Banking, Trade, and the Making of a Dominant Currency

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4. 'Exorbitant Privilege'
   - Violation of UIP: Dollar risk-free assets pay lower expected returns (in a common currency)

What we do

1. Unified theory for dominance in trade invoicing *and* finance
2. Strategic complementarity of unit of account and store of value
3. Dominant currency, despite multiple candidates
4. 'Currency mismatch' and 'exorbitant privilege'

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Eichengreen (2010): *"...experience suggests that the logical sequencing of steps in internationalizing a currency is: first, encouraging its use in invoicing and settling trade; second, encouraging its use in private financial transactions; third encouraging its use by central banks and governments as a form in which to hold private reserves."*

Main Idea

High $ invoicing

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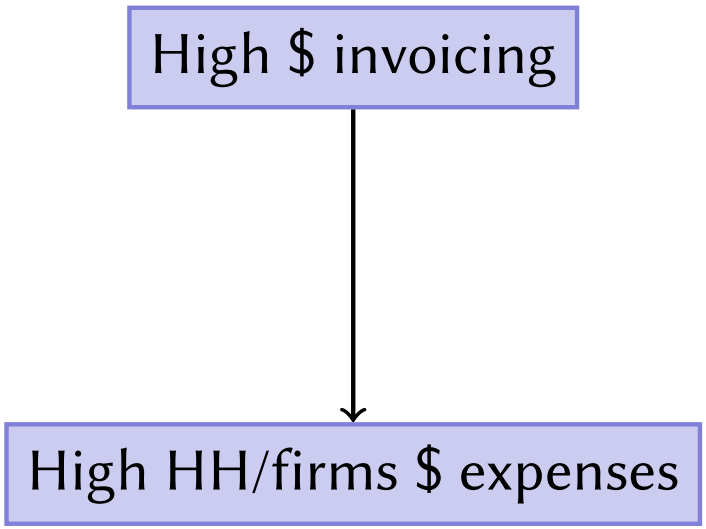

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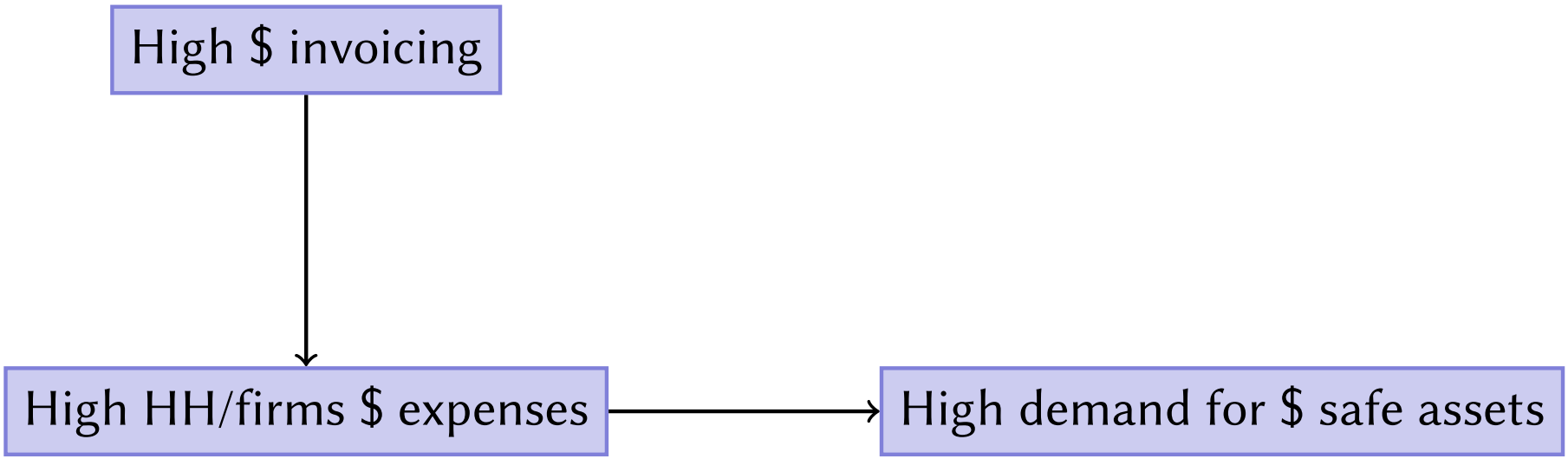
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High HH/firms $ expenses
High demand for $ safe assets

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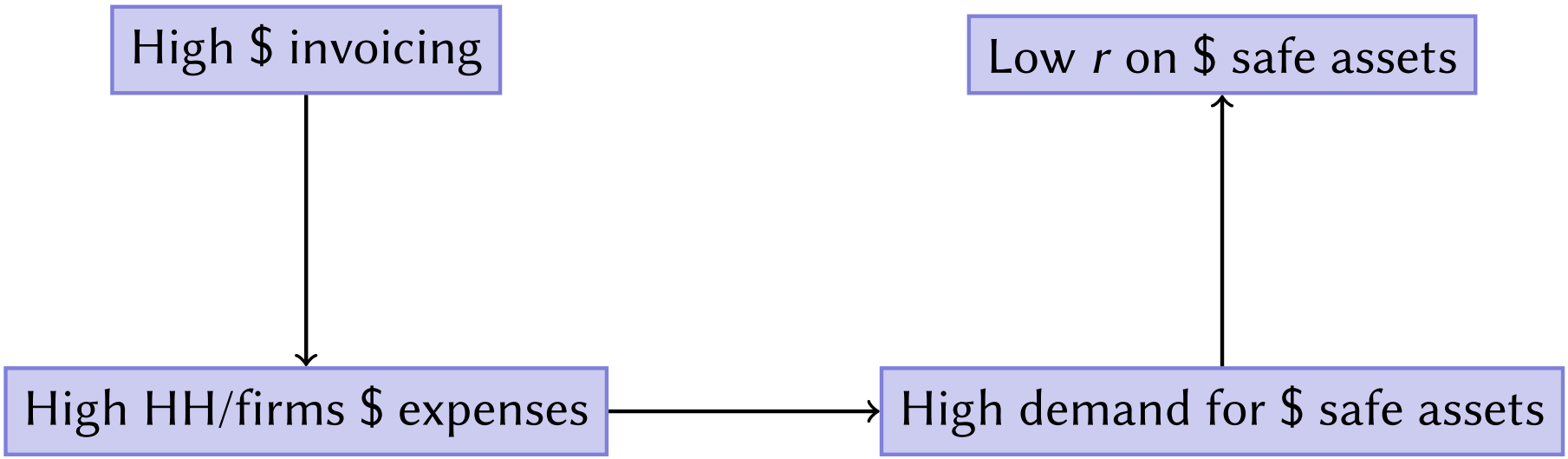
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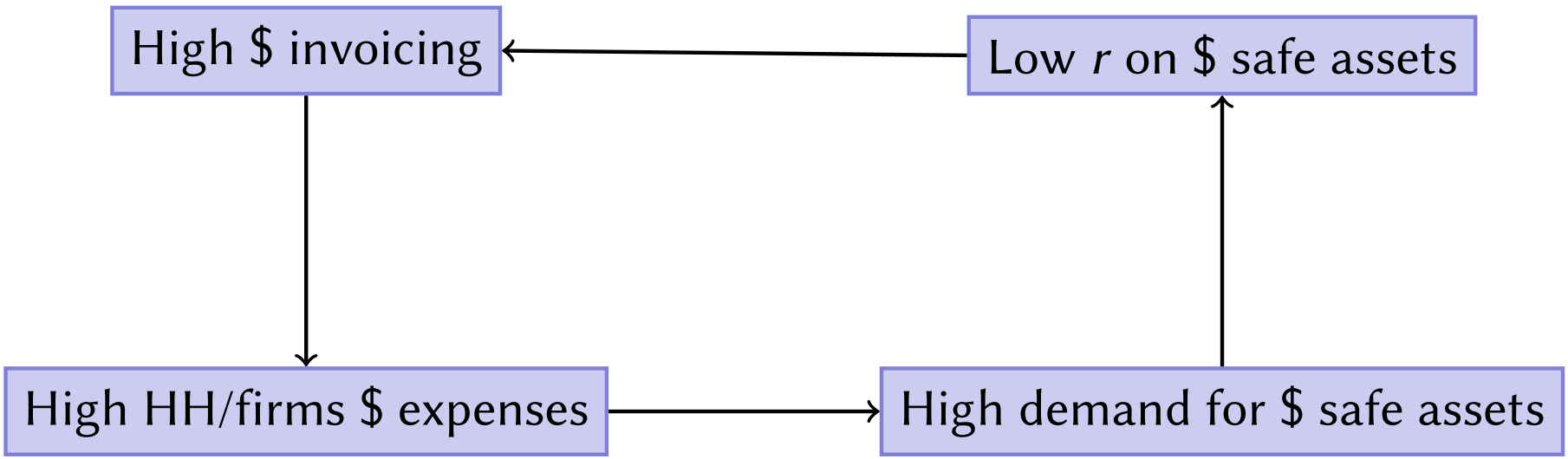
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Model: Exogenous invoicing

- Two countries: *U.S* and an *EM*.
- Two dates: 0 and 1
- Two agents: “Importers/Savers” and “Banks/Borrowers”

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- Importers

$$\max C_0 + \beta \mathbb{E}_0 W_1 + \theta \log(M), \tag{P1}$$

$$C_0 \leq W_0 - Q_h D_h - \mathcal{E}_0 Q_\$ D_\$ - Q_R A_R$$

$$W_1 = D_h + \mathcal{E}_1 D_\$ + \xi A_R,$$

- Preference for safe "money-like" assets, $\theta > 0$

$$M = \left(D_h^{\alpha_h} D_\$^{\alpha_\$} \right)^{\frac{1}{\alpha_h + \alpha_\$}}$$

  - Stein (2012), Krishnamurthy and Vissing-Jorgensen (2012), Sunderam (2014), Greenwood, Hanson and Stein (2015), Nagel (2016)
  - Price in invoice currency set at time 0 and sticky through time 1

Model: Exogenous invoicing go

$$Q_h = \beta + \theta \frac{\alpha_h}{(\alpha_h + \alpha_\$) D_h}$$

$$Q_\$ = \beta + \theta \frac{\alpha_\$}{(\alpha_h + \alpha_\$) D_\$}$$

$$Q_R = \beta$$

- $\mathbb{E}_0(\mathcal{E}_1) = \mathcal{E}_0 = 1; \mathbb{E}_0(\xi) = 1$

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$$\max_{B_h, B_\$, B_R} \mathbb{E}_0 \left[\gamma N - B_h - \mathcal{E} B_\$ - \xi B_R \right]$$

subject to,

$$Q_h B_h + Q_\$ B_\$ + Q_R B_R \geq N$$
$$\bar{\mathcal{E}} B_\$ + B_h \leq \gamma_L N$$

- Limits to safe asset creation
  - γ_L: Worst case payout of project
  - $\bar{\mathcal{E}}$: Worst case value of EM currency
- Comparative disadvantage in manufacturing dollar safe claims
- $\mathbb{E}_0 \gamma = 1, \mathbb{E}_0 \xi = 1$

Model: Exogenous invoicing and banking market structure

- UIP Violation & Exorbitant Privilege: $Q_{\$} > Q_h > Q_R$

$$\frac{Q_{\$} - \beta}{Q_h - \beta} = \bar{\mathcal{E}}$$

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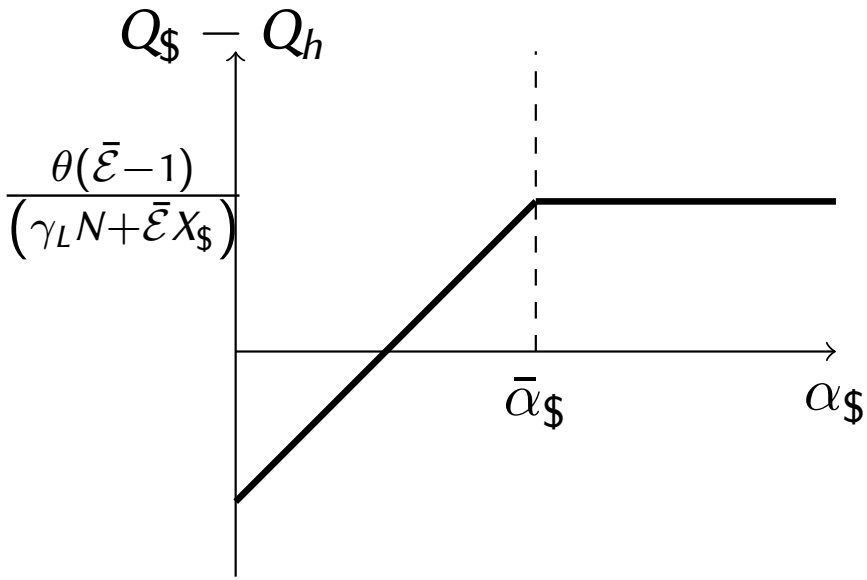
- Fund with \$ deposits if cheaper than funding with h deposits.
- Market clearing

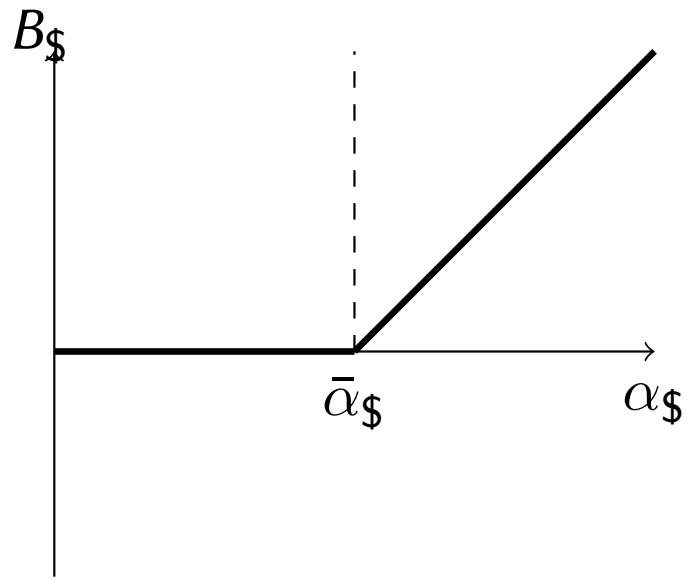
$$D_\$ = B_\$ + \underbrace{X_\$}_{exogenous, US} \qquad D_h = B_h$$

Model: Invoicing Shares, UIP Deviations, Dollar Borrowing

Walking up a supply curve



(a) $Q_\$ - Q_h$



(b) $B_\$$

$$\bar{\alpha}_\$ = \frac{\alpha_h \bar{\mathcal{E}} X_\$}{\gamma_L N}$$

High dollar invoicing $\Longrightarrow$ low return on safe dollar claims

Model: Endogenous Invoicing

- Invoice fraction η of N in dollars (exports)

$$\max_{B_h, B_\$, B_R, \eta} \mathbb{E}_0 \left[\gamma N_0 + \gamma(1-\eta)N + \mathcal{E}\gamma\eta N - B_h - \mathcal{E} B_\$ - \xi B_R - \frac{\phi}{2} N\eta^2 \right]$$

s.t.,

$$\begin{aligned} Q_h B_h + Q_\$ B_\$ + Q_R B_R &\geq N + N_0 \\ \bar{\mathcal{E}} B_\$ + B_h &\leq \gamma_L N_0 + (1-\eta)\gamma_L N + \bar{\mathcal{E}}\eta\gamma_L N \\ B_h &\leq \gamma_L N_0 + (1-\eta)\gamma_L N \end{aligned}$$

- Comparative disadvantage in manufacturing \$ safe claims
  - Currency mismatch: $\bar{\mathcal{E}}$
  - Invoicing costs: $\frac{\phi}{2}\frac{(\eta N)^2}{N}$; Proxies for risk-aversion of ultimate owners of exporting firms.

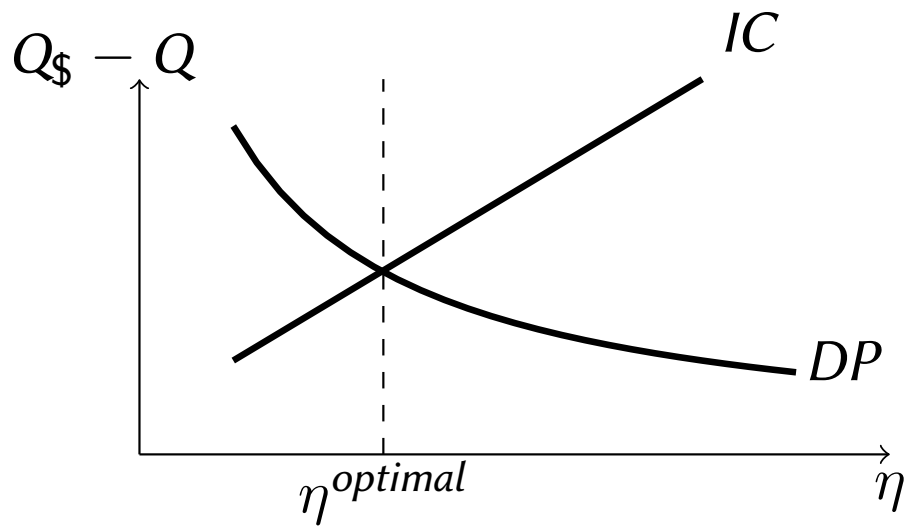
Model: Endogenous Invoicing Shares

- Dollar premium (DP):

$$Q_{\$} - Q_h = \beta \left(\mu(\eta)(\bar{\mathcal{E}} - 1) - \kappa \right)$$

- Invoicing choice (IC):

$$\eta = \frac{\gamma_L}{\beta \phi} \left(Q_{\$} - Q_h \right)$$



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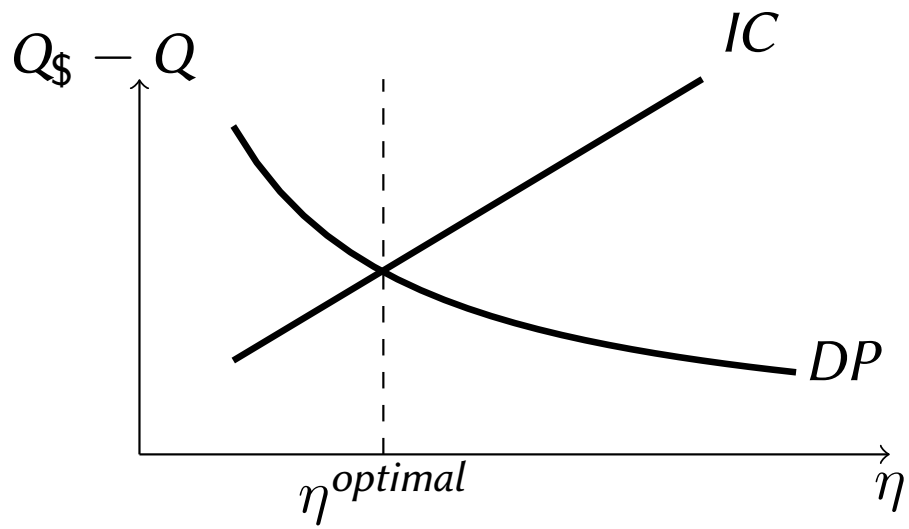


- Why invoice in dollars? To access cheap dollar financing

Endogenous Invoice Shares and Multiple Equilibria

- Continuum of EMs and US
- Safe asset demand only in own local currency and in dollars

$$M_i = \left(D_{hi}^{\alpha_{hi}} D_{\$i}^{\alpha_{\$i}}\right)^{\frac{1}{\alpha_{hi}+\alpha_{\$i}}}$$

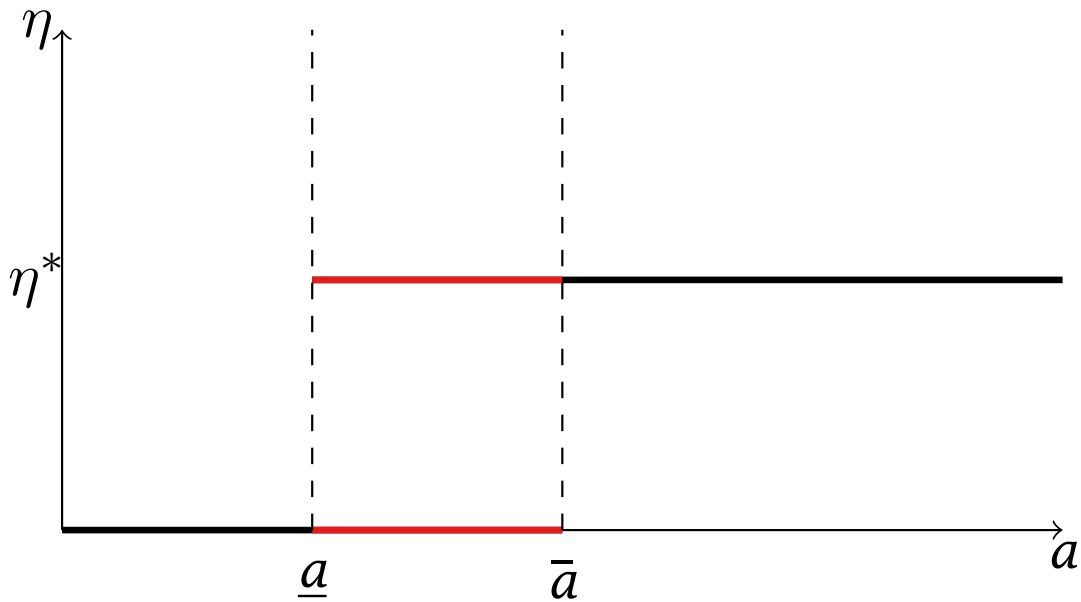
- Invoicing decisions in j effect invoicing shares in i

$$\alpha_{\$i} \equiv a + b \int_{j \neq i} \eta_j dj$$

- $a > 0$: share of U.S. goods
- $b > 0$: share of goods from other EMs; $a + b < 1$
- Integrated markets for dollar deposits, segmented markets for EM currencies.

Simultaneous determination of invoicing and banking

- Multiple Equilibria with varying degrees of dollar invoicing



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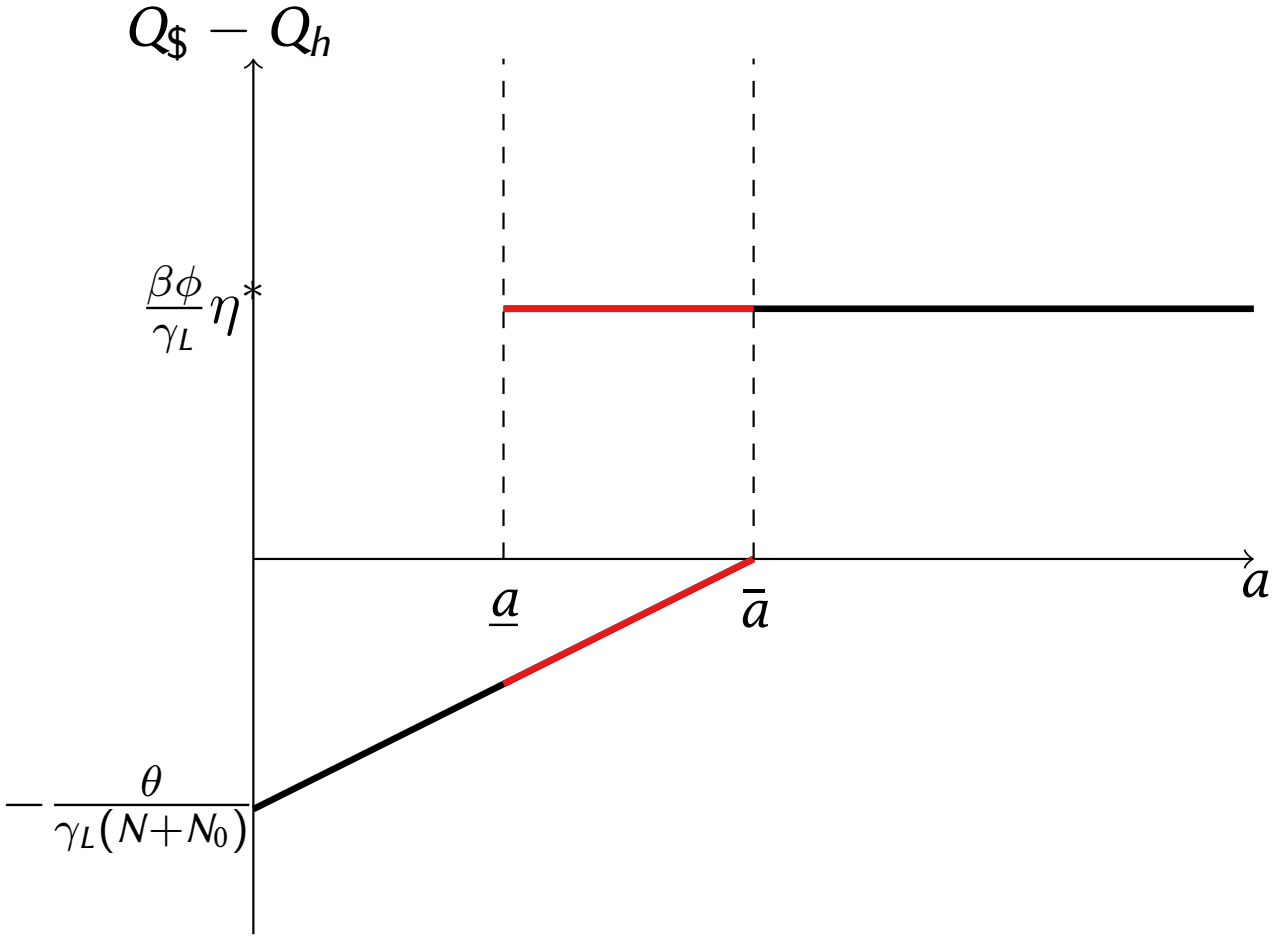

Dollar vs. Euro: Emergence of a dominant currency

- Two global currencies: Dollar and Euro
- EM Importers/Savers

$$M_i = \left(D_{hi}^{\alpha_{hi}} D_{\$i}^{\alpha_{\$i}} D_{€i}^{\alpha_{€i}} \right)^{\frac{1}{\sum \alpha_i}}$$

$$\alpha_{\$i} = a + b \int_{j \neq i} \eta_{\$j} dj \qquad \alpha_{€i} = a + b \int_{j \neq i} \eta_{€j} dj$$

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- Symmetry: $\bar{\mathcal{E}}_{€i} = \bar{\mathcal{E}}_{\$i} = \bar{\mathcal{E}}$
- Integrated markets for dollar and euro deposits

Dollar vs. Euro: Emergence of a dominant currency

- Invoicing decision

$$\eta_{\$i} = \frac{\gamma_L}{\beta\phi}(Q_{\$} - Q_{hi}) - c\eta_{€i}$$
$$\eta_{€i} = \frac{\gamma_L}{\beta\phi}(Q_{€} - Q_{hi}) - c\eta_{\$i}$$

- Market-clearing:

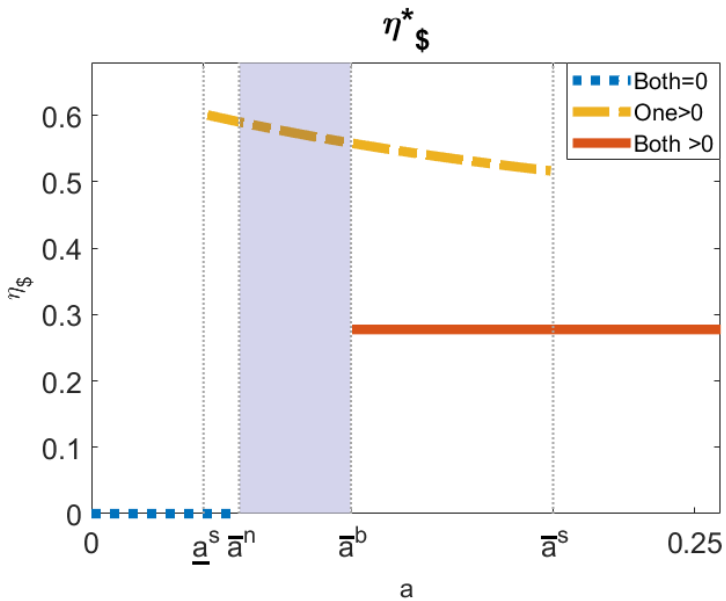
$$\begin{aligned} D_{hi} &= B_{hi} \qquad \forall i \\ A_{Ri} &= B_{Ri} \qquad \forall i \\ \int_i D_{\$i} &= \int_i B_{\$i} + X \\ \int_i D_{€i} &= \int_i B_{€i} + X \end{aligned}$$

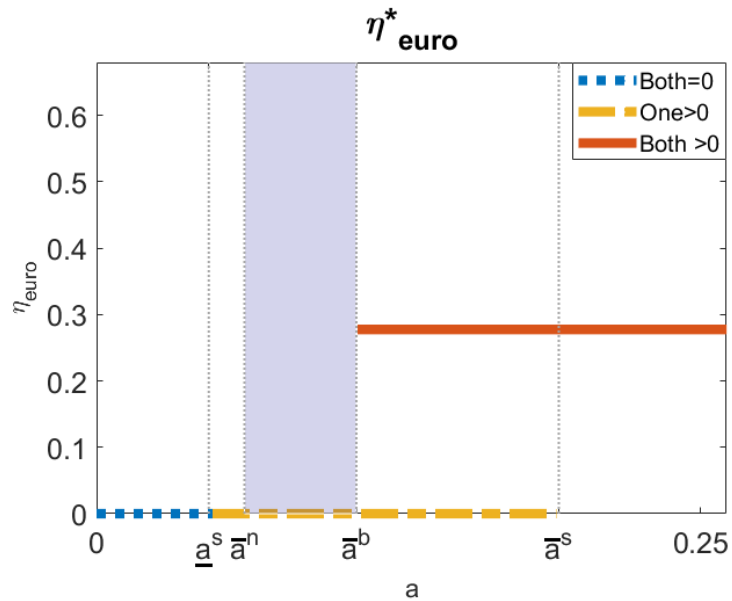
Dollar vs. Euro: Emergence of a dominant currency

- Three possible equilibria
  - No global currency (symmetric)
    - $\eta_{\$} = \eta_{€} = 0, B_{\$} = B_{€} = 0$
  - Single/dominant global currency (asymmetric)
    - $\eta_{\$} > 0, \eta_{€} = 0, B_{\$} > 0, B_{€} = 0$
  - Multiple global currencies (symmetric)
    - $\eta_{\$} > 0, \eta_{€} > 0, B_{\$} > 0, B_{€} > 0$

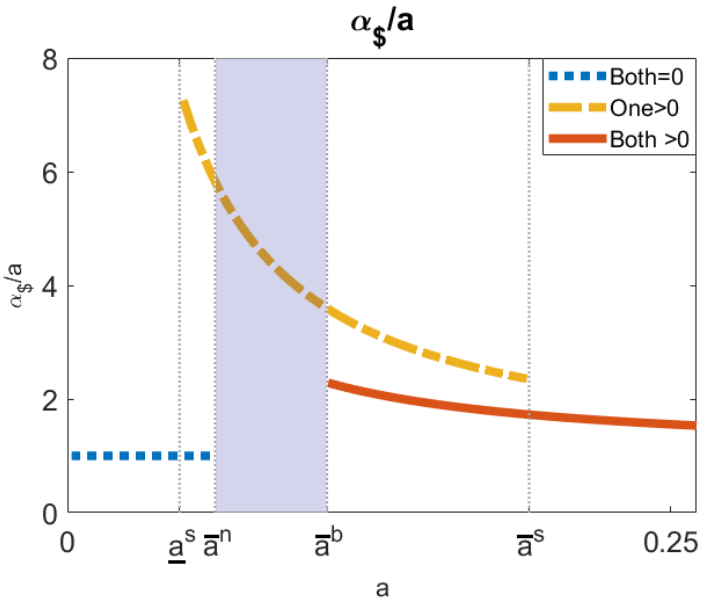
Numerical Example

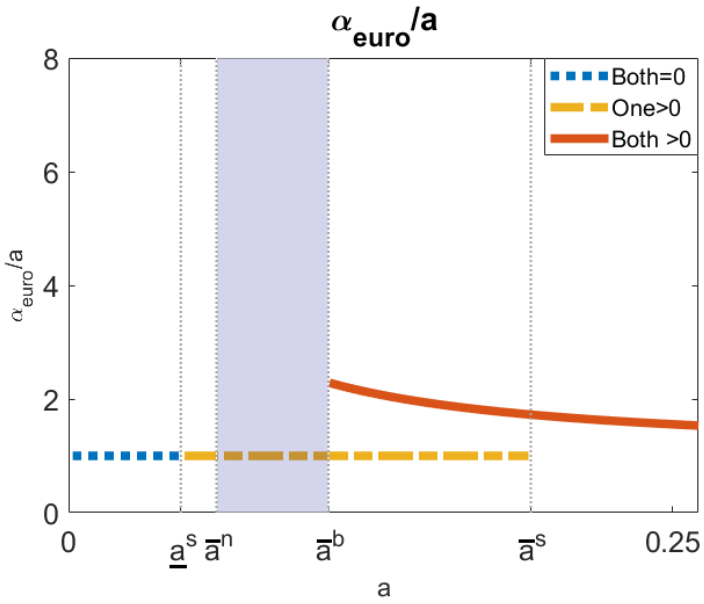
Parameter	N	N_0	X	α_h	ϕ	θ	β	γ_L	$\bar{\mathcal{E}}$	b	c
Value	7	7	3	0.2	0.1	1.4	0.8	0.7	2	0.5	0.8



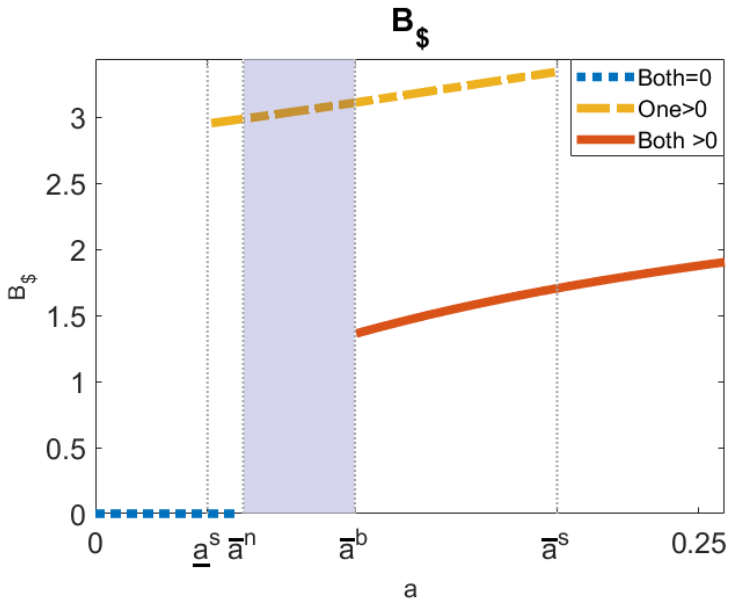


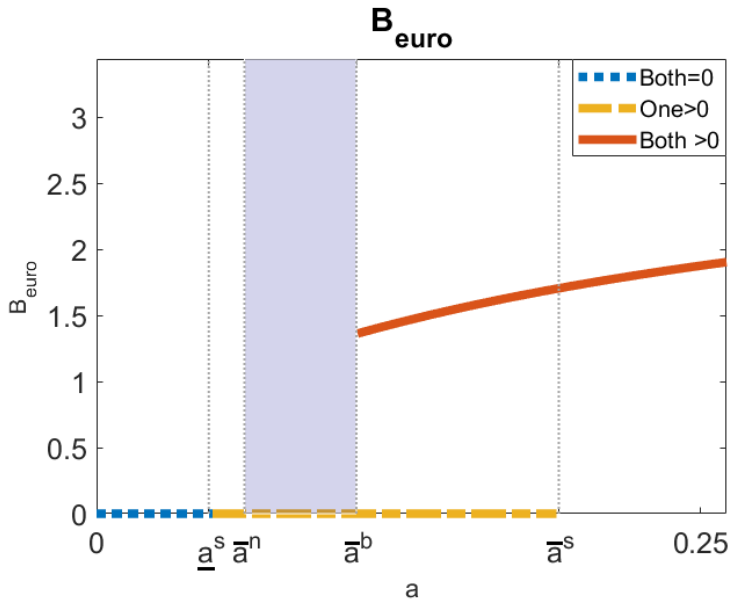
Dominance in Trade Invoicing



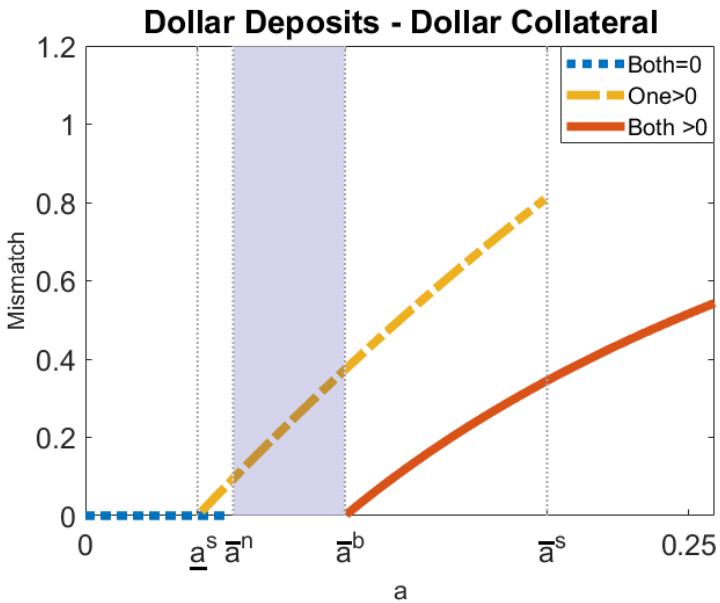


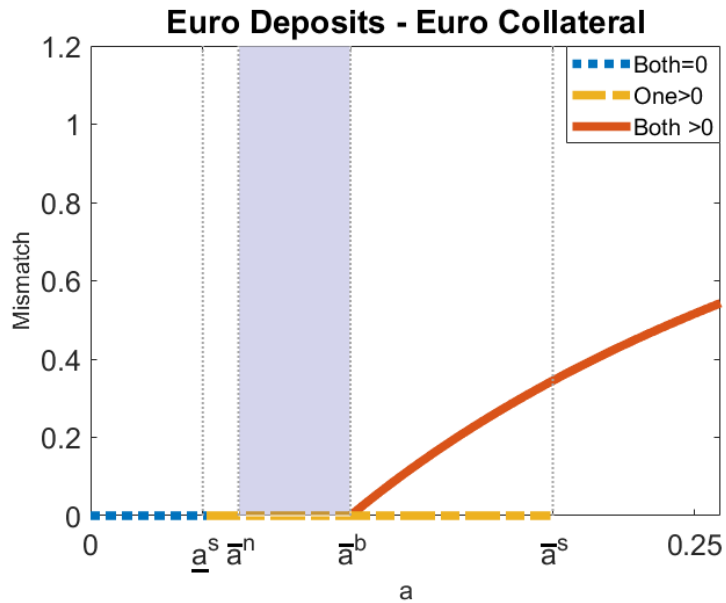
Dominance in Banking



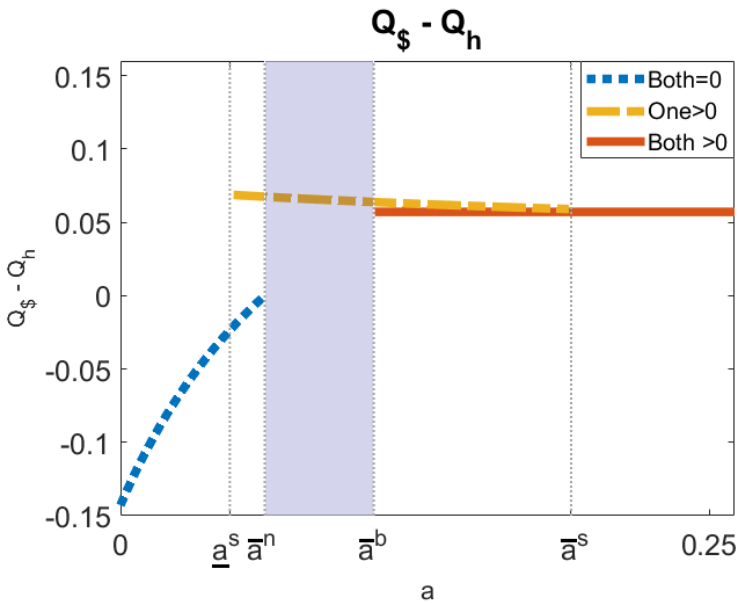


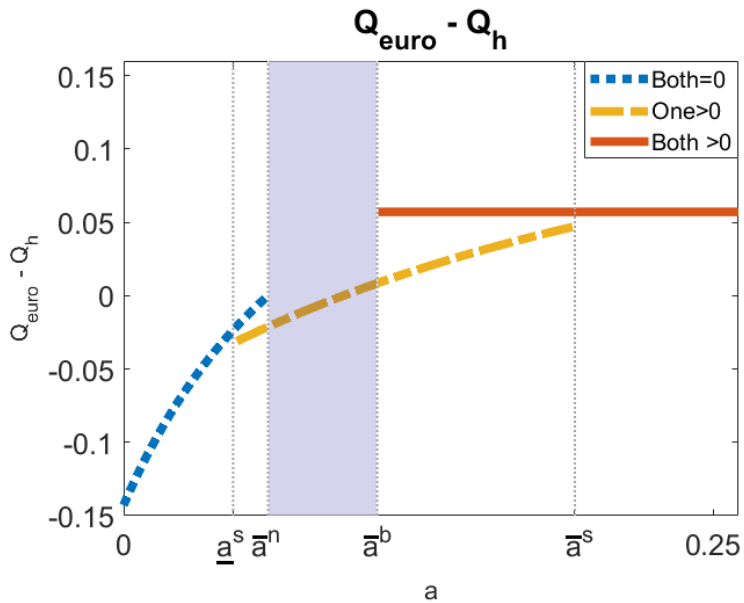
Currency Mismatch





Exorbitant Privilege





Comments

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  - Pre-1999, $a_{\$} >> a_{€}$, Dollar only dominant currency
  - Post-1999, closer in size, but history picks the dollar
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- Why dollarization of central bank reserves?
  - Lender of last resort of banks
  - Central bank asset mix mirrors commercial banks liability structure
  - Obstfeld, Shambaugh and Taylor (2010)

Data: Relation between trade invoicing and bank liabilities

$$\frac{D_{\$,i}}{D_{€,i}} = \frac{\alpha_{\$,i}}{\alpha_{€,i}} \cdot \frac{Q_{€} - \beta}{Q_{\$} - \beta}$$

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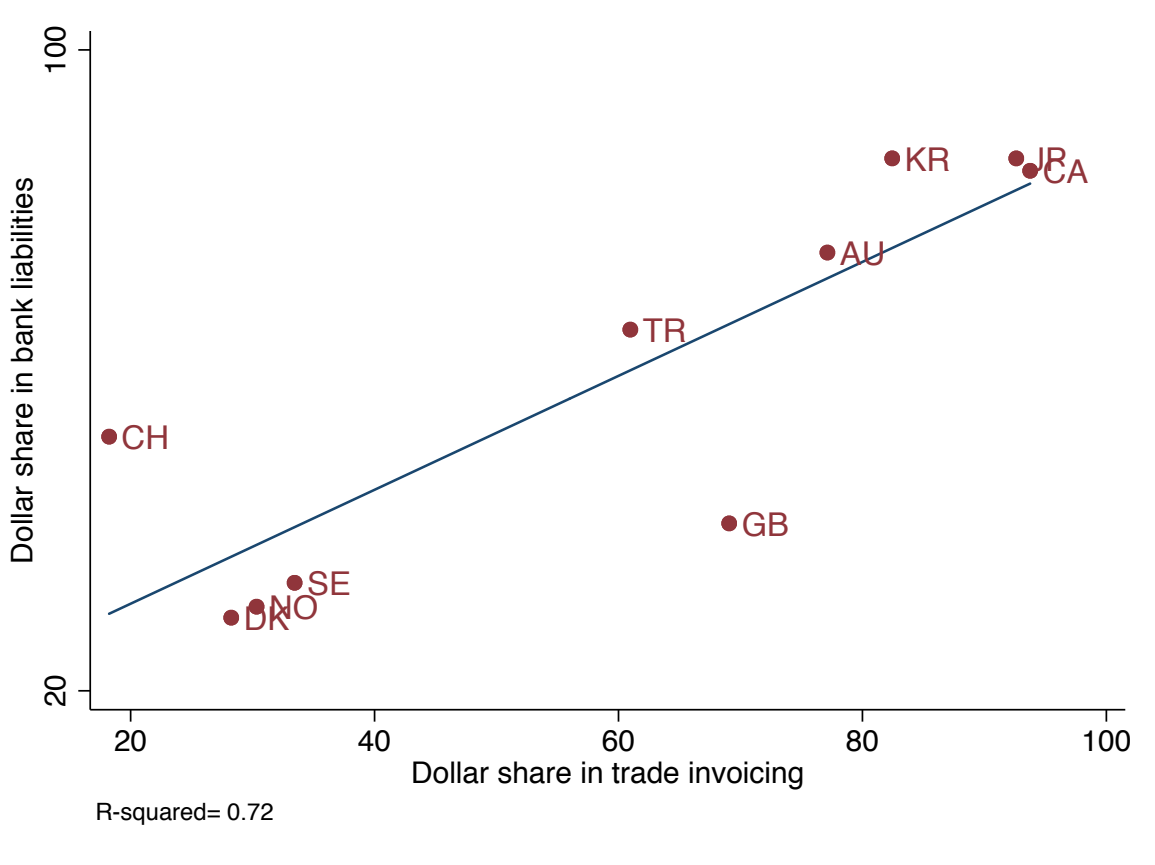

BIS Locational Banking Statistics, Local Liabilities

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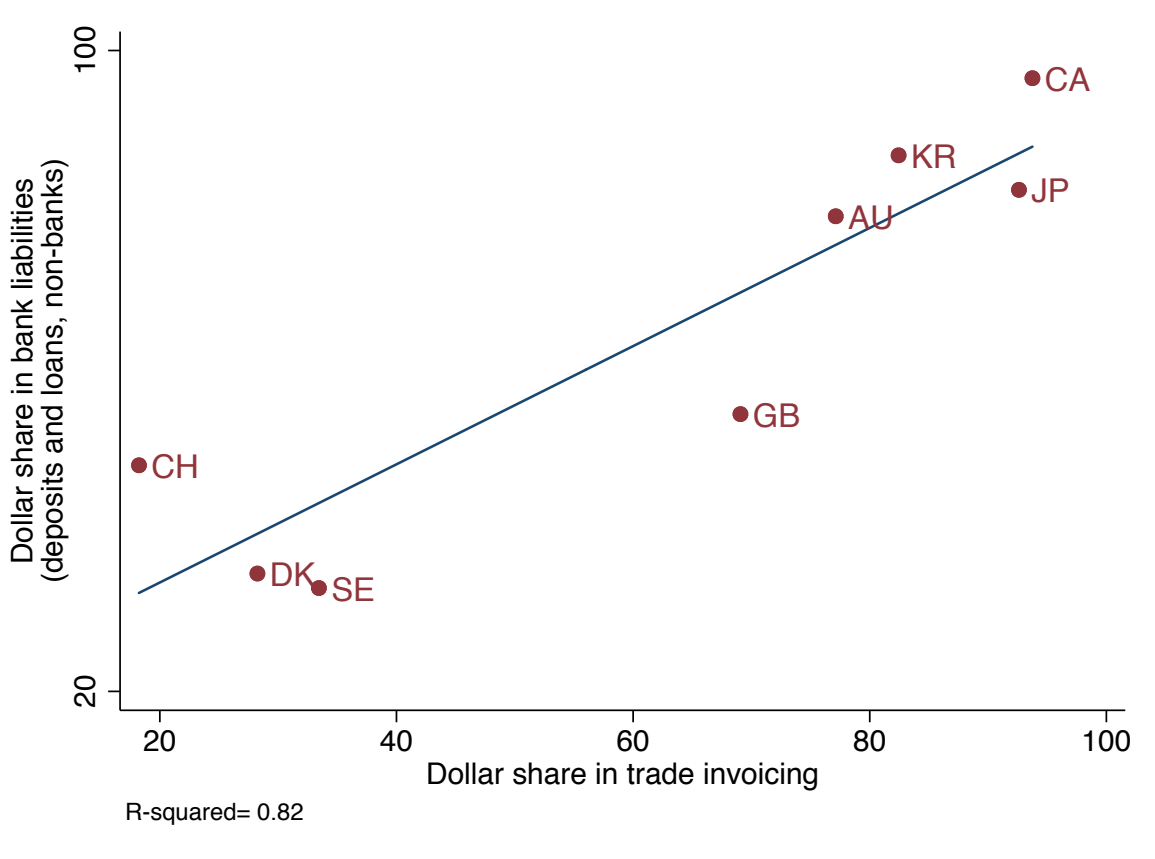

BIS Locational Banking Statistics, Local liabilities

Conclusion

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   - Invoice in dollars because dollar financing cheap
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China's Renminbi

- Share as settlement currency: 0% in 2010, 25% in 2015
- Second most widely used currency in global trade finance

Micro-foundation for P1

back

- Risk-Neutral Investors:

$$\max_{C_0^n, C_1^n, D_h^n, D_\$^n, A_R^n} C_0^n + \beta \mathbb{E}_0 C_1^n, \tag{P2}$$

subject to:

$$C_0^n \leq W_0^n - Q_h D_h^n - \mathcal{E}_0 Q_\$ D_\$^n - Q_R A_R^n$$
$$C_1 = D_h^n + \mathcal{E}_1 D_\$^n + \xi A_R^n,$$

$$D_h^n = D_\$^n = 0 \qquad \text{if} \qquad \begin{array}{r} Q_R = \beta, A_R > 0 \\ Q_h > \beta, Q_\$ > \beta \end{array}$$

Micro-foundation for P1 back

- Risk-Averse Importers:

$$\max_{C_1, D_h, D_\$} \mathbb{E}_0 U(C_1), \tag{P3}$$

subject to:

$$W \geq Q_h D_h - \mathcal{E}_0 Q_\$ D_\$$$
$$P_1 C_1 \leq D_h + \mathcal{E}_1 D_\$,$$

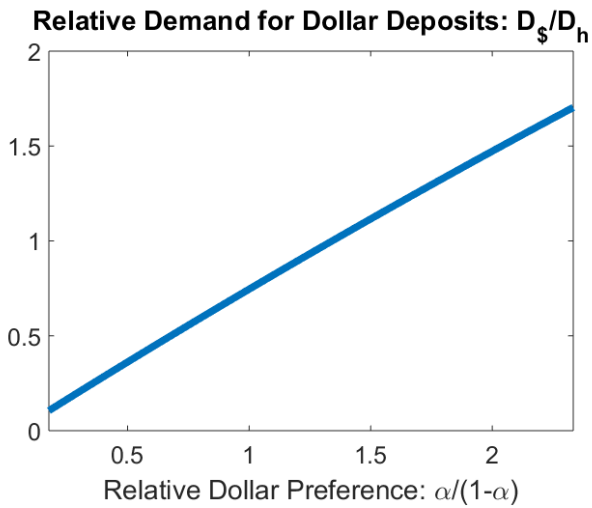
where the consumption aggregator and price level are given by,

$$C = C_h^{1-\alpha} C_\$^{\alpha} \qquad P = \frac{P_h^{1-\alpha} (\mathcal{E}_1 P_\$)^{\alpha}}{\alpha^{\alpha}(1-\alpha)^{1-\alpha}} = \frac{\mathcal{E}_1^{\alpha}}{\alpha^{\alpha}(1-\alpha)^{1-\alpha}} = \nu \mathcal{E}_1^{\alpha}$$

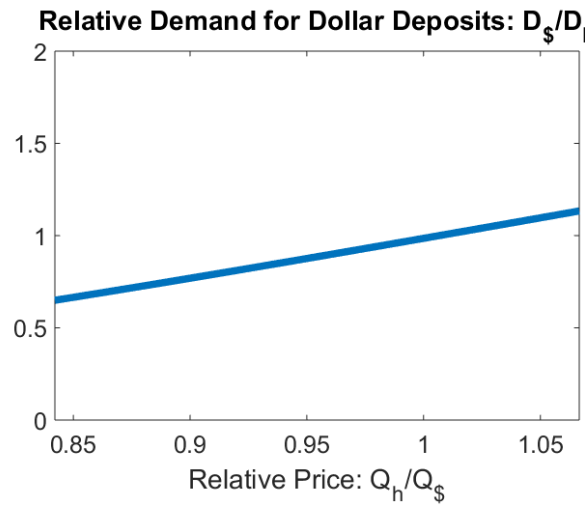
and $\alpha = \frac{\alpha_\$}{\alpha_h + \alpha_\$}$

Micro-foundation for P1

back



(c)

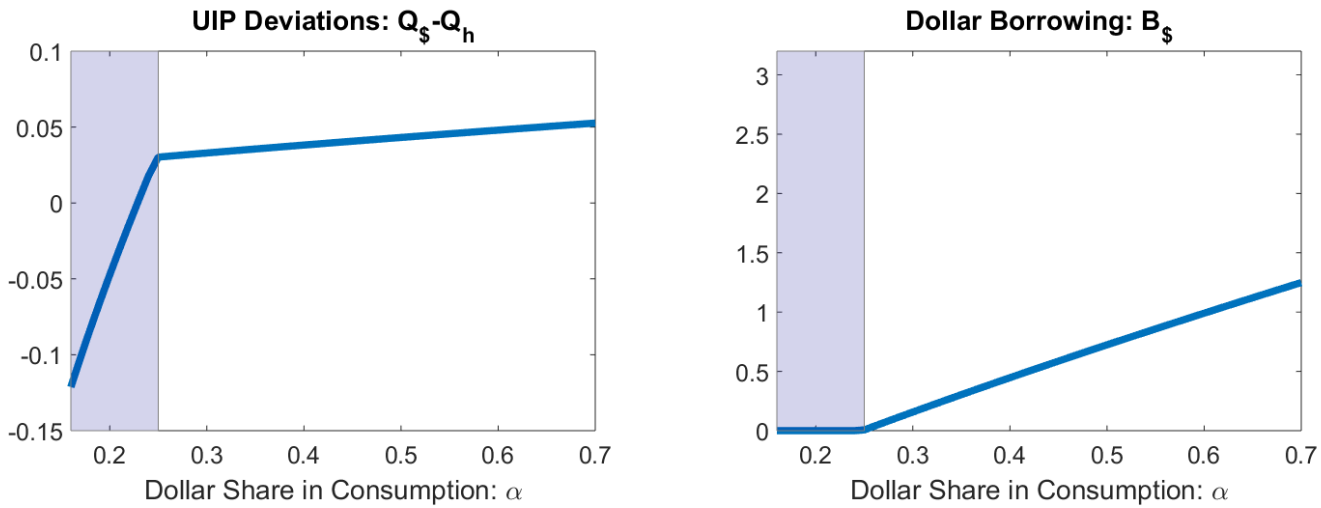


(d)

Figure: Relative demand for dollar deposits (in partial equilibrium)

Micro-foundation for P1

back



(a) (b)

Figure: Full equilibrium