrocha@uvigo.es`.

1 Introduction

The World is experiencing a new wave of protectionism, which has intensified since "liberation day," currently reaching effective tariffs that surpass those established in 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], real and nominal trade flows, and inflation in a world that is more interconnected than ever before, and where retooling production lines is costly and time-consuming, imposing real rigidities.

To this end, we develop a static computable general equilibrium model of the global economy, featuring rich inter-sectoral and country linkages, fixed in dense Leontief coefficient matrices, that we calibrate to match trade observed in the data. The model is designed to isolate the effect of trade shocks on final relative prices across countries, given income and taxes. Their induced change triggers a change in the household's composition of final expenditure between consumption, investment, and foreign consumption goods. We show that it has a first-order effect on the World's standard of living, the distribution of trade, and inflation.

We use the model to simulate several tariff scenarios to quantitatively bound the impact of unilateral tariff shocks on standards of living and real trade flows. The baseline scenario consists of a World's unilateral uniform U.S. tariff of 10%, that is ratcheted up to 15% on members of the EU, to 25% on members of NAFTA and China. The World's GDP in international dollars drops by 0.73%. These losses are broadly distributed, but concentrated in the U.S., which experiences a 0.83% loss, whereas their alleged foes experience smaller losses. Canada suffers losses of 0.67%, China 0.64%, Mexico 0.45%, and the average EU country suffers losses of 0.72%.

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

Everybody loses on average because fixed input-output linkages propagate price distortions well beyond the initially targeted bilateral trade flows. This becomes evident as we simulate rises in U.S. tariffs. 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%

These drops in standards of living go hand in hand with stark changes in the real flow of exports and imports that resemble the J-curve effect of exchange rate devaluations, and it is consistent with the short-run response of the U.S. trade balance during the Smoot-Hawley trade war, and the sinew-U.S. trade conflict begun in 2018. U.S. exports in international dollars drop by 2.93%, and imports drop by 4.16%. Imports drop more than exports, because the U.S. is forcing the rest of the world to spend more dollars, and Leontief coefficients are fixed in the short run, as well as the stocks of physical and human capital across countries.

The drop in real exports and imports is equivalent to a U.S. retreat from global trade flows that is rerouted, particularly through Mexico, which increases its exports by 3.53% and imports by 3.02%. Therefore, the trade network absorbs a substantial amount of the trade flows that the U.S. relinquishes, constituting one of the biggest shots to the foot of a country in recent economic history. Our model simulations point to a non-linear amplification of these effects if the U.S. tops China with a 145% unilateral tariff. In such a case, the World's GDP in international dollars drops by 3.38%. These losses are broadly distributed, but concentrated in the U.S., which experiences a 3.78% loss, the largest among everyone in the sample. Canada suffers losses of 3.14%, Mexico 2.40%, and China 2.93%.

Our findings position this 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 1930s 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. Non-retaliators are exposed to a larger change in exports relative to imports. Under a gold standard, non-reciprocated tariffs act as a shock to bilateral nominal exchange rates and produce a J-curve effect. In the very short run, contracts, input complementarities, and delivery lags freeze quantities; therefore, the only margins that can move are prices, which raise the domestic-currency value of imports faster than that of exports.

Another strand revisits tariff incidence, using scanner-level evidence, 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 explores how firms use third-country detours (Bown and Kolb, 2023) to reduce tax incidence. These studies are also consistent with a J-curve effect.

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 the Supplementary material 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 836×836 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.

3 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 on the European Union, which is held constant for the rest of the cases. In scenario (III), the U.S. imposes a 54% tariff on 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 1 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.

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.

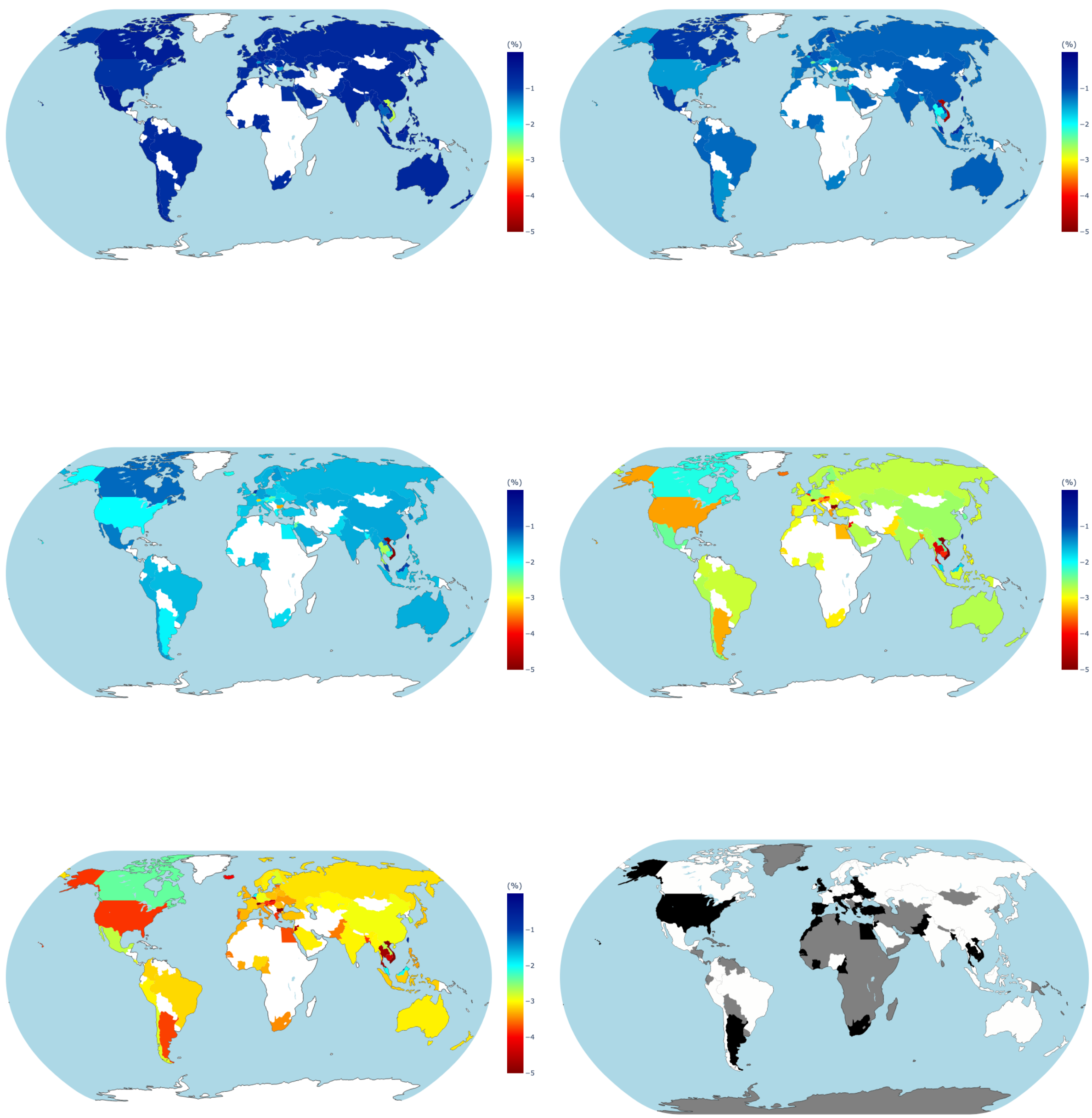
Table 1: GDP growth (%)

	(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 the Supplemental material. Groups of countries are weighted by their relative size in nominal GDP in $US.

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 tariffs rise for Canada, the European Union, Mexico, and particularly for China, color

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 3. 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**.

heterogeneity increases.

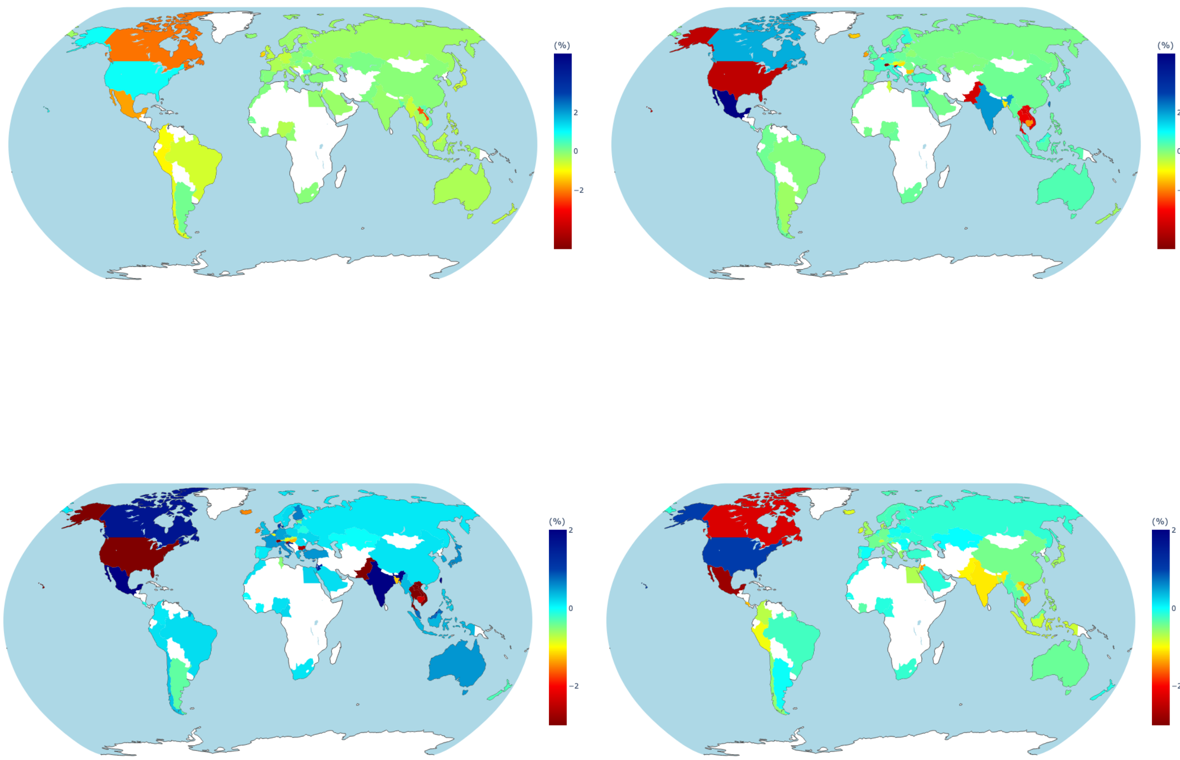
Fajgelbaum et al. (2020) and Caliendo and Parro (2015) find that the first Trump-era tariffs shaved at most 0.4% off U.S. real income, barely half the 0.82% percent contraction we measure under a uniform 15% percent tariff. The gap widens dramatically under escalation: our extreme scenario of a 3.78% 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 lie 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 1 confirms and that Figure 1 visualizes for its spatial dispersion.

Microdata 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. 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

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

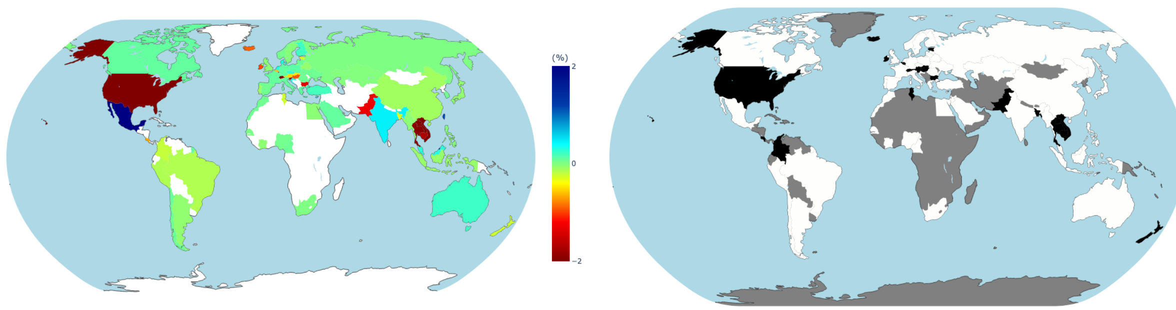


Notes: Figure 2 parses the simulated change in bilateral trade flows under Scenario I. The four world maps are arranged as a 2×2 grid: the **top row** shows *imports* and the **bottom row** *exports*; within each row, the **left panel** records transactions of *intermediate inputs* while the **right 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.

of intermediates, but the import of final goods drops substantially. Conversely, the U.S. exports fewer 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 index, in the first scenario. The trade openness index falls by 2.40% in the U.S.. However,

Figure 3: Trade openness redistribution in scenario I



Notes: Figure 3 reports the simulated change in each country's trade-openness ratio—defined as $(X + M)/\text{GDP}$ 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**.

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.

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.

4 Conclusions

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.

Table 2: The J-curve effect.

	international \$US				nominal \$US	
	m		x		XN	
	(II)	(V)	(II)	(V)	(II)	(V)
United States	-4.16	-11.01	-2.93	-7.74	-5.54	-5.62
China	-0.01	-0.05	-0.27	-0.73	5.46	5.36
Mexico	3.02	4.96	-0.85	-2.40	0.12	0.09
Canada	0.27	0.48	-0.75	-2.23	-0.24	-0.17

Note: Table 2 shows the percent drop in imports m and exports x in international dollars under our benchmark scenario (II) and the most extreme unilateral U.S. tariff policy, with an excise of 145% (V) on China. The last two columns display the change in trade deficit in trillions of nominal U.S. dollars.

These findings complicate the benign view that long-run Armington or Ricardian models offer Ignatenko et al. (2025), 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 poorer in real terms, less open, and with higher deficits, and surrounded by neighbors that trade more, not less.

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