Banking across Borders

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Federal Reserve Bank of New York

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The views expressed in this presentation are those of the author and do not necessarily reflect the position of the Federal Reserve Bank of New York or the Federal Reserve System.
Banking across Borders

**International banking:**
- Banks channel domestic capital to foreign firms → Reallocation of capital
- More likely to be conducted from home (exports)

**Foreign sourcing:**
- Banks raise capital abroad for investment at home (imports) → Reallocation of capital

**Global banking:**
- Banks raise capital abroad and lend it to the same foreign market → Local intermediation
- More likely to be conducted through foreign affiliates (FDI)
Stylized Facts

1. **Expansion**: rise in banks’ foreign activities

2. **From international to global**: increased importance of global banking relative to international banking

3. **Heterogeneity**: in international and global banking

4. **Net capital flows**: capital importers and exporters
This Paper

- provides a model to understand these facts jointly
- takes a trade approach as alternative to portfolio models of cross-border banking
- explains cross-country heterogeneity in global and international banking
- identifies differences in relative factor endowments and differences in banking sector efficiencies as key drivers of banking across borders
- shows the effects of capital account and banking sector liberalization on banking across borders and bank-intermediated capital flows
Overview

Model:

- 2 countries which differ in endowments (Heckscher-Ohlin) and in banking technology (Ricardo)
- Role of banks: to channel capital from depositors to firms domestically and internationally at a cost
- **International banking**: differences in endowments
- **Global banking**: differences in banking sector efficiencies
- **Foreign sourcing**: both factors together
- Foreign bank asset and liability holdings as a function of differences in endowments, difference in efficiencies and the degree of banking sector and capital account liberalization

Empirics:

- Cross-sectional predictions consistent with patterns in the data
- Two different data sets: from Bank for International Settlements and Deutsche Bundesbank
Contribution

International banking:
- Model of trade in banking services consistent with the data
- Benefits of banking across borders

International finance and portfolio literature:
- Gravity relationship does not hold in general for bank assets (complements Okawa and van Wincoop (2012))
- Evidence for diversification (in contrast to correlation puzzle in e.g. Aviat and Coeurdacier (2007))

International macro and financial frictions:
- Banks as vehicles of international capital flows affect the allocation of capital
- Capital flows non-linear in financial development
- Banks channel capital downstream (consistent with evidence in Alfaro et al. (2011))
Literature


- **Topics related to multinational banking**: Cetorelli and Goldberg (2009), de Haas and Lelyveld (2010), Calzolari and Loranth (2010), Dell’Ariccia and Marquez (2010); Eaton (1994)

- **Trade and investment in banking**: Ennis (2001); Lehner (2009); De Blas and Russ (2010, 2012); Buch, Koch and Koetter (2009)


- **Financial frictions and capital flows**: Ju and Wei (2010), Antras and Caballero (2009), Mendoza, Quadrini, Rios-Rull (2009)...

- **Empirical papers**: Buch (2000); Buch, Koch, Koetter (2011), Focarelli and Pozzolo (2005); Buch and Lipponer (2007); Claessens and van Horen (2007, 2010); Papaïannou (2009);...
Closed Economy Model
Closed economy setup

**Entrepreneurs**
- Invest own capital in firm
- Raise external capital

**Banks**
- Channel depositor capital to entrepreneurs at cost $c$

**Depositors**
- Invest capital in banks
- Receive interest $1+r$

**Firms**
- Constant returns
- Capital input $z$ fixed
- $Y = z*R + l*w$

**K Capitalists**

**L Workers**
Market clearing and factor prices

- Capital market clearing pins down number of firms: $N = K/z$
- Labor market clearing ensures $l = L/N$
- Wages $w$ and return on capital $R$ determined by marginal products:

$$F(L, K) + K = F_L(1, K/L)L + (1 + F_K(1, K/L))K = wL + R K \quad (1)$$

- Entrepreneurs collect $R$ and pay bankers and implicitly entrepreneurs
Financial interest rate

- Capitalists can become entrepreneurs or depositors
- Free entry condition:
  \[ zR - (c + 1 + r)(z - 1) = (1 + r) \]  
  \( z \) represents the number of entrepreneurs.

- Interest rate:
  \[ 1 + r = R - c \frac{z - 1}{z} = (1 + F_K(1, K/L)) - c \frac{z - 1}{z} \]  
  Here, \( F_K \) is a function of capital and labor.

- Wedge between marginal product of capital and financial interest rate due to financial frictions
- The lower the efficiency of the banking sector, the lower the financial interest rate
Open Economy Model
Open economy setup

- Country 1 and country 2 differ with respect to endowments and banking sector efficiency
- Depositors, workers and entrepreneurs are immobile
- Banks can lend to firms abroad and take deposits abroad
- Two types of barriers to banking across borders:
  - Cost of lending to foreign firms $\tau_{ij}$: capital account openness
  - Cost of sourcing capital abroad $t_{ij}$: banking sector openness
- Banks are capacity constraint:

$$c_j(D_{ij}) = a_j(1 + \frac{D_{ij}}{K_j})^\gamma,$$

where $D_{ij}$ are the deposits that banking sector $j$ takes in country $i$ and vice versa if $D_{ij} < 0$. 
Choice of entrepreneurs

Domestic Banking: $A_{ij}=0, LI_{ij}=0$

International Banking: $A_{ij}>0, LI_{ij}=0$

Global Banking: $A_{ij}>0, LI_{ij}>0$

Foreign Sourcing: $A_{ij}=0, LI_{ij}>0$
Equilibrium

- As entrepreneurs demand foreign banking services, interest rates and monitoring costs change:

\[ 1 + r_j = R_j(K_{ij}) - c_j(D_{ij}) \frac{z - 1}{z} \] (5)

- In an equilibrium, the capital flow \( K_{ij} \), foreign deposits \( D_{ij} \) and the implied interest rates and intermediation costs are consistent with the entrepreneurs’ demand for banking across borders

- Capital flows in one direction

- Only one banking sector takes foreign deposits

- Entrepreneurs either prefer domestic banks and domestic capital or they are indifferent
Types of equilibria

1. No trade: $A_{ij} = Ll_{ij} = 0$

2. International banking $j$: $A_{ij} > 0$, $Ll_{ij} = 0$

3. Foreign sourcing $j$: $A_{ij} = 0$, $Ll_{ij} > 0$

4. International and global banking $j$: $A_{ij} > 0$, $Ll_{ij} > 0$, $A_{ij} \geq L_{ij}$

5. Foreign sourcing and global banking $j$: $A_{ij} > 0$, $Ll_{ij} > 0$, $A_{ij} < L_{ij}$

6. International banking $i$ and foreign sourcing $j$: $A_{ij} = 0$, $Ll_{ij} > 0$, $A_{ji} > 0$, $L_{ji} = 0$
Equilibrium types: $\Delta(K/L) = K_j/L_j - K_i/L_i$, $\Delta a = a_i - a_j$
Key propositions

Assets $A_{ij}$:

- $\Delta \left( \frac{K}{L} \right) = \frac{K_j}{L_j} - \frac{K_i}{L_i} \uparrow \Rightarrow A_{ij} \uparrow$
- $\Delta a = a_i - a_j \uparrow \Rightarrow A_{ij} \uparrow$
- $t_i, \tau_i \downarrow \Rightarrow A_{ij} \uparrow$
- $t_j, \tau_j \downarrow \Rightarrow A_{ij} \downarrow$

Liabilities $LL_{ij}$:

- $\Delta \left( \frac{K}{L} \right) \uparrow \Rightarrow LL_{ij} \downarrow$
- $\Delta a \uparrow \Rightarrow LL_{ij} \uparrow$
- $t_i, \tau_i \downarrow \Rightarrow LL_{ij} \uparrow$
- $t_j, \tau_j \downarrow \Rightarrow LL_{ij} \downarrow$

Liabilities /Assets $\frac{LL}{A}_{ij}$:

- $\Delta \left( \frac{K}{L} \right) \uparrow \Rightarrow \frac{LL}{A}_{ij} \downarrow$
Banking across borders arises from differences in the return to capital and in banking sector efficiency across countries.

Foreign assets increase with both capital account and banking sector liberalization in recipient countries (Fact 1: expansion).

Banking sector liberalization leads to a rise in global banking relative to international banking (Fact 2: from international to global).
Differences in endowments and differences in efficiencies determine the degree of global banking versus international banking/foreign sourcing (Fact 3: **heterogeneity**)

The ratio of foreign liabilities to foreign assets increases with the relative capital scarcity of a country (Fact 4: **net capital flows**)

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Friederike Niepmann  (NY FED)  Banking across Borders  21 May 2013
Empirics
Assets and liabilities data:
- Consolidated Banking Statistics provided by BIS: aggregate data
- Auslandsstatus-Report from Deutsche Bundesbank: bank-level data
- Around 23 source countries and 86 recipient countries
- Cross-section of the year 2005

Measure of endowments and efficiency:
- Differences in endowments measured by 5-year lagged differences in human capital adjusted capital-labor ratios
- Banking sector efficiency proxied by the 5-year lagged average ratio of overhead costs to total assets or net interest rate margin of a country’s banking sector
Baseline regression

\[
\log(y_{ij[k]}) = \delta_1 \Delta \log(K/L_{ij}) + \delta_2 \Delta \log(a_{ij}) + X'_j \beta_j + [X'_i \beta_i] + X'_{ij} \beta_{ij} + \alpha_i + [\alpha_k] + \epsilon_{ij[k]}.
\]

- \(\Delta \log\): difference of logs between countries \(i\) and \(j\)
- \(X_i, X_j\): log of GDP, log of population, dummy for systemic banking crisis, property rights, financial openness, bank entry barriers
- \(X_{ji}\) (proxies for transaction costs): log of distance, colonial relationship, contiguity common official language, common currency, common legal system

<table>
<thead>
<tr>
<th>Dependent variable (y_{ij[k]})</th>
<th>(\Delta a)</th>
<th>(\Delta (K/L))</th>
</tr>
</thead>
<tbody>
<tr>
<td>assets</td>
<td>positive</td>
<td>positive</td>
</tr>
<tr>
<td>liabilities</td>
<td>positive</td>
<td>negative</td>
</tr>
<tr>
<td>liabilities/assets</td>
<td>ambiguous</td>
<td>negative</td>
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## Baseline results

<table>
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<tr>
<th></th>
<th>assets</th>
<th>liabilities</th>
<th>liabilities/assets</th>
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<tbody>
<tr>
<td></td>
<td>BIS (1)</td>
<td>BBK (2)</td>
<td>BIS (3)</td>
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<td>BBK (4)</td>
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<td>BIS (5)</td>
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<td></td>
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<td>BBK (6)</td>
</tr>
<tr>
<td>Δ log(net interest margin$_{ij}$)</td>
<td><strong>1.525</strong>††</td>
<td><strong>0.339</strong>††</td>
<td><strong>1.238</strong>††</td>
</tr>
<tr>
<td></td>
<td>(0.345)</td>
<td>(0.174)</td>
<td>(0.272)</td>
</tr>
<tr>
<td>Δ log($K/L_{ij}$)</td>
<td>1.243</td>
<td>0.222</td>
<td>-1.613††</td>
</tr>
<tr>
<td></td>
<td>(1.412)</td>
<td>(0.258)</td>
<td>(0.900)</td>
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<tr>
<td>concentration$_{j}$</td>
<td>0.379</td>
<td>3.771*</td>
<td>-2.607**</td>
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<td>(1.476)</td>
<td>(2.079)</td>
<td>(0.659)</td>
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<td>(0.605)</td>
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<td>0.00574</td>
<td>0.0137**</td>
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<td>1.530**</td>
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<td>(0.357)</td>
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<td>log(distance$_{ij}$)</td>
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<td>-1.008**</td>
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<td>(0.0708)</td>
<td>(0.235)</td>
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<td>(0.264)</td>
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<td>0.853**</td>
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<td>-0.832**</td>
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<td>R-squared</td>
<td>0.719</td>
<td>0.494</td>
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### Baseline results (continued)

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<th>BIS (1)</th>
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<th>BIS (3)</th>
<th>BBK (4)</th>
<th>BIS (5)</th>
<th>BBK (6)</th>
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</thead>
<tbody>
<tr>
<td>( \Delta \log(\text{net interest margin}_{ij}) )</td>
<td>1.525††</td>
<td>0.339††</td>
<td>1.238††</td>
<td>0.429††</td>
<td>-0.806††</td>
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<td>( \Delta \log(K/L_{ij}) )</td>
<td>1.243</td>
<td>0.222</td>
<td>-1.613††</td>
<td>-0.0852</td>
<td>-1.283††</td>
<td>-0.861††</td>
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<td>(0.900)</td>
<td>(0.290)</td>
<td>(0.874)</td>
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<td>contiguity(_{ij})</td>
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<td>0.323</td>
<td>0.492</td>
<td>0.0314</td>
<td>0.911**</td>
<td>-1.298**</td>
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<td>(0.294)</td>
<td>(0.256)</td>
<td>(0.432)</td>
<td>(0.369)</td>
<td>(0.367)</td>
<td>(0.610)</td>
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<td>common legal system(_{ij})</td>
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<td>0.0535</td>
<td>0.864**</td>
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<td>0.587**</td>
<td>0.269</td>
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<td>(0.187)</td>
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<td>(0.381)</td>
<td>(0.521)</td>
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<td>common language(_{ij})</td>
<td>0.239</td>
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<td>0.102</td>
<td>1.651**</td>
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<td>(0.607)</td>
<td>(0.582)</td>
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<td>colony(_{ij})</td>
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<td>1.700**</td>
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<td>(0.254)</td>
<td>(0.267)</td>
<td>(0.466)</td>
<td>(0.406)</td>
<td>(0.306)</td>
<td>(0.641)</td>
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<td>log(GDP(_{j}))</td>
<td>-0.200</td>
<td>0.709**</td>
<td>1.505**</td>
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<td></td>
<td>(0.675)</td>
<td>(0.209)</td>
<td>(0.513)</td>
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<tr>
<td>log(GDP(_{i}))</td>
<td></td>
<td>0.455*</td>
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<td>0.805</td>
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<td>(0.258)</td>
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<td>(0.554)</td>
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<tr>
<td>log(GDP per capita(_{j}))</td>
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<td>0.805</td>
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<td>-0.595*</td>
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<td>(0.390)</td>
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<tr>
<td>log(population(_{j}))</td>
<td>1.209*</td>
<td>0.237</td>
<td></td>
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<tr>
<td></td>
<td>(0.636)</td>
<td>(0.520)</td>
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<td>log(population(_{i}))</td>
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<td>-0.252</td>
<td>0.118</td>
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<td>(0.218)</td>
<td>(0.235)</td>
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<tr>
<td>Observations</td>
<td>1,319</td>
<td>18,879</td>
<td>488</td>
<td>41,739</td>
<td>485</td>
<td>18542</td>
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<td>R-squared</td>
<td>0.719</td>
<td>0.494</td>
<td>0.621</td>
<td>0.412</td>
<td>0.436</td>
<td>0.337</td>
</tr>
</tbody>
</table>
Comparative statics

Quantifications based on $\delta_1 = 0.23$ and $\delta_2 = 0.17$ for assets and $\delta_1 = -0.01$ and $\delta_2 = 0.32$ for liabilities:

- If the German banking sector (54th percentile) was as efficient as the Dutch (5th percentile), then bank asset (liability) holdings of German banks would increase by 33% (63%).
- If Brazil (60th percentile) was as capital abundant as Spain (85th percentile), foreign assets of Brazilian banks would increase by 40%, foreign liabilities would decline by 17%.
Robustness

Alternative theories are excluded:
- Follow-your-customer hypothesis not the full story
- Diversification puzzle seems resolved

Extensive margin and problem of the zeros:
- Predictions also hold for extensive margin
- Heckman selection correction does not change results

Robust to alternative specifications:
- 10-year lags
- Alternative base years in BIS sample
- Absolute differences
**Follow-your-customer and diversification**

<table>
<thead>
<tr>
<th></th>
<th>assets</th>
<th>liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BIS (1)</td>
<td>BBK (2)</td>
</tr>
<tr>
<td>Δ log(net interest margin$_{ij}$)</td>
<td>1.054$^{††}$ (0.578)</td>
<td>0.364$^{††}$ (0.175)</td>
</tr>
<tr>
<td>Δ log($K / L_{ij}$)</td>
<td>-0.580 (1.354)</td>
<td>0.122 (0.300)</td>
</tr>
<tr>
<td>growth correlation$_{ij}$</td>
<td>-0.0641 (0.363)</td>
<td>-0.528$^{†}$ (0.330)</td>
</tr>
<tr>
<td>log(FDI$_{ij}$)</td>
<td>0.378** (0.0534)</td>
<td>0.342** (0.113)</td>
</tr>
<tr>
<td>concentration$_{j}$</td>
<td>2.886 (1.929)</td>
<td></td>
</tr>
<tr>
<td>concentration$_{i}$</td>
<td></td>
<td>-0.0454 (0.489)</td>
</tr>
<tr>
<td>financial freedom$_{j}$</td>
<td>-0.0281* (0.0134)</td>
<td></td>
</tr>
<tr>
<td>financial freedom$_{i}$</td>
<td>-0.00258 (0.00491)</td>
<td></td>
</tr>
<tr>
<td>openness$_{j}$</td>
<td>0.424 (0.459)</td>
<td></td>
</tr>
<tr>
<td>openness$_{i}$</td>
<td></td>
<td>0.0532 (0.102)</td>
</tr>
<tr>
<td>Observations</td>
<td>644</td>
<td>17,144</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.806</td>
<td>0.518</td>
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</tbody>
</table>
Conclusions

- Differences in banking sector efficiencies and differences in endowments drive banking across borders
- Potential gains from international and global banking
- Evidence for diversification
- Who channels capital across borders matters for the allocation of capital
Thank you for your attention and comments!
1. Expansion: rise in banks’ foreign activities
2. From international to global: increased importance of global banking

Data: Consolidated Banking Statistics (Bank for International Settlements)
3. **Heterogeneity**: in international and global banking

4. **Net capital flows**: capital importers and exporters

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Data: provided by BIS (see McCauley, McGuire, von Peter (2010))

<table>
<thead>
<tr>
<th>Bank Assets</th>
<th>Bank Liabilities</th>
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<tbody>
<tr>
<td>![Graph of Bank Assets]</td>
<td>![Graph of Bank Liabilities]</td>
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<th>JP</th>
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<tbody>
<tr>
<td>![Net claims]</td>
<td>![Cross-border assets]</td>
<td>![Local assets]</td>
<td>![Net liabilities]</td>
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</tbody>
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Friederike Niepmann (NY FED) | Banking across Borders | 21 May 2013
Variation in $K/L$ and $a$
Special case $\gamma = 0$

Figure: Capital account liberalization

- **Country i**
  - **Firm**
    - MPK $R_i$
  - **Banker**
    - Monitoring cost $c_i$
  - **Depositors**
    - Financial interest rate $r_i$

- **Country j**
  - **Firm**
    - MPK $R_j$
  - **Banker**
    - Monitoring cost $c_j$
  - **Depositors**
    - Financial interest rate $r_j$

$A_{ij} = K_{ij}$
Special case: $\gamma = 0$

Complete capital account liberalization ($t_{ij} = t_{ji} = \infty$ and $\tau_{ij} = \tau_{ji} = 0$):

- International banking only
- Entrepreneurs compare $c_i + 1 + r_i$ and $c_j + 1 + r_j$
- Banking sector with best cost-interest rate combination exports capital and banking services
- In equilibrium, $K_{ij}$ is such that entrepreneurs are indifferent, implying:

$$ (c_i - c_i) = (R_j - R_i)z $$

(7)

- High interest rate offset by low service fee
- If $K_{ij} > 0$, banking sector $j$ has positive foreign assets $A_{ij} = K_{ij}$ on its balance sheet; $A_{ji} = D_{ij} = D_{ji} = 0$
Special case $\gamma = 0$

Figure: Banking sector liberalization

\[ A_{ij} \]
\[ LI_{ij} \]

Country i

- Firm
  - MPK $R_i$

- Banker
  - Monitoring cost $c_i$

- Depositors
  - Financial interest rate $r_i$

Country j

- Firm
  - MPK $R_j$

- Banker
  - Monitoring cost $c_j$

- Depositors
  - Financial interest rate $r_j$
Special case: $\gamma = 0$

Additional banking sector liberalization ($t_{ij} = t_{ji} = \tau_{ij} = \tau_{ji} = 0$):

- Global banking and foreign sourcing possible
- Interest rates equalize across countries
- Complete specialization: high efficiency banks serve the entire market
- MPKs equalize: $K_{ij}$ solves $R_j = R_i$
- Assume $c_i > c_j$, then only banks from country $j$ are active
- Banking sector $j$ intermediates all depositor capital in country $i$: $LI_{ij} = D_{ij}$
- Foreign assets $A_{ij}$ consist of foreign depositor capital plus capital flow:

$$A_{ij} = D_{ij} + K_{ij} \quad (8)$$
Special case: $\gamma = 0$

Global versus international banking:

- Ratio of liabilities to assets measures the importance of global banking relative to international banking

\[
\frac{LL_{ij}}{A_{ij}} = \frac{D_{ij}}{D_{ij} + K_{ij}} = \frac{K_i(z - 1) - K_{ij}}{(K_i + K_{ij})(z - 1)}
\]  

- $\frac{LL_{ij}}{A_{ij}} = 1$ if $K_{ij} = 1$: global banking
- $\frac{LL_{ij}}{A_{ij}} < 1$ if $K_{ij} > 1$: global banking and international banking
- $\frac{LL_{ij}}{A_{ij}} > 1$ if $K_{ij} < 1$: global banking and foreign sourcing
Remarks

A measure of global vs. international banking/foreign sourcing

- No trade, foreign sourcing: $\frac{LI}{A_{ij}} \rightarrow \infty$
- International banking: $\frac{LI}{A_{ij}} = 0$
- Global banking and foreign sourcing: $\frac{LI}{A_{ij}} > 1$
- Global and international banking: $\frac{LI}{A_{ij}} < 1$
- Special case: $\frac{LI}{A_{ij}} = 1$

Allocation of capital:

- Equilibrium condition: ", $c_i + 1 + r_i = c_2 + 1 + r_j$"
- Country with efficiency advantage has higher interest rate and exports more capital than MPK equalization prescribes
- Banking sector liberalization leads to capital outflow of the financially underdeveloped country
Data (continued)

- **Measure of capital account liberalization:**
  - Chinn and Ito Index
  - Based on de facto measures of impediments to capital account transactions

- **Measure of banking sector liberalization:**
  - Financial Freedom Index from Heritage Foundation
  - Measures among other things barriers to foreign bank entry
  - Highly correlated with Chinn and Ito Index ($\rho = 0.58$)