

Strategic Liquidity Mismatch and Financial Sector Stability

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Motivation

- ▶ Banks have a *unique ability to create liquidity* by financing illiquid assets with liquid liabilities (Diamond and Dybvig, JPE 1983)
- ▶ Combination of lending and deposit-taking activities *protects firms and households against liquidity shocks* (Kashyap et al., JF 2002) and *promotes economic growth* (Bencivenga and Smith, RES 1991)
- ▶ However, intrinsic fragility problem → excessive liquidity mismatch can lead to bank runs, breakdown of wholesale markets, and distressed asset sales that *threaten banks' solvency and the financial system* (Brunnermeier JEP 2009, Tirole, JEL 2011)
- ▶ Relationship between excessive liquidity transformation and financial instability further exacerbated when banks *collectively engage in strategic risk-taking behavior* (e.g., Farhi and Tirole, AER 2012)

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- ▶ **WHY DO BANKS ENGAGE IN COLLECTIVE RISK-TAKING?**
 1. **Bailout guarantees** in case of generalized distress - too-many-to-fail problem (Farhi and Tirole, AER 2012; Acharya et al., RCFS 2016)
 2. **Relative performance evaluation** in bank managers' compensation (Ozdenoren and Yuan, RES 2017; Albuquerque et al., RFS 2018)
 3. **Learning motives** i.e., free-riding in information acquisition (Banerjee, QJE 1992; Bikhchandani et al., JEP 1998)
- ▶ *Despite extensive theoretical literature, collective risk-taking strategies among banks have not yet been empirically tested...*
- ▶ **THIS PAPER:** shows *empirically* that commercial banks consider the liquidity mismatch positions of their competitors strategically when determining their own, and that such collective risk-taking behavior has a negative impact on financial sector stability

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 - Sows the seeds for costly crises associated with sharp recessions and distributional consequences (Reinhart and Rogoff, 2009)
 - Historically, credit growth on banks' asset-side of the B/S and liquidity mismatch indicators are better predictors of systemic financial crises than solvency measures (Jordà et al., 2017)
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 - ▶ 1 SD increase in liquidity created by competitors → up to 29% increase in liquidity created by individual banks
 - ▶ Peer effects stronger in less profitable and riskier banks, more prevalent in non-crisis years, and concentrated in the asset-side component of liquidity creation of which lending is a key component
- ▶ EXISTING EVIDENCE: competitors affect banks' *lending* decisions (Rajan, QJE 1994; Uchida and Nakagawa, JFI 2007) and *liquidity* choices (Bonfim and Kim, 2017); and firms' *dividend payment* decisions (Grennan, JFE 2018) and *leverage* choices (Leary and Roberts, JF 2014)
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2. Strategic liquidity mismatch decisions increase both individual banks' default risk and overall systemic risk

- ▶ Response of individual banks to competitors' choices is asymmetric
- ▶ 1 SD increase in peer effect → up to 6% increase in default risk of individual institutions and up to 15% increase in systemic risk

- ▶ EXISTING EVIDENCE: idiosyncratic bailout guarantees lead to additional bank risk-taking (Dam and Koetter, RFS 2012) → but moral-hazard not confined to banks choosing to bear excessive exogenous risk
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IDENTIFICATION STRATEGY

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Manski (RES 1993) baseline linear-in-means model

$$y_{i,j,t} = \mu_i + \beta \bar{y}_{-i,j,t} + \lambda' \bar{X}_{-i,j,t-1} + \gamma' X_{i,j,t-1} + \delta' Z_{j,t-1} + v_t + \varepsilon_{i,j,t}$$

- ▶ Peer effects captured by coefficient $\beta \rightarrow$ influence of competitors liquidity mismatch positions on those of bank i

Endogeneity problems:

1. *Reflection*: Peers average liquidity $\bar{y}_{-i,j,t}$ determined simultaneously with outcome variable $y_{i,j,t}$
 - ▶ Cannot disentangle if bank i 's decision is the cause or the effect of its peers' respective choices
2. *Correlated effects*: banks in the same local network are subject to common but unobserved shocks which lead to similar policies

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- ▶ **Solution:** explore systematic differences in peer group composition to identify peer effects (Bramoullé et al., JE 2009)

- ▶ Partially overlapping peer groups allows to use liquidity mismatch position of a “peer’s peer” as an IV \rightarrow instrument orthogonal to $\bar{y}_{-i,j,t}$, thus extracting exogenous part of its variation
- ▶ Such indirect peers also generate within-group variation in $\bar{y}_{-i,j,t}$, thus solving the reflection problem

- ▶ **How?**

- ▶ Large cross-border banking groups manage liquidity on a global scale and coordinate their risk-management policies within the group (e.g., Cetorelli and Goldberg, JF 2012; Anginer et al., JFI 2017)
- ▶ *Identifying assumption:* in addition to the liquidity choices of its direct competitors, a foreign-owned subsidiary also takes into consideration the overall liquidity transformation policies of its parent bank-holding group when determining its own

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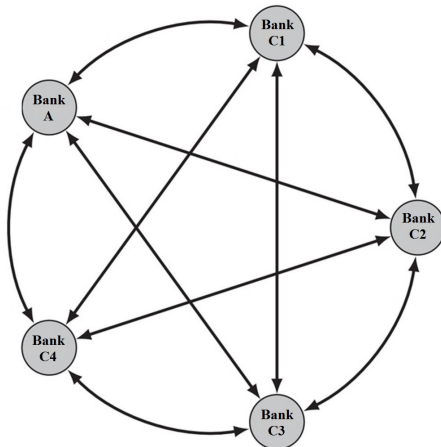
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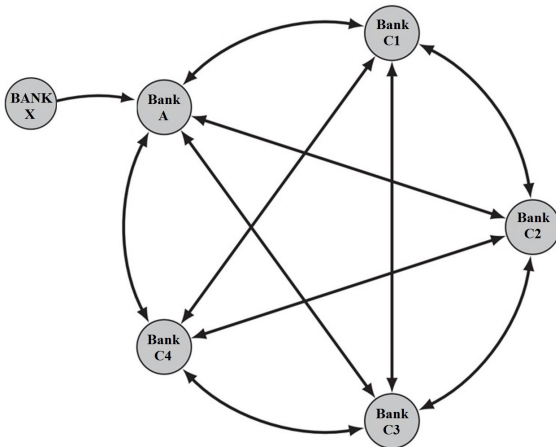
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Identification Strategy



- ▶ Simple network of banks operating in same country j in period t where:
(i) *Bank A* is a foreign-owned subsidiary; (ii) *Banks Cs* are its domestic local competitors - similar size and business model

Identification Strategy



- ▶ Liquidity mismatch position of a bank-holding group (*Bank X*) based in country f can be used as an instrument for all banks in country j (*Banks Cs*) that belong to peer group of its foreign subsidiary (*Bank A*)

Criteria to Specify Peer Groups

1. *Country and Year:*

- ▶ Within-country banks have higher incentives to mimic their peers since they *share same LOLR*
- ▶ Firms *select peers narrowly when setting RPE* to filter out common exogenous shocks to performance
- ▶ Learning likely to occur within countries where banks face similar economic framework and economic environment, and *information for managers of small banks is more accessible*

2. *Business Model:* only commercial banks included in the sample

3. *Bank Size:* each peer group in each country j in each year t has a maximum of 20 banks in the benchmark case

- ▶ We need to have at least 1 foreign-owned subsidiary within the 20 banks to identify the remaining 19
- ▶ Bizjak et al. (JFE 2011) → average peer group size when setting executive compensation is 17.3 for S&P 500 firms.

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3. *Bank Size:* each peer group in each country j in each year t has a maximum of 20 banks in the benchmark case

- ▶ We need to have at least 1 foreign-owned subsidiary within the 20 banks to identify the remaining 19
- ▶ Bizjak et al. (JFE 2011) → average peer group size when setting executive compensation is 17.3 for S&P 500 firms.

Criteria to Specify Peer Groups

1. *Country and Year:*

- ▶ Within-country banks have higher incentives to mimic their peers since they *share same LOLR*
- ▶ Firms *select peers narrowly when setting RPE* to filter out common exogenous shocks to performance
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▶ Reported peer groups of largest US banks

Liquidity Mismatch Indicator

Berger and Bouwman (RFS 2009) Liquidity Creation measure

- ▶ Step 1: Classify all bank B/S items as liquid, semi-liquid, or illiquid and assign liquidity weights based on ease, cost and time it takes:
 1. For a bank to dispose of its obligations to meet demand for liquidity
 2. For customers to withdraw liquid funds from the bank
- ▶ Step 2:

$$\begin{aligned}
 \text{LiquidityCreation} = & + \frac{1}{2} \text{IlliquidAssets} + \frac{1}{2} \text{LiquidLiabilities} \\
 & - \frac{1}{2} \text{LiquidAssets} - \frac{1}{2} \text{IlliquidLiabilities} \\
 & \hline
 & \text{TotalAssets}
 \end{aligned}$$

- ▶ Banks create liquidity by financing illiquid assets (e.g., corporate loans) with liquid liabilities (e.g., demand deposits)
- ▶ Banks destroy liquidity by financing liquid assets (e.g., cash) with illiquid liabilities (e.g., long-term funding) or equity

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DATA

Data

1. Main Sample: 14,438 bank-year observations → 1,612 commercial banks in 32 OECD countries from 1999 to 2014
 - ▶ Banks' balance-sheets and income statements → Bankscope
 - ▶ Restrict coverage to largest 100 commercial banks in each country i.e., exclude smaller (mostly regional) banks in the US and Japan.
 - ▶ Bank ownership data → manually collected from various sources:
 - ▶ BvD ownership database, banks' annual reports and websites, newspaper articles. Data is further cross-checked with the Claessens and van Horen (IMF 2015) bank ownership database.
 - ▶ Daily stock prices and no. shares outstanding → Datastream
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RESULTS

Peer effects in banks' liquidity mismatch decisions

1.1 Baseline Results

| Dep Var: Liquidity Creation | (1) | (2) | (3) | (4) | (5) | (6) |
|-----------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| Peers' Liquidity Creation | 0.058*** (3.337) | 0.052*** (2.913) | 0.064*** (4.053) | 0.056*** (3.271) | 0.091*** (4.443) | 0.085*** (3.540) |
| Peers' Size | 0.008 (0.994) | 0.010 (1.353) | 0.009 (1.206) | 0.011 (1.376) | 0.009 (0.820) | 0.009 (0.921) |
| Peers' Capital Ratio | 0.005 (1.018) | 0.004 (0.925) | 0.012* (1.789) | 0.010 (1.591) | 0.019*** (2.724) | 0.017*** (2.773) |
| Peers' ROA | 0.001 (0.410) | 0.000 (0.037) | -0.001 (-0.297) | -0.001 (-0.390) | 0.004 (0.977) | 0.005 (1.520) |
| Peers' Deposit Share | 0.001 (0.415) | 0.003 (0.810) | -0.003 (-0.516) | -0.001 (-0.173) | 0.003 (0.588) | 0.003 (0.636) |
| Peers' NPL Provisions | 0.000 (0.037) | 0.000 (-0.007) | -0.001 (-0.467) | -0.001 (-0.302) | 0.002 (0.741) | 0.003 (1.187) |
| Peer Group Size | 10 | 10 | 20 | 20 | 30 | 30 |
| No. Observations | 12,066 | 12,066 | 13,887 | 13,887 | 14,438 | 14,438 |
| No. Banks | 1,483 | 1,483 | 1,566 | 1,566 | 1,612 | 1,612 |
| No. Peer Groups | 143 | 143 | 80 | 80 | 59 | 59 |
| Bank and Country Controls | Y | Y | Y | Y | Y | Y |
| Additional Controls | N | Y | N | Y | N | Y |
| Year and Bank FE | Y | Y | Y | Y | Y | Y |
| First-Stage F-stat | 30.59 | 26.77 | 19.75 | 17.99 | 13.61 | 11.27 |
| First-Stage Instrument | 0.017*** (5.531) | 0.016*** (5.174) | 0.019*** (4.445) | 0.017*** (4.242) | 0.016*** (3.690) | 0.013*** (3.357) |

▶ OLS estimates

1.1 Baseline Results

- ▶ *Peer banks play an important role in determining individual banks' liquidity mismatch policies:*
 - ▶ 1 SD increase in peers' average liquidity creation \rightarrow 5.2–9.1 percentage point increase in bank i 's liquidity creation, corresponding to a 17–29 percent increase relative to the mean
- ▶ Banks' liquidity decisions are in large part *direct responses to the liquidity choices of peer banks* and, to a lesser extent, to changes in their characteristics.
- ▶ Instrument is always significant at the 1% level in the 1st stage of the 2SLS estimation in all specifications and the cluster-robust Kleibergen and Paap (JE 2006) F-statistic also rejects the hypothesis of a weak IV

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1.2. Robustness Tests

1. Alternative IVs:

- ▶ Regress liquidity created by parent bank-holding group with country-level characteristics and country and time FE → use the residual as instrument [▶ Table](#)
- ▶ Instrument peers' liquidity with the lagged idiosyncratic component of peers' equity returns (Leary and Roberts, JF 2014) [▶ Table](#)

2. Alternative peer group definitions:

- ▶ Form peer groups using peer-weighted averages based on size similarity - inverse of Euclidean distance i.e., the smaller the distance between two banks, the more weight it has [▶ Table](#)
- ▶ Falsification test where peer groups are defined globally [▶ Table](#), . . .

3. Alternative econometric specifications:

- ▶ *2SLS with Country \times Year Fixed Effects* [▶ Table](#)
- ▶ *Alternative liquidity mismatch measure: NSFR* [▶ Table](#)
- ▶ Use lagged peers banks' liquidity creation [▶ Table](#), . . .

1.3. Quarterly US Sample

- ▶ **Quarterly sample of banks operating in the US** → 597 commercial banks, 1999Q1 to 2014Q4
 - ▶ Allows testing whether the results on peer influence are sensitive to the use of higher frequency data
 - ▶ Preserves homogeneity in terms of regulatory framework, accounting standards and macroeconomic conditions
 - ▶ Information provided in “Call Reports” considerably more granular → allows using the Berger and Bouwman (RFS 2009) on-and-off-balance-sheet liquidity creation measure:
 - ▶ Crucial component given importance of off-balance-sheet liquidity creation through loan commitments, standby letters of credit and other claims to liquid funds (e.g., Kashyap et al., JF 2002)
 - ▶ In the US, for instance, this accounts for almost half of all liquidity created (Berger and Bouwman, RFS 2009)

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1.3. Quarterly US Sample

| | On-and-off-B/S Liquidity Creation | | | On-B/S Liquidity Creation | | |
|---------------------------|--------------------------------------|-----------------------|-----------------------|------------------------------|-----------------------|-----------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Peers' Liquidity Creation | 0.042** (2.287) | 0.046* (1.840) | 0.054** (2.250) | 0.037*** (2.591) | 0.045** (2.332) | 0.054*** (2.585) |
| Peer Group Size | 10 | 20 | 30 | 10 | 20 | 30 |
| No. Observations | 16,784 | 16,784 | 16,784 | 16,784 | 16,784 | 16,784 |
| No. Banks | 597 | 597 | 597 | 597 | 597 | 597 |
| Bank Characteristics | Y | Y | Y | Y | Y | Y |
| Peers Avg. Controls | Y | Y | Y | Y | Y | Y |
| Quarter FE | Y | Y | Y | Y | Y | Y |
| Bank FE | Y | Y | Y | Y | Y | Y |
| First-Stage F-stat | 28.08 | 27.02 | 38.48 | 35.07 | 39.41 | 47.24 |
| First-Stage Instrument | -0.003*** (-5.299) | -0.002*** (-5.198) | -0.002*** (-6.203) | -0.003*** (-5.922) | -0.002*** (-6.278) | -0.002*** (-6.873) |

► Summary Statistics - US sample

RESULTS

Mechanisms and Heterogeneity

2.1. Asset vs. liability side of liquidity creation

| | Asset-Side Liq. Creation | | | Liability-Side Liq. Creation | | |
|---------------------------------|--------------------------|--------------------|--------------------|------------------------------|------------------|--------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Peer Banks' Asset-Side LC | 0.040*** (3.152) | 0.041** (2.007) | 0.061** (2.335) | | | |
| Peer Banks' Liability-Side LC | | | | 0.013 (0.430) | 0.014 (0.641) | -0.014 (-0.079) |
| Peer Group Size | 10 | 20 | 30 | 10 | 20 | 30 |
| No. Observations | 12,109 | 13,940 | 14,491 | 12,109 | 13,940 | 14,491 |
| No. Banks | 1,483 | 1,566 | 1,612 | 1,483 | 1,566 | 1,612 |
| Bank, Peer and Country Controls | Y | Y | Y | Y | Y | Y |
| Year and Bank FE | Y | Y | Y | Y | Y | Y |
| First-Stage F-stat | 39.23 | 10.82 | 10.67 | 5.64 | 4.72 | 0.09 |

- ▶ Collective risk-taking behavior is driven by liquidity created on the asset-side, of which lending is a key component
- ▶ Consistent with Rajan (QJE 1994) and Uchida and Nakagawa (JFI 2007)

▶ US sample: Asset vs. liability side of LC

▶ US sample: Off-balance-sheet LC

2.2. Cross-sectional heterogeneity and business cycle

| Dep Var: Liquidity Creation | Capital Ratio | ROA | Deposit Share | Non-Interest Revenue | Liquidity Ratio | Business Cycle |
|--------------------------------|---------------------|---------------------|---------------------|-------------------------|---------------------|---------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Peers' LC $\times I_{low}$ | 0.088*** (3.568) | 0.050* (1.915) | 0.076*** (3.699) | 0.042 (1.472) | 0.059*** (2.933) | |
| Peers' LC $\times I_{med}$ | 0.036*** (3.089) | 0.045*** (3.489) | 0.041*** (3.586) | 0.021* (1.811) | 0.033*** (3.215) | |
| Peers' LC $\times I_{high}$ | 0.012 (1.131) | 0.019** (2.222) | 0.012 (1.160) | 0.037*** (3.869) | 0.020* (1.785) | |
| Peers' LC $\times I_{99-06}$ | | | | | | 0.079*** (5.221) |
| Peers' LC $\times I_{07-09}$ | | | | | | 0.045 (1.094) |
| Peers' LC $\times I_{10-14}$ | | | | | | 0.116* (1.795) |
| No. Observations | 13,887 | 13,887 | 13,887 | 13,887 | 13,887 | 13,887 |
| No. Banks | 1,566 | 1,566 | 1,566 | 1,566 | 1,566 | 1,566 |
| Bank and Peers Characteristics | Y | Y | Y | Y | Y | Y |
| Country Controls | Y | Y | Y | Y | Y | Y |
| Year and Bank FE | Y | Y | Y | Y | Y | Y |

- Peer effects concentrated in less profitable and more risky banks e.g., lower capital, lower deposit share, lower liquidity ratios, and higher non-interest revenue share, and more prevalent in non-crisis years

2.3. Who mimics who?

| Dep Var: Liquidity Creation | (1) | (2) | (3) | (4) |
|---------------------------------|---------------------|------------------|--------------------|---------------------|
| | S → S & L → L | S → L & L → S | S → S | L → L |
| Peers' Liquidity Creation | 0.086*** (6.105) | 0.025 (0.675) | 0.051** (2.421) | 0.090*** (5.810) |
| No. Observations | 8,453 | 8,593 | 4,132 | 4,295 |
| No. Banks | 1,173 | 1,181 | 638 | 546 |
| Bank, Peer and Country Controls | Y | Y | Y | Y |
| Year and Bank FE | Y | Y | Y | Y |

- ▶ Large and small banks' liquidity mismatch decisions are only sensitive to the choices of their respective counterparts

2.4. Asymmetric behavior

| | Liquidity Creation | | | Δ Liquidity Creation | | |
|---|---------------------|---------------------|---------------------|-----------------------------|---------------------|--------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Peers' Liq. Creation $\times I_{LC\downarrow}$ | 0.068*** (3.140) | 0.054** (2.373) | 0.086*** (3.496) | | | |
| Peers' Liq. Creation $\times I_{LC\uparrow}$ | 0.076*** (3.154) | 0.087*** (4.072) | 0.109*** (4.441) | | | |
| Δ Peers' Liq. Creation $\times I_{LC\downarrow}$ | | | | -0.015 (-0.369) | -0.057 (-1.235) | -0.068 (-0.737) |
| Δ Peers' Liq. Creation $\times I_{LC\uparrow}$ | | | | 0.070* (1.770) | 0.051*** (3.386) | 0.059* (1.691) |
| Peer Group Size | 10 | 20 | 30 | 10 | 20 | 30 |
| No. Observations | 12,066 | 13,887 | 14,438 | 9,511 | 11,572 | 12,035 |
| No. Banks | 1,483 | 1,566 | 1,612 | 1,218 | 1,337 | 1,358 |
| Bank, Peer and Country Controls | Y | Y | Y | Y | Y | Y |
| Year and Bank FE | Y | Y | Y | Y | Y | Y |
| Mean Dep. Var | 0.306 | 0.314 | 0.316 | 0.001 | 0.001 | 0.001 |

- ▶ Individual banks mimic their respective peers strongly when these competitors are increasing liquidity risk rather than decreasing it

RESULTS

Collective risk-taking and financial sector stability

Identification strategy

Empirical model to examine impact of peer effects on financial stability

Step 1:

$$y_{i,j,t} = \mu_i + \beta_{j,t} \bar{y}_{-i,j,t} + \lambda' \bar{X}_{-i,j,t-1} + \gamma' X_{i,j,t-1} + \delta' Z_{j,t-1} + v_t + \varepsilon_{i,j,t}$$

- ▶ $\beta_{j,t}$ is now allowed to vary across countries and over time
- ▶ In practice: model estimated for each country-year combination by shocking the average peer effect in the overall sample with two indicator variables specifying country and year e.g., UK in 2010:

$$y_{i,j,t} = \mu_i + [\beta_0 + (\beta_1 \times I_{UK} \times I_{2010})] \bar{y}_{-i,j,t} + \lambda' \bar{X}_{-i,j,t-1} + \gamma' X_{i,j,t-1} + \delta' Z_{j,t-1} + v_t + \varepsilon_{i,j,t}$$

Step 2:

$$STA_{i,j,t} = \kappa + \delta \hat{\beta}_{j,t} + \gamma' X_{i,j,t-1} + \eta' Z_{j,t-1} + \mu_i + v_t + u_{i,j,t}$$

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Financial stability indicators

- ▶ **Z-score (distance-to-default)** to capture individual bank's default risk i.e., $(ROA+E/A)/sd(ROA) \rightarrow$ e.g., Laeven and Levine (JFE 2009), Dam and Koetter (RFS 2012)
- ▶ **MES and SRISK** (Acharya et al., RFS 2017; Brownlees and Engle, RFS 2017) to capture systemic risk
 - ▶ MES: bank i expected equity loss (in %) in year t conditional on market experiencing one of its 5% lowest returns in that year
 - ▶ SRISK: expected bank i 's capital shortage (in billion USD) during a period of system distress and severe market decline
 - ▶ Long-run MES approximated as $1-\exp(-18*MES)$
 - ▶ Unlike MES, SRISK also a function of book value of debt, market value of equity and minimum capital requirements

3.1. Peer effects and default risk

| | lnZscore _{3y} | | | lnZscore _{5y} | | |
|--|------------------------|-----------|-----------|------------------------|-----------|-----------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Peer Effect: | -0.387*** | -0.373*** | -0.384*** | -0.225*** | -0.261*** | -0.519*** |
| Liq. Creation - $\widehat{\beta}_{j,t}^{LC}$ | (-5.424) | (-4.441) | (-4.095) | (-3.176) | (-3.003) | (-4.539) |
| Peer Group Size | 10 | 20 | 30 | 10 | 20 | 30 |
| No. Observations | 10,328 | 11,904 | 12,390 | 7,869 | 9,100 | 9,411 |
| No. Banks | 1,351 | 1,426 | 1,463 | 1,125 | 1,196 | 1,227 |
| Adj. R-squared | 0.478 | 0.477 | 0.477 | 0.623 | 0.623 | 0.624 |
| Bank characteristics | Y | Y | Y | Y | Y | Y |
| Country controls | Y | Y | Y | Y | Y | Y |
| Year FE | Y | Y | Y | Y | Y | Y |
| Bank FE | Y | Y | Y | Y | Y | Y |

- ▶ 1 SD increase in peer effect → up to 6% increase in default risk of individual institutions

▶ Results with the NSFR as liquidity mismatch measure

3.2. Peer effects and systemic risk

| | MES | | | SRISK | | |
|--|---------|----------|---------|----------|----------|---------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Peer Effect: | 0.620* | 0.915*** | 0.930** | 3.123*** | 2.537*** | 1.773** |
| Liq. Creation - $\widehat{\beta}_{j,t}^{LC}$ | (1.820) | (2.770) | (2.552) | (2.626) | (2.635) | (2.137) |
| Peer Group Size | 10 | 20 | 30 | 10 | 20 | 30 |
| No. Observations | 1,783 | 2,197 | 2,374 | 1,783 | 2,197 | 2,374 |
| No. Banks | 244 | 273 | 290 | 244 | 273 | 290 |
| Adj. R-squared | 0.711 | 0.690 | 0.693 | 0.806 | 0.802 | 0.802 |
| Bank characteristics | Y | Y | Y | Y | Y | Y |
| Country controls | Y | Y | Y | Y | Y | Y |
| Year FE | Y | Y | Y | Y | Y | Y |
| Bank FE | Y | Y | Y | Y | Y | Y |

- ▶ 1 SD increase in peer effect → up to 4% increase in MES and up to 15% increase in SRISK

▶ Results with the NSFR as liquidity mismatch measure

▶ US sample and CoVaR

Summary

1. Liquidity mismatch *choices* of competitors *do matter* for liquidity mismatch *decisions* of individual banks
2. This effect is asymmetric and concentrated on the asset-side component of liquidity creation
3. Strategic liquidity risk management decisions increase (i) individual banks' default risk and (ii) overall systemic risk

POLICY IMPLICATIONS:

- ▶ From a macro-prudential perspective, results highlight the importance of dealing with the *systemic component of funding liquidity risk*
- ▶ Move from *bailouts to credible bail-ins* is an important step to mitigate incentives for collective risk-taking behavior → despite the negative but limited short-term costs for the real economy (Beck, Da-Rocha-Lopes, and Silva, 2018)

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Appendix: 2SLS with Country x Year Fixed Effects

| Dep Var: Liquidity Creation | (1) | (2) | (3) |
|-----------------------------|---------------------|---------------------|---------------------|
| Peers' Liquidity Creation | 0.041*** (2.656) | 0.040** (2.340) | 0.059* (1.918) |
| Peer Group Size | 10 | 20 | 30 |
| No. Observations | 11,674 | 11,631 | 10,382 |
| No. Banks | 1,447 | 1,348 | 1,192 |
| No. Peer Groups | 139 | 68 | 42 |
| Bank Characteristics | Y | Y | Y |
| Peers Avg. Characteristics | Y | Y | Y |
| Bank FE | Y | Y | Y |
| Country x Year FE | Y | Y | Y |
| First-Stage F-stat | 28.32 | 15.37 | 9.68 |
| First-Stage Instrument | 0.016*** (5.322) | 0.016*** (3.920) | 0.010*** (3.111) |

- ▶ Helps ruling out alternative explanations e.g., results driven by changes in competition, regulations or supervisory effort in a country

▶ Back

Appendix: Modified IV

| | IV: Idiosyncratic Component of Foreign Parents' Liquidity Creation | | | | | |
|---|--|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| Dep Var: Liquidity Creation | (1) | (2) | (3) | (4) | (5) | (6) |
| <i>Panel A - IV: $\hat{\varepsilon}_{p,j,t} = \widehat{LC}_{p,j,t} - \hat{\tau}' Z_{j,t-1} - \hat{\omega}_j - \hat{v}_t$</i> | | | | | | |
| Peers' Liquidity Creation | 0.106*** (3.504) [12,066] | 0.107*** (3.306) [12,066] | 0.099*** (6.966) [13,887] | 0.099*** (6.955) [13,887] | 0.110*** (5.061) [14,438] | 0.115*** (4.618) [14,438] |
| <i>Panel B - IV: $\hat{v}_{p,j,t} = \widehat{LC}_{p,j,t} - \hat{m}_{tj}$</i> | | | | | | |
| Peers' Liquidity Creation | 0.073** (2.130) [12,066] | 0.078** (2.253) [12,066] | 0.086*** (5.434) [13,887] | 0.085*** (5.619) [13,887] | 0.090*** (4.262) [14,438] | 0.089*** (4.306) [14,438] |
| Peer Group Size | 10 | 10 | 20 | 20 | 30 | 30 |
| Bank and Country Controls | Y | Y | Y | Y | Y | Y |
| Additional Controls | N | Y | N | Y | N | Y |
| Year and Bank FE | Y | Y | Y | Y | Y | Y |

- ▶ Residuals should better capture the idiosyncratic nature of the foreign parents' liquidity transformation risk-management policies

Appendix: Alternative IV

- ▶ Alternative IV following Leary and Roberts (JF 2014) → lagged idiosyncratic component of peer banks' equity returns:

| | (1) | (2) | (3) |
|----------------------------|---------------------|---------------------|---------------------|
| Peers' Liquidity Creation | 0.096*** (3.217) | 0.087*** (3.532) | 0.088*** (3.528) |
| Peer Group Size | 10 | 20 | 30 |
| No. Observations | 3,007 | 3,007 | 3,007 |
| No. Banks | 293 | 293 | 293 |
| No. Peer Groups | 36 | 25 | 22 |
| Bank Characteristics | Y | Y | Y |
| Peers Avg. Characteristics | Y | Y | Y |
| Country Controls | Y | Y | Y |
| Year and Bank FE | Y | Y | Y |
| First-Stage F-stat | 18.88 | 31.14 | 29.28 |
| First-Stage Instrument | 0.007*** (4.345) | 0.010*** (5.580) | 0.009*** (5.411) |

▶ Back

Appendix: Robustness tests

- ▶ Peer weighted-averages based on size similarity and falsification test where peer groups are defined globally:

| | Weighted Peer Avg. | Peer Groups Defined Globally | | |
|----------------------------|---------------------|------------------------------|---------------------|--------------------|
| | (1) | (2) | (3) | (4) |
| Peers' Liquidity Creation | 0.088** (2.338) | 0.009 (0.638) | 0.002 (0.077) | 0.008 (0.382) |
| Peer Group Size | - | 10 | 20 | 30 |
| No. Observations | 15,529 | 14,937 | 15,819 | 15,923 |
| No. Banks | 1,680 | 1,652 | 1,677 | 1,689 |
| No. Peer Groups | - | 126 | 64 | 43 |
| Bank Characteristics | Y | Y | Y | Y |
| Peers Avg. Characteristics | Y | Y | Y | Y |
| Country Controls | Y | Y | Y | Y |
| Year FE | Y | Y | Y | Y |
| Bank FE | Y | Y | Y | Y |
| Country-Year FE | N | N | N | N |
| First-Stage F-stat | 24.91 | 14.35 | 7.535 | 4.427 |
| First-Stage Instrument | 0.010*** (4.991) | 0.008*** (3.788) | 0.004*** (2.745) | 0.004** (2.104) |

Appendix: Summary statistics

| Variables | N | Mean | SD | P25 | P50 | P75 |
|--|--------|-------|--------|--------|-------|-------|
| <i>Liquidity mismatch indicators:</i> | | | | | | |
| Liquidity Creation | 14,438 | 0.316 | 0.235 | 0.173 | 0.342 | 0.471 |
| LC Asset-side | 14,438 | 0.170 | 0.219 | 0.032 | 0.226 | 0.344 |
| LC Liability-side | 14,438 | 0.146 | 0.147 | 0.037 | 0.144 | 0.255 |
| NSFR _i | 14,438 | 0.995 | 0.522 | 0.738 | 0.890 | 1.078 |
| <i>Bank-level characteristics:</i> | | | | | | |
| Size | 14,438 | 8.279 | 2.119 | 6.684 | 8.103 | 9.706 |
| Capital Ratio | 14,438 | 0.100 | 0.079 | 0.056 | 0.080 | 0.116 |
| ROA | 14,438 | 0.006 | 0.013 | 0.002 | 0.006 | 0.011 |
| Deposit Share | 14,438 | 0.586 | 0.222 | 0.444 | 0.619 | 0.761 |
| NPL Provisions | 14,438 | 0.005 | 0.008 | 0.000 | 0.002 | 0.005 |
| <i>Country-specific characteristics:</i> | | | | | | |
| GDP per Capita | 14,438 | 10.42 | 0.554 | 10.37 | 10.53 | 10.71 |
| GDP Growth Volatility | 14,438 | 0.019 | 0.012 | 0.010 | 0.016 | 0.025 |
| Concentration | 14,438 | 0.187 | 0.133 | 0.094 | 0.151 | 0.251 |
| Prudential Regulation Intensity | 14,438 | 0.553 | 2.247 | -1.000 | 0.000 | 1.000 |
| <i>Financial stability indicators:</i> | | | | | | |
| Ln(Z-score) _{3y} | 12,390 | 3.700 | 1.333 | 2.896 | 3.668 | 4.482 |
| Ln(Z-score) _{5y} | 9,411 | 3.361 | 1.143 | 2.688 | 3.389 | 4.045 |
| Marginal Expected Shortfall (%) | 2,374 | 2.423 | 2.212 | 0.781 | 1.952 | 3.422 |
| S-RISK (bil USD) | 2,374 | 3.172 | 13.845 | 0.000 | 0.040 | 1.013 |

Appendix: Reported peer groups of largest US banks

| | Wells Fargo | JPMorgan Chase | Citigroup | U.S. Bancorp | PNC | BNY Mellon | State Street | Capital One |
|--------------------|-------------|----------------|-----------|--------------|-----|------------|--------------|-------------|
| American Express | X | X | X | | | | | X |
| Bank of America | X | X | X | X | X | | | X |
| BNY Mellon | X | | X | | | | X | |
| BB&T | X | | | X | X | | | X |
| Capital One | X | | X | | X | | X | |
| Citigroup | X | X | | | | | | X |
| Fifth Third | X | | | X | X | | | X |
| Goldman Sachs | X | X | X | | | | X | |
| JPMorgan Chase | X | | X | X | X | X | X | X |
| KeyCorp | X | | | X | X | | | |
| Morgan Stanley | X | X | X | | | X | X | |
| PNC | X | | X | X | | X | X | X |
| Regions | X | | | X | X | | | X |
| State Street | X | | | | | X | | |
| SunTrust | X | | | X | X | | | X |
| U.S. Bancorp | X | | X | | X | X | X | X |
| Wells Fargo | | X | X | X | X | X | X | X |
| AIG | | | X | | | | | |
| MetLife | | | X | | | | | |
| Prudential | | | X | | | X | | |
| M&T Bank | | | | | X | | | |
| BlackRock | | | | | | X | X | |
| Franklin Resources | | | | | | X | X | |
| Charles Schwab | | | | | | X | | |
| Northern Trust | | | | | | X | X | |
| Ameriprise | | | | | | | X | |
| Discover | | | | | | | | X |
| Total No. Peers | 16 | 6 | 13 | 9 | 11 | 11 | 12 | 12 |

Appendix: Additional summary statistics – OECD sample

| Variables | N | Mean | SD | P25 | P50 | P75 |
|---|--------|-------|-------|-------|-------|-------|
| <i>Additional bank and country characteristics:</i> | | | | | | |
| Liquidity Ratio | 14,438 | 0.078 | 0.097 | 0.015 | 0.039 | 0.103 |
| Non-Interest Income Revenue | 14,438 | 0.369 | 0.233 | 0.203 | 0.336 | 0.500 |
| Cost-to-Income Ratio | 14,438 | 0.633 | 0.285 | 0.502 | 0.622 | 0.744 |
| Global Integration | 14,438 | 0.823 | 0.623 | 0.501 | 0.614 | 0.962 |
| Deposit Insurance | 14,438 | 0.984 | 0.124 | 1.000 | 1.000 | 1.000 |
| IFRS | 14,438 | 0.201 | 0.400 | 0.000 | 0.000 | 0.000 |
| <i>Peer Averages (peer group size: 20 banks)</i> | | | | | | |
| Peers' Liquidity Creation | 13,887 | 0.309 | 0.120 | 0.237 | 0.320 | 0.389 |
| Peers' NSFR _i | 13,887 | 1.009 | 0.220 | 0.854 | 0.982 | 1.120 |
| Peers' Size | 13,887 | 8.231 | 1.865 | 6.786 | 8.255 | 9.561 |
| Peers' Capital Ratio | 13,887 | 0.103 | 0.042 | 0.076 | 0.097 | 0.122 |
| Peers' ROA | 13,887 | 0.006 | 0.006 | 0.003 | 0.006 | 0.010 |
| Peers' Deposit Share | 13,887 | 0.577 | 0.110 | 0.500 | 0.577 | 0.653 |
| Peers' NPL Provisions | 13,887 | 0.005 | 0.004 | 0.002 | 0.003 | 0.006 |
| Peers' Liquid Assets | 13,887 | 0.079 | 0.058 | 0.035 | 0.058 | 0.110 |
| Peers' Cost to Income | 13,887 | 0.635 | 0.141 | 0.573 | 0.639 | 0.714 |
| Peers' Non-Interest Revenue | 13,887 | 0.370 | 0.113 | 0.294 | 0.372 | 0.440 |

▶ Back

Appendix: Summary statistics – US sample

| Variables | N | Mean | SD | P25 | P50 | P75 |
|---------------------------------------|--------|-------|-------|-------|-------|-------|
| <i>Liquidity mismatch indicators:</i> | | | | | | |
| Liquidity Creation (“catfat”) | 16,784 | 0.398 | 0.150 | 0.300 | 0.402 | 0.498 |
| Liquidity Creation (“catnonfat”) | 16,784 | 0.305 | 0.125 | 0.229 | 0.311 | 0.390 |
| LC Asset-side | 16,784 | 0.121 | 0.120 | 0.045 | 0.128 | 0.203 |
| LC Liability-side | 16,784 | 0.185 | 0.069 | 0.139 | 0.183 | 0.231 |
| LC Off-balance-sheet | 16,784 | 0.092 | 0.055 | 0.055 | 0.080 | 0.113 |
| <i>Bank-level characteristics:</i> | | | | | | |
| Size | 16,784 | 14.58 | 1.435 | 13.54 | 14.26 | 15.26 |
| Capital Ratio | 16,784 | 0.095 | 0.022 | 0.080 | 0.092 | 0.106 |
| ROA | 16,784 | 0.005 | 0.007 | 0.003 | 0.005 | 0.009 |
| Deposit Share | 16,784 | 0.778 | 0.082 | 0.728 | 0.791 | 0.839 |
| NPL Provisions | 16,784 | 0.011 | 0.005 | 0.008 | 0.010 | 0.012 |

▶ Back

Appendix: Peer effects in banks' liquidity mismatch decisions – OLS estimates

| Dep Var: Liquidity Creation | (1) | (2) | (3) | (4) | (5) | (6) |
|-----------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| Peers' Liquidity Creation | 0.031*** (7.990) | 0.030*** (7.904) | 0.048*** (8.934) | 0.046*** (9.294) | 0.056*** (8.431) | 0.054*** (8.933) |
| Peers' Size | 0.008 (0.963) | 0.010 (1.332) | 0.009 (0.990) | 0.011 (1.268) | 0.007 (0.615) | 0.009 (0.821) |
| Peers' Capital Ratio | 0.002 (0.426) | 0.002 (0.441) | 0.009 (1.361) | 0.009 (1.347) | 0.013* (1.731) | 0.013* (1.910) |
| Peers' ROA | 0.001 (0.321) | -0.000 (-0.037) | -0.001 (-0.126) | -0.001 (-0.299) | 0.005 (1.003) | 0.005 (1.319) |
| Peers' Deposit Share | -0.000 (-0.071) | 0.002 (0.503) | -0.004 (-0.844) | -0.002 (-0.293) | -0.000 (-0.002) | 0.002 (0.319) |
| Peers' NPL Provisions | -0.000 (-0.092) | -0.000 (-0.137) | -0.001 (-0.354) | -0.001 (-0.238) | 0.002 (0.622) | 0.003 (0.951) |
| Peers' Liquid Assets | | 0.003 (0.847) | | 0.004 (0.933) | | 0.006 (1.256) |
| Peers' Cost to Income | | -0.002 (-0.489) | | -0.001 (-0.336) | | 0.002 (0.293) |
| Peers' Non-Interest Revenue | | 0.008*** (2.706) | | 0.008** (2.199) | | 0.009** (2.503) |
| Peer Group Size | 10 | 10 | 20 | 20 | 30 | 30 |
| No. Observations | 12,066 | 12,066 | 13,887 | 13,887 | 14,438 | 14,438 |
| No. Banks | 1,483 | 1,483 | 1,566 | 1,566 | 1,612 | 1,612 |
| Bank and Country Controls | Y | Y | Y | Y | Y | Y |
| Additional Controls | N | Y | N | Y | N | Y |
| Year and Bank FE | Y | Y | Y | Y | Y | Y |

Appendix: Peer effects in banks' liquidity mismatch decisions – additional tests A

| Dep Var: Liquidity Creation | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---------------------------------|--------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| <i>Do not consider a foreign parent if its subsidiary is too small or too large</i> | | | | | | |
| Peers' Liquidity Creation | 0.057*** (2.856) [10,332] | 0.053** (2.505) [10,332] | 0.073*** (4.638) [12,966] | 0.068*** (3.945) [12,966] | 0.091*** (5.754) [13,895] | 0.086*** (4.748) [13,895] |
| Peer Group Size | 10 | 10 | 20 | 20 | 30 | 30 |
| Bank and Country Controls | Y | Y | Y | Y | Y | Y |
| Additional Controls | N | Y | N | Y | N | Y |
| Year and Bank FE | Y | Y | Y | Y | Y | Y |

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Appendix: Peer effects in banks' liquidity mismatch decisions – additional tests B

| Dep Var: Liquidity Creation | (1) | (2) | (3) | (4) | (5) | (6) |
|--|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| <i>Panel A: Exclude all foreign-owned subsidiaries</i> | | | | | | |
| Peers' Liquidity Creation | 0.041** (2.404) [9,662] | 0.030* (1.707) [9,662] | 0.054*** (3.114) [11,255] | 0.040** (2.176) [11,255] | 0.066*** (2.790) [11,761] | 0.045* (1.691) [11,761] |
| <i>Panel B: Standard errors clustered at the bank-level</i> | | | | | | |
| Peers' Liquidity Creation | 0.058*** (3.689) [12,066] | 0.052*** (3.197) [12,066] | 0.064*** (4.332) [13,887] | 0.056*** (3.593) [13,887] | 0.091*** (4.701) [14,438] | 0.085*** (3.615) [14,438] |
| <i>Panel C: Lagged peers banks' liquidity creation</i> | | | | | | |
| Peers' Liquidity Creation | 0.048** (2.313) [12,066] | 0.043** (1.979) [12,066] | 0.051** (2.411) [13,887] | 0.041* (1.733) [13,887] | 0.090*** (4.263) [14,438] | 0.081*** (3.390) [14,438] |
| <i>Panel D: Drop banks with asset growth above 75% in any of the years</i> | | | | | | |
| Peers' Liquidity Creation | 0.057*** (3.295) [9,214] | 0.053*** (2.937) [9,214] | 0.062*** (3.681) [10,630] | 0.053*** (2.936) [10,630] | 0.076*** (3.261) [11,085] | 0.065** (2.440) [11,085] |
| Peer Group Size | 10 | 10 | 20 | 20 | 30 | 30 |
| Bank and Country Controls | Y | Y | Y | Y | Y | Y |
| Additional Controls | N | Y | N | Y | N | Y |
| Year and Bank FE | Y | Y | Y | Y | Y | Y |

Appendix: Peer effects in banks' liquidity mismatch decisions – NSFR

| Dep Var: NSFR _{<i>i</i>} | (1) | (2) | (3) | (4) | (5) | (6) |
|-----------------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| Peers' NSFR _{<i>i</i>} | 0.157*** (2.681) | 0.156*** (2.675) | 0.106*** (2.653) | 0.099** (2.373) | 0.112** (2.495) | 0.107** (2.274) |
| Peers' Size | 0.020 (0.934) | 0.024 (1.189) | 0.041* (1.948) | 0.045** (2.139) | 0.021 (1.135) | 0.021 (1.196) |
| Peers' Capital Ratio | 0.011 (0.813) | 0.012 (0.903) | 0.015 (1.375) | 0.013 (1.194) | 0.018 (1.578) | 0.017 (1.566) |
| Peers' ROA | 0.006 (1.085) | 0.007 (1.229) | 0.002 (0.374) | 0.003 (0.491) | 0.009* (1.886) | 0.01* (1.689) |
| Peers' Deposit Share | 0.043** (2.170) | 0.045** (2.332) | 0.044** (2.090) | 0.044** (2.157) | 0.056** (2.005) | 0.055** (2.069) |
| Peers' NPL Provisions | 0.002 (0.421) | 0.003 (0.781) | -0.001 (-0.164) | 0.001 (0.235) | 0.005 (1.192) | 0.007 (1.369) |
| | | (0.296) | | (1.332) | | (0.521) |
| Peer Group Size | 10 | 10 | 20 | 20 | 30 | 30 |
| No. Observations | 12,066 | 12,066 | 13,887 | 13,887 | 14,438 | 14,438 |
| No. Banks | 1,483 | 1,483 | 1,566 | 1,566 | 1,612 | 1,612 |
| No. Peer Groups | 143 | 143 | 80 | 80 | 59 | 59 |
| Bank and Country Controls | Y | Y | Y | Y | Y | Y |
| Additional Controls | N | Y | N | Y | N | Y |
| Year and Bank FE | Y | Y | Y | Y | Y | Y |
| First-Stage F-stat | 13.50 | 13.43 | 15.72 | 15.48 | 10.67 | 10.34 |
| First-Stage Instrument | 0.018*** (3.674) | 0.018*** (3.665) | 0.019*** (3.965) | 0.019*** (3.934) | 0.014*** (3.266) | 0.013*** (3.216) |

Appendix: Asset vs. liability side of liquidity creation

| | Asset-Side Liq. Creation | | | Liability-Side Liq. Creation | | |
|-------------------------------|--------------------------|--------------------|--------------------|------------------------------|--------------------|------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Peer Banks' Asset-Side LC | 0.034*** (2.688) | 0.029** (2.293) | 0.049** (2.406) | | | |
| Peer Banks' Liability-Side LC | | | | -0.055 (-0.297) | -0.025 (-1.013) | 0.059 (1.089) |
| Peer Group Size | 10 | 20 | 30 | 10 | 20 | 30 |
| No. Observations | 16,784 | 16,784 | 16,784 | 16,784 | 16,784 | 16,784 |
| No. Banks | 597 | 597 | 597 | 597 | 597 | 597 |
| Bank and Peer Controls | Y | Y | Y | Y | Y | Y |
| Quarter and Bank FE | Y | Y | Y | Y | Y | Y |
| First-Stage F-stat | 43.37 | 83.73 | 58.24 | 0.13 | 7.09 | 2.18 |

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Appendix: Peer effects in off-balance-sheet liquidity creation decisions

| Dep Var: Off-Balance-Sheet Liquidity Creation | (1) | (2) | (3) |
|---|--------------------|------------------|------------------|
| Peers' Off-Balance-Sheet Liquidity Creation | -1.611 (-0.003) | 0.024 (0.659) | 0.029 (0.385) |
| Peer Group Size | 10 | 20 | 30 |
| No. Observations | 16,784 | 16,784 | 16,784 |
| No. Banks | 597 | 597 | 597 |
| Bank and Peer Controls | Y | Y | Y |
| Quarter and Bank FE | Y | Y | Y |
| First-Stage F-stat | 0.000 | 5.397 | 1.188 |

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Appendix: Peer effects in liquidity mismatch decisions and default risk – NSFR

| | lnZscore _{3y} | | | lnZscore _{5y} | | |
|---|------------------------|----------|----------|------------------------|----------|----------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Peer Effect: | -0.570** | -0.581** | -0.659** | -0.517*** | -0.432* | -0.348 |
| $NSFR_i - \widehat{\beta_{j,t}^{NSFR_i}}$ | (-2.487) | (-2.109) | (-2.351) | (-2.679) | (-1.838) | (-1.495) |
| Peer Group Size | 10 | 20 | 30 | 10 | 20 | 30 |
| No. Observations | 10,328 | 11,904 | 12,390 | 7,869 | 9,100 | 9,411 |
| No. Banks | 1,351 | 1,426 | 1,463 | 1,125 | 1,196 | 1,227 |
| Adj. R-squared | 0.476 | 0.476 | 0.476 | 0.623 | 0.622 | 0.622 |
| Bank characteristics | Y | Y | Y | Y | Y | Y |
| Country controls | Y | Y | Y | Y | Y | Y |
| Year FE | Y | Y | Y | Y | Y | Y |
| Bank FE | Y | Y | Y | Y | Y | Y |

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Appendix: Peer effects in liquidity mismatch decisions and systemic risk – NSFR

| | MES | | | SRISK | | |
|---|---------|---------|---------|----------|---------|---------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Peer Effect: | 1.890** | 2.130** | 2.043** | 10.462** | 9.889** | 8.495* |
| $NSFR_i - \widehat{\beta}_{j,t}^{NSFR_i}$ | (2.222) | (2.153) | (2.317) | (2.092) | (2.334) | (1.805) |
| Peer Group Size | 10 | 20 | 30 | 10 | 20 | 30 |
| No. Observations | 1,783 | 2,197 | 2,374 | 1,783 | 2,197 | 2,374 |
| No. Banks | 244 | 273 | 290 | 244 | 273 | 290 |
| Adj. R-squared | 0.712 | 0.690 | 0.693 | 0.806 | 0.802 | 0.803 |
| Bank characteristics | Y | Y | Y | Y | Y | Y |
| Country controls | Y | Y | Y | Y | Y | Y |
| Year FE | Y | Y | Y | Y | Y | Y |
| Bank FE | Y | Y | Y | Y | Y | Y |

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Appendix: Peer effects and systemic risk – US sample and CoVaR

| | CoVaR | | | | | |
|--|----------|----------|-----------|----------|---------|----------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Peer Effect: | 1.186*** | 6.590*** | 12.181*** | | | |
| Liq. Creation ("catfat") - $\widehat{\beta}_{j,t}^{LC_{cf}}$ | (3.121) | (3.356) | (5.226) | | | |
| Peer Effect: | | | | 1.131*** | 3.216** | 6.304*** |
| Liq. Creation ("catnonfat") - $\widehat{\beta}_{j,t}^{LC_{cnf}}$ | | | | (2.774) | (2.411) | (3.763) |
| Peer Group Size | 10 | 20 | 30 | 10 | 20 | 30 |
| No. Observations | 14,221 | 14,221 | 14,221 | 14,221 | 14,221 | 14,221 |
| No. Banks | 501 | 501 | 501 | 501 | 501 | 501 |
| Adjusted R-squared | 0.863 | 0.863 | 0.863 | 0.907 | 0.907 | 0.907 |
| Bank characteristics | Y | Y | Y | Y | Y | Y |
| Quarter FE | Y | Y | Y | Y | Y | Y |
| Bank FE | Y | Y | Y | Y | Y | Y |

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