Global Bank Lending and Exchange Rates

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Disclaimer: The views expressed in this paper are those of the authors and do not necessarily represent those of the Bank for International Settlements (BIS).
Motivation

Nexus between capital flows and exchange rates

• Global banks play a vital role in channeling global portfolio flows

• Global banks are also active in a key segment of global flows: cross-currency lending
  ■ Role of intermediaries in FX markets (Gabaix & Maggiori (2015))
  ■ Inelastic markets hypothesis (Gabaix & Koijen (2021a)):
    Asset prices react to shifts in quantities (“flows”)
Motivation

Nexus between capital flows and exchange rates

- Global banks play a vital role in channeling global portfolio flows
- Global banks are also active in a key segment of global flows: cross-currency lending
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  - Inelastic markets hypothesis (Gabaix & Koijen (2021a)):
    Asset prices react to shifts in quantities (“flows”)

→ How do cross-currency loan flows affect exchange rates?
  - What shapes the elasticity of exchange rates w.r.t. flows?
  - How do shifts in cross-currency lending affect funding market conditions?
What we do in this paper ...

What we do:

- Conceptual framework for cross-currency loan flows and exchange rates
- Estimate empirically how cross-currency lending impacts exchange rates

Basic idea/ mechanism:

→ when a foreign bank grants a USD loan, it needs to acquire USD liquidity
→ puts pressure on exchange rates and short-term funding markets

Deploying a GIV instrument to gauge:

- Exchange rate elasticity with respect to cross-currency loan flows
- Impact of loan flows on conditions in USD funding markets
Global syndicated USD bank lending between 2001-2021

- Non-US bank → US borrower
- US bank → non-US borrower
- non-US bank → non-US borrower
Preview of main findings

1. Exchange rate responds to cross-currency lending flows
   → Net USD lending by foreign banks ↑ → USD appreciates

2. Tightness in USD funding and intermediation constraints affect the exchange rate response
   → Appreciation more pronounced when USD funding more constrained

3. Net USD lending by foreign banks adds to pressure in USD funding markets
   → CIP deviations tend to widen
Overview of related literature (non-exhaustive)

Impact of imbalances and intermediation constraints for exchange rates: e.g.,
Gabaix & Maggiori (2015)


Methodology: e.g., Gabaix & Kojien (2021a), Gabaix & Kojien (2021b), Shen & Zhang (2022), Camanho, Hau & Rey (2022)
Institutional background

- Non-US banks regularly originate USD denominated loans
- Popular funding sources:
  - Use local currency funding + FX swap
  - USD wholesale funding
- Exchange of home currency liquidity for USD liquidity
- Liquidity needed shortly after loan origination
- Need to roll over the (FX swap) funding (unless loan is sold or has matured)
Funding mechanism for USD loans originated by foreign banks

Non-US Global Bank

EUR depositors

FX swap

FX market

EUR liquidity pool

EUR deposit

USD liquidity pool

USD loan payment

USD client
Generalization of Ivashina, Scharfstein & Stein (2015):

- Static model with two time periods
- Two players: EUR bank and globally active dealer
  - EUR bank:
    - decides on lending in EUR or USD
    - USD loan funding either via FX swaps, or USD wholesale market
  - Dealer:
    - offers funding via FX swaps at increasing (balance sheet) cost of doing so

Details on model equations
1. Increased USD lending by foreign banks → USD appreciation
   → Positive exchange rate elasticity

2. When it is more costly for the dealer to provide swaps, the exchange rate elasticity is higher

3. For higher USD wholesale funding rates, the USD appreciates by more

4. When the foreign bank increases loan supply, the CIP deviation widens
   → foreign bank USD lending leads to tighter USD funding conditions
Data overview

- Syndicated loan data: Refinitiv DealScan

- Combine with other data sources:
  - CP/CD issuance volume: Refinitiv Eikon
  - Global cross-border banking statistics: BIS CBS/LBS
  - FFIEC call reports

- 223 internationally operative banks o/w 209 domiciled outside the US
- Banks from 14 different countries for the time period 1997-01 to 2021-12
- Around 30,000 non-US borrowers and 16,000 US borrowers

▶ Summary statistics
Measuring cross-currency lending flows

⇒ Look at changes in **USD loan originations by foreign banks** relative to changes in loan originations in currency $c$ by **US banks**

$$\Delta NCCL_{c,t} = \underbrace{\Delta \log(\text{loans}_{c,t}^{\text{USD}})}_{\text{Change in outstanding USD lending of foreign banks}} - \underbrace{\Delta \log(\text{loans}_{US,t}^{c})}_{\text{Change in outstanding foreign currency lending of US banks}}$$

- **NCCL$_{c,t}$↑** → relative increase in USD lending by foreign banks vs foreign currency lending by US peers ...
We estimate the two-step procedure:

1st-stage:

$$\Delta NCCL_{c,t} = \theta \ z_{c,t} + \text{Controls}_{c,t} + \epsilon_{c,t}$$

2nd-stage:

$$\Delta s_{c,t} = \phi \ \Delta NCCL_{c,t} + \text{Controls}_{c,t} + \theta_{c,t},$$

- Elasticity $\phi$: effect of net cross-currency lending on the exchange rate
- S: FCU/USD $\rightarrow$ higher S: USD appreciation
Estimation of the effect of loan flows on exchange rates

**Simultaneity bias** in regression of loan flows on exchange rate changes

→ **Solution:** Gabaix & Koijen (2021b) Granular IV (GIV) approach

- Idea: Idiosyncratic shocks to large banks affects aggregate flows more than shocks to smaller banks, but *not* exchange rates
**Estimation of the effect of loan flows on exchange rates**

**Simultaneity bias** in regression of loan flows on exchange rate changes

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- Idea: Idiosyncratic shocks to large banks affects aggregate flows more than shocks to smaller banks, but *not* exchange rates

**Intuition:** G-SIB suffering reputational damage

- Deposit withdrawals accelerate / counterparties cut limits
- No *direct* effect of reputational damage on FX rates
- But, bank might (have to) reduce lending
- Greater effect on loan flows the larger the bank
- GIV captures the variation in *idiosyncratic shocks*
Granular instrumental variable approach

⇒ Compute difference in volume-weighted and equally-weighted flows:

\[ \Delta_{c,t}^{\text{Inflow}} = \sum_{j \in C_c} \Delta l_{j,USD,t}^{c} \times w_{j,USD,t-1}^{c} - \frac{1}{N_{C_c}} \sum_{j \in C_c} \Delta l_{j,USD,t}^{c} \]

Volume-weighted average

Equally-weighted average

\(\Delta l_{j,USD,t}^{c}\): change in the outst. originated USD loans of bank \(j\) over month \(t\)

\(w_{j,USD,t-1}^{c}\): share of outst. USD loans in \(t - 1\) of bank \(j\) from currency area \(c\)

\(N_{C_c}\): number of foreign banks that grant USD loans
Granular instrumental variable approach

⇒ Compute difference in **volume-weighted** and **equally-weighted** flows:

\[ \Delta_{c,t}^{\text{Inflow}} = \sum_{j \in C_c} \Delta l_{j,USD,t}^c \times w_{j,USD,t-1}^c - \frac{1}{N_{C_c}} \sum_{j \in C_c} \Delta l_{j,USD,t}^c \]

- **Volume-weighted average**
- **Equally-weighted average**

\( \Delta l_{j,USD,t}^c \): change in the outst. originated USD loans of bank \( j \) over month \( t \)

\( w_{j,USD,t-1}^c \): share of outst. USD loans in \( t - 1 \) of bank \( j \) from currency area \( c \)

\( N_{C_c} \): number of foreign banks that grant USD loans

• Proceed analogously for loan outflows, and define the instrument \( z_{c,t} \):

\[ z_{c,t} = \Delta_{c,t}^{\text{Inflow}} - \Delta_{c,t}^{\text{Outflow}} \]

→ captures differential effect of large vs. small banks on aggregate loan flow
## Baseline results

<table>
<thead>
<tr>
<th>$\Delta$NCCL$_{c,t}$</th>
<th>$\Delta s_{c,t}$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>81.06</td>
</tr>
<tr>
<td></td>
<td>95.63</td>
</tr>
<tr>
<td></td>
<td><strong>72.33</strong></td>
</tr>
<tr>
<td></td>
<td>(15.09)</td>
</tr>
<tr>
<td></td>
<td>(18.77)</td>
</tr>
<tr>
<td></td>
<td><strong>(13.20)</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Observations</th>
<th>1266</th>
<th>1184</th>
<th>1184</th>
</tr>
</thead>
<tbody>
<tr>
<td>Macro-controls</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Currency FE</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Year FE</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Currency Areas</td>
<td>14</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Pseudo-$R^2$</td>
<td>0.03</td>
<td>0.07</td>
<td>0.15</td>
</tr>
</tbody>
</table>

→ 1 ppt increase in net loan flows into the USD → 72bp USD appreciation

→ 1 σ (≈ $42bn$) increase translates to a 36 bp appreciation of the USD

▶ Details on sample
The effect is much stronger post-GFC

<table>
<thead>
<tr>
<th>$\Delta NCCL_{c,t}$</th>
<th>Pre-GFC</th>
<th>Post-GFC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>18.90</td>
<td>71.95</td>
</tr>
<tr>
<td></td>
<td>(18.98)</td>
<td>(18.04)</td>
</tr>
</tbody>
</table>

- Observations: 448, 736
- Macro-controls: Yes, Yes
- Currency FE: Yes, Yes
- Year FE: Yes, Yes
- Currency Areas: 8, 14
- Pseudo-$R^2$: 0.03, 0.11

→ Rise in net cross-currency flows into USD leads to USD appreciation after GFC
Inspecting the mechanism

What shapes the exchange rate elasticity w.r.t. bank lending flows?

1. Importance of intermediary constraints
   - More constrained intermediaries charging a higher price for providing USD liquidity
     → Broker-dealer leverage  
     → More details.

2. Importance of USD funding conditions
   - Funding conditions evolving over the monetary policy cycle
   - Liquidity holdings among US banks

3. When the foreign bank increases USD loan supply, the CIP deviation widens
Exchange rate elasticity and the US monetary policy cycle

<table>
<thead>
<tr>
<th>Fed Cycle</th>
<th>Hike</th>
<th>No Change</th>
<th>Ease</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Delta s_{c,t}$</td>
<td>100.9</td>
<td>21.20</td>
<td>-22.38</td>
</tr>
<tr>
<td>$\Delta \text{NCCL}_{c,t}$</td>
<td>18.87</td>
<td>49.83</td>
<td>144.7</td>
</tr>
</tbody>
</table>

| | Observations | Currency Areas | Pseudo-$R^2$ |
| | 332 | 11 | 0.06 |
| | 629 | 13 | 0.10 |
| | 223 | 10 | 0 |

- Exchange rates react more to cross-currency loan flows when the Federal Reserve is tightening policy
- Periods when foreign banks need to compete harder for USD funding
## Exchange rate elasticity and USD funding scarcity

<table>
<thead>
<tr>
<th>( \Delta s_{c,t} )</th>
<th>Share of reserves</th>
<th>Share of loans to foreign banks</th>
<th>Reserve concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>( \Delta \text{NCCL}_{c,t} )</td>
<td>-68.43</td>
<td><strong>98.69</strong></td>
<td>-0.803</td>
</tr>
<tr>
<td></td>
<td>(50.51)</td>
<td><strong>(22.88)</strong></td>
<td>(48.34)</td>
</tr>
<tr>
<td>Observations</td>
<td>338</td>
<td>393</td>
<td>459</td>
</tr>
<tr>
<td>Currency Area</td>
<td>12</td>
<td>12</td>
<td>14</td>
</tr>
<tr>
<td>Pseudo-( R^2 )</td>
<td>0.10</td>
<td>0.09</td>
<td>0.10</td>
</tr>
</tbody>
</table>

→ When US banks have less reserves (to distribute), \( \hat{\phi} \) tends to be larger
Interim summary

So far:

• Exchange rates are affected by cross-currency loan flows (Implication 1)

• $\bar{\phi}$ greater when ...
  - ... broker-dealers face more difficulties expanding the balance sheet by deploying more leverage (Implication 2)
  - ... conditions in USD funding markets are tighter (Implication 3)

Now:

⇒ focus more directly on how cross-currency lending flows impact USD short-term funding markets

→ CIP deviations (Implication 4)

→ USD CP/CD issuance
Lending flows and the term structure of CIP deviations

- Endogeneity of lending with respect to funding conditions

→ Gabaix & Koijen (2021b) Granular IV method also suitable here

We estimate the two-step procedure:

1st-stage:

$$\Delta \text{NCCL}_{c,t} = \theta z_{c,t} + \text{Controls}_{c,t} + \varepsilon_{c,t}$$

2nd-stage:

$$\text{CIP deviation}_{n,c,t} = \psi \Delta \text{NCCL}_{c,t} + \text{Controls}_{c,t} + \vartheta_{c,t},$$

→ Elasticity $\psi$: effect of net cross-currency lending (NCCL) on CIP deviation
Rise in lending flows into USD widens CIP deviations

Increase of net cross-currency lending by one std. dev.
→ CIP deviation widens by 4.8 annualized bp for 3M maturity
→ USD funding conditions for non-US banks worsen
Impact on other segments of USD funding markets

• FX swap funding is expensive
  ■ Do banks over time substitute FX swap funding with CPs/CDs?

• USD funding market highly segmented
  ■ Which types of banks can substitute FX swap funding?
Impact on other segments of USD funding markets

- FX swap funding is expensive
  - Do banks over time substitute FX swap funding with CPs/CDs?

- USD funding market highly segmented
  - Which types of banks can substitute FX swap funding?

⇒ How does USD CP/CD issuance evolve after a pick-up in USD lending by foreign banks?

- We estimate a local linear projection

\[ \Delta \log \left( (CP+CD)_{c,r,t+i} \right) = \Delta \log (USD \text{ Lending}_{c,t}) + \text{Controls}_{c,t} + \theta_{c,t}, \]

$(CP+CD)_{c,r,t+i}$: USD CP/CD issuance volume of banks

USD Lending$_{c,t}$: Outstanding USD loans of banks

$c$: Currency area

$r$: Issuer rating
Well-rated banks increase their USD CP/CD issuance after some months
Additional tests and robustness

1. “Lending Tightness” as an alternative instrument
   ▶ Details on results

2. Spot and forward exchange rates
   ▶ Details on results

3. Banking systems with USD deficit exhibit larger response
   ▶ Details on results
Conclusion

• Cross-currency lending flows significantly move exchange rates
  - Primarily so after the GFC (characterised by structural shifts in funding markets and banking regulation)

• When a foreign bank issues a USD loan, it needs to source USD liquidity
  ⇒ Puts pressure on USD funding markets
  ⇒ Leads to an exchange rate appreciation

• International spillover effects of monetary policy may be magnified by the cross-currency lending activities of global banks
Appendix
Maximization Problem I

Bank:

\[
\max_{L^D, L^E, D^S} \left\{ \begin{array}{l}
S^{E/D} \left[ g \left(L^D\right) - \left(L^D - D^S\right)(1 + r^S) \right] - p^S D^S \\
+ h \left(L^E\right) - \left(L^E + D^S\right)(1 + r^E) - \frac{\phi}{2} \max \left(0, L^E + D^S - \bar{D}\right)^2
\end{array} \right\}
\]

\begin{align*}
\text{Proceeds from lending in USD} & \quad \text{Cost of USD swap} \\
\text{Proceeds from EUR lending} & \quad \text{Cost of raising additional deposits}
\end{align*}

s.t. \( K - S^{E/D} L^D - L^E \geq c. \)

\( L^D: \) USD denominated loans, \( L^E: \) EUR denominated loans, \( D^S: \) Deposits used for swap
Dealer’s objective function:

\[
\max_{I^S} f(W - (1 + \Gamma)I^S) + p^S I^S,
\]

where \( f(x) = \theta \log(x) - x \)

\( I^S \): Supply of swaps
Table: Global syndicated lending differentiated by borrower and lender origin

<table>
<thead>
<tr>
<th>Category</th>
<th>Obs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual Loans</td>
<td>83,563</td>
</tr>
<tr>
<td>Individual Tranches</td>
<td>131,509</td>
</tr>
<tr>
<td>Borrower-Lender-Loan connections</td>
<td>1,284,863</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>USD loans</th>
<th>to US borrowers</th>
<th>to non-US borrowers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obs.</td>
<td>Countries</td>
<td>Obs.</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>-----------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Lending Parent Banks</td>
<td>209</td>
<td>31</td>
</tr>
<tr>
<td>Borrowers</td>
<td>16,289</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tranche Term</td>
<td>4.21</td>
<td>2.05</td>
<td>4.90</td>
<td>3.43</td>
</tr>
<tr>
<td>Ind. USD Loan size (mn)</td>
<td>54.97</td>
<td>176.08</td>
<td>66.33</td>
<td>2,047.38</td>
</tr>
</tbody>
</table>
• Final sample consists of banks headquartered in Australia, Canada, China, Denmark, the Euro Area, Great Britain, Japan, Mexico, Norway, Singapore, South Africa, South Korea, Sweden, Switzerland, and the US.

• 223 internationally operative banks, of which 209 are domiciled outside the US

• We exclude
  - public banks
  - small and locally-oriented banks

• All issued term loans and credit lines from Refinitiv LPC DealScan for the time period 1997-01 to 2021-12
<table>
<thead>
<tr>
<th>Measure Level</th>
<th>Leverage Ratio</th>
<th>Leverage Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>$\Delta NCCL_{c,t}$</td>
<td>78.29</td>
<td>-35.31</td>
</tr>
<tr>
<td></td>
<td>(25.65)</td>
<td>(76.72)</td>
</tr>
</tbody>
</table>

- Observations: 774, 410
- Macro-controls: Yes, Yes
- Currency FE: Yes, Yes
- Year FE: Yes, Yes
- Currency Areas: 12, 13
- Pseudo-$R^2$: 0.04, 0.06

$\rightarrow$ Effect is stronger, when broker-dealers exhibit below average leverage.
Non-US bank USD loans and local USD liabilities:

(a) Euro Area banks

(b) British banks

→ Cross-border bank lending increased greatly
→ Funding gap intensified
When the Fed hikes interest rates, exchange rates react more to loan flows. High funding market stress leads to higher exchange rate elasticity.
### Accounting for Cross-Country Funding Differences

<table>
<thead>
<tr>
<th>Banking system with $\Delta_{NCCL_{c,t}}$</th>
<th>$\Delta s_{c,t}$</th>
<th>Net USD surplus</th>
<th>Net USD deficit</th>
<th>Interaction Term</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>73.00</td>
<td>82.08</td>
<td>0.175</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(64.46)</td>
<td>(18.44)</td>
<td>(0.0891)</td>
</tr>
<tr>
<td>Observations</td>
<td>487</td>
<td>555</td>
<td>1042</td>
<td></td>
</tr>
<tr>
<td>Year FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Currency Areas</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Pseudo-$R^2$</td>
<td>0.110</td>
<td>0.100</td>
<td>0.180</td>
<td></td>
</tr>
</tbody>
</table>

→ Stronger effect for currency areas that exhibit **negative net USD claims**
• An instrument needs to affect lending, but not exchange rates

• Potential candidate: Proxy for “lending tightness”.

→ **EBA capital exercise** as a quasi-natural experiment

• Differential effect of European banks compared to Canada and UK
Lending Tightness as an Alternative Instrument

• An instrument needs to affect lending, but not exchange rates

• Potential candidate: Proxy for “lending tightness”.

→ EBA capital exercise as a quasi-natural experiment

• Differential effect of European banks compared to Canada and UK

Definition:

Lending tightness\(_{c,t} = \text{lending conditions}_{c,t-3} \times \text{Tier 1 capital}_{c,t} \times \mathbb{1}_{EBA}^{c,t}\)

Interaction of

• (Expected) lending demand conditions of banks (higher value = worse)

• Average Tier 1 capital holdings of banks

• Binary variable indicating European banks
**Tighter Lending Conditions Lead to USD Appreciation**

<table>
<thead>
<tr>
<th>First Stage</th>
<th>Second Stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Delta \text{NCCL}_{c,t}$</td>
<td>$\Delta s_{c,t}$</td>
</tr>
<tr>
<td>Lending tightness</td>
<td>-0.013</td>
</tr>
<tr>
<td></td>
<td>(0.004)</td>
</tr>
<tr>
<td>$\Delta \text{NCCL}_{c,t}$</td>
<td></td>
</tr>
</tbody>
</table>

- Observations: 93 93
- Currency Areas: 3 3

F-test: 12.04  Pseudo – $R^2$: 0.136

→ More loan flows into the USD lead to USD appreciation

**But:** Few countries and small time horizon (2011/06 to 2013/12)
### Elasticity of Spot Rate, Forward Rate and Forward Points

<table>
<thead>
<tr>
<th>ΔNCCL_{c,t}</th>
<th>Spot rate</th>
<th>Forward rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>72.33</td>
<td>52.37</td>
</tr>
<tr>
<td></td>
<td>(13.20)</td>
<td>(8.677)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Observations</th>
<th>1184</th>
<th>1038</th>
</tr>
</thead>
<tbody>
<tr>
<td>Currency Areas</td>
<td>14</td>
<td>13</td>
</tr>
<tr>
<td>Pseudo-(R^2)</td>
<td>0.15</td>
<td>0.11</td>
</tr>
</tbody>
</table>

→ Results hold for forward rate as well
References


