Tariffs as Taxes on Capital

Rubén Domínguez-Díaz[1] Marta Domínguez-Jiménez[2]

José-Elías Gallegos[1] Javier Quintana[1]

[1]Banco de España [2]CEMFI

29 October 2026 | Banca d'Italia

BdI and ECB conference on

Trade, value chains and financial linkages in the global economy

This project received the support of a fellowship from the "la Caixa" Foundation (ID 100010434) fellowship code LCF/BQ/DR23/12000010.

The views expressed are those of the authors and do not necessarily represent the views of the Banco de España, the European Central Bank, or the Eurosystem.

Tariffs and the use of imported goods

What changes when a tariffed good is used to build capital?

Use of the import	Margin directly affected
Consumption	The price of the household consumption basket
Intermediate inputs	The cost of current production
Investment goods	The price of accumulating productive capital

Investment responds through an intertemporal choice, before the capital stock adjusts.

A new international investment database

We build a new database linking capital-goods suppliers to the countries and sectors that invest.

$$\underbrace{s^{I}_{klij}}_{\text{investment sourcing share}}$$

buyer: country k, sector i
supplier: country l, sector j

- **New dimension:** the investing sector, absent from OECD ICIO investment flows.
- **Construction:** national investment accounts and OECD ICIO, linked through 13 asset classes.

Construction

The investment Euler equation

- **Investment choice:** trade off today's cost against future capital income.

$$q^I_{ki,t} \quad U'(C_{k,t}) = \beta\, \mathbb{E}_t\left[U'(C_{k,t+1})\left\{r^K_{ki,t+1} + (1-\delta_{ki})q^I_{ki,t+1}\right\}\right]$$

Notation (P^C: consumption price)

- $q^I = P^I/P^C$: relative investment price.
- $r^K = R/P^C$: real capital rental income.
- δ: depreciation; β: discount factor.
- U': marginal utility.

Investment decision

- Households invest by destination sector.
- Bundles combine domestic and foreign goods.

- **General equilibrium:** returns, demand, prices and monetary policy jointly determine investment.

User cost

The investment Euler equation

- **Investment choice:** trade off today's cost against future capital income.

$$q^I_{ki,t}\, U'(C_{k,t}) = \beta\, \mathbb{E}_t\left[U'(C_{k,t+1})\left\{r^K_{ki,t+1} + (1-\delta_{ki})q^I_{ki,t+1}\right\}\right]$$

Notation (P^C: consumption price)

- $q^I = P^I/P^C$: relative investment price.
- $r^K = R/P^C$: real capital rental income.
- δ: depreciation; β: discount factor.
- U': marginal utility.

Investment decision

- At fixed producer prices and exchange rates, q^I rises when tariffed goods weigh more in investment than consumption.
- Other things equal, this **discourages investment before capital adjusts**.

- **General equilibrium:** returns, demand, prices and monetary policy jointly determine investment.

User cost

The quantitative experiment

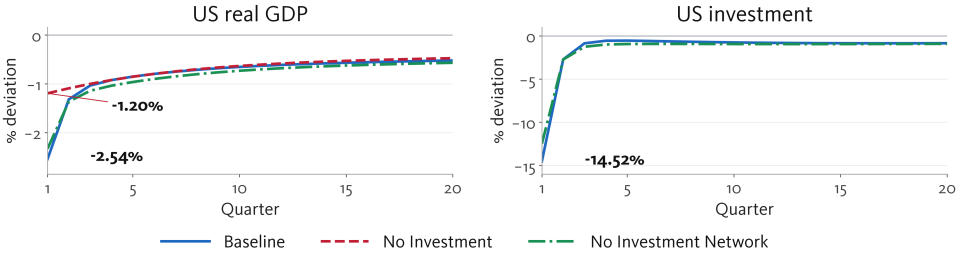
- **Five economies, 44 sectors each.** US, China, Spain, rest of the euro area, and rest of the world.
- **Open-economy New Keynesian model.**
  Sticky prices and wages, sectoral capital, and endogenous monetary policy.
- **Uniform US tariff: +10 pp** on all foreign origins and sectors.
- Quarterly persistence $\rho^{\tau} = 0.99$; no retaliation.

No Investment benchmark: reassign the capital cost share to intermediate inputs, preserving exposure to traded goods, labor shares, and markups.

Counterfactuals Calibration

Capital more than doubles the impact output loss

Responses to a +10 pp uniform US tariff, in percent deviations from steady state.



Impact GDP: -2.54% with capital versus -1.20% without it.
Baseline investment falls 14.52%.

Counterfactuals

Investment exposure predicts output losses

Which exposure best explains the response to a tariff on one sector?

	Univariate R^2		
	Final demand	Intermediate inputs	Investment goods
Real GDP	0.25	0.56	**0.77**
Investment	0.12	0.32	**0.92**
CPI inflation	0.87	0.35	0.26

44 model experiments: a +10 pp US tariff on one sector, across foreign origins. Aggregate US responses are cumulated over 12 quarters.

Exposure measures

Optimizing the composition of a tariff package

Hold the average tariff fixed. Change the goods it falls on.

$$\sum_{s=1}^{44} \omega_s^{\text{IMP}} \tau_s = 10 \text{ pp}, \qquad 0 \leq \tau_s \leq 50 \text{ pp}.$$

- ω_s^{IMP}: sector s's share of steady-state US imports.
- One tariff per sector, applied to all foreign origins.
- **Optimize all 44 tariffs** to minimize cumulative US GDP losses over 12 quarters.
- Common persistence $\rho^{\tau} = 0.99$; no endogenous retaliation.

Constraints and welfare

The optimized package cuts US output losses by 69%

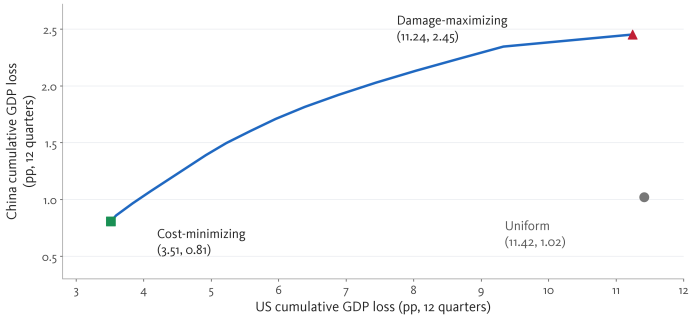
Outcome	Uniform 10 pp	Optimized
US GDP loss	11.42	**3.51**
China GDP loss	1.02	0.81
US CPI inflation	0.87	1.01

Units: sum of the first 12 quarterly responses, in percentage points. GDP losses are positive magnitudes.

- The optimized package sets zero tariffs on capital-goods sectors as well as on key intermediate inputs.
- Higher tariffs on consumer goods bring somewhat more CPI inflation.

Sensitivity

The composition frontier



Same 10 pp import-weighted average tariff. Sectoral wedges between 0 and 50 pp.

In the baseline model, the uniform package lies inside the attainable set.

At no larger US loss, sectoral redesign raises China's loss from **1.02 to 2.45**.

This is a GDP-incidence frontier under fixed policy constraints.

Bilateral instruments

Conclusions

- A new international investment database maps who buys capital goods and where they come from.
- Tariffs on these goods affect investment on impact, through the price of accumulating capital.
- Investment exposure helps explain which tariffs drive output losses.

The composition of a tariff package is central to its aggregate cost. In the model, redesigning the composition of the tariff package cuts the cumulative US output loss by about two-thirds at the same average tariff.

Thank you for your attention!

Investment-matrix construction

1. National accounts identify investment by asset and destination sector.
2. The asset-to-producer bridge maps 13 operational asset classes to OECD ICIO capital-goods flows.
3. Sector investment shares allocate flows across buyers, preserving OECD ICIO capital-goods totals.

$$\sum_{l,j} s^I_{klij} = 1, \qquad \omega^I_{klij} = \chi_{ki} s^I_{klij}, \qquad \sum_{l,j} \omega^I_{klij} = \chi_{ki}.$$

χ_{ki} is investment expenditure relative to destination-sector gross sales. Where sector-by-asset data are missing, country-specific sector size and observed asset totals discipline a projection. These are constructed bilateral sector flows, not direct observations of every buyer-supplier link.

Back

Direct user-cost amplification

Relative investment price, holding producer prices and exchange rates fixed:

$$\widehat{p}^{I}_{ki,t} = (e^{I}_{kis} - FD_{ks})\tau_{ks,t}.$$

Direct expected rental-rate component, holding the real risk-free return fixed:

$$\mathbb{E}_t \widehat{r}_{ki,t+1} = \mathcal{A}_{ki}(\rho^{\tau})(e^{I}_{kis} - FD_{ks})\tau_{ks,t}, \quad \mathcal{A}_{ki}(\rho) = \frac{1-\beta(1-\delta_{ki})\rho}{1-\beta(1-\delta_{ki})}.$$

- e^{I}_{kis}: imported sector-s share of buyer i's investment bundle.
- FD_{ks}: imported sector-s share of household expenditure.
- $\mathcal{A}(1) = 1$; $\mathcal{A}(\rho) > 1$ for $\rho < 1$. Transitory tariffs amplify this direct component.

Back

What the counterfactuals remove

Economy	Capital and investment structure
Baseline	Sector-specific capital stocks and international investment sourcing
No Investment	No physical capital or investment dynamics. Reallocate the capital cost share to intermediates using scaled investment sourcing weights.
No Investment Network	Capital remains. One aggregate investment bundle and stock per country, with static allocation of capital services across sectors ($\nu_K = 1$).

$$\widetilde{\omega}^X_{klij} = \omega^X_{klij} + \frac{\varsigma_{ki}}{\chi_{ki}}\omega^I_{klij} \qquad (\chi_{ki} > 0)$$

ς: capital income share; χ: investment expenditure share. No Investment preserves labor shares and markups.

Experiment Aggregate results

Calibration and monetary policy

Object	Quarterly calibration
Consumption and intermediate flows	2022 OECD ICIO
Investment sourcing and depreciation	Constructed matrix and asset-specific EU KLEMS rates
Discount factor / tariff persistence	$\beta = 0.99$ / $\rho^{\tau} = 0.99$
Capital-labor-intermediate substitution	$\psi = 0.5$
Investment substitution across sectors	0.2 (within energy / non-energy nests)
Origin substitution within sector	1
Taylor rule	Smoothing 0.7, inflation 1.5, real GDP 0.125

Sticky prices and wages. Spain and the rest of the euro area share monetary policy and a fixed internal exchange rate.

Back

Exposure definitions

$$FD_{ks} = \frac{\sum_{l \neq k} \beta^C_{kls}}{\sum_l \sum_j \beta^C_{klj}}, \qquad IO_{ks} = \sum_{l \neq k} \sum_i \lambda_{ki} \omega^X_{klis}, \qquad KI_{ks} = \sum_{l \neq k} \sum_i \lambda_{ki} \omega^I_{klis}.$$

- FD: consumption expenditure share on imported sector-s goods.
- IO and KI: Domar-weighted intermediate-input and investment purchases from imported sector s.
- λ_{ki}: sector gross sales relative to country GDP. ω^X and ω^I: purchases relative to buyer gross sales.

Across 44 tariffed-sector experiments, R^2 measures explanatory power within the model.

Back

Policy constraints and welfare

- **GDP objective:** the sum of 12 quarterly percent deviations. It does not deliver a consumption-equivalent welfare ranking.
- **Fixed average tariff:** 10 pp at steady-state import weights; revenue and distortions may change.
- **Instrument limits:** 25, 50 and 100 pp caps cut US losses by 50%, 69% and 77%, respectively.
- **Retaliation:** no endogenous foreign policy response. The frontier is not a strategic equilibrium.

The alternative stabilization objective is reduced-form.

Design Composition results

Bilateral tariff composition

12-quarter cumulative GDP losses (pp), shown as positive magnitudes.

Package	US loss	China loss	EA loss
Uniform	11.42	1.02	2.62
Cost-minimizing	3.51	0.81	2.62
Damage-maximizing, sectoral	11.24	2.45	1.17
Damage-maximizing, bilateral	11.42	5.63	1.46
Spillover-constrained, bilateral	11.42	5.63	0.65

All packages: 10 pp import-weighted average and 50 pp cap.

- 44 sectoral instruments or 176 origin-sector instruments.
- Damage maximization keeps US GDP loss no higher than the uniform benchmark.
- The spillover constraint caps the EA loss at one-quarter of its uniform loss.

Back