

Syndication, Interconnectedness, and Systemic Risk

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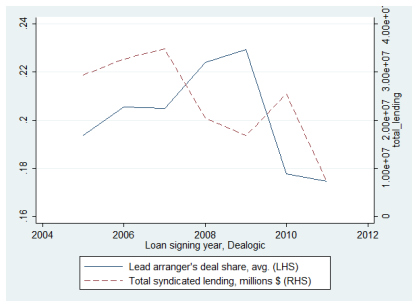
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Discussion by Vladyslav Sushko (BIS)
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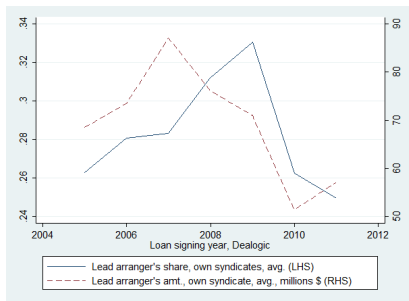
Syndicated loan market

- **Size:** By 2007, accounted for 40% of all cross-border funding to US and more than 2/3 of cross-border flows to EMEs (De Haas and Van Horen, 2012)
- **Volatility:** During the crisis market collapsed from USD 800 to 300 billion in quarterly issuance volume, back to pre-crisis levels by 2011 (Gadanecz, 2011).
- **Originate-to-distribute model:** Lead arranger retains 1/3 each syndicated loan on average (Ivashina and Scharfstein 2010).
 - The lead arrangers choose the participant lenders and administer the loan/syndicate, whereas participant lenders essentially just fund the loan
 - The remaining share is sold to a syndicate of investors including banks, pension funds, mutual funds, hedge funds, and sponsors of structured products.

Interaction between lead arrangers and other lenders



Inverse relation of lead arrangers' share to total lending



Asymmetric exposure of lead arrangers

Ivashina and Scharfstein (2010, AER) attribute such rise in lead share to dominance of bank capital shocks over shocks to borrower collateral.

Paper's contributions

Novel measure of interconnectedness:

- Euclidean distance between banks based on commonality in industry exposures (SIC: division, 2-digit, 3-digit, 4-digit)

Market structure dynamics

- Concentrate syndicate partners among banks with similar loan portfolios → increasing interconnectedness over time
- Interconnectedness increases in assets and diversification

Efficiency vs stability tradeoff:

- Interconnectedness (overlapping portfolios) negatively associated with systemic risk measures (SRISK, CoVaR, DIP) in “good times”, but positively associated during recessions.
- Interconnectedness more important than size (market share) for systemic risk.

Data

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- **Portfolio allocation.** When only total facility \$ amt reported: assumptions about lead-arranger vs participant allocations, or entire loan amt goes to lead-arrangers? Pro rata if multiple lead arrangers?

Collaboration in Loan Syndicates

[Table 3.II, 2-digit SIC]

$$I_{m,n,k,t}^M = \alpha - 0.042^{***} \times \sqrt{\sum_{j=1}^J (w_{i,j,t} - w_{k,j,t})^2} + 0.020^{***} \times I_{m,n,t}^{LR} + 0.533^{***} \times I_{n,k,t}^{BR} + 0.004^{***} \times \frac{L_{m,t}}{L_t} + \epsilon_{m,n,k,t}$$

- Interpreting the magnitude of the coefficient on distance?
- Which driver more important: *diversification* or *relationships*?
- \Rightarrow add to controls $\left[1 - \sum_{j=1}^J (w_{i,j,t})^2\right]$ for $i = m, n$?
- $N = 10,916,818!$ Split sample regressions/rolling coeffs, etc?
- Distribution matters:

	Empirical					Uniform (10 th , 90 th)	
	μ	σ	10 th	50 th	90 th	μ (U)	σ (U)
Distance, 2-digit SIC	1.007	0.317	0.531	1.05	1.414	0.9725	0.255
Interconnectedness, 2-digit SIC	28.9	14.1	12.4	27.8	48.8	30.6	10.51

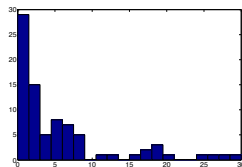
Alternatively defined interconnectedness

Empirical network exhibits a core-periphery structure.

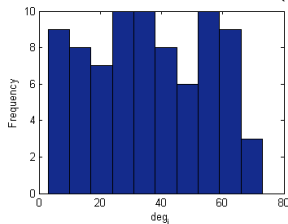
Network map



Out-degree distribution



Distance, based on Cai et al (2015)



Directed network of banks in the syndicated loan market. A directed link is drawn from a participating bank to a lead bank (Nirei, Sushko, Caballero, 2015).

Determinants of interconnectedness

[Table 4.B.II, 2-digit SIC]

$$\left[1 - \frac{\sum_{m \neq n} \sqrt{\sum_{j=1}^J (w_{m,j,t} - w_{n,j,t})^2}}{\sqrt{2}} \right] = \alpha + 0.0334^{***} \times \left[1 - \sum_{j=1}^J (w_{m,j,t})^2 \right] + 0.150^{***} \times \sum_{j=1}^J (I_{m,j,t}) + FE_m + \epsilon_{m,t}$$

- $\ln[\text{Total Assets}]$ also significant, what about $\Delta \text{Loans-to-} \Delta \text{Total Assets}$ (eg a bank's relative exposure)?
- *Interconnectedness* explained using *diversification* and *specialization*; yet all functions of $w_{n,j,t}$ or $I_{n,j,t}$.
- Link with next section: what values of *diversification* and *specialization* associated with *Interconnectedness* such that Systemic Risk_{it} reaches 10th percentile in crises?

Interconnectedness and systemic risk

Expected capital shortfall conditional on systemic crisis (“participation approach”):

$$SRISK_{it}(\alpha) = \max \left\{ 0 ; \left[k \frac{D_{it} + E_{it}}{E_{it}} - 1 + (1 - k) \exp(18 \times \overbrace{\beta_{it}}^{MES_{it}} \times ES_{mt}(\alpha)) \right] + E_{it} \right\}$$

SRISK ranking 71.4% match with **leverage** in normal times, but 60% match with **equity beta** in crisis times, Benoit et al (2015).

Contribution of a bank to financial system VaR (“contribution approach”):

$$\Delta CoVaR_{it}(\alpha) = \frac{\rho_{it}\sigma_{mt}}{\sigma_{it}} [VaR_{it}(\alpha) - VaR_{it}(0.5)]$$

For a given institution $\Delta CoVaR$ is proportional (by the **linear projection of firm return on market return**) to VaR ; perfect correlation in time-series, Benoit et al (2015)

Unified framework for SRISK and $\Delta CoVaR$: demeaned returns follow bivariate GARCH, market and firm shocks are *i.i.d.*, set conditional

event $C = VaR_{mt}(\alpha)$; $C(r_{it}) : r_{it} = VaR_{it}(\alpha)$

Interconnectedness and systemic risk

2-digit SIC (Tables 6.B & 7.A)	SRISK%	1%CoVaR
Interconnectedness	-0.003* (0.0016)	-0.003* (0.0015)
Recession	-0.110 (0.0834)	0.268*** (0.0744)
Interconnectedness x Recession	0.004*** (0.0016)	0.003** (0.0016)
Ln [Total Assets]	0.130*** (0.0411)	0.071*** (0.0245)
Market Share	0.013 (0.0113)	0.002 (0.0029)
Lead Fixed Effects	Yes	Yes
N =	3,866	1,785
Adjusted R2	0.7824	0.6952

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- In the 1%CoVaR regression, recession may be capturing **stock market volatility** & bank **VaR**.

Interconnectedness and systemic risk

Back to Ivashina and Scharfstein (2010, AER): bank capital shocks more important than credit demand shocks.

- Lead share \uparrow as volumes \downarrow during financial recessions
- But, the fall in credit demand itself not associate with rise in lead share
- Tighter credit standards actually associated with higher lead share

→ Alternative interconnectedness weighting scheme, $x_{i,k,t}$ based on industry exposures where both are lead arrangers (differences should emerging going from 2- and 4-digit SIC)

Suggest to relate to the forecast framework of eg. Andrian and Brunnermeir (2011) for the case of CoVaR:

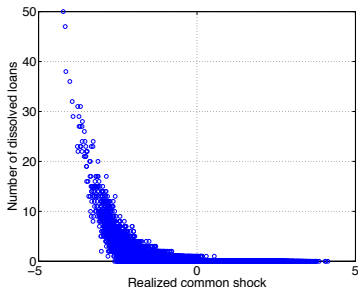
- Use $t - 1$ explanatory variables
- Replace *Recession* with individual bank *VaR*'s
- Other controls: book equity, market β , leverage, etc..
- Test whether degree of portfolio commonality in the syndicated loan market improves CoVaR forecast in t
- Consider quantile regressions
- similar strategy for other systemic risk measures

Simulations suggest syndicated interconnectedness propagates bank shocks

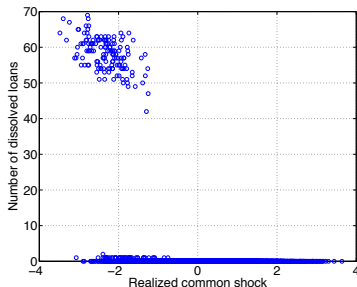
- Risk neutral banks maximize returns subject to a VaR constraint
- Lead arrangers follow a threshold rule: dissolve the syndicate own equity shock adverse enough or enough participants withdraw
- Endogenous probability distribution of aggregate withdrawals

Incidents of massive dissolutions of loans even when the negative common shock is mild.

Autarky model



Syndicated network model



Equity shock has an idiosyncratic and a common component: $e'_j = e + \sqrt{\theta}\epsilon_c + \sqrt{1-\theta}\epsilon_j$; $\theta = 0.5$:

50% of banks' equity shock is common. Source: Nirei, Sushko, Caballero (2015).

Market-level (time-series) tests

- Suggest similar approach focused on bank shock propagation as in panel analysis
- In addition, the aggregate market-level regressions, could also be used to test if syndicated interconnectedness propagates systemic bank crises to the syndicated loan market:

$$\begin{aligned}\Delta \text{Ln}[\text{Market Size}_t] = & \alpha + \beta_1 \times \text{Interconnectedness}_{t-1} + \\ & \beta_2 \times \text{Ln}[\text{CATFIN}_{t-1}] + \beta_3 \times (\text{Interconnectedness}_{t-1} \times \text{Ln}[\text{CATFIN}_{t-1}]) \dots \\ & + \beta_4 \times \text{Recession}_{t-1} + \beta_5 \times (\text{Interconnectedness}_{t-1} \times \text{Recession}_{t-1}) + \\ & \beta_5 \times \text{CorporateCDS}_t + \dots\end{aligned}$$

where CorporateCDS_t controls for borrower credit risk.

Summary of comments

Paper's contribution:

- Novel measure portfolio choice correlation based on actual exposures
- Increasing interconnectedness of the syndicated loan market over time driven by portfolio similarities and complementarities in lender & borrower relationships
- Efficiency vs stability tradeoff: Interconnectedness associated with less systemic risk measures in “good times”, but more risk during recessions.

Comments (& low hanging fruit):

- *Diversification vs relationship* in syndicate formation (& evolution over time)?
- Tailor empirics to large sample size ([split sample regressions](#), [rolling regressions](#)) and interest in the extremes ([quantile regressions](#))
- Take into account [lead](#) vs [participant](#) interconnectedness
- Sensitivity to [shocks to bank capital](#)
- Build on [existing forecast frameworks](#) for CoVaR and other systemic risk measures to test for syndicated interconnectedness as a propagation mechanism