Tariffs and Monetary Policy in a Low Pass-Through Environment:

The Return of the ZLB

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1 Question and Answer

- Should a tariff-imposing country adopt monetary tightening or easing?
- Perfect Pass-Through Environment: the Ramsey planner tightens.
- Imperfect Pass-Through Environment: the Ramsey planner eases substantially.
- The accommodative response survives when Foreign demand and Foreign monetary policy are endogenized in a two-country economy.
- Economically relevant changes can push the desired rate to the ZLB without an exogenous natural-rate shock.

2 Controlled Pass-Through Comparison

- Start from the SOE framework of Monacelli (2025).
- Home producers use producer-currency pricing (PCP) in both environments.
- Perfect Pass-Through: no sticky importer-price block; the law of one price holds for imports.
- Imperfect Pass-Through: add domestic importers using local-currency pricing (LCP).
- The tariff experiment, fiscal closure, PCP producer block, and basic trade structure are otherwise retained.
- The controlled change is the short-run pass-through environment.

3 Imperfect Pass-Through: Sticky Domestic Importers

- Domestic importers buy Foreign goods at the border acquisition price $\mathcal{E}_t P^*_{F,t}$ and sell them in Home currency at a tariff-exclusive price.
- A resetting importer chooses $\overline{P}_{F,t}$ to solve

$$\max_{\overline{P}_{F,t}} E_t \sum_{k=0}^{\infty} \theta_M^k Q_{t,t+k} \left[\overline{P}_{F,t} - (1-\tau) \mathcal{E}_{t+k} P^*_{F,t+k} \right] C_{F,t+k|t}.$$

- Only a fraction $1 - \theta_M$ can reset its local-currency price each period.
- Hence the border acquisition price can move immediately while the local importer price remains sticky.

4 The LOOP Gap

- With sticky local import prices, the law of one price need not hold:

$$\mathcal{E}_t P^*_{F,t} \neq P_{F,t}.$$

- Define the LOOP gap as

$$\Psi_t \equiv \frac{\mathcal{E}_t P^*_{F,t}}{P_{F,t}}.$$

- Perfect Pass-Through implies $\Psi_t = 1$; under Imperfect Pass-Through, Ψ_t moves endogenously.
- With the subsidy normalization, $1/\Psi_t$ is the importer markup relative to its desired level.
- Hence $\Psi_t \neq 1$ is itself an importer-pricing distortion.

5 Tariff and the Household Relative Purchase Price

- Define the ex-tariff relative price of imports

$$S_t \equiv \frac{\mathcal{E}_t P^*_{F,t}}{P_{H,t}}.$$

- The Home household pays the *cum-tariff* relative purchase price

$$\frac{(1+\tau_{M,t})P_{F,t}}{P_{H,t}} = \frac{1+\tau_{M,t}}{\Psi_t} S_t.$$

- For given S_t and Ψ_t, a higher import tariff raises this relative purchase price.
- For given S_t, a higher LOOP gap Ψ_t lowers the cum-tariff relative price of imports $(1+\tau_{M,t})S_t/\Psi_t$.

6 Relative-Price Externality

- In the Imperfect Pass-Through Environment, the relative-price externality is jointly reflected in S_t and Ψ_t.
- Monetary accommodation and the associated depreciation keep S_t higher than under a less accommodative path, supporting Home demand, output, and income.
- Because $P_{F,t}$ is sticky, the same depreciation raises $\mathcal{E}_t P^*_{F,t}$ relative to $P_{F,t}$ and therefore raises Ψ_t.
- The LOOP gap is distortionary, but imperfect pass-through lets the planner exploit the relative-price externality more effectively while trading this gain against sticky-inflation costs.

7 The Planner Solves a Nonlinear Ramsey Problem

- The social planner chooses the allocation to maximize

$$\mathcal{U} = E_0 \sum_{t=0}^{\infty} \beta^t \left(\log C_t - \frac{N_t^{1+\varphi}}{1+\varphi} \right),$$

  subject to the nonlinear private-equilibrium conditions and the ZLB.
- The policy results reported in the figures come from this nonlinear Ramsey problem.

8 Welfare Cost Function: The Planner's Purposes

- To clarify the social planner's purposes, we derive the welfare cost function while we assume that the planner maximizes the utility function.

$$\mathcal{L}_t^{SOE,IPT} = \frac{1}{2}[\Lambda_y(y_t - y_t^w)^2 + \Lambda_\psi(\psi_t - \psi_t^w)^2 + \Lambda_{\pi,H}\pi_{H,t}^2 + \Lambda_{\pi,F}\pi_{F,t}^2].$$

- Under Perfect Pass-Through, the relative-price externality operates through S_t alone; under Imperfect Pass-Through, the same externality is jointly reflected in S_t and Ψ_t.
- ψ_t^w is the Welfare Relevant LOOP Gap and $\psi_t - \psi_t^w$ its deviation.
- Λ_ψ is smaller than the sticky-inflation weights, but the tariff creates a quantitatively large LOOP-gap deviation.

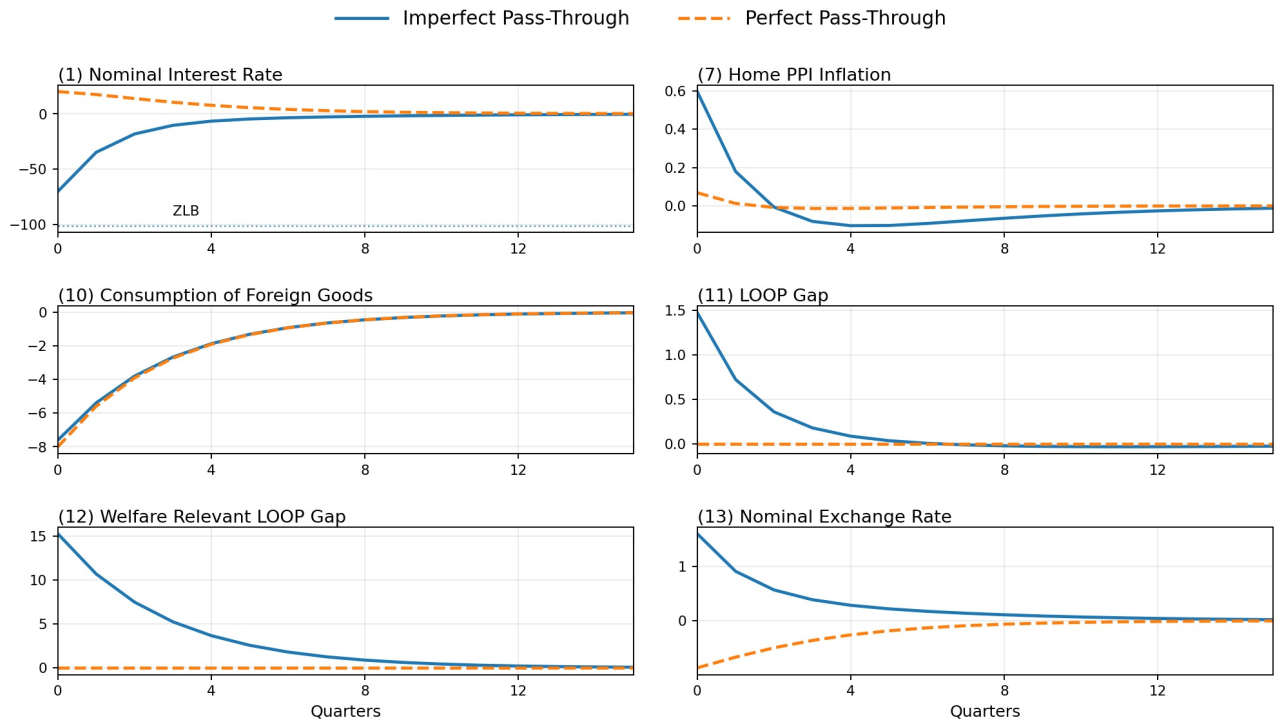
9 Why Perfect Pass-Through Calls for Tightening

- Under Perfect Pass-Through, the tariff raises the *cum-tariff* price of Foreign goods relative to Home goods and induces expenditure switching toward Home goods.
- The resulting increase in Home demand raises Home production and labor input, increasing Home producer real marginal cost.
- Through the Home producer Phillips curve, higher real marginal cost puts upward pressure on Home PPI inflation, so the Ramsey planner tightens.

10 Why Imperfect Pass-Through Calls for Easing

- Monetary accommodation and the associated depreciation keep S_t higher than under a less accommodative path, supporting Home demand, output, and income.
- Because the local import price $P_{F,t}$ is sticky, the depreciation also raises the LOOP gap Ψ_t instead of passing one-for-one into the local ex-tariff import price.
- For a given S_t, the rise in Ψ_t offsets part of the tariff-induced increase in the household-facing cum-tariff relative price $(1 + \tau_{M,t})S_t/\Psi_t$.
- The planner trades these gains against importer-price and Home-PPI inflation costs.

11 SOE Benchmark: Perfect vs. Imperfect Pass-Through



Perfect pass-through: tightening.

Imperfect pass-through: substantial easing.

12 SOE Welfare Accounting

Welfare component ($\times 10^{-3}$)	Optimal − zero response
Welfare Relevant Output Gap	+0.369
Welfare Relevant LOOP Gap Deviation	−1.615
Home PPI inflation	+0.670
Ex-tariff import inflation	+0.031
Total quadratic welfare cost	−0.545

- The table reports Welfare Cost under the optimal nominal-rate response—the rate cut—relative to the counterfactual zero response.
- The optimal monetary policy lowers total quadratic welfare cost by 0.545×10^{-3}.
- The nominal depreciation raises the LOOP gap Ψ_t; under the optimal response, the Welfare Relevant LOOP Gap Deviation component falls by 1.615×10^{-3}.

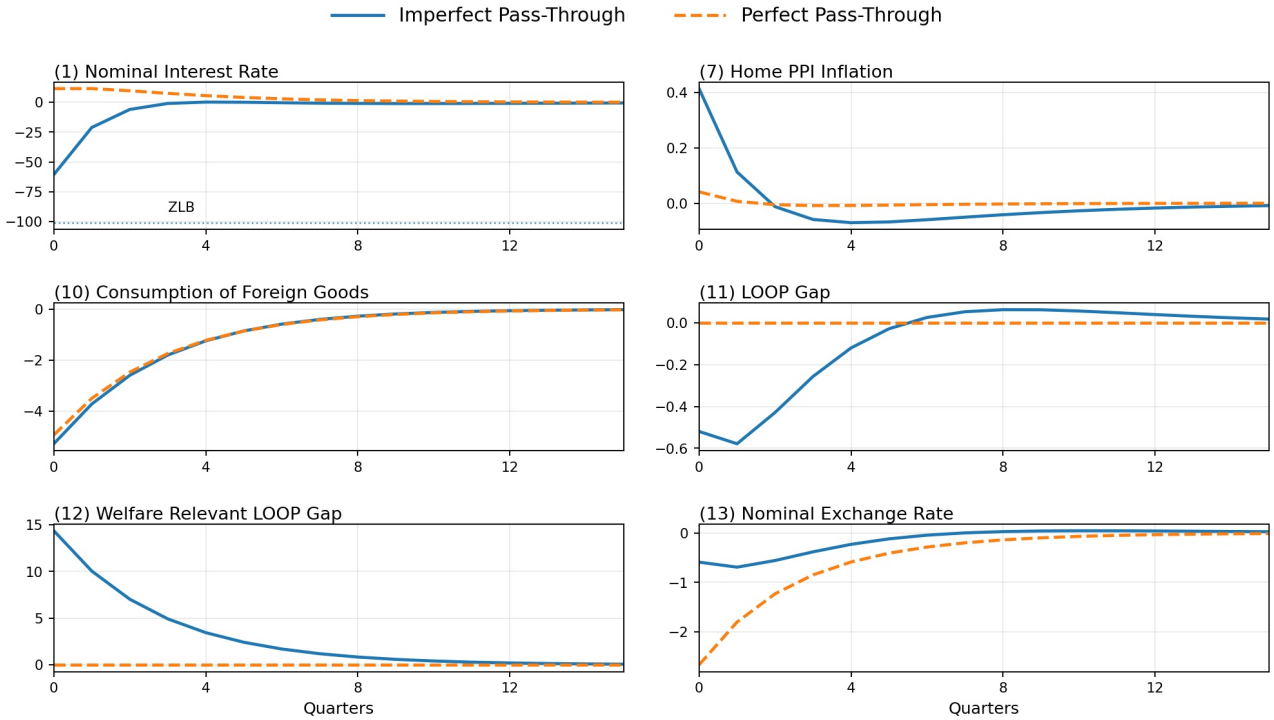
13 Two-Country Model: Overview

- Foreign demand and Foreign monetary policy are endogenous, and complete international financial markets link the two countries.
- Home bias is introduced through the common openness parameter $\upsilon = 0.30$.
- Home's economic-size share is set to $\nu = 0.27$, matching the U.S. share of world GDP.
- The Home import expenditure weight is

$$\omega_F = \upsilon(1 - \nu) = 0.219.$$

- Thus imports account for 21.9% of Home expenditure, close to the 22.3% average ratio of U.S. imports of goods and services to personal consumption expenditures over 2000–2025.

14 Two-Country Benchmark: Accommodation Survives



Home still eases, but Home now appreciates rather than depreciates.

15 Why Home Still Cuts Its Policy Rate

- Home still cuts its nominal interest rate in the two-country economy.
- Foreign cuts its rate more persistently, so the relative interest-rate path appreciates the Home currency. This differs from the SOE, but Home monetary policy remains accommodative.
- Further Home easing would put additional upward pressure on Home PPI inflation and raise total Home welfare cost, so the optimal rate cut stops at this degree of accommodation.

16 The Return of the ZLB

- Benchmark imperfect pass-through already calls for substantial accommodation in the SOE and two-country economy, with the ZLB slack.
- We change one economically relevant dimension at a time and ask whether it pushes the desired rate to the ZLB.
- The five cases are not unrelated liquidity-trap shocks; each adds a different force to an accommodation that is already large.
- No separate demand shock or exogenous natural-rate shock is added.

17 How Close Is the Desired Rate to the ZLB?

Case	Home actual	Home notional	ZLB quarters
SOE: high substitution ($\eta = 3$)	−101.01	−119.95	1
SOE: external habit	−101.01	−185.31	2
Two-country: reciprocal tariffs	−101.01	−210.62	3
Two-country: roundabout production	−101.01	−106.95	1
Two-country: open-loop Nash	−101.01	−101.31	1

Each experiment pushes the ZLB-relaxed Home rate below zero.

Interest-rate entries are impact deviations from steady state in basis points.

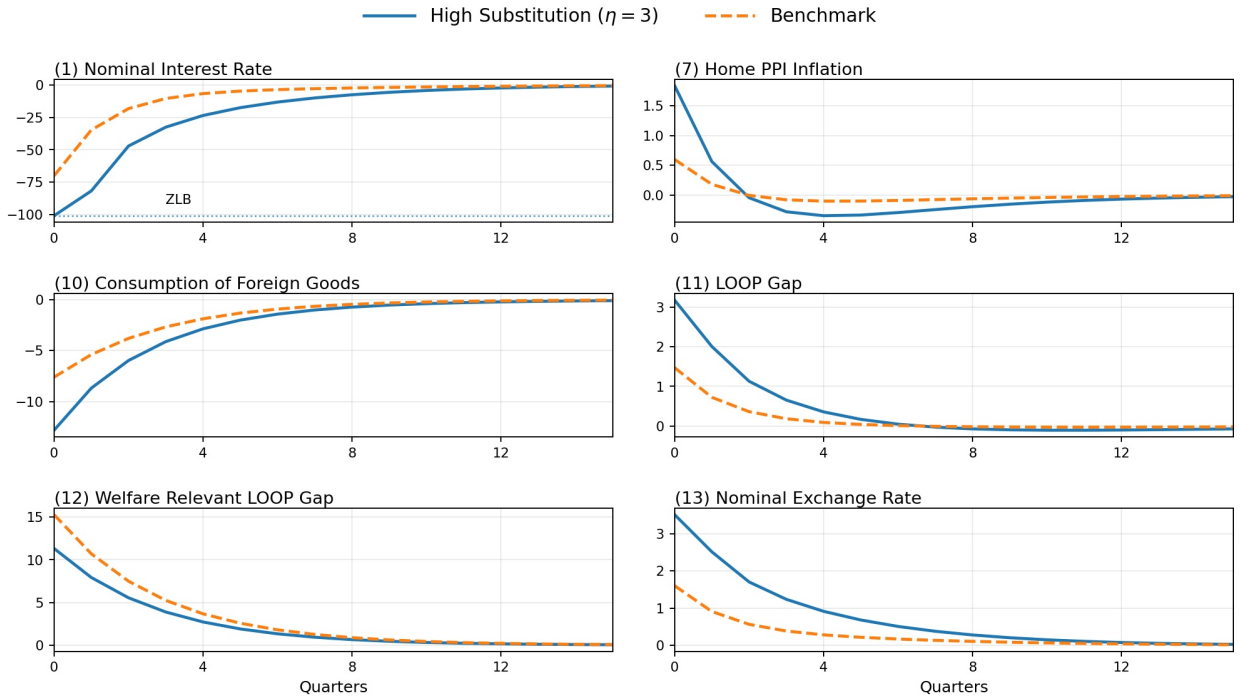
18 High Substitutability: Why the ZLB Appears

- Only the Home–Foreign substitution elasticity changes:

$$\eta: \ 1.5 \longrightarrow 3.$$

- A higher η makes a given movement in the household-facing relative import price generate a larger change in the composition of Home consumption.
- The Welfare Relevant LOOP-gap weight rises while the Home-PPI-inflation weight falls. Together with the more elastic relative-demand response, this strengthens the incentive for a larger joint S_t–Ψ_t adjustment; the higher import-price-inflation weight works in the opposite direction.
- The resulting desired rate cut exceeds the available conventional-policy space, so the ZLB binds.

19 High Substitutability: IRF and the ZLB



The Welfare Relevant LOOP Gap itself is smaller than in the benchmark. Stronger easing instead reflects the larger quantity response to the joint movement of S_t and Ψ_t and the associated welfare trade-off. The desired rate crosses zero and the ZLB binds for one quarter.

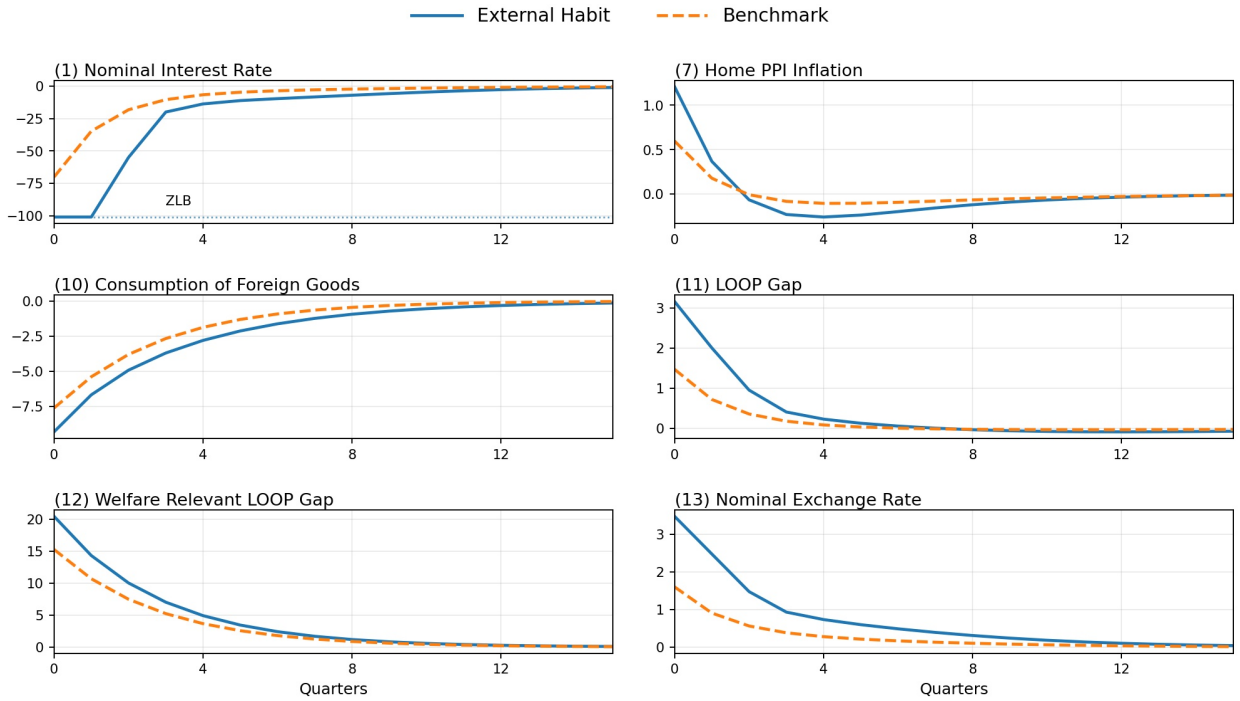
20 External Habit: Why the ZLB Appears

- Lifetime utility becomes

$$\mathcal{U} = E_0 \sum_{t=0}^{\infty} \beta^t \left[\log\left(C_t - hC_{t-1}^{\text{agg}}\right) - \frac{N_t^{1+\varphi}}{1+\varphi} \right].$$

- The planner internalizes that higher current consumption becomes a higher inherited consumption benchmark in the next period.
- For given future current consumption, a higher inherited benchmark lowers habit-adjusted consumption. The planner therefore has an incentive to sustain a higher future output and income path.
- This intertemporal force requires a larger and more persistent rate cut; the desired rate exceeds the available conventional-policy space, so the ZLB binds.

21 External Habit: IRF and the ZLB



External habit makes the aggregate-consumption consequences of the accommodation intertemporal. Higher current consumption raises the next period's inherited habit benchmark, so the Ramsey authority sustains output and income with larger and more persistent accommodation. The ZLB binds for two quarters.

22 Reciprocal Tariffs: Why the ZLB Appears

- Benchmark:

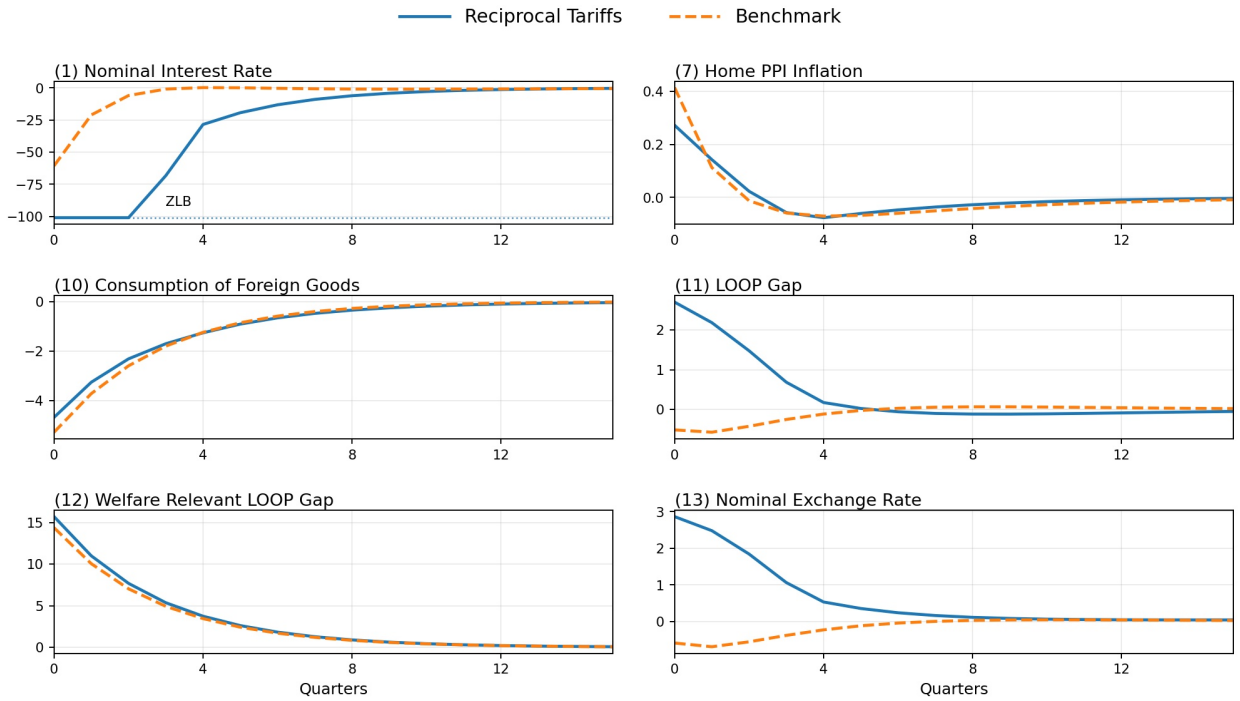
$$\tau_{M,t} > 0, \qquad \tau^*_{M,t} = 0.$$

- Reciprocal-tariff experiment:

$$\tau_{M,t} > 0, \qquad \tau^*_{M,t} > 0.$$

- The Foreign tariff reduces Foreign demand for Home goods, weakening Home activity and Home producer real marginal cost.
- The resulting additional downward pressure on Home PPI inflation calls for much stronger Home easing.
- The desired rate crosses zero, so the ZLB binds.

23 Reciprocal Tariffs: IRF and the ZLB



The foreign-demand spillback provides the main additional producer-price stabilization force. Home therefore needs substantially stronger easing than under the unilateral benchmark, and the ZLB binds for three quarters.

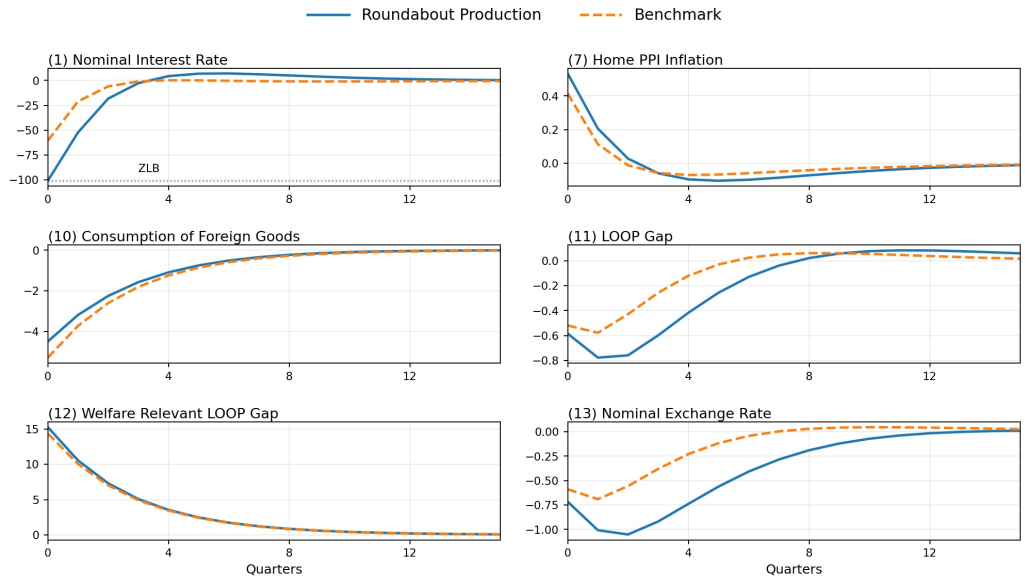
24 Roundabout Production: Why the ZLB Appears

- Following Basu (1995), Home and Foreign producers use produced goods as intermediate inputs:

$$Y_t \Delta_{H,t} = \left(\frac{N_t}{1-\zeta}\right)^{1-\zeta} \left(\frac{\mathcal{I}_t}{\zeta}\right)^{\zeta}.$$

- ζ is the intermediate-input share. We set $\zeta = 0.50$, the lower bound of the 0.5–0.7 range regarded as reasonable by Huang and Liu (2004).
- The Home tariff reduces Home demand for Foreign intermediate goods; weaker Foreign activity then lowers Foreign demand for Home final and intermediate goods.
- This material-input spillover–spillback places downward pressure on Home activity, producer real marginal cost, and Home PPI inflation.

25 Roundabout Production: Marginal Cost and the IRF



$$MC_t^r = (C_t N_t^{\varphi})^{1-\zeta}\, \mathcal{G}(S_t/\Psi_t, \tau_{M,t}).$$

Since $1-\zeta$ is the labor share, a given rise in Home activity provides less support to producer real marginal cost. Producer-price dispersion is also more costly because intermediate inputs are themselves produced goods. Together with the material-input spillback, these forces require stronger easing; the ZLB binds on impact.

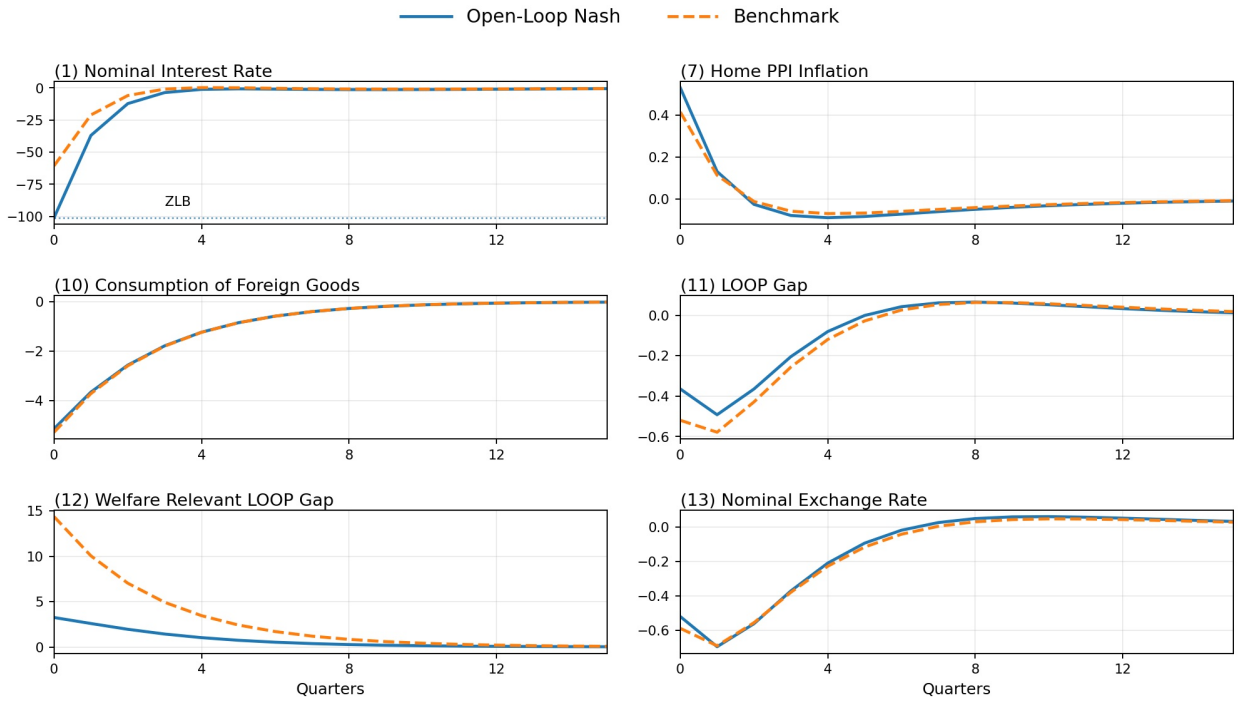
26 Open-Loop Nash: Why the ZLB Appears

- Under open-loop Nash, Home's strategic policy path is

$$\{\Pi_{H,t}\}_{t\geq 0},$$

  while the complete Foreign PPI-inflation path $\{\Pi^*_{F,t}\}_{t\geq 0}$ is taken as given.
- Home import-price inflation becomes a much less independent stabilization object than in the benchmark allocation game.
- The stabilization problem is therefore more concentrated on the Home producer-price block, requiring stronger monetary accommodation in this calibration.
- The desired cut just crosses the ZLB.

27 Open-Loop Nash: IRF and the ZLB



The stabilization problem becomes more concentrated on the Home producer-price block. The monetary policy needed to implement the preferred Home PPI-inflation path is therefore more accommodative in this calibration. The desired cut just crosses the ZLB.

28 Conclusion

- Changing the short-run pass-through environment can turn the Ramsey response to a tariff from tightening into substantial easing.
- With imperfect pass-through, monetary easing exploits the open-economy relative-price externality more effectively: depreciation supports Home output and income, while sticky local import prices prevent a one-for-one increase in the domestic import price.
- Accommodation remains optimal in the two-country economy even though the Home currency appreciates, with Home PPI-inflation stabilization limiting further easing.
- Changing one economically relevant dimension can strengthen this already large desired easing enough for the ZLB to bind without an exogenous natural-rate shock.