Banking, Trade, and the Making of a Dominant Currency

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What is a “Dominant Currency”? 

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   - Dollar Invoicing in World Imports = 4.7
     Imports from U.S.
   - Euro Invoicing in World Imports = 1.2
     Imports from Euro Area
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2. **International bank funding and corporate borrowing**
   - Dollar liabilities of non-U.S. banks comparable to U.S. banks
   - 62% of foreign currency local liabilities of banks denominated in dollars
   - **Currency mismatch**
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   - Dollar: 64%; Euro: 20%; Yen: 4%
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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’
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’

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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High HH/firms $ expenses
Main Idea

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High HH/firms $ expenses

High demand for $ safe assets
Main Idea

- High $ invoicing
  - High HH/firms $ expenses
  - Low $ safe assets
  - High demand for $ safe assets
Main Idea

High $ invoicing \rightarrow \text{High HH/firms $ expenses} \rightarrow \text{High demand for $ safe assets} \leftarrow \text{Low } r \text{ on $ safe assets}
Model: Exogenous invoicing

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

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

\[
\max C_0 + \beta E_0 W_1 + \theta \log(M), 
\tag{P1}
\]

\[
C_0 \leq W_0 - Q_h D_h - E_0 Q_\$ D_\$ - Q_R A_R
\]

\[
W_1 = D_h + E_1 D_\$ + \xi A_R,
\]

- Preference for safe “money-like” assets, \( \theta > 0 \)

\[
M = \left( D_\alpha \alpha_h D_\alpha \alpha_\$ \right) \frac{1}{\alpha_h + \alpha_\$}
\]

- Price in invoice currency set at time 0 and sticky through time 1
Model: Exogenous invoicing

\[ Q_h = \beta + \theta \frac{\alpha_h}{(\alpha_h + \alpha_S)D_h} \]

\[ Q_S = \beta + \theta \frac{\alpha_S}{(\alpha_h + \alpha_S)D_S} \]

\[ Q_R = \beta \]

- \( \mathbb{E}_0(\mathcal{E}_1) = \mathcal{E}_0 = 1; \mathbb{E}_0(\xi) = 1 \)
Model: Exogenous invoicing

- **EM Banks** (agglomeration of banks and borrowing firms)
- **N local currency risky projects**
Model: Exogenous invoicing

- **EM Banks** (agglomeration of banks and borrowing firms)
- **$N$ local currency risky** projects
- Safe local claims $B_h$; safe dollar claims $B_\$;$ risky local bonds $B_R$

\[
\begin{align*}
Q_h B_h + Q_\$ B_\$ + Q_R B_R & \geq N \bar{E} B_\$ + B_h \\
\gamma L N & \leq \bar{E} B_\$ + B_h
\end{align*}
\]

- Limits to safe asset creation
- $\gamma L$: Worst case payout of project
- $\bar{E}$: Worst case value of EM currency
- Comparative disadvantage in manufacturing dollar safe claims

$E_0 \gamma = 1, E_0 \xi = 1$
Model: Exogenous invoicing

- **EM Banks** (agglomeration of banks and borrowing firms)
- **$N$ local currency risky projects**
- Safe local claims $B_h$; safe dollar claims $B_\$;$ risky local bonds $B_R$

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

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
  - $\gamma_L$: 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:** \( Q_S > Q_h > Q_R \)

\[
\frac{Q_S - \beta}{Q_h - \beta} = \bar{E}
\]
Model: Exogenous invoicing and banking market structure

• **UIP Violation & Exorbitant Privilege:** $Q_S > Q_h > Q_R$

\[
\frac{Q_S - \beta}{Q_h - \beta} = \bar{\epsilon}
\]

• Fund with $ deposits if cheaper than funding with $ h deposits.
Model: Exogenous invoicing and banking market structure

• **UIP Violation & Exorbitant Privilege:** $Q^S > Q_h > Q^R$

\[
\frac{Q^S - \beta}{Q_h - \beta} = \bar{E}
\]

• Fund with $ deposits if cheaper than funding with $ h deposits.

• Market clearing

\[
D^S = B^S + \underbrace{X^S}_{\text{exogenous, US}} \quad D_h = B_h
\]
Model: Invoicing Shares, UIP Deviations, Dollar Borrowing

Walking up a supply curve

\[ \bar{\alpha}_S = \frac{\alpha_h \bar{\mathcal{E}} X_s}{\gamma_L N} \]

High dollar invoicing \(\implies\) low return on safe dollar claims
Model: Endogenous Invoicing

- Invoice fraction $\eta$ 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.,

$$Q_h B_h + Q_\$ B_\$ + Q_R B_R \geq N + N_0$$

$$\bar{\mathcal{E}} B_\$ + B_h \leq \gamma_L N_0 + (1 - \eta) \gamma_L N + \bar{\mathcal{E}} \eta \gamma_L N$$

$$B_h \leq \gamma_L N_0 + (1 - \eta) \gamma_L N$$

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

- Dollar premium (DP):
  \[ Q_\$ - Q_h = \beta (\mu(\eta)(\bar{E} - 1) - \kappa) \]

- Invoicing choice (IC):
  \[ \eta = \frac{\gamma L}{\beta \phi} (Q_\$ - Q_h) \]
Model: Endogenous Invoicing Shares

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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

\[ M_i = \left( D^{\alpha_{hi}}_{hi} D^{\alpha_{i}}_{i} \right)^{\frac{1}{\alpha_{hi} + \alpha_{i}}} \]

- 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
Simultaneous determination of invoicing and banking

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Dollar vs. Euro: Emergence of a dominant currency

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

\[ M_i = \left( D_{\alpha_{hi}}^\alpha D_{\alpha_i}^{\alpha_s} D_{\alpha_i}^{\alpha_e} \right) \sum_{\alpha_i}^{1} \]

\[ \alpha_{\$i} = a + b \int_{j \neq i} \eta_{\$j} dj \quad \alpha_{\varepsilon_i} = a + b \int_{j \neq i} \eta_{\varepsilon_j} dj \]
Dollar vs. Euro: Emergence of a dominant currency

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

\[ M_i = \left( D_{hi}^{\alpha_{hi}} D_{\$i}^{\alpha_{\$i}} D_{\€i}^{\alpha_{\€i}} \right) \sum_{\alpha_i}^{1} \]

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

- 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:

\[
D_{hi} = B_{hi} \quad \forall i \\
A_{Ri} = B_{Ri} \quad \forall i \\
\int_i D_{\$i} = \int_i B_{\$i} + X \\
\int_i D_{\€i} = \int_i B_{\€i} + X
\]
Dollar vs. Euro: Emergence of a dominant currency

• Three possible equilibria
  • No global currency (symmetric)
    • $\eta_\$ = \eta_\varepsilon = 0, B_\$ = B_\varepsilon = 0$
  • Single/dominant global currency (asymmetric)
    • $\eta_\$ > 0, \eta_\varepsilon = 0, B_\$ > 0, B_\varepsilon = 0$
  • Multiple global currencies (symmetric)
    • $\eta_\$ > 0, \eta_\varepsilon > 0, B_\$ > 0, B_\varepsilon > 0$
Numerical Example

<table>
<thead>
<tr>
<th>Parameter</th>
<th>N</th>
<th>N₀</th>
<th>X</th>
<th>αₜ</th>
<th>φ</th>
<th>θ</th>
<th>β</th>
<th>γₗ</th>
<th>$\bar{E}$</th>
<th>b</th>
<th>c</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>7</td>
<td>7</td>
<td>3</td>
<td>0.2</td>
<td>0.1</td>
<td>1.4</td>
<td>0.8</td>
<td>0.7</td>
<td>2</td>
<td>0.5</td>
<td>0.8</td>
</tr>
</tbody>
</table>
Dominance in Trade Invoicing
Dominance in Banking
Currency Mismatch

Dollar Deposits - Dollar Collateral

Euro Deposits - Euro Collateral
Exorbitant Privilege

![Graphs showing Q_s - Q_h and Q_euro - Q_h](image-url)
• **Which currency dominates?** The role of history
  • Pre-1999, $a_\$ >> a_\€$, Dollar only dominant currency
  • Post-1999, closer in size, but history picks the dollar
  • Can take a long time to reverse
Comments

• **Which currency dominates?** The role of history
  • Pre-1999, $a_\$ >> a_\euro$, Dollar only dominant currency
  • Post-1999, closer in size, but history picks the dollar
  • Can take a long time to reverse

• **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

\[
\frac{D_{\$,i}}{D_{\$,i}} = \frac{\alpha_{\$,i}}{\alpha_{\$,i}} \cdot \frac{Q_{\$} - \beta}{Q_{\$} - \beta}
\]
Data: Relation between trade invoicing and bank liabilities

\[ \frac{D_{\$i}}{D_{\varepsilon,i}} = \frac{\alpha_{\$i}}{\alpha_{\varepsilon,i}} \cdot \frac{Q_{\varepsilon} - \beta}{Q_{\$} - \beta} \]

R-squared = 0.72

BIS Locational Banking Statistics, Local Liabilities
Data: Relation between trade invoicing and bank liabilities

BIS Locational Banking Statistics, Local liabilities
Conclusion

1. **Unified theory** for dominance in trade invoicing *and* finance
   - Invoice in dollars because dollar financing cheap
   - Dollar financing cheap because of invoicing in dollars

2. **Strategic complementarity** of unit of account and store of value

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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
Risk-Neutral Investors:

\[
\max_{C_0^n, C_1^n, D_h^n, D_\$, A_R^n} \quad C_0^n + \beta E_0 C_1^n, \quad \text{(P2)}
\]

subject to:

\[
C_0^n \leq W_0^n - Q_h D_h^n - \varepsilon_0 Q_\$ D_\$ - Q_R A_R^n
\]

\[
C_1 = D_h^n + \varepsilon_1 D_\$ + \xi A_R^n,
\]

\[
Q_R = \beta, A_R > 0
\]

\[
D_h^n = D_\$ = 0 \quad \text{if} \quad Q_h > \beta, Q_\$ > \beta
\]
Micro-foundation for P1

- Risk-Averse Importers:

\[
\begin{align*}
\max_{C_1, D_h, D_\$} & \quad \mathbb{E}_0 U(C_1), \\
\text{subject to:} & \quad W \geq Q_h D_h - \mathcal{E}_0 Q_\$ D_\$ \\
& \quad P_1 C_1 \leq D_h + \mathcal{E}_1 D_\$, \\
\end{align*}
\]  

(P3)

where the consumption aggregator and price level are given by,

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

and \(\alpha = \frac{\alpha_\$}{\alpha_h + \alpha_\$}\).
**Figure**: Relative demand for dollar deposits (in partial equilibrium)
Micro-foundation for P1

Figure: Full equilibrium

(a) UIP Deviations: $Q_s - Q_h$

(b) Dollar Borrowing: $B_s$