Shared Borrowers, Shared Stress: The Credit-Line Channel of Contagion

Fabian Greimel
University of Vienna

Carlos A. Ramírez
Federal Reserve Board

Network Science in Economics | Miami
April 11, 2026

New York Times

NATIONAL EDITION

Rain and snow showers continue from Boston to Philadelphia as a storm moves off shore today. Showers and mountain snow persist in the West. Weather map, Page A24.

...ompany SATURDAY, MARCH 11, 2023 Prices in Canada may be higher $4.00

Labor Market Keeps Riding Its Hot Streak

U.S. Adds 311,000 Jobs as Some Sectors Slow

By LYDIA DePILLIS

The labor market continued its energetic expansion in February, extending a hotter-than-expected streak that has created abundant job opportunities while frustrat-

U.S. TAKES OVER CRUCIAL LENDER IN TECH WORLD

BIGGEST BUST SINCE '08

Investors Batter Stocks of Other Banks Catering to Start-Up Clients

Motivation

- 13 March 2023: Silicon Valley Bank (SVB) collapses

  NYT: [...] a financial contagion appeared to spread through parts of the financial sector [...]

  Investors dumped stocks of [banks] [...] which cater to start-up clients and have similar investment portfolios.

- Can we quantify the systemic consequences *before* markets react?
- Which banks would be affected, and by how much?
- Real-time guidance: Bail-out or accept failure?

What we do

1. Introduce the credit-line channel of contagion
   - Two banks are linked if they provide credit lines to the same firm
   - "Shared borrowers, shared stress"
2. Construct a spillover matrix and bank-level systemicness measures
3. Compute these measures using supervisory microdata from the Fed (FR Y14)
4. Show that the channel is quantitatively important
5. Exposure to other banks' shocks (via credit line network) predicts returns

What we do

1. Introduce the credit-line channel of contagion
   - Two banks are linked if they provide credit lines to the same firm
   - "Shared borrowers, shared stress"
2. Construct a spillover matrix and bank-level systemicness measures
3. Compute these measures using supervisory microdata from the Fed (FR Y14)
4. Show that the channel is quantitatively important
5. Exposure to other banks' shocks (via credit line network) predicts returns

Why we do this

- Current systemic risk measures rely on market data: pick up a crisis too late
- We use supervisory data to quantify potential spillovers *ex ante*

Measuring sytemic risk

spillover from bank a to bank b

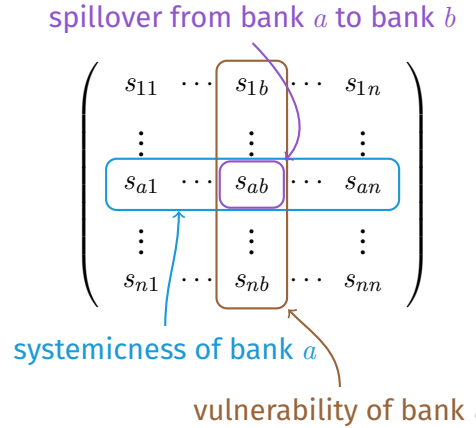
- How does a shock to bank a impact b?
- single entry of the spillover matrix S

systemicness of bank a

- How does a shock to a impact the system?
- row of the spillover matrix S

vulnerability of bank b

- How does a system-wide shock impact b?
- column of the spillover matrix S



Literature on Measuring Systemic Risk

Paper	Scope	Method
Greenwood et al. (2015, JFE)	syst. & vuln.	structural (fire sales)
Duarte and Eisenbach (2021, JF)	syst. & aggr. vuln.	structural (fire sales)
Acharya et al. (2017, RFS)	vulnerability	structural
Brownlees and Engle (2017, RFS)	vulnerability	reduced-form
Adrian and Brunnermeier (2016, AER)	systemicness	reduced-form
Diebold and Yılmaz (2014, JE)	spillover	reduced-form (VAR)
Denbee et al. (2021, JFE)	spillover	structural (interbank)
Elsinger et al. (2006, MS)	spillover	structural (interbank & correlated portfolios)

Terminology follows Greenwood et al. (2015, "vulnerability" vs "systemicness").

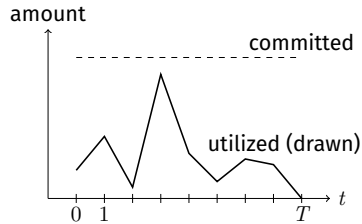
What this paper adds to the literature

- This paper measures spillovers in a structural way
- other such papers use interbank lending (which dried out after 2007)
- ... and correlated loan portfolios (Elsinger et al., 2006)
- Elsinger et al. (2006):
  1. overlapping loan portfolios are more important than interbank lending
  2. idea: correlation of default risk on the loans
  3. similarity: banks are linked if they lend to the same sector
  4. difference: need a shock in the real sector, whereas our mechnism doesn't

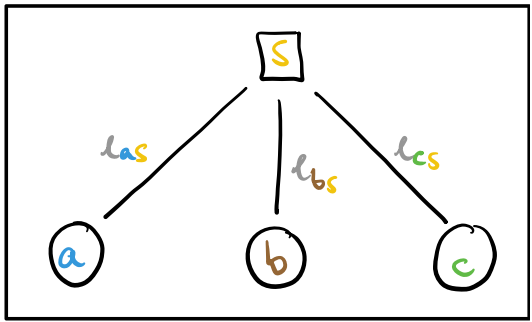
Mechanism: Shared Borrowers, Shared Stress

Background: How (revolving) credit lines work

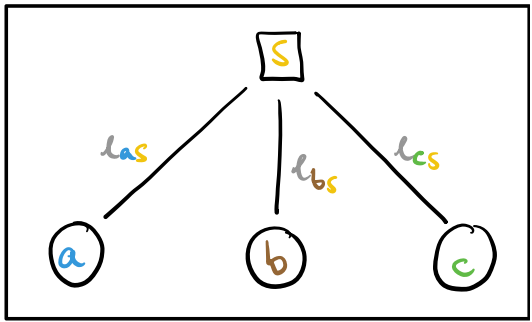
- bank commits a certain amount for T periods
- firm can draw down and repay at their will
- utilization is typically around 50%
- draw downs rise sharply in stress periods

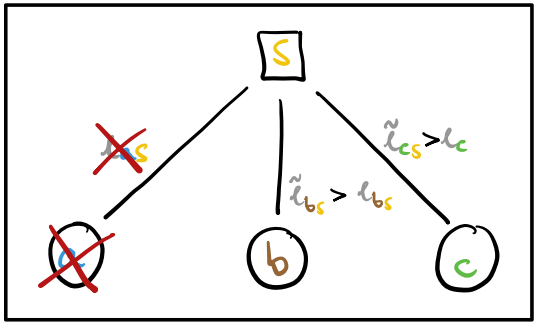


A sector has credit lines with multiple banks

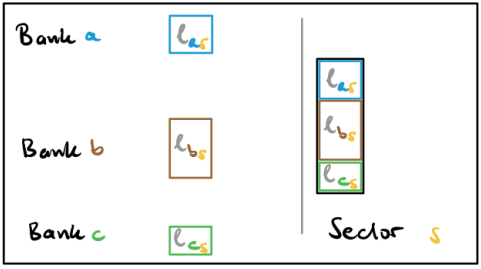


A sector has credit lines with multiple banks — one of them defaults



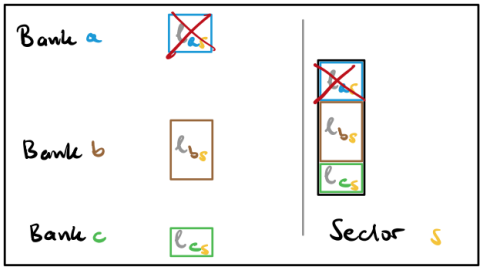


The Credit-Line Channel of Contagion



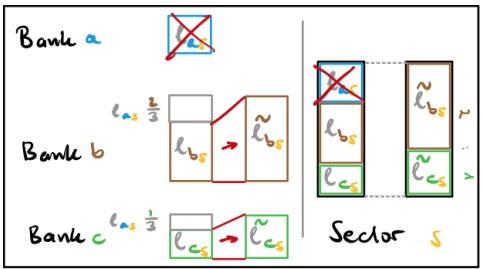
- Sector s has credit lines with multiple banks (a, b, c)

The Credit-Line Channel of Contagion



- Sector s has credit lines with multiple banks (a, b, c)
- Bank a cuts lending or fails, so the sector loses liquidity equal to ℓ_{as}.

The Credit-Line Channel of Contagion



- Sector s has credit lines with multiple banks (a, b, c)
- Bank a cuts lending or fails, so the sector loses liquidity equal to ℓ_{as}.
- Sector s uses credit lines with Banks b and c to compensate

  $\Longrightarrow$ unexpected outflow for b and c

"Shared Borrowers, Shared Stress"

The Credit-Line Channel of Financial Contagion

- the unexpected outflow to Sector s is $\tilde{\ell}_{bs} - \ell_{bs}$
- suppose that a and b have multiple common borrowers, then the total outflow is

$$\text{total outflow}_{a \to b} = \sum_{s'} \tilde{\ell}_{bs'} - \ell_{bs'}$$

- against what should this outflow be compared?

The Credit-Line Channel of Financial Contagion

- the unexpected outflow to Sector s is $\tilde{\ell}_{bs} - \ell_{bs}$
- suppose that a and b have multiple common borrowers, then the total outflow is

$$\text{total outflow}_{a \to b} = \sum_{s'} \tilde{\ell}_{bs'} - \ell_{bs'}$$

- against what should this outflow be compared?
  - utilized credit lines
  - liquidity buffer
- let's define two scale-free measures of spillovers of bank a to b

$$s_{ab} = \frac{\text{total outflow}_{a \to b}}{\text{liquidity buffer}_b}$$

$$\tilde{s}_{ab} = \frac{\text{total outflow}_{a \to b}}{\text{total utilized}_b}$$

What liquidity buffer?

- Regulation requires holding *high quality liquid assets* (HQLA) to survive 30 days of stress
- Only one component of HQLA is directly observable to us: cash & reserves

⇝ Use cash & reserves as a proxy for HQLA

⇝ compare additional outflow to cash & reserves

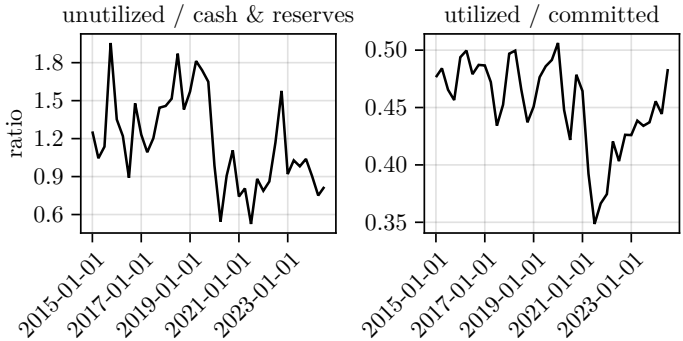
Data

Data

- loan-level corporate lending data (FR Y14)
  - loan amount, type of loan (term loan vs credit lines), borrower characteristics
  - covers *bank holding companies* with assets $> \$100$ billion (≈ 20 banks)
  - available 2013–2025

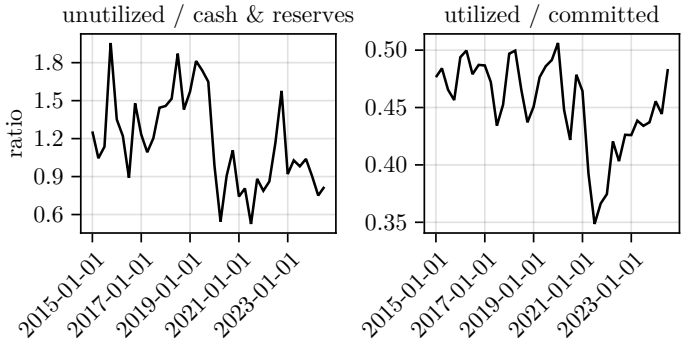
  $\rightsquigarrow$ build bank-industry-quarter panel of (utilized/unutilized) credit lines
- balance sheet data (FR Y9C)
  - includes total assets, cash & reserves, ...
  - covers *bank holding companies* with assets $> \$3$ billion ($\gg 20$ banks)

Data: Credit lines and liquidity buffer



Notes: Computed from FR Y–14 and FR Y–9C data for 2015Q1–2024Q4. Sample restricted to Bank Holding Companies covered in FR Y-14.

Data: Credit lines and liquidity buffer



Notes: Computed from FR Y–14 and FR Y–9C data for 2015Q1–2024Q4. Sample restricted to Bank Holding Companies covered in FR Y-14.

- ⇝ unutilized credit lines often outweigh cash & reserves
- ⇝ utilization rate typically $< 50\%$

Results

Measuring sytemic risk

spillover from bank a to bank b

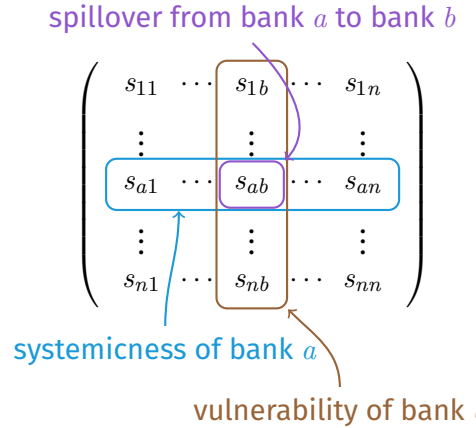
- How does a shock to bank a impact b?
- single entry of the spillover matrix S

systemicness of bank a

- How does a shock to a impact the system?
- row of the spillover matrix S

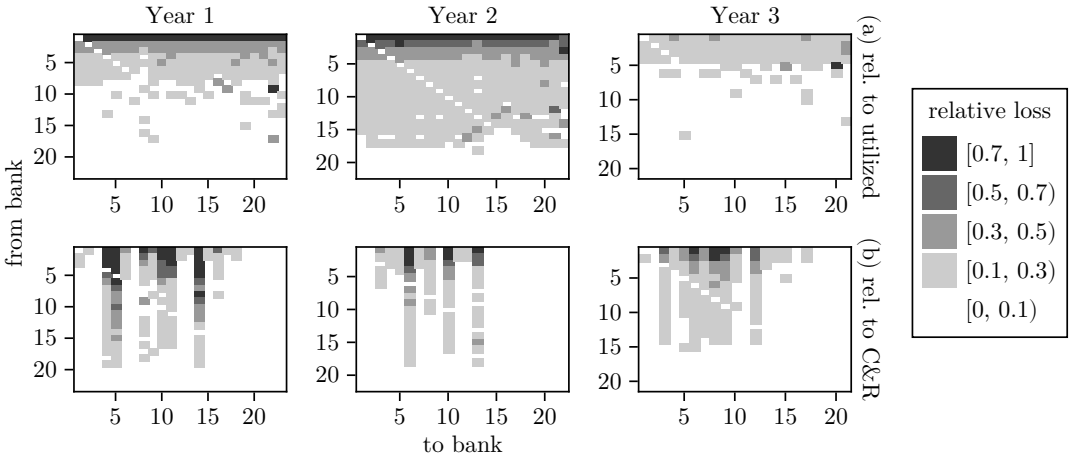
vulnerability of bank b

- How does a system-wide shock impact b?
- column of the spillover matrix S

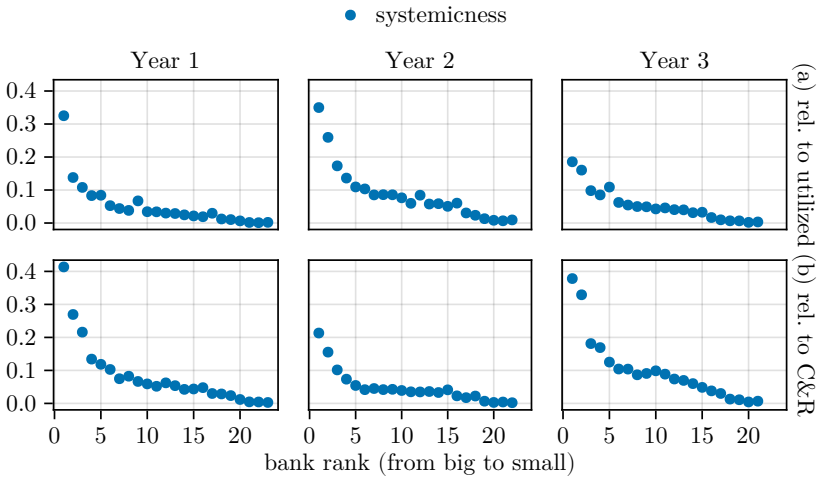


Spillover matrix

"additional liquidity outflow from bank j if bank i defaulted"



Systemicness: Average spillover of a bank's default

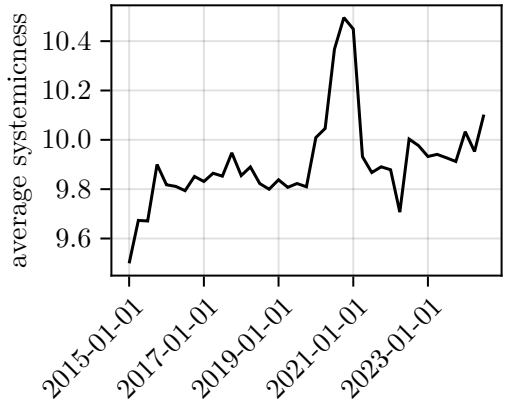


Systemicness is not explained by balance-sheet aggregates

	Systemicness
Committed credit lines	-0.004^{**}
	(0.001)
Utilized credit lines	0.02741^{***}
	(0.00343)
Total assets	0.0895
	(0.0515)
N	883
R^2	0.467

Notes: The dependent variable is $\log(\text{systemicness})$ at the bank–quarter level. Balance-sheet variables are measured in billions of U.S. dollars. Standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 0.1%, 1%, and 5% levels, respectively.

Average systemicness over time



Do spillovers predict returns?

- bank's exposure to network spillovers:

$$\text{Exposure}_{i,t} = \frac{\sum_{j \neq i} s_{ji,t} \left[-\min(\varepsilon_{j,t}, 0) \right]}{\sum_{j \neq i} s_{ji,t}},$$

  - $s_{ji,t}$ denotes the spillover coefficient from bank j to bank i
  - $\varepsilon_{j,t}$ is a residualized bank-level return shock obtained from a factor model
  - captures how bank i is affected by adverse shocks to other banks through credit-line network.
- baseline regression

$$r_{i,t} = \alpha_i + \tau_t + \beta_0 \, \text{Exposure}_{i,t} + u_{i,t},$$

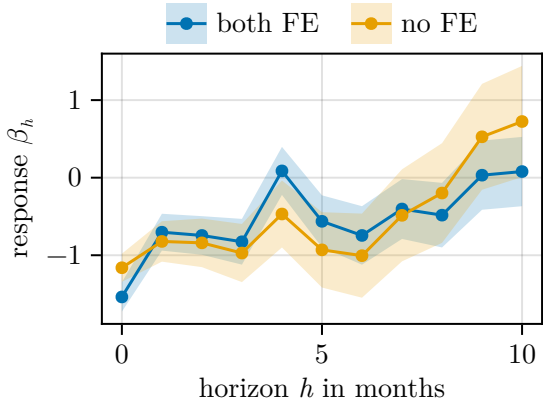
  - $r_{i,t}$ denote the return of bank i in quarter t.
  - α_i and τ_t denote bank and quarter fixed effects

Spillovers do predict returns

	(1)	(2)	(3)	(4)
Exposure	-1.161^{***}	-1.536^{***}	-1.162^{***}	-1.537^{***}
	(0.093)	(0.096)	(0.092)	(0.096)
Quarter FE	No	Yes	No	Yes
Bank FE	No	No	Yes	Yes
Observations	2,178	2,178	2,178	2,178
R^2	0.067	0.333	0.061	0.329

Notes: The dependent variable is the monthly bank equity return. Exposure is constructed as a weighted average of negative residualized shocks at other banks, using the spillover matrix as weights. Standard errors are in parentheses. ***, **, and * denote statistical significance at the 0.1%, 1%, and 5% levels, respectively.

Spillovers do predict returns: Impulse response



Notes: The figure plots local projection estimates of β_h, where exposure is measured at time t and the dependent variable is the cumulative return $R_{i,t\to t+h}$. Shaded bands denote 95% confidence intervals.

Conclusion

Takeaways

- Shared credit-line borrowers create a structural, observable channel of bank-to-bank contagion.
- Supervisory data are enough to construct a spillover matrix and systemicness in real time.
- Spillovers are large and heterogeneous and are not captured by simple balance-sheet size.
- Exposure to connected banks' shocks is priced immediately in bank equity returns.

Bottom line

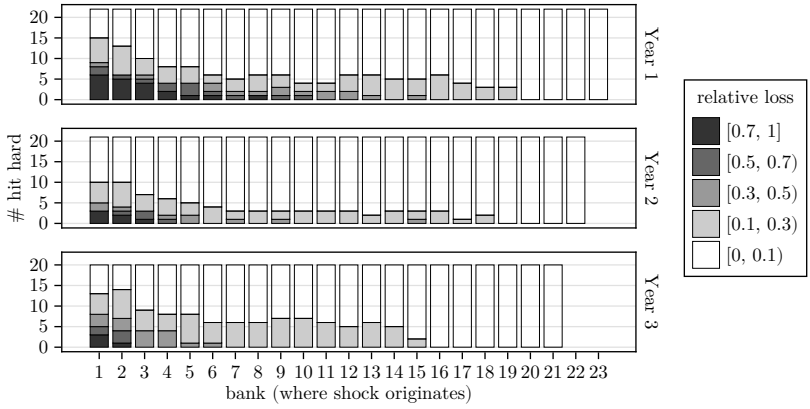
Monitoring credit-line linkages can complement market-based systemic-risk surveillance at the support-versus-resolution margin.

Backup: Summary Statistics

Variable	Median	Q25	Q75
FR Y14 (loan-level data)			
committed credit lines	53.4	28.1	106.3
unutilized credit lines	29.6	14.4	72.6
utilized credit lines	24.3	12.1	36.9
FR Y9C (balance sheet data)			
cash and reserves	28.8	10.4	98.4
total assets	272.2	157.1	838.3

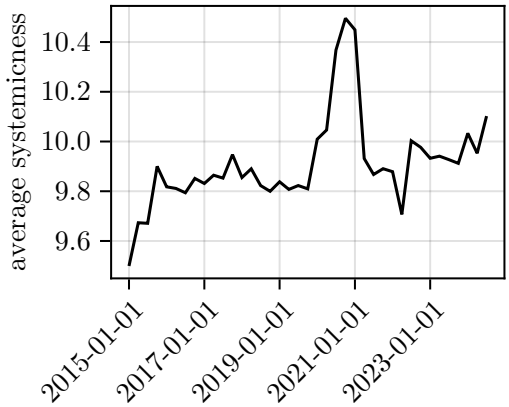
Values are in billion USD. Sample: 2015Q1–2024Q4, restricted to the 23 BHCs observed in at least 30 quarters.

Backup: Systemicness Decomposition



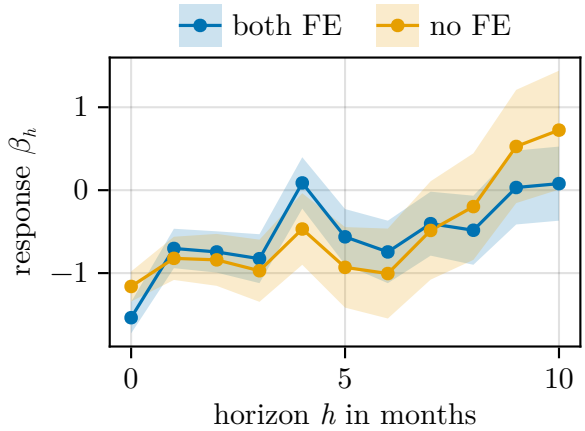
Systemicness broken down by component, showing how individual bilateral spillovers contribute to each bank's aggregate systemicness.

Backup: Average Systemicness Over Time



Aggregate systemicness is relatively stable before 2020, spikes in 2020Q1, and declines only gradually afterward.

Backup: Dynamic Response of Returns



The impact response is negative on impact and attenuates at longer horizons.

Backup: Factor-Model Shock Construction

At the bank-month level, residualized shocks come from

$$r_{i,t}^{e} = \alpha + \boldsymbol{\beta}'\mathbf{F}_t + \varepsilon_{i,t},$$

with downside shocks $-\min(\varepsilon_{i,t}, 0)$.

- Factors: MKT, SMB, HML, DEF (BAA10Y), TERM (T10Y3M).
- Exposure uses only the negative part of the residual, orthogonal to common equity, credit, and rate factors.

Backup: Robustness to Unnormalized Exposure

Alternative exposure:

$$\text{Exposure}_{i,t}^{\text{sum}} = \sum_{j \neq i} S_{ji,t} \left[-\min(\varepsilon_{j,t}, 0) \right].$$

Spec	Sum Exposure
No FE	-0.158^{***}
Quarter FE	-0.132^{***}
Bank FE	-0.203^{***}
Both FE	-0.175^{***}

Contemporaneous returns

Spec	Sum Exposure
No FE	0.024
Quarter FE	0.081^{***}
Bank FE	0.033
Both FE	0.109^{***}

Next-period returns

Backup: Confidentiality Treatment

- The paper reports the same calendar quarter in three non-consecutive years.
- Exact years remain omitted pending Federal Reserve disclosure approval.
- Cross-sectional rankings and magnitudes are the relevant objects for interpretation, not the calendar labels themselves.

References

Acharya, V. V., L. H. Pedersen, T. Philippon, and M. Richardson (2017): "Measuring systemic risk," *Review of Financial Studies*, 30, 2–47.

Adrian, T. and M. K. Brunnermeier (2016): "CoVaR," *American Economic Review*, 106, 1705.

Brownlees, C. and R. F. Engle (2017): "SRISK: A conditional capital shortfall measure of systemic risk," *Review of Financial Studies*, 30, 48–79.

Literature ii

Denbee, E., C. Julliard, Y. Li, and K. Yuan (2021): "Network risk and key players: A structural analysis of interbank liquidity," *Journal of Financial Economics*, 141, 831–859.

Diebold, F. X. and K. Yilmaz (2014): "On the network topology of variance decompositions: Measuring the connectedness of financial firms," *Journal of Econometrics*, 182, 119–134.

Duarte, F. and T. M. Eisenbach (2021): "Fire-sale spillovers and systemic risk," *Journal of Finance*, 76, 1251–1294.

Elsinger, H., A. Lehar, and M. Summer (2006): "Risk assessment for banking systems," *Management science*, 52, 1301–1314.

Greenwood, R., A. Landier, and D. Thesmar (2015): "Vulnerable banks," *Journal of Financial Economics*, 115, 471–485.