Global Banks Dynamics and the International Transmission of Shocks*

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“Spanish-based Santander (...) acquired Sovereign Bank in 2009 as the springboard for its US ambitions, [establishing] 700 branches and ATMs across nine northeastern states.”

“Santander is the fourth-largest bank by deposits in Massachusetts and has 1.7 million US customers. Emilio Botin, chairman of the parent company, said last week during a visit to the United States that he hopes to see profits for the American business double in three years to $2 billion.”
We develop a **structural model of entry in the foreign banking market** to understand their role in shock transmission.

- The model is a “good description” of the foreign banking sector in the US:
  - assumptions motivated by institutional details of the sector;
  - model designed to replicate empirical patterns on the activities of foreign banking institutions in the US:
    - differences in presence, size and activities of the different entry alternatives.

- Structural model is amenable to **counterfactual analysis** to study:
  - the risk implications of foreign banking;
  - the efficiency properties of regulation.
• **Empirical analysis of foreign banking:**

• **Models of Trade and FDI in the Banking Sector:**

• **To build our model:**
  – **Micro-founded Models of Banking:**
  – **Models of investment under uncertainty:**
    Dixit (1989), Fillat and Garetto (2012)
Data Description and Sources

- Regulatory reporting data filed by US domestic banks, US subsidiaries of foreign banks, and U.S. branches/agencies of foreign banks (Call Reports - FFIEC 002, 031,041)

- Foreign owned institutions:
  - U.S. branches and agencies of foreign banks, and
  - U.S. banks of which more than 25% is owned by a foreign banking organization or where the relationship is reported as being a controlling relationship.

- Data on foreign parents (Europe and Asia)
  - SNL

How do Foreign Banks Enter the US Market?

- **Subsidiary Banks:**
  - 43 banks, total assets approx $1.1tn or 7% of all bank assets;
  - subject to US regulation and capital requirements;
  - give loans and accept both wholesale and retail deposits (with deposit insurance);
  - arm’s length relationship with the parent.

- **Branches and Agencies:**
  - 235 branches and agencies, total assets approx $2.4tn, or 15.3% of all bank assets;
  - subject to US regulation but **NOT** to capital requirements;
  - give loans and accept only wholesale deposits (they cannot accept insured deposits);
  - display large intrafirm flows with the foreign parent.

- **Other:** Edge and Agreement Corporations, Representative offices and Non-depository trusts.
Foreign Banking Institutions: Total Flows

- % of Foreign C&I Loans
- % of Foreign Loans
- % of Foreign Total Assets
- % of Foreign Deposits

[Data source: Federal Reserve Board of Governors, U.S. Share Data for U.S. Offices of Foreign Banking Organizations.]
### Foreign Banking Institutions: Summary Statistics

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Median</th>
<th>N. obs.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assets</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Domestic</td>
<td>1,649.91</td>
<td>33,640.07</td>
<td>147.62</td>
<td>6934</td>
</tr>
<tr>
<td>Foreign Subsidiary</td>
<td>15,270.86</td>
<td>35,613.84</td>
<td>1,314.64</td>
<td>64</td>
</tr>
<tr>
<td>Foreign Branch</td>
<td>8,892.19</td>
<td>19,548.42</td>
<td>803.33</td>
<td>215</td>
</tr>
<tr>
<td><strong>Deposits</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Domestic</td>
<td>1,160.49</td>
<td>23,003.66</td>
<td>123.82</td>
<td>6934</td>
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<tr>
<td>Foreign Subsidiary</td>
<td>11,006.95</td>
<td>26,373.87</td>
<td>985.61</td>
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<tr>
<td>Foreign Branch</td>
<td>5026.401</td>
<td>11990.65</td>
<td>299.34</td>
<td>215</td>
</tr>
<tr>
<td><strong>Loans</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Domestic</td>
<td>940.6878</td>
<td>16038.81</td>
<td>93.389</td>
<td>6934</td>
</tr>
<tr>
<td>Foreign Subsidiary</td>
<td>8092.347</td>
<td>17701.04</td>
<td>748.5415</td>
<td>64</td>
</tr>
<tr>
<td>Foreign Branch</td>
<td>2215.568</td>
<td>5411.098</td>
<td>345.288</td>
<td>215</td>
</tr>
</tbody>
</table>

Size Differences: Assets

Average Assets

⇒ Size distributions
Intra-firm Flows between Branches and Parents

- Introduction
- Data
- Relevance
- Size
- Intra-firm
- Portfolio Composition
- Selection
- Summary
- Model
- Calibration
- Conclusions

The chart illustrates the net due to and from intra-firm flows over time from 1995q1 to 2013q1. The y-axis represents the net dollar amount, while the x-axis shows the time periods. The chart includes a legend indicating net due to in blue and net due from in red.
Portfolio Composition: Loans-to-Assets Ratio

Loans / Assets

- 1995q4
- 1997q4
- 1999q4
- 2001q4
- 2003q4
- 2005q4
- 2007q4
- 2009q4

- foreign-branch
- foreign-subsidiary
- domestic bank
Comparison of foreign national banks vs. foreign parents of U.S.-based subsidiaries and branches.
**Size of Domestic versus Foreign Assets.** Relationship between the share of U.S. assets (in a parent’s total assets) versus the parent’s size. Source: SNL data for top tier parents of U.S. branches and subsidiaries from Europe, 2013.
Stylized Facts

- Foreign banking in the US is a **large** phenomenon.
- Foreign banks are **larger** than domestic incumbents.
- **Global** banks are larger than non-global banks: evidence of **selection**.
- **Subsidiaries of foreign banks** are larger than **foreign branches**, and more similar to the domestic incumbents in their activities.
- Foreign **branches** appear to be a **source of funding** to their parents during most of the sample (pre-2011)

A good structural model of foreign banking must be

- consistent with these facts
- be able to answer the question of why and how banks expand
- explain what risks international expansion poses to them and the system.
- allow us to run counterfactuals and help design optimal regulatory policies
The Environment of the Model

- Two countries, Home and Foreign (denoted by *).
- Time is continuous.
- Each country is populated by a large mass of national banks:
  - each bank offers one-period loans ($L$), makes investments ($I$) and accepts deposits ($D$);
  - each bank has some market power in the loans market (start with monopolistic competition to rule out strategic considerations).
- Study the decision of banks from the Home country to enter the Foreign country:
  - each bank enters if it can make positive profits in the Foreign country;
  - the rationale for entry is given by differentiation (spatial or product);
  - a bank can enter a market either as a branch or as a subsidiary.
The Environment of the Model (contd.)

- Banks are heterogeneous in their ability $a$ of managing loans, investments and deposits:
  - Each bank has management costs $a \cdot C(D, L, I)$, where $C(D, L, I)$ is a convex function;
  - When a bank enters the Foreign market, it transfers his efficiency $a$ to the subsidiary or branch.

- There are sunk costs of entry, depending on the organizational form of the foreign affiliate: $F_s > F_b > 0$.

- Loans and investments are risky (on aggregate)

- Subsidiaries pay deposit insurance $f_p$

↓

The solution of the optimal entry problem is a **bank-specific policy function** that determines a bank’s entry decision and mode of entry as a function of bank-level characteristics and aggregate variables (aggregate loan demand and return on investments).
Why THIS model?

- Broader research agenda on the risk implications of foreign activities, building on Fillat and Garetto (2012), Fillat, Garetto and Oldenski (2014):
  - aggregate, country-specific shocks and sunk costs of entry generate hysteresis in firms’ decisions;
  - entry after a series of positive shocks may not be followed by exit when shocks revert (Dixit 1989, Baldwin and Krugman 1989);
  - possible “optimal losses” are a source of risk to the firm.

- This model:
  - allows us to quantify the risk arising from banks’ foreign activities associated with different kinds of shocks;
  - can be used to perform counterfactual exercises where we modify institutional features of the sector and evaluate their consequences for risk exposure.
What the model does not do (yet)

- Address information asymmetries
  - the Monti-Klein bank is a technology to transform deposits into loans
- Liquidity issues
  - branches play a liquidity provision role in reality
  - business decision vs. productivity driven
  - there is no maturity mismatch
- Cross border banking
  - banks do not lend across borders (i.e., FDI vs. exports)
- Drivers of aggregate shocks in the banking sector.
**Intra-temporal Problem: National Banks**

Determine the optimal per-period profits of a bank given its foreign status.

- A national bank chooses the optimal amounts of loans $L$, deposits $D$, investment $I$, interbank borrowing $M$, to maximize its profits $\pi_N$:

\[
\max_{L,I,D,M} \pi_N = \text{pr}_L(L) \cdot L - (1 - p)L + \bar{r}_I I - r_D D - r_M M - ... \\
\text{s.t. } M + D + \bar{E} = L + I \quad \text{(resource constraint)} \\
\frac{\bar{E}}{\omega_L L + \omega_I I} \geq k \quad \text{(capital requirement)}.
\]

where $p$ is the probability of loan repayment, $f_p$ is the deposit insurance premium, $k$ is the capital requirement, and $\omega_L, \omega_I$ are weights. $r_L(L)$ is a downward-sloping demand for loans, while $\bar{r}_I, r_D, r_M$, and initial equity are taken as given by the bank.
Intra-temporal Problem: Parent + Foreign Sub Pair

In a parent + subsidiary pair, the profit maximization problem of the parent in the home country is identical to the problem of a national bank. The foreign subsidiary is operated as an independent entity to maximize its profits $\pi_S$:

$$\max_{L^*, I^*, D^*, M^*} \pi_S = \underbrace{pr_L^*(L^*) \cdot L^* - (1 - p)L^* + \bar{r}_I I^* - r_D D^* - ...}_{\text{resource constraint}}$$

$$r_M M^* - aC(D^*, L^*, I^*) - f_p \cdot D^* - F_S$$

s.t. $M^* + D^* + \bar{E}^* = L^* + I^*$ (resource constraint)

$$\frac{\bar{E}^*}{\omega_L L^* + \omega_I I^*} \geq k$$ (capital requirement).
Intra-temporal Problem: Parent + Foreign Branch Pair

- Due to the possibility of internal transfers between a parent and a foreign branch, we solve their problems jointly.

\[
\max_{L, I, D, M, L^*, I^*, D^*, M^*, T} \quad pr_L(L) \cdot L - (1 - p)L + \tilde{r}_I I - r_D D - r_M M - ...
\]
\[
aC'(D, L, I) - f_p \cdot D + ...
\]
\[
pr_L^*(L^*) \cdot L^* - (1 - p)L^* + \tilde{r}_I^* I^* - r_D^* D^* - ...
\]
\[
r_M^* M^* - aC'(D^*, L^*, I^*) - F_B
\]
\[
s.t. \quad M + D + E + T = L + I \quad \text{(parent’s resource constraint)}
\]
\[
M^* + D^* = L^* + I^* + T \quad \text{(branch’s resource constraint)}
\]
\[
\frac{E}{\omega_L L + \omega_I I + \omega_L^* L^* + \omega_I^* I^*} \geq k \quad \text{(BHC capital req.)}
\]

where \( T \) denotes the intrafirm transfer (\( T > 0 \) when the branch is lending to the parent), and \( r_D^w \) denotes the interest rate on wholesale deposits.
First Order Conditions

Domestic Bank - Subsidiary (same with *)

\[ [D] : r_M = r_D + a \frac{\partial C}{\partial D} + f_p \]

\[ [L] : p(r'_L(L)L + r(L)) = (1 - p) + a \frac{\partial C}{\partial L} + r_M(1 - k\omega_L) \]

\[ [I] : r_I = a \frac{\partial C}{\partial I} + r_M(1 - k\omega_I) \]

BHC with Branch (domestic vars. same as above)

\[ [D^*] : r^*_M = r^*_{WD} + a \frac{\partial C}{\partial D^*} \]

\[ [L^*] : p^*(r'^*_L(L^*)L^* + r^*(L^*)) = (1 - p^*) + a \frac{\partial C}{\partial L^*} + r^*_M - r_M k\omega_L \]

\[ [I] : r^*_I = a \frac{\partial C}{\partial I^*} + r^*_M - r_M k\omega_I \]
Intra-temporal Problem: Matching Cross-Sectional Facts

Two key assumptions needed:

1. $F_S > F_B$;
2. $r_D^w > r_D + f_p$.

- fixed costs and monopolistic competition ⇒ foreign branches and subsidiaries are larger (on average) than the incumbent firms;
- assumption 2 ⇒ branches have higher MC of deposits than subsidiaries ⇒ subsidiaries are larger than branches in the deposits market;
- branches have higher MC than subsidiaries in all markets, but lower sunk costs (assumption 1), ⇒ selection of less efficient, smaller (more efficient, larger) banks into branches (subsidies);
- the model generates intrafirm transfers between parents and branches.
Two key assumptions needed:

1. $F_S > F_B$;
2. $r^w_D > r_D + f_p$.

- **fixed costs and monopolistic competition** ⇒ foreign branches and subsidiaries are **larger** (on average) than the incumbent firms;
- assumption 2 ⇒ branches have **higher MC of deposits** than subsidiaries ⇒ subsidiaries are larger than branches in the deposits market;
- branches have **higher MC** than subsidiaries **in all markets**, but lower sunk costs (assumption 1), ⇒ **selection** of less efficient, smaller (more efficient, larger) banks into branches (subsidiaries);
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## Calibration

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Definition</th>
<th>Value</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>$p$</td>
<td>prob. of loan repayment</td>
<td>0.96</td>
<td>World Bank</td>
</tr>
<tr>
<td>$\eta$</td>
<td>elasticity of loan demand</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>$\beta_L, \beta_I, \beta_D$</td>
<td>param. of cost function</td>
<td>0.001, 0.0035, 0.0001</td>
<td></td>
</tr>
<tr>
<td>$k$</td>
<td>capital requirement</td>
<td>(0.04, 0.08)</td>
<td>Basel II/III</td>
</tr>
<tr>
<td>$\omega_L, \omega_I$</td>
<td>weights for RWA</td>
<td>(0.2, 0.8)</td>
<td></td>
</tr>
<tr>
<td>$f_p$</td>
<td>insurance premium</td>
<td>(0.005, 0.035)</td>
<td>FDIC</td>
</tr>
<tr>
<td>$F_S, F_B$</td>
<td>sunk entry costs</td>
<td>(180, 140)</td>
<td></td>
</tr>
</tbody>
</table>

### Rates

<table>
<thead>
<tr>
<th>Rate</th>
<th>Definition</th>
<th>Value</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>$r_I$</td>
<td>av. return on investment</td>
<td>0.009</td>
<td>treasuries</td>
</tr>
<tr>
<td>$r_D$</td>
<td>int. rate on retail deposits</td>
<td>0.0025</td>
<td>one-year CD</td>
</tr>
<tr>
<td>$r_D^w$</td>
<td>int. rate on whol. deposits</td>
<td>0.006</td>
<td>LIBOR</td>
</tr>
</tbody>
</table>
Numerical example: Funding shock

Implications of the calibration:
- branches are 25% more abundant than subs
- loans larger by 6%
- deposits 3.66 times larger.
- foreign branches borrow 3 times more than subs in the interbank market, then transfer funds to parent
- average intrabank branch transfer 78% larger than branch loans

Funding shock: \( r_D = 0.80 \) (from 0.25) and interbank market shock \( r_M^* = 1.1 \) (from 1.0)
Baseline \( r_D = 0.25, r_D^* = 0.25, r_M = 1.10, r_M^* = 1.00, r_{Dw} = 0.6 \)

<table>
<thead>
<tr>
<th>Params. (in bps)</th>
<th>( n_S/n_B )</th>
<th>( L_S/L_B )</th>
<th>( D_S/D_B )</th>
<th>( M_S/M_B )</th>
<th>( T_B/L_B )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( r_D = 0.25, r_D^* = 0.25, r_M = 1.10, r_M^* = 1.00 )</td>
<td>0.81</td>
<td>1.06</td>
<td>3.66</td>
<td>0.34</td>
<td>1.78</td>
</tr>
<tr>
<td>( r_D = 0.80, r_D^* = 0.25, r_M = 1.10, r_M^* = 1.00 )</td>
<td>0.09</td>
<td>1.06</td>
<td>2.76</td>
<td>0.23</td>
<td>2.13</td>
</tr>
<tr>
<td>( r_D = 0.25, r_D^* = 0.80, r_M = 1.10, r_M^* = 1.00 )</td>
<td>0.00</td>
<td>NaN</td>
<td>NaN</td>
<td>NaN</td>
<td>1.43</td>
</tr>
<tr>
<td>( r_D = 0.25, r_D^* = 0.80, r_M = 1.10, r_M^* = 1.10 )</td>
<td>0.00</td>
<td>NaN</td>
<td>NaN</td>
<td>NaN</td>
<td>-0.30</td>
</tr>
<tr>
<td>baseline w/ ( r_{Dw} = 0.7 )</td>
<td>6.08</td>
<td>1.00</td>
<td>3.87</td>
<td>Inf</td>
<td>-0.74</td>
</tr>
</tbody>
</table>
Conclusions

- Growing interest (and literature!) on the operations of multinational banks.
- In this paper we provide a structural model that is designed to reproduce features of the foreign banking sector, including endogeneity of entry decisions and the choice of the mode of entry.
- Funding shocks have an impact on the intensive and extensive margin of the global banks loan supply in host country.
- The model has the potential to become a laboratory to conduct policy analysis.
History of Banking Regulation

- **1927** – McFadden Act prohibits interstate banking.
- **1978** – International Banking Act:
  - brings foreign banks within the federal regulatory framework,
  - requires deposit insurance for branches of foreign banks engaged in retail deposit taking in the U.S.
- **1991** – FBSEA (Foreign Bank Supervision Enhancement Act), part of FDICIA (Federal Deposit Insurance Corporation Improvement Act):
  - eliminates deposit insurance for branches of foreign banks.
- **1994** – Riegle-Neal Interstate Banking and Branching Efficiency Act:
  - adequately capitalized and managed Bank Holding Companies (BHCs) are permitted to acquire banks in any state. The law is the same for both domestic and international banks.
Size Distributions

Cumulative Size Distribution – Deposits
Date: Q4/2010

Cumulative Size Distribution – Loans
Date: Q4/2010

Cumulative Size Distribution – Assets
Date: Q4/2010

Source: only foreign-owned institutions
The FDIC determines the deposit insurance premium (or “assessment”) on a risk basis. A bank’s assessment is calculated by multiplying its assessment rate $AR$ by its assessment base, where a bank’s assessment base is equal to its average consolidated total assets minus its average tangible equity.\footnote{Definition from the Dodd-Frank Act.}

Hence the total premium $F_p$ is given by:

$$F_p = AR \cdot (L + I - \mathbb{1}_{M<0} M - E) \approx f_p \cdot D$$

where the parameter $f_p$ is given by the assessment rate:

<table>
<thead>
<tr>
<th>Assessment Rate (pct. points)</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5 to 9</td>
<td>14</td>
<td>23</td>
<td>35</td>
<td>5 to 35</td>
</tr>
</tbody>
</table>
Regress log rank on log size ⇒ \( \vartheta / \eta = .5 \).