THE OPTIMAL MONETARY POLICY RESPONSE TO TARIFFS

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Motivation

- **How should a central bank respond to import tariffs?**
  - Tighten monetary policy to contain inflationary pressures, or...
  - Neutral monetary stance (“look-through”) and allow one-time jump in the CPI?

Jay Powell pushes back on calls for Federal Reserve rate cuts as soon as July

US central bank chair tells congressional committee economy remains ‘solid’ but tariffs could push up prices

Jay Powell has been under fire from the US president over the Federal Open Market Committee’s decision to keep interest rates on hold © Mark Schiefelbein/AP

Top Federal Reserve official calls for rate cuts as soon as July

Governor Chris Waller says US has yet to see an inflation ‘shock’ from Donald Trump’s tariffs

Christopher Waller joined the Fed’s policy-setting panel in 2020 after being nominated by Donald Trump during his first term as president © Bloomberg

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This paper:

- Optimal monetary policy response to tariffs is **expansionary**

Overview

- Open-economy New Keynesian model with home and imported goods
  - Macroeconomic effects depend on monetary policy

Overview

- PPI targeting: tariffs generally contractionary—always fall for small tariffs

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flex-price allocation ("look-through")

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  - Fiscal externality $\Rightarrow$ Depress inefficiently imports

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Tariffs can lead to an expansion or contraction in output

≠ textbook cost-push shock

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  Trade surplus, even with permanent tariff

Monetary stimulus leads to temporary rise in output and savings

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→ Trade surplus, even with permanent tariff

→ Exchange-rate depreciation, unlike conventional view

→ Weak dollar since April 2nd

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  Exchange-rate depreciation, unlike conventional view
- Extensions: temporary/anticipated, ex/endogenous TOT, supply chains

Literature on Tariffs in International Macro

- Classic question: Are tariffs expansionary or contractionary? Keynes vs. Mundell
- Recent studies: Auray, Devereux, Eyquem (2022,2024); Eichengreen (2019); Barattieri, Cacciatore and Ghironi (2021); Comin and Johnson (2021); Jeanne (2021); Jeanne-Son (2024); Bergin and Corsetti (2021); Erceg, Prestipino and Raffo (2023); Lloyd and Marin (2024)
- Bergin-Corsetti (2023): under cooperation, *contractionary* policy for tariff-imposing country

Our contribution:

- Optimal policy for tariff-imposing country:
  - *Expansionary* policy is optimal
  - Fiscal externality ⇒ tariff $\neq$ TOT shock
- Characterize analytically when tariffs have expansionary vs. contractionary effects, through labor supply channel

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Active agenda!

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  - Two final consumption goods: home-produced (h) and foreign-produced (f)
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  - Monetary policy does not affect terms of trade
- Monetary authority: sets monetary policy optimally, taking as given tariffs $\{\tau_t\}$

Households

$$\sum_{t=0}^{\infty} \beta^t \Big[U(c_t^h, c_t^f) - v(\ell_t) \Big]$$

$$U(c_t^h, c_t^f) = \frac{\sigma}{\sigma - 1} \left[\omega (c_t^h)^{1-\frac{1}{\gamma}} + (1-\omega)(c_t^f)^{1-\frac{1}{\gamma}} \right]^{\frac{\gamma}{\gamma-1} \frac{\sigma-1}{\sigma}}, \quad v(\ell_t) = \omega \frac{\ell_t^{1+\psi}}{1+\psi}$$

- Budget constraint:

$$P_t^h c_t^h + P_t^f (1 + \tau_t) c_t^f + \frac{e_t b_{t+1}}{R^*} + \frac{B_{t+1}}{R_t} = e_t b_t + B_t + W_t \ell_t + T_t + D_t$$

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- Law of one price (before tariffs): $P_t^h = e_t P_t^{h*}, \quad P_t^f = e_t P_t^{f*}$

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- Law of one price (before tariffs): $P_t^h = e_t P_t^{h*}$, $\quad P_t^f = e_t P_t^{f*}$
- Terms-of-trade exogenous $p \equiv \frac{P_t^{f*}}{P_t^{h*}}$ $\quad \Leftarrow$ Limit case w/ export elasticity $= \infty$

Firms

- Production of final goods uses domestic inputs (CES technology)
- Domestic inputs
  - Produced with labor $y_{jt} = \ell_{jt}$
  - Monopolistic competition + Rotemberg price adjustment costs
  - Steady-state subsidy to correct markup

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$$(1+\pi_t)\pi_t = \frac{\varepsilon}{\varphi}\left[\frac{W_t}{P_t^h} - 1\right] + \beta\frac{u_h(c_{t+1}^h, c_{t+1}^f)}{u_h(c_t^h, c_t^f)}\frac{\ell_{t+1}}{\ell_t}(1+\pi_{t+1})\pi_{t+1}$$

where $\pi_t \equiv P_t^h / P_{t-1}^h - 1$ is Producer Price Index (PPI) inflation

Competitive Equilibrium

- Optimization (households and firms) + govt. budget + labor market clearing.

$$\tau_t P_t^f c_t^f = T_t + s P_t^h y_t$$

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- Balance of payments:

$$\underbrace{\left(1 - \Upsilon \frac{\varphi}{2}\pi_t^2\right)\ell_t - c_t^h}_{\text{exports}} - \underbrace{pc_t^f}_{\text{imports}} = \underbrace{\frac{b_{t+1}}{R^*} - b_t}_{\text{capital outflows}}$$

Υ → Fraction of price adjustment costs that are a deadweight loss ($1 - \Upsilon$ rebated)

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- Portfolio undetermined, assume $B_0 = 0$ $\Leftarrow$ Abstract from valuation effects

Efficient Allocation

$$\max_{\left\{b_{t+1},c_t^f,c_t^h,\ell_t\right\}} \sum_{t=0}^{\infty} \beta^t [u(c_t^h, c_t^f) - v(\ell_t)],$$

$$\text{s.t } c_t^h + pc_t^f + \frac{b_{t+1}}{R^*} = b_t + \ell_t.$$

Efficient Allocation

$$\frac{v'(\ell_t)}{u_h(c_t^h, c_t^f)} = 1$$

$$\frac{u_f(c_t^h, c_t^f)}{u_h(c_t^h, c_t^f)} = p$$

$$u_h(c_t^h, c_t^f) = \beta R^* u_h(c_{t+1}^h, c_{t+1}^f)$$

$$\ell_t - c_t^h - pc_t^f = \frac{b_{t+1}}{R^*} - b_t$$

Competitive equilibrium

$$\frac{W}{P_h} = \frac{v'(\ell_t)}{u_h(c^h, c^f)}$$

$$(1+\pi_t)\,\pi_t = \frac{\varepsilon}{\varphi}\left[\frac{v'(\ell_t)}{u_h(c_t^h, c_t^f)} - 1\right] + \frac{1}{R^*}\frac{\ell_{t+1}}{\ell_t}(1+\pi_{t+1})\,\pi_{t+1}$$

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- Tariffs: distort MRS $= p$ constraint
- Sticky prices: labor wedge & inflation costs

} Two distortions

Competitive equilibrium $\tau = 0$

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COMPETITIVE EQUILIBRIUM $\tau = 0$ (with $\pi_t = 0$)

$$0 = \frac{\varepsilon}{\varphi}\left[\frac{v'(\ell_t)}{u_h(c_t^h, c_t^f)} - 1\right]$$

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Employment under Look-Through Policy

Definition: A policy of **"look-through"** targets PPI inflation, $\pi_t = 0$ for all t

- Closes labor wedge and replicates flex-price allocation

  → Absent tariffs, this is optimal ⇐ Divine coincidence

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Proposition. Assume that $\beta R^* = 1, \tau_t = \tau, b_0 = 0$. Then, employment is given by

$$\ell_t(\tau) = \left[\frac{\Theta_\tau + \tau}{1+\tau}(\omega\Theta_\tau)^{\frac{\sigma-\gamma}{\gamma-1}}\right]^{\frac{1}{1+\sigma\psi}}, \qquad \text{where } \Theta_\tau \equiv 1 + \left(\frac{1-\omega}{\omega}\right)^\gamma [p(1+\tau)]^{1-\gamma} > 1$$

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and

$$c_t^h(\tau) = \frac{1+\tau}{\Theta_\tau + \tau} \ell_t(\tau), \qquad c_t^f(\tau) = \frac{\Theta_\tau - 1}{p\left(\Theta_\tau + \tau\right)} \ell_t(\tau)$$

Are Tariffs Expansionary or Contractionary?

- Under look-through policy

$$\frac{d \log \ell(\tau)}{d\tau} = - \overbrace{\frac{(\Theta_\tau - 1)}{(1+\sigma\psi)(1+\tau)(\Theta_\tau+\tau)\Theta_\tau}}^{>0} [\sigma\Theta_\tau + (\sigma - \gamma)\tau]$$

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  - For small τ, increase in tariffs are always contractionary—even in the absence of TOT or exchange rate movements (cf. Mundell, 1961)

Are Tariffs Expansionary or Contractionary?

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  - For small τ, increase in tariffs are always contractionary—even in the absence of TOT or exchange rate movements (cf. Mundell, 1961)
  - For large τ: contractionary if goods are Hicksian complements ($\sigma < \gamma$)
    - but may by expansionary if goods are Hicksian substitutes ($\sigma > \gamma$)

Ramsey Optimal Monetary Policy

$$\max_{\pi_t, b_{t+1}, \ell_t, c_t^f, c_t^h} \quad \sum_{t=0}^{\infty} \beta^t \Big[u(c_t^h, c_t^f) - v(\ell_t) \Big],$$

$$\text{s.t.} \quad c_t^h + p\, c_t^f + \frac{b_{t+1}}{R^*} = b_t + \ell_t \left(1 - \Upsilon \frac{\varphi}{2} \pi_t^2 \right)$$

$$\frac{1-\omega}{\omega} \left(\frac{c_t^h}{c_t^f} \right)^{\frac{1}{\gamma}} = p\,(1 + \tau_t)$$

$$u_h(c_t^h, c_t^f) \;=\; \beta R^* u_h(c_{t+1}^h, c_{t+1}^f)$$

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$$\text{s.t.} \quad c_t^h + p\, c_t^f + \frac{b_{t+1}}{R^*} = b_t + \ell_t$$

Sticky prices induce costs only from output gap

$$\frac{1-\omega}{\omega} \left(\frac{c_t^h}{c_t^f} \right)^{\frac{1}{\gamma}} = p\,(1 + \tau_t)$$

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$$\max_{b_{t+1},\ell_t,c_t^f,c_t^h} \sum_{t=0}^{\infty} \beta^t \left[u(c_t^h, c_t^f) - v(\ell_t) \right], \qquad \Upsilon = 0, \tau_t = \tau, \beta R^* = 1,$$

s.t. $$c_t^h + p\, c_t^f + \frac{b_{t+1}}{R^*} = b_t + \ell_t$$

$$\frac{1-\omega}{\omega} \left(\frac{c_t^h}{c_t^f} \right)^{\frac{1}{\gamma}} = p\,(1 + \tau\ )$$

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Ramsey problem reduced to planner choosing ℓ directly, while households choose c^h, c^f

Ramsey Optimal Monetary Policy

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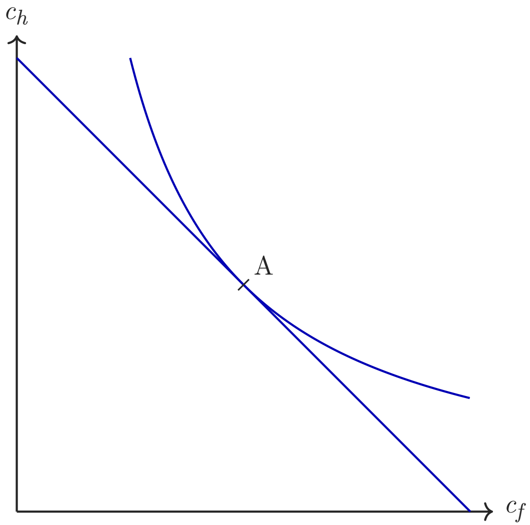
Optimal policy:

$$\ell_t^{opt}(\tau) = \left(\frac{1+\tau}{1+\Theta_\tau^{-1}\tau}\right)^{\frac{\sigma}{1+\sigma\psi}} \left[\frac{\Theta_\tau+\tau}{1+\tau}\left(\omega\Theta_\tau\right)^{\frac{\sigma-\gamma}{\gamma-1}}\right]^{\frac{1}{1+\sigma\psi}} > \ell_t^{\text{look}}(\tau).$$

Why is Stimulus Optimal?

$$\max_{c^h,\, c^f} \; u(c^h, c^f) - v(\ell)$$

$$\text{s.t.} \quad c^h + p(1+\tau)c^f = w\ell + d + T$$



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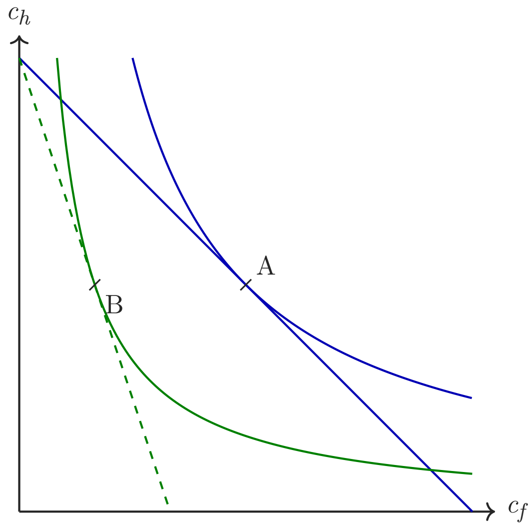

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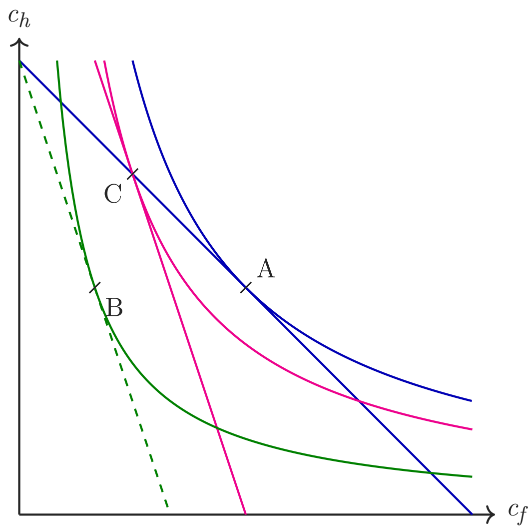

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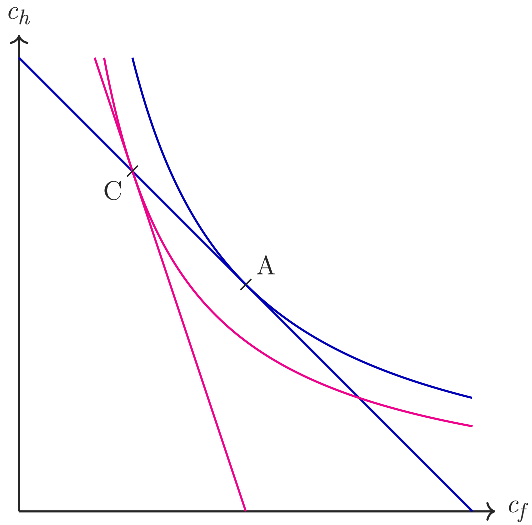

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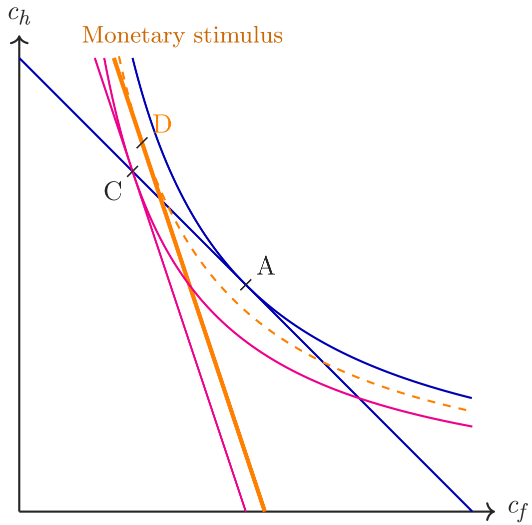
$$\max_{c^h, c^f} \; u(c^h, c^f) - v(\ell)$$

$$\text{s.t.} \quad c^h + p(1+\tau)c^f = w\ell + d + T(C^f)$$



Employment under Optimal Policy

$$\frac{d\log \ell^{opt}}{d\tau} = \frac{(\Theta_\tau - 1)}{(1+\sigma\psi)(1+\tau)(\Theta_\tau + \tau)\Theta_\tau}(1-\sigma)\gamma\tau$$

Employment under Optimal Policy

$$\frac{d \log \ell^{opt}}{d\tau} = \frac{(\Theta_\tau - 1)}{(1+\sigma\psi)(1+\tau)(\Theta_\tau + \tau)\Theta_\tau}(1-\sigma)\gamma\tau$$

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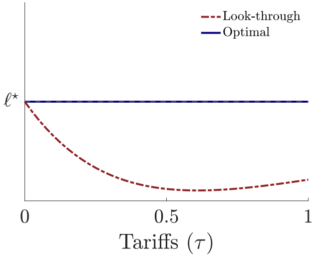
Employment Response: Optimal Policy vs. Look-through

(b) σ = 1



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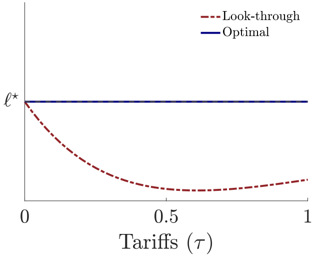
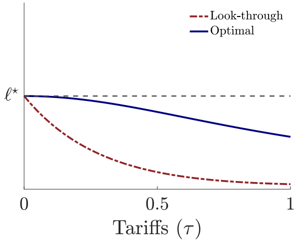


(c) σ = 2



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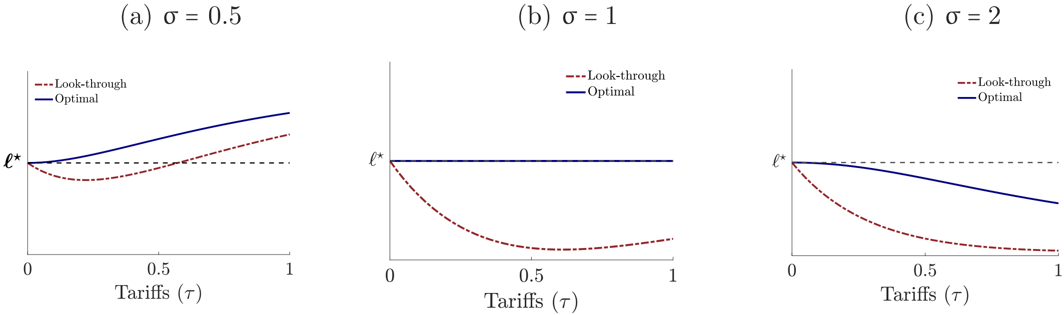

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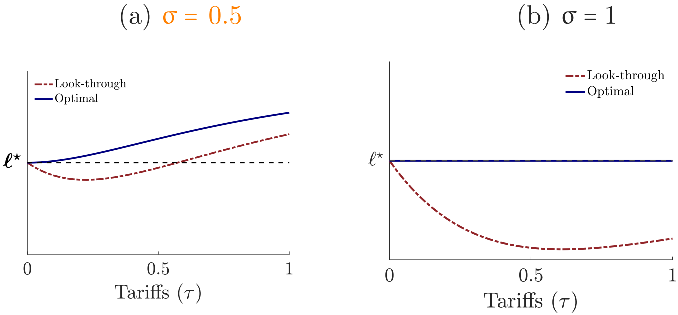


Under optimal policy, output is always above natural level.

- If $\sigma < 1$, output exceeds efficient level as well

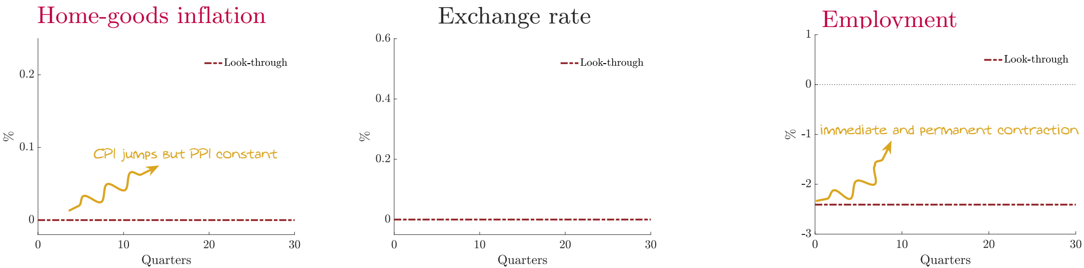
Calibration

Price adj. costs not rebated: $\Upsilon = 1$

Parameter	Description	Value
β	Discount factor	0.99
γ	Elasticity between h and f	4
σ	Intertemporal elasticity	0.5
ψ	Inverse Frisch elasticity	1
ε	Elasticity of substitution (varieties)	6

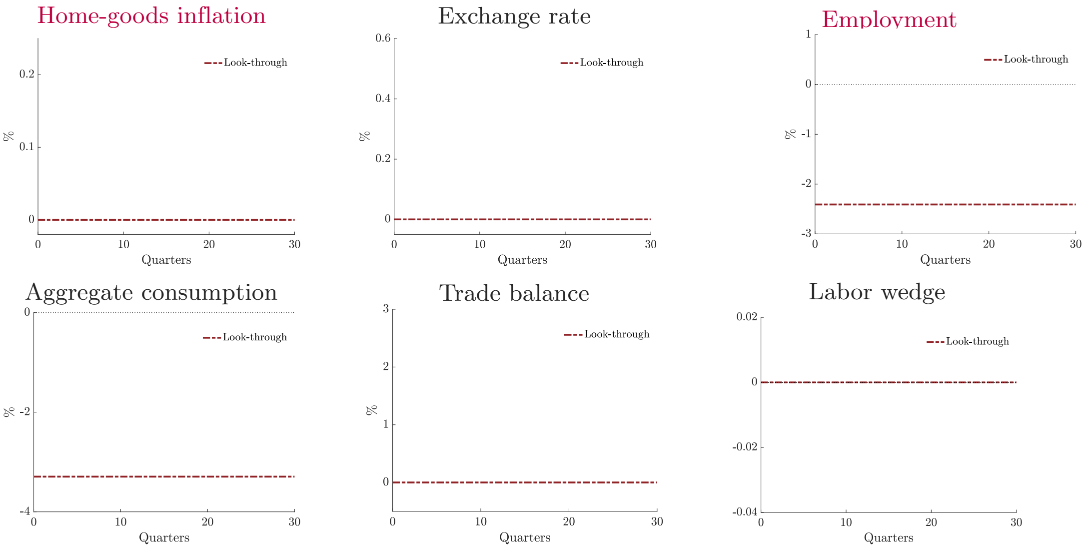
- Calibrate φ, ω to match: (i) slope of Phillips Curve =0.0055 (Hazell et al.); (ii) imports to tradable GDP
- Non-linear impulse response to permanent tariff $\tau_t = 0.15$ (baseline)

Permanent Tariff: Look-through



Inflation is annualized. Consumption, employment and the exchange rate are expressed in percentage deviation from the pre-tariff allocation. Trade balance are expressed as a fraction of GDP.

Permanent Tariff: Look-through vs. Optimal Policy



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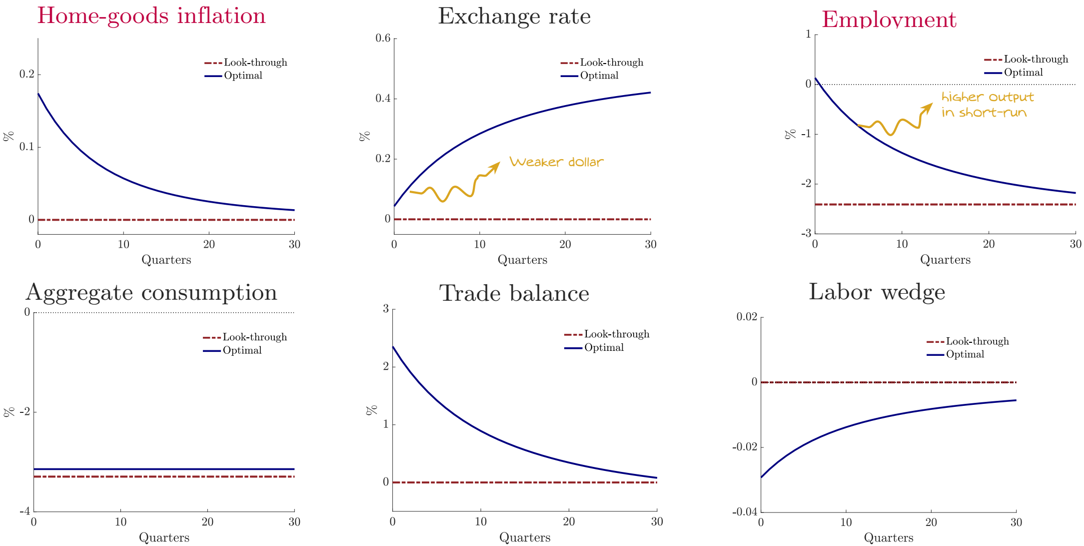

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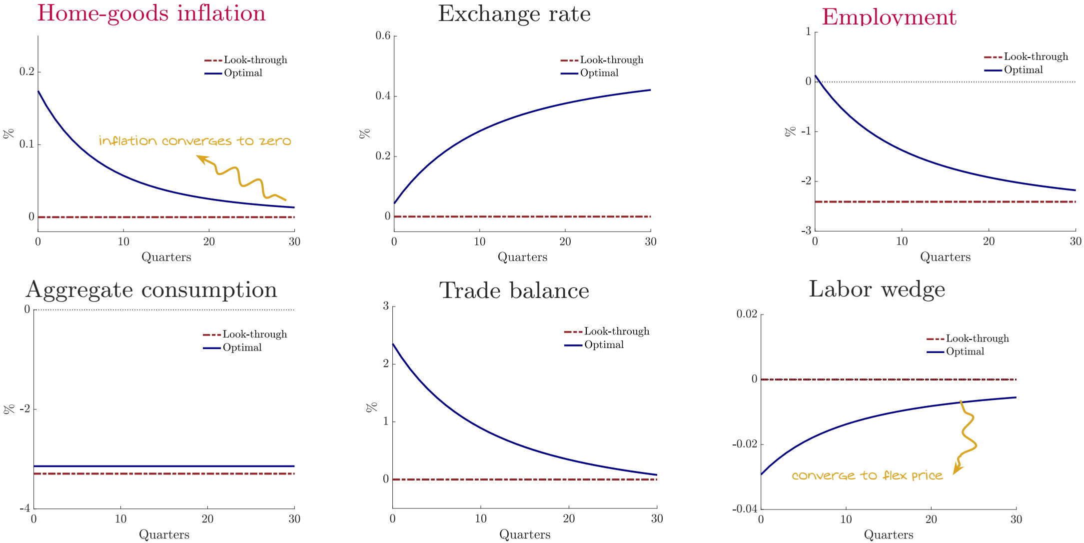

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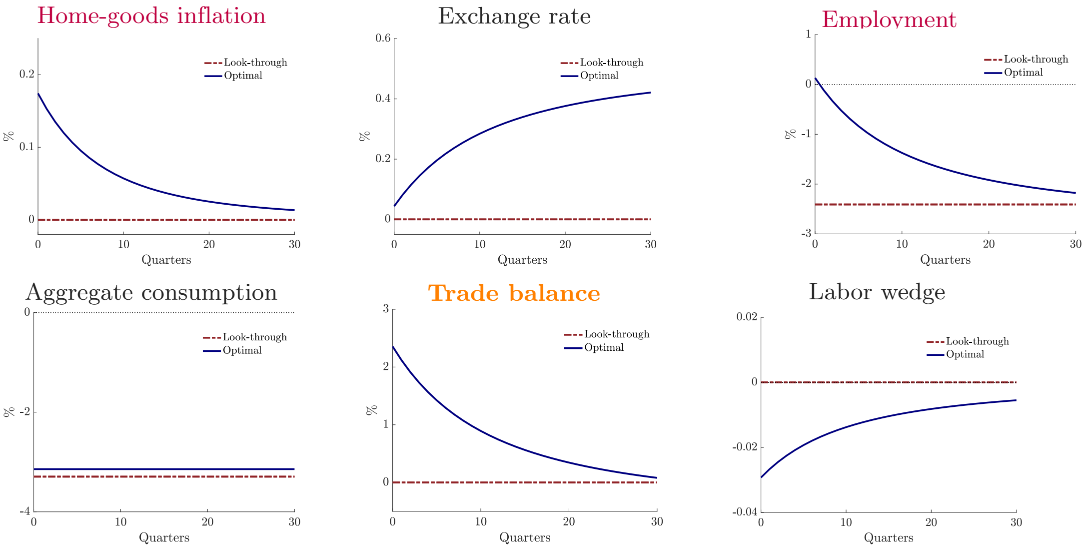

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Additional Results in the Paper

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- Anticipated shocks: ⏩ Details
  - Respond today, but less strongly
  - Trade deficit on impact
- PPI vs. CPI Targeting ⏩ Details
  - Much larger losses under CPI targeting
- Main extensions
  i) Endogenous terms-of-trade
  ii) Imported intermediate inputs
  iii) Distorted steady state
- Welfare

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Endogenous TOT

- Continuum of SOE where c^f is a CES composite of goods produced abroad

$$c_{it} = \left[\omega\left(c_{it}^h\right)^{1-\frac{1}{\gamma}} + (1-\omega)\left(c_{it}^f\right)^{1-\frac{1}{\gamma}}\right]^{\frac{\gamma}{\gamma-1}}, \quad c_{it}^f = \left(\int_0^1 \left(c_{it}^k\right)^{1-\frac{1}{\theta}} dk\right)^{\frac{\theta}{\theta-1}}$$

- Export demand for home good

$$p_t = A\left(y_t - c_t^h\right)^{\frac{1}{\theta}} \qquad \text{Baseline } \theta = \infty$$

- Optimal tariff is positive $\tau^* = \frac{1}{\theta-1}$ with $\theta > 1$
  - Output above natural level $\iff \tau > \tau^*$.
    - Same as baseline: any increase in tariff leads to policy easing
  - Quantitatively, modest attenuation of stimulus Results

Tariffs on Imported Inputs

- Production of domestic varieties $y_{jt} = \ell_{jt}^{1-\nu} x_{jt}{}^{\nu}$
- NK Phillips curve:

$$(1+\pi_t)\pi_t = \frac{\varepsilon}{\varphi}\left[mc_t - 1\right] + \beta \frac{u_h(c_{t+1}^h, c_{t+1}^f)}{u_h(c_t^h, c_t^f)} \frac{y_{t+1}}{y_t}(1+\pi_{t+1})\pi_{t+1},$$

$$mc_t = \left[\frac{W_t}{(1-\nu)P_t^h}\right]^{1-\nu}\left[\frac{p(1+\tau_t^x)}{\nu}\right]^{\nu}$$

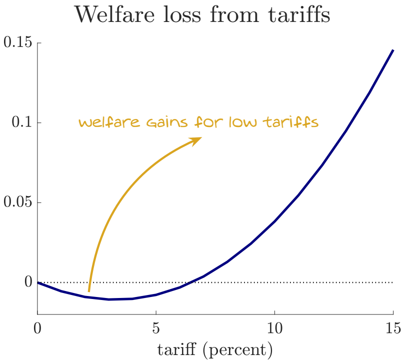
- Same as baseline: firms perceive cost of imported inputs to be larger than social one

  $\Rightarrow$ Optimal policy is stimulative

Quantitatively, larger welfare gains and increase in employment

The case with distorted steady state

- Start now from $s = 0$ and use tariff revenue to subsidize labor $P_t^f \tau_t c_t^f = s_t W_t \ell_t$
  - Unambiguous increase in employment
  - Inflation is mitigated despite larger increases in output



Conclusions

- Optimal monetary policy response to tariffs is to overheat economy
  - Monetary stimulus to offset fiscal externality
  - Let inflation rise above and beyond the direct effects from tariffs

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- Optimal monetary policy response to tariffs is to overheat economy
  - Monetary stimulus to offset fiscal externality
  - Let inflation rise above and beyond the direct effects from tariffs
- Trade surplus in response to permanent tariffs
- Dollar depreciation since April 2 is not puzzling

Extra Slides

Welfare

	Gains Optimal Policy	Losses from Tariffs	
		Optimal Policy	Look-through
Baseline	0.009	0.99	1.00
Anticipated tariffs	0.008	0.96	0.97
Temporary tariffs	0.001	0.19	0.19
Endogenous TOT	0.007	0.68	0.69
Model w/ imported inputs			
Tariffs on c and x	0.32	1.61	1.91
Tariffs on c	0.01	1.00	1.01
Tariffs on x	0.22	0.59	0.80

Note: Welfare corresponds to permanent consumption equivalence (%).

Temporary Tariff $\tau_t = 0.97 \cdot \tau_{t-1}$

back

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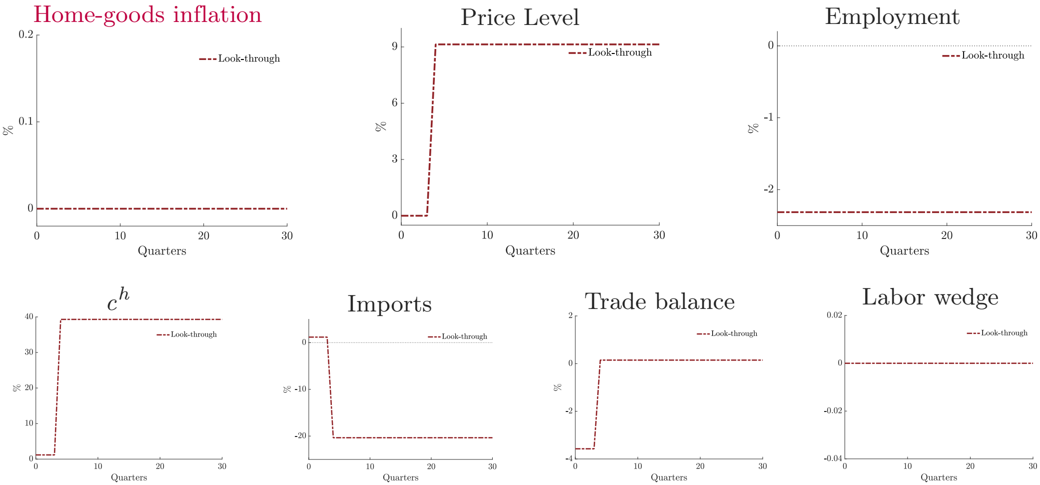
back

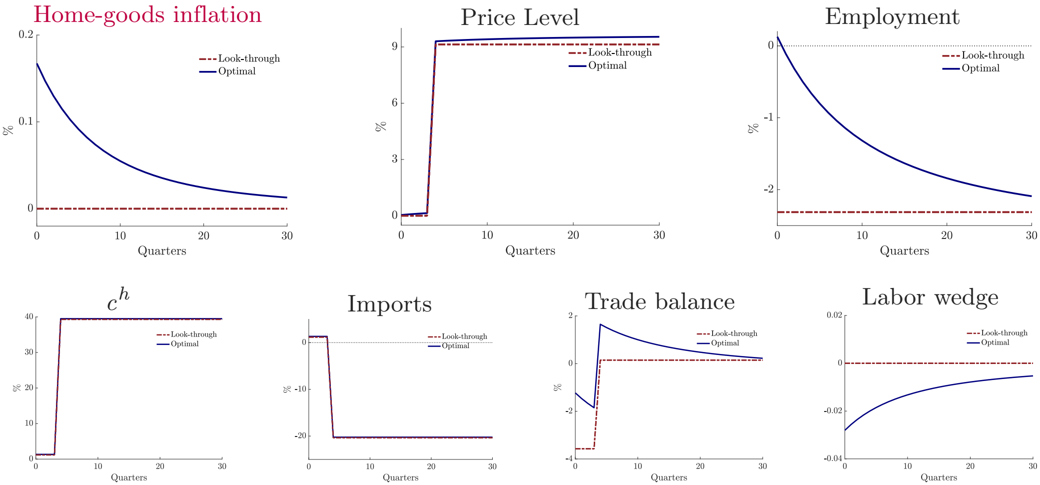
As in the case of a permanent tariff, optimal MP stimulates the economy

Anticipation Effects

back



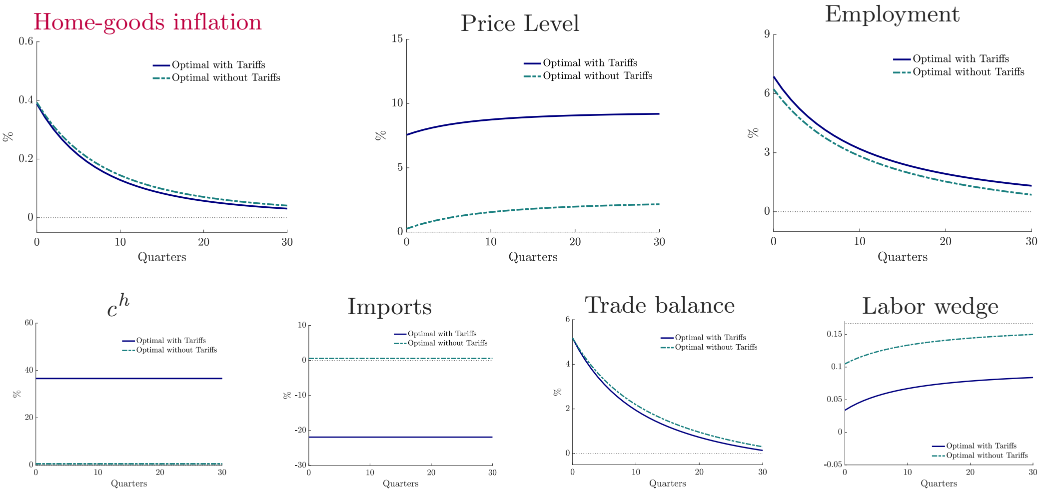
Anticipation Effects ▸ back



MP less expansionary: imports inefficiently high before tariff takes place

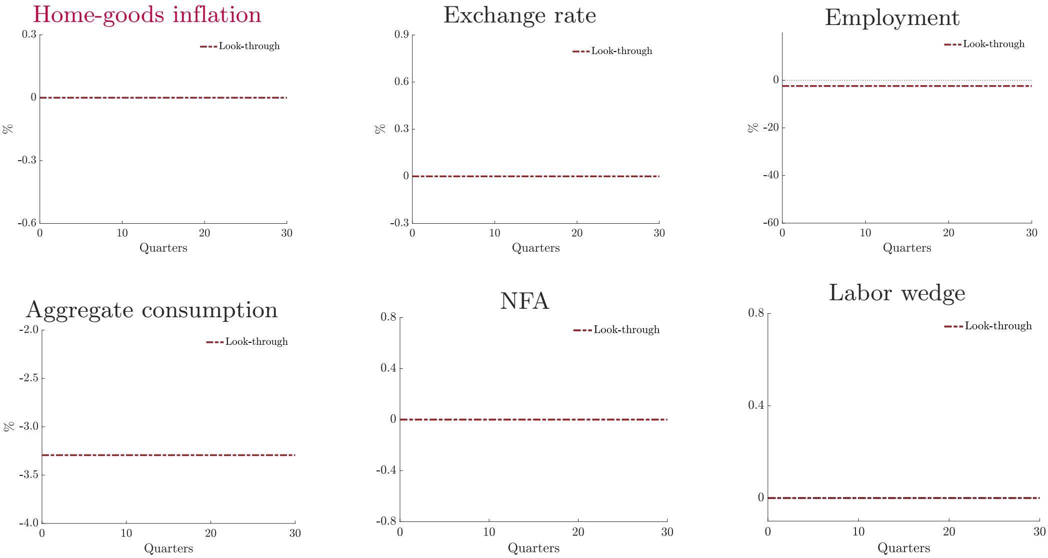
The Case with Distorted Steady State

▸ back



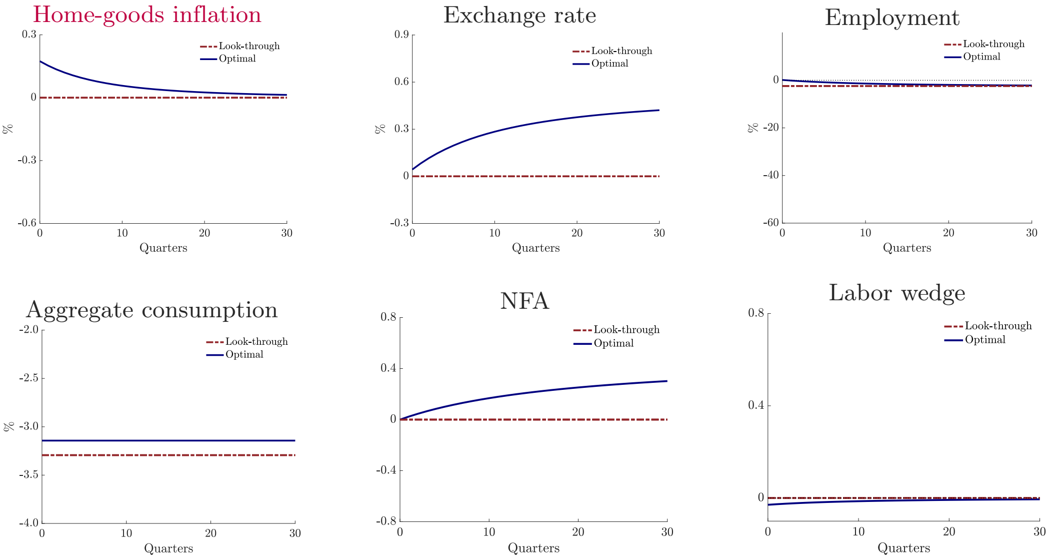
CPI Targeting Rule

Permanent Tariff ⏩ Back



Permanent Tariff

▸▸ Back



Permanent Tariff

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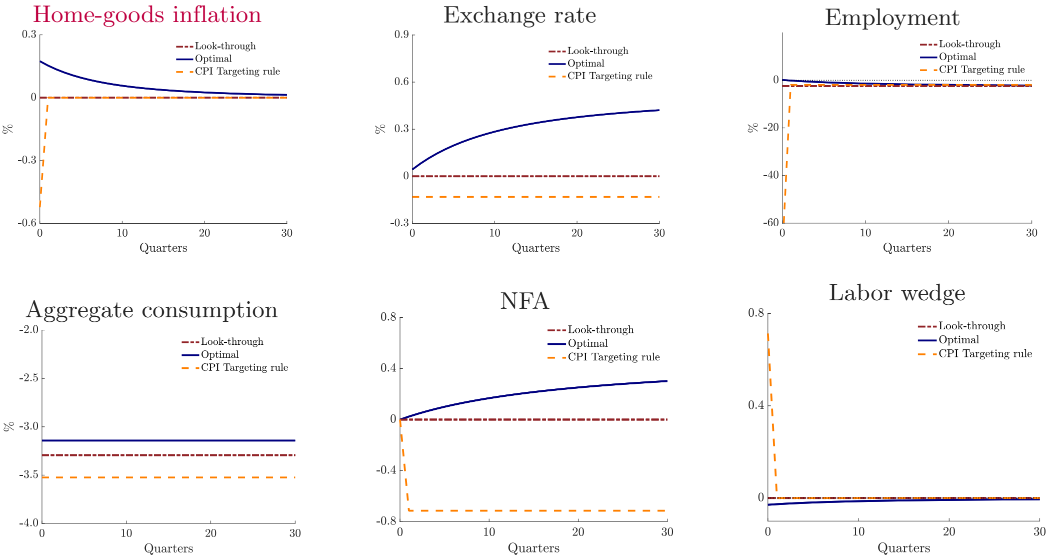

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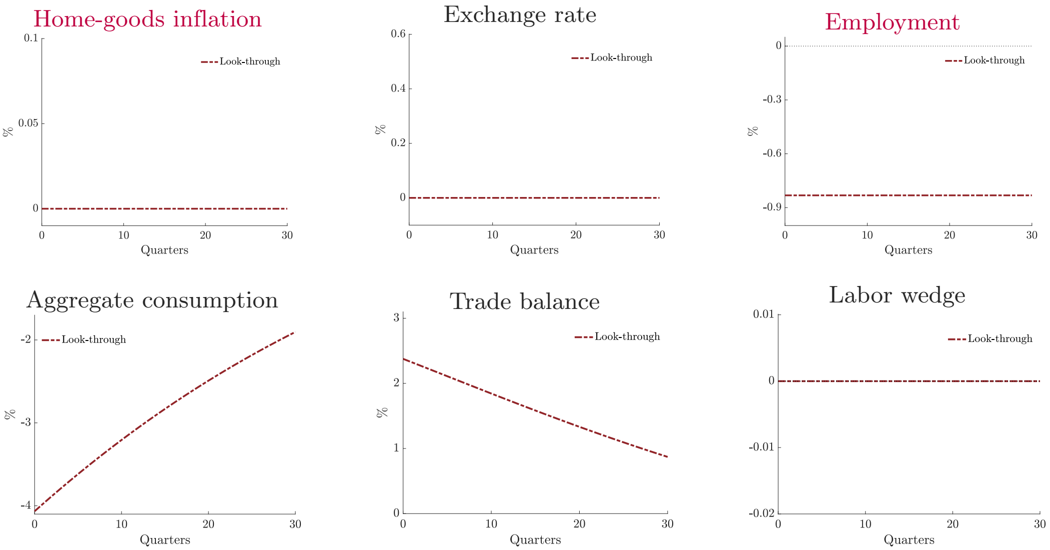

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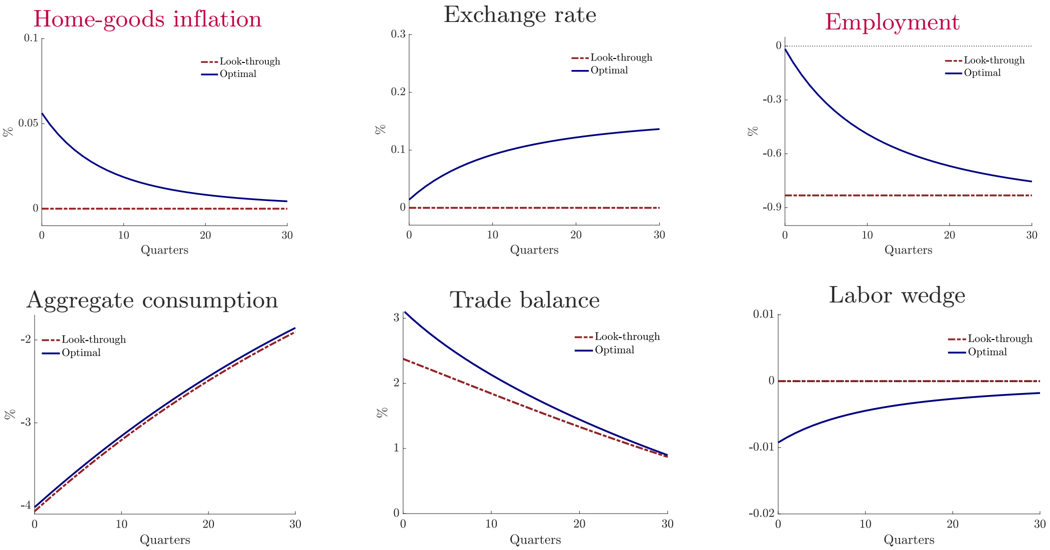

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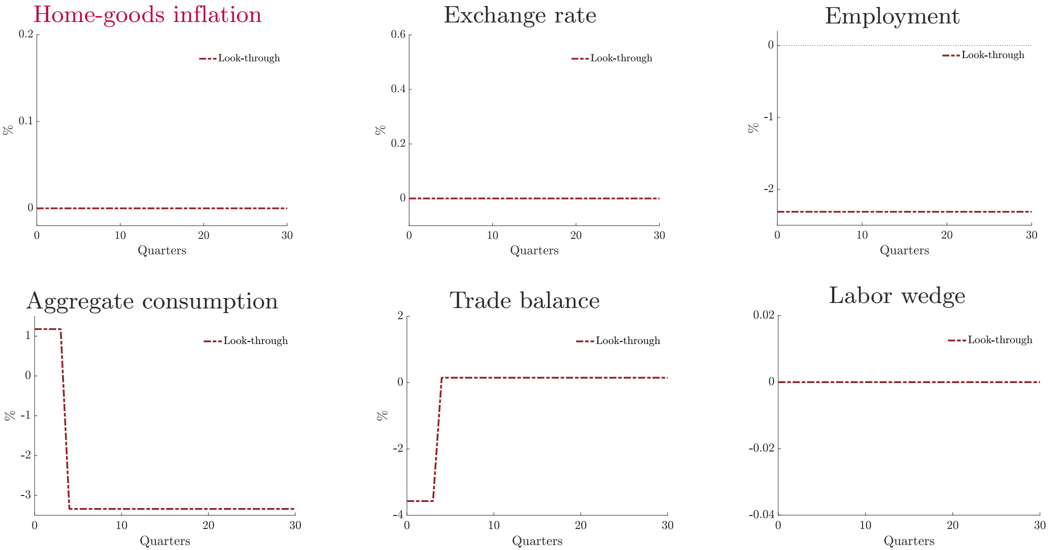

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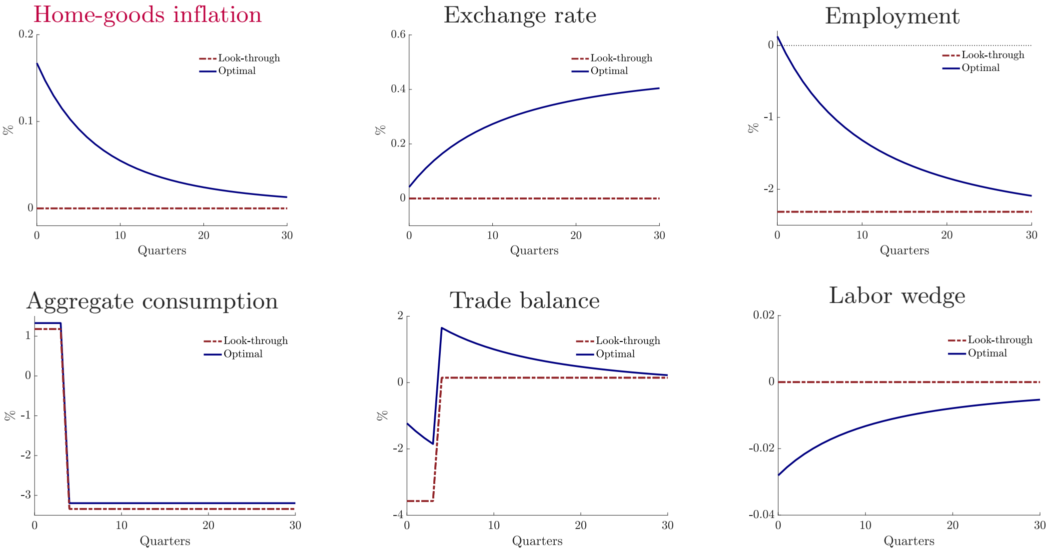

The Case with Distorted Steady State ▸ back