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The third-country effects of trade wars

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Abstract

We study how trade wars propagate to countries that are not directly targeted. We develop a three-country New Keynesian model with trade in final and intermediate goods, incomplete asset markets, and asymmetric monetary regimes, and quantify the spillovers of the 2025 U.S.-China tariff escalation to the euro area. A bilateral U.S.-China trade war generates large and asymmetric welfare losses for the U.S. and China, while the euro area benefits temporarily from trade diversion. Once tariffs extend to euro-area goods, third-country welfare flips into losses and the Chinese downturn deepens. Welfare-maximizing retaliatory tariffs by the euro area deliver only modest domestic improvements, at the cost of large additional losses for the U.S. and China. Overall, the global incidence of trade policy is *intrinsically* multilateral: third-country gains under bilateral protectionism are short-lived, reverse once protection broadens, and cannot be inferred from two-country analysis.

Keywords: Protectionism, Trade Wars, Third-country effects.

JEL Classifications: F30, F40, F41.

Non-technical summary

Trade tensions between large economies have implications beyond the countries directly involved. When the United States and China raise tariffs on each other, economies that trade intensively with both – such as the euro area – are inevitably affected. Whether such third countries benefit from trade diversion or instead suffer from weaker global demand, tighter financial conditions and adverse price movements is a quantitative question.

This paper studies how tariff escalations between the United States and China propagate to a third economy. We focus on the 2025 U.S.-China tariff escalation, which raised average U.S. tariffs on Chinese goods by almost 37 percentage points and Chinese tariffs on U.S. goods by around 11 percentage points with wide coverage. We examine how these measures affect the euro area, how outcomes change if tariffs are extended to euro-area goods, and what constitutes a welfare-maximizing response for the euro area.

To this end, we develop and quantify a three-country macroeconomic model with trade in final and intermediate goods, capital accumulation, nominal rigidities and incomplete international financial markets. The framework incorporates exchange-rate adjustments, differences in monetary policy regimes and the interaction between tariffs, production costs and inflation. It is calibrated to match key trade patterns and macroeconomic features of the United States, the euro area and China.

Three main results emerge. First, a bilateral U.S.-China trade war generates large and asymmetric welfare losses for the two protagonists. Output, investment and consumption decline persistently in both economies. Inflation rises temporarily in the United States due to tariff pass-through and relative price adjustments, while in China the partial exchange-rate stabilization objective induces a contractionary monetary response, leading to persistent disinflation and a deeper real contraction. The euro area is only marginally affected in the short run and may experience small temporary gains as demand is redirected toward its producers, although these gains fade as global demand weakens.

Second, third-country gains are fragile. Once tariffs extend to euro-area goods, the euro area's welfare turns negative and output contracts as the cushioning effect from trade diversion disappears. China's downturn deepens further, while the United States records only limited additional welfare improvements through tariff revenues and terms-of-trade effects.

Third, we analyze the euro area's welfare-maximizing tariff response. While optimal retaliatory tariffs can generate moderate domestic welfare gains, they do so mainly by reallocating demand across countries and increasing global losses, and they entail a non-negligible short-run contraction in domestic output.

Overall, third-country benefits from bilateral trade wars are temporary and contingent on remaining outside the protectionist perimeter. Once tariffs broaden, global welfare losses dominate, and the macroeconomic effects for open economies depend not only on direct trade exposures but also on exchange-rate regimes, financial linkages and strategic policy interactions.

1 Introduction

Trade wars between systemic economies have major consequences not only for the protagonists but also for countries that are not directly targeted. This paper asks: how do tariff escalations between the United States (U.S.) and China affect third countries that trade intensively with both? More broadly, are such countries genuine beneficiaries of trade diversion, or instead hidden victims of weaker global demand, tighter monetary conditions, and adverse price dynamics?

The question is timely. In November 2025, according to the Peterson Institute for International Economics, the U.S. raised tariffs on Chinese imports by 36.8 percentage points – from an average of 20.7% to 57.6% – while China increased tariffs on U.S. goods by 11.4 percentage points – from 21.2% to 32.6%. These actions effectively extended tariff coverage to nearly all bilateral trade flows, marking one of the most significant episodes of protectionism in recent decades.

While much of the literature emphasizes the direct costs for the U.S. and China, international transmission to third economies remains comparatively underexplored. Yet these spillovers are economically central: they determine whether third countries can temporarily absorb diverted trade flows, or instead suffer from a broad contraction in activity and disinflationary or inflationary pressures.

We address this question in a three-country New Keynesian model with monopolistic competition, Rotemberg price adjustment costs, capital accumulation with investment frictions, and international trade in both final and intermediate goods. Financial markets are incomplete and asymmetric: U.S. residents trade only domestic bonds, while the euro area (EA, our baseline third country) and China can also hold U.S. bonds subject to portfolio adjustment costs. Tariffs are bilateral and *ad valorem*; pricing is in producer currency. Monetary policy follows country-specific Taylor-type rules, with China combining interest-rate stabilization and exchange-rate targeting as in Auray, Devereux, and Eyquem (2025a).

We conduct three sets of experiments. First, we quantify the macroeconomic and welfare effects of the 2025 U.S.-China tariff escalation. Second, we consider counterfactual extensions in which the U.S. also imposes tariffs on euro-area (EA) goods. Third, we evaluate the EA's welfare-maximizing retaliatory response. Three quantitative patterns emerge.

First, the 2025 U.S.-China tariff escalation produces a deep and asymmetric contraction. The U.S. faces the largest welfare losses (around –1.5% of steady-state consumption on impact); China experiences significant losses too (about –1.2%); but the EA is only marginally affected, owing to trade diversion. The shock raises quarterly CPI inflation in both the EA and the U.S. by 0.2 and 0.5 percentage points respectively (roughly 0.8–2 percentage points at an annual rate), while China experiences persistent deflation as its exchange-rate objective forces a contractionary monetary stance. We also show running a counterfactual two-country experiement that the presence of a third trading partner substantially attenuates the macroeconomic costs of bilateral protectionism. When the euro area is removed from the model, the U.S.-China trade war becomes significantly more contractionary and much more costly for both economies, highlighting the stabilizing role played by third-country trade diversion.

Second, the EA's buffering role is fragile. Once the U.S. extends tariffs to EA goods, third-country welfare flips into clear losses and the EA experiences a contraction in activity. China's downturn deepens, while U.S. welfare improves only slightly through terms-of-trade gains and tariff-revenue rebates. In this environment, welfare-maximizing EA retaliation implies large tariff hikes, but delivers limited domestic welfare gains while significantly worsening welfare in the U.S. and China.

Third, the experiments highlight a robust multilateral mechanism. Third-country gains under bilateral trade wars are an artefact of trade diversion and reverse once protection becomes multilateral. The same forces that initially benefit the EA – trade reallocation, higher external demand, and relative-price improvements – are overturned when the EA becomes directly targeted. This reversal is large, nonlinear, and cannot be inferred from the bilateral logic of standard two-country models.

Our contribution is threefold. First, we provide a tractable three-country framework that embeds the mechanisms needed to capture third-country spillovers from tariff wars – final- and intermediate-goods trade, incomplete asset markets, and CPI-PPI wedges. Second, we show how a three-country environment reshapes both the welfare effects of bilateral trade wars and the welfare-maximizing tariff response of a non-targeted economy. Third, we demonstrate that multilateral interactions affect the incidence of trade wars: welfare responses, optimal tariffs, and price dynamics differ in magnitude, and sometimes in sign, from those predicted by two-country models.

The remainder of the paper is organized as follows. Section 2 reviews the related literature. Section 3 presents the model. Section 4 discusses the baseline calibration and analyzes the effects of the 2025 U.S.-China tariff escalation as well as an extension in which the U.S. imposes tariffs on EA goods, including a decomposition of the marginal effects of this shock. Section 5 characterizes the EA's welfare-maximizing tariff policy and its dynamics. Section 6 discusses the numerical results. Section 7 concludes.

2 Literature Review

A large literature examines the macroeconomic effects of trade policy. In open-economy DSGE frameworks, protectionist measures typically depress activity and reallocate expenditure across sources through relative-price adjustments. Barattieri, Cacciatore, and Ghironi (2021) study a small open economy with endogenous tradability and firm entry and show that model-implied responses align with evidence from past protectionist episodes. In multi-country environments with tariffs and export subsidies, Erceg, Prestipino, and Raffo (2023) emphasize the role of real exchange-rate movements and expectations of retaliation. Using cross-country data, Furceri et al. (2018) document that tariff increases are systematically contractionary. Lindé and

Pescatori (2019) characterizes conditions under which Lerner symmetry holds and shows how deviations in pass-through and substitution shape aggregate outcomes.

A complementary literature studies interactions between tariff policy and monetary stabilization. Bergin and Corsetti (2020) analyze how monetary policy shapes comparative advantage when tariffs are present; in a subsequent quantitative framework with intermediate inputs and firm entry, Bergin and Corsetti (2023) show that expansionary monetary responses can offset the deflationary impulse of tariff hikes. In dynamic New Keynesian settings, Auclert, Rognlie, and Straub (2025) show that recession-induced import compression can temporarily improve the trade balance, with aggregate effects highly sensitive to trade and intertemporal elasticities. Bianchi and Coulibaly (2025) and Monacelli (2025) derive optimal monetary responses and find that accommodation mitigates the contraction in activity. Our focus differs: rather than characterizing optimal policy, we provide a fully dynamic three-country evaluation of tariff shocks under incomplete asset markets, capital accumulation, and empirically disciplined monetary rules.

Distributional and external-balance considerations also feature prominently in recent contributions. Itskhoki and Mukhin (2025) show that the welfare effects of tariffs depend on a country's net foreign asset position through valuation channels interacting with the terms of trade, and Auray, Devereux, and Eyquem (2025b) highlight related spillovers through financial linkages. These mechanisms are particularly relevant when tariff changes originate in large economies, since movements in relative prices, external positions, and exchange rates transmit to trade partners through both final and intermediate goods markets.

A growing empirical and quantitative literature revisits trade elasticities and adjustment dynamics. Boehm, Levchenko, and Pandalai-Nayar (2023) estimate substantially lower short-run than long-run trade elasticities, and Chen et al. (2024) attribute persistent quantity responses to sluggish supplier reallocation. These findings motivate our emphasis on transitional dynamics in a three-country model with intermediate inputs and investment adjustment costs.

Recent work quantifies the consequences of the 2025 U.S. tariff episode. Rodríguez-Clare, Tintelnot, and Traiberman (2025) examine regional outcomes in a model with nominal rigidities and report short-run gains in manufacturing employment alongside aggregate income losses and sizable cross-state heterogeneity. Ignatenko et al. (2025) study a global environment with retaliation and find that unilateral tariff-revenue gains are short-lived once partners respond. Earlier contributions on country size, coordination failures, and agreement formation (Limao and Saggi, 2013) provide a theoretical basis for understanding how trade policies by large economies propagate to third countries.

3 Model

We study a three-country economy $k \in \{\text{us}, \text{ea}, \text{cn}\}$ with capital accumulation, monopolistic competition, Rotemberg price adjustment costs, bilateral *ad valorem* tariffs, and trade in both final and intermediate goods. Financial-market access is asymmetric: U.S. households trade only a domestic bond, whereas EA and Chinese (CN) households can also hold U.S. bonds subject to portfolio adjustment costs.

Prices and exchange rates are defined as follows. $P^{\text{ppi}}_{k,t}$ denotes the producer price index in country k, and $P_{k,t}$ denotes the CPI. Let $S^{k,i}_t$ be the nominal exchange rate (units of currency k per unit of currency i). The CPI-PPI relative price is:

$$\mathcal{P}_{k,t} \equiv \frac{P_{k,t}}{P^{\text{ppi}}_{k,t}}. \tag{1}$$

Further, for any origin i and destination k, the bilateral real relative price based on PPIs is:

$$\mathcal{S}_{i\to k,t} \equiv \frac{S^{k,i}_t P^{\text{ppi}}_{i,t}}{P^{\text{ppi}}_{k,t}}. \tag{2}$$

We also define the intermediate-input price index in country k, $P_{x,k,t}$, and its relative value to the domestic PPI:

$$\mathcal{P}_{x,k,t} \equiv \frac{P_{x,k,t}}{P^{\text{ppi}}_{k,t}}. \tag{3}$$

The nominal rental rate of capital is Z^k_t.

3.1 Households

Preferences. A representative household in country k has CRRA utility over consumption and disutility from labor:

$$\mathbb{E}_t \sum_{s\geq 0} \beta^s \left[\frac{(C^k_{t+s})^{1-\sigma}}{1-\sigma} - \chi \frac{(H^k_{t+s})^{1+\psi}}{1+\psi} \right], \qquad \lambda^k_t \equiv (C^k_t)^{-\sigma}. \tag{4}$$

Final-good aggregation and price index. Households consume and invest a CES composite of final goods sourced from the three origins. Let $C^k_{i,t}$ denote the quantity of final goods from origin i absorbed in country k for consumption purposes, and $I^k_{i,t}$ the analogous quantity used for investment. The CES aggregators are

$$C^k_t = \left[\gamma_{k,k} (C^k_{k,t})^{\frac{\lambda-1}{\lambda}} + \sum_{i=k} \gamma_{i,k} (C^k_{i,t})^{\frac{\lambda-1}{\lambda}} \right]^{\frac{\lambda}{\lambda-1}}, \qquad I^k_t = \left[\gamma_{k,k} (I^k_{k,t})^{\frac{\lambda-1}{\lambda}} + \sum_{i=k} \gamma_{i,k} (I^k_{i,t})^{\frac{\lambda-1}{\lambda}} \right]^{\frac{\lambda}{\lambda-1}}, \tag{5}$$

where $\lambda > 1$ is the elasticity of substitution and $\{\gamma_{i,k}\}$ are origin-specific weights satisfying $\gamma_{k,k} + \sum_{i=k} \gamma_{i,k} = 1$. We parameterize these weights as:

$$\gamma_{k,k} = n_k + x_k(1-n_k), \qquad \gamma_{i,k} = (1-x_k)(1-n_k)\omega_i \qquad \text{for } i = k, \qquad \sum_{i=k} \omega_i = 1. \tag{6}$$

Relative to Auray, Devereux, and Eyquem (2025a), the parameters ω_i allow for origin-specific import composition within total foreign absorption in destination k. Let $\tau_{k,i,t}$ denote the tariff imposed by destination k on imports from origin i. The consumer price index (CPI) consistent with bundles defined in Equation (5) is:

$$P_{k,t} = \left[\gamma_{k,k} (P_{k,t}^{\text{ppi}})^{1-\lambda} + \sum_{i=k} \gamma_{i,k} \left((1 + \tau_{k,i,t}) S_t^{k,i} P_{i,t}^{\text{ppi}} \right)^{1-\lambda} \right]^{\frac{1}{1-\lambda}}. \tag{7}$$

Thus, tariffs enter the CPI by raising tariff-inclusive import prices, shifting expenditure across origins, and moving the CPI-PPI wedge $\mathcal{P}_{k,t}$.

Final-good demands. Cost minimization implies that, for any final use $Y_t^k \in \{C_t^k, I_t^k\}$ and corresponding origin-specific components $Y_{i,t}^k \in \{C_{i,t}^k, I_{i,t}^k\}$,

$$Y_{k,t}^k = \gamma_{k,k} \left(\frac{P_{k,t}^{\text{ppi}}}{P_{k,t}} \right)^{-\lambda} Y_t^k, \qquad Y_{i,t}^k = \gamma_{i,k} \left(\frac{(1 + \tau_{k,i,t}) S_t^{k,i} P_{i,t}^{\text{ppi}}}{P_{k,t}} \right)^{-\lambda} Y_t^k \quad \text{for } i = k. \tag{8}$$

It is more convenient to express these demands in PPI-relative terms using $\mathcal{P}_{k,t}$ and $\mathcal{S}_{i\to k,t}$. Since $P_{k,t} = \mathcal{P}_{k,t} P_{k,t}^{\text{ppi}}$ and $(1 + \tau_{k,i,t}) S_t^{k,i} P_{i,t}^{\text{ppi}} = (1 + \tau_{k,i,t}) \mathcal{S}_{i\to k,t} P_{k,t}^{\text{ppi}}$, demands in Equation (8) become:

$$Y_{k,t}^k = \gamma_{k,k} (\mathcal{P}_{k,t})^{\lambda} Y_t^k, \qquad Y_{i,t}^k = \gamma_{i,k} \left(\frac{\mathcal{P}_{k,t}}{(1 + \tau_{k,i,t}) \mathcal{S}_{i\to k,t}} \right)^{\lambda} Y_t^k \quad \text{for } i = k. \tag{9}$$

Capital accumulation. Capital evolves subject to convex investment adjustment costs:

$$K_t^k = (1 - \delta) K_{t-1}^k + I_t^k \left(1 - \frac{\varphi}{2} \left(\frac{I_t^k}{I_{t-1}^k} - 1 \right)^2 \right). \tag{10}$$

Budget constraints and asset market access. Households trade a domestic one-period bond B_t^k and, when permitted, a U.S. bond $B_t^{k,\text{us}}$. Access is governed by:

$$\kappa_k^{\text{us}} = \mathbf{1}\{k \in \{\text{ea}, \text{cn}\}\}, \qquad \nu_k \geq 0, \qquad \nu_{\text{us}} = 0. \tag{11}$$

Define real net foreign assets (in CPI units of country k) as:

$$f_t^{k,\text{us}} \equiv \frac{S_t^{k,\text{us}} B_t^{k,\text{us}}}{P_{k,t}}. \tag{12}$$

When $\kappa_k^{\text{us}} = 1$, holding U.S. bonds entails a quadratic portfolio cost paid in units of the domestic consumption basket:

$$\Lambda_t^{k,f} \equiv \frac{\nu_k}{2} \left(f_t^{k,\text{us}} - \bar{f}^{k,\text{us}} \right)^2, \qquad \Lambda_t^{\text{us},f} = 0. \tag{13}$$

The nominal budget constraint is then:

$$B_t^k + \kappa_k^{\text{us}} S_t^{k,\text{us}} B_t^{k,\text{us}} + P_{k,t}(C_t^k + I_t^k + \kappa_k^{\text{us}} \Lambda_t^{k,f}) \\ = B_{t-1}^k R_{t-1}^k + \kappa_k^{\text{us}} S_t^{k,\text{us}} B_{t-1}^{k,\text{us}} R_{t-1}^{\text{us}} + Z_t^k K_{t-1}^k + W_t^k H_t^k + \Pi_t^k + TR_t^k. \tag{14}$$

This formulation is consistent with the definition of C_t^k and I_t^k as CES composites priced at $P_{k,t}$. Tariff revenues are rebated lump-sum to households in the destination country and included in transfers TR_t^k.

Optimality conditions. The domestic Euler equation is:

$$1 = \beta \mathbb{E}_t \left[\frac{\lambda_{t+1}^k}{\lambda_t^k} \frac{R_t^k}{\pi_{t+1}^k} \right], \qquad \pi_{t+1}^k \equiv \frac{P_{k,t+1}}{P_{k,t}}. \tag{15}$$

For countries with access to the U.S. bond, the foreign-bond Euler equation is:

$$1 + \nu_k \left(f_t^{k,\text{us}} - \bar{f}^{k,\text{us}} \right) = \beta \mathbb{E}_t \left[\frac{\lambda_{t+1}^k}{\lambda_t^k} \frac{S_{t+1}^{k,\text{us}}}{S_t^{k,\text{us}}} \frac{R_t^{\text{us}}}{\pi_{t+1}^k} \right] \quad \text{if } \kappa_k^{\text{us}} = 1. \tag{16}$$

The portfolio wedge disciplines external positions and dampens exchange-rate movements under incomplete markets. Labor supply satisfies:

$$\chi (H_t^k)^\psi = (C_t^k)^{-\sigma} \frac{W_t^k}{P_{k,t}}. \tag{17}$$

Tariffs affect this margin through changes in the CPI and therefore in the real wage $W_t^k / P_{k,t}$ and the perceived purchasing power of income.

Investment is governed by q-theory. Let q_t^k denote Tobin's q in units of the consumption basket. The Euler equation for q_t^k is:

$$q_t^k = \mathbb{E}_t \left[\frac{\lambda_{t+1}^k}{\lambda_t^k} \frac{Z_{t+1}^k}{P_{k,t+1}} + q_{t+1}^k (1 - \delta) \right]. \tag{18}$$

Define investment growth $d_t^k \equiv I_t^k / I_{t-1}^k - 1$. The first-order condition associated with the adjustment cost in Equation (10) is:

$$q_t^k \left(1 - \frac{\varphi}{2} (d_t^k)^2 - \varphi d_t^k (1 + d_t^k) \right) = 1 - \beta \mathbb{E}_t \left[\frac{\lambda_{t+1}^k}{\lambda_t^k} q_{t+1}^k \varphi d_{t+1}^k (1 + d_{t+1}^k)^2 \right]. \tag{19}$$

Tariffs increase the relative price of imported investment goods inside $P_{k,t}$, lowering the effective return to investment and, through Equations (18)-(19), reducing capital accumulation.

Stochastic discount factors. Households discount CPI-denominated payoffs, whereas firms' revenues and costs are naturally expressed in PPI units. We therefore define the stochastic discount factor that prices one unit of domestic producer value in period t relative to period $t-1$ as:

$$\mathcal{M}_{k,t} = \beta \frac{\lambda_t^k \mathcal{P}_{k,t-1}}{\lambda_{t-1}^k \mathcal{P}_{k,t}}. \tag{20}$$

3.2 Firms

In each country, a measure n_k of monopolistically competitive firms produces differentiated varieties. A firm in country k produces variety ω with technology:

$$Y_t^k(\omega) = A_t^k \left[K_{t-1}^k(\omega)^\alpha H_t^k(\omega)^{1-\alpha} \right]^{1-\eta} X_t^k(\omega)^\eta, \tag{21}$$

where $X_t^k(\omega)$ is a CES composite of domestic and imported intermediate inputs.

Intermediate-input aggregation and price index. Let $X_{j,t}^k$ denote the quantity of intermediate inputs from origin j used by producers in country k. The CES aggregator is:

$$X_t^k = \left[\gamma_{x,k,k} (X_{k,t}^k)^{\frac{\lambda-1}{\lambda}} + \sum_{j=k} \gamma_{x,j,k} (X_{j,t}^k)^{\frac{\lambda-1}{\lambda}} \right]^{\frac{\lambda}{\lambda-1}}. \tag{22}$$

The corresponding intermediate-input price index in currency k is:

$$P_{x,k,t} = \left[\gamma_{x,k,k} (P_{k,t}^{\text{ppi}})^{1-\lambda} + \sum_{j=k} \gamma_{x,j,k} \left((1+\tau_{k,j,t}) S_t^{k,j} P_{j,t}^{\text{ppi}} \right)^{1-\lambda} \right]^{\frac{1}{1-\lambda}}. \tag{23}$$

Define $\mathcal{P}_{x,k,t} \equiv P_{x,k,t} / P_{k,t}^{\text{ppi}}$. The implied intermediate-input demands are:

$$X_{k,t}^k = \gamma_{x,k,k} (\mathcal{P}_{x,k,t})^\lambda X_t^k, \qquad X_{j,t}^k = \gamma_{x,j,k} \left(\frac{\mathcal{P}_{x,k,t}}{(1+\tau_{k,j,t}) \mathcal{S}_{j\to k,t}} \right)^\lambda X_t^k \quad \text{for } j = k. \tag{24}$$

Tariffs on imported inputs raise $P_{x,k,t}$ relative to $P_{k,t}^{\text{ppi}}$, increasing marginal costs and generating a cost-push channel for inflation.

Price setting. Let $MC_t^k(\omega)$ denote nominal marginal cost in currency k, and $\Pi_t^k(\omega) = [P_{k,t}^{\text{ppi}}(\omega) - MC_t^k(\omega)] Y_t^k(\omega)$ denote nominal operating profits. Each firm chooses its producer price subject to Rotemberg adjustment costs:

$$\max_{\{P_{k,t+j}^{\text{ppi}}(\omega)\}_{j\geq 0}} \mathbb{E}_t \sum_{j\geq 0} \mathcal{M}_{k,t+j} \left[\frac{\Pi_{t+j}^k(\omega)}{P_{k,t+j}^{\text{ppi}}} - \frac{\phi}{2} \left(\frac{P_{k,t+j}^{\text{ppi}}(\omega)}{P_{k,t+j-1}^{\text{ppi}}(\omega)} - 1 \right)^2 Y_{t+j}^k \right]. \tag{25}$$

Cost minimization over inputs implies the variable input conditions (in producer units):

$$\frac{Z_t^k}{MC_t^k} = (1-\eta)\alpha\frac{Y_t^k}{K_{t-1}^k}, \qquad \frac{W_t^k}{MC_t^k} = (1-\eta)(1-\alpha)\frac{Y_t^k}{H_t^k}, \qquad \frac{P_{x,k,t}}{MC_t^k} = \eta\frac{Y_t^k}{X_t^k}. \tag{26}$$

Under symmetry, letting $\pi_{k,t}^{\text{ppi}} \equiv P_{k,t}^{\text{ppi}}/P_{k,t-1}^{\text{ppi}}$ and $mc_t^k \equiv MC_t^k/P_{k,t}^{\text{ppi}}$, the price-setting condition yields a New Keynesian Phillips curve:

$$\epsilon(1-mc_t^k) = 1-\phi(\pi_{k,t}^{\text{ppi}}-1)\pi_{k,t}^{\text{ppi}} + \mathbb{E}_t\mathcal{M}_{k,t+1}\phi(\pi_{k,t+1}^{\text{ppi}}-1)\pi_{k,t+1}^{\text{ppi}}Y_{t+1}^k/Y_t^k. \tag{27}$$

An increase in input tariffs raises $P_{x,k,t}$ and therefore mc_t^k, putting upward pressure on desired producer-price inflation.

3.3 Trade, aggregation, and market clearing

Absorption and import definitions. Final absorption in destination k is

$$Y_t^k \equiv C_t^k + I_t^k + \Lambda_t^{k,f}, \tag{28}$$

where $\Lambda_t^{k,f}$ is defined in Equation (13). Using Equations (9) and (24), bilateral imports into destination j from origin $k = j$ (combining final and intermediate uses) are:

$$M_{j\leftarrow k,t} = \gamma_{k,j}\left(\frac{\mathcal{P}_{j,t}}{(1+\tau_{j,k,t})\mathcal{S}_{k\to j,t}}\right)^{\lambda}(C_t^j+I_t^j) + \gamma_{x,k,j}\left(\frac{\mathcal{P}_{x,j,t}}{(1+\tau_{j,k,t})\mathcal{S}_{k\to j,t}}\right)^{\lambda}X_t^j. \tag{29}$$

Similarly, the domestic absorption of origin-k goods (final and intermediate) is given by:

$$D_t^k = \gamma_{k,k}(\mathcal{P}_{k,t})^{\lambda}(C_t^k+I_t^k) + \gamma_{x,k,k}(\mathcal{P}_{x,k,t})^{\lambda}X_t^k. \tag{30}$$

These expressions make transparent why the wedges $\mathcal{P}_{j,t}$ and $\mathcal{P}_{x,j,t}$ matter: they convert tariff-inclusive import prices expressed relative to the domestic PPI into CPI- and input-price-relative demand shifters.

Goods-market clearing. Let $Y_{k,t}$ denote output per firm in country k under symmetry. Goods-market clearing for origin k is

$$n_kY_{k,t}\left(1-\frac{\phi}{2}(\pi_{k,t}^{\text{ppi}}-1)^2\right) = n_kD_t^k + \sum_{j=k} n_jM_{j\leftarrow k,t}. \tag{31}$$

Tariffs affect equilibrium allocations through three distinct mechanisms. First, by changing tariff-inclusive relative prices in final-good demand, they generate expenditure switching across origins and move the CPI-PPI wedge, which feeds into household real wages, wealth, and intertemporal choices. Second, the rebated income increases consumption through a standard wealth effect. Third, by changing the intermediate-input price index relative to the PPI, they shift marginal costs and hence producer-price inflation through (27).

3.4 International asset markets and UIP

Combining the EA/CN foreign-bond Euler Equation (16) with the U.S. domestic Euler Equation (15) yields a risk-adjusted UIP condition for each country with access to the U.S. bond:

$$1 = \mathbb{E}_t \left[\frac{\mathcal{M}_{k,t+1}}{\mathcal{M}_{\text{us},t+1}} \frac{\mathcal{S}_{\text{us}\to k,t+1}}{\mathcal{S}_{\text{us}\to k,t}[1+\nu_k(f_t^{k,\text{us}} - \bar{f}^{k,\text{us}})]} \right], \qquad k \in \{\text{ea}, \text{cn}\}. \tag{32}$$

Portfolio costs act as a state-dependent wedge that forces external positions back toward $\bar{f}^{k,\text{us}}$ and reduces exchange-rate volatility under incomplete markets. The U.S. bond market clears in nominal units:

$$n_{\text{us}} B_t^{\text{us}} + n_{\text{ea}} B_t^{\text{ea,us}} + n_{\text{cn}} B_t^{\text{cn,us}} = 0. \tag{33}$$

3.5 Monetary policy

The U.S. and the EA follow inertial Taylor rules:

$$\log(\beta R_t^k) = \rho_r \log(\beta R_{t-1}^k) + (1-\rho_r) \left[\mu \log(\pi_t^k) + d_y \log\left(Y_t^k / Y_{t-1}^k \right) \right], \qquad k \in \{\text{us}, \text{ea}\}. \tag{34}$$

Further, as in Auray, Devereux, and Eyquem (2025a), China partly stabilizes the U.S./CN nominal exchange rate. Let $\omega_p \in [0,1]$ be the weight on the peg component, the monetary policy satisfies:

$$\omega_p \left[\frac{\mathcal{S}_{\text{us}\to\text{cn},t-1}}{\mathcal{S}_{\text{us}\to\text{cn},t}} - \frac{\pi_t^{\text{cn}}}{\pi_t^{\text{us}}} \right] + (1-\omega_p) \left[\beta R_t^{\text{cn}} - \beta (R_{t-1}^{\text{cn}})^{\rho_r} \left((\pi_t^{\text{cn}})^{\mu} \left(\frac{Y_t^{\text{cn}}}{Y_{t-1}^{\text{cn}}} \right)^{d_y} \right)^{1-\rho_r} \right] = 0. \tag{35}$$

The first term targets the nominal U.S./CN exchange rate adjusted for relative inflation, while the second term converges to a standard Taylor rule as $\omega_p \to 0$.

3.6 Discussion

The model features three layers of wedges that are central for interpreting tariff spillovers. The CPI–PPI wedge $\mathcal{P}_{k,t}$ links the household's consumption basket to domestic producer prices; it shapes real wages, wealth, and intertemporal decisions, and it appears directly in final-good demand (9). The intermediate-input wedge $\mathcal{P}_{x,k,t}$ governs production costs and marginal costs, and it therefore drives the cost-push component of producer-price inflation through (27). Finally, portfolio costs generate wedges in international Euler equations (16) and the resulting UIP conditions (32), limiting risk sharing and moderating exchange-rate adjustments.

Tariffs operate through three different channels. On the demand side, tariff-inclusive relative prices move expenditure across origins in both consumption and investment. Second, when the tariff-setting country is large these reallocations interact with terms-of-trade movements and tariff-revenue rebates. Third, on the supply side, tariffs on imported intermediates increase $P_{x,k,t}$ relative to $P_{k,t}^{\text{ppi}}$, raising marginal costs and inflation pressure in producer prices. Monetary policy responds to CPI inflation and output growth in the U.S. and EA, and to a combination of domestic stabilization and exchange-rate objectives in China, so tariff-induced price movements translate into regime-specific interest-rate adjustments that shape the cross-country propagation of the shock.

4 Baseline

4.1 Calibration

We calibrate the quarterly model to match standard open-economy macro moments and documented features of trade across the United States (U.S.), the euro area (EA), and China (CN). Table 2 summarizes parameter definitions, values, and targets/sources.

Preferences and technology. We set the discount factor to $\beta = 0.99$, delivering a steady-state real interest rate near 4% p.a. in line with baseline NK calibrations. Risk aversion is $\sigma = 1.5$, a standard value in international NK models; the Frisch curvature $\psi = 2.5$ implies a Frisch elasticity of 0.4, consistent with micro-macro syntheses surveyed in Chetty et al. (2011). The capital share $\alpha = 0.36$ and depreciation rate of capital $\delta = 0.025$ are conventional quarterly values. Investment adjustment costs $\varphi = 2.75$ are chosen to produce plausible investment dynamics in the presence of sticky prices.

Final output uses an intermediate bundle with share $\eta = 0.40$, consistent with Bergin and Corsetti (2023). The elasticity among differentiated varieties is set to $\epsilon = 6$, implying a 20% steady-state gross markup, a common choice in NK models with Rotemberg frictions. The Rotemberg parameter $\phi = 100$ governs the slope of the Phillips curve and implies a 0.06 slope of the linearized curve.

Monetary policy. For the U.S. and EA Taylor rules, we use $\rho_r = 0.8$, $\mu = 1.5$, and $d_y = 0$ – canonical values in the international monetary policy literature. For China, we allow a managed float by setting the peg weight to $\omega_p = 0.15$, somewhat lower than estimated by Auray, Devereux, and Eyquem (2025a), to reflect lower nominal exchange rate stabilization concerns over the recent period.

Trade elasticities and home bias. We set the Armington elasticity across origins to $\lambda = 5$, within the range of long-run trade elasticities estimated by Feenstra et al. (2018), or Imbs and Méjean (2017). Using bilateral trade data for the year 2023, we calibrate the origin-bias parameters $\omega_{i|k}$ as the share of imports sourced from country i in total foreign absorption of destination k, separately for final and intermediate goods. This yields the numbers in Table 1.[1]

Home-bias parameters x_k are then chosen to match average trade openness (exports + imports over GDP) in the data for 2023: 25% for the U.S., 37% for CN, and 44.5% for the EA after removing

[1] Trade data are taken from the OECD Bilateral Trade in Goods by End-use database, available at `https://www.oecd.org/en/data/datasets/bilateral-trade-in-goods-by-industry-and-end-use-category.html`.

Table 1: Origin bias parameters for final and intermediate goods ($\omega_{i|k}$).

	Final goods (FG)			Intermediate goods (INT)		
Destination \ Origin	U.S.	CN	EA	U.S.	CN	EA
U.S.	–	0.581	0.419	–	0.356	0.644
CN	0.283	–	0.717	0.504	–	0.496
EA	0.266	0.734	–	0.547	0.453	–

intra-EA trade.[2] The implied values are $x_{\text{us}} = 0.625$, $x_{\text{ea}} = 0.877$, and $x_{\text{cn}} = 0.620$.

Country sizes and TFP levels. Population weights are pinned down by World Bank population data implying $n_{\text{us}} = 0.160$, $n_{\text{ea}} = 0.167$, $n_{\text{cn}} = 0.673$. Relative TFPs scale with GDP per capita using the intermediate share, $A_k \propto (\text{GDPpc}_k/\text{GDPpc}_{\text{us}})^{1-\eta}$. Based on WorldBank data about GDP per capita (PPP in constant dollars) yielding $A_{\text{us}} = 1$, $A_{\text{ea}} = 0.84$, and $A_{\text{cn}} = 0.5$ given $\eta = 0.40$.

Tariffs. Bilateral tariffs follow PIIE's tariff tracker: pre-2025 U.S. tariffs on Chinese goods averaged about 20.7%, while current (post-actions) are roughly 57.6%; Chinese tariffs on U.S. goods have risen to about 32.6% (coverage near 100%).[3] In the baseline (pre-2025) we set: $\bar{\tau}_{\text{us,cn}} = 0.207$, $\bar{\tau}_{\text{cn,us}} = 0.212$, and $\bar{\tau} = 0.03$ for all other bilateral pairs.

International asset markets. Other countries can hold U.S. bonds subject to standard portfolio adjustment costs $\nu_{\text{ea}} = \nu_{\text{cn}} = 0.0025$, a standard magnitude ensuring stationarity of net foreign assets (see Ghironi and Melitz (2005)).

Summary We summarize parameter values in Table 2 below, and contrast the implied CPI/trade weights $\gamma_{i,k}$.

4.2 A Baseline U.S. vs China Trade War

Using the calibrated model we are now ready to investigate the effects of a baseline trade war between the U.S. and China. According to the Peterson Institute of International Economics, in November 2025 the U.S. applied an average tariff rate of 57.6%, covering 100% of Chinese goods, while China imposed an average tariff rate of 32.6%, covering 100% of U.S. goods. Compared to the pre-Trump trade decisions (January 2025), this represents a 36.8pp increase of the U.S. tariff on Chinese goods ($\tau_{\text{us,cn}}$) and a 11.4pp increase of the Chinese tariff on U.S. goods ($\tau_{\text{cn,us}}$).

[2] Trade openness and population are from World Bank WDI. For EA, we halve gross openness to remove intra-area trade.

[3] Peterson Institute for International Economics (PIIE) tariff tracker; see Bown (2019) for background and methodology. We take the levels reported in the tracker as our targets as of late September 2025.

Table 2: Baseline calibration.

Object	Symbol	Value	Target / Source
Preferences and technology			
Discount factor	β	0.99	Real rate near 4% p.a..
Risk aversion	σ	1.5	Standard value.
Frisch curvature	ψ	2.5	Chetty et al. (2011).
Capital share	α	0.36	Conventional quarterly value.
Depreciation	δ	0.025	Conventional quarterly value.
Inv. adj. costs	φ	2.75	$\sigma(I)/\sigma(Y) \approx 3$.
Intermediate share	η	0.40	Bergin and Corsetti (2023).
Variety elasticity	ϵ	6	20% gross markup.
Rotemberg cost	ϕ	100	NKPC slope of 0.06.
Monetary policy			
Interest smoothing	ρ_r	0.80	Conventional.
Inflation weight	μ	1.50	Standard Taylor weight.
Output-growth weight	d_y	0.00	No response to growth.
CN peg weight	ω_p	0.15	Arbitrary.
Trade elasticities and home bias			
Armington elasticity	λ	5	Imbs and Méjean (2017).
Home bias (U.S.)	x_{us}	0.625	Trade openness ≈25% (WDI).
Home bias (EA)	x_{ea}	0.877	Trade openness ≈44.5% (WDI).
Home bias (CN)	x_{cn}	0.620	Trade openness ≈37% (WDI).
Country size and productivity			
Population share (U.S.)	n_{us}	0.160	World Bank population (U.S. 335M).
Population share (EA)	n_{ea}	0.167	World Bank population (EA 349M).
Population share (CN)	n_{cn}	0.673	World Bank population (CN 1410M).
TFP level (U.S.)	A_{us}	1.00	Normalized.
TFP level (EA)	A_{ea}	0.84	$A_k \propto (\text{GDPpc}_k/\text{GDPpc}_{\text{us}})^{1-\eta}$.
TFP level (CN)	A_{cn}	0.50	$A_k \propto (\text{GDPpc}_k/\text{GDPpc}_{\text{us}})^{1-\eta}$.
Tariffs (pre-2025 baseline)			
U.S. on CN	$\bar{\tau}_{\text{us,cn}}$	0.207	PIIE tracker (Bown, 2019).
CN on U.S.	$\bar{\tau}_{\text{cn,us}}$	0.212	PIIE tracker (Bown, 2019).
Other bilateral pairs	$\bar{\tau}$	0.030	Small MFN-style baseline.
International asset markets			
Portfolio adj. (EA)	ν_{ea}	0.0025	Ghironi and Melitz (2005).
Portfolio adj. (CN)	ν_{cn}	0.0025	Ghironi and Melitz (2005).

Notes: Trade openness and population shares are from World Bank World Development Indicators (WDI); for the euro area, openness is halved to remove intra-EA trade. Tariff levels and (near-)100% bilateral coverage are taken from the Peterson Institute for International Economics (PIIE) tariff tracker; see Bown (2019). TFP levels use WDI GDP per capita and the mapping $A_k \propto (\text{GDPpc}_k/\text{GDPpc}_{\text{us}})^{1-\eta}$ with $\eta = 0.40$.

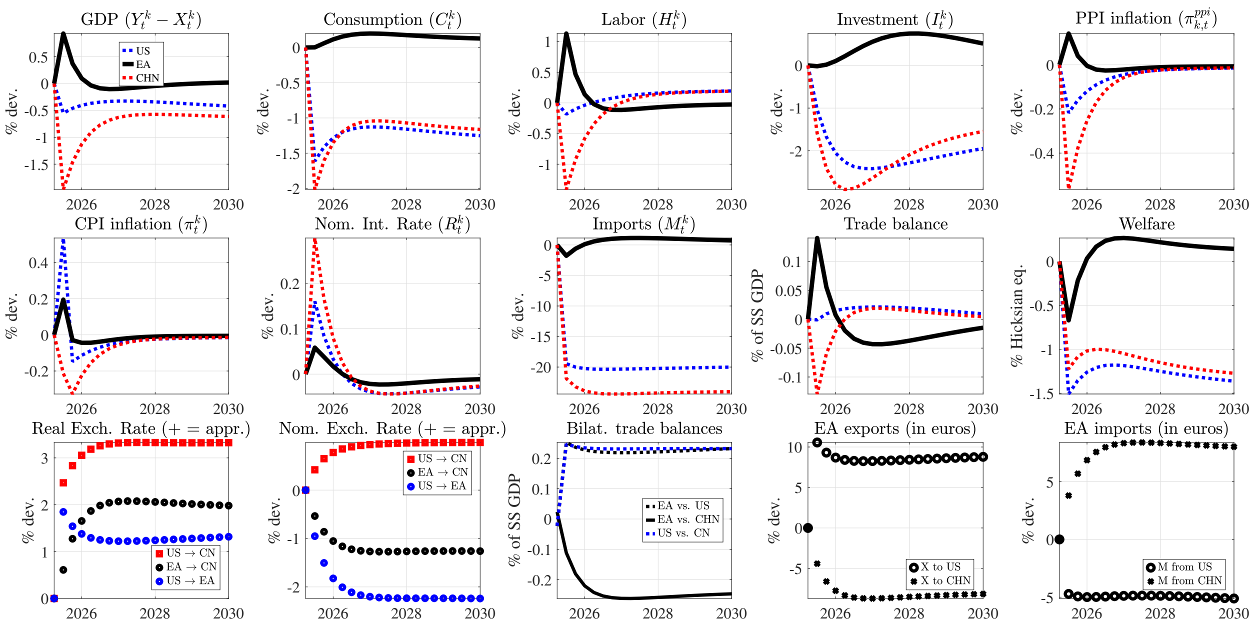
CES weights $\gamma_{i,k}$ and $\gamma_{x,i,k}$.

	Final goods			Intermediate goods		
Destination \ Origin	U.S.	CN	EA	U.S.	CN	EA
U.S.	0.6850	0.1830	0.1320	0.6850	0.1121	0.2029
CN	0.0352	0.8757	0.0891	0.0626	0.8757	0.0616
EA	0.0273	0.0752	0.8975	0.0560	0.0464	0.8975

Construction: For $i = k$, $\gamma_{i,k} = (1 - x_k)(1 - n_k)\omega_{i|k}$, where $\omega_{i|k}$ are the bilateral origin shares reported in Table 1. Domestic weights are given by $\gamma_{k,k} = 1 - \sum_{i=k} \gamma_{i,k}$. We use $(n_{\text{us}}, n_{\text{ea}}, n_{\text{cn}}) = (0.160, 0.167, 0.673)$ and $(x_{\text{us}}, x_{\text{ea}}, x_{\text{cn}}) = (0.625, 0.877, 0.62)$. Rows sum to one by construction.

Figure 1 reports the effects of such increases in bilateral tariffs running deterministic and non-linear model simulations.[4] Shocks are considered as permanent so the simulations basically report the transition from a pre-trade-war steady state to the post-trade-war steady state. The figure reports the most relevant macroeconomic and trade variables as well as the resulting welfare losses, computed as percentage Hicksian equivalent changes in pre-trade-war steady-state consumption.[5]

Figure 1: Baseline Bilateral U.S. vs China Trade War.



Note Unless specified otherwise: Black: euro area, Blue: U.S., Red: China. Panels display deviations from the pre-trade-war steady state unless noted. Imports are converted in units of EA goods, as they enter in the EA trade balance and NFA dynamic equations. Real exchange rates are PPI-based bilateral relative prices as defined in the model. The U.S. tariff increases by 36.8pp and the Chinese tariff on U.S. goods by 11.4pp starting from a 20.7% and 21% level, respectively. Other bilateral tariffs are set to 3%.

Trade reallocation. The asymmetric tariff hikes generate large expenditure switching and highly uneven macroeconomic outcomes. The dominant mechanism is import compression, particularly on the U.S. side. The sharp 37pp increase in U.S. tariffs on Chinese goods induces a dramatic contraction in U.S. imports from China, while Chinese imports from the U.S. also fall, though less abruptly.

[4] We make use of the deterministic simulation algorithm of Dynare (Adjemian et al. (2011))

[5] For each country $k \in \{\text{us}, \text{ea}, \text{cn}\}$ and each date t, the Hicksian consumption-equivalent welfare change ξ_t^k is defined implicitly by:

$$u\left(C_t^{k,\text{TW}}, H_t^{k,\text{TW}}\right) = u\left((1 + \xi_t^k/100)C_{ss}^k, H_{ss}^k\right),$$

where C_{ss}^k and H_{ss}^k denote pre-trade-war steady-state consumption and hours. This measure captures the per-period welfare cost of the trade war in consumption-equivalent units and converges to the welfare effect of the new steady state as the transition unfolds.

This asymmetry is mirrored in relative prices. The U.S. real exchange rate appreciates markedly vis-à-vis China – by around 3 percent in the new steady state – reflecting both the direct tariff wedge and the equilibrium adjustment needed to redirect global demand. The appreciation reallocates expenditure toward U.S. goods and third-country producers, while compressing U.S. export competitiveness. In contrast, China experiences a real depreciation against the dollar, consistent with weaker domestic demand and capital outflow pressures.

Despite the magnitude of bilateral trade reallocation, aggregate trade balances move comparatively little. Bilateral balances shift in opposite directions and largely offset each other in the aggregate, underscoring that large gross trade adjustments need not translate into large net external imbalances.

China. China experiences the most pronounced contraction. GDP falls sharply on impact and remains persistently below its initial steady state. Consumption and especially investment decline substantially, with investment dropping by almost 3 percent at its trough. Imports collapse by more than 20 percent, reflecting both weaker domestic absorption and the direct effects of U.S. tariffs on export revenues.

The exchange-rate regime amplifies these dynamics. The renminbi depreciates in real terms against the dollar, and the peg component of monetary policy induces a contractionary response. The nominal interest rate rises sharply on impact, reinforcing the decline in investment and domestic demand. As a result, both CPI and PPI inflation turn negative and remain persistently below baseline. Deflation is driven by weak domestic demand and lower marginal costs, the latter reflecting both reduced intermediate input usage and the exchange-rate adjustment.

Welfare losses in China exceed 1 percent of steady-state consumption in Hicksian equivalent terms on impact and remain persistently large.

United States. The U.S. also experience a contraction, though more moderate. GDP declines by roughly 0.5 percent in the medium run. Consumption falls by about 1.5 percent, and investment contracts by more than 2 percent at its trough. Imports from China collapse, while exports weaken due to the real appreciation of the dollar and softer foreign demand.

Tariffs compress imports from China directly, while the stronger dollar erodes the competitiveness of U.S. exporters in third markets. This double squeeze on imports and exports explains the contraction in activity despite partial income support. CPI inflation spikes initially due to tariff pass-through and imported price pressures, but the effect is short-lived: the dollar appreciation, weak demand, and declining producer prices dominate after a few quarters, pushing CPI inflation back down. Monetary policy tightens only marginally in response to the temporary inflation surge and then eases as the demand-driven downturn prevails.

Welfare losses in the U.S. amount to about 1.5 percent in Hicksian equivalent terms on impact and remain persistently negative.

Euro area. The EA initially benefits from trade diversion. As U.S. buyers (firms and consumers) substitute away from Chinese suppliers toward EA producers, exports to the U.S. rise on impact. At the same time, the real appreciation of the euro vis-à-vis the renminbi makes Chinese goods relatively cheaper for EA buyers, leading to a reallocation of european imports away from the U.S. and toward China. Together, these forces generate a favorable shift in trade flows for the EA, the trade balance improves as a result of the bileral trade balance against the U.S. increasing more than the bilateral balance against China deteriorates.

Output increases on impact, driven by stronger external demand, with investment and consumption responding through higher expected rental returns and positive terms-of-trade effects against China. CPI inflation picks up as demand pressures pass through to prices, though monetary policy reacts only moderately. These results are robust to alternative assumptions on international financial integration: increasing the portfolio adjustment cost parameter ν from 0.0025 to 0.01 leaves EA spillovers and bilateral trade reallocations essentially unchanged (Appendix A).

Over the medium run, the initial gains are dampened as the global downturn in U.S. and Chinese demand become deeper. Welfare losses remain much smaller than in China or the U.S., around 0.5 percent on impact, and eventually turn slightly positive in the medium run, reflecting the temporary benefits of trade diversion. Despite sizable trade reallocation – both export and import flows display significant changes – the aggregate trade balance trade moves relatively little because bilateral trade balances move in offsetting directions.

Summary. The baseline trade war scenario underscores three distinct transmission channels. First, *expenditure switching* reallocates demand toward the EA, mitigating its exposure while amplifying the contraction in the U.S. This mechanism reflects both direct substitution away from targeted bilateral trade and indirect reallocations through relative prices. Second, *exchange-rate dynamics* interact with monetary regimes: the dollar's appreciation partially protects the U.S. through improved terms of trade, whereas China's exchange-rate targeting policy leads to contractionary monetary adjustments that magnify output's downturn. Third, *price and policy responses* diverge: CPI inflation spikes temporarily in the U.S. and the EA due to tariff pass-through (in the U.S.) and stronger demand (EA), but declines in China where peg-induced tightening and currency depreciation lower internal demand and marginal costs. Monetary tightening remains mild in the U.S. and the EA, and is clearly contractionary in China. Appendix A shows that this asymmetry is quantitatively important: removing China's exchange-rate stabilization component ($\omega_p = 0$) substantially attenuates China's contraction and deflation, while leaving U.S. and EA responses only marginally affected.

Overall, these asymmetries explain why tariff wars generate sizable international spillovers and why third-country effects can, at least temporarily, appear expansionary – in the baseline case for the EA – despite global welfare losses. In welfare terms, China and the U.S. bear similar costs, and the EA incurs only marginal effects that turn slightly positive after a few quarters, as trade diversion partly offsets the global slowdown. This naturally raises the question of how important this adjustment margin is for the bilateral dynamics themselves. We address this question by considering a counterfactual two-country economy in which the euro area is removed.

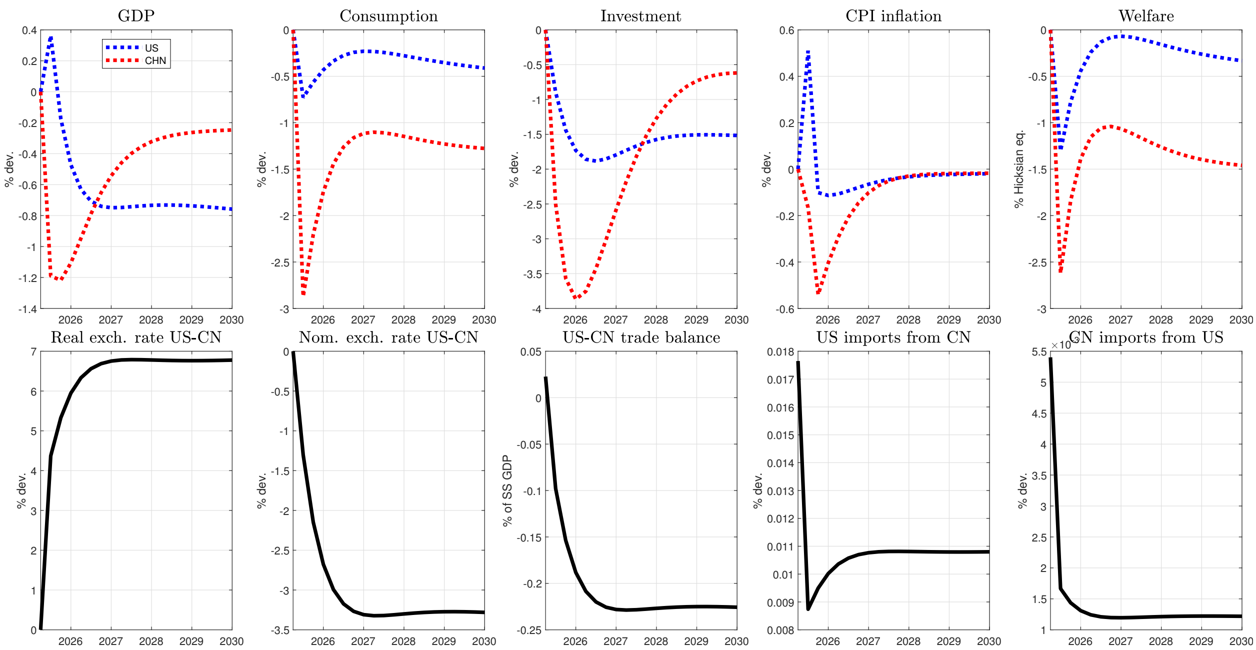
4.3 Third Country as a Buffer

The previous experiment highlights that the EA acts as a buffer in the U.S.-China trade war through trade diversion. A natural question is whether this buffering role materially affects the magnitude of the bilateral adjustment between the U.S. and China. To answer this question, we conduct a simple counterfactual experiment that removes the third country from the model.

Specifically, we recalibrate the model so that the EA population share converges to zero while keeping the U.S.-China bilateral structure unchanged. All CES weights are rescaled accordingly so that trade takes place only between the U.S. and China. This counterfactual therefore approximates the outcome that would arise in a standard two-country model subject to the same tariff shocks.

Figure 2 reports the marginal effect of removing the euro area, relative to the baseline three-country environment. Several striking differences emerge.

Figure 2: Marginal Effects of Removing the Third Country



Note: Panels display the marginal effects of a U.S.-China trade war in a two-country economy relative to the baseline three-country model.

First, the bilateral trade war becomes significantly more contractionary for both countries. Output falls by an additional 0.8–1.2 percent relative to the three-country baseline, with the largest impact amplification occurring in China. Consumption and investment also decline much more strongly, with investment dropping by up to 4 percent relative to the baseline path. Welfare losses deepen substantially in both economies as well, reaching an additional 1 to 2.5 percent of steady-state consumption in Hicksian equivalent terms.

Second, the adjustment in relative prices becomes much stronger. The U.S. terms of trade improve more dramatically when the euro area is absent, with the bilateral real exchange rate appreciating by around 6–7 percent. Intuitively, when China loses access to an alternative export market, the U.S. gains substantially more bargaining power in the bilateral relationship, allowing relative prices to move more clearly in its favor.

Third, despite these much larger macroeconomic adjustments, bilateral trade quantities bearly change relative to the three-country benchmark. Imports and exports between the U.S. and China remain broadly similar, indicating that most of the additional adjustment occurs through prices and domestic demand rather than through further trade reduction.

These results illustrate that the presence of a third trading partner fundamentally alters the equilibrium adjustment to bilateral protectionism. In the three-country economy, part of the shock is absorbed through trade diversion toward the euro area. When this adjustment margin disappears, the bilateral conflict becomes a much more severe macroeconomic shock for both countries. This finding highlights a key limitation of two-country frameworks: they systematically overstate the contractionary effects of bilateral trade wars by ignoring the stabilizing role played by third-country trade reallocation.

4.4 A Global Trade War

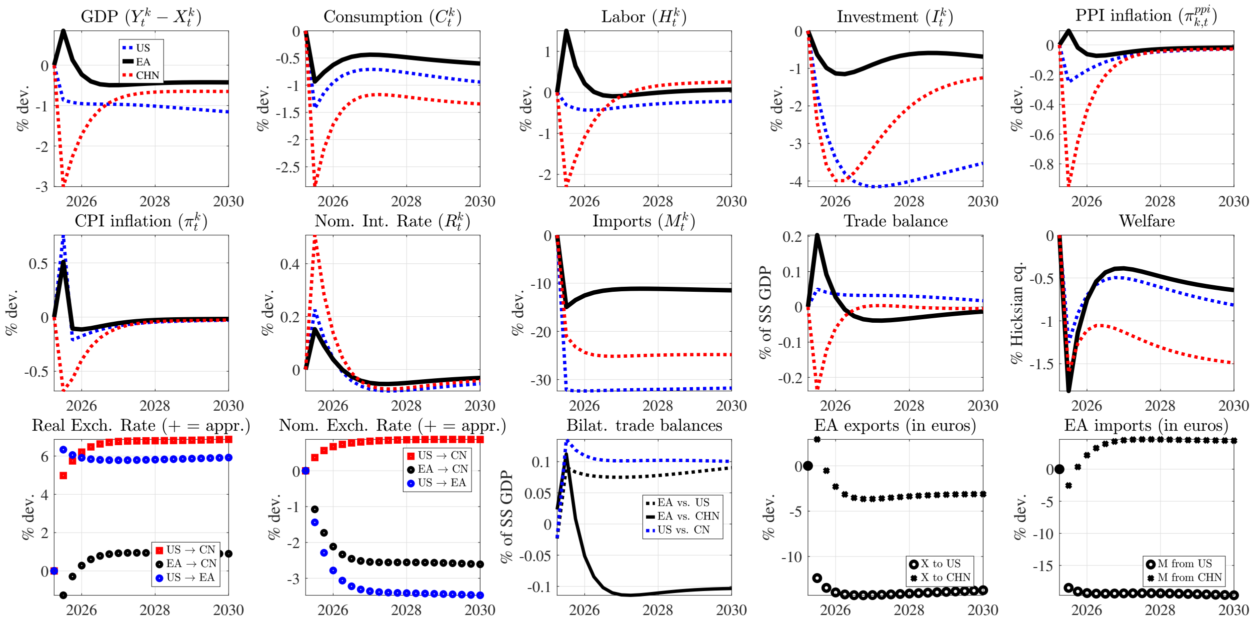
Let us now turn to the effects of a global trade war. Relative to the baseline scenario, this case adds a further 10 percentage point increase in the U.S. tariff on EA goods. We first examine the aggregate dynamics in Figure 3, before isolating the marginal effects of the additional U.S. tariff on EA exports in Figure 4.

Three differences relative to the bilateral U.S.-China conflict stand out. First, the EA becomes directly targeted, reversing the pattern of trade diversion observed in the baseline. Second, inflationary pressures in the U.S. intensify as tariffs are extended to a second major trading partner. Third, the global downturn deepens, as all three regions are now simultaneously affected by negative trade and demand shocks.

Relative prices, exchange rates, and expenditure switching. The additional U.S. tariff on EA goods generates a sharp appreciation of the dollar against the euro, on top of the appreciation vis-à-vis both currencies already present in the baseline (Figure 3, panel "Real exch. rate"). The bilateral real appreciation against the euro rises to around 6 percent, reflecting both the direct tariff wedge and the general tightening of global financial conditions. Through general-equilibrium trade reallocation and income effects, the dollar also appreciates further against the renminbi, while the euro depreciates in real terms vis-à-vis the renminbi (Figure 4, panel "Real exch. rate").

These relative price adjustments lead to a marked compression of U.S. imports from the EA (Figure 4, panel "EA exports"), reinforcing the import contraction generated by the U.S.-China tariff escalation. At the same time, U.S. imports from China remain severely depressed, so that total U.S. import volumes fall substantially (by more than 30 percent). As a result, U.S. expenditure is marginally reallocated away from EA goods, and toward Chinese goods.

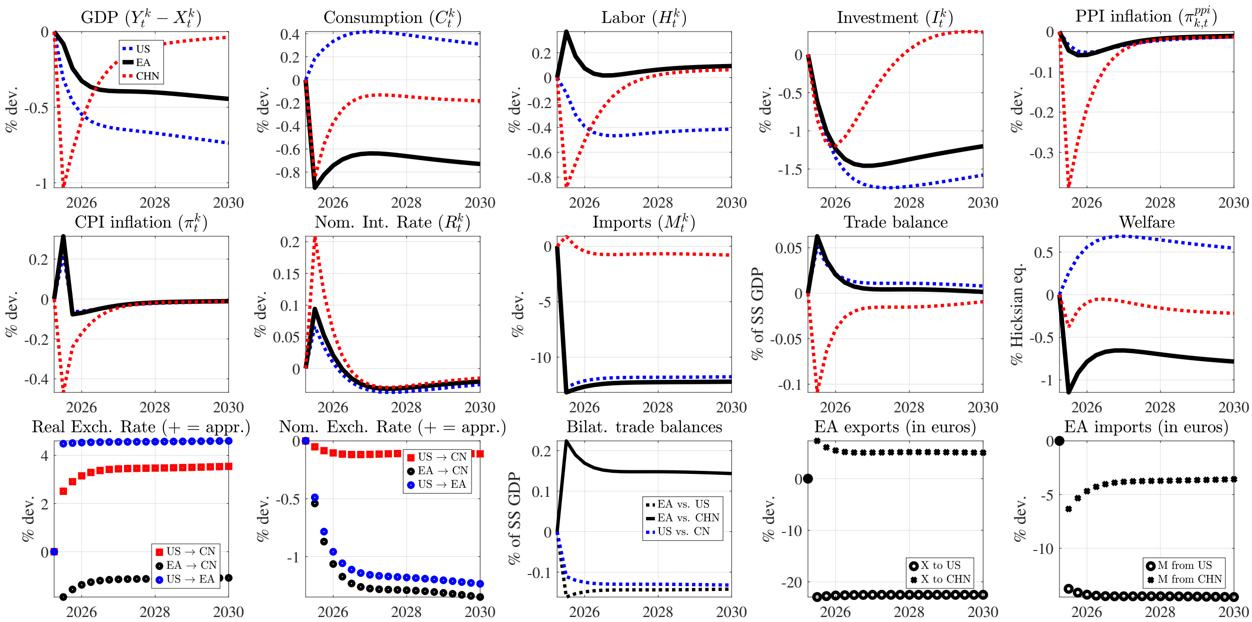
Figure 3: Global Trade War.



Note: Black: Euro area, Blue: U.S., Red: China. Panels display deviations from the pre-trade-war steady state unless noted. Imports are converted in units of EA goods, as they enter in the EA trade balance and NFA dynamic equations. Real exchange rates are PPI-based bilateral relative prices as defined in the model. The U.S. tariff increases by 36.8pp and the Chinese tariff on U.S. goods by 11.4pp starting from a 20.7% and 21% level, respectively. The U.S. tariff on EA goods increases by 10pp, starting from a 3% level. Other bilateral tariffs are set to 3%.

On the EA side, the loss of price competitiveness in the U.S. market induces a partial reorientation of exports toward China. As shown in the "EA exports (in euros)" panel, exports to the U.S. decline sharply – around 25% at the margin, while exports to China rise (Figure 4, panel "EA exports"). EA imports from both the U.S. and China decline, reflecting weaker domestic demand and the euro's real depreciation against the renminbi, which raises the relative price of Chinese goods in euro terms. Overall, the pattern of trade diversion observed in the baseline scenario is overturned: instead of benefiting from third-market substitution, the EA now loses market shares in the U.S. while China absorbs part of the displaced U.S. demand.

Figure 4: Global Trade War – marginal effects of the U.S. tariff on EA goods.



Note: Black: Euro area, Blue: U.S., Red: China. Panels display deviations from the global trade-war equilibrium. Imports are converted in units of EA goods, as they enter in the EA trade balance and NFA dynamic equations. Real exchange rates are PPI-based bilateral relative prices as defined in the model. The U.S. tariff increases by 36.8pp and the Chinese tariff on U.S. goods by 11.4pp starting from a 20.7% and 21% level, respectively. The U.S. tariff on EA goods increases by 10pp, starting from a 3% level. Other bilateral tariffs are set to 3%.

United States. For the U.S., extending tariffs to EA goods strengthens the same expenditure-switching and terms-of-trade mechanisms as in the bilateral U.S.-China scenario, but now applied to a second major supplier. The tariff-induced appreciation of the dollar reduces the foreign-currency cost of U.S. absorption and, together with the additional tariff revenues rebated to households, supports private consumption (Figure 4, panel "Consumption").

At the same time, the stronger dollar and higher imported input costs weigh on production incentives and external demand. Output, hours, and investment all decline relative to the U.S. - China trade-war equilibrium (Figure 4, panels "GDP", "Labor", and "Investment"), reflecting weaker net exports and lower expected returns to capital. Hence, the marginal tariff generates a further contraction in activity even as it raises consumption.

In welfare terms, the consumption-support channel dominates: the additional tariff on EA goods slightly *attenuates* U.S. welfare losses relative to the baseline trade war (Figure 4, panel "Welfare"). The marginal welfare gain from a 10 percentage point increase in the tariff on EA goods amounts to about 0.5 percent of steady-state consumption in Hicksian equivalent terms. CPI inflation increases somewhat further on impact due to tariff pass-through (panel "CPI inflation"), inducing a short-lived tightening of monetary policy (panel "Nom. int. rate"). The policy response fades quickly as activity and inflation pressures weaken.

Euro area. Unsurprisingly, the EA is the main new loser in marginal scenario of experiencing a 10 percentage point increase in the tariffs hitting its exports. The additional U.S. tariff constitutes a direct negative external demand shock, as access to the U.S. market deteriorates sharply. Output, and investment, and consumption all fall on impact (Figure 4, panels "GDP", "Investment", and "Consumption").

One mitigating channel operates, but remains quantitatively limited: part of the lost U.S. export demand is redirected toward China. As shown in Figure 4, exports to China increase, partially offsetting the large contraction of exports to the U.S. However, this reallocation is insufficient to compensate for the scale of the demand loss in the U.S. market. At the same time, EA imports from both trading partners fall, reflecting weaker domestic absorption and the rise in the euro price of Chinese goods associated with the euro's real depreciation against the renminbi.

CPI inflation increases, by about 0.3 percentage points (panel "CPI inflation"), as the exchange-rate depreciation raises import prices while the contraction in domestic demand dampens underlying price pressures. Monetary policy tightens in response (panel "Nom. int. rate"). Overall, the EA experiences a persistent, externally driven slowdown accompanied by moderate but clearly negative welfare losses, reaching around 1 percent of steady-state consumption in Hicksian equivalent terms.

China. China remains the country most severely affected by the global trade war. Although EA exports are partially redirected toward China, the scale of this reallocation is small relative to the contraction in global trade and activity. As a result, GDP, consumption, and investment fall more sharply than in the bilateral scenario (Figure 3).

Figure 4 shows that the additional U.S. tariff on EA goods further depresses Chinese activity, albeit by less than the initial U.S.-China tariff escalation. The modest increase in exports from the EA is dominated by weaker external demand from the U.S. and by the tightening of global financial conditions. CPI and PPI inflation decline further, reflecting weak domestic demand and lower marginal costs.

Despite these deflationary pressures, China's nominal interest rate increases on impact in the marginal experiment (panel "Nom. int. rate"). This reflects the exchange-rate regime rather than domestic stabilization concerns. The additional U.S. tariff on EA goods triggers a tightening of global financial conditions and higher U.S. interest rates, inducing capital outflow pressures from

China. To stabilize the renminbi, the central bank raises its policy rate, even though the currency ultimately appreciates in equilibrium due to weak domestic demand and improved net exports.

The marginal welfare effect of the additional tariff is clearly negative on impact, with losses close to 0.5 percent of steady-state consumption in Hicksian equivalent terms (panel "Welfare"). As the monetary tightening gradually fades out and financial conditions normalize, these losses shrink rapidly and converge to around 0.25 percent. Nevertheless, China remains by far the largest welfare loser of the global trade war.

Trade balances and welfare. Despite large reallocations in bilateral trade flows, movements in aggregate trade balances remain limited (Figure 4, panel "Trade balance"), reflecting offsetting adjustments. For the U.S., tariff revenues and terms-of-trade gains partly stabilize consumption despite falling imports and exports. In the EA and China, weaker domestic demand and investment compress imports, dampening external imbalances even as bilateral trade patterns shift markedly.

In welfare terms, the global trade war unambiguously worsens outcomes relative to the bilateral scenario except for the U.S. economy. The EA moves from modest gains in the baseline scenario to welfare losses once it is directly targeted by U.S. tariffs. Meanwhile, China experiences further deterioration driven by tighter financial conditions and constraints imposed by the exchange-rate regime. By contrast, the U.S. experiences marginal gains resulting from additional tariff rebates and improved terms of trade.

Overall, extending tariffs to the EA transforms a bilateral conflict into a synchronized global downturn. Trade diversion becomes weaker and less effective as a stabilizing mechanism once multiple large economies are targeted simultaneously. This highlights how the depth and coverage of protectionist measures critically shapes both the macroeconomic and welfare consequences of trade wars.

4.5 Taking Stock on the Third-country Effects

In the baseline U.S.-China conflict, the EA initially benefits from trade diversion on both the export and import margins. This reallocation boosts output, consumption, investment, and labor, leading to smaller welfare losses that can even turn into modest welfare gains in the medium run. These improvements, however, are inherently *fragile*: they stem from redirected trade flows rather than from a genuine expansion in global activity. As weaker U.S. and Chinese demand gradually depresses world income, the EA's early gains are eroded.

Once the U.S. broadens tariffs to include EA goods, this buffering mechanism largely disappears. Although part of EA demand shifts toward China, the dominant force becomes the contraction in global activity. Welfare losses in both the EA and China therefore intensify relative to the bilateral scenario.

More generally, positive spillovers to third countries reflect only temporary demand reallocation under distorted trade regimes, not durable improvements in global welfare. When protectionism widens, these diversion effects dissipate quickly, giving way to synchronized downturns and widespread welfare losses.

5 Welfare-maximizing Tariffs in the Third Country

In this Section we investigate the sign and size of welfare-maximizing tariffs for the third country in each trade-war situation (bilateral U.S. vs China, global) and either against the U.S. only or both countries.

From the perspective of the third country, bilateral tariff hikes between the U.S. and China – with or without the U.S. tariff on EA goods – create spillovers: they alter relative prices with both trade partners in a way that can be exploited by the EA through its own trade policy. In particular, an tariff hike from the EA on U.S. or Chinese goods will appreciate the EA's terms of trade, reduce import penetration, and likely improve welfare by reallocating demand toward domestic absorption. Conversely, such tariffs lower welfare in the targeted country by compressing its export demand.

These mechanisms suggest that the welfare-maximizing EA tariff is likely to be strictly positive against at least one trading partner. The quantitative analysis below evaluates the magnitude and direction of these optimal tariffs under the different trade-war scenarios.

5.1 Welfare-maximizing Tariff Levels

We perform the following simulation exercise, running deterministic transitions with (i) the U.S.-China trade war shock, (ii) the U.S. applying a 10pp increase in the tariff against the third country (EA), and (iii) a potential tariff hike by the EA moving $(\tau_{\text{ea,us}}, \tau_{\text{ea,cn}})$. We consider EA tariff increases from 0 pp to 23 pp and compute, for each country $k \in \{\text{us}, \text{ea}, \text{cn}\}$, the consumption-equivalent welfare change ξ_T^k over the full transition horizon $T = 300$.[6] We then normalize welfare gains/losses relative to the status quo featuring only (i) and (ii), so as to isolate how third-country tariffs can raise EA welfare in each trade-war environment.

Figure 5 reports our results. To disentangle the bilateral channels, our top panels report two-dimensional graphs in which only the the EA tariff against the U.S. varies while $\tau_{\text{ea,cn}}$ is held at 0.03, and conversely where the EA tariff against China varies with $\tau_{\text{ea,us}} = 0.03$. The resulting welfare profiles highlight both the direct and indirect spillovers of EA trade policy, and the room for welfare improvements using only one of the two trade policy instruments.

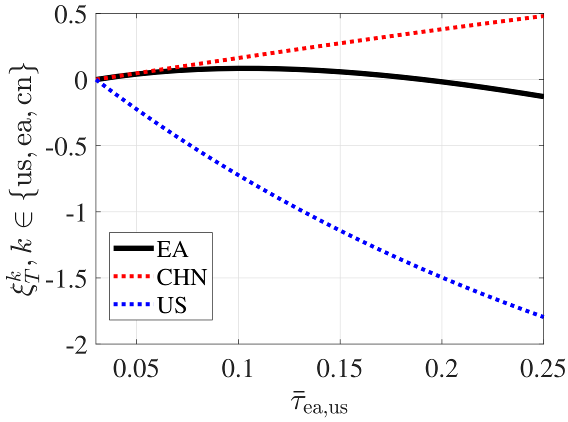
[6] For each country k and horizon T, the consumption-equivalent welfare change ξ_T^k is defined implicitly by:

$$\sum_{t=0}^{T} \beta^t u\left(C_t^k, H_t^k\right) = \sum_{t=0}^{T} \beta^t u\left((1 + \xi_T^k/100) C_{ss}^k, H_{ss}^k\right),$$

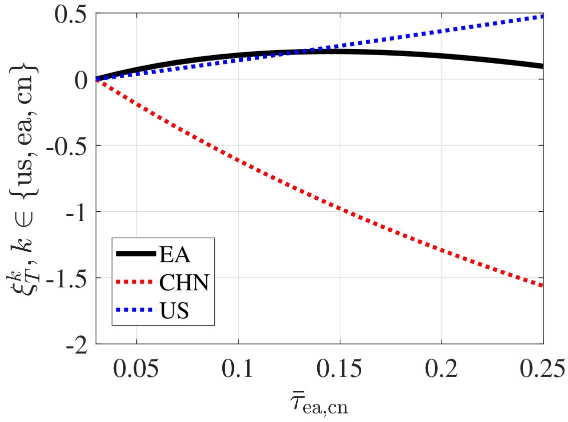
where (C_{ss}^k, H_{ss}^k) denotes the pre-trade-war steady state. This "transition" welfare measure differs from the instantaneous welfare series reported in the IRFs, which is defined period-by-period as the Hicksian equivalent ξ_t^k satisfying $u(C_t^k, H_t^k) = u((1 + \xi_t^k/100) C_{ss}^k, H_{ss}^k)$.

Figure 5: Welfare effects of third-country tariffs against the United States and China.

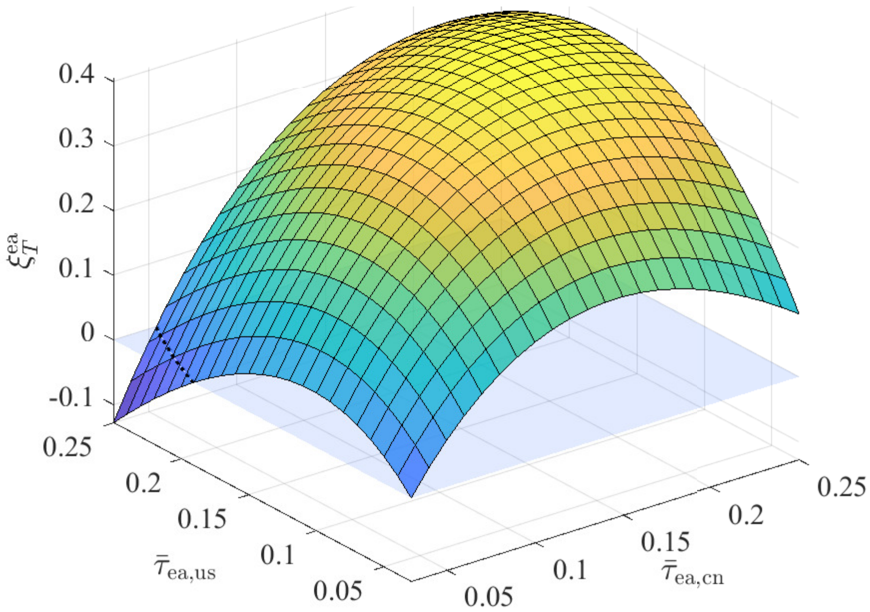
(a) Tariff against the United States



(b) Tariff against China



(c) Joint effects on euro area welfare



Note: The top panels report the marginal welfare impact of varying each bilateral tariff individually, while the bottom panel shows the joint welfare surface for the euro area. Starting from a situation with a U.S. vs China trade war and a 10pp U.S. tariff on EA goods, EA decides to apply tariffs on either U.S. or China. The joint maximum level of tariffs is $(\tau_{\text{ea,cn}}, \tau_{\text{ea,us}}) \approx (0.19, 0.16)$, which raises long-run welfare by 0.454 percent in Hicksian equivalent terms.

The top panels of Figure 5 display welfare profiles when the EA varies one bilateral tariff at a time. Five results stand out.

First, there is room for welfare improvement in the EA with either instrument: for small hikes, $\zeta_T^{ea} > 0$ while the targeted partner suffers $\zeta_T^{target} < 0$. The third country (not targeted) typically benefits more than the the EA, $\zeta_T^{nontarget} > \zeta_T^{ea}$, reflecting strong marginal trade diversion toward the non-targeted market and the EA's terms-of-trade gain being partly offset by weaker global demand.

Second, the scope for welfare gains in the EA is larger when the tariff is levied on Chinese imports than when levied on U.S. imports – the welfare gains from the other country being smaller. This asymmetry is quantitatively consistent with the calibration: China has a much larger origin weight in EA's absorption than the U.S., especially for final goods, so a tariff on China tilts both consumption and production bundles more strongly toward home goods. In addition, China's exchange-rate management amplifies its contraction, reinforcing expenditure switching away from Chinese goods and raising EA's terms of trade.

Third, with a single instrument, the welfare-maximizing hikes are modest: both profiles peak around 10–12pp, with associated welfare *gains* below 0.2% Hicksian equivalent. The *losses* imposed on U.S. or China are potentially much larger than these gains, in the ballpark of 0.5-0.8%, making the world much worse off. Retaliation thus works through the imposition of welfare losses on trade partners more than by significantly raising welfare for the country retaliating.

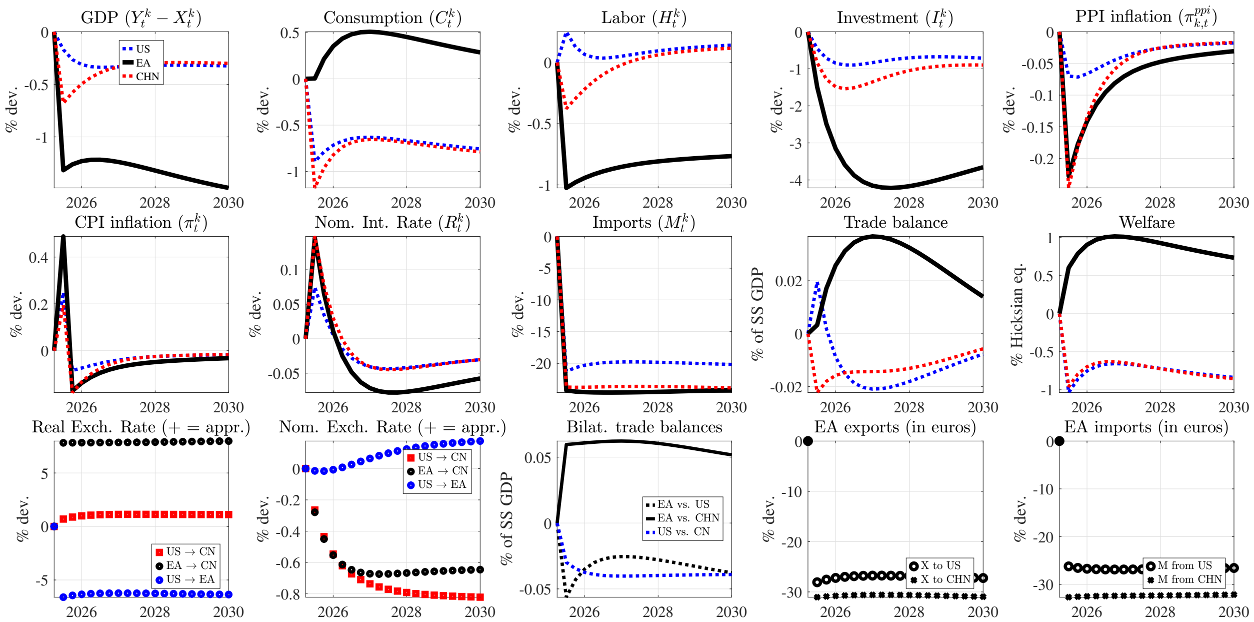
Fourth, beyond the welfare-maximizing level of tariffs, the costs – via higher input prices, weaker trade partner demand, and global activity spillovers – overturn the terms-of-trade and revenue gains, driving ζ_T^{ea} back down.

Fifth, the bottom panel of Figure 5 shows that using both instruments jointly delivers a higher welfare peak for the EA. The joint optimum occurs around $(\tau_{ea,cn}, \tau_{ea,us}) \approx (0.19, 0.16)$, which is *larger* than either unilateral maximizing tariff, and achieves a potential 0.45% welfare gain compared to status quo (*i.e.* U.S.-China trade war plus a 10pp U.S. tariff hike on imports from the EA). The mechanisms are complementary: (i) a tariff on one partner diverts expenditure toward the other foreign supplier unless this second margin is also taxed; (ii) taxing both partners simultaneously reallocates absorption more directly toward domestic goods and reduces the pass-through of any single foreign price; (iii) intermediate-input substitution works in the same direction, lowering real marginal costs in the EA relative to foreign producers when both foreign origins become relatively more expensive. As a result, the marginal benefit of one tariff rises when the other is in place, shifting the welfare peak for the EA to a higher level of tariffs than in either unilateral case, and yielding larger welfare gains.

5.2 Welfare-maximizing Tariffs: Dynamics

We close this section by looking at the marginal effects of implementing the welfare-maximizing tariffs in the third country. Figure 6 reports the dynamic response to the implementation of the welfare-maximizing tariffs in the EA, starting from the global trade-war environment (plus a 10pp hike of the U.S. tariff on EA imports).

Figure 6: Marginal Effects of Welfare-maximizing Tariffs in the euro area – starting from a Global Trade War + U.S. tariff on euro area goods.



Note: Black: euro area, Blue: U.S., Red: China. Panels display deviations from the global trade-war equilibrium + 10pp U.S. tariff on EA goods. Imports are converted in units of EA goods, as they enter in the EA trade balance and NFA dynamic equations. Real exchange rates are PPI-based bilateral relative prices as defined in the model. The U.S. tariff increases by 36.8pp and the Chinese tariff on U.S. goods by 11.4pp starting from a 20.7% and 21% level, respectively. The U.S. tariff on EA goods increases by 10pp, starting from a 3% level. EA tariffs increase by 16pp on Chinese goods and 13pp on U.S. goods starting from a 3% pre-trade-war value.

The adjustment follows the usual sequence observed in models with trade frictions and nominal rigidities. The tariff hikes (+16pp on Chinese goods, +13pp on U.S. goods) trigger a sharp (6-7 percent) appreciation of the EA's terms of trade with respect to both partners, improving relative consumer prices but compressing external demand. Imports from, and exports to, both the U.S. and China fall markedly, consistent with expenditure switching toward domestic absorption. Consumption rises on impact as the improvement in the terms of trade and tariff revenue raise household real income, but investment declines persistently, reflecting the slowdown in expected future activity and higher user cost of capital.

On the supply side, the contraction in imports of intermediate inputs imposes cost-push pressures on production. While producer prices (PPI) temporarily fall due to sluggish pass-through and weaker demand, the relative increase in consumer prices (CPI) induces a short-lived inflationary spike. The monetary authority reacts by tightening policy, which amplifies the short-term downturn. Labor supply declines due to the positive wealth effect associated with higher consumption and tariff revenues, further contributing to the slowdown in output and investment. Overall, the welfare-maximizing tariffs improve the EA's terms of trade and raise steady-state welfare, but at the cost of a temporary recession and higher inflation during the transition.

6 Sensitivity to the trade elasticity and Summary

The numbers in Table 3 collect the impact and long-run effects of the various experiments discussed above for output, demand components, labor, CPI inflation and welfare. Our main experiments are the following: (a) the U.S.-China trade war, (b) the Global trade war (a +10pp hike of U.S. tariffs on EA goods), (c) the optimal EA tariffs on U.S. and Chinese goods (on top of b), and (d) a 10% Chinese export subsidy added to the baseline U.S.-China trade war (on top of a).[7] We report the numbers for the baseline calibration and for an alternative – lower – trade elasticity of $\lambda = 1.5$.

Panel (a) reports the effects of the U.S.-China trade war relative to the pre-trade-war steady state. Under the baseline calibration ($\lambda = 5$), China bears the largest adjustment in real activity: GDP, investment and consumption fall sharply on impact, and welfare losses remain large in the long run. The U.S. also experiences sizeable welfare losses – around -1.5% on impact and -1.65% in the long run – together with a persistent contraction in consumption and investment. By contrast, the EA is partly insulated on impact through trade diversion: activity expands and labor rises, while welfare is slightly negative on impact but turns mildly positive in the long run.

Turning to the alternative calibration of the trade elasticity ($\lambda = 1.5$), the qualitative ranking of welfare costs in Panel (a) changes: China is the primary loser in this scenario, while the EA is comparatively less exposed. However, trade diversion's benefits for production in the EA are substantially smaller in quantity. The GDP response falls from approximately 0.93% to 0.26% on impact and becomes more negative in the long run. China's contraction becomes much more

[7]The dynamics implied by (d) are relegated to Appendix B but we report the short-run and long-run effects in the main text.

Table 3: Impact and long-run effects across scenarios: baseline $\lambda = 5$ vs. alternative $\lambda = 1.5$.

	$\lambda = 5$						$\lambda = 1.5$					
	Impact ($T = 1$)			Long run ($T = 300$)			Impact ($T = 1$)			Long run ($T = 300$)		
	EA	U.S.	CN	EA	U.S.	CN	EA	U.S.	CN	EA	U.S.	CN
(a): U.S.-China trade war												
GDP ($Y_t^k - X_t^k$)	0.93	−0.55	−1.97	−0.03	−0.56	−0.71	0.26	−2.40	−2.71	−0.16	−2.99	−1.72
Investment (I_t^k)	−0.02	−1.04	−1.59	0.06	−1.31	−1.16	0.00	−4.00	−3.57	−0.10	−5.08	−2.58
Consumption (C_t^k)	0.00	−1.61	−2.02	0.06	−1.49	−1.34	−0.15	−1.77	−3.40	−0.11	−1.53	−2.05
Labor (H_t^k)	1.13	−0.18	−1.41	−0.01	0.27	0.24	0.57	−1.93	−1.68	0.02	−0.83	0.14
CPI inflation (π_t^k)	0.19	0.54	−0.21	0.00	0.00	0.00	0.33	1.64	−0.45	0.00	0.00	0.00
Welfare (ξ_T^k)	−0.67	−1.51	−1.22	0.07	−1.65	−1.48	−0.48	−0.72	−2.49	−0.11	−1.07	−2.13
(b): (a) + 10pp U.S. tariff on EA (marg. wrt (a))												
GDP ($Y_t^k - X_t^k$)	−0.08	−0.32	−1.03	−0.54	−0.87	−0.02	−0.34	−0.70	−0.47	−0.51	−1.12	−0.11
Investment (I_t^k)	−0.61	−0.64	−0.85	−0.85	−1.07	−0.02	−0.56	−0.75	−0.83	−0.82	−1.14	−0.12
Consumption (C_t^k)	−0.94	0.19	−0.85	−0.92	0.10	−0.16	−0.83	0.84	−0.70	−0.82	0.75	−0.15
Labor (H_t^k)	0.37	−0.12	−0.89	0.15	−0.35	0.06	0.02	−0.56	−0.32	0.12	−0.66	0.03
CPI inflation (π_t^k)	0.31	0.22	−0.47	0.00	0.00	0.00	0.28	0.21	−0.39	0.00	0.00	0.00
Welfare (ξ_T^k)	−1.15	0.26	−0.38	−1.01	0.30	−0.20	−0.83	1.16	−0.54	−0.90	1.12	−0.16
(c): (b) + optimal EA tariffs (marg. wrt (b))												
GDP ($Y_t^k - X_t^k$)	−1.32	−0.17	−0.68	−1.77	−0.46	−0.44	−1.48	−1.70	−0.92	−2.22	−2.23	−1.10
Investment (I_t^k)	−1.49	−0.45	−0.84	−2.46	−0.76	−0.89	−1.52	−2.26	−1.56	−2.83	−3.46	−2.19
Consumption (C_t^k)	0.00	−0.89	−1.18	−0.23	−0.98	−1.00	1.33	−3.32	−2.18	0.87	−3.54	−2.21
Labor (H_t^k)	−1.02	0.25	−0.38	−0.61	0.20	0.18	−1.40	−0.17	−0.28	−1.18	0.54	0.32
CPI inflation (π_t^k)	0.49	0.25	0.19	0.00	0.00	0.00	0.49	0.86	0.70	0.00	0.00	0.00
Welfare (ξ_T^k)	0.60	−1.04	−0.96	0.13	−1.10	−1.10	2.16	−3.24	−2.03	1.57	−3.81	−2.39
(d): (a) + 10% CN export subsidy (marg. wrt (a))												
GDP ($Y_t^k - X_t^k$)	0.09	−0.41	2.69	0.99	0.16	0.55	0.32	0.53	2.19	0.74	0.91	1.14
Investment (I_t^k)	0.96	0.25	2.01	1.40	0.30	1.09	0.62	1.07	3.23	0.98	1.31	2.03
Consumption (C_t^k)	−0.26	0.30	2.54	−0.28	0.27	1.43	−0.43	0.14	3.49	−0.44	0.01	2.12
Labor (H_t^k)	0.00	−0.56	2.26	0.52	−0.03	−0.30	0.28	0.34	1.38	0.47	0.39	−0.33
CPI inflation (π_t^k)	−0.50	−0.23	0.43	0.00	0.00	0.00	−0.43	−0.67	0.35	0.00	0.00	0.00
Welfare (ξ_T^k)	−0.25	0.62	1.25	−0.59	0.28	1.61	−0.59	−0.04	2.75	−0.72	−0.21	2.31

pronounced in both quantities and welfare (e.g., impact GDP falls from -2.0% to -2.7%, and impact welfare from about -1.2% to -2.5%). Finally, the U.S. experiences a much stronger real contraction in quantities on impact – GDP drops by about -2.4% and investment by -4.0% – while impact welfare losses are not proportionally larger and are even smaller than under $\lambda = 5$. This wedge between quantity responses and welfare reflects that the Hicksian measure summarizes the entire allocation (consumption, labor, and the transition path), rather than output alone.

Panel (b) isolates the marginal contribution of the additional 10pp U.S. tariff on EA goods, relative to the bilateral trade war. When $\lambda = 5$, the additional tariff imposes a significant burden on the EA and, to a lesser extent, China. This is evidenced by a substantial decline in EA consumption in the immediate aftermath, with considerable long-term welfare losses. Conversely, the U.S. experiences modest gains in welfare, attributable to the augmentation of tariff revenue and an improvement in terms of trade. When $\lambda = 1.5$, the same unilateral U.S. measure becomes substantially more beneficial for the U.S. in welfare terms (about +1.16% on impact and +1.12% in the long run). On partners, the pattern is more mixed: the EA loses less on impact than under $\lambda = 5$, while China loses more in the short run; in the long run, the EA loss is slightly smaller than under $\lambda = 5$, and China is again only mildly affected. Overall, lowering λ strengthens the unilateral incentive for the U.S. by increasing the extent to which tariff wedges operate through incidence and real-income effects rather than through expenditure switching.

Panel (c) reports the marginal effects of the EA optimally raising its tariffs on U.S. and Chinese goods on top of the global trade war. When $\lambda = 5$, the results point to a beggar-thy-neighbor best response: the EA attains a welfare gain of about 0.6% on impact and 0.13% in the long run, but this comes with a sizeable short-run domestic recession (GDP falls by about 1.3%) and substantial welfare losses for the U.S. and China. With $\lambda = 1.5$, these forces are dramatically amplified. The EA's welfare gain rises to roughly 2.16% on impact and 1.57% in the long run, while welfare losses for the U.S. and China become very large (on the order of -3% on impact and even larger in the long run). The macroeconomic contraction is also stronger for the U.S. and for the EA itself. Hence, under lower trade elasticity, "optimal" third-country tariffs act even more clearly as a redistribution device rather than a source of efficiency gains: they shift welfare toward the tariff setter by imposing large additional costs on its trading partners, while global welfare unambiguously deteriorates.

Across scenarios (a) to (c), inflation remains highly asymmetric: the U.S. and the EA experience inflation spikes, while China experiences deflation. The main difference when $\lambda = 1.5$ is not the sign pattern but the intensity of price responses – especially the much larger U.S. inflation spike in the baseline trade war – consistent with weaker expenditure switching and stronger real-income effects.

Panel (d) looks at the marginal effects of a 10% Chinese export subsidy, starting from the bilateral trade-war equilibrium.[8] For $\lambda = 5$, the subsidy is a powerful instrument for China, generating large gains in activity and welfare, while the U.S. benefits modestly and the EA ultimately loses in welfare. With a lower trade elasticity $\lambda = 1.5$, China's welfare gains from the subsidy

[8]See Appendix B for a detailed analysis.

become even larger on impact, while spillovers become more adverse overall: the EA's welfare losses deepen, and the U.S. no longer benefits, experiencing slightly negative welfare effects both on impact and in the long run. This pattern is consistent with weaker trade substitution making unilateral interventions more potent redistributive tools: the implementing country gains more, and partners bear a larger share of the adjustment.

Overall, Table 3 delivers three main lessons. First, trade wars are globally costly and highly asymmetric: China bears the largest losses, the U.S. suffers persistent welfare costs, and any third-country gains from diversion are small and fragile. Second, tariff responses by the third country are strongly beggar-thy-neighbor: the EA can raise its welfare only by inducing a deeper global downturn and imposing large additional losses on its trading partners. Third, export subsidies by the targeted country work in the opposite direction: they can undo a substantial fraction of the targeted country's trade-war losses, but at the expense of other countries through trade diversion.

A key sensitivity result is that lowering the trade elasticity λ makes these redistribution mechanisms sharper. With weaker substitution across traded goods, tariff hikes translate less into expenditure switching and more into incidence and real-income effects, so unilateral measures tend to generate larger welfare gains for the implementing country and larger welfare losses for partners – while third-country spillovers remain scenario-dependent.

7 Conclusion

This paper has analyzed the international transmission of trade-policy shocks in a three-country New Keynesian framework calibrated to the United States (U.S.), the euro area (EA), and China. We show that the 2025 U.S.-China tariff escalation generates a deep and asymmetric global downturn, but also creates the appearance of short-run gains for a third country through trade diversion.

A key insight of the paper is that the global incidence of trade policy depends crucially on the structure of the trading network. In our quantitative analysis, the euro area acts as a buffer that absorbs part of the disruption generated by the U.S.–China conflict. Removing this third-country adjustment margin substantially amplifies the contraction in both economies.

Once the U.S. extend protection to EA goods, the initial expansion vanishes, the EA experiences welfare losses, and the Chinese contraction amplifies. In this sense, bilateral logic provides a misleading guide to multilateral tariff incidence.

Further, both retaliatory tariffs and export-subsidy policies are shown to hinge critically on multilateral interactions. The EA's optimal unilateral tariffs are large and deliver limited local welfare gains at the cost of large welfare losses for the trade partners. A symmetric Chinese export subsidy generates large domestic improvements but starkly asymmetric spillovers across trading partners.

These findings highlight the need for a multilateral perspective in evaluating trade and industrial policy: predictions based on two-country models systematically miss sign reversals, cross-country asymmetries, and the erosion of initial benefits as protection spreads geographically to third countries. Future work could leverage this framework to study coordinated tariff design, global supply-chain disruptions, or the interaction between trade policy and other global issues, such as climate border adjustment taxes.

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A Robustness: Exchange-rate regime and financial integration

This appendix reports two robustness exercises for the baseline bilateral U.S.-China trade war experiment analyzed in the main text. In both cases, we keep the tariff shock path and the calibration unchanged, and modify only one block of the model at a time. The goal is to assess whether two modeling features that are central for international transmission in New Keynesian environments – the exchange-rate regime in China and the degree of international financial integration – materially affect the qualitative and quantitative patterns highlighted in the baseline.

First, we isolate the role of China's exchange-rate objective by considering a pure Taylor-rule regime, setting $\omega_p = 0$ in Equation (35). This removes the exchange-rate stabilization component and allows the nominal exchange rate to adjust endogenously in response to tariff-induced inflation and output movements. Second, we examine the sensitivity of the results to the portfolio adjustment cost paid on net foreign assets. Specifically, we increase ν from 0.0025 in the baseline calibration to 0.01, strengthening the wedge in the foreign-bond Euler equation (16) and further limiting international risk sharing.

A.1 China under a pure Taylor rule

Figure 7 replicates Figure 1 for the baseline U.S.-China tariff experiment, but under a pure Taylor rule in China ($\omega_p = 0$). Relative to the baseline managed exchange-rate regime, this experiment shifts part of China's adjustment from domestic quantities and prices toward the nominal exchange rate. This provides a direct assessment of the extent to which China's large welfare losses and persistent deflation in the baseline are driven by the exchange-rate objective rather than by tariffs alone.

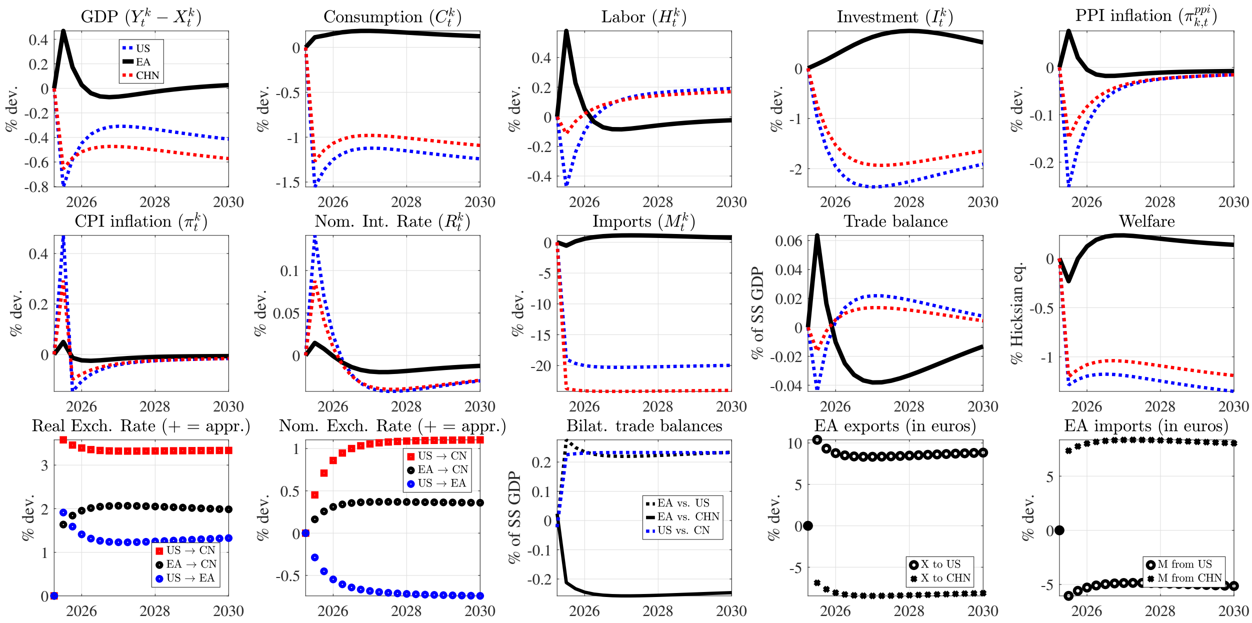
Figure 7 shows that the baseline transmission to China is highly sensitive to the exchange-rate objective embedded in Equation (35). Under a pure Taylor rule, the Chinese contraction is substantially attenuated: GDP, consumption, labor, and investment fall by less on impact and recover faster than in the baseline managed regime.

Inflation dynamics also change markedly. In the baseline, the exchange-rate objective forces China to engineer a persistent disinflation through higher interest rates; once the peg component is removed, the monetary tightening is much weaker and the deflationary episode is substantially reduced.

The exchange-rate adjustment is correspondingly different. Without the peg component, the nominal and real exchange rates absorb a larger share of the adjustment. In particular, China experiences a stronger real appreciation relative to both the U.S. and the EA than in the baseline, reflecting the fact that the adjustment relies more on relative prices and less on domestic demand compression.

By contrast, the implications for the U.S. and the EA remain comparatively modest. Their output, inflation, and welfare responses are slightly affected by the change in China's monetary

Figure 7: Baseline Bilateral U.S. vs China Trade War: China Under a Pure Taylor Rule.



Note Unless specified otherwise: Black: euro area, Blue: U.S., Red: China. Panels display deviations from the pre-trade-war steady state unless noted. Imports are converted in units of EA goods, as they enter in the EA trade balance and NFA dynamic equations. Real exchange rates are PPI-based bilateral relative prices as defined in the model. The U.S. tariff increases by 36.8pp and the Chinese tariff on U.S. goods by 11.4pp starting from a 20.7% and 21% level, respectively. Other bilateral tariffs are set to 3%. In this figure, China follows a pure Taylor rule ($\omega_p = 0$).

regime, indicating that the baseline spillovers to third countries are primarily driven by tariff-induced relative-price changes and trade diversion, rather than by the specific form of China's exchange-rate management.

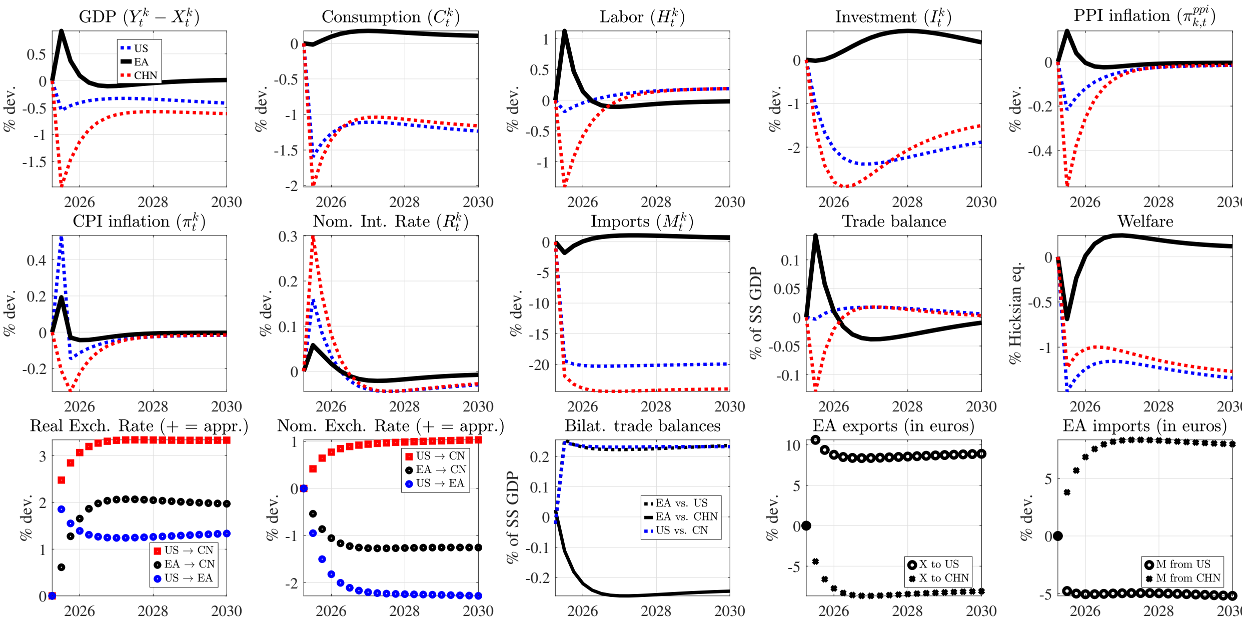
A.2 Stronger portfolio adjustment costs

We next assess the sensitivity of the baseline trade-war spillovers to the strength of the portfolio adjustment cost that disciplines net foreign asset positions. In the model, this friction enters the foreign-bond Euler Equation (16) through the wedge $1 + \nu_k(f_t^{k,\text{us}} - \bar{f}^{k,\text{us}})$ and limits international risk sharing by inducing mean reversion in external positions. We therefore increase ν from 0.0025 in the baseline calibration to 0.01 for the two countries that trade the U.S. bond, namely the EA and China.

Figure 8 replicates Figure 1 under this higher value of ν. The impulse responses are nearly indistinguishable from the baseline. Quantitatively, raising ν has only minor effects on exchange-rate dynamics, external adjustment, and welfare in all three economies. This result indicates that, for the 2025 tariff escalation considered here, the baseline transmission is driven primarily by the trade and price-setting blocks rather than by international financial linkages.

Figure 8 shows that the baseline trade-war transmission is essentially unaffected by a sub-

Figure 8: Baseline Bilateral U.S. vs China Trade War: Higher Portfolio Adjustment Costs.



Note Unless specified otherwise: Black: euro area, Blue: U.S., Red: China. Panels display deviations from the pre-trade-war steady state unless noted. Imports are converted in units of EA goods, as they enter in the EA trade balance and NFA dynamic equations. Real exchange rates are PPI-based bilateral relative prices as defined in the model. The U.S. tariff increases by 36.8pp and the Chinese tariff on U.S. goods by 11.4pp starting from a 20.7% and 21% level, respectively. Other bilateral tariffs are set to 3%. In this figure, the portfolio adjustment cost parameter is increased from $\nu = 0.0025$ to $\nu = 0.01$ for $k \in \{\text{ea}, \text{cn}\}$.

stantial increase in the portfolio adjustment cost. Raising ν from 0.0025 to 0.01 for the EA and China leaves the responses of output, inflation, trade flows, exchange rates, and welfare nearly unchanged in all three economies. In particular, the dynamics of bilateral real exchange rates and the cross-country allocation of the contraction remain almost identical to the baseline.

This robustness exercise is nonetheless informative. Since ν directly governs the strength of the wedge in the foreign-bond Euler Equation (16) and therefore the degree of international risk sharing, it provides a natural diagnostic of whether the baseline results rely on financial rebalancing and valuation effects. The near invariance of the impulse responses indicates that, for the 2025 tariff escalation considered here, the main propagation mechanisms operate through trade linkages, CPI-PPI wedges, and monetary-policy reactions, rather than through the quantitative strength of international portfolio adjustment costs. In other words, the third-country effects highlighted in the main text are not an artefact of the particular parametrization of the portfolio wedge used to stabilize net foreign assets.

B Effects of a Chinese Export Subsidy

In this section we introduce an *ad valorem* export subsidy granted by China on shipments to destination $j \in \{\text{us}, \text{ea}\}$. Let $\varsigma_{j\leftarrow \text{cn},t} \in [0,1)$ denote the subsidy rate (zero in the baseline). It scales the tariff–inclusive foreign price of Chinese varieties faced by buyers in j. For compactness, define the generalized bilateral purchase price:

$$\tilde{P}_{i\to k,t} \equiv (1+\tau_{k,i,t})(1-\varsigma_{k\leftarrow i,t})S_t^{k,i}P_{i,t}^{\text{ppi}}, \qquad \varsigma_{k\leftarrow i,t} = \begin{cases} \varsigma_{k\leftarrow \text{cn},t} & \text{if } i = \text{cn}, \\ 0 & \text{otherwise.} \end{cases} \tag{36}$$

Hence, a positive $\varsigma_{j\leftarrow \text{cn},t}$ reduces the effective import price of Chinese goods in j by the factor $(1-\varsigma_{j\leftarrow \text{cn},t})$.

The subsidy directly affects final-goods CPIs as well as intermediate-input price index in destination k. For the countries importing subsidized imports, the consumption gains stem from lower import prices but lead to substitute demand away from local goods. For production the access to cheaper input can stimulate output, investment and labor demand. For the country imposing the subsidy the gains stem from sustained economic activity driven by higher external demand, and the cost from a terms-of-trade depreciation that makes imports more costly. Finally, the subsidies must be financed by either tariffs or lump-sum taxes.

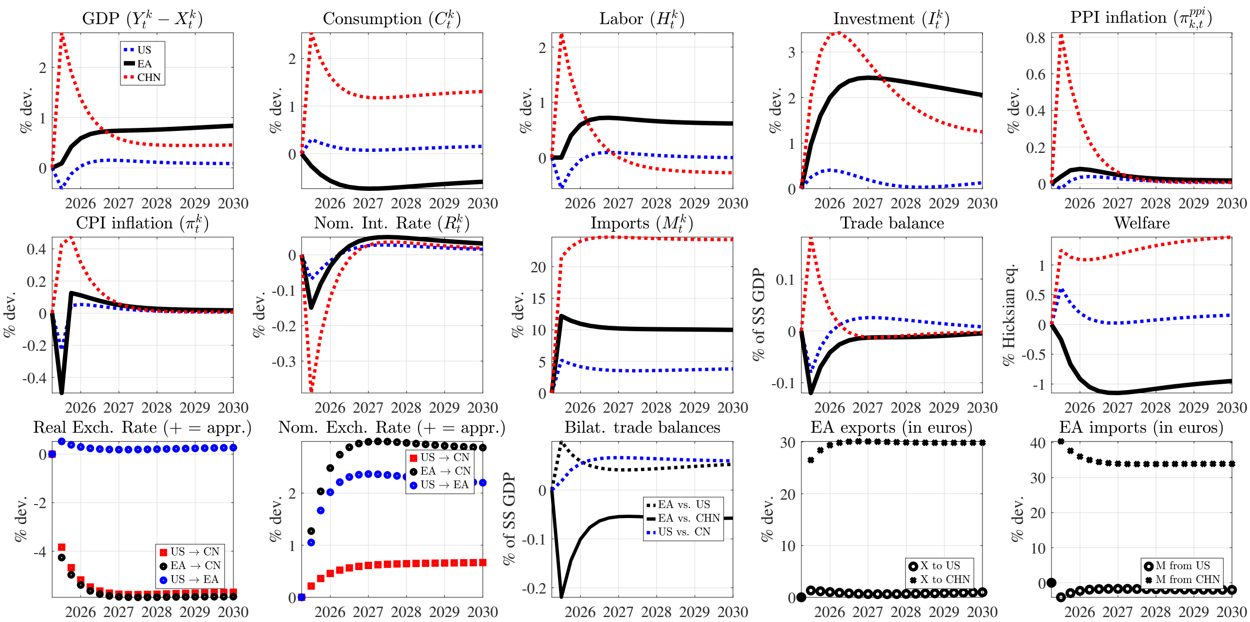
In the quantitative exercise below we consider a 10 percent uniform Chinese export subsidy $\varsigma_{\text{cn},t}$ applied either to shipments to the U.S. and the EA. Figure 9 reports the marginal effects of such an export subsidy, starting from the global trade-war path.

The shock produces a sizeable and immediate expansion in Chinese activity. GDP, consumption, investment, and labor all increase significantly on impact, reflecting the sharp rise in foreign demand for Chinese goods. Imports of intermediates also surge, supporting the production boom. The subsidy thus acts primarily as a demand stimulus, magnified by the large export shares of Chinese goods in partner absorption.

Foreign economies experience the opposite pattern. Both the U.S. and the EA display a mild contraction on impact, driven by a shift away from their goods in international trade. The associated decline in production and labor income explain the small but noticeable drops in GDP and consumption in both economies.

Price dynamics display a clear cross-country asymmetry. In China, the expansion in external demand and higher input usage generate upward pressure on domestic marginal costs, leading to a short–lived increase in CPI inflation. In contrast, the U.S. and the EA both face deflationary pressures: the real appreciation, cheaper imports from China, and weaker domestic activity all contribute to lower producer and consumer prices. Monetary policy reacts accordingly in both countries by loosening mildly. In China the peg component of monetary policy fights appreciation tensions – the Renminbi is high demand because goods are denominated in the producer currency – which further fuels expansion.

Figure 9: Marginal Effects of Chinese Export Subsidies (10%) – starting from a Global Trade War.



Note: Black: euro area, Blue: U.S., Red: China. Panels display deviations from the global trade-war equilibrium. Imports are converted in units of EA goods, as they enter in the EA trade balance and NFA dynamic equations. Real exchange rates are PPI-based bilateral relative prices as defined in the model. The U.S. tariff increases by 36.8pp and the Chinese tariff on U.S. goods by 11.4pp starting from a 20.7% and 21% level, respectively. Chinese subsidies to goods exported both to the U.S. and the euro area rise permanently from 0 to 0.1 on impact.

Welfare effects mirror these adjustment patterns. China gains substantially from the subsidy – around 1.5% in Hicksian consumption–equivalent terms. The U.S. experience small positive welfare effects – roughly 0.5% on impact, converging to zero in the long run – mostly driven by cheaper imported intermediates and final goods. By contrast, the EA suffers a welfare loss of close to 1%, both reflecting its lower exposure to Chinese goods compared to the U.S., and it higher bilateral exposure to U.S. goods.

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