Monetary Stabilization of Sectoral Tariffs

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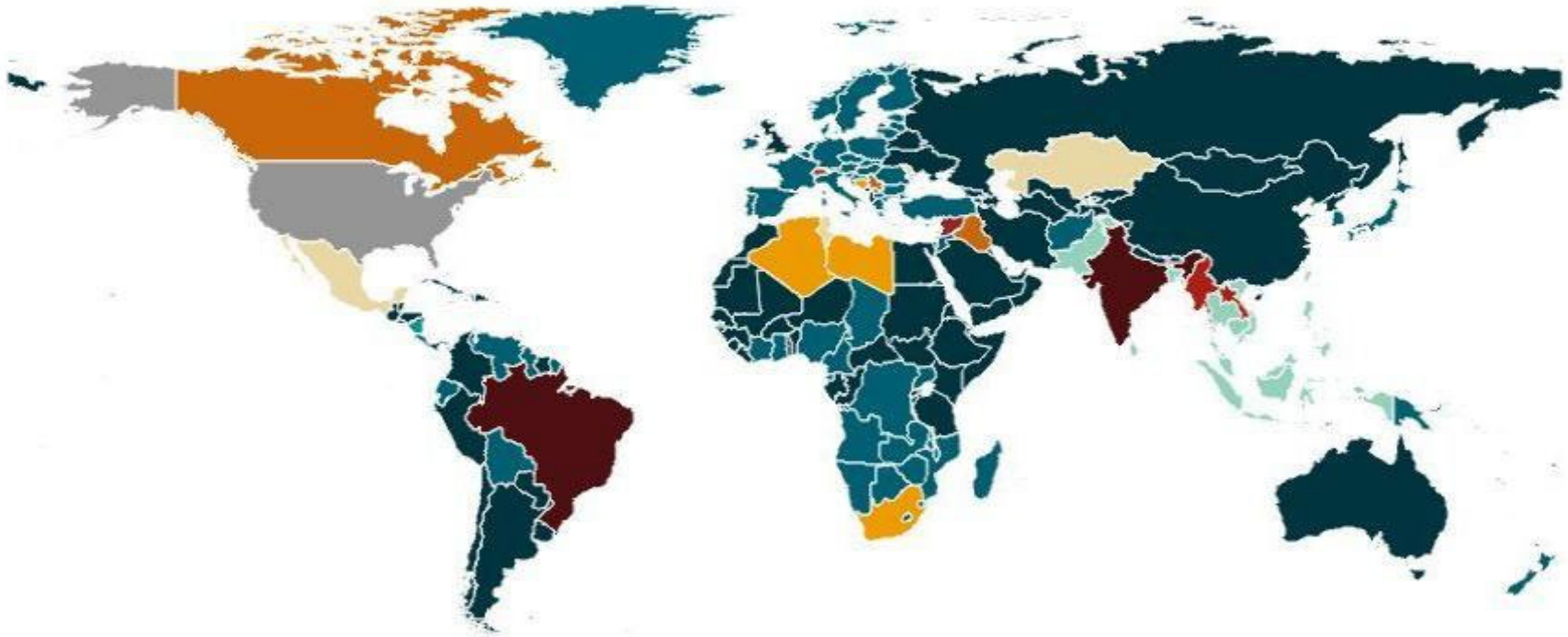
Global Distribution of U.S. Import Tariff Rates

Presidential tariff modifications as of November 1, 2025

10% 15% 18% 19% 20% 25% 30% 35% 39% 40% 41% 50%
NA



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Footnotes

Source: whitehouse.gov

Monetary policy makers trying to discern appropriate response to tariff shocks

Wall Street Journal, A Trade War Puts Pressure on the Federal Reserve (March 16): "Lowering interest rates to soften the negative shock risks embedding higher inflation into the economy."

J. Powell speech April 16: "We may find ourselves in the challenging scenario in which our dual-mandate goals are in tension."

Motivation

- Standard macro models predict tariffs raise prices and dampen output.
- Implies dilemma for monetary policy: tightening to moderate inflation could worsen output loss.
- Recent literature shows aggregate implications of tariffs depend on monetary policy rules.
- Subset of literature goes on to asks what is the optimal monetary policy response to tariffs.

Related literature

- Most assume standard Taylor rule: Barattieri et al. (2017), Linde-Pescatori (2019)), Kalemli-Özcan, et al. (2025)…
- Small number study optimal policy; differ in treatment of tariff revenue, small open, tariff ex/endogenous
  - Bergin and Corsetti (2023): optimal mon. expansion in symmetric tariff war.
  - Auray, et al. (2024) and (2025): strategic joint tariff and monetary policy.
  - Monacelli (2025): Efficient mon. expansion prevent exchange rate apprec. in SOE; amplify output rise.
  - Bianchi and Coulibaly (2025): expansionary policy to offset inefficient fall in imports in SOE.

This paper contributes

- Highlight role of the exchange rate policy as a tool to offset tariff distortions.
- Unlike SOE models, our two-country model shows effects of tariff on victim country, and delegation of optimal monetary responses between countries.
- Relative to our 2023 paper, addresses case of unilateral tariff, which now appears more relevant.
- Relative to existing macro literature, we consider effects on sectoral reallocation (crucial in trade literature): tariffs on autos & parts, v. ag. & metals.

Main findings

- Domestic Currency appreciation can help offset rise in relative price of imports created by tariff, under domestic currency price stickiness.
- Must balance this objective against side effects of the required monetary policies.
- Optimal policy implemented mainly by *foreign monetary expansion* rather than home contraction.
- Result opposite of related papers:
  - Bianchi and Coulibaly (2025): no role for exchange rate due to particular SOE specification.
  - Monacelli (2025): optimal currency depreciation to support output expansion.

Overview of model

- Two country New Keynesian (sticky price, Dynamics Stochastic GE) macro model
- Augmented with features from trade literature:
  - Ad-valorum tariffs with revenue rebated
  - Roundabout production
  - Firm entry dynamics
  - Reallocation between multiple sectors.
- Paper includes analytical solutions for simplified case; here present simulations of full model

Overview of Model, cont'd

- Production requires labor and intermediates.
- Endogenous labor supply (leisure affects utility).
- Trade in bonds permits non-zero trade balance.
- Ad-valorum tariffs exogenous and distortionary. Subject to AR shocks (rebated to households).
- Solved numerically for second-order approximation around deterministic steady state.
- Compute conditional welfare including transition.
- Monetary policy rules: standard Taylor (CPI) rule, PPI target, Ramsey optimal (cooperative) policy.

Overview of Model, cont'd

Two tradable sectors:

1) Differentiated manufacturing sector (D):
   - monopolistic competition
   - firm entry subject to sunk cost
   - sticky prices due to adjustment cost (PCP benchmark, also LCP, DCP)
   - iceberg trade cost
   - (no firm heterogeneity in productivity)

2) Non-differentiated but still traded sector (N)
   (commodities, ag)
   - Perfect compet., flexible prices, costless trade
   - Potentially country-specific (nests BKK good).

Goods market structure

Home consumption index, C, includes

- n varieties h of the differentiated good (D) produced in Home country,
- n^* varieties f produced in Foreign,
- home-country-specific (non-differentiated) good (H)
- A foreign-country-specific good (F).

$$C_t \equiv C_{D,t}^{\theta} C_{N,t}^{1-\theta}$$

where

$$C_{D,t} \equiv \left(\int_0^{n_t} c_t(h)^{\frac{\phi-1}{\phi}} dh + \int_0^{n_t^*} c_t(f)^{\frac{\phi-1}{\phi}} df \right)^{\frac{\phi}{\phi-1}}$$

$$C_{N,t} \equiv \left(\nu^{\frac{1}{\eta}} C_{H,t}^{\frac{\eta-1}{\eta}} + (1-\nu)^{\frac{1}{\eta}} C_{F,t}^{\frac{\eta-1}{\eta}} \right)^{\frac{\eta}{\eta-1}}$$

Tariffs

- Ad-valorem tariff imposed by importing country on price of imported goods.
- Tariff revenue rebated to households.
- Distorts the relative price between domestic and imported goods faced by consumers (and firms for intermediate inputs)

$$c_t(f) = \left(\frac{e_t \overline{p_t^*(f)} T_{D,t}}{\overline{p_t(h)}} \right)^{-\phi} c_t(h)$$

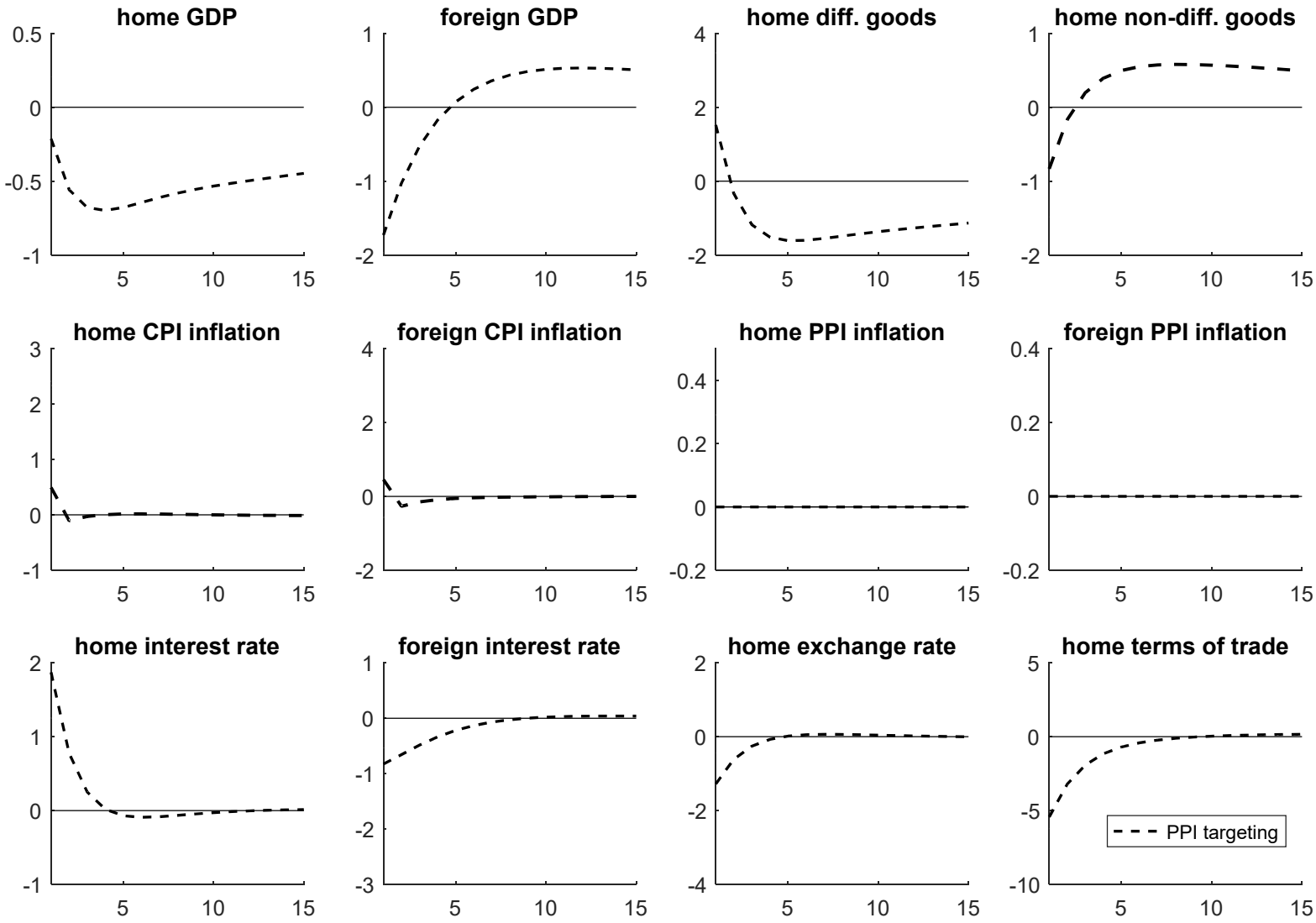
Parameter Values

Preferences	
Risk aversion	$\sigma = 2$
Time preference	$\beta = 0.99$
Labor supply elasticity	$1/\psi = 1.9$
Differentiated goods share	$\theta = 0.45$
Non-differentiated goods home bias	$\nu = 0.5$
Differentiated goods elasticity	$\phi = 5.2$ (also 3.8)
Non-differentiated goods elasticity	$\eta = 5.2$ (also 1.5, 15)
Substitution between sectors	$\xi = 1$ (also 0.5, 1.5)
Technology	
Firm death rate	$\delta = 0.025$
Price stickiness	$\psi_P = 49$
Intermediate input share	$\varsigma = 1/3$
Differentiated goods trade cost	$\tau_D = 0.44$
Non-differentiated goods trade cost	$\tau_N = 0.44$
Mean sunk entry cost	$\overline{K} = 1$
Firm entry adjustment cost	$\lambda = 0.10$
Bond holding cost	$\psi_B = 10^{-6}$

Parameter values continued

Monetary Policy (for Taylor Rule)	
Interest rate smoothing	$\gamma_i = 0.7$
Inflation response	$\gamma_p = 1.7$
GDP response	$\gamma_Y = 0.1$
Tariff shock	
Mean	$\overline{T_D} = \overline{T_N} = 1.02$
Standard deviation	$\sigma_{\varepsilon_T} = 0.08$
Autoregressive parameter	$\rho_T = 0.56$

Figure 1. Unilateral home tariff on differentiated imports



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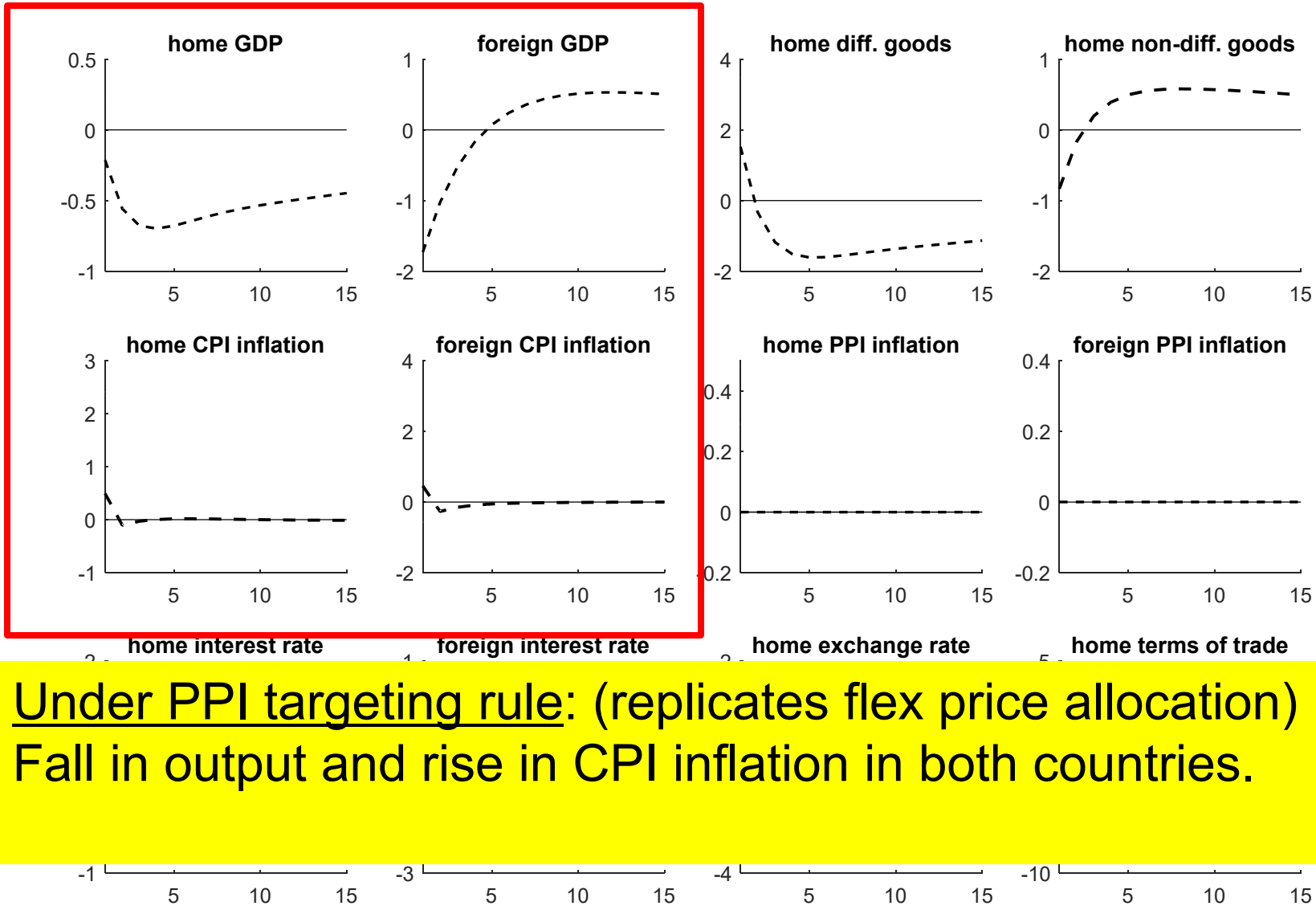

Under PPI targeting rule: (replicates flex price allocation)
Fall in output and rise in CPI inflation in both countries.

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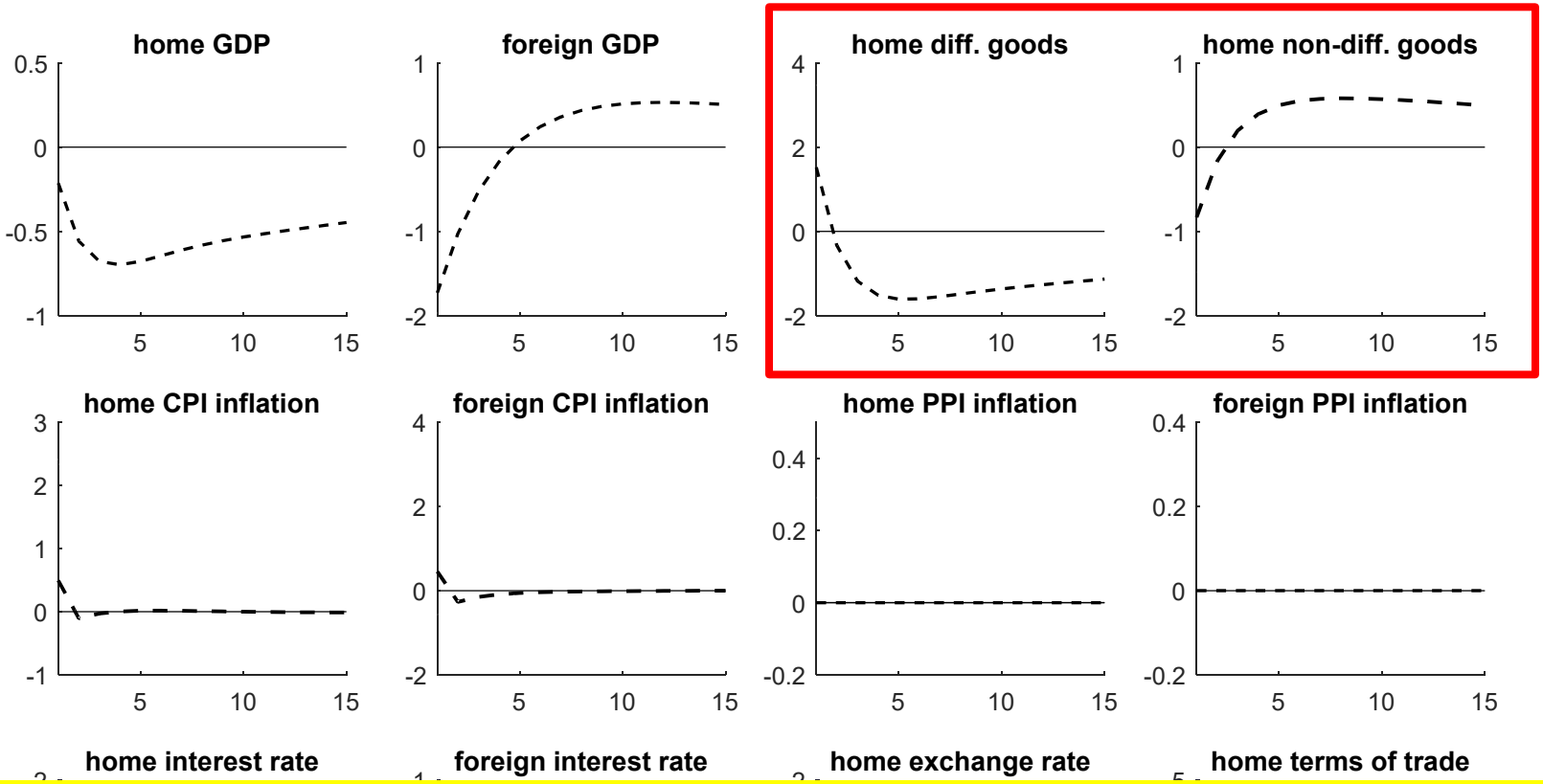

Under PPI targeting rule:

Fall in output and rise in CPI inflation in both countries.

Short-run reallocation toward differentiated goods, away from non-differentiated (opposite in foreign country).

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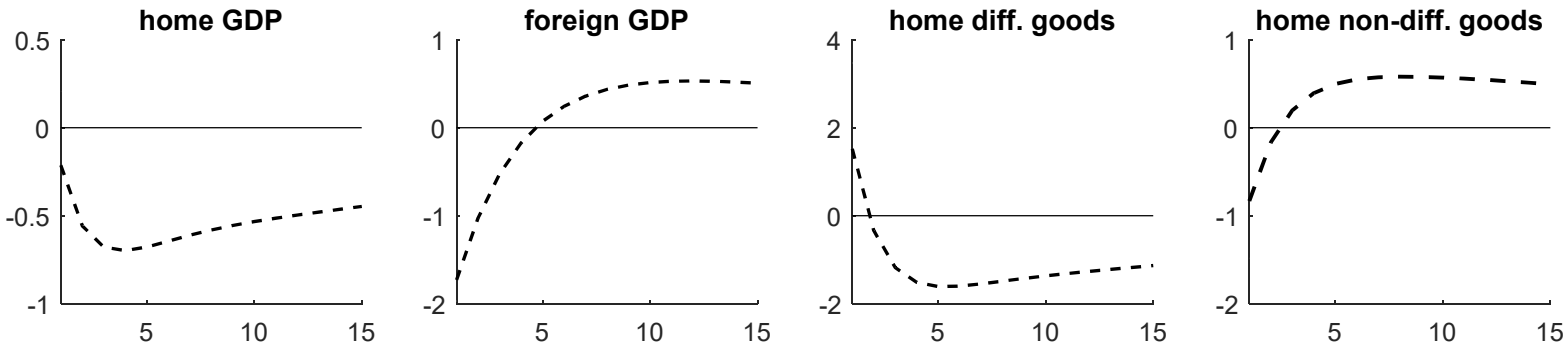
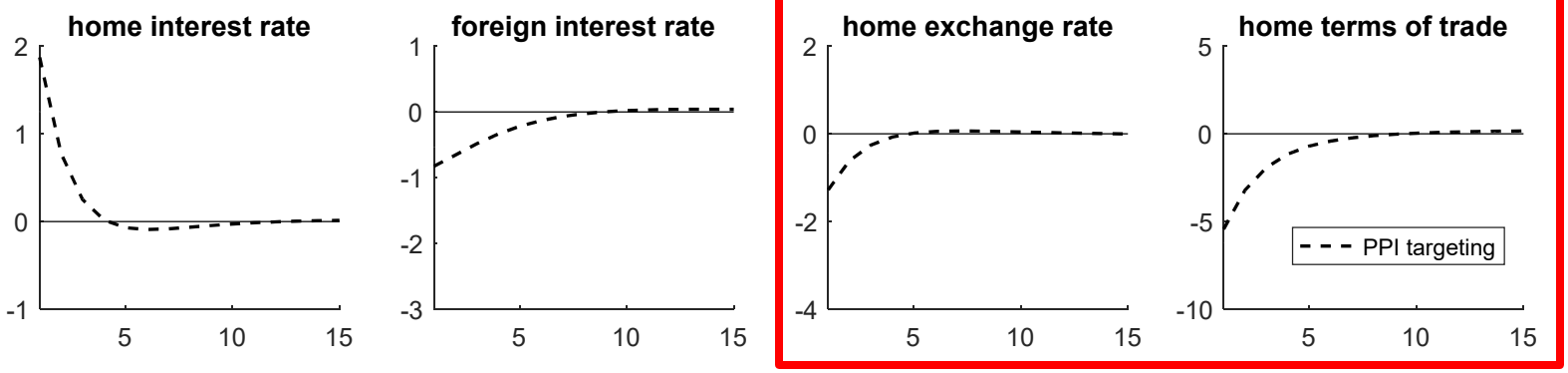


Under PPI targeting rule:

Fall in relative home/foreign price of differentiated goods (inclusive of tariffs)

Some appreciation of the home currency.



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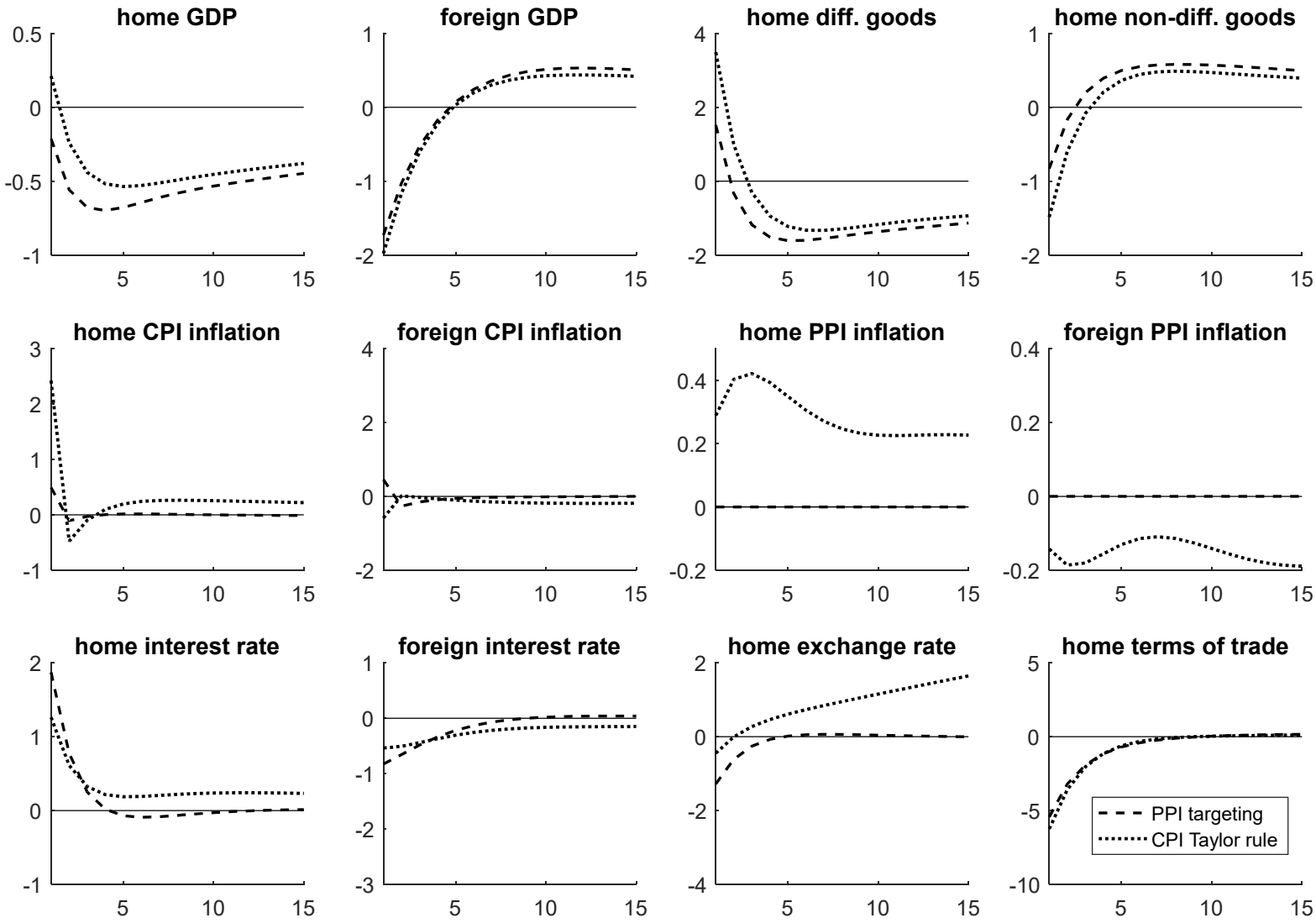

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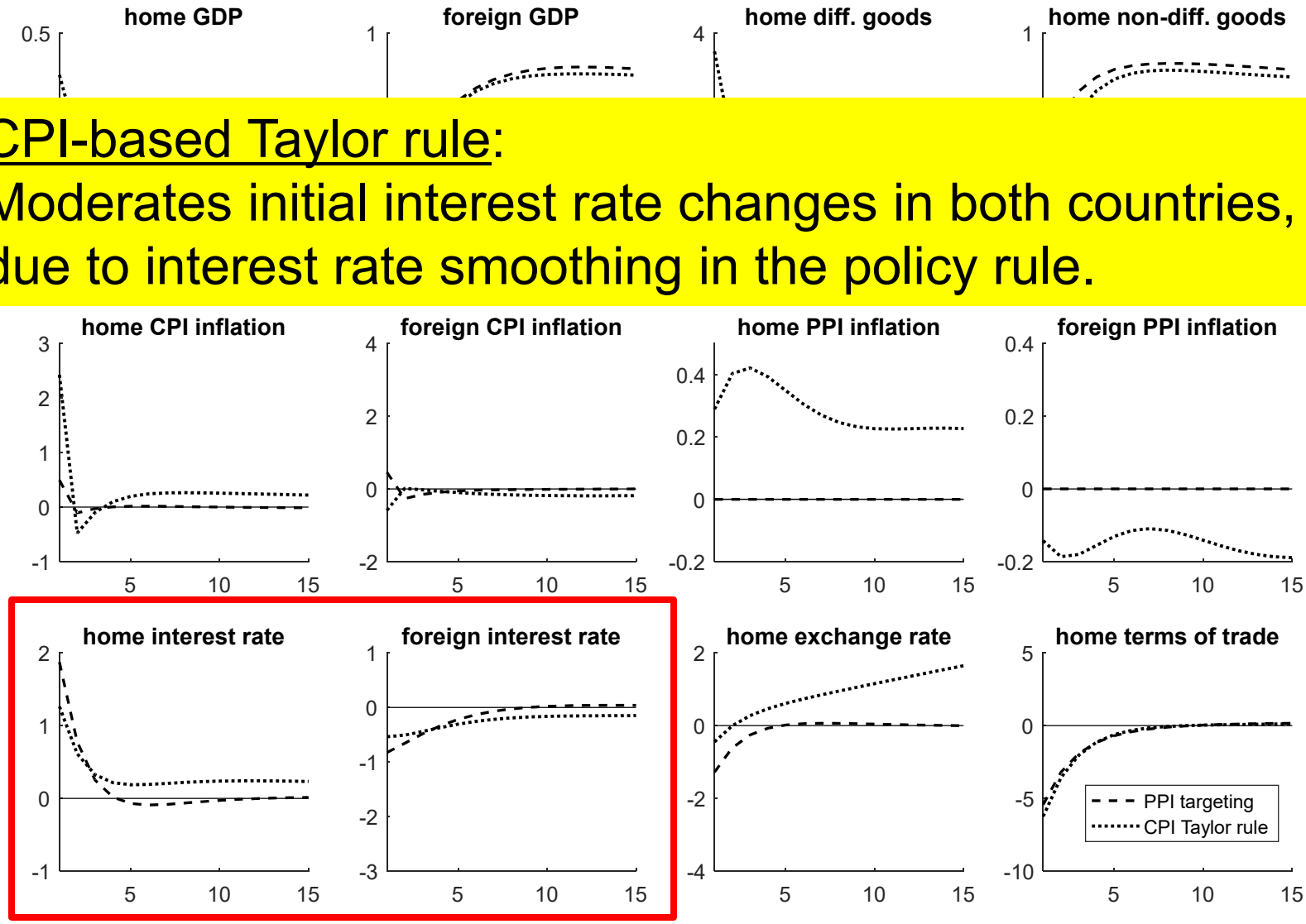

CPI-based Taylor rule:
Moderates initial interest rate changes in both countries, due to interest rate smoothing in the policy rule.

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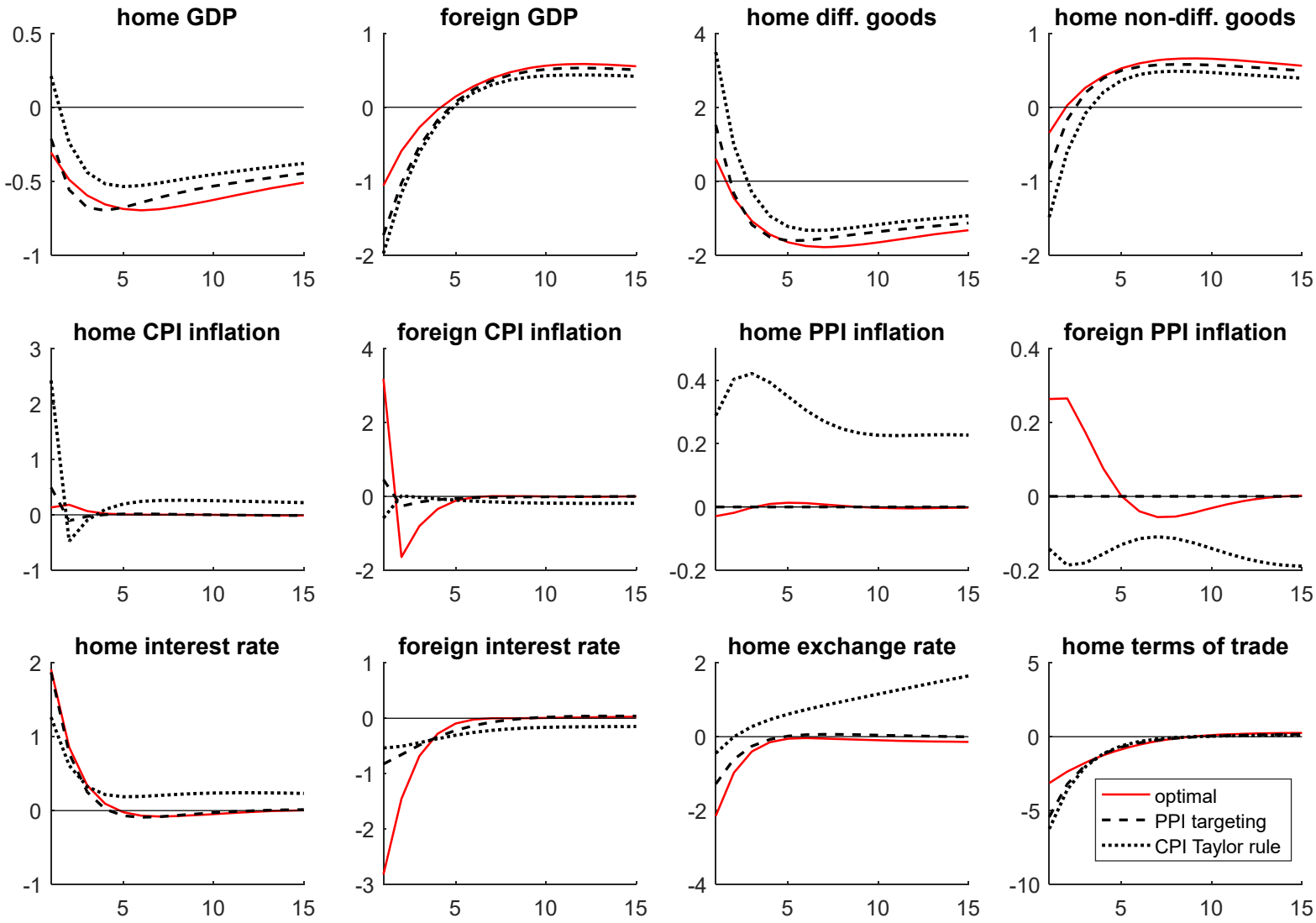

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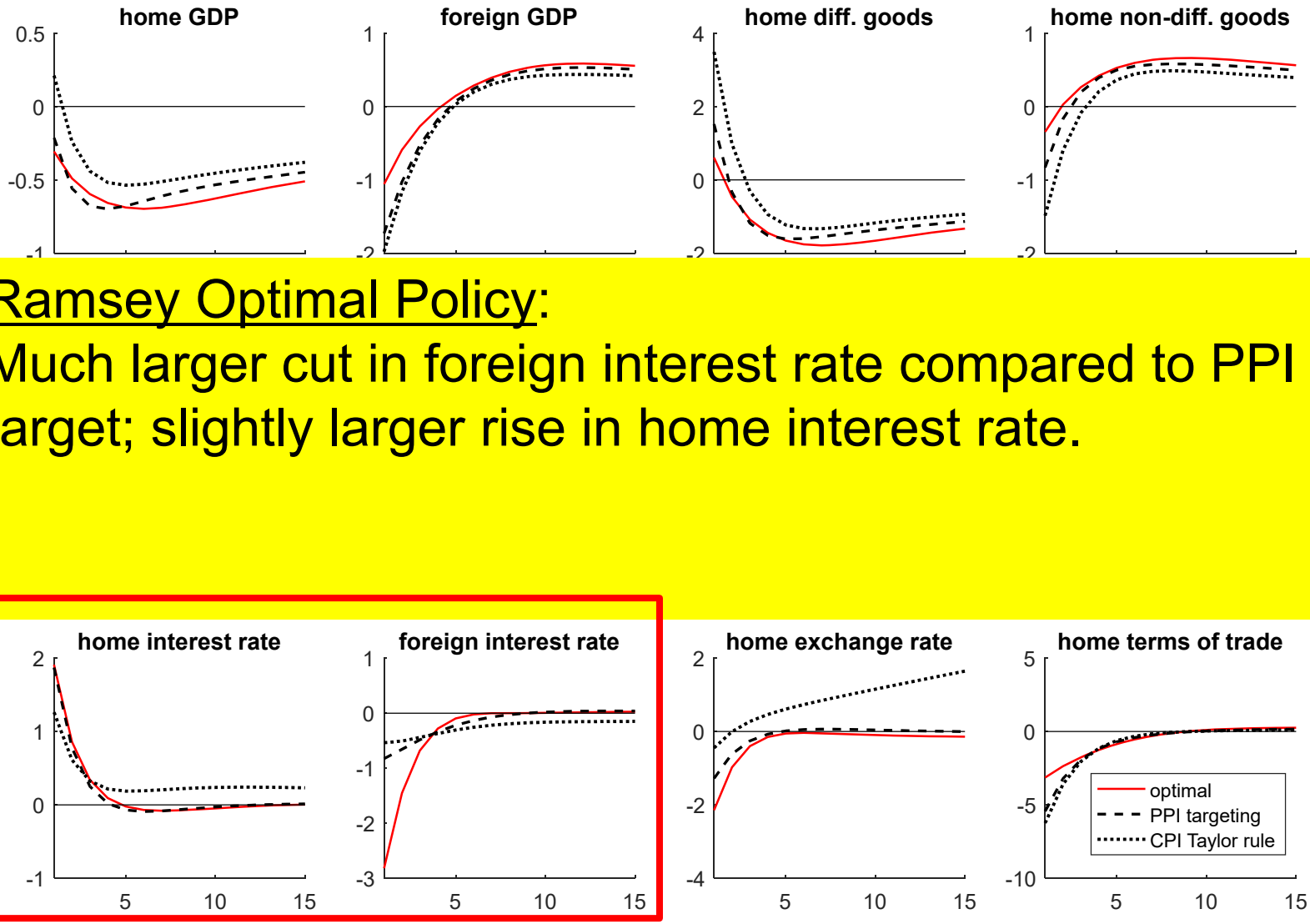

Ramsey Optimal Policy:

Much larger cut in foreign interest rate compared to PPI target; slightly larger rise in home interest rate.

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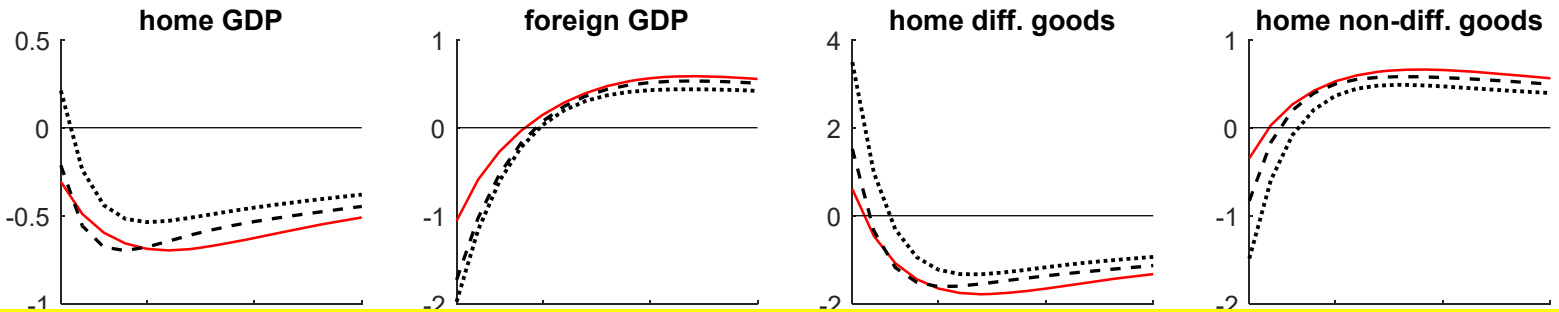
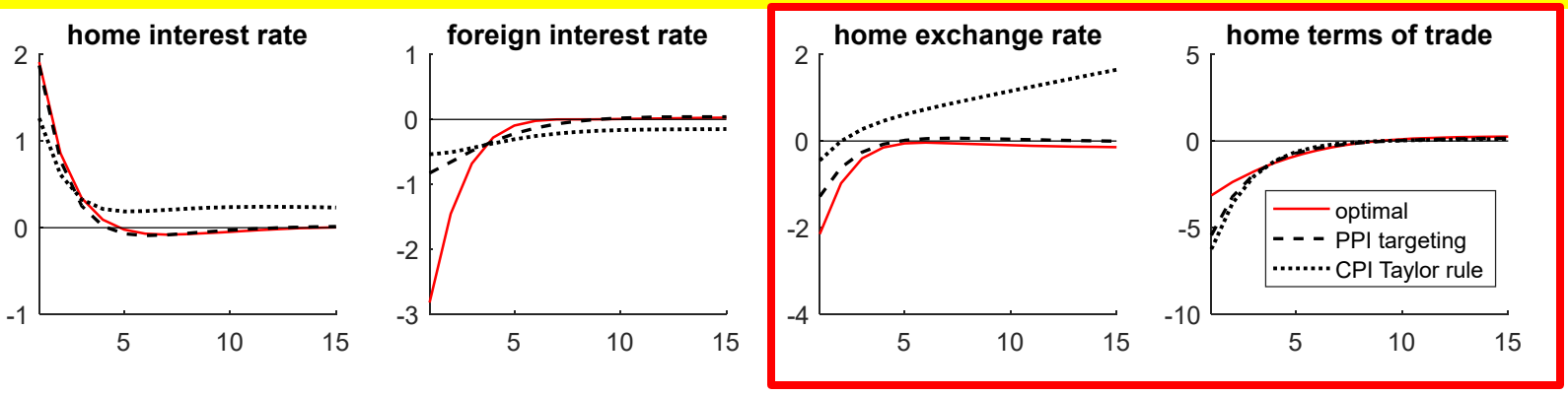


Ramsey Optimal Policy:

Much larger cut in foreign interest rate compared to PPI target; slightly larger rise in home interest rate.

Which makes the home currency appreciate more and offsets part of the effect of tariff on relative prices.



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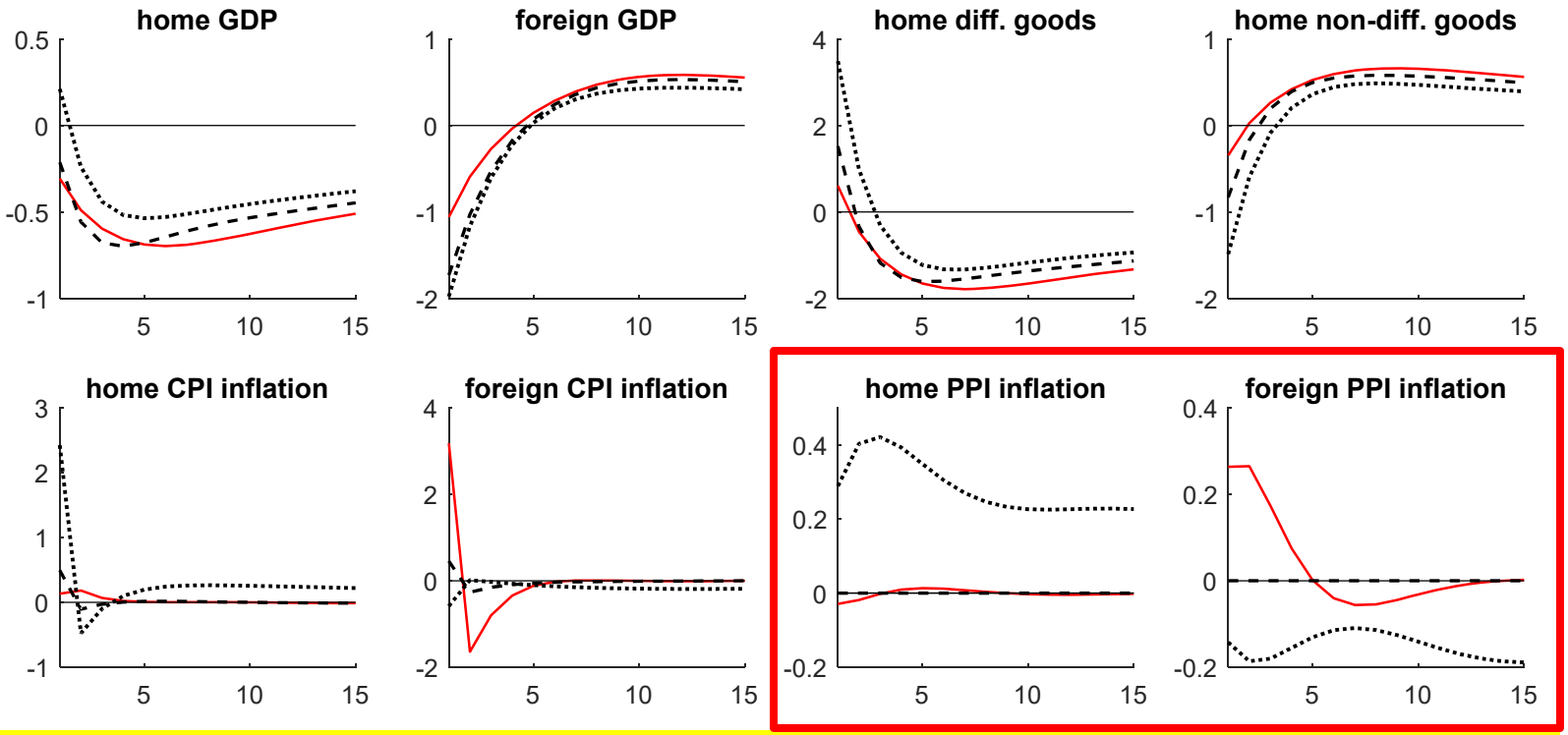

Optimal Policy:

In terms of PPI inflation, see is large foreign expansion, and small foreign contraction.

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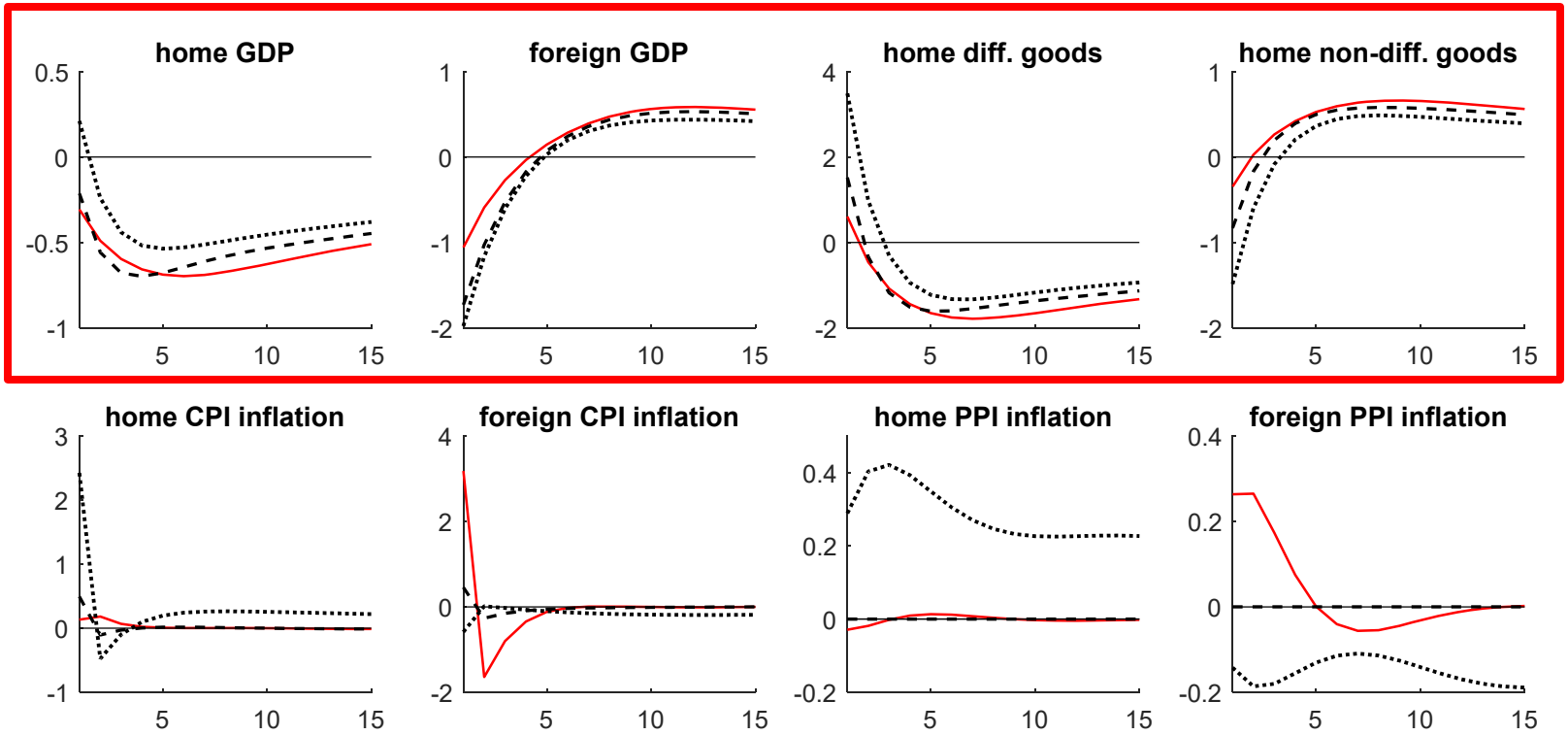

Optimal Policy:

In terms of PPI inflation, see is large foreign expansion, and small home contraction.

Helps offset sectoral reallocation.

Partly offset foreign GDP contraction, but not home GDP

Table 1: Welfare gains from Ramsey Policy
(% change from Taylor rule, C units)

	tariff shock	world	home	foreign
1.	unilateral home tariff on differentiated goods	0.096	0.162	0.031
2.	home DCP	0.046	0.066	0.026
3.	both countries LCP	0.042	0.037	0.047
4.	sectors complements (ξ=0.5)	0.113	0.185	0.040
5.	sectors substitutes (ξ=1.4)	0.093	0.151	0.034
6.	nondifferentiated goods BKK (η=1.5)	0.092	0.148	0.036
7.	nondiff. goods homogeneous (η=15)	0.108	0.118	0.099
8.	persistent tariff (ρ_T = 0.95)	0.444	0.194	0.694
9.	nontraded non-differentiated good	0.110	0.116	0.103
10.	symmetric tariff on differentiated goods	0.027	0.027	0.027
11.	home DCP	0.057	-0.100	0.215
12.	unilateral home tariff on non-differentiated goods	0.215	0.035	-0.006
13.	symmetric tariff on non-differentiated goods	0.013	0.013	0.013
14.	home diff. tariff; foreign non-diff. tariff	0.121	0.174	0.067

Summary of benchmark case:

In 2-country model with stickiness in producer currency:

- Optimal policy appreciates home currency, to offset effect of tariff on relative pries of home consumer.
- Requires foreign monetary expansion;
- Home either contracts (case of high trade elasticity) or expands less than foreign (low trade elasticity).
- Permission for a foreign competitive devaluation?
- Note: both countries generally benefit from this policy, since it offsets distortionary tariff.

Summary: Alternate cases

1) Stickiness in local currency of buyer (LCP):

- Blocks exchange rate pass through (but not tariff).
- Optimal policy cannot stabilize home import demand through exchange rate, so instead it
- Stabilizes home import demand by home expansion.

2) Stickiness in dominant home currency (DCP)

- In between benchmark and LCP case.

3) Tariff on home non-differentiated imports

- Monetary policy no effect on non-diff sector.
- Optimal policy stabilizes home differentiated demand with home expansion.

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Lesson:

Optimal (cooperative) policy uses home exchange rate appreciation to offset tariff when it can.

In cases exchange rate not available as tool, use overall home monetary expansion to stabilize differentiated import demand.

Extra Slides

Figure 2. Unilateral home tariff on differentiated imports, LCP price stickiness

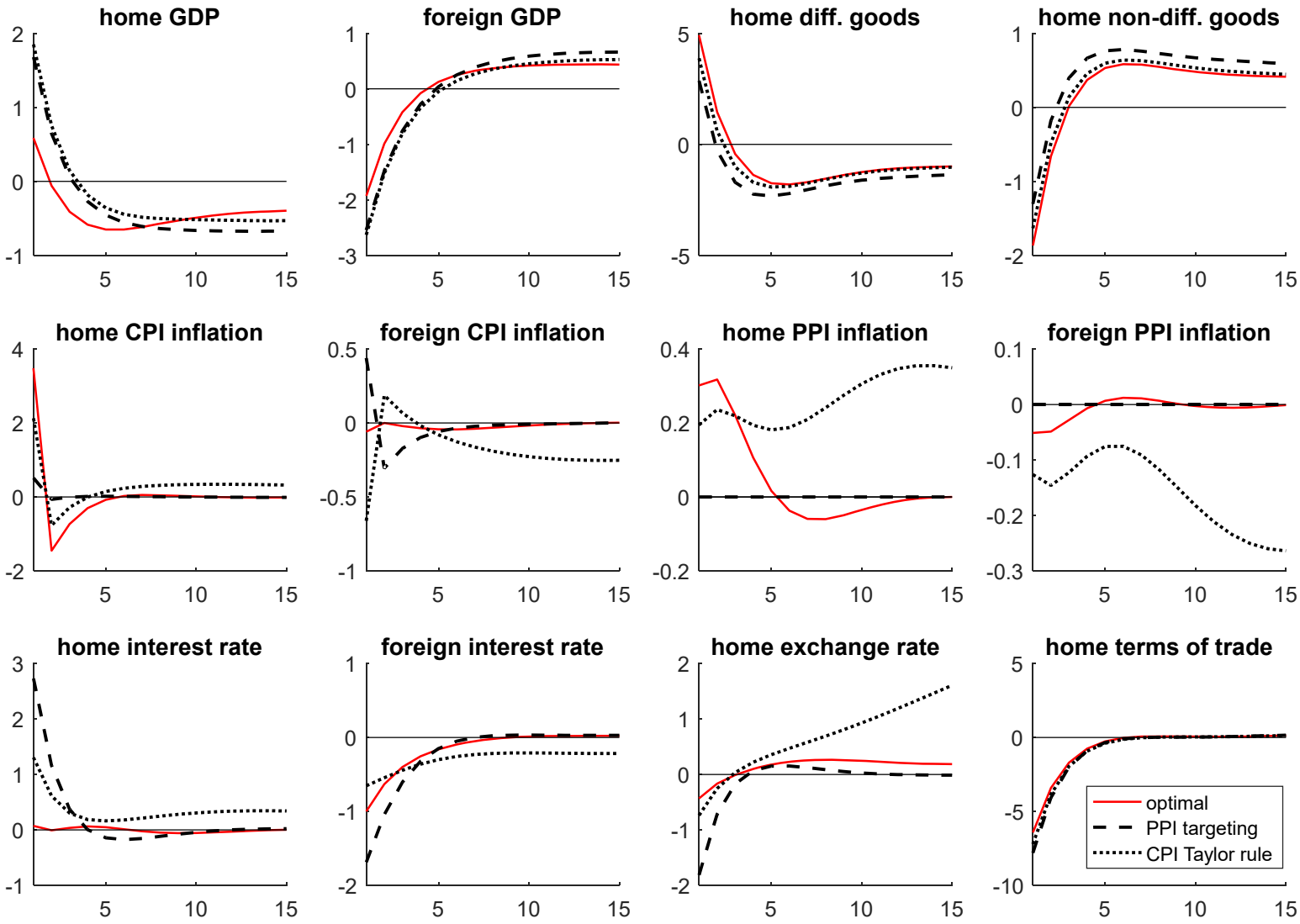
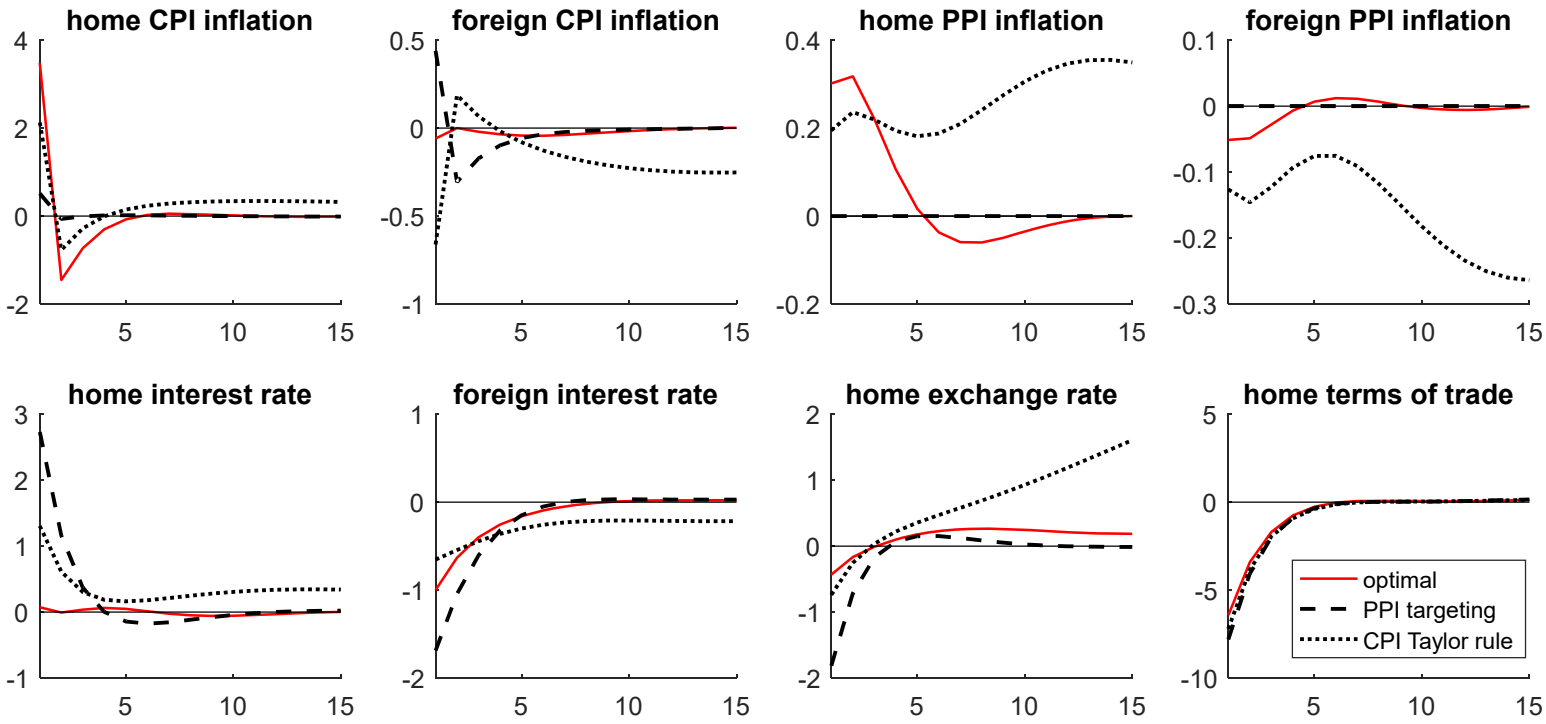


Figure 2. Unilateral home tariff on differentiated imports, LCP price stickiness

LCP blocks exchange rate pass through
(but not tariff pass through).

Optimal policy cannot stabilize home import demand through exchange rate effect on price faced by home.



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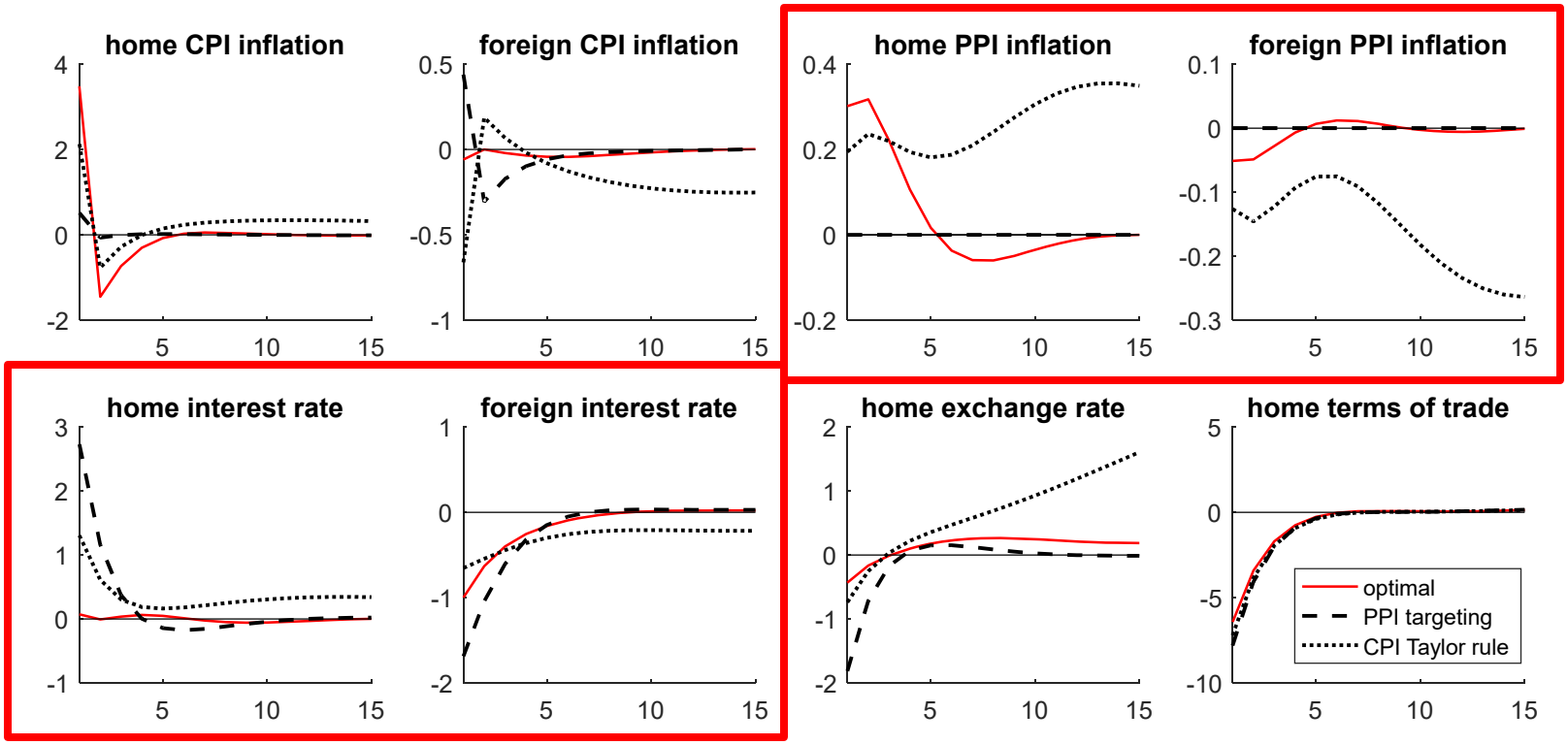
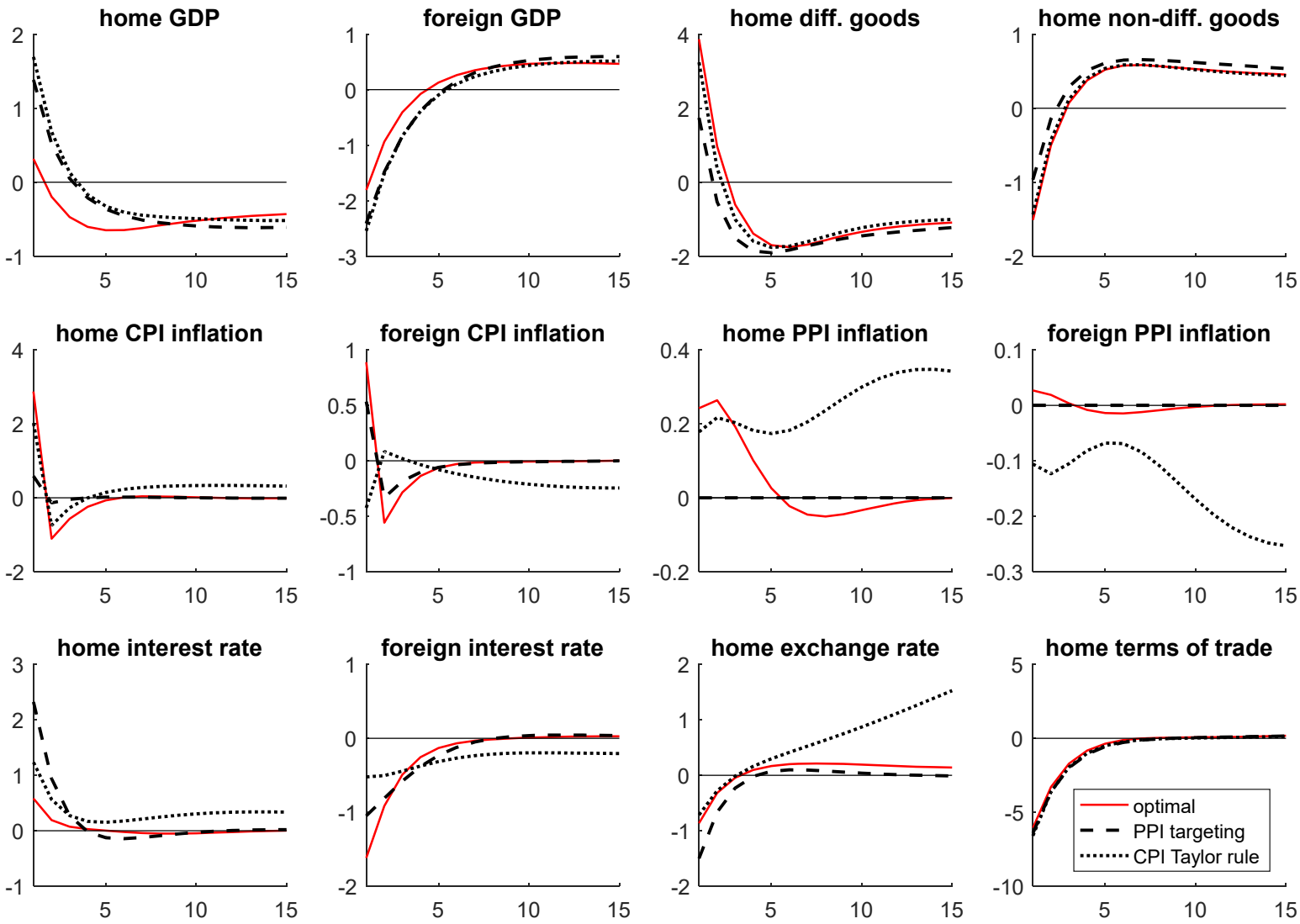
So policy stabilizes home import demand for by boosting overall home demand.

Calls for home expansion and foreign contraction relative to PPI targeting.



Home tariff on differentiated imports, home currency dominant (DCP price stickiness)



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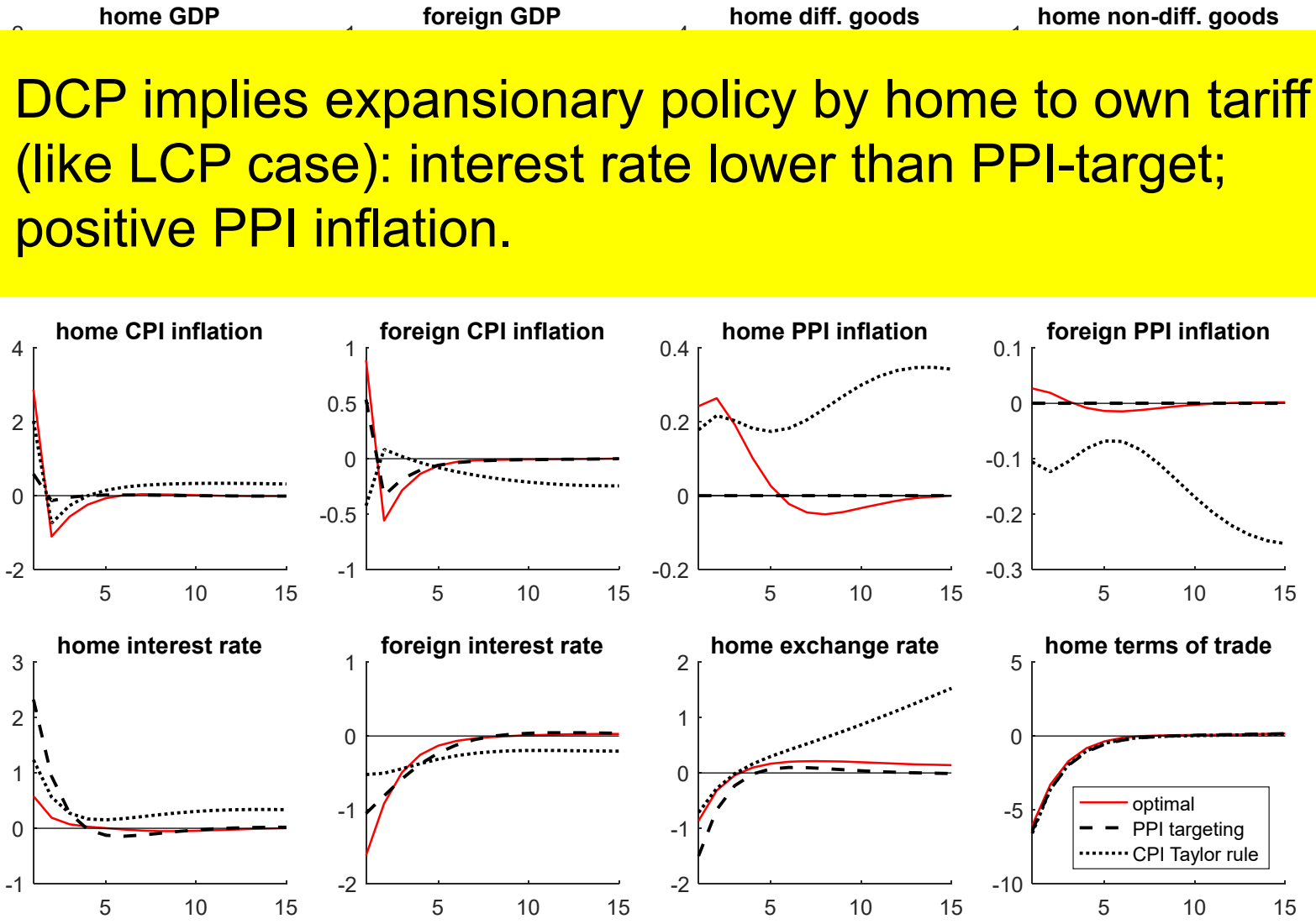
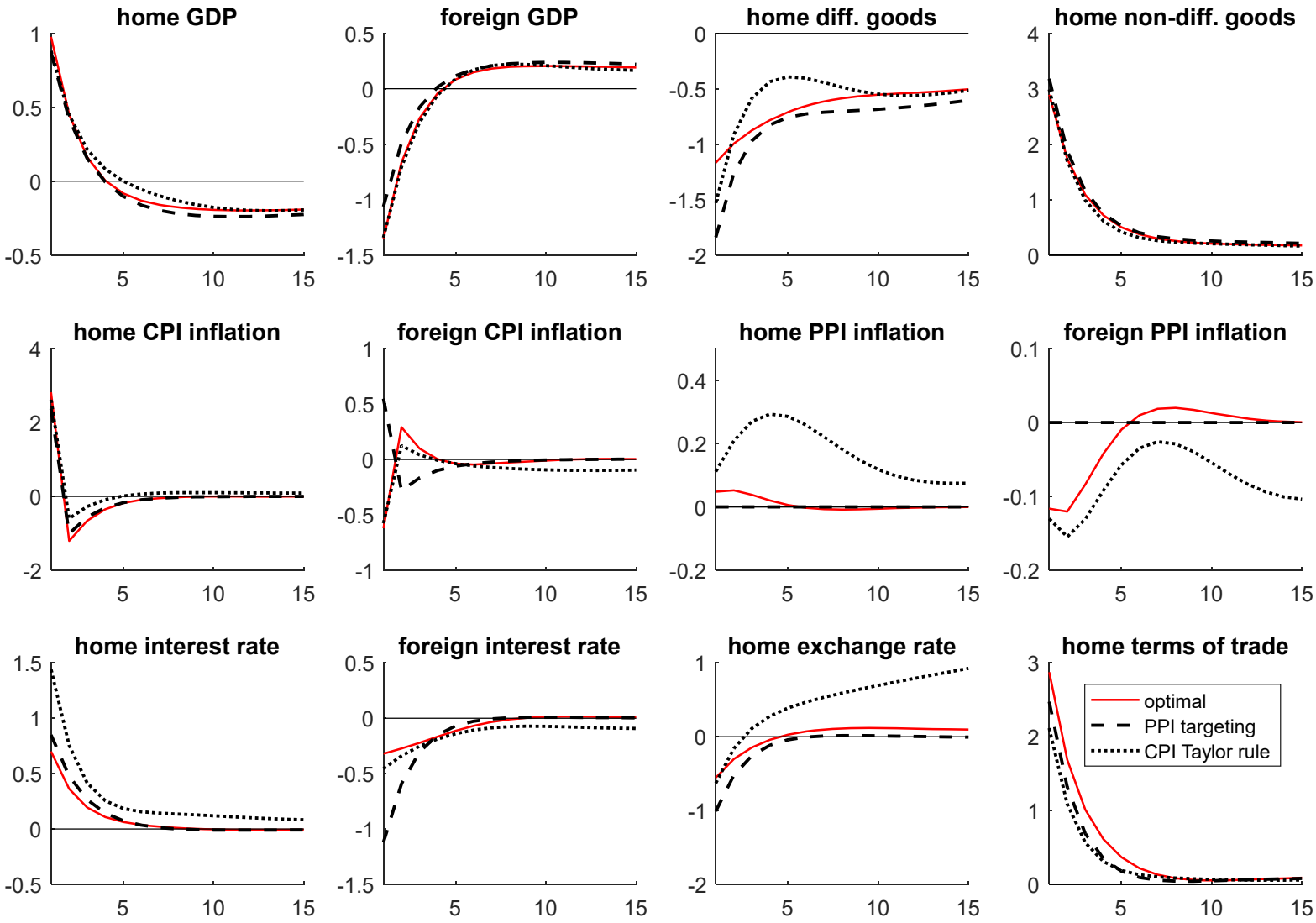


DCP implies expansionary policy by home to own tariff (like LCP case): interest rate lower than PPI-target; positive PPI inflation.

Figure 3. Unilateral home tariff on non-differentiated imports



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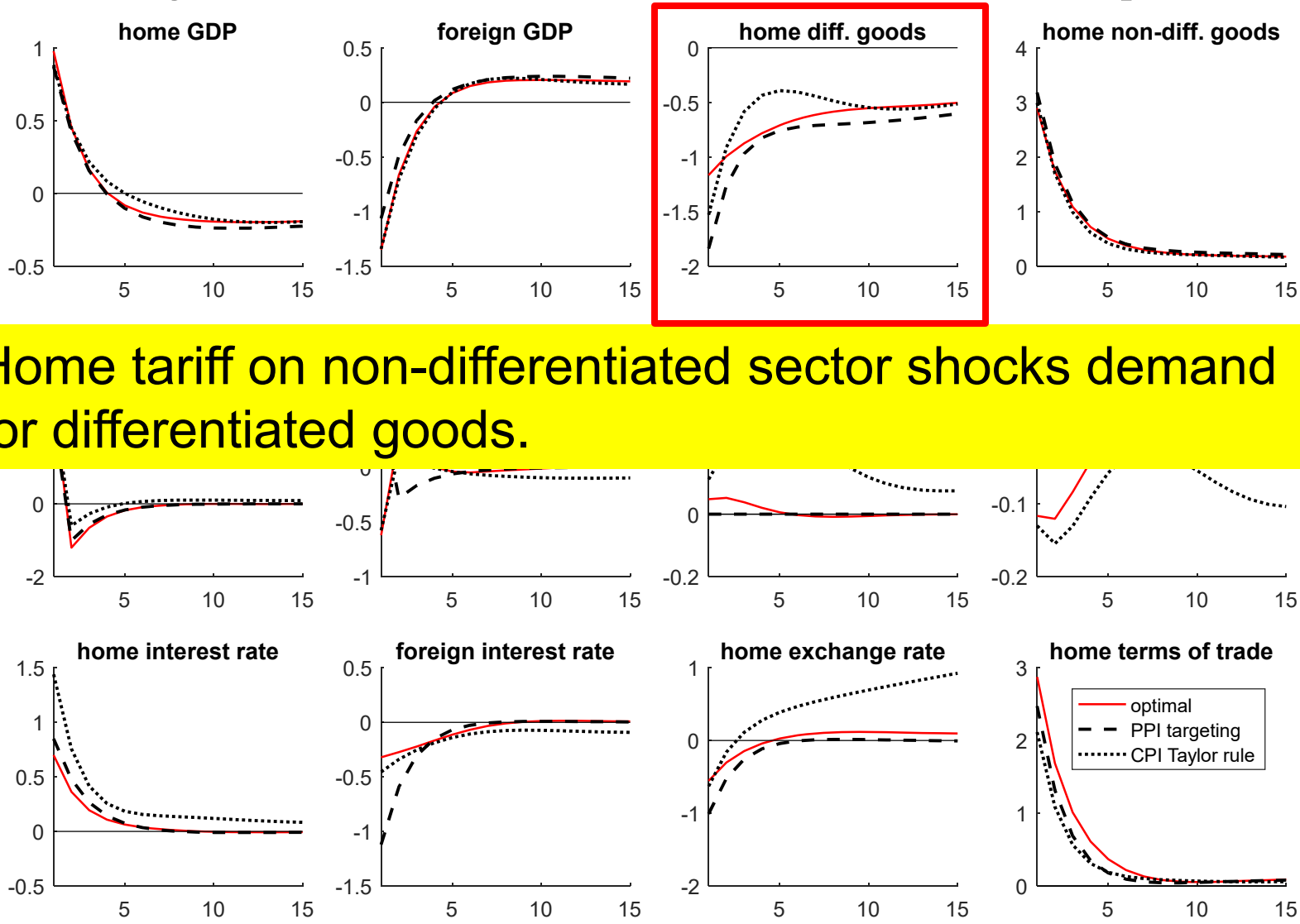
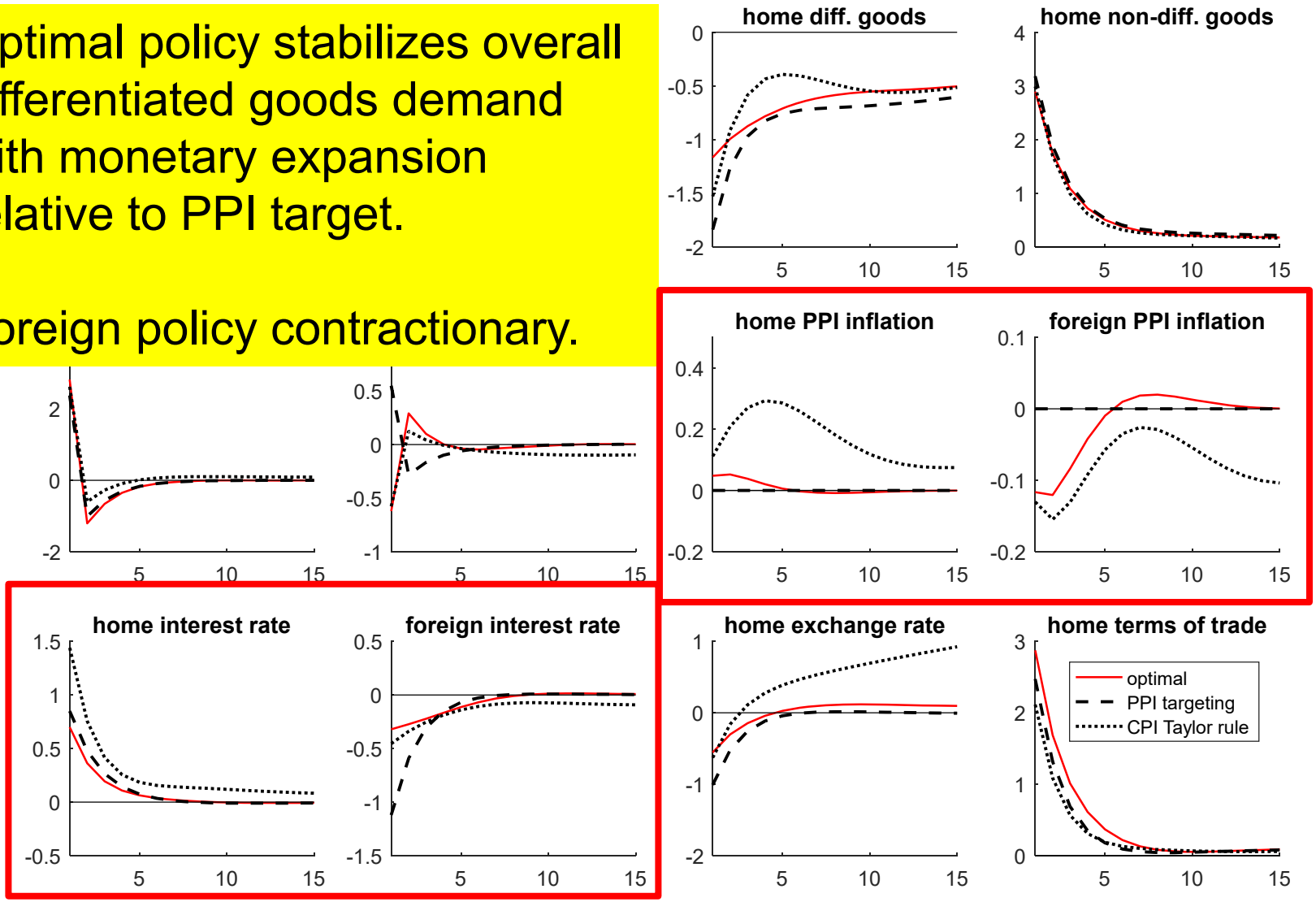


Home tariff on non-differentiated sector shocks demand for differentiated goods.

Figure 3. Unilateral home tariff on non-differentiated imports

Optimal policy stabilizes overall differentiated goods demand with monetary expansion relative to PPI target.

Foreign policy contractionary.



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Summary of Results

- If stickiness in producer currency, optimal policy uses exchange rate to offset tariff.
- Requires either contraction in tariff imposer or lesser expansion (low elasticity).
- When exchange rate not available (tariff war in Bergin-Corsetti 2023, LCP stickiness), monetary expansion optimal. DCP in between.
- Tariff on non-diff. goods: optimal to dampen exch. rate appreciation; inverse of diff. tariff.
- If US tariffs on autos met by foreign tariffs on US ag., implies amplified sectoral reallocation.

Differentiated (Manufacturing) Goods

- Production of $y_t(h)$ uses labor $l_t(h)$ and composite of other differentiated goods $G_t(h)$, with sector productivity shock, α_{Dt}

$$y_t(h) = \alpha_{D,t}\left[G_t(h)\right]^{\zeta}\left[l_t(h)\right]^{1-\zeta}$$

- Manufacturing firms
  - prepay a one-time sunk entry cost, K_t, in units of combined labor and differentiated goods index.
  - set prices subject to Rotemberg adjustment cost in domestic currency units (producer currency pricing); output demand determined.
  - Face trade cost τ_D in selling in foreign market.

Firm Problem

- Managers maximize firms' value, sum of discounted profits:

$$v_t(h) = E_t\left\{\sum_{s=0}^{\infty}\left(\beta(1-\delta)\right)^s \frac{\mu_{t+s}}{\mu_t}\pi_{t+s}(h)\right\}$$

Subject to exit shock, δ, where $\mu_t = P_t C_t^{\sigma}$ and profits are:

$$\pi_t(h) = p_t(h)d_t(h) + e_t p_t^*(h)d_t^*(h) - mc_t y_t(h) - P_t AC_{p,t}(h)$$

$$mc_t = \zeta^{-\zeta}(1-\zeta)^{\zeta-1} P_{D,t}{}^{\zeta} W_t^{1-\zeta} / \alpha_{D,t} \text{ is marginal cost.}$$

- Optimal choice of inputs:

$$\frac{P_{D,t}G_t(h)}{W_t l_t(h)} = \frac{\zeta}{1-\zeta}$$

Price setting

- Price changes subject to Rotemberg adjustment cost:

$$AC_t(h) = \frac{\psi_P}{2}\left(\frac{p_t(h)}{p_{t-1}(h)} - 1\right)^2 p_t(h)\, y_t(h)$$

- Optimal price setting:

$$p_t(h) = \frac{\phi}{\phi - 1} mc_t + \frac{\psi_P}{2}\left(\frac{p_t(h)}{p_{t-1}(h)} - 1\right)^2 p_t(h) - \psi_P \frac{1}{\phi - 1}\left(\frac{p_t(h)}{p_{t-1}(h)} - 1\right)\frac{p_t(h)^2}{p_{t-1}(h)}$$

$$+ \frac{\psi_P}{\phi - 1} E_t\left[\beta \frac{\Omega_{t+1}}{\Omega_t}\left(\frac{p_{t+1}(h)}{p_t(h)} - 1\right)\frac{p_{t+1}(h)^2}{p_t(h)}\right]$$

Where

$$\Omega_t = \left[\left(\frac{p_t(h)}{P_{D,t}}\right)^{-\phi}\left(C_{D,t} + G_t + ne_t(1-\theta_K)K_t + AC_{P,D,t} + AC_{B,D,t}\right)\right.$$

$$\left. + \left(\frac{(1+\tau_D)p_t(h)}{e_t P^*_{D,t}}\right)^{-\phi}(1+\tau_D)\left(C^*_{D,t} + G^*_t + ne^*_t(1-\theta_K)K^*_t + AC^*_{P,D,t} + AC^*_{B,D,t}\right)\right] \Big/ \mu_t$$

Firm Entry

- Firms enter until the point that firm value equals the entry cost:

$$v_t(h) = P_{Dt} K_t$$

- Sunk cost subject to congestion externality:

$$K_t = \overline{K}\left(ne_t / ne_{t-1}\right)^{\chi}$$

function of number of new firm entrants (ne).

$$n_{t+1} = (1-\delta)(n_t + ne_t)$$

Non-differentiated Good Production

- Production linear in labor, subject to own shocks:

$$y_{H,t} = \alpha_{N,t} l_{H,t}$$

- Firms perfectly competitive, price takers:

$$p_{H,t} = W_t / \alpha_H$$

- Trade subject to iceberg trade cost:

$$p^*_{H,t} = p_{H,t} \left(1 + \tau_N\right) / e_t$$

Households Problem

$$\max E_0 \sum_{t=0}^{\infty} \beta^t \left[\frac{1}{1-\sigma} C_t^{1-\sigma}{}_t + \chi \ln \frac{M_t}{P_t} - \frac{1}{1+\psi} l_t^{1+\psi} \right]$$

$$P_t C_t = W_t l_t + \int_0^{n_t} \pi_t(h)\, dh - W_t q + M_t - M_{t-1} + B_t - (1 + i_{t-1}) B_{t-1} - T_t$$

- Utility from consumption, real money balances (M/P); disutility from labor (l).
- Income from labor earnings at wage rate W, interest (i) on domestic bonds (B), profits from ownership of firms (π). Pay lump sum tax (T).
- Implies standard Household FOCs for Consumption Euler, labor supply, money demand

Household Problem Implies

Defining $\mu_t = P_t C_t^{\sigma}$,

Consumption Euler: $$\frac{1}{\mu_t} = \beta\left(1+i_t\right) E_t\left[\frac{1}{\mu_{t+1}}\right]$$

Labor supply: $$W_t = l_t^{\psi}\,\mu_t$$

Money demand: $$M_t = \mu_t\left(\frac{1+i_t}{i_t}\right)$$

Interest rate parity:

$$\mathrm{E_t}\left[\frac{\mu_t}{\mu_{t+1}}\frac{e_{t+1}}{e_t}\left(1+\mathrm{i}_t^*\right)\left(1+\psi_B\left(\frac{e_t B_{ft}}{p_{Ht} y_{Ht}}\right)\right)\right] = \mathrm{E_t}\left[\frac{\mu_t}{\mu_{t+1}}\left(1+\mathrm{i_t}\right)\right]$$

Monetary Policy rules

1.PPI inflation target

$$\frac{p_t(h)}{p_{t-1}(h)} = \upsilon$$

2. Ramsey optimal policy maximizes:

$$\max E_0 \sum_{t=0}^{\infty} \beta^t \left(\frac{1}{2}\left(\frac{1}{1-\sigma} C_t^{1-\sigma} - \frac{1}{1+\psi} l_t^{1+\psi} \right) + \frac{1}{2}\left(\frac{1}{1-\sigma} C_t^{*1-\sigma} - \frac{1}{1+\psi} l_t^{*1+\psi} \right) \right)$$

3. Taylor rule stabilizing CPI inflation:

$$1 + i_t = (1 + i_{t-1})^{\gamma_i} \left[(1 + \bar{i}) \left(\frac{P_t}{P_{t-1}} \right)^{\gamma_p} \left(\frac{Y_t}{\bar{Y}} \right)^{\gamma_Y} \right]^{1-\gamma_i}$$

Includes output deviation.

$$Y_t = \left(\int_0^{n_t} p_t(h) y_t(h) dh + p_{Ht} y_{Ht} \right) / P_t$$

shocks

- Tariff shocks:

$$\begin{bmatrix} \log T_{D,t} - \log \overline{T_D} \\ \log T^*_{D,t} - \log \overline{T^*_D} \\ \log T_{N,t} - \log \overline{T_N} \\ \log T^*_{N,t} - \log \overline{T^*_N} \end{bmatrix} = \rho_T \begin{bmatrix} \log T_{D,t-1} - \log \overline{T_D} \\ \log T^*_{D,t-1} - \log \overline{T^*_D} \\ \log T_{N,t-1} - \log \overline{T_N} \\ \log T^*_{N,t-1} - \log \overline{T^*_N} \end{bmatrix} + \varepsilon_{Tt}$$

Welfare

- computed in terms of consumption units that households would be willing to forgo to continue under the Ramsey policy regime:
- Impose identical initial conditions across different monetary policy regimes, using Ramsey allocation,
- we include transition dynamics in the computation to avoid spurious welfare reversals:

Intuition from simplified model

- Non-differentiated good homogeneous across countries (trick from trade literature) $(\eta \to \infty)$
- Cobb-Douglas aggregator $C_t \equiv \left(C_{DHt}^{1/2} C_{DFt}^{1/2}\right)^{\theta} \left(C_{Nt}^{1/2}\right)^{1-\theta}$
- Log utility: $U_t = \ln C_t - \kappa l_t$
- Follow Corsetti-Pesenti (2009) to define variable, ,$\mu_t = P_t C_t$ to denote monetary stance.
- Labor supply implies: $W_t = \kappa \mu_t$
- Production uses only labor $Y_{it} = \alpha_i L_{it}, \quad i = D, N$
- Price setting under PCP stickiness:

$$P_{DHt} = \frac{\phi}{\phi - 1} E_{t-1}\left[\left(1 + \frac{\alpha_N^*}{\alpha_N}\frac{1}{T_{N,t} T_{Dt}^*}\right)\frac{\kappa \mu_t}{\alpha_D}\right] \Big/ E_{t-1}\left[\left(1 + \frac{\alpha_N^*}{\alpha_N}\frac{1}{T_{N,t} T_{Dt}^*}\right)\right]$$

Intuition from simplified model

- To study a home tariff non-diff. sector requires home be both a producer and importer: implies bounds on tariff and productivities:

$$1 < \frac{\alpha_N^*}{\alpha_N T_{N,t} T_{Dt}^*} < \frac{2}{\theta} - 1$$

- Price parity pins down exchange rate as function of mon. policies, productivities, and tariff.

$$e_t = \frac{P_{NH,t}}{P_{NF,t}^* T_{N,t}} = \frac{\left(W_t / \alpha_N\right)}{\left(W_t^* / \alpha_N^*\right) T_{N,t}} = \frac{\mu_t \alpha_N^*}{\mu_t^* \alpha_N T_{N,t}}$$

Optimal Monetary Policy (PCP)

Derive optimal monetary policy stance (summarized in μ_t) to maximize $E_{t-1}[U_t]$, (both Nash and Cooperative)

home: $\mu_t^{OP} = a\left(1+\frac{\alpha_N^*}{\alpha_N}\frac{1}{T_{N,t}T_{Dt}^*}\right)^{-1}$ foreign: $\mu_t^{*OP} = a\left(1+\frac{\alpha_N}{\alpha_N^*}\frac{T_{Nt}}{T_{Dt}}\right)^{-1}$

Implications for Home monetary policy responses:

- Foreign tariff on home differentiated exports (T_D^*): Monetary expansion.
- Home tariff on differentiated imports (T_D): no response.
- Home tariff on non-differentiated good: Monetary expansion.

Optimal Monetary Policy (LCP)

Optimality condition for monetary policy stance μ_t both Nash and Cooperative):

home: $$\frac{1}{\mu_t} = \frac{1}{2}\frac{1}{E_{t-1}\left[\mu_t\right]} + \frac{1}{2}\frac{1}{T_{Dt}} \Big/ E_{t-1}\left[\frac{\mu_t}{T_{Dt}}\right]$$

foreign: $$\frac{1}{\mu_t^*} = \frac{1}{2}\frac{1}{E_{t-1}\left[\mu_t^*\right]} + \frac{1}{2}\frac{1}{T_{Dt}^*} \Big/ E_{t-1}\left[\frac{\mu_t^*}{T_{Dt}^*}\right]$$

- Not a closed form solution
- But clear that now home policy responds to home differentiated tariff not foreign. Inverted from PCP.

Optimal Monetary Policy (DCP)

Home currency dominant (home sets export prices PCP, and foreign sets export prices LCP), implies hybrid optimal policy condition:

home: $$\frac{1}{\mu}-\frac{1}{2}\frac{\left(1+\frac{\alpha_N^*}{\alpha_N}\frac{1}{T_{N,t}T_{Dt}^*}\right)\frac{\kappa}{\alpha_D}}{E_{t-1}\left[\left(1+\frac{\alpha_N^*}{\alpha_N}\frac{1}{T_{N,t}T_{Dt}^*}\right)\frac{\kappa\mu_t}{\alpha_D}\right]}-\frac{1}{2}\frac{\frac{1}{T_{Dt}}}{E_{t-1}\left[\frac{\mu_t}{T_{Dt}}\right]}=0$$

foreign: $$\mu_t^*=E_{t-1}\left[\mu_t^*\right]$$

- Home: No closed form solution (like LCP).
- Implies home policy responds both to home tariff (like LCP) and to foreign tariff (like PCP).
- Foreign: constant policy, $\mu_t^*=a$ not respond any tariff.

Numerical Simulations:

Calibrating differentiated sector

- Share of differentiated goods: Rauch (1999).
- Elasticities of Substitution: Broda and Weinstein (2006) 5.2 for differentiated goods (as defined by Rauch 1999).
- Intermediates share from outside lit. ς =1/3.
- Calibrate trade cost to match exports as share of GDP: τ_D = 0.44

Corresponding price indexes and demands:

$$P_t \equiv \frac{P_{D,t}^{\theta} P_{N,t}^{1-\theta}}{\theta^{\theta}\left(1-\theta\right)^{1-\theta}}$$

$$P_{D,t} = \left(n_t p_t\left(h\right)^{1-\phi} + n_t^{*}\left(p_t\left(f\right)T_{D,t}\right)^{1-\phi} \right)^{\frac{1}{1-\phi}}$$

$$P_{N,t} = \left(\nu P_{H,t}{}^{1-\eta} + \left(1-\nu\right)\left(P_{F,t}T_{N,t}\right)^{1-\eta} \right)^{\frac{1}{1-\eta}}$$

$$C_{D,t} = \theta\left(P_{D,t} / P_t\right)^{-\xi} C_t \qquad C_{N,t} = C_{D,t} = \left(1-\theta\right)\left(P_{N,t} / P_t\right)^{-\xi} C_t$$

$$c_t(h) = \left(p_t\left(h\right) / P_{Dt}\right)^{-\phi} C_{Dt} \qquad C_{Ht} = \nu\left(P_{Ht} / P_{Nt}\right)^{-\eta} C_{Nt}$$

$$C_{H,t} = \nu\left(P_{H,t} / P_{N,t}\right)^{-\eta} C_{N,t} \qquad C_{Ft} = \left(1-\nu\right)\left(P_{Ft} / P_{Nt}\right)^{-\eta} C_{Nt}$$

Market clearing

- Labor: $\int_0^{n_t} l_t(h)dh + l_{H,t} = l_t$

- Bonds: $B_{Ht} + B_{Ht}^* = 0$

  $B_{Ft} + B_{Ft}^* = 0.$

- Balance of Payments:

$$\int_0^{n_t} p_t^*(h)\left(d_t^*(h)\right)dh - \int_0^{n_t^*} p_t(f)\left(d_t(f)\right)df + P_{Ht}^*\left(C_{H,t}^* + AC_{P,H,t}^* + AC_{B,H,t}^*\right)$$

$$-P_{F,t}\left(C_{F,t} + AC_{P,F,t} + AC_{B,F,t}\right) - i_{t-1}B_{H,t-1}^* + e_t i_{t-1}^* B_{F,t-1} = \left(B_{H,t}^* - B_{H,t-1}^*\right) + e_t\left(B_{F,t} - B_{F,t-1}\right)$$

- Government budget constraint:

$$T_t = \left(M_{t-1} - M_t\right) + \left(T_{D,t} - 1\right)n_{t-1}^* d_t(f) + \left(T_{N,t} - 1\right)\left(C_{F,t} + AC_{P,F,t} + AC_{B,F,t}\right)$$

Appx Figure 1. Full impulse responses to a rise in home tariff on differentiated imports

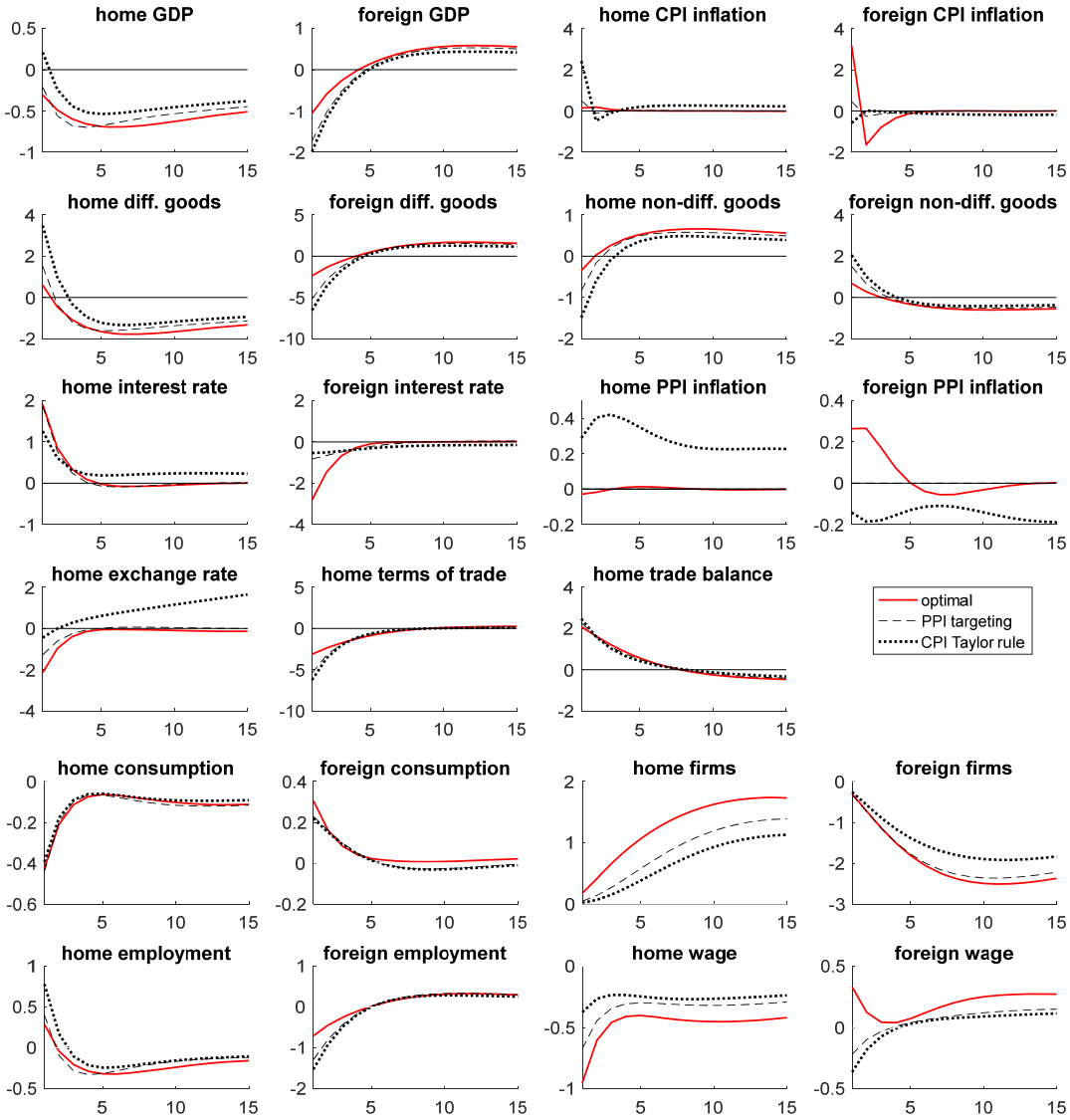
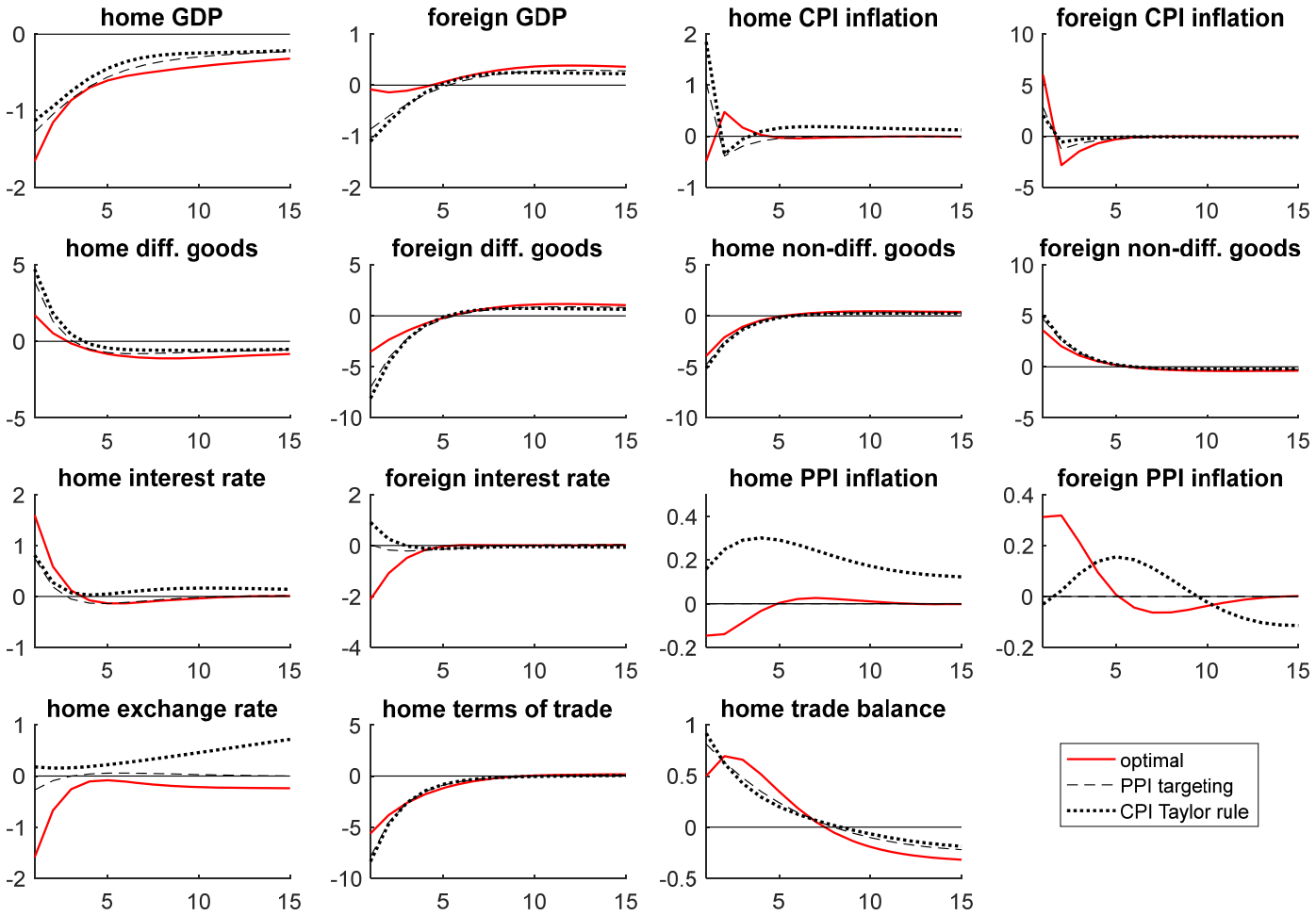
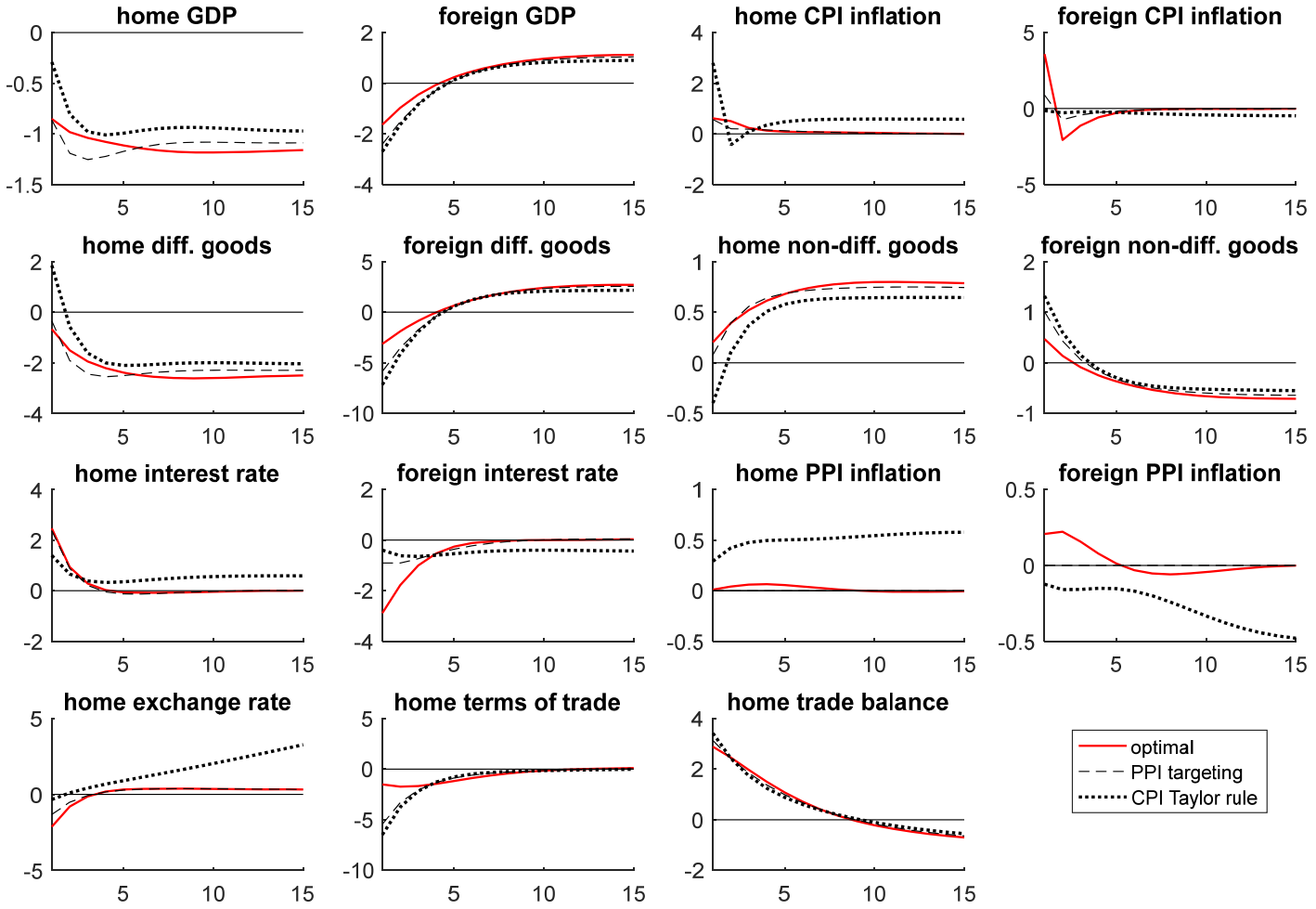


Figure 4. Home tariff on differentiated imports, foreign tariff on non-differentiated imports

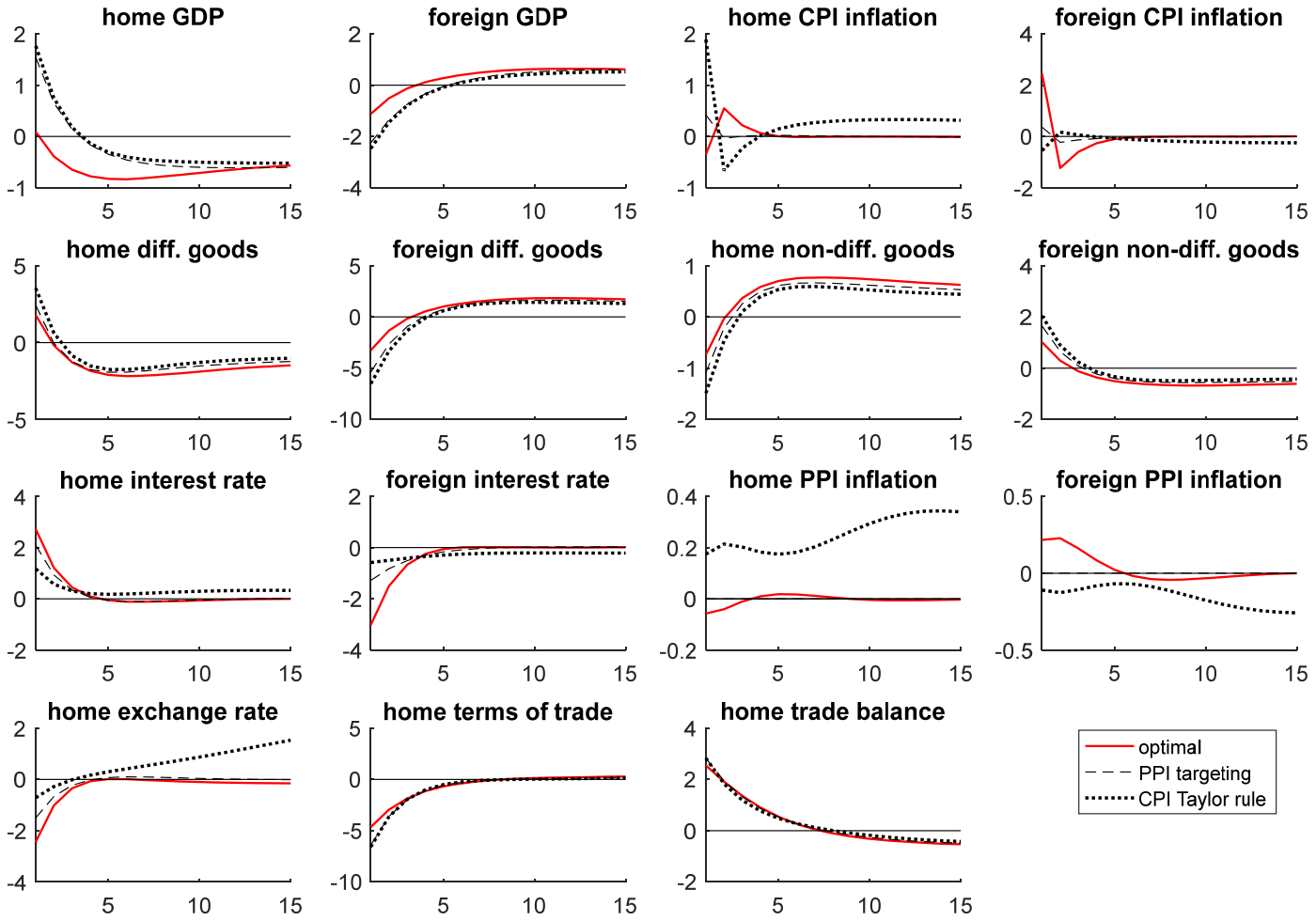


Appendix Figure 2. Impulse responses to a rise in home tariff on differentiated imports, lower trade elasticity (3.8)



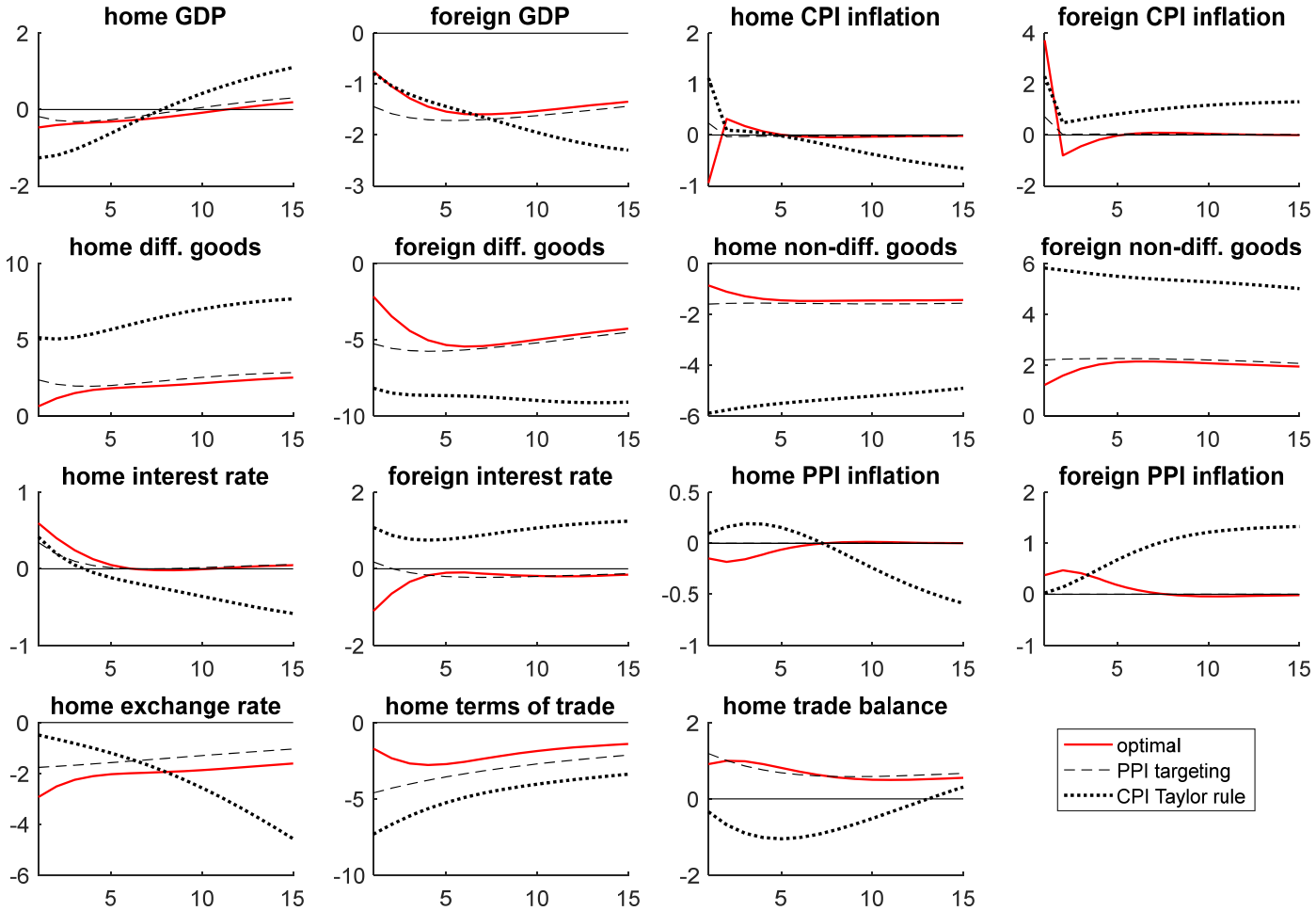
Vertical axis is percent deviation from steady state (1=1%); horizontal axis is time (in quarters). Trade balance reported as percent of GDP. Interest rates in percentage points. Inflation rates annualized.

Appendix Figure 4. Impulse responses to a rise in home tariff on differentiated imports; foreign currency dominant



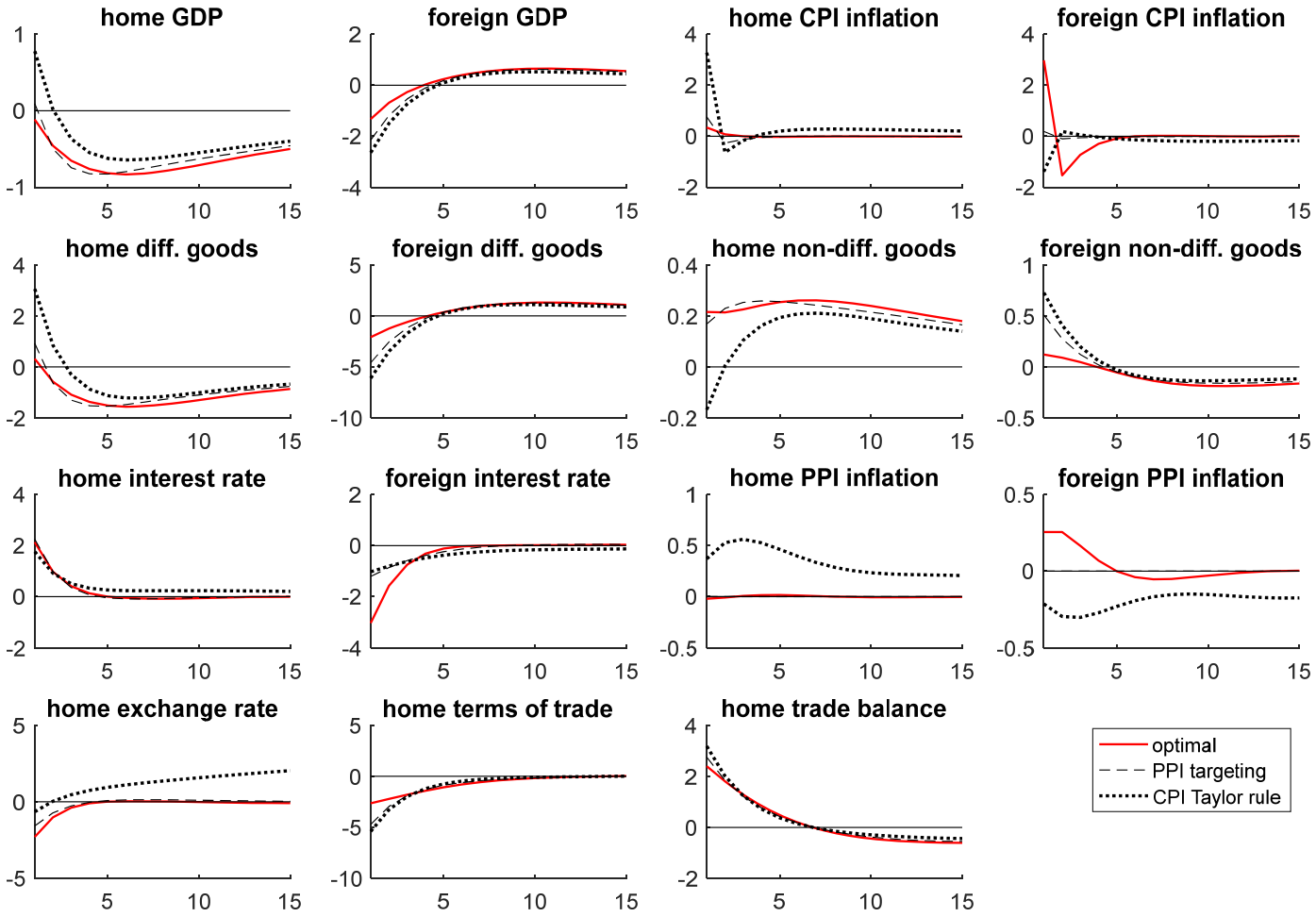
Vertical axis is percent deviation from steady state (1=1%); horizontal axis is time (in quarters). Trade balance reported as percent of GDP. Interest rates in percentage points. Inflation rates annualized.

Appendix Figure 5. Impulse responses to a more persistent tariff on home differentiated imports



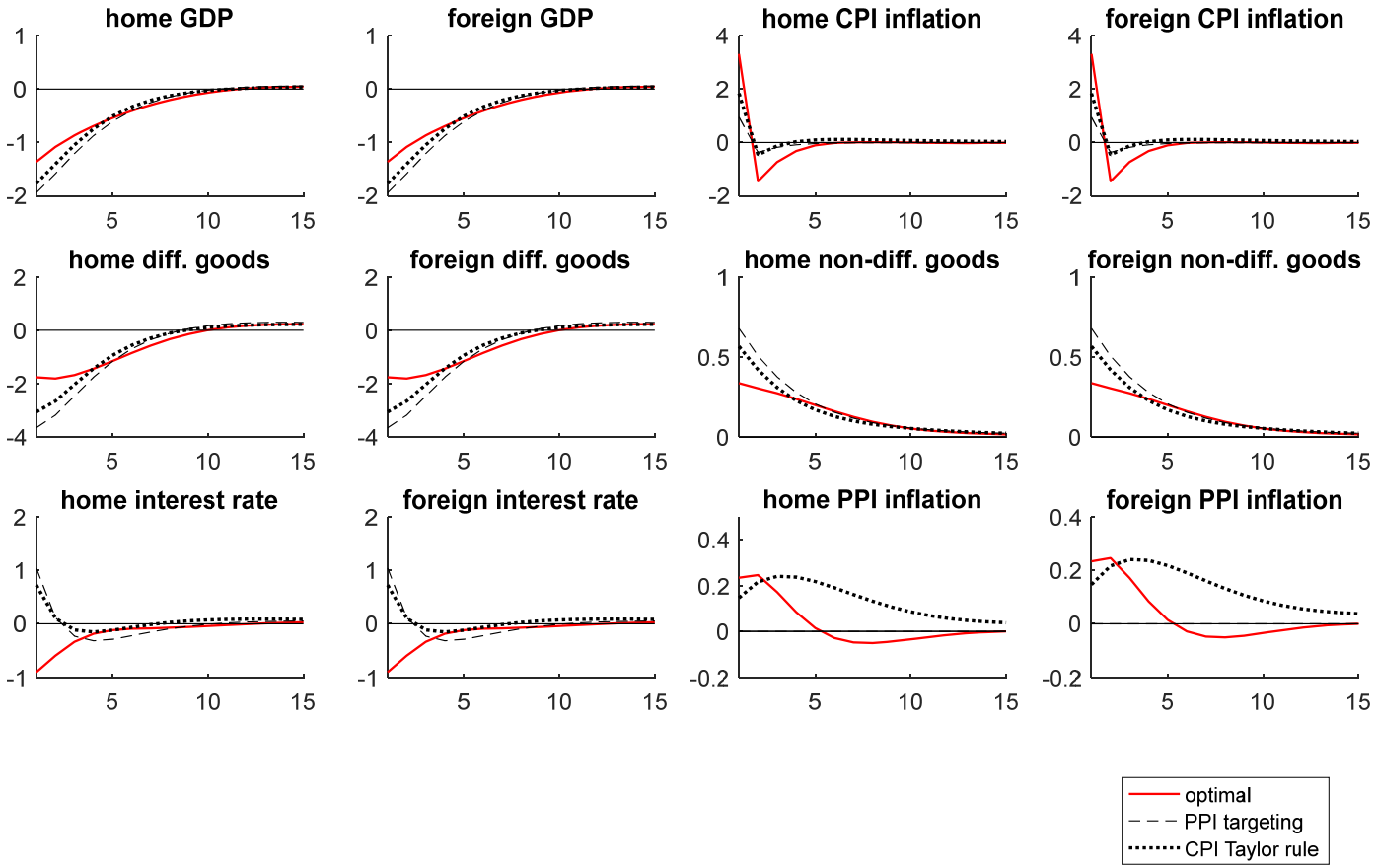
Vertical axis is percent deviation from steady state (1=1%); horizontal axis is time (in quarters). Trade balance reported as percent of GDP. Interest rates in percentage points. Inflation rates annualized.

Appendix Figure 6. Impulse responses to home tariff on differentiated imports, nontraded non-diff. goods



Vertical axis is percent deviation from steady state (1=1%); horizontal axis is time (in quarters). Trade balance reported as percent of GDP. Interest rates in percentage points. Inflation rates annualized.

Appendix Figure 7. Impulse responses to a symmetric tariff to differentiated imports in both countries



Vertical axis is percent deviation from steady state (1=1%); horizontal axis is time (in quarters). Trade balance reported as percent of GDP. Interest rates in percentage points. Inflation rates annualized.