The Optimal Macro Tariff

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Questions

1. **Can tariffs permanently close trade imbalances?**

2. **Do larger trade deficits imply higher optimal tariff?**

3. **Do tariffs undermine U.S. "exorbitant privilege"?**

Country Budget Constraint: Taxonomy of Models

Long-run **trade deficit** is determined by the country's **financial position**:

$$\underbrace{-\sum_{t=0}^{\infty} \bar{R}^{-t} NX_t}_{\textbf{LR trade deficit}} = \underbrace{\bar{R}\,\mathcal{B}_{-1}}_{\text{(0) exogenous initial NFA}}$$

where $\mathcal{B}_{-1}$ are initial net foreign assets, $\bar{R}$ is risk-free rate

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2. Tariffs generically affect exchange rates and generate valuation effects (1)
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   — optimal tariff is well-defined, but even infinite tariffs cannot close imbalances
2. Tariffs generically affect exchange rates and generate valuation effects ①
   — tariffs can close imbalances, optimal tariff depends on external asset positions
3. "Convenience yields" / "exorbitant privilege" $\Rightarrow$ systematic excess returns ②
   — tariffs undermine exorbitant privilege

Related Literature

- **Classics**: Lerner (1936), Baldwin (1948), Johnson (1950, 1953), Gros (1987), Jones (1967), Razin and Svensson (1983), Diamond and Mirrlees (1971), Dixit and Norman (1980), Helpman and Krugman (1989), Bagwell and Staiger (1999), Ossa (2016), Caliendo and Parro (2022)
- **Recent**: Auray, Devereux, Eyquem (2024, 2025), Ignatenko et al. (2025), Alessandria et al. (2025), Rodríguez-Clare, Ulate, Vasquez (2025), Kalemli-Ozcan, Soylu, Yildirim (2025), Ostry, Lloyd, Corsetti (2025), Bai, Lu, Wang (2025)
- **Imbalances**: Lorenzoni (2019), Aguiar, Amador, Fitzgerald (2025), Reyes-Heroles (2016), Cuñat, Zymek (2024), Pujolas, Rossbach (2024), Costinot, Werning (2025), Davila et al. (2025), Caliendo, Kortum, Parro (2025), Hassan et al. (2025), Jiang et al. (2025)
- **Tariffs and MP**: Bergin and Corsetti (2023), Bianchi and Coulibaly (2024), Monacelli (2025), Auclert, Rognlie, Straub (2025), Werning, Lorenzoni, Guerrieri (2025)
- **Other**: Gourinchas and Rey (2007), Farhi, Gopinath, Itskhoki (2014), Itskhoki and Mukhin (2022), Lloyd and Marin (2023), Aguiar, Itskhoki, Mukhin (2024)

BALANCED TRADE

Setup

- **Two countries**: Home (US) and Foreign (RoW*)

- **Two goods**:

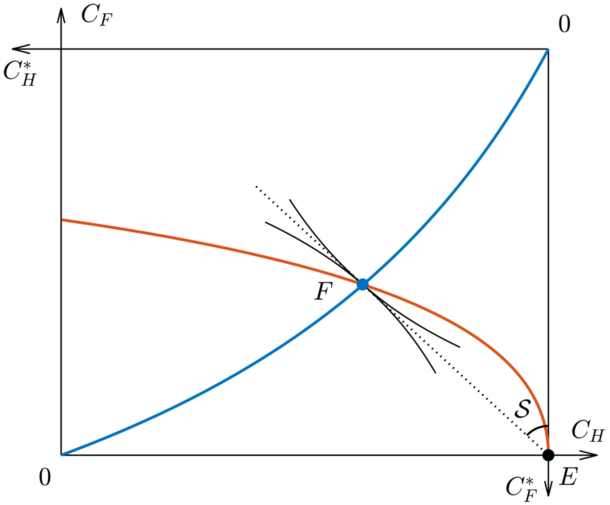
$$Y = C_H + C_H^* \qquad \text{and} \qquad Y^* = C_F + C_F^*$$

- **CES preferences** with elasticities $\theta, \eta > 1$ and home bias

$$u(C_H, C_F) = \left[(1-\gamma)^{\frac{1}{\theta}}\ C_H^{\frac{\theta-1}{\theta}}\ +\ \gamma^{\frac{1}{\theta}}\ C_F^{\frac{\theta-1}{\theta}}\right]^{\frac{\theta}{\theta-1}}$$

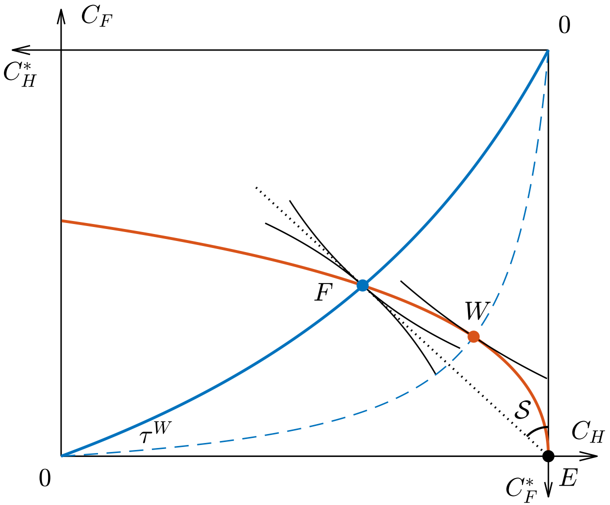
$$u^*(C_H^*, C_F^*) = \left[{\gamma^*}^{\frac{1}{\eta}} {C_H^*}^{\frac{\eta-1}{\eta}} + (1-\gamma^*)^{\frac{1}{\eta}} {C_F^*}^{\frac{\eta-1}{\eta}}\right]^{\frac{\eta}{\eta-1}}$$

Balanced Trade



- **Lerner symmetry**: only overall tariff $\tau \equiv \tau^I \tau^E$ matters for allocation
  - — same terms-of-trade $\mathcal{S} \equiv \frac{P_F^*}{P_H^*}$, different (producer price) real exchange rate $\mathcal{Q} \equiv \frac{P_F^*}{P_H}$

Balanced Trade



- **Optimal tariff**: $\tau^W = 1 + \frac{1}{\eta - 1} \cdot \frac{1}{\Lambda^*} > 1$, where $\Lambda^* \equiv \frac{P_F^* C_F^*}{P^* C^*} = \frac{C_F^*}{Y^*}$

GLOBAL IMBALANCES

Two Tariffs

- **International portfolios**: $NFA \equiv$ foreign assets $-$ liabilities $= P_F^* B^* - P_H B$
- **Result**: cross-border positions in nominal/real bonds, equities/FDI and future CY can be mapped into NFA with B, B^* invariant to tariffs ▸ details ▸ CY

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  1. Lerner symmetry does not hold
  2. Any balanced-trade equilibrium, including trade autarky, can be implemented
  3. Optimal policy engineers max transfer (VA) with unbounded $\tau^I, \tau^E, \mathcal{Q}$, but finite $\mathcal{S}$

Can Import Tariff close Trade Imbalance?

- Constraints when export tax is not available $\tau^E = 1$:

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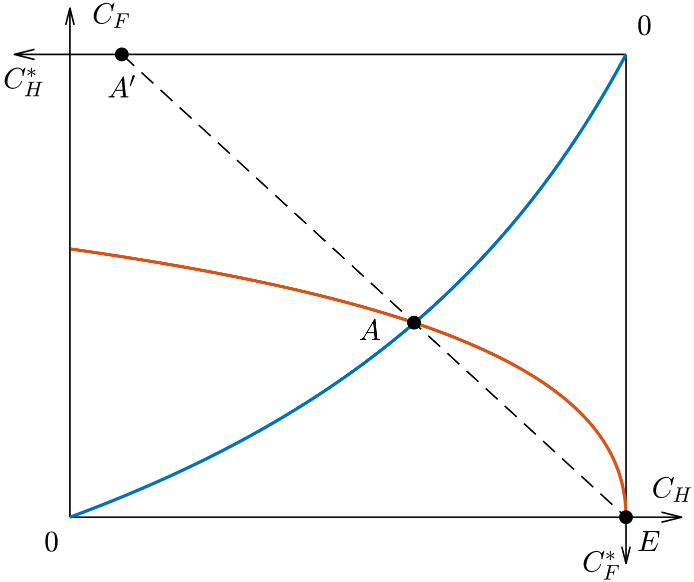

NX>0 figures

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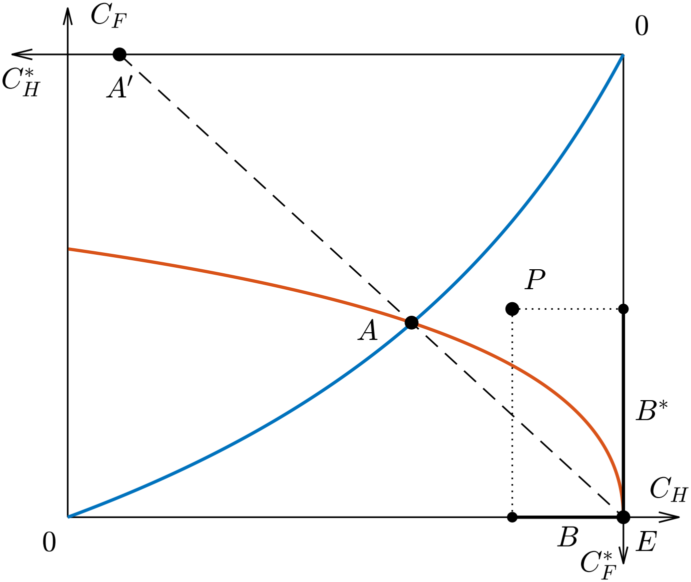

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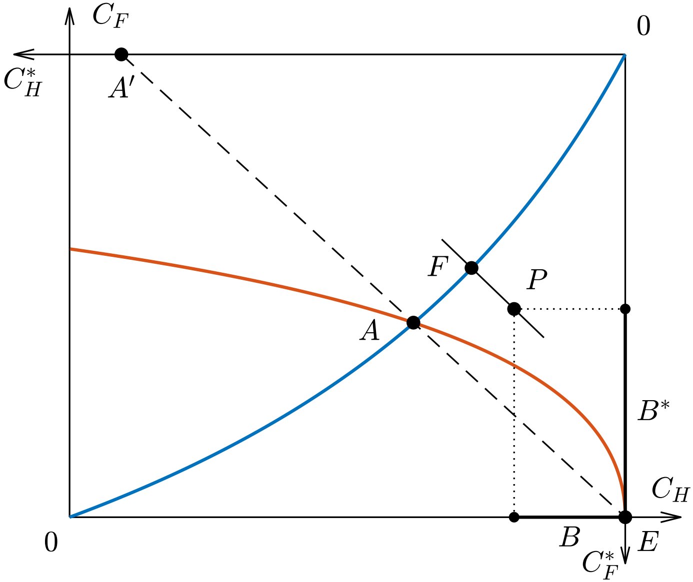

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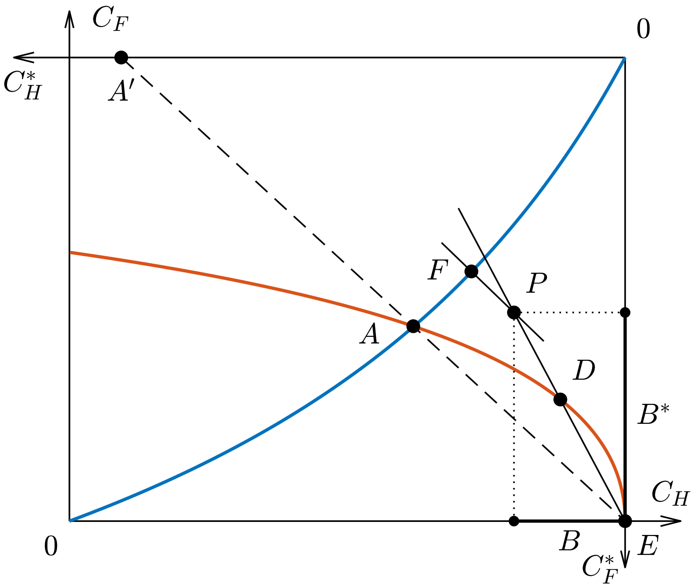

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  2. new level $\mathcal{Q} = B/B^*$ is independent of trade shares and elasticities
     - required tariff is $\mathrm{d} \log \mathcal{Q} \approx -\frac{1}{2} \mathrm{d} \log \tau^I$ ▸ details ▸ calibration
     - $\tau^I = 100\%$, $\mathcal{Q} \downarrow$ by 30%, $C \downarrow$ by 3.2%, $\Lambda \uparrow$ to 97.2%, tradable sector $\downarrow$

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  3. same can be achieved with export subsidy $\tau^E < 1$, unlike Lerner symmetry
     — though the resulting ToT and allocation are different

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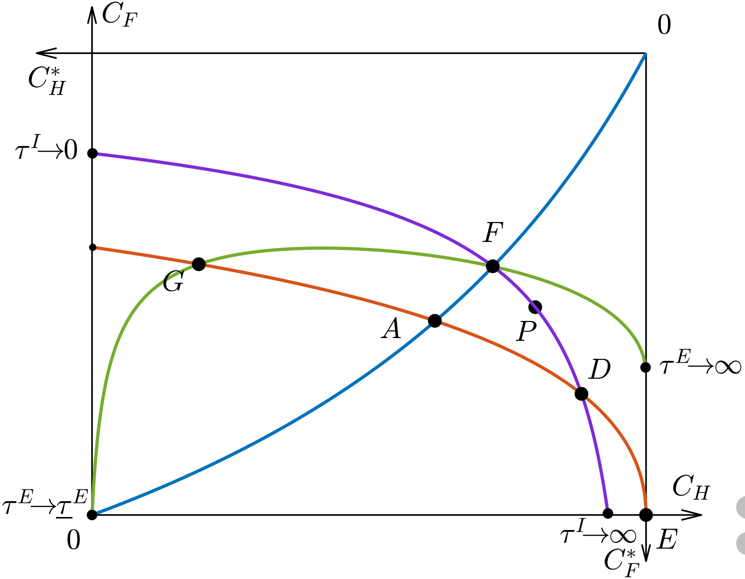

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- **US**: $B \gg 0$ reduces optimal τ^I from 34% to 7%, welfare gains from 0.9% to 0.1%
  - — ToT manipulation vs. valuation effect ($\tau \uparrow \Rightarrow \mathcal{Q} \downarrow \Rightarrow NFA \downarrow$) table figures

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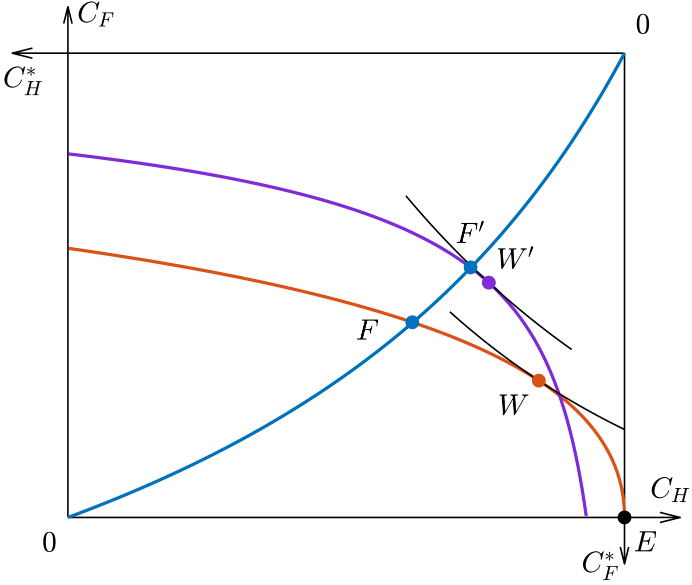

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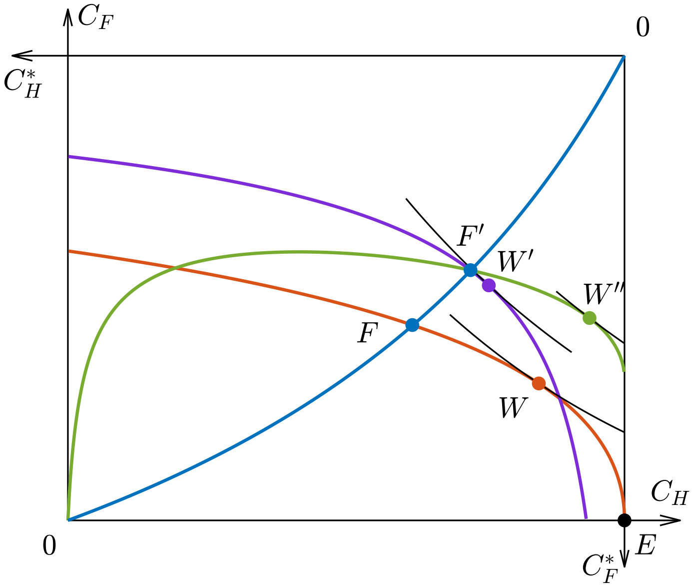

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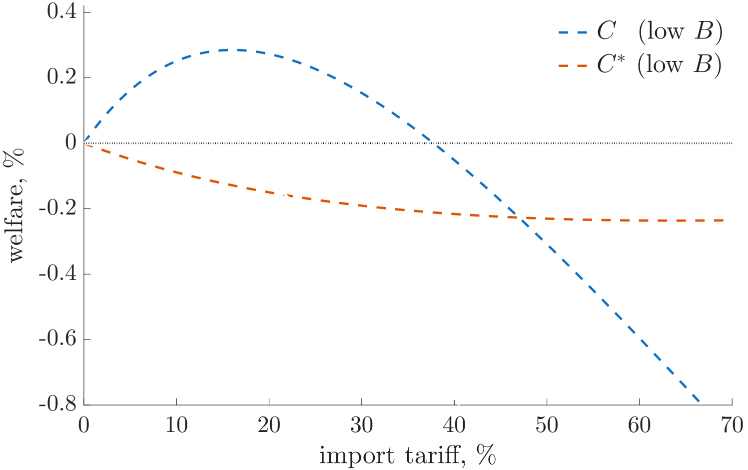
- **Optimal export tariff**:

$$\tau^E = 1 + \frac{1}{\eta - 1} \cdot \frac{1}{\Lambda^*} + \frac{\eta}{\eta - 1}\frac{1}{\theta} \cdot \frac{1}{\Lambda} \cdot \frac{\bar{B}}{IM} \qquad \text{and} \qquad \mathcal{Q} = \tau^E \mathcal{S}$$

Retaliation and Trade War



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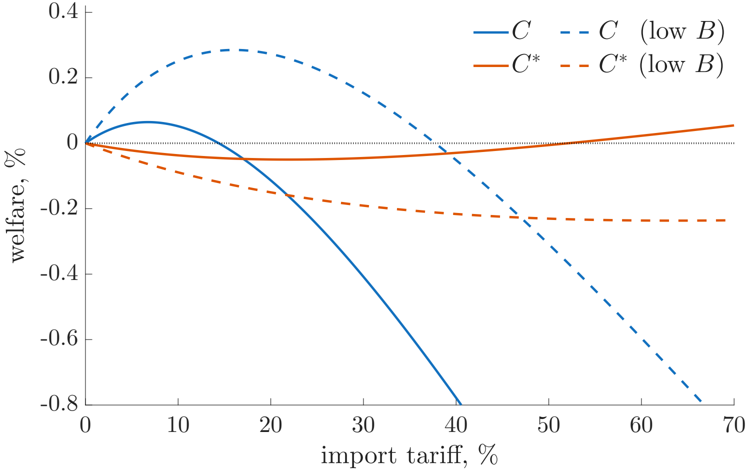

- High U.S. import tariff benefits the RoW via valuation effects

  $\Rightarrow$ no retaliation might be needed

Retaliation and Trade War

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	$B = B^* = 0$				$B^* > B > 0$			
	τ^I	τ^{I*}	C	C^*	τ^I	τ^{I*}	C	C^*
Unilateral	34.00	0.00	0.85	-0.40	6.75	0.00	0.06	-0.03
Trade war	33.67	34.76	-1.21	-0.25	5.37	4.42	-0.03	-0.02

(all in percent) details

ENDOGENOUS PORTFOLIO

Portfolio Choice

- Static model with ex-ante portfolio choice:
  - stochastic Y, Y^*, equity as the only assets
  - separable preferences $\eta = \theta = \frac{1}{\sigma}$
  - convenience yields (discount $\chi < 1$ on foreign assets)
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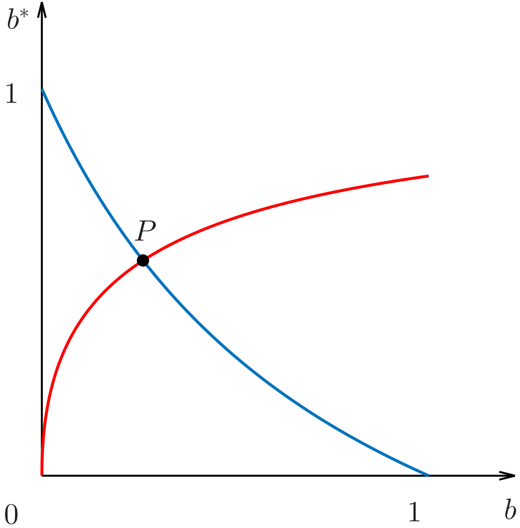
- Portfolio (b, b^*) determined by contract curve and ex-ante budget constraint:

$$\frac{1-\gamma^*}{\gamma^*}\frac{b^*}{1-b^*} = \tau^{-\theta}\frac{\gamma}{1-\gamma}\frac{1-b}{b}, \qquad \frac{\chi b^*}{(1-b^*)^{\frac{1}{\theta}}} = \left(\frac{\gamma^*}{1-\gamma^*}\right)^{\frac{1}{\theta}} \frac{\mathbb{E}Y^{\frac{\theta-1}{\theta}}}{\mathbb{E}Y^{*\frac{\theta-1}{\theta}}} b^{\frac{\theta-1}{\theta}}$$

Policy Implications



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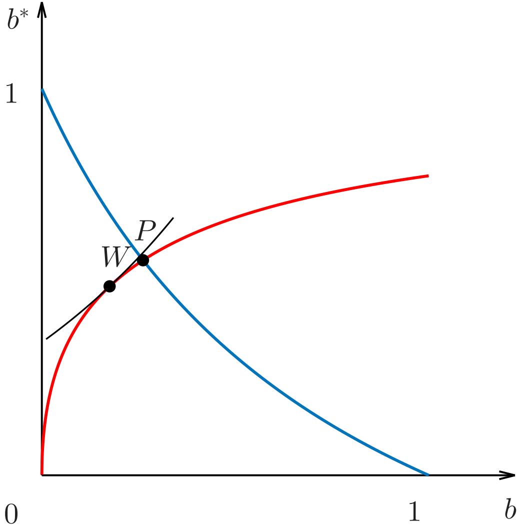

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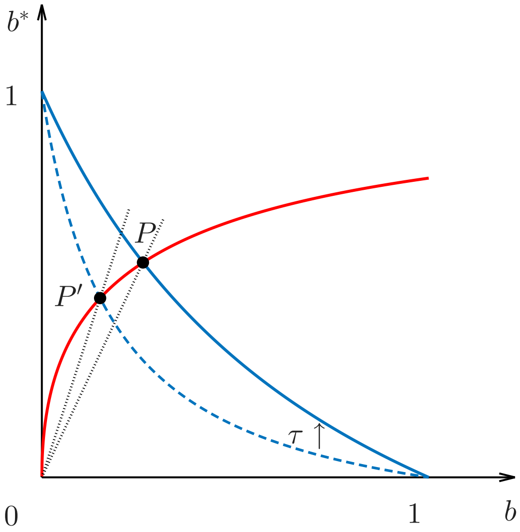

1. b as a hedge against trade war for the RoW (strategically and not)

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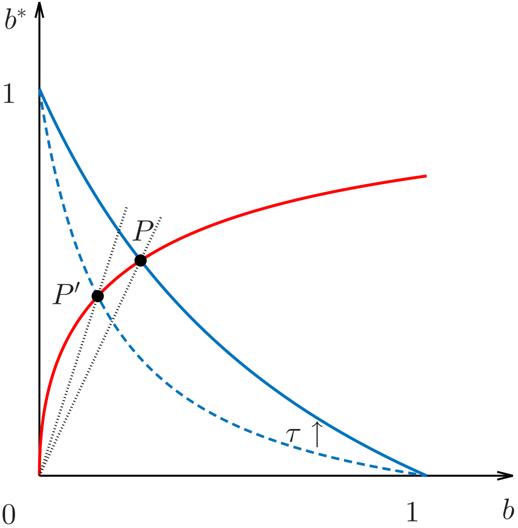

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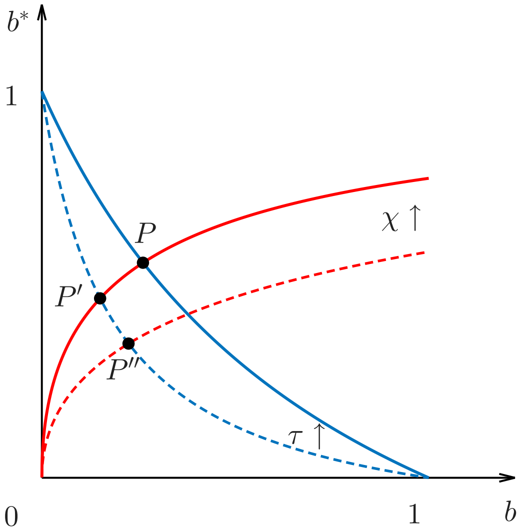
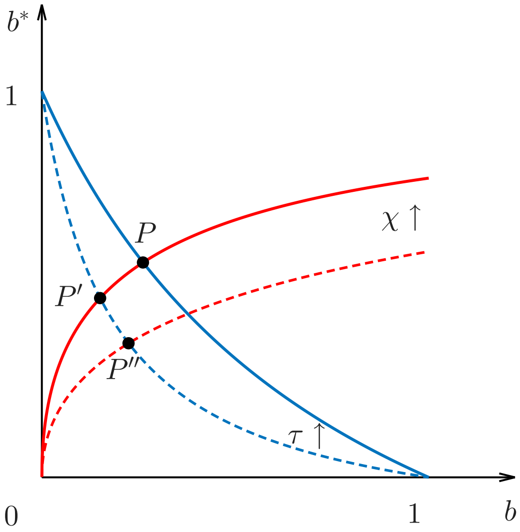
   — $\tau \uparrow \Rightarrow \mathcal{Q} \downarrow \Rightarrow b^*/b \uparrow \Rightarrow$ NFA($\mathcal{Q}$) $\uparrow$
2. retrenchment $b, b^* \downarrow$, fall in privilege $(\chi - 1)b^* \downarrow$
   — complementarities $\tau \uparrow \Leftrightarrow b \downarrow$

Policy Implications



1. b as a hedge against trade war for the RoW (strategically and not)
   — $\tau \uparrow \Rightarrow \mathcal{Q} \downarrow \Rightarrow b^*/b \uparrow \Rightarrow$ NFA($\mathcal{Q}$) $\uparrow$
2. retrenchment $b, b^* \downarrow$, fall in privilege $(\chi - 1)b^* \downarrow$
   — complementarities $\tau \uparrow \Leftrightarrow b \downarrow$
3. additional losses if CY deteriorate $\chi \uparrow$
   — $b^* \downarrow\downarrow$, can explain USD depreciation

Policy Implications



1. b as a hedge against trade war for the RoW (strategically and not)

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2. retrenchment $b, b^*\downarrow$, fall in privilege $(\chi-1)b^*\downarrow$

   — complementarities $\tau\uparrow\Leftrightarrow\ b\downarrow$

3. additional losses if CY deteriorate $\chi\uparrow$

   — $b^*\downarrow\downarrow$, can explain USD depreciation

4. higher tariff under commitment than discretion:

$$\tau^C = 1+\frac{1}{\eta-1}\cdot\frac{1}{\Lambda^*},\quad \tau^D = 1+\frac{1}{\eta\left(1+\frac{\bar{B}}{EX-\bar{B}}\right)-1}\cdot\frac{1}{\Lambda^*}$$

Conclusion

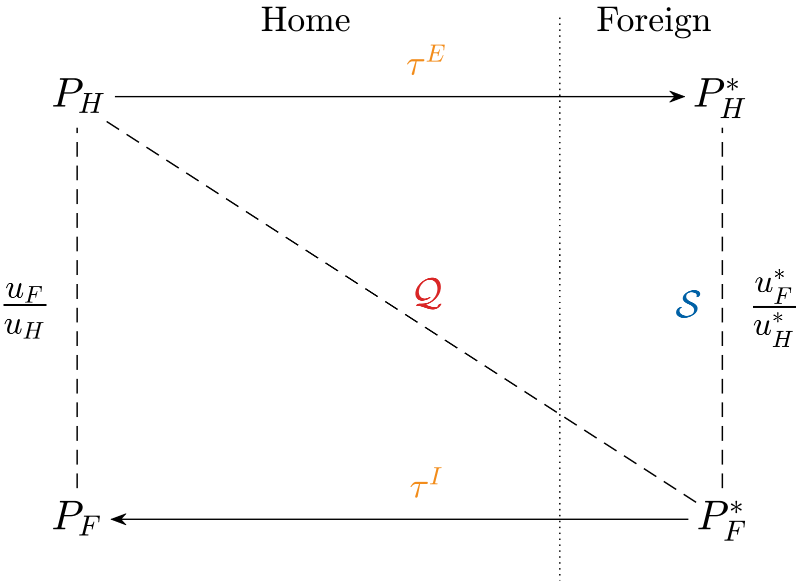
1. **Can tariffs permanently close trade imbalances?**
   - yes... but only via valuation effects on int'l asset positions
   - RER appreciates, secondary role of trade parameters, import tariff $\sim$ export subsidy
   - expanding jobs in tradable sector requires trade subsidy

2. **Is optimal tariff higher under trade deficit?**
   - yes... in an unrealistic special case and for different reasons
   - U.S. optimal tariff is five times lower than under balanced trade

3. **Do tariffs undermine U.S. "exorbitant privilege"?**
   - demand for U.S. assets as insurance against trade war
   - retrenchment of cross-border positions and smaller privilege

APPENDIX

Relative Prices



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Decentralized Equilibrium

Given tariffs $\{\tau^I, \tau^E\}$, allocation $\{C_H, C_F, C_H^*, C_F^*\}$ and prices $\{P_H, P_F, P_H^*, P_F^*\}$ satisfy

- LOP deviations due to tariffs:

▸ prices

$$P_F = \tau^I P_F^* \quad \text{and} \quad P_H^* = \tau^E P_H$$

- Household optimization:

$$\frac{u_F}{u_H} = \frac{P_F}{P_H} \quad \text{and} \quad \frac{u_F^*}{u_H^*} = \frac{P_F^*}{P_H^*}$$

- Country's budget constraint:

$$P_H^* C_H^* = P_F^* C_F$$

- Market clearing:

$$Y = C_H + C_H^* \quad \text{and} \quad Y^* = C_F + C_F^*$$

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- Household optimization:

$$\frac{u_F}{u_H} = \frac{P_F}{P_H} \quad \text{and} \quad \frac{u_F^*}{u_H^*} = \mathcal{S}$$

- Country's budget constraint:

$$\mathcal{S}^{-1} C_H^* = C_F$$

- Market clearing:

$$Y = C_H + C_H^* \quad \text{and} \quad Y^* = C_F + C_F^*$$

Decentralized Equilibrium

Given tariffs $\{\tau^I, \tau^E\}$, allocation $\{C_H, C_F, C_H^*, C_F^*\}$ and prices $\{P_H, P_F, P_H^*, P_F^*\}$ satisfy

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$$\frac{u_F}{u_H} = \frac{P_F}{P_H} \quad \text{and} \quad \frac{u_F^*}{u_H^*} = \mathcal{S}$$

- Country's budget constraint:

$$u_H^* \cdot C_H^* = u_F^* \cdot C_F$$

- Market clearing:

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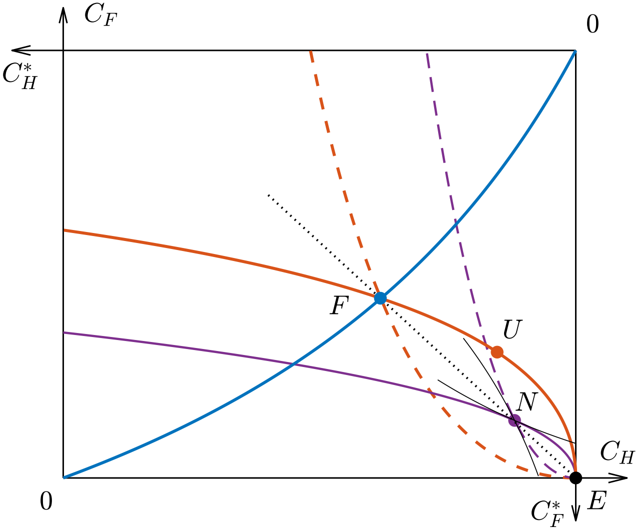
Trade War Nash



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Manufacturing Employment

- Tradables and non-tradables:

$$u = \frac{\rho}{\rho - 1}\left(\kappa C_N^{\frac{\rho-1}{\rho}} + C_T^{\frac{\rho-1}{\rho}}\right), \qquad C_T = \left[(1-\gamma)^{\frac{1}{\theta}} C_H^{\frac{\theta-1}{\theta}} + \gamma^{\frac{1}{\theta}} C_F^{\frac{\theta-1}{\theta}}\right]^{\frac{\theta}{\theta-1}} \quad \rho \leq \theta$$

- Production economy:

$$C_N = Y_N = F_N(L_N), \qquad Y = F_T(L_T), \qquad L_N + L_T = L$$

Manufacturing Employment

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- Production economy:

$$C_N = Y_N = F_N(L_N), \qquad Y = F_T(L_T), \qquad L_N + L_T = L$$

- Labor market equilibrium:

$$\frac{P_H}{P_N} = \frac{W/F_T'}{W/F_N'} = \frac{F_N'(L-L_T)}{F_T'(L_T)} \quad \text{and} \quad \frac{P_H}{P_N} = \frac{u_H}{u_N} = \frac{u_H\big(F_T(L_T)-g(C_F), C_F\big)}{u_N\big(F_N(L-L_T)\big)}$$

Manufacturing Employment

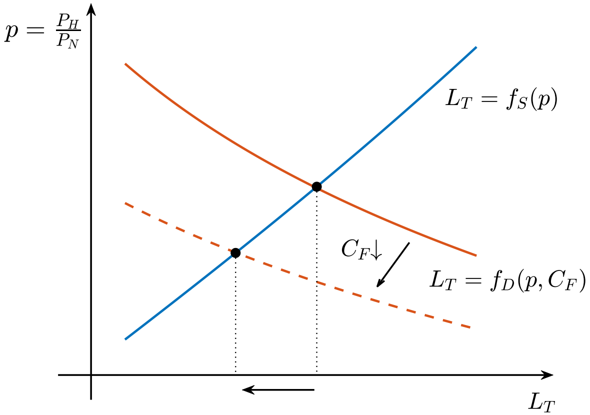

Figure: Tradable-sector employment

- Both a "China shock" $(Y^* \uparrow)$ and tariff τ reduce tradable employment L_T
- **Proposition**: To increase L_T, the planner needs to use trade subsidy

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Global Imbalances (Gourinchas & Rey 2007)

- General restriction on long-run trade imbalance from country budget constraint

$$\mathcal{B}_t - \mathcal{R}_t \mathcal{B}_{t-1} = NX_t$$

1. Long-run trade deficit is determined by the financial position ($\bar{R} \equiv 1/\beta$):

$$\underbrace{-\sum_{t=0}^{\infty} \beta^t NX_t}_{\text{long-run trade deficit}} = \underbrace{\bar{R}\,\mathcal{B}_{-1}}_{\substack{\text{exogenous}\\ \text{initial NFA}}} + \underbrace{(\mathcal{R}_t - \bar{R})\mathcal{B}_{-1}}_{\substack{\text{on-impact}\\ \text{valuation effect}}} + \underbrace{\sum_{t=1}^{\infty} \beta^t \left(\mathcal{R}_t - \bar{R}\right) \mathcal{B}_{t-1}}_{\text{future realized excess returns}}$$

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2. If there is no financial arbitrage, then there exists SDF Θ_{t+1} such that:

$$-\sum_{t=0}^{\infty} \mathbb{E}_t\{\Theta_t NX_t\} = \bar{R}\,\mathcal{B}_{-1} + (\mathcal{R}_0 - \bar{R})\mathcal{B}_{-1},$$

where $\mathbb{E}_t\{\Theta_{t+1}(\mathcal{R}_{t+1} - \bar{R}_t)\} = 0$ and $\mathbb{E}_0 \Theta_t = \beta^t$.

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- Tariffs do, in general, have valuation effects on a country's international portfolio
  - but not shaped by trade shares, trade elasticities, or terms of trade

Exchange Rate Effect of Tariffs

- **Result**: the elasticity of the ToT and RER wrt import tariff is

$$\frac{\partial s}{\partial \tau}\Big|_{B=B^*} = -\frac{(1-\gamma)\theta}{1+(1-\gamma^*)(\eta-1)+(1-\gamma)(\theta-1)+(1-\gamma-\gamma^*)\frac{\bar{B}}{IM}} < 0$$

  — absolute value increasing in γ, decreasing in γ^* and $\bar{B} \equiv P_H B$

  — under $\eta = \theta$, $\gamma^*, \gamma \approx 0$, simplifies to $\frac{\partial s}{\partial \tau} = -\frac{\theta}{2\theta-1+\frac{\bar{B}}{IM}}$

- **Non-linear effects** (see diagrams): $\quad \tau^I \to \infty$

  — $C_F = 0, \quad 0 < C_H^* < 0, \quad NX > 0,$ finite $\mathcal{S} = \mathcal{Q}$ and VA

  — intuition: $\mathcal{Q} \to 0$ is inconsistent with $EX > 0$ required under $NFA < 0$

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Exchange Rate Effect of Tariffs

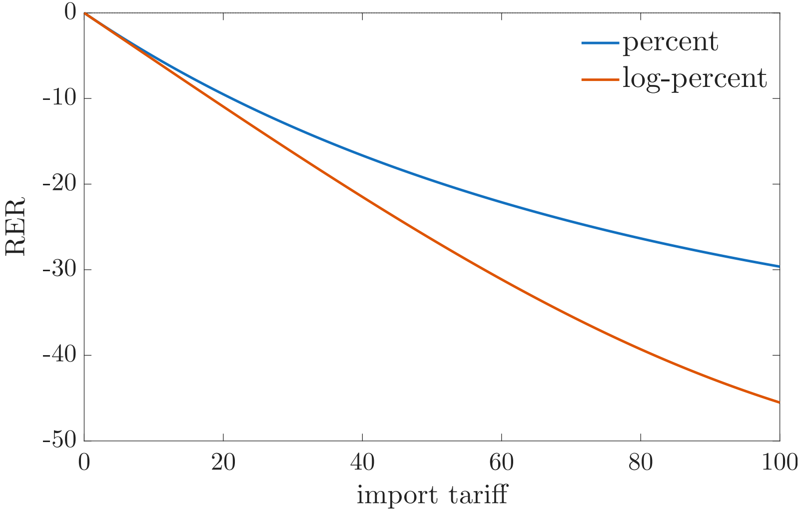

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Illustration: Closing Trade Surplus

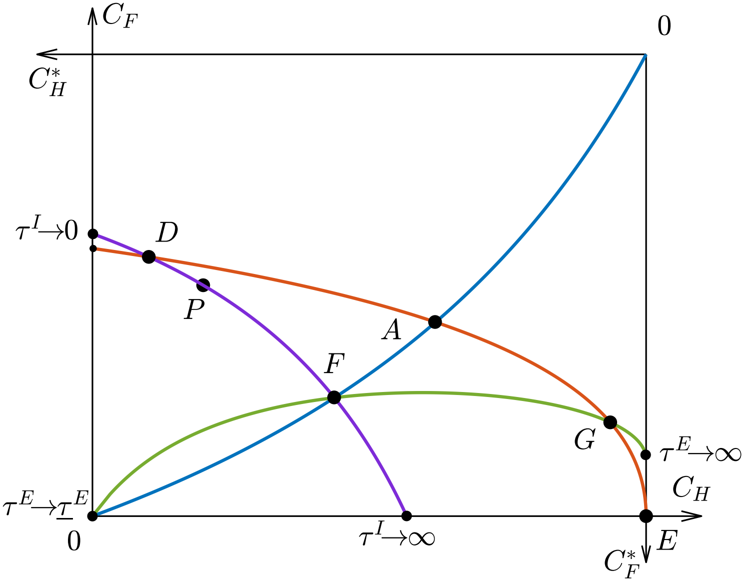

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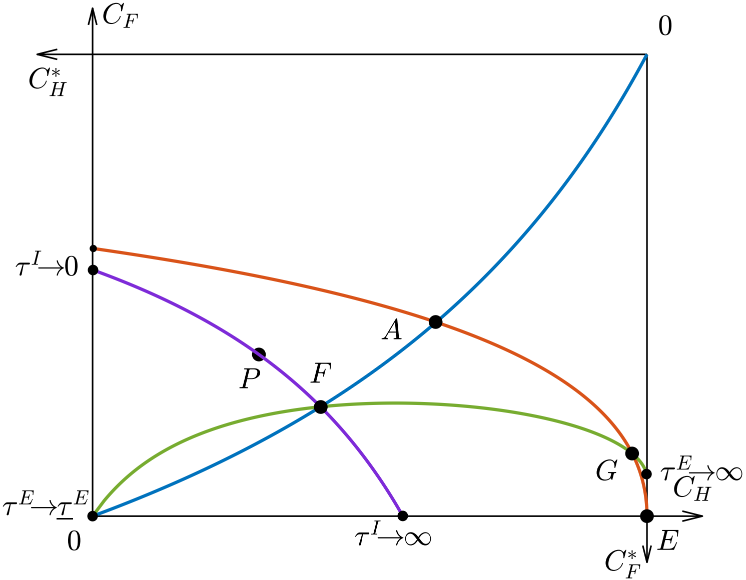
Illustration: Closing Trade Surplus



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Multiple Assets

- **Result**: Under the assumptions below, nominal bonds, real bonds, equity and FDI can be split into groups B and B^* such that the tariff-induced valuation effects are given by $\mathcal{E} = \mathcal{Q}$ and absent, respectively

- Assumptions:

  1. monetary policy stabilizes producer prices
  2. exogenous endowment and LOP holds
  3. SDF orthogonal to tariffs and exchange rates...

back

Multiple Assets

asset	returns		
	nominal	in F goods	given MP
Home nominal bond	1	$\frac{1}{p_F^* \mathcal{E}}$	$\frac{1}{\tau^E \mathcal{S}} = \frac{1}{\mathcal{E}}$
Home real bond	p_H	$\frac{p_H}{p_F^* \mathcal{E}}$	$\frac{1}{\tau^E \mathcal{S}} = \frac{1}{\mathcal{E}}$
Home equity	$p_H Y$	$\frac{p_H}{p_F^* \mathcal{E}} Y$	$\frac{Y}{\tau^E \mathcal{S}} = \frac{Y}{\mathcal{E}}$
Foreign nominal bond	$\mathcal{E}$	$\frac{1}{p_F^*}$	1
Foreign real bond	$\mathcal{E} p_F^*$	1	1
Foreign equity	$\mathcal{E} p_F^* Y^*$	Y^*	Y^*

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Convenience Yields

- Assumptions:
  - exogenous and constant supply of bonds B and B^* available to other economy
  - US bonds lower transaction costs (similar results with BiU)
  - transaction costs and interest on assets are reimbursed lump-sum to households

- Foreign households solve:

$$\max_{\{C_t^*, B_t\}} \quad \sum_{t=0}^{\infty} \beta^t u^*(C_t^*)$$

$$\text{s.t.} \quad P_H \left(\frac{B_t}{R_t} - B_{t-1} \right) = P_{Ft}^* Y_t^* + T_t^* - P_t^* C_t^* + P_{Ft}^* v(B_t)$$

- **Result**: there is no transition dynamics and the budget constraint collapses to

$$P_F^* C_F - P_H^* C_H^* = P_F^* \tilde{B}^* - P_H \tilde{B}, \qquad \tilde{B} \equiv (1-\beta)B, \;\; \tilde{B}^* \equiv (1-\beta)B^* + v'(B)B$$

back

Multiple Countries

- The method with implementability generalizes to multiple countries

$$\max_{\{C_j^*\}} \quad u\big(\{Y_j - C_j^*\}_{j=0}^N\big) \qquad \text{s.t.} \qquad \sum_{j=0}^N u_j^*\big(\{C_j^*\}\big)(Y_j^* - C_j^*) = 0.$$

- **Proposition**: Optimal import tariffs are determined by the system

$$\tau_j = \frac{1}{\Lambda_j^*}\left[\frac{1}{\theta}\bar{\tau}_j + \frac{\theta-1}{\theta}\sum_{i=1}^N \alpha_{ji}\bar{\tau}_i\right], \quad \text{where} \quad \bar{\tau}_i \equiv \sum_{j=0}^N s_{ji}\tau_j, \;\; \alpha_{ji} \equiv \frac{C_{ji}}{Y_j}, \;\; \Lambda_j^* \equiv 1-\alpha_{j0}$$

- If foreign countries share consumption risk, then the optimal tariff for country j is:

$$\tau_j = 1 + \frac{1}{\theta-1}\frac{1}{\Lambda_j^*}, \qquad \text{where} \quad \Lambda_j^* \equiv \frac{C_j^*}{Y_j}$$

Many Countries w/ Quasi-Linear Preferences

- Multiple countries indexed by $i = 0, 1, \ldots, N$, with $i = 0$ as the U.S.
- Each country has endowment Y_i of its unique good and Y_{mi} of a common commodity m:

$$u_i \;=\; \frac{\theta - 1}{\theta} \sum_{j=0}^{N} \gamma_{ji}^{1/\theta} C_{ji}^{(\theta-1)/\theta} \;+\; C_{mi}$$

- Price of m normalized to one and no tariffs on m, no asset positions
- **Optimal tariffs**:

$$\tau_i^E \;=\; \frac{\theta}{\theta - 1} \qquad \text{and} \qquad \tau_i^I \;=\; 1 \;+\; \frac{1}{\theta}\,\frac{1 - \Lambda_i}{\Lambda_i}, \text{ where } \Lambda_i \equiv \frac{Y_i - C_{i0}}{Y_i}.$$

  — each tariff is independent of the availability of other ones

  — total tariff the same as in the baseline model $\tau_i^I \cdot \tau_i^E = 1 + \frac{1}{\theta - 1}\frac{1}{\Lambda_i}$

  — bilateral balance does not affect optimal tariffs, but matters for retaliation

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Global Imbalances

- General restriction on long-run trade imbalance from country budget constraint
- In any t, B^j_{t-1}, $j \in J_{t-1}$ are asset holding paying dividend D^j_t and valued at Q^j_t, with realized return $R^j_t \equiv (Q^j_t + D^j_t)/Q^j_{t-1}$
- $\bar{R}_t$ is the risk-free interest rate between t and $t+1$ (known at t)
- The value of new asset positions at t: $\mathcal{B}_t \equiv \sum_{j \in J_t} Q^j_t B^j_t$
- The pay-out on entire NFA position: $\mathcal{R}_t \mathcal{B}_{t-1} \equiv \sum_{j \in J_{t-1}} (Q^j_t + D^j_t) B^j_{t-1}$
- Flow budget constraint:
$$\mathcal{B}_t - \mathcal{R}_t \mathcal{B}_{t-1} = NX_t$$
- **Lemma**: If there is no arbitrage in J_t, then there exists SDF Θ_{t+1} such that:
$$\mathbb{E}_t\{\Theta_{t+1}(\mathcal{R}_{t+1} - \bar{R}_t)\} = 0.$$

Country Budget Constraint: Taxonomy of Models

Long-run **trade deficit is determined by** the country's **financial position**:

$$\mathcal{B}_t = \mathcal{R}_t \mathcal{B}_{t-1} + NX_t$$

Country Budget Constraint: Taxonomy of Models

Long-run **trade deficit is determined by** the country's **financial position**:

$$\mathcal{B}_t = \bar{R}\mathcal{B}_{t-1} + (\mathcal{R}_t - \bar{R})\mathcal{B}_{t-1} + NX_t$$

Country Budget Constraint: Taxonomy of Models

Long-run **trade deficit is determined by** the country's **financial position**:

$$\underbrace{-\sum_{t=0}^{\infty} \bar{R}^{-t} NX_t}_{\textbf{LR trade deficit}} = \underbrace{\bar{R}\,\mathcal{B}_{-1}}_{\text{(0) exogenous initial NFA}} + \underbrace{(\mathcal{R}_0 - \bar{R})\mathcal{B}_{-1}}_{\text{(1) on-impact valuation effect}} + \underbrace{\sum_{t=1}^{\infty} \bar{R}^{-t}(\mathcal{R}_t - \bar{R})\mathcal{B}_{t-1}}_{\text{(2) future realized excess returns}}$$

where $\mathcal{B}_{-1}$ are initial net foreign assets, $\mathcal{R}_t$ are portfolio returns, and $\bar{R}$ is risk-free rate

1. Conventional trade models: (1) $=$ (2) $= 0$
   — long-run trade deficit is exogenous (absent if (0) $= 0$), even though trade/GDP↓ in τ
2. More generally, tariffs affect asset prices (e.g., ER) and have valuation effects (1)
   — tariffs can change financial position and hence LR trade deficit: $\mathcal{R}_0 \propto \mathcal{Q}_0/\mathcal{Q}_{-1}$
3. "Convenience yields" / "exorbitant privilege" $\Rightarrow$ systematic excess returns (2) $\neq 0$
   — essential to make sense of the historical and recent US experience

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Long-run Trade Imbalance

- **Proposition**: Long-run trade deficit is determined by the financial position:

$$\underbrace{-\sum_{t=0}^{\infty}\beta^t NX_t}_{\text{long-run trade deficit}} = \underbrace{\bar{R}\,\mathcal{B}_{-1}}_{\substack{\text{exogenous}\\ \text{initial NFA}}} + \underbrace{(\mathcal{R}_t - \bar{R})\mathcal{B}_{-1}}_{\substack{\text{on-impact}\\ \text{valuation effect}}} + \underbrace{\sum_{t=1}^{\infty}\beta^t\left(\mathcal{R}_t - \bar{R}\right)\mathcal{B}_{t-1}}_{\text{future realized excess returns}},$$

  where $\bar{R} = 1/\beta$ is the unconditional average risk-free rate.

- **Corollary**: If there is no arbitrage $\forall s \geq t$, then expected long-run trade deficit:

$$-\sum_{t=0}^{\infty}\mathbb{E}_t\{\Theta_t NX_t\} = \bar{R}\,\mathcal{B}_{-1} + (\mathcal{R}_0 - \bar{R})\mathcal{B}_{-1}, \qquad \text{where} \quad \mathbb{E}_0\Theta_t = \beta^t.$$

- Tariffs do, in general, have valuation effects on a country's international portfolio
  - but not shaped by trade shares, trade elasticities, or terms of trade
  - there is an optimal tariff even without the effect on the LR trade imbalance

A Model with Convenience Yields

- Home B_t and foreign B_t^*, exogenously supplied (e.g., govt debt or Lucas trees)
- Foreign households

$$\max_{\{C_t^*, B_t\}} \sum_{t=0}^{\infty} \beta^t \Big(u(C_t^*) + v_t(B_t) \Big) \text{ s.t. } Q_t B_t = (P_{Ht} + \delta Q_t) B_{t-1} + P_{Ft}^* Y_t^* - P_t^* C_t^* + T_t^*$$

- Return $R_t = \frac{P_{Ht} + \delta Q_t}{Q_{t-1}}$ for $\delta \in [0, 1]$. Euler equation:

$$Q_t = \beta \frac{u'(C_{t+1}^*)}{u'(C_t^*)} \frac{P_t^*}{P_{t+1}^*} (P_{Ht+1} + \delta Q_{t+1}) + \frac{v_t'(B_t)}{u'(C_t^*)/P_t^*}$$

- Flow budget constraint, where NFA is $\mathcal{B}_t \equiv Q_t^* B_t^* - Q_t B_t$:

$$\mathcal{B}_t = R_t^* \mathcal{B}_{t-1} + (R_t^* - R_t) Q_{t-1} B_{t-1} + NX_t,$$

Valuation Effects

- Steady state with $R < 1/\beta$ and $R^* = 1/\beta$ where:

$$Q^* = \frac{\beta}{1-\beta\delta} P_F^* \qquad \text{and} \qquad Q = \frac{1}{1-\beta\delta}\left(\beta P_H + \frac{v'(B)}{u'(C^*)/P^*}\right)$$

- Country budget constraint:

$$NX + (1-\beta)\Big((P_F^* + \delta Q^*)B^* - (P_H + \delta Q)B\Big) + \frac{v'(B)B}{u'(C^*)/P^*} = 0$$

- **Lemma**: The intertemporal budget constraint is equivalent to

$$NX + \frac{1-\beta}{1-\beta\delta}(P_F^* B^* - P_H B) + \frac{1-\delta}{1-\beta\delta} \cdot \frac{v'(B)B}{u'(C^*)/P^*} = 0.$$

Valuation effects are zero for equity ($\delta = 1$), highest for short-term bonds ($\delta = 0$).

Optimal Tariff with Convenience Yield

- **Lemma**: An import tariff can depreciate the real exchange rate $\mathcal{Q} = P_F^*/P_H$ if it triggers negative valuation effects due to a reduction in convenience yield $v'(B)$.

- **Proposition**: If CY is exogenous, the optimal import tariff is given by

$$\tau = 1 + \frac{1}{\eta\left(1 + \frac{\bar{B}}{EX-\bar{B}}\right) - 1} \cdot \frac{1 + (1-\Lambda^*)\frac{CY}{EX-\bar{B}}}{\Lambda^*}, \tag{1}$$

  where $\bar{B}^* \equiv \frac{1-\beta}{1-\beta\delta} P_F^* B^*$ and $\bar{B} \equiv \frac{1-\beta}{1-\beta\delta} P_H B$ are flow cash payouts on home assets and liabilities, and $CY \equiv \frac{1-\delta}{1-\beta\delta}\frac{v'(B)B}{u'(C^*)/P^*}$ is the flow value of convenience yield, such that $NX + (\bar{B}^* - \bar{B}) + CY = 0$ is the country budget constraint.

- If convenience yield is endogenous to trade war, then welfare benefits of tariff must offset the cost of loss of excess returns

Dynamic Model with Convenience Yields

- How can the US have $NX < 0$ and $NFA < 0$? Why did USD depreciate in 2025?
- Home/foreign assets: prices Q_t, Q_t^*, payoffs P_{Ht}, P_{Ft}, mature randomly w/p $1-\delta$
  - $\delta = 0$ for short-term bonds
  - $\delta = 1$ for equity
- Simplifying assumptions:
  1. home (foreign) assets held only by foreign (home) h/h $\Rightarrow$ trivial portfolio problem
  2. constant supply of assets $\Rightarrow$ no transition dynamics
  3. foreign utility $u(C_t^*) + v_t(B_t)$ $\Rightarrow$ convenience yields on home assets
- Flow budget constraint, where NFA is $\mathcal{B}_t \equiv Q_t^* B_t^* - Q_t B_t$:

$$\mathcal{B}_t = R_t^* \mathcal{B}_{t-1} + NX_t + (R_t^* - R_t) Q_{t-1} B_{t-1}$$

  - $R < R^*$ sustains $NX < 0$ and $\mathcal{B} < 0$

Trade Policy

- **Intertemporal budget constraint**:

$$NX + \underbrace{\frac{1-\beta}{1-\beta\delta}(P_F^* B^* - P_H B)}_{\text{flow } NFA = \bar{B}^* - \bar{B}} + \underbrace{\frac{1-\delta}{1-\beta\delta} \cdot \frac{v'(B)B}{u'(C^*)/P^*}}_{\text{flow } CY} = 0$$

1. **Equity** $\delta = 1$: net VA are zero and all results from static model are unchanged
   — even if $v_t(\cdot)$ responds to tariffs
   — on-impact VA and future CY offset each other

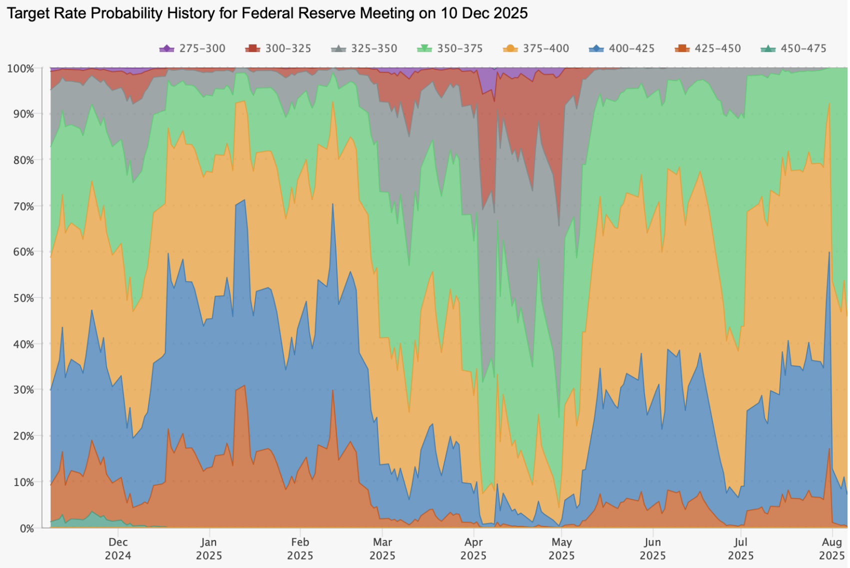
2. **Bonds** $\delta < 1$:
   a) optimal tariff is lower if trade war decreases CY (continuously or discretely)
   b) import tariff can depreciate RER if it lowers CY
      — few other shocks can explain USD depreciation

Why Did the Dollar Depreciate?

Why Did the Dollar Depreciate?

1. **Monetary policy**: expectations about lower interest rates

Why Did the Dollar Depreciate?



Why Did the Dollar Depreciate?

1. **Monetary policy**: expectations about lower interest rates
2. **Recession**: negative effects of trade war on the economy
   — negative shock to U.S. tradable sector a la Brexit?

Why Did the Dollar Depreciate?

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2. **Recession**: negative effects of trade war on the economy
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   — stock market meltdown, increase in UST yields, dollar depreciation on April 2, 2025

Why Did the Dollar Depreciate?

US yields and dollar have parted company

Rising US yields typically support the dollar, as do geopolitical tensions (as the dollar is often seen as a haven asset). Since Donald Trump unleashed his trade war, however, US yields have soared and the dollar has plunged.

The dollar usually moves in lockstep with US yields… until 'liberation day'

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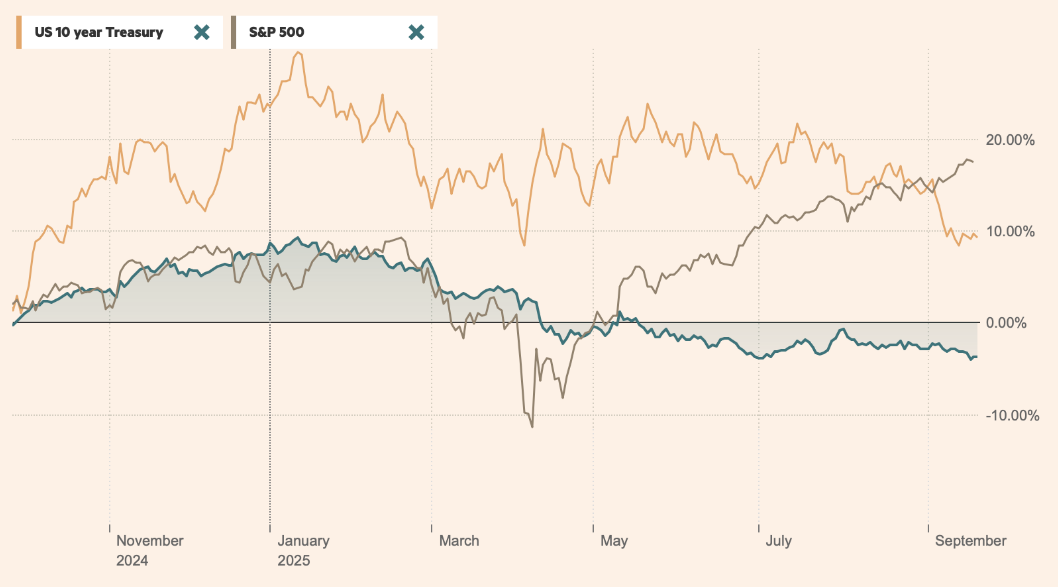

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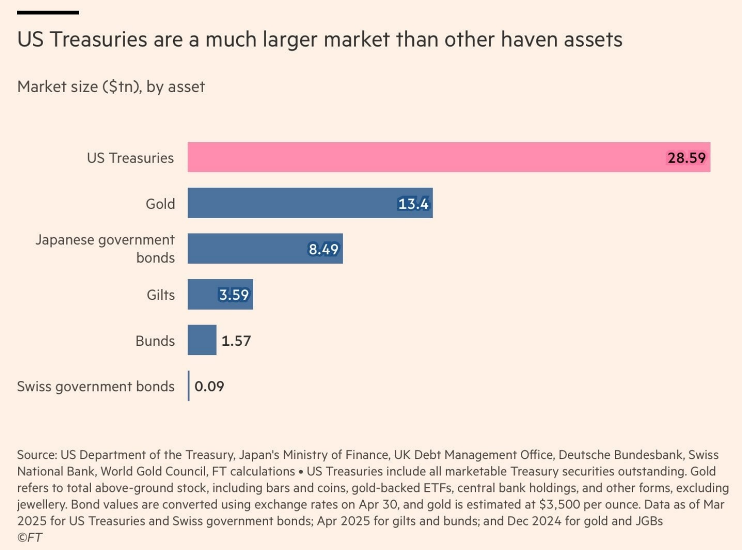

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Why Did the Dollar Depreciate?


US dollar + Add to myFT

Foreign investors in US assets rush for protection against swings in dollar

Sharp increase in hedging comes amid broad rethink on exposure to greenback

Hedged ETF flows into US assets now surpass unhedged

Foreign-domiciled ETF inflows into US assets

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- Loss of exorbitant privilege $\Rightarrow$ weaker dollar + rebalancing of trade

$$NX(\mathcal{S}) + NFA(\mathcal{Q}) + CY(\mathbf{X}) = 0$$

Calibration

- Elasticities: $\theta = \eta = 4$
- Empirical targets:

$$\frac{IM}{GDP} = 14\%, \quad \frac{EX}{GDP} = 11\%, \quad \frac{\bar{B}}{GDP} = 4\% \cdot 180\% = 7.2\%$$

- Trade shares:

$$\bar{\gamma} = \frac{P_F C_F}{PC} = \frac{IM}{GDP - NX} = 13.6\%, \qquad \bar{\gamma}^* = \frac{P_H^* C_H^*}{P^* C^*} = \frac{EX}{GDP^* + NX} = 2.8\%,$$

$$\bar{\alpha} = \frac{P_H^* C_H^*}{P_H Y} = \frac{EX}{GDP} = 11\%, \qquad \bar{\alpha}^* \equiv \frac{P_F C_F}{P_F^* Y^*} = \frac{IM}{GDP^*} = 3.5\%$$

- Asset positions:

▸ fiscal revenues

▸ closing imbalances

$$\bar{b} \equiv \frac{P_H B}{P_H Y} = \frac{\bar{B}}{GDP} = 7.2\%, \qquad \bar{b}^* \equiv \frac{P_F^* B^*}{P_H Y} = \frac{\bar{B}^*}{GDP} = 10.2\%$$

Numerical Results

	τ^I	τ^{I*}	C	C^*	$\mathcal{Q}$	T	NX
Baseline calibration							
Unilateral	6.75	0.00	0.06	-0.03	-3.53	0.82	-2.64
Trade war	5.37	4.42	-0.03	-0.02	-0.83	0.64	-2.92
Fiscal revenues	67.16	0.00	-1.91	0.05	-23.76	2.94	-0.58
Closing imbalance	98.46	0.00	-3.20	0.15	-29.41	2.76	0.00
No imbalances							
Unilateral	34.00	0.00	0.85	-0.40	-14.76	2.27	0.00
Trade war	33.67	34.76	-1.21	-0.25	1.47	1.38	0.00
Fiscal revenues	81.18	0.00	0.37	-0.66	-27.99	2.78	0.00

τ^I, τ^{I*} are in percent, C, C^* and $\mathcal{Q}$ are percent changes, T and NX are percent of initial GDP

fiscal revenues optimal tariff retaliation

Alternative Calibration

- Target U.S. portfolio and leave trade shares as a residual:

$$\frac{\bar{B}}{GDP} = 7.2\%, \qquad \frac{\bar{B}^*}{GDP} = 4\%, \qquad \frac{IM + EX}{GDP} = 25\%$$

	τ^I	τ^{I*}	C	C^*	$\mathcal{Q}$	T	NX
Unilateral	11.14	0.00	0.16	-0.07	-4.48	0.94	3.38
Trade war	8.38	12.95	-0.37	-0.01	4.21	0.61	3.03
Fiscal revenues	52.02	0.00	-0.76	-0.14	-15.20	1.88	3.81
Improving NX	∞	0.00	-4.95	-0.07	-26.39	0.00	4.26

τ^I, τ^{I*} are in percent, $C, C^*, \mathcal{Q}$ are percent changes, T and NX are in percent of initial GDP

back

Alternative Objectives

1. **Manufacturing employment**: details

   - tradable-employment-maximizing tariff... is a trade subsidy, i.e. $\partial L_T/\partial \tau < 0$
   - even when "China shock" decreases manufacturing employment, i.e. $\partial L_T/\partial Y^* < 0$

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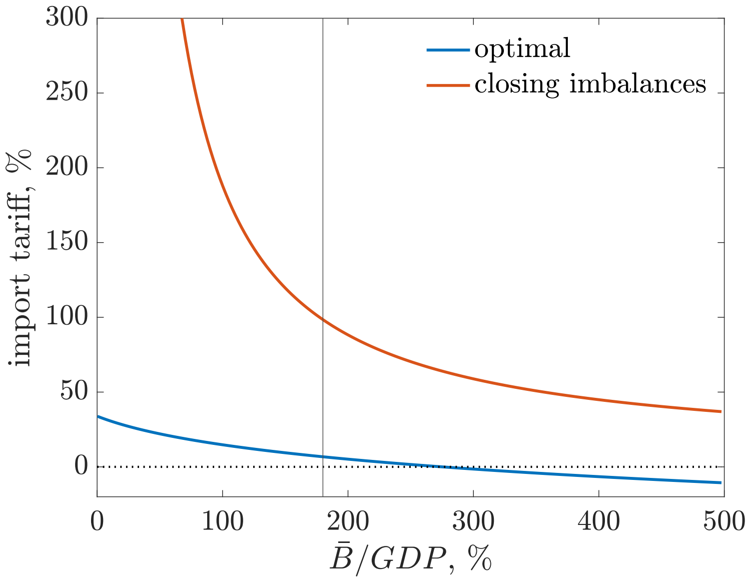
Role of Gross Positions (keeping free-trade $NX = \text{const}$)



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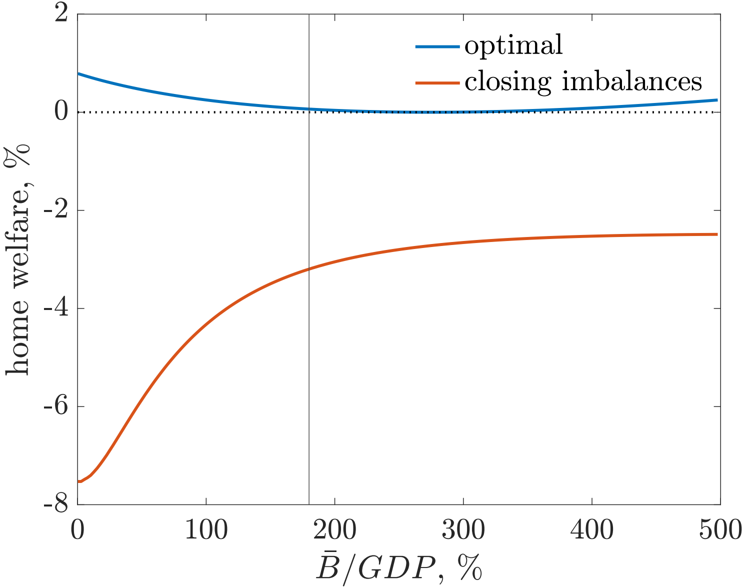

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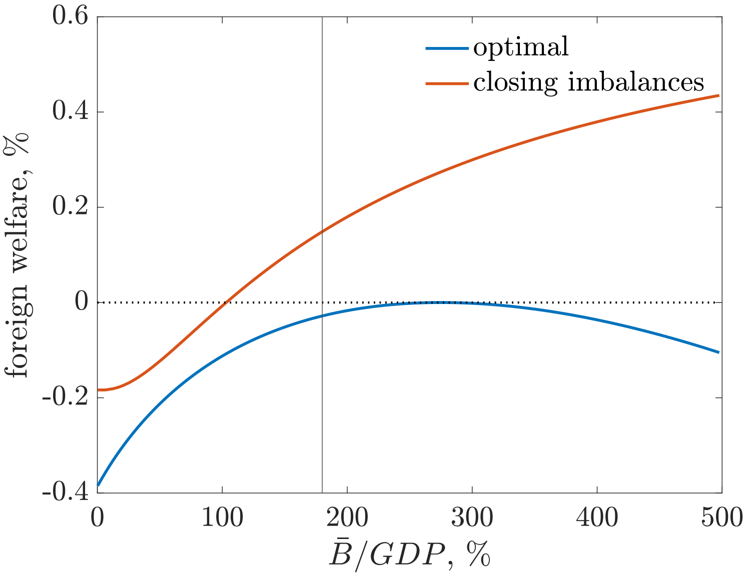

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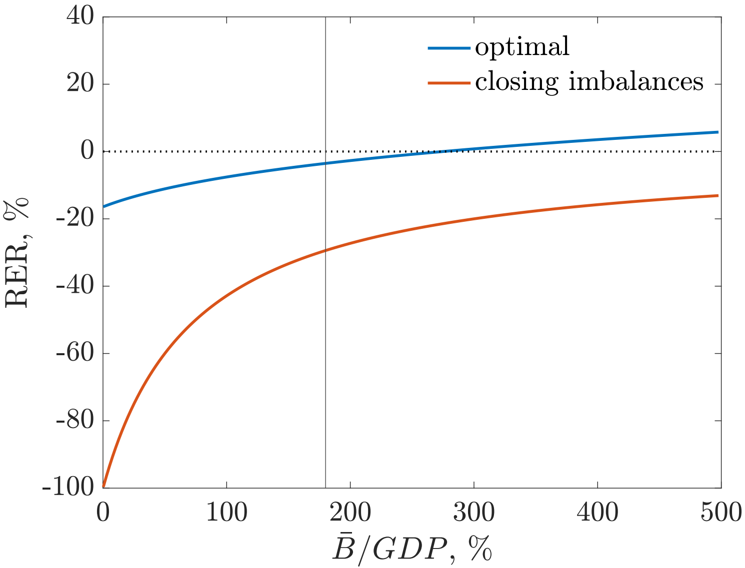

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