Granular Banking Flows and Exchange-Rate Dynamics

HKIMR, AMRO, ECB, ESM and BOFIT Workshop on

'Recent Developments and Future Prospects for the International Monetary System'

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This Paper: Motivation and Questions

- **FX Puzzles**: ‘disconnect’ between exchange rates and macro fundamentals
- **Causality**: long-standing challenge identifying exogenous variation in cross-border flows

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- **Identification**: extract exogenous idiosyncratic cross-border banking flows through novel Granular Instrumental Variables (GIVs)

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Our Questions

- **What is the causal effect of cross-border capital flows on USD exchange rate?**
- **How inelastic is the relationship between FX and the supply and demand for USDs?**
- **What role do banks’ constraints play?**

This Paper: Contributions

- Document **novel facts** on banks' cross-border positions in UK, world's largest IFC
  - UK-resident banks account for $\sim 18\%$ of all cross-border banking claims (1997Q1-2019Q3)
  - Pareto principle: $\sim 20\%$ of banks explain $\sim 80\%$ of USD-denominated positions

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- Present **new model** of international flows with financial frictions and heterogeneous banks
  - Heterogeneous risk-taking capacity across global banks
  - Bank-specific and time-varying beliefs about returns to different assets

$\Rightarrow$ Large banks play **bigger role** in exchange-rate determination

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- Use model-consistent GIV as exogenous variation to provide **new empirical insights**
  - 1% $\uparrow$ external *net* USD-debt $\Rightarrow$ persistent $\sim 2\%$ USD/GBP appreciation
  - *State dependence*: effects twice as large when banks' capital ratios are 1 s.d. below average

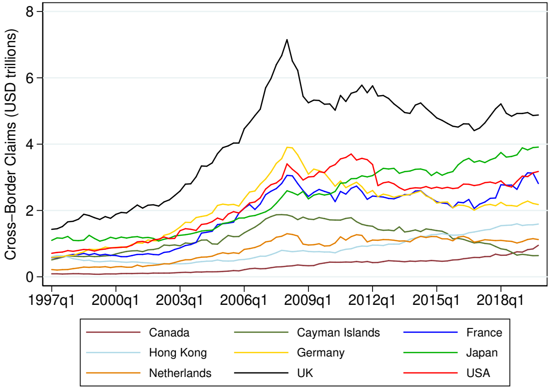
$\Rightarrow$ UK-resident banks' USD-demand **inelastic**, in part linked to their risk-bearing capacity

Our Data

Documenting Granularity

UK an International Financial Centre (IFC)

Cross-border banking claims by origin country



Source: BIS Locational Banking Statistics

- **World's biggest IFC**: UK claims $\sim 18\%$ of all cross-border banking claims, $\sim 5\%$ of all intnl. asset positions
- UK-based banks' foreign claims ~ 2.5 times UK GDP and $\sim 60\%$ larger than US banks

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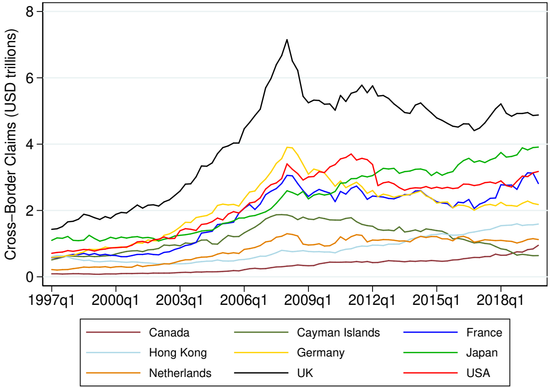

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Our Bank-Level Data on UK-Resident Banks:

- Quarterly 1997Q1-2019Q3
- Disaggregated cross-border positions:
  - USD (44%), EUR (38%), GBP, JPY and CHF
  - Assets: Debt (80%), Equity (20%)
  - Liabilities: Deposits

Details

Our Paper and Data vs. Literature

Aldasoro, Beltrán, Grinberg and Mancini-Griffoli (2023)

+ We capture granularity at *bank level*, using data for *biggest* intermediary country in Aldasoro et al. (2023) dataset

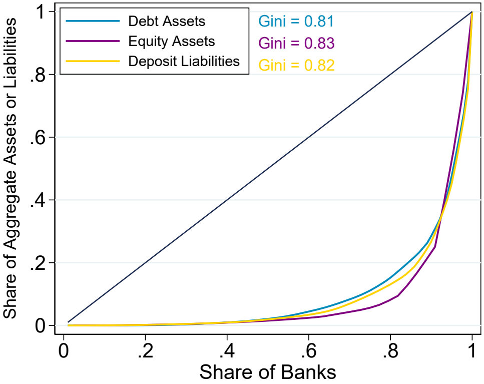
⇒ We require exogeneity at bank level, not country level

Camanho, Hau and Rey (2022)

+ We study all flows (debt & equity), not just equity rebalancing flows
+ We focus on \$7 trillion market (2008Q1), 7-times larger than Camanho et al. (2022)
+ Data allows us to focus on role for policy-relevant constraints (e.g., bank capital)

⇒ More representative sample, with links to practical regulations

Banking Flows from UK are Granular



Notes: Lorenz curves and Gini coefficients for UK banks' average debt, equity and deposits.

- Gini coefficients for UK-resident banks' cross-border positions highlight considerable heterogeneity
- Zipf's law in cross-border positions

▸ Log-Rank/Log-Size

$\Rightarrow$ Pareto principle: ~ 20% of banks explain ~ 80% of cross-border asset (debt and equity) and liability positions

A Heterogeneous-Bank Model

Identifying the Role of Large Banks in FX Determination to Build the GIV

A Granular Gamma Model

Building on Gabaix and Maggiori (2015), UK-resident bank i for each asset class j solves:

$$V_{i,t}^{j} = \max_{Q_{i,t}^{j}>0} \; \mathbb{E}_t \left[\exp(b_{i,t}^{j}) \frac{R_{t+1}^{j}}{R_t} \frac{\mathcal{E}_{t+1}}{\mathcal{E}_t} - 1 \right] Q_{i,t}^{j}$$

$$\text{s.t.} \quad V_{i,t}^{j} \geq \Gamma_i^{j} Q_{i,t}^{j} \cdot Q_{i,t}^{j} \qquad \text{(Incentive Compatibility)}$$

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Three Novel Features:

1. Bank-specific divertable fraction $\Gamma_i^j = \Gamma^j (\overline{Q}_i^j / \sum_{i=1}^n \overline{Q}_i^j)^{-1} \Rightarrow$ heterogeneity in bank size
2. Bank-specific time-varying belief $b_{i,t}^j \Rightarrow$ biggest banks' have largest effect on eqlbrm. $(1+2)$
3. Global demand system with multiple assets $j \Rightarrow$ FX determined with sup./dem. for assets

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Optimality: first-order approximation and first-difference imply following USD 'demand'

$$\Delta q_{i,t}^j = \phi^j \cdot \Big(\Delta b_{i,t}^j + \Delta \mathbb{E}_t[r_{t+1}^j] - \Delta r_t - \Delta e_t + \Delta \mathbb{E}_t[e_{t+1}] \Big)$$

Equilibrium in Granular Gamma Model: Towards the GIV

Global Equilibrium: RoW has symmetric 'supply' expression with ϕ_R^j and $\Delta b_{R,t}^j$, so equilibrium is:

$$\Delta e_t = \frac{1}{m} \sum_{j=1}^{m} \left(\Delta \mathbb{E}_t [r_{t+1}^j] + \frac{\phi^j}{\phi^j + \phi_R^j} \Delta b_{S,t}^j + \frac{\phi_R^j}{\phi^j + \phi_R^j} \Delta b_{R,t}^j \right) - \Delta r_t - \Delta \mathbb{E}_t [e_{t+1}]$$

where $b_{S,t}^j := \sum_{i=1}^n S_{i,t-1}^j b_{i,t}^j$ with $S_{i,t-1}^j := Q_{i,t-1}^j / \sum_{i=1}^n Q_{i,t-1}^j$

$\Rightarrow$ Large banks play **bigger role** in exchange-rate determination

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Beliefs: $\Delta b_{i,t}^j = u_{i,t}^j + \lambda_i^j \eta_t^j + controls_{i,t-1}^j$

- η_t^j are vectors of unobserved common factors with bank-level loadings λ_i^j
- $u_{i,t}^j$ are unobserved i.i.d. shocks with $\mathbb{E}[u_{i,t}^j(\eta_t^j, \Delta b_{R,t}^j)] = 0$

GIV Identification from Granular Gamma Model

Following Gabaix and Koijen (2022, 2020), we build the GIV:

$$z_t^j := \Delta q_{S,t}^j - \Delta q_{E,t}^j = \Delta b_{S,t}^j - \Delta b_{E,t}^j$$

where $q_{E,t}^j = \sum_{i=1}^n E_i^j q_{i,t}^j$ with $E_i^j := 1/n$

- **Relevance**: Idiosyncratic flows by large granular banks can affect aggregate flows
- **Exogeneity**: Requires common factors to be uncorrelated with size $\lambda_S^j - \lambda_E^j = 0$

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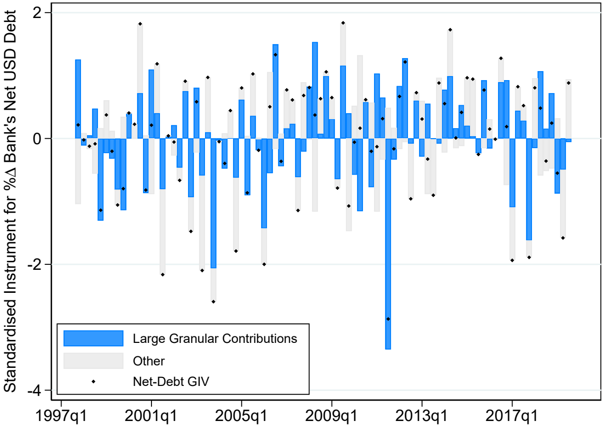
Accounting for Threats to Identification:

- GIV corrects for mechanical 'exchange-rate valuation effects'
- Include bank and macro controls (incl. balance-sheet info., asset returns, exp. FX moves...)
- Control for unobserved common factors using principal-component analysis
- Conduct narrative checks into drivers of GIV...

Narrative Checks into Main Drivers of GIV



Notes: Decomposition of GIV for net USD-debt positions

- Observe banks that explain large share of GIV changes (here: $> 20\%$ of a s.d.)
- Small number (~ 10) of large banks
- Use (confidential) bank-level info to conduct check using *FT* archives
- *What news is associated with the banks that explain largest moves in GIV in given quarter?*

Narrative Checks into Main Drivers of GIV

Notes: Main themes from narrative checks

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- Small number (~ 10) of large banks
- Use (confidential) bank-level info to conduct check using *FT* archives
- *What news is associated with the banks that explain largest moves in GIV in given quarter?*
- Findings reveal many events that are unlikely to be systematically related to macro outlook or possible confounders

Empirical Results

Estimating the Causal Links and Structural Parameters

Multipliers Linking Cross-Border Positions and USD/GBP

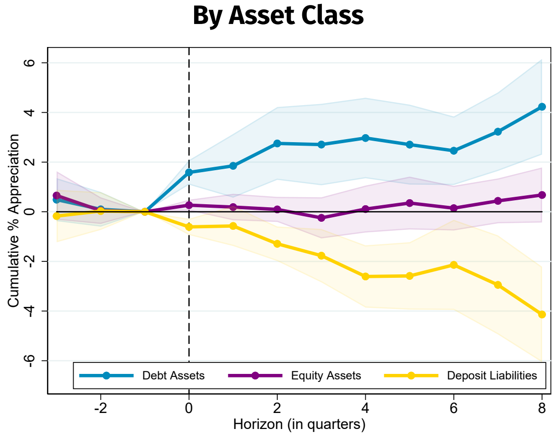
$$\Delta e_t = \sum_{j=1}^{m} M^j z_t^j/m + \beta controls_t + u_t$$

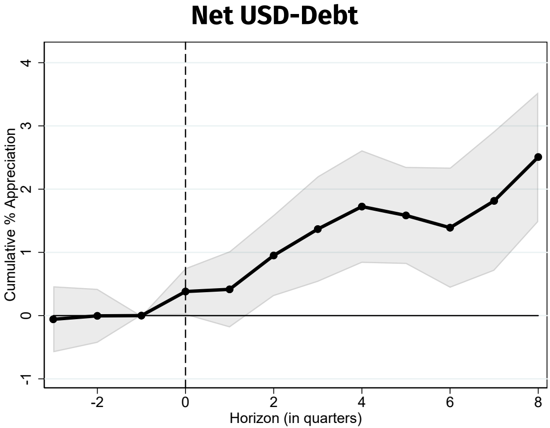
	Dep. Var.: % change nominal USD/GDP, Δe_t				
Panel A: Multipliers for Specific Assets and Liabilities					Per UK GDP
z_t^j/m: Debt (Assets)	2.000***	1.231***	1.190***	1.585***	2.64
	(0.358)	(0.198)	(0.208)	(0.253)	
z_t^j/m: Equity (Assets)	0.423***	0.251*	0.277**	0.265**	2.21
	(0.142)	(0.139)	(0.136)	(0.112)	
z_t^j/m: Liabilities	-1.135***	-0.485***	-0.443**	-0.610***	1.00
	(0.346)	(0.168)	(0.175)	(0.167)	
Panel B: Multipliers for Net USD-Debt Positions					
z_t^{net}: Net-Debt	0.818***	0.378**	0.367**	0.381**	
(Debt − Deposits)	(0.275)	(0.159)	(0.169)	(0.189)	
Macro Controls	No	Yes	Yes	Yes	Yes
Bank Controls	No	No	Yes	Yes	Yes
Components	No	No	No	5	5

Notes: ***, **, * denote 1, 5 and 10% significance, using Newey and West (1987) standard errors with 12 lags.

Dynamic Effects of Flows on USD/GBP

$$e_{t+h} - e_{t-1} = \sum_{j=1}^{m} M_h^j \frac{z_t^j}{m} + \beta_h controls_t + u_{t+h}$$





Notes: 95% confidence bands from Newey and West (1987) s.e. with 12 lags

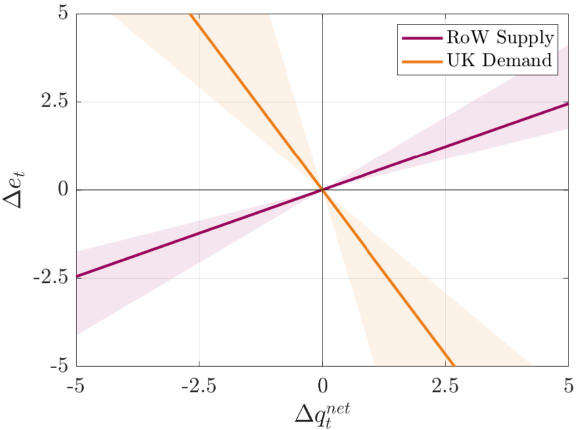
Supply and Demand Elasticities with 2SLS

USD Supply from RoW: $\Delta q^{net}_{S,t} = \phi^{net}_R \Delta e_t + \beta^{net}_{\phi_R} controls_t + u_t$				
2nd Stage				
Δe_t	0.821***	1.793**	1.804**	2.037**
	(0.294)	(0.719)	(0.767)	(0.824)
1st-Stage F-stat.	8.85	34.22	30.94	32.66
USD Demand from UK-Resident Banks: $\Delta q^{net}_{E,t} = -\phi^{net} \Delta e_t + \beta^{net}_{\phi} controls_t + u_t$				
2nd Stage				
Δe_t	-0.402***	-0.854**	-0.888**	-0.538*
	(0.138)	(0.377)	(0.368)	(0.321)
1st-Stage F-stat.	8.85	34.22	27.81	33.71
Macro Controls	No	Yes	Yes	Yes
Bank Controls	No	No	Yes	Yes
Components	No	No	No	5

Notes: 95% confidence bands from Newey and West (1987) s.e. with 12 lags

Inelasticity in the Gamma Model

Estimated Supply and Demand Curves for USD



Notes: Shaded areas denote Newey and West (1987) standard-deviation error bands (12 lags).

(Granular) Gamma Model

- Point estimates indicate that USD demand (orange) is price-inelastic
- At odds with micro-foundations underpinning the Gamma model
- In world with arbitrageurs, would expect demand to be elastic with respect to price

We Propose

- Alternative constraint $V_{i,t}^j \geq (\Gamma_i^j Q_{i,t}^j)^{\gamma_i^j} \cdot Q_{i,t}^j$, where γ_i^j mediates degree of moral hazard

Drivers of Inelastic Demand: The Role of Banks' Constraints

$$\Delta e_t = M z_t^{net} + \delta \left(z_t^{net} \times Cap_{S,t-1} \right) + \vartheta Cap_{S,t-1} + \beta_M^j C_t^j + u_t$$

	(1)	(2)	(3)	(4)
	DEP. VAR.: % change nominal USD/GBP, Δe_t			
z_t^{net}	0.760***	0.350**	0.337**	0.363**
	(0.219)	(0.144)	(0.145)	(0.167)
$z_t^{net} \times Cap_{S,t-1}$	-0.598*	-0.480**	-0.488**	-0.413**
	(0.319)	(0.207)	(0.212)	(0.188)
$Cap_{S,t-1}$	-0.001	-0.000	-0.005	-0.004
	(0.004)	(0.003)	(0.005)	(0.004)
Macro Controls	No	Yes	Yes	Yes
Bank Controls	No	No	Yes	Yes
Components	No	No	No	5

Notes: 95% confidence bands from Newey and West (1987) s.e. with 12 lags

Conclusion

Use bank-level data to construct new GIVs for intnl. banking flows from world's largest IFC

- ⋆ Document **granularity** in banks' cross-border currency positions
- ⋆ Reflect this in new model, where **large banks play biggest role in FX determination**
- ⋆ Use model to derive **novel GIVs** capturing exogenous idiosyncratic shocks to intnl. flows
- ⋆ GIVs reveal that (net) flows have **significant and persistent causal effects** on exchange rates
  - 1% $\uparrow$ UK-resident banks' net external USD-debt position $\Rightarrow \sim 2$% USD appreciation
- ⋆ UK-resident banks' USD-demand is **inelastic**...
  - At odds with view that arbitrage results in elastic markets
- ⋆ ...in part linked to banks' **risk-bearing capacity**
  - Effects of (net) flows twice as large when banks' capital ratios are 1 s.d. below average

References

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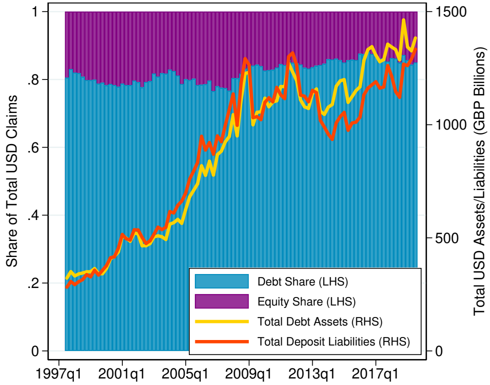
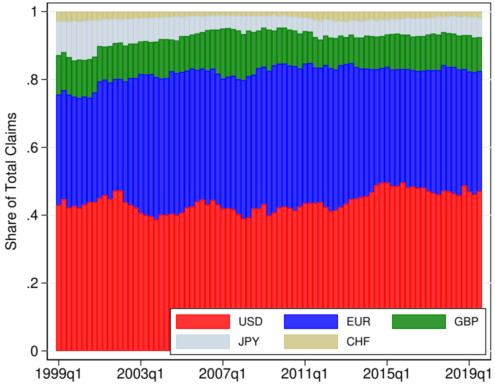
Appendix

Decomposing UK-Based Banks' Cross-Border Claims and Liabilities



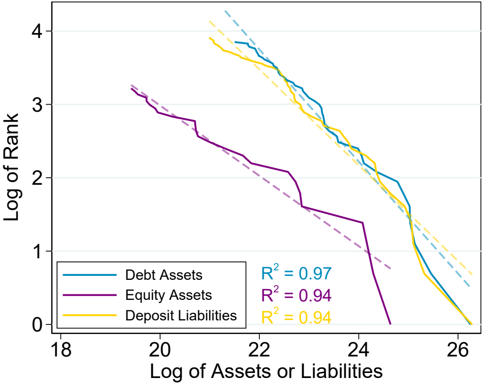


Notes: Total USD-denominated cross-border claims by asset class (debt and equity) and total liabilities.

Notes: UK-resident banks' total cross-border claims by currency.

Back

Banking Flows from UK are Granular: Further Evidence



- Compare log-rank of banks' size to log of banks' size
- Fact that straight lines fit this relationship, with such high R^2, provides evidence of:
  - Granularity
  - Relationship consistent with Zipf's law

Back

Notes: log-rank vs log-size with linear best fit lines and the associated R^2, for average debt, equity and deposits.