

Counterparty Choice, Bank Interconnectedness, and Systemic Risk

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Motivation

Bank interconnections through common counterparty (CP) exposures previously identified as a source of systemic risk (BCBS (2011), FCIC (2012))





Today, nearly half of the arrangements in the OTC derivative markets involve non-bank counterparties with multiple bank relationships

• Do they still pose as potential sources of systemic stress?

Post-crisis reforms were aimed to mitigate systemic risks, though there is still debate on their effectiveness

- Recent events (e.g., Archegos) suggest remaining deficiencies
- Uncleared derivatives still account for half of aggregate derivative exposures
- Some post-crisis reforms for uncleared derivatives may still result in undercollateralization, particularly for large concentrated positions (Cont, 2018)
- Lack of transparency in uncleared derivative markets poses challenges for banks in sizing aggregate CP exposures
- Bank capital requirements focus on direct, bilateral exposures, overlooking interconnections to other banks through common counterparties



Theoretical literature has established a link between banks' interconnectedness and its contribution to systemic fragility

 Theory assumes banks subject to exogenous shocks only (Allen & Gale, 2000; Freixas et al., 2000; Gai et al., 2011; Acemoglu et al., 2015)

Network risk-taking externality: Connected banks' choices of risk exposure are strategically complementary

- Banks in financial networks, particularly densely connected ones, may endogenously expose to greater risks due to moral hazard
- Connected banks may choose to correlate their risk exposure (Jackson and Pernoud, 2019; and Shu, 2019)

Limited empirical work on banks' risk-taking externality within a network

• Central to our understanding of financial system resiliency to contagion



<u>This paper</u>: Investigates existence of endogenous risk-taking behavior in banks when choosing non-bank counterparties in OTC derivative markets

- Do banks consider the network structure in choosing their CPs? If so, to what extent do these choices increase network fragility?
- How do bank interconnections through common counterparties propagate systemic effects?

Confidential data allow us to precisely quantify network mapping between banks and CPs in the uncleared derivatives markets

Econometric methods help distinguish bank CP choice from time-varying heterogeneity associated with CP and other bank factors.

Preview of Results



- 1. Banks tend to choose riskier, interconnected CPs for their largest exposures
 - Fixed effects estimators allow us to purge the effects of regulatory shocks as well as other forms of CP and bank heterogeneity
 - Interconnectedness not only negative associated with credit risk hedging, but also positively associated with net CDS protection sales
 - The effects on CP choice reverse during the pandemic, as banks reduced their exposures to those CPs
 - Suggest the existence of bank risk-shifting in CP choice
- 2. Common CP exposures positively associated with bank systemic risk outcomes
 - Employ novel tests that focus on bank pairwise CP exposures and employs a battery of fixed effects to mitigate influence of bank heterogeneity
 - Effects stronger during stress periods (namely, for NBFI CP exposures)
 - Suggest consequences for fragilities related to common CP exposures



CCAR Bank CP Disclosures (FR Y-14, Schedule L)

- Confidential CP-level data for largest U.S. G-SIBs
 - Spans all OTC derivatives activities, including interest rate, FX, credit, equity, commodity derivatives
 - Provides CP identities and position information (exposures, collateral, hedging, and risk ratings)
- Coverage of almost all uncleared OTC derivative positions for reporting banks
 - Quarter-end snapshots from 2013 to 2020
 - 36% of global OTC derivative markets

Analysis focuses on uncleared CP exposures

- Uncleared positions account for 49% of all derivatives activities (notional) by reporting banks
- Losses from uncleared positions are solely borne by the bank, while those from cleared positions are mutualized

Network Interconnectedness

OFR



(b) Common CPs over Time





Issue: Interconnectedness may be correlated with unobservable demand (i.e., CP) and other supply (i.e., bank) factors

- Bank CP choice may be a product of assortative matching (Duffie et al., 2007) and not necessarily due to bank risk-shifting incentives
- 1. <u>CPs (Demand)</u>: Larger CPs better able to afford fixed costs of multiple dealer relationships, post collateral, may be of better quality
- 2. <u>Banks (Supply)</u>: Larger banks may have larger / different trading businesses, face differing regulatory restrictions, better able to manage CP risks
- 3. <u>Regulatory (Demand and Supply)</u>: Uncleared margin rules, Basel III bank reforms, central clearing

Our Approach: Use fixed effects estimators that purges *time-varying* unobservable CP and bank heterogeneity in our tests

Issue: While regulatory data allows us an unfettered view into the financial network mapping, banks may not have the same information

 Not accounting for this will likely lead to attenuation issues, particularly for CPs where banks have no existing relationships

However, banks may be able to produce such information over the course of the relationship for existing CPs

- Banks may produce soft information through the course of the relationship, particularly when hard information is scarce (Liberti and Pedersen, 2018)
- Relationships in OTC markets are generally sticky (Afonso et al., 2014; Du et al., 2019; Henderschott et al., 2020), and may allow banks to glean information through the counterparty's trading and non-trading activities

Our Approach: Focus tests on differences in the effects of interconnectedness for banks with existing versus no existing relationship with CPs



We construct a panel to allow us to study how banks (*i*) form linkages with CPs (*j*) with existing and non-existing relationships in next quarter (t+1).

 $\begin{aligned} Link_{i,j,t+1} &= \beta_1 \times IC_{i,j,t} + \beta_2 \times Relationship_{i,j,t} \\ &+ \beta_3 \times Relationship_{i,j,t} \times IC_{i,j,t} + \beta \times X_{i,j,t} + \gamma_{j \times t} + \gamma_{i \times t} + \gamma_{i \times j} + \xi_{i,j,t+1} \end{aligned}$

- *Link*: Dummy if bank *i* has (material) relationship w CP *j* next quarter
- *IC*: Number of banks with exposures to CP *j*
- *Relationship*: Dummy if bank *i* has existing relationship w CP *j*
- Fixed effects (γ): Bank-date, CP-date, and bank-CP
- Bank-CP control variables (X): current credit exposures, collateral, net hedges, WAM, cleared-to-uncleared exposures, and default probability*

* Available at CP-level



1. Banks' preference for a more densely connected network

Banks are more likely to establish and maintain relationships with CPs with more connections with other banks

	(1)	(2)	(3)	(4)
Specification for <i>Link</i> _{i,j,t+1}	All	All	All	All
Current Relationship Subsample:	No	Yes	All	All
IC	0.041***	0.126***	0.041***	
Relationship _{i,j,t}			0.819***	0.487***
IC × Relationship _{i,j,t}			0.085***	0.125***
Bank × Date FEs	NO	NO	NO	YES
CP × Date FEs	NO	NO	NO	YES
Bank × CP FEs	NO	NO	NO	YES
Control Variables	NO	NO	NO	YES



2. Interconnectedness effects concentrated in material exposures

Effects strongest for counterparties with large positions, which are generally riskier, and go in the opposite direction for counterparties with smaller positions



Do banks hedge credit exposures to interconnected CPs? What other credit exposures do banks have to the CPs?

 $\% NetHedge_{i,j,t} = \delta_1 \times IC_{i,j,t} + \delta_2 \times Material_{i,j,t} + \delta_3 \times Material_{i,j,t} \times IC_{i,j,t} + \delta \times X_{i,j,t} + \gamma_{i \times t} + \varphi_{i,j,t}$

- %NetHedge: Net single name CDS hedge positions for bank *i* where CP *j* is the reference entity, scaled by CP exposure
- *IC*: Number of banks with exposures to CP *j*
- *Material*: Dummy if bank *i* has existing material relationship w CP *j*
- Fixed effects (γ): Bank-date
- Bank-CP control variables (X): existing credit exposures, collateral, WAM, cleared-to-uncleared exposures, total CDS volume, and default probability*

Focus on current bank-CP relationship subsample



3. CP interconnectedness has negative association w credit risk hedging

Effects are pronounced for material CPs, inconsistent with risk-sharing

	(1)	(2)	(3)
Current Relationship Subsample:	Yes	Material	Yes
Dependent Variable:	%NetHedge _{i,j,t}	%NetHedge _{i,j,t}	%NetHedge _{i,j,t}
IC	-0.026***	-0.055***	-0.008*
Material _{i,j,t}			-0.005***
IC × Material _{i,j,t}			-0.064***
Bank × Date FEs	YES	YES	YES
Control Variables	YES	YES	YES



4. Banks more likely to be net protection sellers of interconnected CPs

In other words, credit risk exposures are even larger when accounting for activities outside of direct bilateral arrangements with the CP

• Consistent with Elliott et al. (2021)

	(1)	(2)	(3)
Current Relationship Subsample:	Yes	Material	Yes
	Protection	Protection	Protection
Dependent Variable:	Seller _{i,j,t}	Seller _{i,j,t}	Seller _{i,j,t}
IC	0.098***	0.187***	0.053***
Material _{i,j,t}			0.017***
IC × Material _{i,j,t}			0.163***
Bank × Date FEs	YES	YES	YES
Control Variables	YES	YES	YES



Does CP risk alter the effects of interconnectedness?

 $\begin{aligned} Link_{i,j,t+1}^{Material} &= \theta_1 \times IC_{i,j,t} + \theta_2 \times Relationship_{i,j,t} + \theta_3 \times Relationship_{i,j,t} \times IC_{i,j,t} + \theta_4 \times IC_{i,j,t} \times PD_{j,t} + \theta_5 \times Relationship_{i,j,t} \times PD_{j,t} + \theta_6 \times Relationship_{i,j,t} \times IC_{i,j,t} \times PD_{j,t} + \theta \times X_{i,j,t} + \gamma_{j\times t} + \gamma_{i\times t} + \varepsilon_{i,j,t+1} \end{aligned}$

- The triple interaction term (i.e., θ_6) evaluates the differences in the effect of interconnectedness for CPs with high vs low risk
- For ease of interpretability, we will focus on marginal effect estimates based on the fitted model for results hereafter



5. Interconnectedness effect almost twice as large for riskier CPs

Effects increase in CP risk for material exposures (shown below), but go in the opposite direction or is absent for non-material exposures (not shown)





6. Effects concentrated before 2020, reverse during pandemic

Conditioning effect of CP risk disappears in 2020, likely due to banks reducing exposures to riskier, interconnected CPs



Results so far provide evidence of fragility due to bank CP choice

 We next investigate whether common CP exposures are a source of systemic stress

We start by leveraging the CP-level data to calculate *pairwise* CP exposures between banks i_1 and i_2 at each point in time

• %CommonPairExposure: Fraction of bank i_1 's total bilateral exposures associated with CPs shared with bank i_2

We evaluate the relationship between the pairwise exposures with joint bank tail risks

• Comovement in daily idiosyncratic returns volatility between bank i₁ and i₂

Omitted factors associated with time-varying pairwise differences in bank characteristics (e.g., trading businesses) purged using fixed effects

• Two-way FEs on bank i_1 -date and bank i_2 -date levels

Example of Pairwise Exposure Construction





7. Common CP exposures positively associated with joint bank tail risks

Suggests connection between common CP exposures to systemic risk outcomes

• Effects insensitive to decomposition of common CP exposures based on nonbank financial versus non-financial corporate CPs

Dependent Variable:	$ ho^{\text{IdRet}}_{i1,i2,t+1}$	$ ho_{i1,i2,t+1}^{IdRet}$	$ ho_{i1,i2,t+1}^{ldRet}$	$\rho^{\text{IdRet}}_{i1,i2,t+1}$
	(1)	(2)	(3)	(4)
%CommonPairExposure _{i1,i2,t}	0.709***			
Non-Bank Financial Non-Bank Financial		0.778***		0.738***
Non-Financial Corporate Non-Financial Corporate			0.674***	0.617***
Bank i ₁ × Year × Quarter FEs	YES	YES	YES	YES
Bank i ₂ × Year × Quarter FEs	YES	YES	YES	YES



8. Effects pronounced during stress periods, mainly for NBFI exposures

Effects during normal periods are significant across CP types, higher during stress periods

• Effects during stress periods primarily for NBFI CP exposures



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This paper empirically investigates endogenous risk-taking behavior of banks arising from the moral hazard from network formation

- Supportive evidence based on bank counterparty choice and hedging behavior
- Directly show systemic effects associated with common counterparty exposures

Policy implications:

- 1. Bank regulators primarily focus on direct bilateral exposures
- Existing data can be used to quantify and monitor broader connections
- 2. Bank behavior may exacerbate fragility related to dense network structures through CP choice
- However, banks demonstrated resilience in the face of severe shocks in March 2020, aided in part by regulatory interventions and post-crisis regulations
- 3. Systemic risk-shifting behavior by banks may also be present in CCPs