

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

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New York Times

Company

SATURDAY, MARCH 11, 2023

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.

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 predict the implications?
- Should SVB be bailed out or not?

What we do

1. Introduce the credit line channel of contagion:
Two banks are linked if they lend to the same firm
2. Construct measures of systemic risk
3. Compute these measures using loan-level data from the Fed (FR Y14)
4. Show that the channel is quantitatively important

Next steps

1. Case Study: The collapse of Silicon Valley Bank in March 2023
2. Compare with established measures of systemic risk (CoVaR, SRISK)

Why we do this

- main measures of systemic risk are based on market data, can detect that a crisis has arrived
- our measure use pre-crisis data to predict consequences of crisis (which banks *would* suffer, how bad would it be)

Measuring systemic risk

connectedness of banks b with a

- How does a shock to bank a impact b ?
- single entry of the contagion matrix C

systemicness of bank a

- How does a shock to a impact the system?
- row of the contagion matrix C

vulnerability of bank b

- How does a system-wide shock impact b ?
- column of the contagion matrix C

connectedness of banks a and b

c_{11}	\cdots	c_{1b}	\cdots	c_{1n}
\vdots		\vdots		\vdots
c_{a1}	\cdots	c_{ab}	\cdots	c_{an}
\vdots		\vdots		\vdots
c_{n1}	\cdots	c_{nb}	\cdots	c_{nn}

systemicness of bank a

vulnerability of bank b

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	
Brownlees and Engle (2017, RFS)	vulnerability	
Adrian and Brunnermeier (2016, AER)	systemicness	
Diebold and Yilmaz (2014, JE)	connectedness	reduced-form (VAR)
Denbee et al. (2021, JFE)	connectedness	structural (interbank)
Elsinger et al. (2006, MS)	connectedness	structural (interbank & correlated portfolios)

Terminology follows Greenwood et al. (2015, “vulnerability” vs “systemicness”) and Diebold and Yilmaz (2014, “connectedness”).

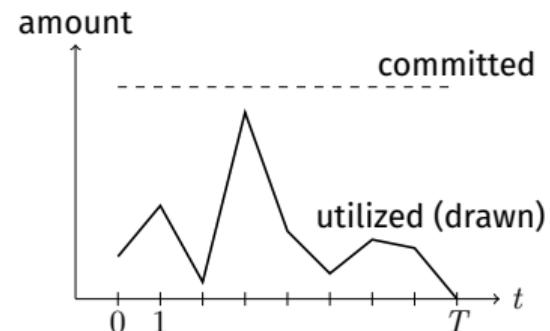
What this paper adds to the literature

- This paper measures **connectedness** 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 to the same sector
 4. difference: need a shock in the real sector, whereas our mechanism doesn't

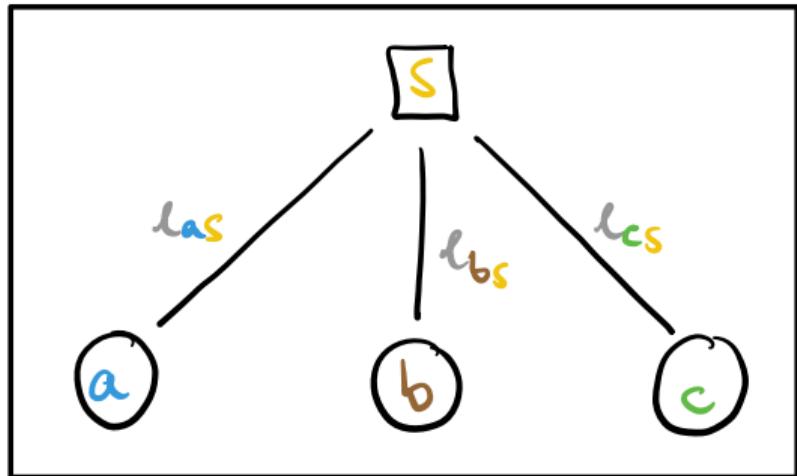
Mechanism: Shared Borrowers, Shared Stress

Background: How (revolving) credit lines work

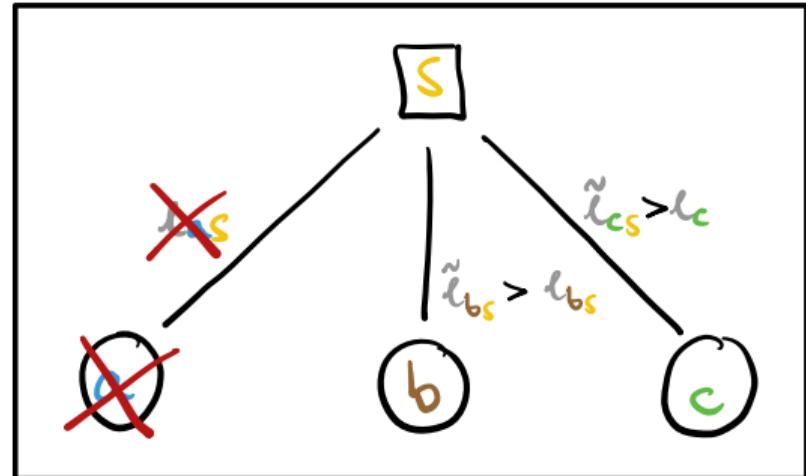
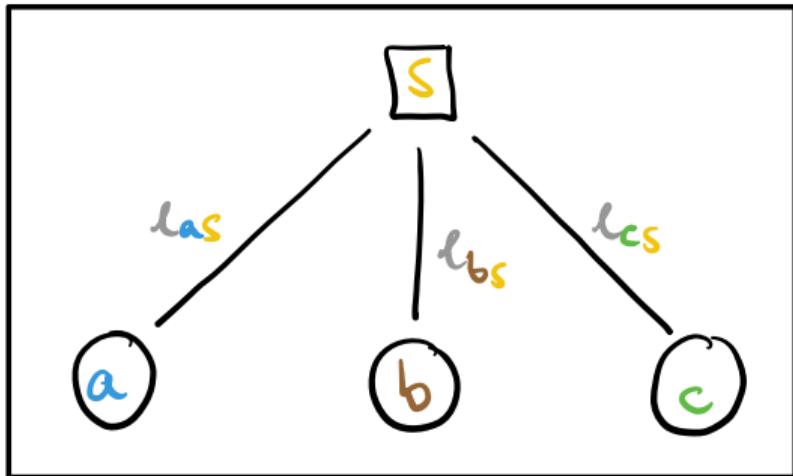
- bank commits a certain amount for T periods
- firm can draw down and repay at their will
- used for short-term liquidity needs and as buffer
- utilization is usually way below 50%
- credit lines account for 30% of corporate debt



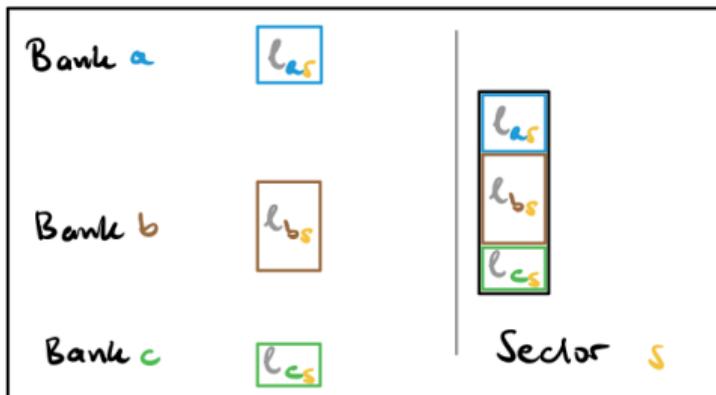
A sector has credit lines with multiple banks



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

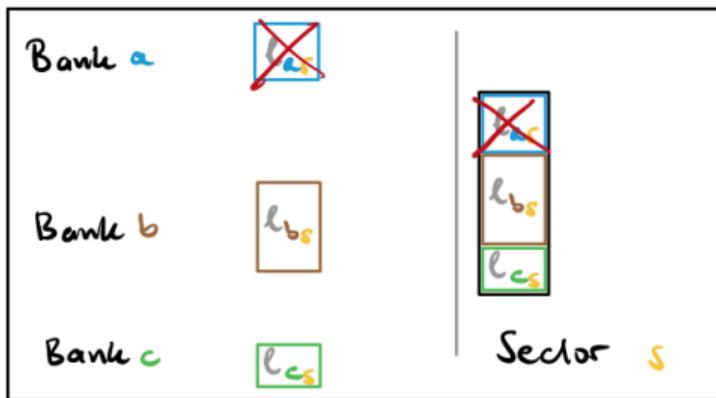


The Credit-Line Channel of Contagion



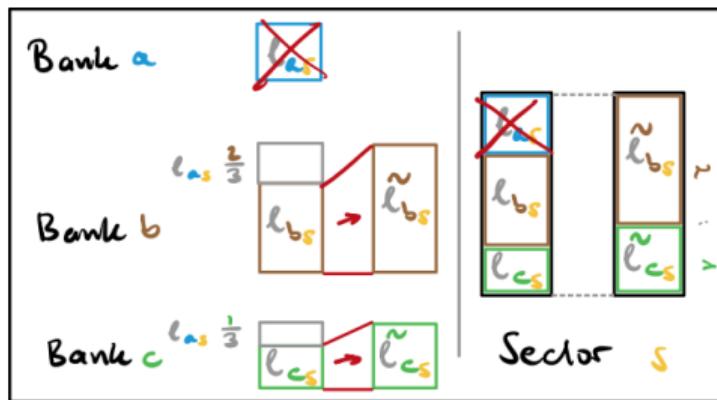
- Sector s has credit lines with multiple banks (a, b, c)

The Credit-Line Channel of Contagion



- Sector s has credit lines with multiple banks (a, b, c)
- Bank a defaults \implies Sector s has liquidity shortfall of ℓ_{as}

The Credit-Line Channel of Contagion



- Sector *s* has credit lines with multiple banks (*a*, *b*, *c*)
- Bank *a* defaults \Rightarrow Sector *s* has liquidity shortfall of ℓ_{as}
- Sector *s* uses credit lines with Banks *b* and *c* to compensate
 \Rightarrow 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

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

- against what should this outflow be compared?
 - utilized credit lines
 - cash & reserves (as a proxy high-quality liquid assets)
- let's define two measures of connectedness of bank a and b

$$c_{ab} = \frac{\text{total outflow}_{a \rightarrow b}}{\text{cash \& reserves}_b}$$

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

Why Cash & Reserves

- Regulation requires holding *high quality liquid assets* (HQLA) to survive 30 days of stress
 - ~~ compare additional outflow to cash and reserves (a proxy of HQLA)

Measuring systemic risk

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connectedness of banks a and b

$$\left(\begin{array}{cccc} c_{11} & \cdots & c_{1b} & \cdots & c_{1n} \\ \vdots & & \vdots & & \vdots \\ c_{a1} & \cdots & c_{ab} & \cdots & c_{an} \\ \vdots & & \vdots & & \vdots \\ c_{n1} & \cdots & c_{nb} & \cdots & c_{nn} \end{array} \right)$$

systemicness of bank a

vulnerability of bank b

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 (\approx 20 banks)
 - available 2013–2025
- 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: Summary statistics

Variable	Median	Q25	Q75
<i>FR Y14 (loan-level data; 20 largest banks)</i>			
committed credit lines	55.0	30.6	120.5
unutilized credit lines	31.4	13.5	63.3
utilized credit lines	27.9	12.6	41.9
<i>FR Y9C (balance sheet data, many more banks)</i>			
cash and reserves	31.8	9.3	92.2
total assets	279.4	157.8	706.7

Notes: Values in billion USD. Summary statistics for a single (unspecified) year.

~~~ unutilized credit lines in the same ballpark as cash and reserves

## Results

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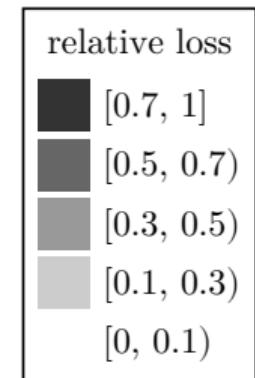
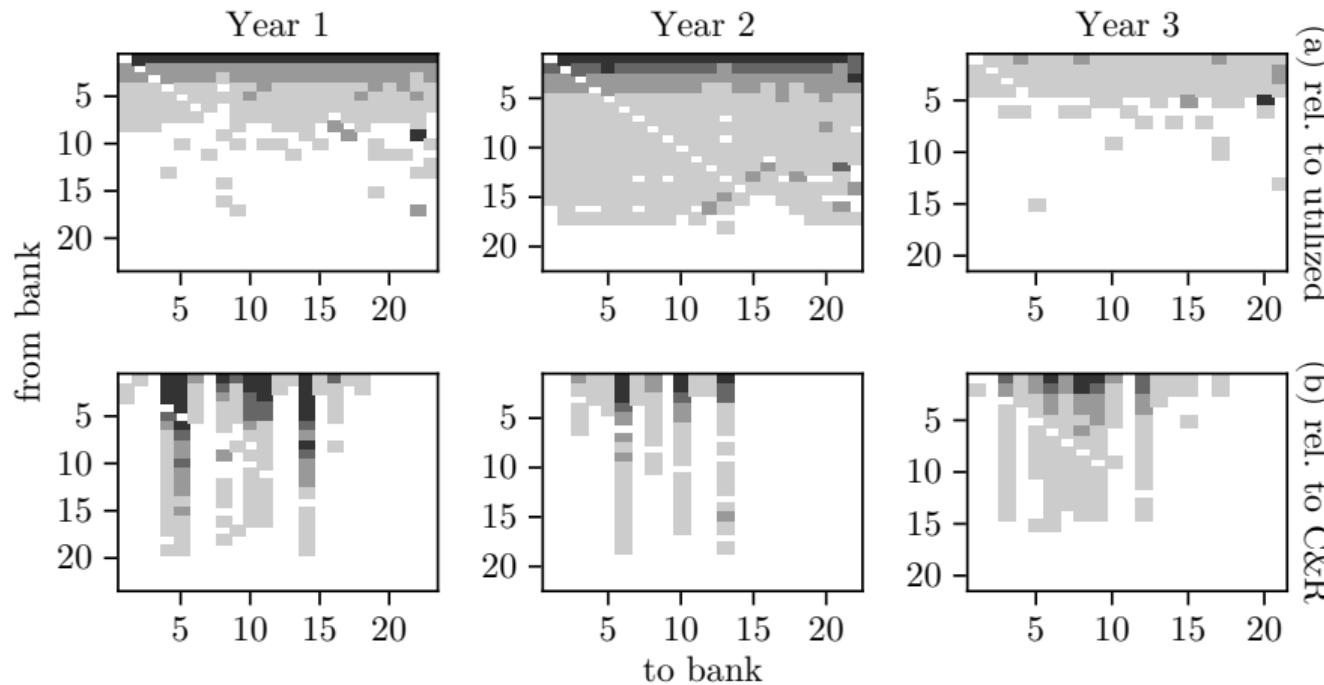
## Results: Overview

- Contagion matrix
- Systemicity
- Vulnerability

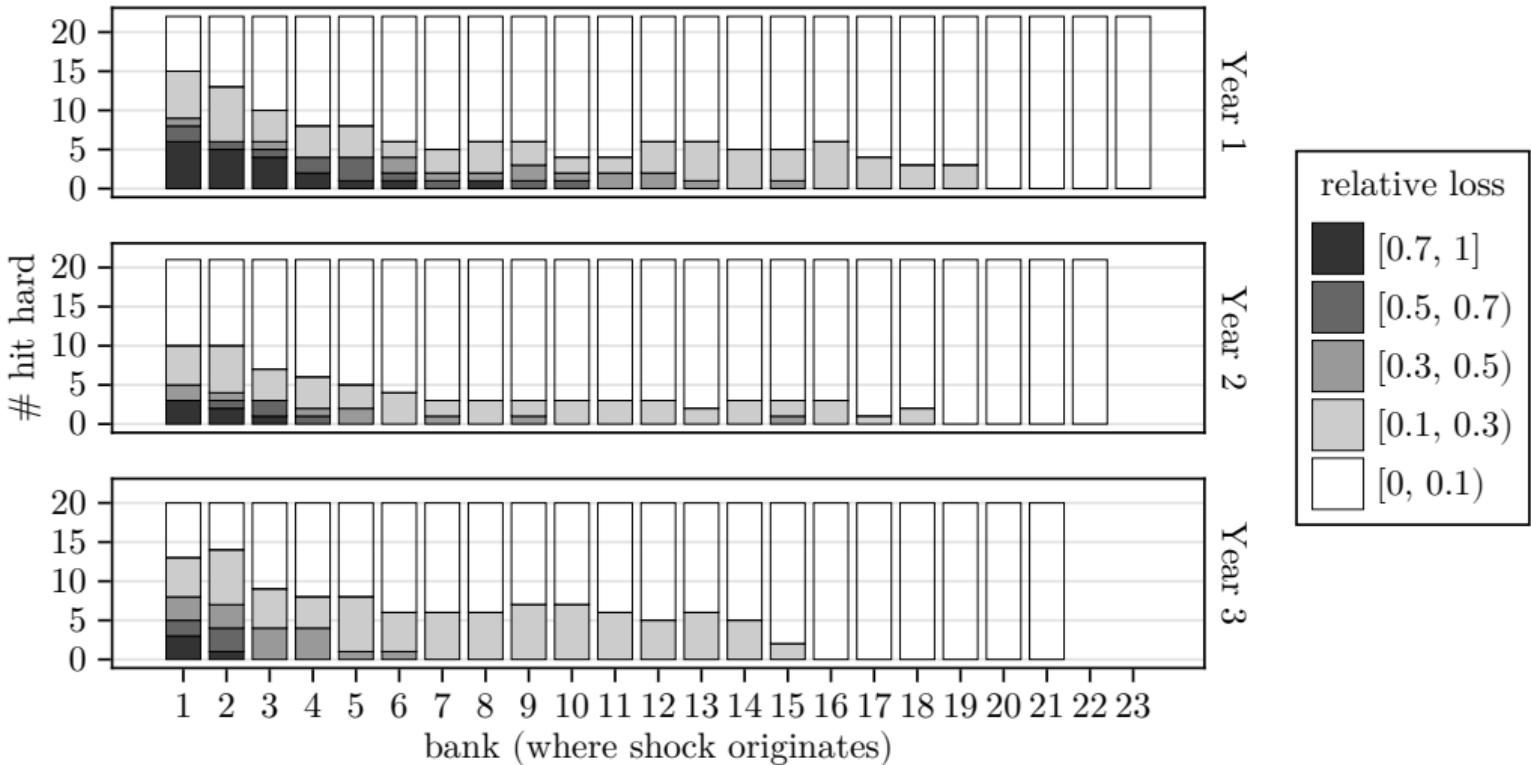
## The Contagion Matrix

- Interpretation: How strong is the propagation from one to another bank?
- Measure: additional liquidity outflow of bank  $j$  if bank  $i$  reduces their lending
- What baseline to use?
  - utilized credit lines?
  - cash & reserves? relevant for regulators (cf HQLA)

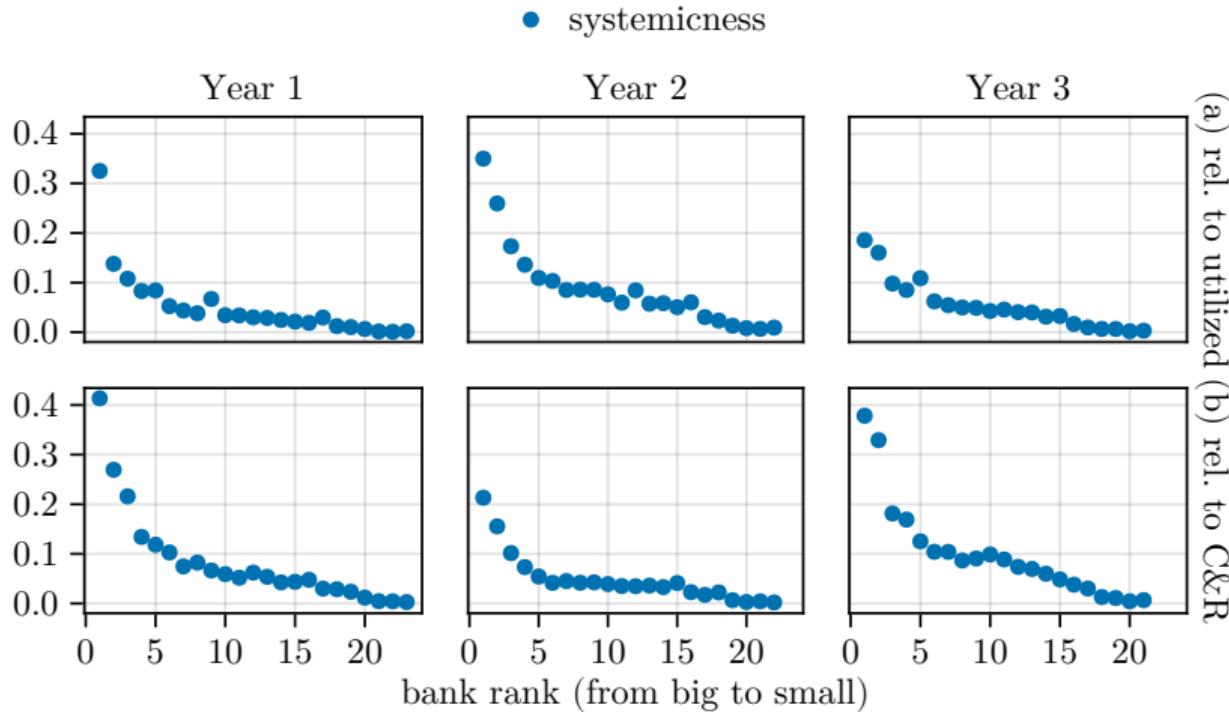
# Contagion matrix



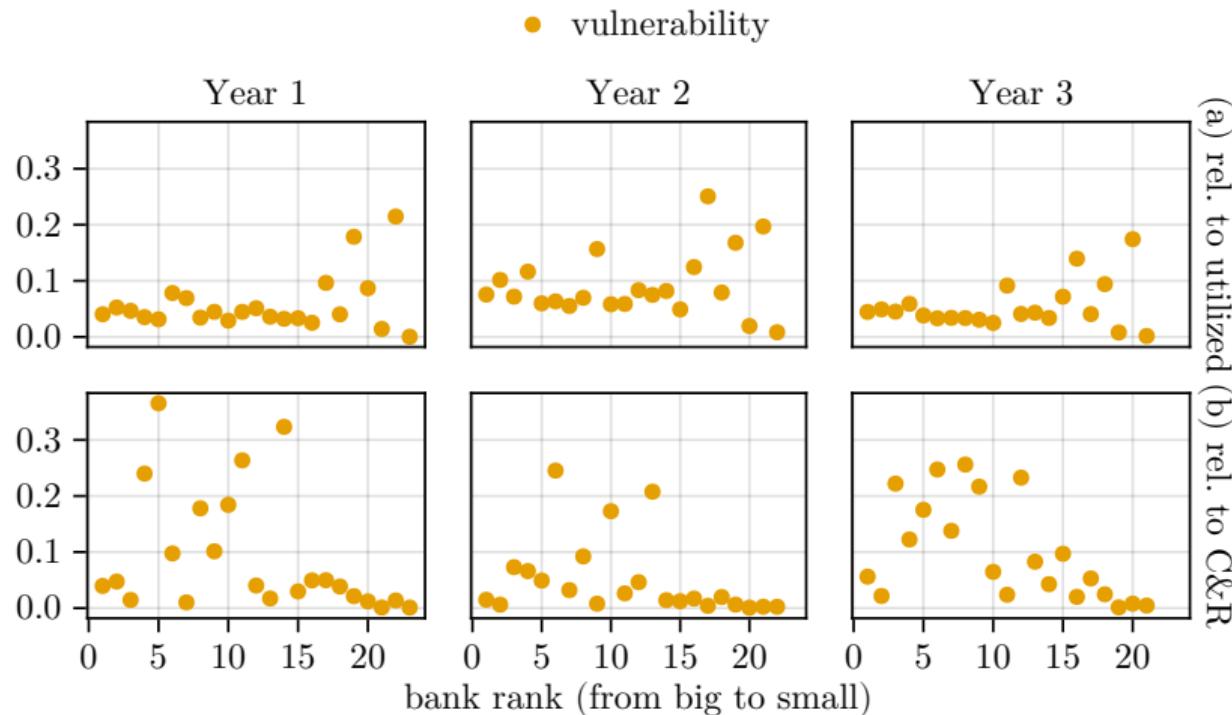
## Systemicness 1



## Systemicness 2 (average propagation)



# Vulnerability



## Conclusion

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