Global Bank Lending and Exchange Rates

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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")

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→ **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:

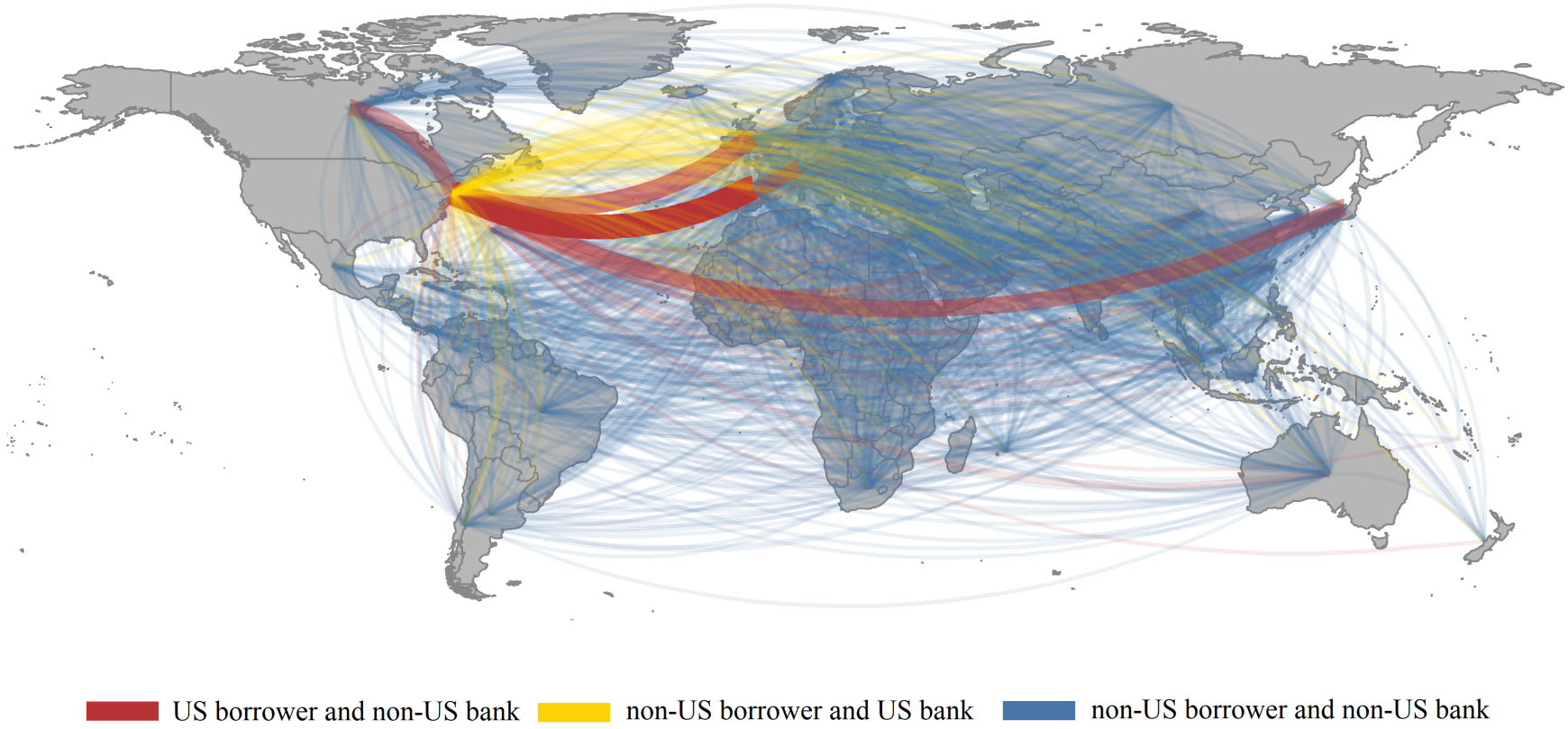
→ when a foreign bank grants a USD loan, it needs to acquire USD liquidity

→ 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)

Frictions in international funding markets: e.g., Avdjiev, Du, Koch & Shin (2019), Rime, Schrimpf & Syrstad (2022), Du, Tepper & Verdelhan (2018b), Correa, Du & Liao (2020)

Cross-border bank flows and economic outcomes: e.g., Bruno & Shin (2015), Buch, Bussierè, Goldberg & Hills (2019), Adrian & Xie (2020), Buch & Goldberg (2020), Bräuning & Ivashina (2020), Meisenzahl, Niepmann & Schmidt-Eisenlohr (2020), Shen & Zhang (2022), Correa, Paligorova, Sapriza & Zlate (2022), Niepmann & Schmidt-Eisenlohr (2023)

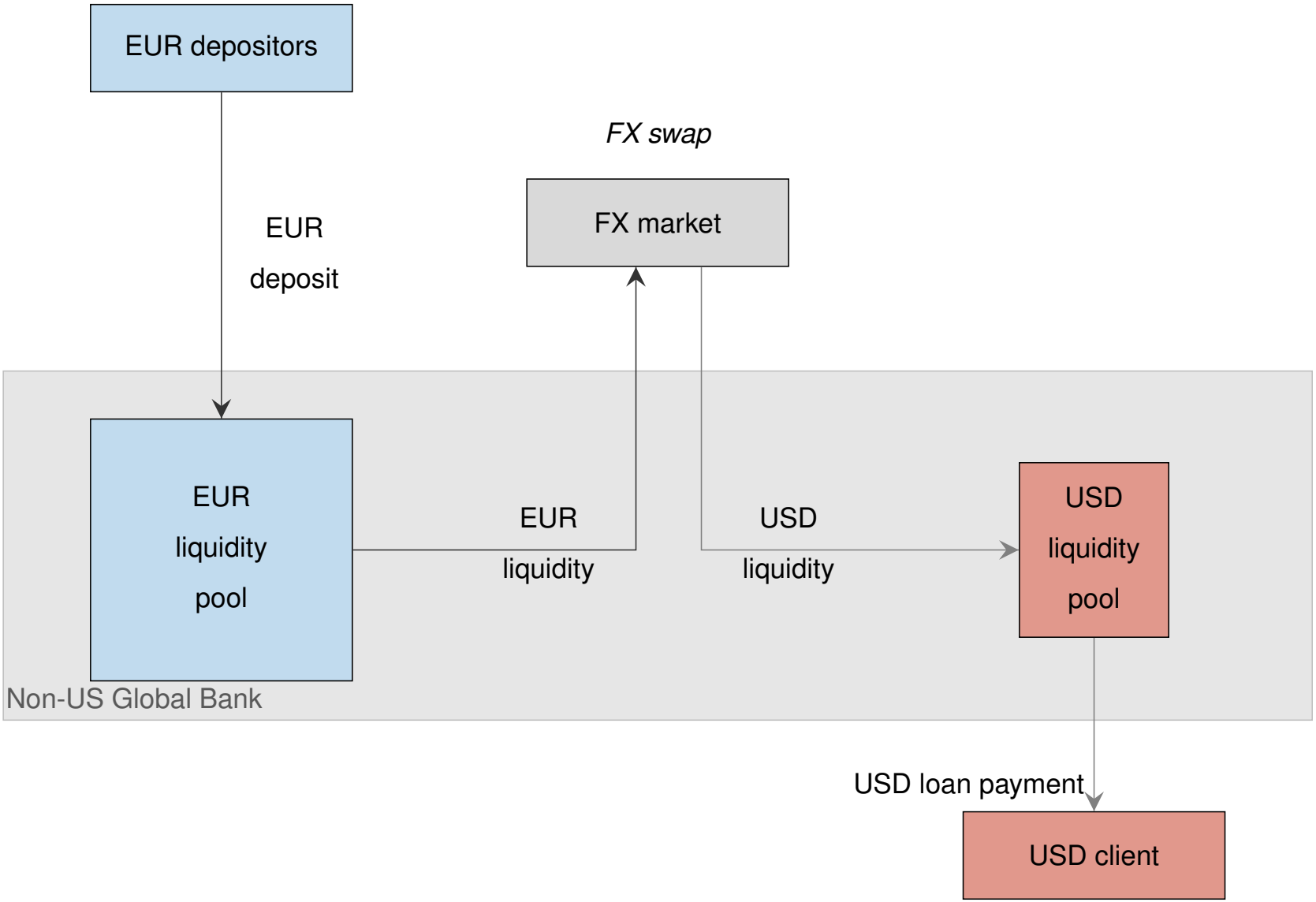
Global bank USD funding: e.g., Aldasoro & Ehlers (2018), Aldasoro, Ehlers, McGuire & von Peter (2020), Aldasoro, Ehlers & Eren (2022a), Anderson, Du & Schlusche (2021)

Methodology: e.g., Gabaix & Koijen (2021a), Gabaix & Koijen (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



Conceptual motivation

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

Implications

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

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

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

- $\text{NCCL}_{c,t} \uparrow \rightarrow$ relative increase in USD lending by foreign banks vs foreign currency lending by US peers ...

Estimating the exchange rate elasticity

We estimate the two-step procedure:

1st-stage:

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

2nd-stage:

$$\Delta s_{c,t} = \phi \, \widehat{\Delta \text{NCCL}}_{c,t} + \text{Controls}_{c,t} + \vartheta_{c,t},$$

- Elasticity ϕ: 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

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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

$\Rightarrow$ Compute difference in **volume-weighted** and **equally-weighted** flows:

$$\Delta_{c,t}^{\text{Inflow}} = \underbrace{\sum_{j \in C_c} \Delta l_{j,USD,t}^{c} \times w_{j,USD,t-1}^{c}}_{\text{Volume-weighted average}} - \underbrace{\frac{1}{N_{C_c}} \sum_{j \in C_c} \Delta l_{j,USD,t}^{c}}_{\text{Equally-weighted average}}$$

$\Delta l_{j,USD,t}^{c}$: 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

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- Proceed analogously for loan outflows, and define the instrument $z_{c,t}$:

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

$\rightarrow$ captures differential effect of large vs. small banks on aggregate loan flow

Baseline results

	$\Delta s_{c,t}$		
ΔNCCL$_{c,t}$	81.06	95.63	**72.33**
	(15.09)	(18.77)	**(13.20)**
Observations	1266	1184	1184
Macro-controls	No	Yes	Yes
Currency FE	No	No	Yes
Year FE	No	No	Yes
Currency Areas	14	14	14
Pseudo-R^2	0.03	0.07	0.15

$\rightarrow$ 1 ppt increase in net loan flows into the USD $\rightarrow$ 72bp USD appreciation

$\rightarrow$ 1 σ ($\approx \$42bn$) increase translates to a 36 bp appreciation of the USD

▹ Details on sample

The effect is much stronger post-GFC

	$\Delta s_{c,t}$	
	Pre-GFC	Post-GFC
ΔNCCL$_{c,t}$	18.90	**71.95**
	(18.98)	**(18.04)**
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*

▹ Graphical illustration

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

	$\Delta s_{c,t}$		
	Fed Cycle		
	Hike	No Change	Ease
ΔNCCL$_{c,t}$	**100.9**	21.20	-22.38
	(18.87)	(49.83)	(144.7)
Observations	332	629	223
Currency Areas	11	13	10
Pseudo-R^2	0.06	0.10	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

	$\Delta s_{c,t}$					
	Share of reserves		Share of loans to foreign banks		Reserve concentration	
	High	Low	High	Low	High	Low
ΔNCCL$_{c,t}$	-68.43	**98.69**	-0.803	**134.7**	**79.63**	47.85
	(50.51)	**(22.88)**	(48.34)	**(38.17)**	**(29.88)**	(34.43)
Observations	338	393	459	277	395	341
Currency Area	12	12	14	11	13	12
Pseudo-R^2	0.10	0.09	0.10	0.07	0.11	0.07

$\rightarrow$ When US banks have less reserves (to distribute), $\widehat{\phi}$ tends to be larger

Interim summary

So far:

- Exchange rates are affected by cross-currency loan flows (Implication 1)
- $\widehat{\phi}$ 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:

$\Rightarrow$ focus more directly on how cross-currency lending flows impact **USD short-term funding markets**

$\rightarrow$ CIP deviations (Implication 4)

$\rightarrow$ 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:

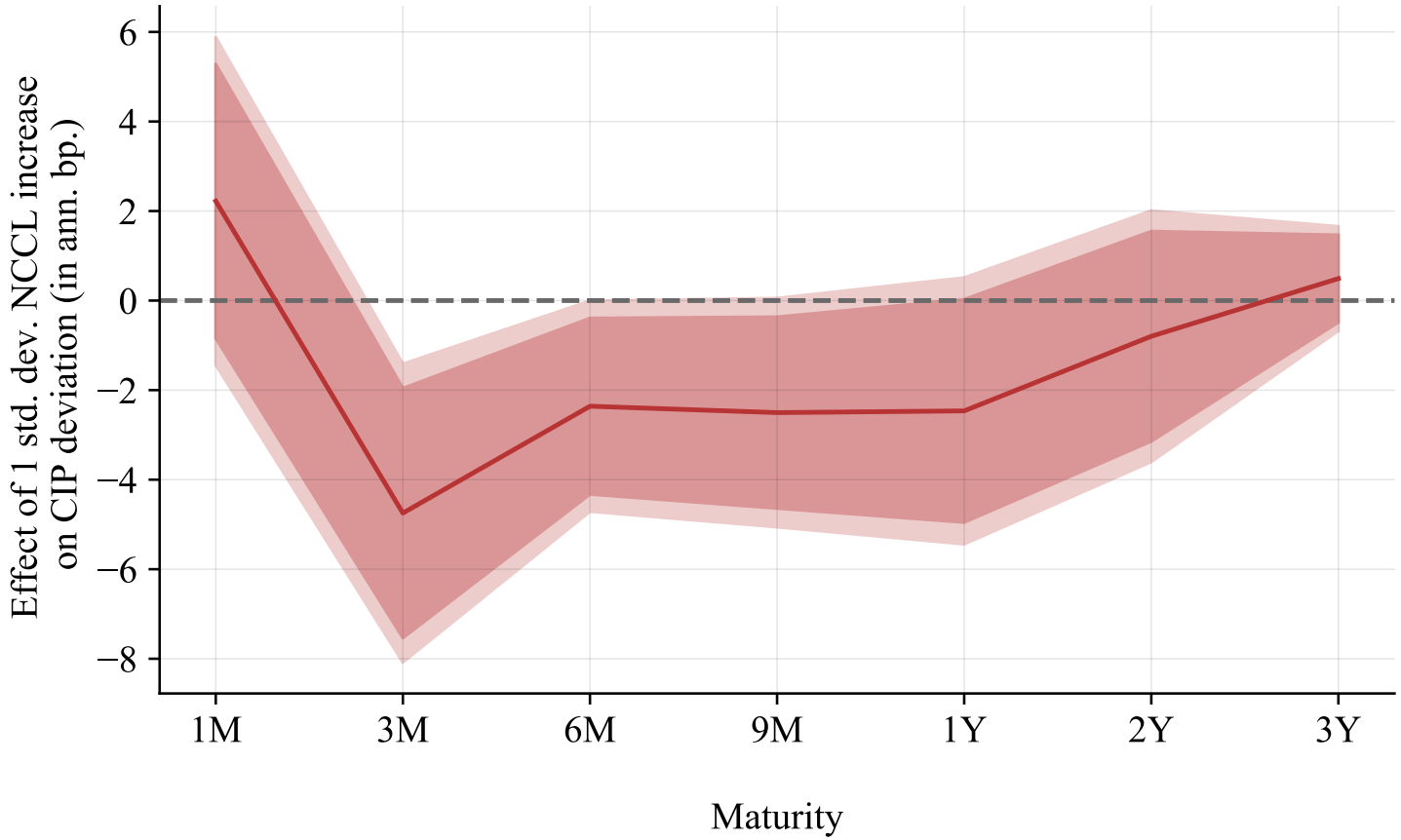
$$\Delta\text{NCCL}_{c,t} = \theta \underbrace{z_{c,t}}_{\text{GIV}} + \text{Controls}_{c,t} + \varepsilon_{c,t}$$

2nd-stage:

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

→ Elasticity ψ: 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?

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  - Which types of banks can substitute FX swap funding?

$\Rightarrow$ **How does USD CP/CD issuance evolve after a pick-up in USD lending by foreign banks?**

- We estimate a local linear projection

$$\Delta log(\text{CP+CD}_{c,r,t+i}) = \Delta log(\text{USD Lending}_{c,t}) + \text{Controls}_{c,t} + \vartheta_{c,t},$$

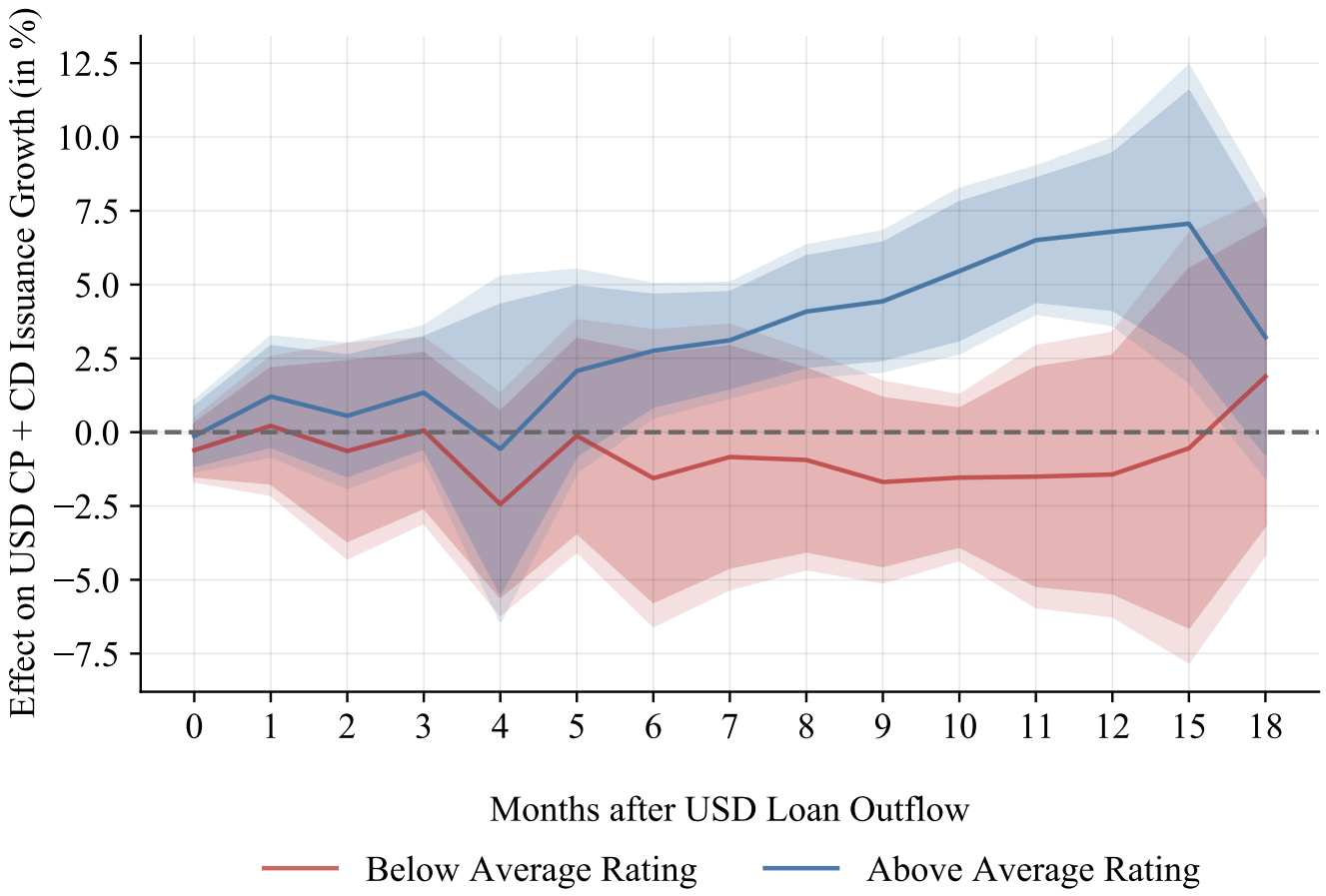
$(\text{CP+CD})_{c,r,t+i}$: USD CP/CD issuance volume of banks

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

c: Currency area

r: Issuer rating

USD CP & CD Issuance After USD Lending Outflows



→ 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

  $\Rightarrow$ Puts pressure on USD funding markets

  $\Rightarrow$ 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

▹ Back.

Bank:

$$\max_{L^D, L^E, D^S} S^{E/D} \underbrace{\left[g\left(L^D\right) - \left(L^D - D^S\right)\left(1 + r^{\$}\right) \right]}_{\text{Proceeds from lending in USD}} - \underbrace{p^S D^S}_{\text{Cost of USD swap}}$$

$$+ \underbrace{h\left(L^E\right) - \left(L^E + D^S\right)\left(1 + r^{€}\right)}_{\text{Proceeds from EUR lending}} - \underbrace{\frac{\phi}{2} \max\left(0, L^E + D^S - \bar{D}\right)^2}_{\text{Cost of raising additional deposits}},$$

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

L^D: USD denominated loans, L^E: EUR denominated loans, D^S: Deposits used for swap

Maximization Problem II

▹ Back.

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

Summary statistics

▹ Back.

Table: Global syndicated lending differentiated by borrower and lender origin

Category	Obs.			
Individual Loans	83,563			
Individual Tranches	131,509			
Borrower-Lender-Loan connections	1,284,863			
USD loans	to US borrowers		to non-US borrowers	
	Obs.	Countries	Obs.	Countries
Lending Parent Banks	209	31	222	31
Borrowers	16,289	1	29,297	165
	Mean	Std. Dev.	Mean	Std. Dev.
Tranche Term	4.21	2.05	4.90	3.43
Ind. USD Loan size (mn)	54.97	176.08	66.33	2,047.38

Sample of globally active banks ▹ Back.

- 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

Exchange Rate Elasticity and Broker-Dealer Leverage Constraints

	$\Delta s_{c,t}$	
Measure Level	Leverage Ratio Low	Leverage Ratio High
ΔNCCL$_{c,t}$	**78.29**	-35.31
	(25.65)	(76.72)
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

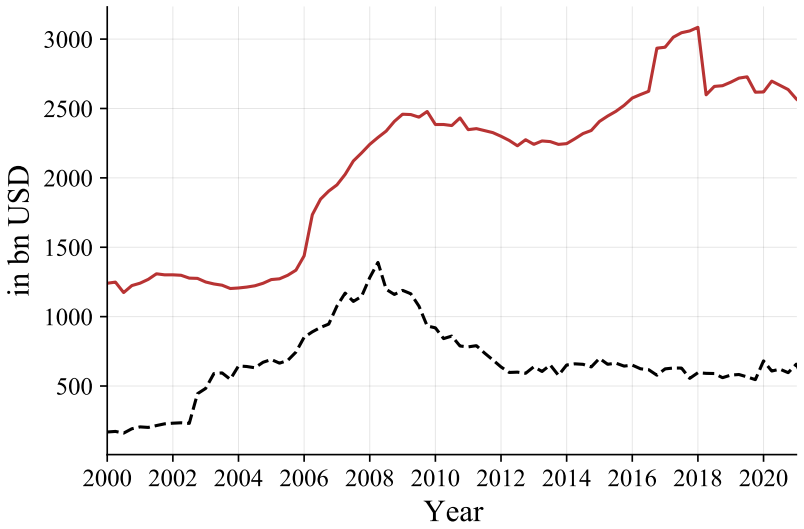
$\rightarrow$ Effect is stronger, when broker-dealers exhibit below average leverage

Post-GFC Developments - Funding Conditions

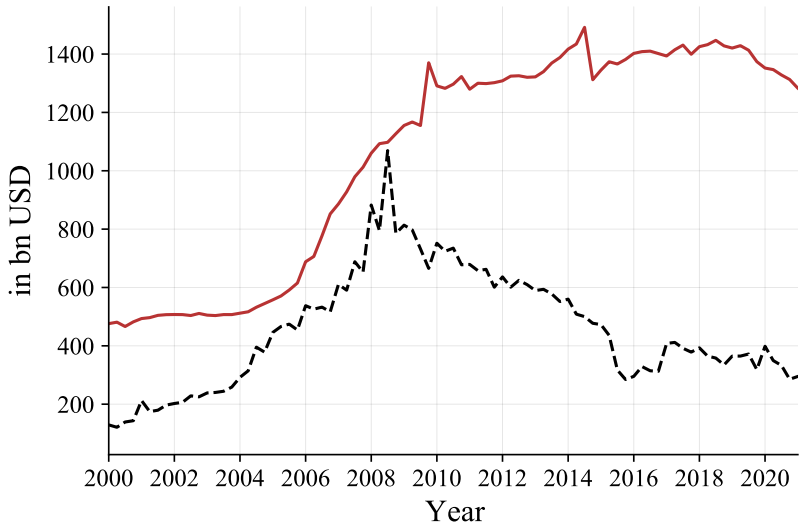
▹ Back.

Non-US bank USD loans and local USD liabilities:

(a) Euro Area banks



(b) British banks



Syndicated USD Loans Local USD liabilities in US

→ Cross-border bank lending increased greatly

→ Funding gap intensified

Exchange Rate Elasticity and US Monetary/Funding Conditions

▸ Back

	$\Delta s_{c,t}$	
	CIP deviation (3M)	
	Small	Large
ΔNCCL$_{c,t}$	33.60	**112.7**
	(53.93)	**(51.93)**
Observations	189	73
Currency Areas	7	8
Pseudo-R^2	0.02	0.05

→ When the Fed hikes interest rates, exchange rates react more to loan flows

→ High funding market stress → higher exchange rate elasticity

Accounting for Cross-Country Funding Differences

▹ Back.

	$\Delta s_{c,t}$		
Banking system with	Net USD surplus	Net USD deficit	Interaction Term
ΔNCCL$_{c,t}$	73.00	82.08	0.175
	(64.46)	(18.44)	(0.0891)
Observations	487	555	1042
Year FE	Yes	Yes	Yes
Currency Areas	4	5	6
Pseudo-R^2	0.110	0.100	0.180

→ Stronger effect for currency areas that exhibit negative net USD claims

▹ Graph on sample.

Lending Tightness as an Alternative Instrument ▹ Back.

- 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

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Definition:

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

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

▹ Back.

	First Stage	Second Stage
	$\Delta\text{NCCL}_{c,t}$	$\Delta s_{c,t}$
Lending tightness	-0.013	
	(0.004)	
$\Delta\text{NCCL}_{c,t}$		329.0
		(133.8)
Observations	93	93
Currency Areas	3	3
	F-test: 12.04	Pseudo $-R^2$: 0.136

$\rightarrow$ 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

▹ Back.

	Spot rate	Forward rate
$\Delta\text{NCCL}_{c,t}$	72.33	52.37
	(13.20)	(8.677)
Observations	1184	1038
Currency Areas	14	13
Pseudo-R^2	0.15	0.11

$\rightarrow$ Results hold for forward rate as well

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