Tariffs and "Unconventional" Monetary Policy: The Return of the ZLB

Eiji Okano
Nagoya City University

Yang Zhou
Nagoya City University

Masataka Eguchi
Nagoya City University

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1 Motivation (1): Policy Background

- Tariffs have returned as macroeconomic shocks, not only as trade-policy instruments.
- The Trump administration paired the introduction of reciprocal tariffs with a major tax-cut package, the One Big Beautiful Bill.
- The White House (2025) presented the package as delivering large tax cuts and higher take-home pay for working households.
- This recent U.S. policy mix motivates the fiscal interpretation of tariff revenues in the paper.

1 Motivation (2): Tariff Revenues and Tax Adjustment

- The policy background motivates the paper's focus on an interaction between tariff revenues and distortionary tax adjustment.
- The argument does not require literal one-for-one earmarking of tariff revenues to a particular tax bill.
- Tariff revenues enter the consolidated government budget constraint.
- Given a Bohn-type primary-balance rule, the labor income tax adjusts residually.

1 Motivation (3): Why the Monetary Response Can Reverse

- The conventional intuition is that tariffs raise import prices and CPI inflation, so monetary policy should tighten.
- With tariff revenues in the government budget constraint, the induced tax adjustment changes this logic.
- Higher tariff revenues lower the residual labor income tax required to implement the fiscal rule.
- The tax cut raises natural output and lowers real marginal cost.
- Under sticky prices, this creates downward pressure on the output gap and PPI inflation, so Ramsey policy eases.

1 Motivation (4)

Tariff increase

$\Downarrow$

Tariff revenue rises

$\Downarrow$

Residual labor income tax falls

$\Downarrow$

Natural output rises and real marginal cost falls

$\Downarrow$

Output gap and PPI inflation fall under sticky prices

$\Downarrow$

Ramsey policy lowers the nominal interest rate

1 Motivation (5)

- The paper's headline result is therefore not merely that tariffs can be contractionary.
- The sharper result is this:
- A tariff shock can require monetary easing strong enough to bring back the ZLB.
- This can happen even when the steady-state nominal interest rate is positive.

1 Motivation (6): What the Paper Does

1. Introduce a government budget constraint with nominal debt and distortionary labor taxation into a New Keynesian open-economy tariff model.
2. Compare Ramsey optimal policy with CPI inflation targeting and with a lump-sum tax benchmark.
3. Show when tariff shocks generate a ZLB-constrained commitment policy.
4. Extend the analysis to a two-country model to separate domestic and global ZLB margins.

1 Motivation (7): Main Messages

- The optimal response to import tariffs depends critically on the fiscal treatment of tariff revenues.
- CPI inflation targeting has a tightening bias after a tariff shock.
- The ZLB incidence depends on tariff size, country size, and whether tariffs are unilateral or reciprocal.
- Tariffs can therefore call for "unconventional" monetary policy through a fiscal-tax channel absent from lump-sum tax models.

2 Literature (1)

- The paper builds on the New Keynesian open-economy tariff framework of Galí and Monacelli (2016) and Monacelli (2025).
- Monacelli (2025) shows that CPI inflation targeting can generate a tightening bias after tariff shocks.
- Bergin and Corsetti (2023) and Bianchi and Coulibaly (2025) also challenge the view that tariffs always call for monetary tightening.
- The present paper adds the government budget constraint and distortionary labor taxation.

2 Literature (2): Distinction from Bianchi–Coulibaly

- Bianchi and Coulibaly (2025): tariff revenues create a fiscal externality because private import decisions use tariff-inclusive prices.
- Here: tariff revenues operate through the consolidated government budget constraint.
- The Bohn-type primary-balance rule pins down the surplus requirement.
- The labor income tax adjusts residually.
- The result is a tax-induced movement in the natural allocation and real marginal cost.

2 Literature (3): ZLB Literature

- Standard ZLB episodes are usually generated by adverse demand shocks, low natural rates, financial shocks, or policy constraints.
- Here, the ZLB can arise from a trade-policy shock.
- The mechanism is endogenous: tariff revenue lowers the residual labor tax, lowers PPI inflationary pressure, and reduces the desired nominal interest rate.

3 Baseline Model (1): Difference from Monacelli (2025)

- Starting point: a small open economy New Keynesian model close to Monacelli (2025).
- Common core with Monacelli (2025): Calvo price setting, import tariffs, relative-price adjustment, and elastic import/export demands.
- Main departures from Monacelli (2025):
  - nominal government debt,
  - labor income taxation,
  - a Bohn-type fiscal rule.
- These additions make tariff revenues affect monetary policy through the fiscal-tax channel.

3 Baseline Model (2): Main Assumptions

- Representative household with log consumption utility and disutility from labor.
- Monopolistically competitive firms produce differentiated domestic goods.
- Firms set prices à la Calvo; no employment subsidy removes the markup distortion.
- The law of one price holds for imported goods.
- Domestic and international financial markets are complete.
- Fiscal policy follows a Bohn-type primary-balance rule.
- Government expenditure is set to zero to isolate the tariff-revenue channel.

3 Baseline Model (3): Government Budget Constraint

- The flow real government budget constraint is

$$B_t = B_{t-1}(1 + i_{t-1})\Pi_t^{-1} - SP_t. \tag{1}$$

- The primary balance is

$$SP_t = \frac{1}{P_t}\left(\tau_t W_t N_t + \tau_{M,t} P_{F,t} C_{F,t} - P_{H,t} G_t\right). \tag{2}$$

- Since $G_t = 0$, tariff revenue directly affects the tax rate required to implement fiscal policy.

3 Baseline Model (4): Fiscal Rule and Residual Tax

- Fiscal policy follows a Bohn-type rule:

$$SP_t = \phi_B B_{t-1}, \qquad \phi_B > \frac{1}{\beta} - 1. \tag{3}$$

- The labor income tax rate adjusts residually:

$$\tau_t = \frac{P_t SP_t + P_{H,t} G_t - \tau_{M,t} P_{F,t} C_{F,t}}{W_t N_t}. \tag{4}$$

- Hence, higher tariff revenue lowers τ_t, given the fiscal rule and other variables.

3 Baseline Model (5): Real Marginal Cost

$$MC_t^r = -\frac{U_{n,t}}{U_{c,t}} \frac{\mathcal{G}(S_t, \tau_{M,t})}{A_t(1-\tau_t)}.$$

$$\mathcal{G}(S_t, \tau_{M,t}) \equiv \frac{P_t}{P_{H,t}} = \left[(1-\upsilon) + \upsilon(1+\tau_{M,t})^{1-\eta} S_t^{1-\eta}\right]^{1/(1-\eta)}.$$

- A labor income tax cut lowers real marginal cost directly through the denominator.
- The tariff also enters real marginal cost through the CPI-PPI ratio $\mathcal{G}(S_t, \tau_{M,t})$.
- This is the object that links the fiscal block to the open-economy relative-price block.

3 Baseline Model (6): Natural Output

- Log-linearizing the flexible-price equilibrium yields

$$y_t^n = \left(\frac{1}{\Omega_s} + \varphi\right)^{-1} \left[(1+\varphi)a_t + \frac{\Omega_{\tau_M}}{\Omega_s}\tau_{M,t} - \frac{\gamma\eta}{\Omega_s}\tau_{X,t} - \frac{\tau}{1-\tau}\widehat{\tau}_t^n + \frac{1-\upsilon}{\Omega_s}\widehat{g}_t\right].$$

- In the lump-sum tax environment of Monacelli (2025), the natural level of output depends on tariff wedges.
- Here, it also depends on labor income taxation.
- A labor income tax cut raises the natural level of output.

3 Baseline Model (7): CPI and Relative Prices

- The CPI is

$$P_t = \left[(1-\upsilon)P_{H,t}^{1-\eta} + \upsilon \widetilde{P}_{F,t}^{1-\eta}\right]^{1/(1-\eta)},$$

- with cum-tariff import price

$$\widetilde{P}_{F,t} = (1+\tau_{M,t})P_{F,t}.$$

- A tariff has a direct positive effect on CPI inflation.
- Ramsey policy does not mechanically offset this CPI effect.

3 Baseline Model (8): Price Setting

- Firms set prices à la Calvo.
- The reset price satisfies

$$\widetilde{p}_{H,t} = \frac{\mathcal{M}\mathcal{Z}_{p,t}}{\mathcal{K}_{p,t}}.$$

- PPI inflation is pinned down by

$$1 = \theta \Pi_{H,t}^{\varepsilon-1} + (1-\theta)\widetilde{p}_{H,t}^{1-\varepsilon}.$$

- Lower real marginal cost and a lower output gap put downward pressure on PPI inflation.

4 Ramsey Policy and the ZLB (1)

- Constrained-efficient policy maximizes household utility subject to the equilibrium restrictions.
- The planner chooses real allocations, relative prices, inflation, the primary balance, the labor income tax, and the nominal interest rate.
- The FONCs are not individual targeting rules.
- They characterize the joint welfare tradeoff among real allocation, price dispersion, fiscal implementation, and the ZLB.

4 Ramsey Policy and the ZLB (2): ZLB Constraint

- The notional nominal interest rate is

$$i_{not,t} = E_t \left[\frac{1}{\beta} \frac{\mathcal{G}(S_{t+1}, \tau_{M,t+1})}{\mathcal{G}(S_t, \tau_{M,t})} \frac{U_{c,t}}{U_{c,t+1}} \Pi_{H,t+1} \right] - 1.$$

- If $i_{not,t} > 0$, then $i_t = i_{not,t}$.
- If $i_{not,t} \leq 0$, then $i_t = 0$.
- In IRFs plotted as deviations from steady state, the ZLB is approximately $-(1/\beta - 1) \simeq -0.0101$.

4 Calibration

Parameter	Value	Interpretation
β	0.99	steady-state annual nominal rate about 4 percent
ε	3.8	steady-state markup about 35 percent
θ	0.8	average price duration of five quarters
υ	0.3	import share in small open economy
η	1.5	elasticity of substitution
φ	2.2	labor-disutility curvature
ρ_τ	0.7	benchmark tariff persistence
ϕ_B	0.02	Bohn-type fiscal response

- Robustness: $\rho_\tau = 0.8$, $\theta = 0.7$, and $\phi_B = 0.03$.

4 Calibration: Fiscal Response Parameter

- The fiscal-response parameter is set to $\phi_B = 0.02$, following Galí (2020), and satisfies $\phi_B > 1/\beta - 1$.
- It disciplines the surplus-debt feedback:

$$SP_t = \phi_B B_{t-1}.$$

- After tariff revenues are realized, the residual labor-income-tax rate adjusts to implement this rule.

4 Calibration (continued): Empirical Range

- Empirical fiscal-reaction estimates put ϕ_B in a similar range.
- Bohn (1998) reports about 0.028–0.054 for the U.S.
- Ghosh et al. (2013) report about 0.02–0.06 for advanced economies.
- Abiad and Ostry (2005) report about 0.04–0.09 for emerging economies.
- Checherita-Westphal and Zdarek (2017) report about 0.03–0.05 for the euro area.
- These estimates discipline ϕ_B, not the residual labor-tax response directly.
- Hence the robustness case uses $\phi_B = 0.03$.

5 Small Open Economy: Preview

- Three comparisons isolate the fiscal-tax channel.
  1. Baseline model versus lump-sum tax model.
  2. Ramsey optimal policy versus CPI inflation targeting.
  3. Benchmark persistence and stickiness versus high persistence and low stickiness.
- The key variables are the nominal interest rate, PPI inflation, output gap, labor income tax, primary balance, and real interest rate.

5 Small Open Economy (1): Baseline vs Lump-sum

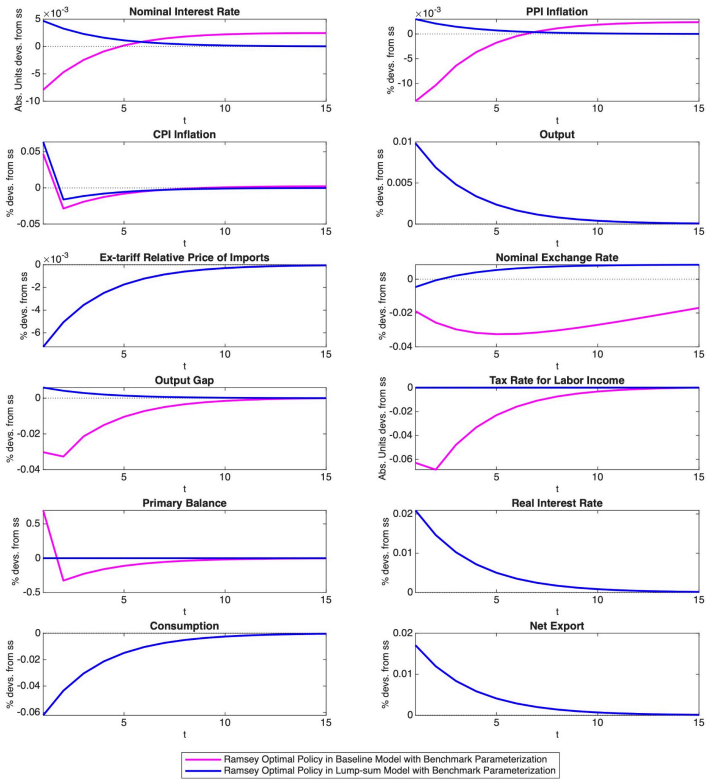

Fig. 1: Impulse Responses to a 20% Rise in Import Tariffs under Ramsey Policy: Comparison with the Lump-sum Tax Model.

5 Small Open Economy (2): Interpreting Fig. 1

- In the lump-sum tax model, the tariff mainly works through relative prices and expenditure switching.
- In the baseline model, tariff revenue improves the primary balance and lowers the labor income tax (Panels 8 and 9, Fig. 1).
- The tax cut raises natural output and lowers real marginal cost.
- The output gap becomes negative and PPI inflation falls (Panels 2 and 7, Fig. 1).
- Hence, the nominal interest rate falls under Ramsey policy (Panel 1, Fig. 1).

5 Small Open Economy (3): Tightening Bias

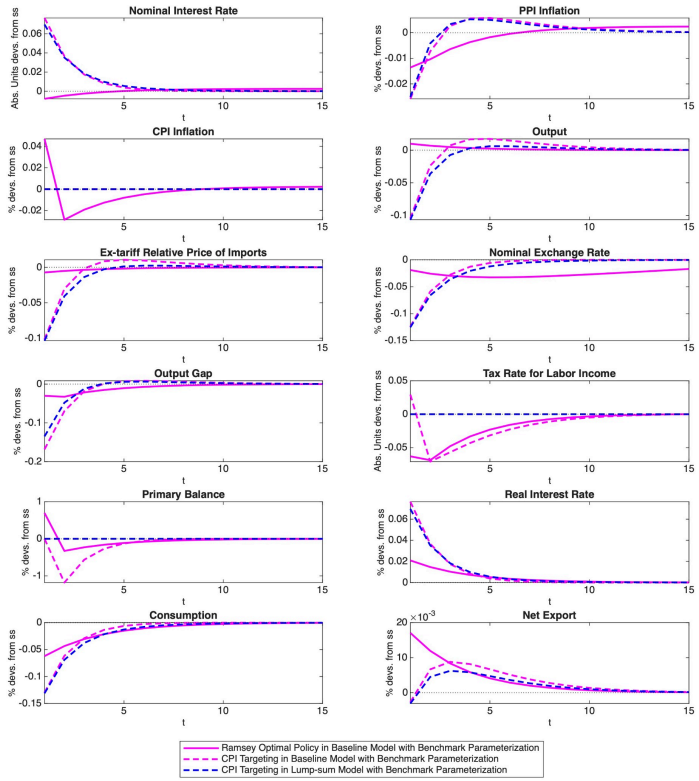

Fig. 2: Impulse Responses to a 20% Rise in Import Tariffs: Tightening Bias under CPI Inflation Targeting.

5 Small Open Economy (4): Interpreting Fig. 2

- CPI inflation targeting treats the tariff primarily as an import-price shock.
- To stabilize CPI inflation, the central bank must engineer lower PPI inflation (Panel 2, Fig. 2).
- That requires monetary tightening and a contraction in activity.
- In the baseline model, this is the opposite of the Ramsey response (Panel 1, Fig. 2).
- The tightening bias is therefore larger once tariff revenues affect distortionary taxation.

5 Small Open Economy (5): High Persistence

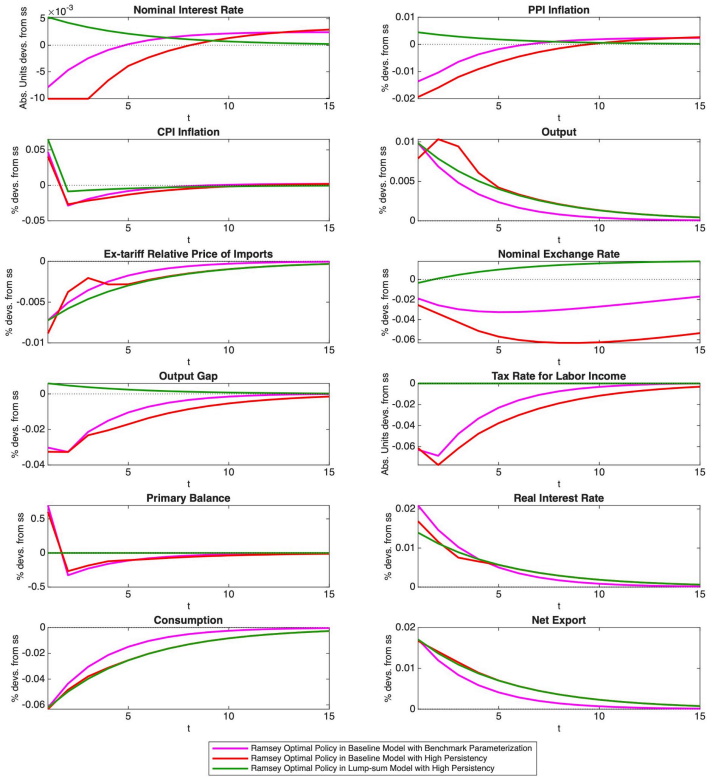

Fig. 3: Impulse Responses to a 20% Rise in Import Tariffs under High Persistence.

5 Small Open Economy (6): Why High Persistence Makes the ZLB Bind

- Higher persistence makes tariff revenues and the residual labor-tax cut last longer.
- The tax cut keeps labor cost and real marginal cost low for a longer period.
- It also keeps the higher natural level of output persistent.
- Hence, PPI deflation and the negative output gap are more persistent.
- Ramsey policy requires a larger and more persistent nominal-interest-rate cut.
- The notional nominal interest rate becomes negative, so the actual rate is constrained at the ZLB (Panel 1, Fig. 3).

5 Small Open Economy (7): Low Stickiness

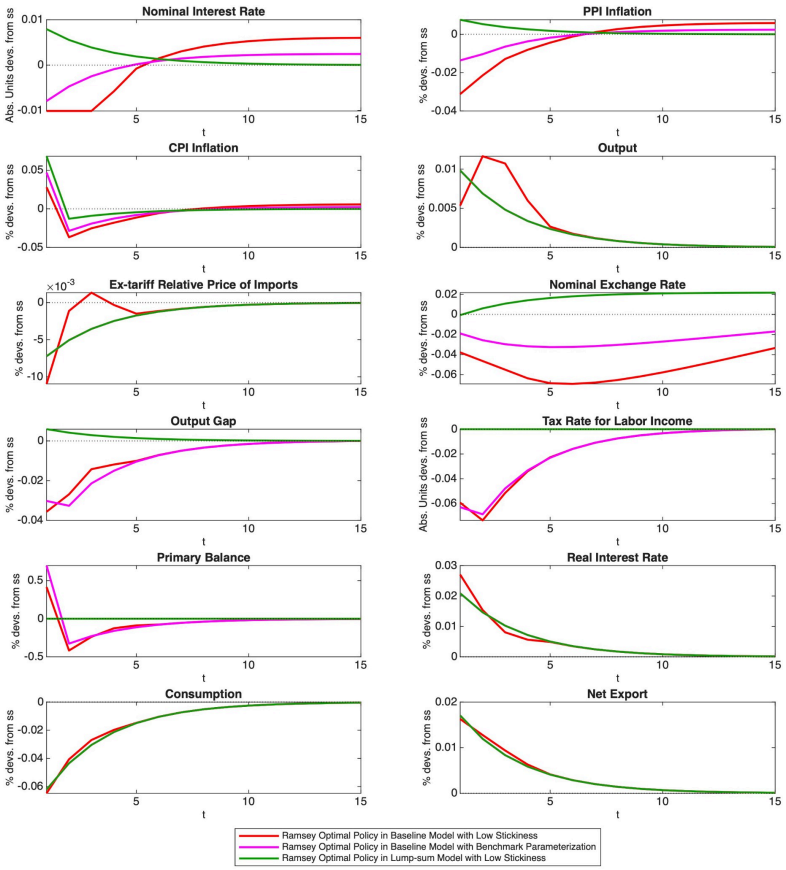

Fig. 4: Impulse Responses to a 20% Rise in Import Tariffs under Low Stickiness.

5 Small Open Economy (8): Why Lower Stickiness Makes the ZLB Bind

- The natural level of output is a flexible-price object; it is not affected by price stickiness.
- Lower stickiness changes the pass-through from lower labor cost and real marginal cost to PPI inflation.
- The tariff-induced labor-income-tax cut lowers labor cost and real marginal cost.
- With more firms resetting prices, PPI disinflation is stronger and the output gap declines more.
- Ramsey policy requires a larger nominal-interest-rate cut; the notional rate falls below zero, and the ZLB binds (Panel 1, Fig. 4).

5 Small Open Economy (9): Takeaway

- Under benchmark persistence and stickiness, the baseline model already reverses the sign of the optimal interest-rate response.
- Under high tariff persistence, the nominal interest rate reaches the ZLB because the tax cut and real-marginal-cost decline become more persistent (Panel 1, Fig. 3).
- Under lower price stickiness, the pass-through from lower labor cost to PPI inflation is stronger, so the nominal interest rate again reaches the ZLB (Panel 1, Fig. 4).
- The SOE model identifies the fiscal-tax channel cleanly.

Discussion Checkpoint 1

Does the fiscal closure look like an innocuous modeling detail, or does it change the monetary-policy problem itself?

- Useful point for discussion: the tariff is both a relative-price shock and a fiscal shock.
- The fiscal instrument used to absorb tariff revenue determines the natural allocation.

6 Two-country Model (1): Why Extend the Model?

- The small open economy model takes foreign variables as given.
- The two-country model adds international general-equilibrium feedback.
- It separates two margins:
  - domestic margin: does the tariff-imposing country hit the ZLB?
  - global margin: is the ZLB pressure transmitted abroad?
- Country size is therefore central.

6 Two-country Model (2): Country Size

- Countries are H and F.
- The population share of country H is $1 - \upsilon$.
- Therefore a larger υ means a smaller and more open country H.
- Three cases:
  - $\upsilon = 0.50$: same-size countries,
  - $\upsilon = 0.73$: H is about U.S.-GDP size,
  - $\upsilon = 0.99$: H is a very small open economy.

6 Unilateral Home Tariff (1): Same-size Countries

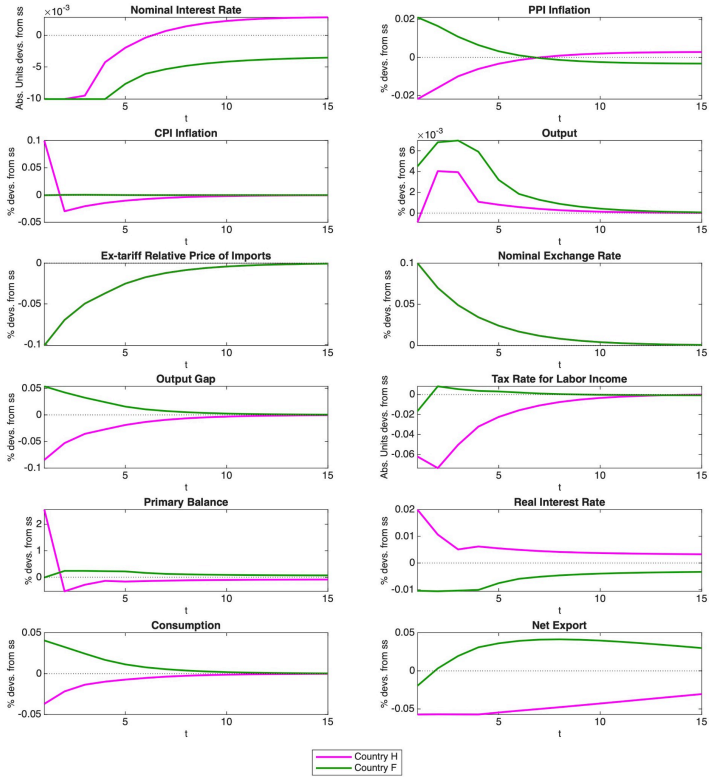

Fig. 5: 20% Increase in the Import Tariff in Country H: Same-size Countries.

6 Unilateral Home Tariff (2): Interpreting Fig. 5

- The Home nominal interest rate reaches the ZLB through the fiscal-tax channel (Panel 1, Fig. 5).
- Since countries are symmetric, the shock also generates a large Foreign response.
- Foreign policy accommodation raises Foreign output and PPI inflation under the constrained Ramsey allocation (Panels 2 and 7, Fig. 5).
- Both countries reach the ZLB: the tariff generates a global lower-bound episode.

6 Unilateral Home Tariff (3): U.S.-size Country H

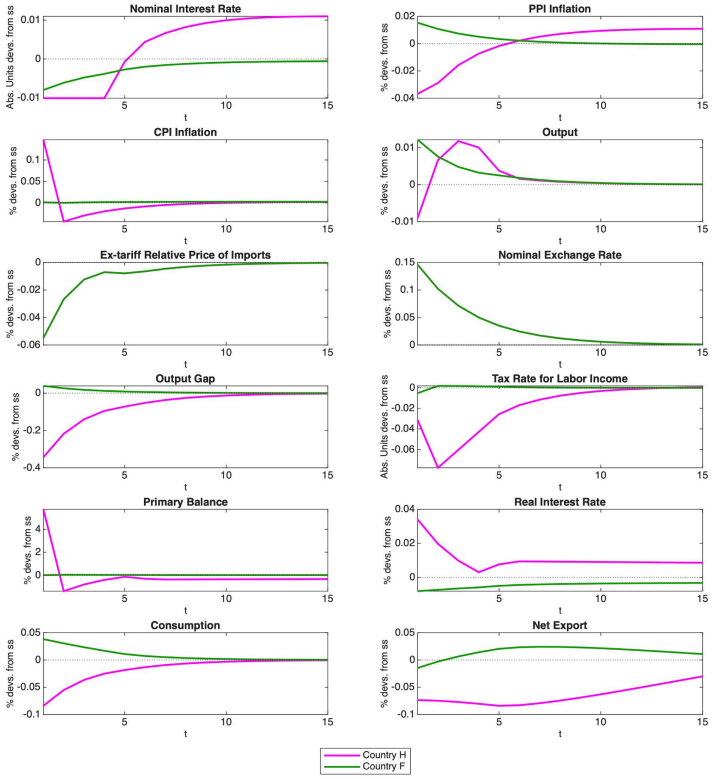

Fig. 6: 20% Increase in the Import Tariff in Country H: U.S.-GDP-size Country H.

6 Unilateral Home Tariff (4): Interpreting Fig. 6

- The Home ZLB still binds even when H is smaller than the rest of the world (Panel 1, Fig. 6).
- The Foreign nominal interest rate falls but does not hit the ZLB.
- Hence, a U.S.-size tariff shock produces a domestic ZLB episode with sizable, but not binding, foreign spillovers.
- The need for unconventional policy is concentrated in the tariff-imposing country.

6 Unilateral Home Tariff (5): Small Country H

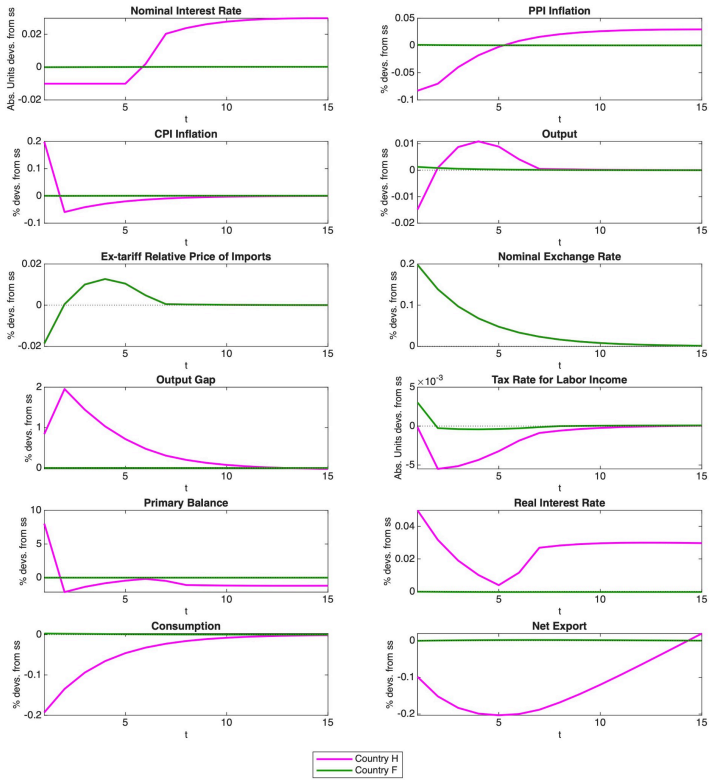

Fig. 7: 20% Increase in the Import Tariff in Country H: Small Tariff-imposing Country.

6 Unilateral Home Tariff (6): Interpreting Fig. 7

- The Home nominal interest rate reaches the ZLB despite the very small size of country H.
- This is a domestic lower-bound episode, not a global one.
- The Foreign economy is essentially unaffected because H is only one percent of the world economy.
- Smallness reduces spillovers, but openness strengthens the domestic fiscal-tax and relative-price channels.

6 Unilateral Home Tariff (7): Tariff Size and Country Size

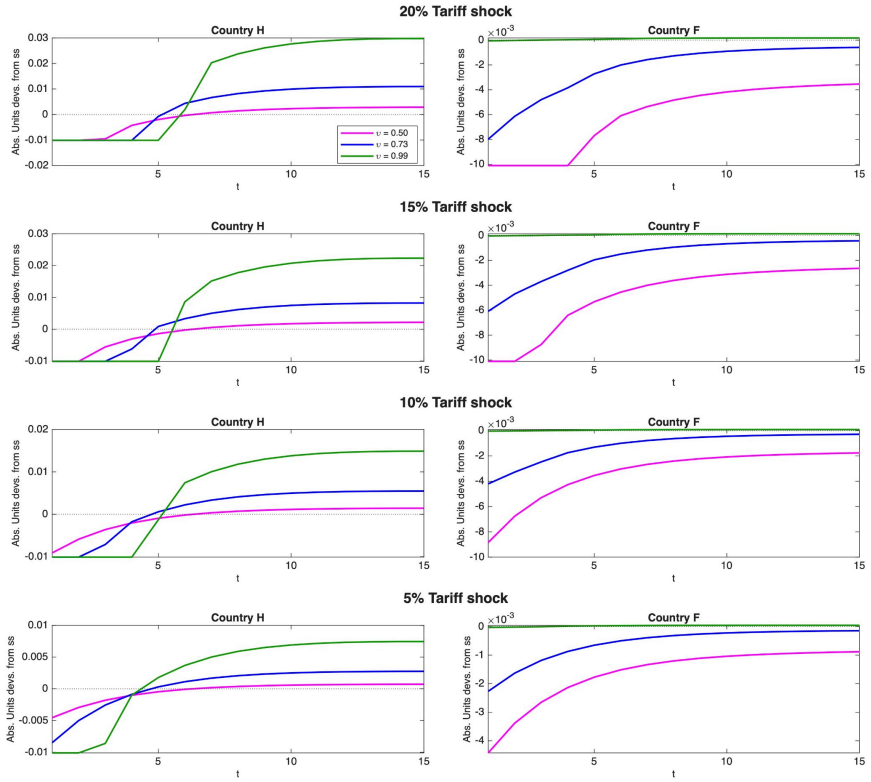

Fig. 8: Nominal Interest Rate Responses to Home Import Tariffs: Alternative Tariff Sizes and Country Sizes.

6 Unilateral Home Tariff (8): ZLB Incidence

Tariff shock	$\upsilon = 0.50$ Same-size countries	$\upsilon = 0.73$ U.S.-size H	$\upsilon = 0.99$ Small H
20%	H, F	H	H
15%	H, F	H	H
10%	–	H	H
5%	–	–	H

- Domestic ZLB force strengthens as H becomes smaller and more open.
- Global ZLB force appears only when the tariff-imposing country is large enough.
- A dash means that neither country clearly reaches the ZLB.

6 Foreign Tariff against Small H

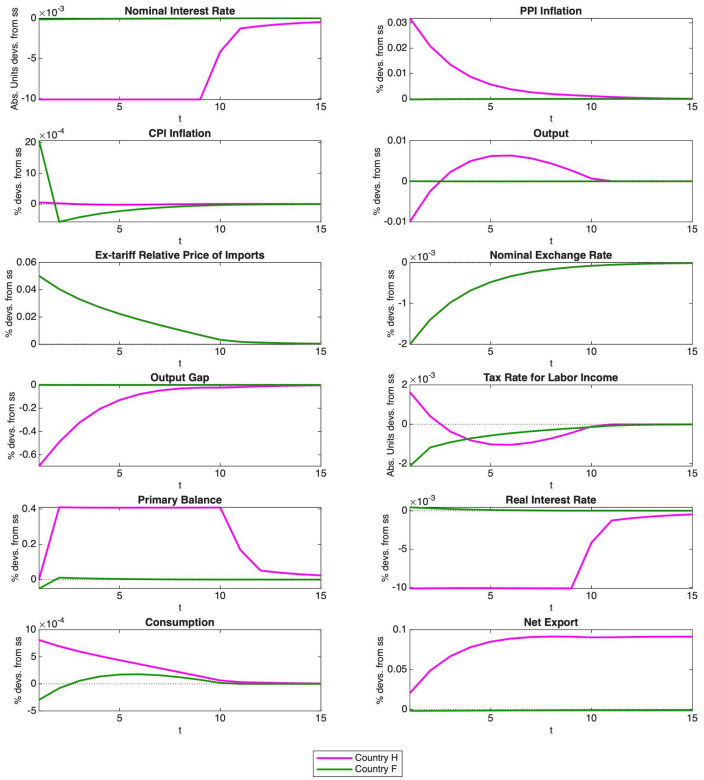

Fig. 9: 20% Increase in the Import Tariff in Country F: Small Country H Hit by Foreign Import Tariffs.

6 Foreign Tariff against Small H: Takeaway

- Fig. 9 is a useful asymmetry check.
- A foreign tariff imposed by the large country has a very different incidence from a tariff imposed by the small country.
- The exposure of the affected country and the fiscal treatment of tariff revenues determine which economy faces the lower-bound force.
- This reinforces the distinction between domestic and global ZLB margins.

Discussion Checkpoint 2

Is the ZLB result mainly a tariff-size result, or mainly a country-size and openness result?

- The answer is both.
- Tariff size determines the magnitude of the fiscal-tax shock.
- Country size and openness determine the incidence and international spillover.

7 Reciprocal Tariffs (1): Why This Experiment?

- Recent policy debates focus on reciprocal tariffs rather than purely unilateral tariffs.
- In the model, reciprocal tariffs activate the fiscal-tax channel in both countries.
- The main question is whether this makes the ZLB force global or merely domestic.
- The answer depends again on country size and tariff size.

7 Reciprocal Tariffs (2): Same-size Countries

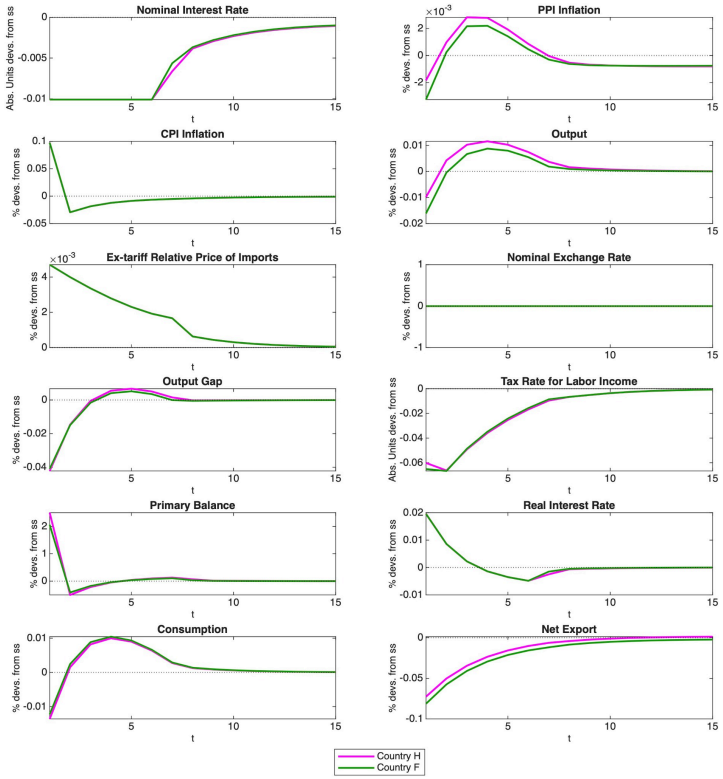

Fig. 10: 20% Reciprocal Increase in Import Tariffs: Same-size Countries.

7 Reciprocal Tariffs (3): U.S.-size Country H

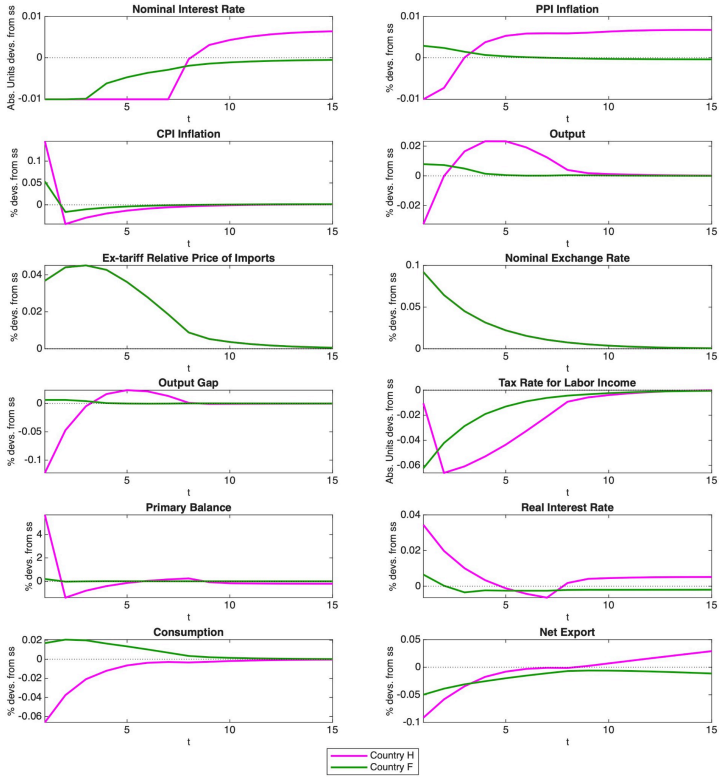

Fig. 11: 20% Reciprocal Increase in Import Tariffs: U.S.-GDP-size Country H.

7 Reciprocal Tariffs (4): Small Country H

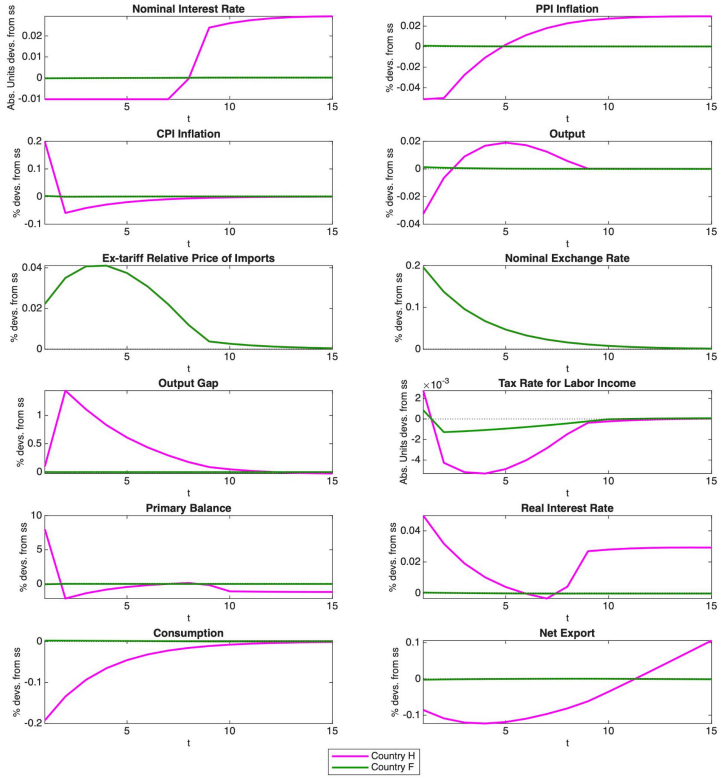

Fig. 12: 20% Reciprocal Increase in Import Tariffs: Small Country H.

7 Reciprocal Tariffs (5): Reading Figs. 10–12

- Same-size countries: reciprocal tariffs can generate a global ZLB episode (Panel 1, Fig. 10).
- U.S.-size H: both nominal interest rates can be constrained, but the Home episode is larger and more persistent (Panel 1, Fig. 11).
- Small H: the Home ZLB force is severe, while the Foreign response is negligible (Panel 1, Fig. 12).
- Reciprocal tariffs make the domestic ZLB result more robust, but global incidence still requires sufficient mutual exposure.

7 Reciprocal Tariffs (6): Tariff Size and Country Size

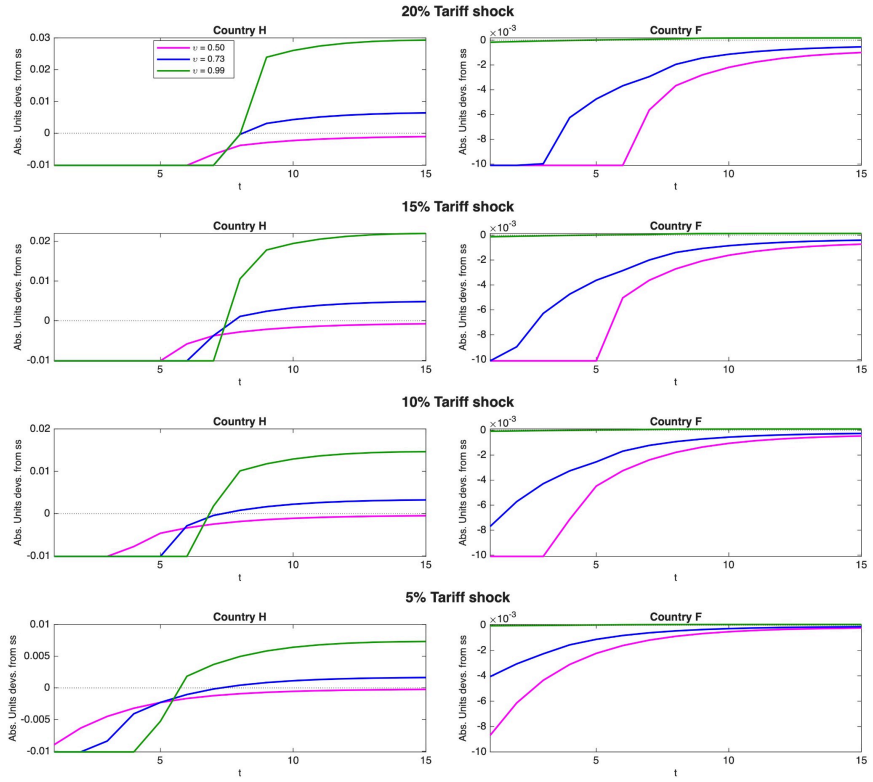

Fig. 13: Nominal Interest Rate Responses to Reciprocal Tariff Increases: Alternative Tariff Sizes and Country Sizes.

7 Reciprocal Tariffs (7): ZLB Incidence

Tariff shock	$\upsilon = 0.50$ Same-size countries	$\upsilon = 0.73$ U.S.-size H	$\upsilon = 0.99$ Small H
20%	H, F	H, F	H
15%	H, F	H, F	H
10%	H, F	H	H
5%	–	H	H

- Reciprocal tariffs make the Home lower-bound force more robust.
- A global ZLB episode appears only when both countries are sufficiently exposed to each other.
- The return of the ZLB is not an artifact of the benchmark 20% tariff shock.

8 Policy Interpretation: Recent U.S. Tariff Experience

- The model does not imply that every tariff increase sends nominal interest rates to zero.
- Recent estimates of effective U.S. tariff rates are in the high single digits to low double digits, depending on methodology.
- Rogoff (2026)'s interpretation that the realized effective increase may have been closer to 6–8 percent is consistent with the threshold pattern.
- Hence, the absence of an actual U.S. ZLB episode is not evidence against the mechanism.
- It is consistent with a model in which ZLB incidence depends on effective tariff size, country size, openness, and reciprocity.

9 Robustness (1): Fiscal Response Parameter in the SOE

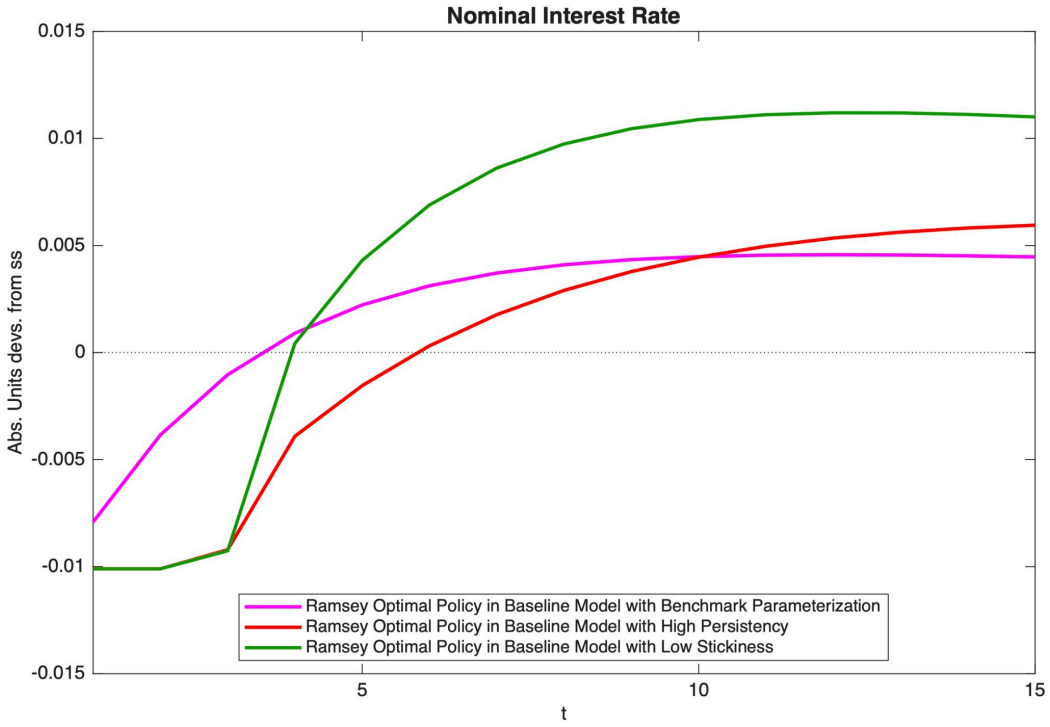

Fig. 14: Robustness to the Fiscal-response Parameter in the Small Open Economy Model with $\phi_B = 0.03$.

9 Robustness (2): Two-country Unilateral Tariffs

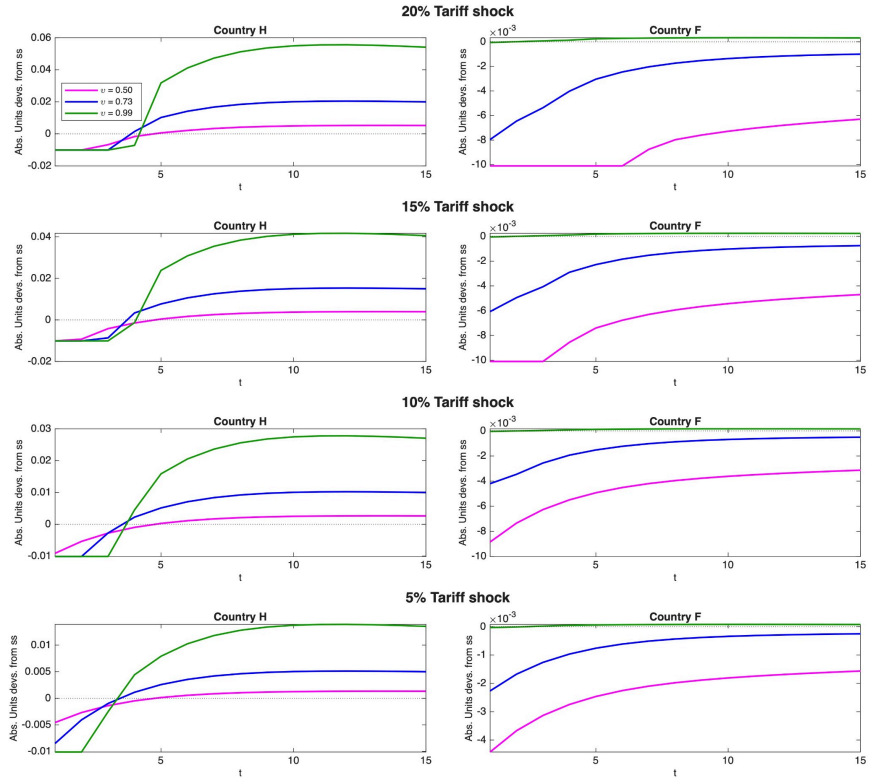

Fig. 15: Robustness to $\phi_B = 0.03$: Home Import Tariff Increases in the Two-country Model.

9 Robustness (3): Two-country Reciprocal Tariffs

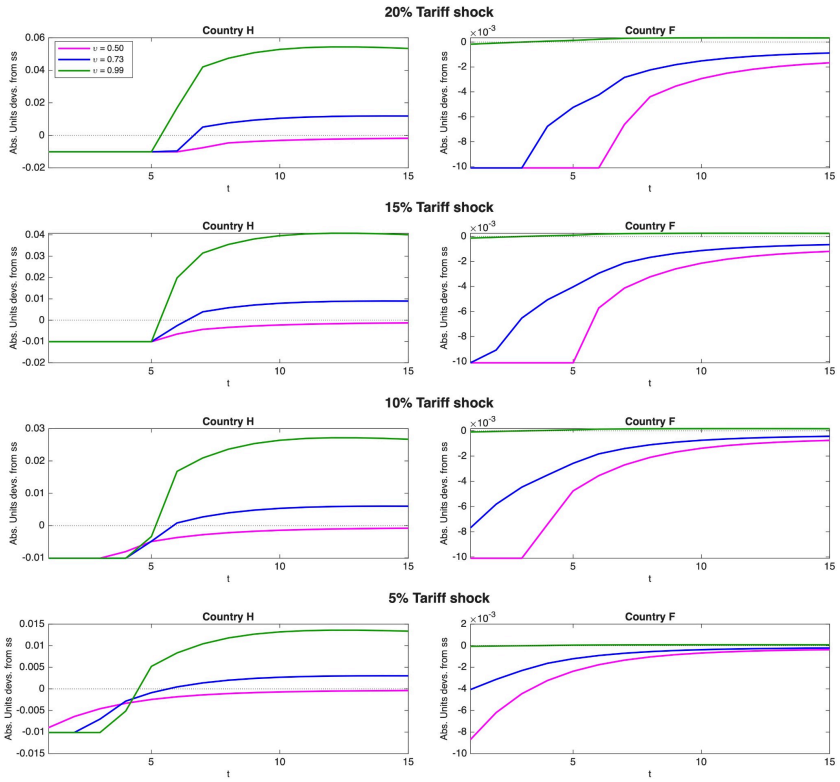

Fig. 16: Robustness to $\phi_B = 0.03$: Reciprocal Tariff Increases in the Two-country Model.

9 Robustness (4): Takeaway

- Raising ϕ_B from 0.02 to 0.03 attenuates some interest-rate responses.
- But the main threshold pattern survives.
- In the SOE model, the ZLB still binds under high persistence and low stickiness (Fig. 14).
- In the two-country model, ZLB incidence still varies systematically with tariff size, country size, and reciprocity (Figs. 15 and 16).

10 Conclusion (1)

- Tariffs are not only relative-price shocks.
- With tariff revenues inside the government budget constraint, tariffs are fiscal shocks.
- Under a Bohn-type fiscal rule, labor income taxation adjusts residually.
- The induced tax cut raises natural output and lowers real marginal cost.
- With sticky prices, this creates downward pressure on the output gap and PPI inflation.

10 Conclusion (2)

- The constrained-efficient response to an import tariff is monetary easing, not tightening.
- CPI inflation targeting points in the wrong direction because it focuses on the direct import-price component of CPI inflation.
- If the required easing is sufficiently large, persistent, or internationally amplified, the ZLB binds.
- Tariffs can therefore transform a conventional monetary-easing problem into an unconventional monetary-policy problem.

10 Conclusion (3): Final Message

The macroeconomic effect of tariffs depends on how tariff revenues are absorbed by the government budget constraint.

- Without that fiscal block, one may expect monetary tightening.
- With distortionary labor taxation and a Bohn-type rule, the optimal response can be monetary easing.
- With sufficiently large, persistent, reciprocal, or asymmetric tariff shocks, the easing requirement can become ZLB-constrained.

Discussion

- Is the Bohn-type rule the right fiscal closure for tariff revenues?
- How should one measure the effective tariff shock for policy applications?
- Does the fiscal-tax channel dominate expenditure switching in empirically relevant cases?
- Should a central bank target CPI inflation, PPI inflation, or a welfare-based objective after tariff shocks?
- What would change under incomplete markets or endogenous tariff policy?