Shock Transmission through Cross-border Bank Lending: Credit and Real Effects

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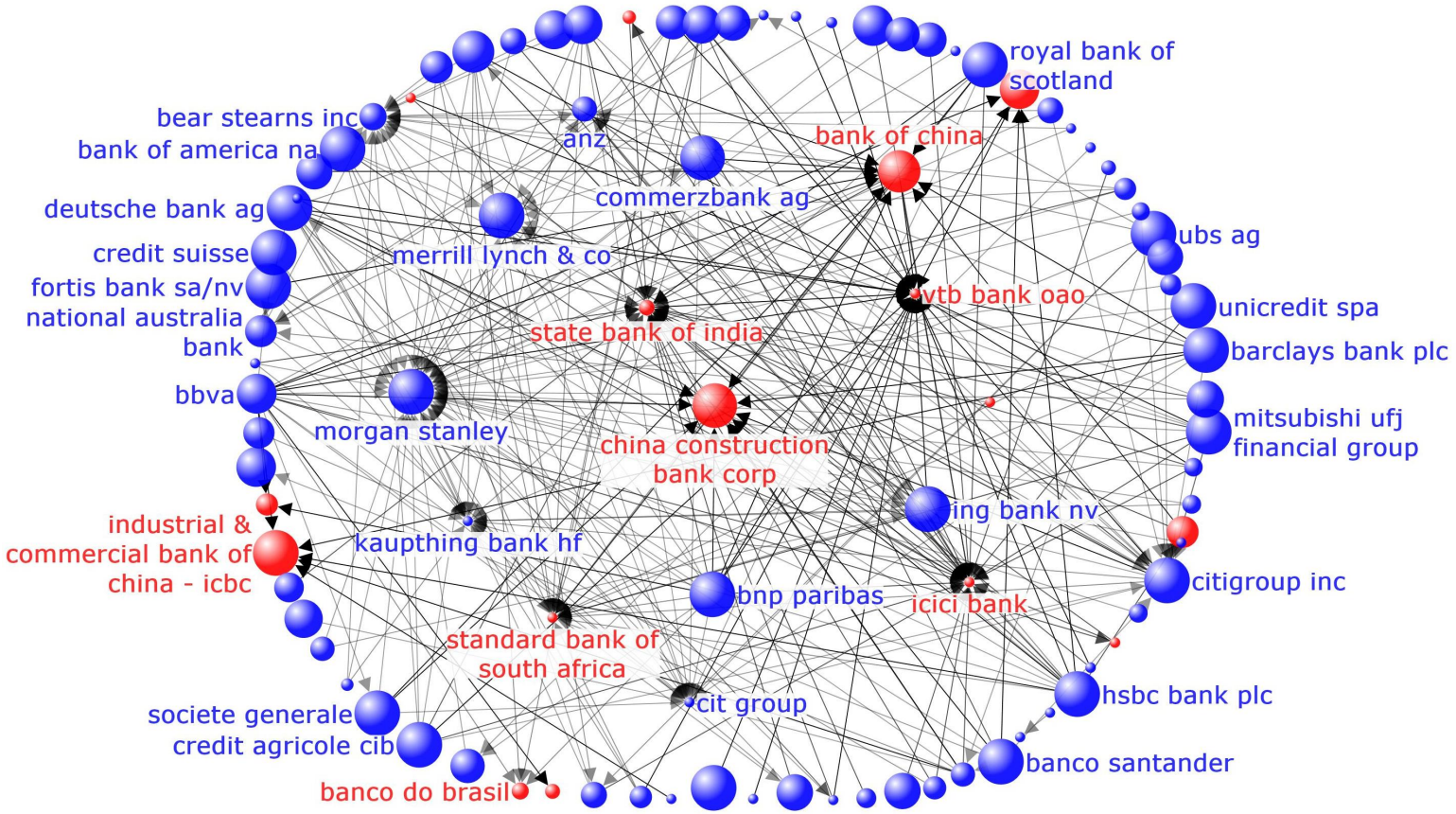
Interbank Networks and the Real Economy

- It is often argued that interconnectedness was a key driver of the 2007-2009 financial crisis
  - Connections among banks, especially across borders, can act as conduits of financial sector shocks
  - Interconectedness "has the potential to magnify shocks to the financial system" Bernanke (2013)
  - Interconnectedness hinder financial institutions' ability to manage risk and can create financial instability during crises Caballero and Simsek (2013)
  - Calls for research on linkages that transmit distress across financial institutions and ultimately impact the broader economy
  - Such research "should ideally include the interactions of interbank exposures with the real economy" Tumpel-Gugerell (2009)
- Growing literature on stability in financial networks
  - Little evidence of transmission through interbank exposures, especially **across borders**, and to the **real economy** (credit supply, firm investment)

The Network of Cross-border Interbank Exposures

In 2007, Citigroup had interbank exposures to 198 banks in 62 countries.



Notes: Visualization contains the largest 100 banks. Nodes represent banks (red for banks in OECD countries; node size proportional to bank size); edges represent interbank exposures (darker for larger USD exposures); arrows show the direction of exposures.

Research Questions

- How do shocks transmit through **cross-border interbank exposures** to affect:
  - Bank profitability (book returns, profit margins)
  - Banks' lending decisions (loan volumes, spreads)
  - Borrowers' real outcomes (asset growth, investment)
- How do shocks transmit through **direct** and **indirect** interbank exposures (1 and 2 steps away from the origin of the shock)
  - Controlling for banks' exposures to the real economy
- Is there **heterogeneity** in the real impact of shocks?
  - Financial vs. non-financial firms
  - Foreign vs. domestic firms
  - Small vs. large firms

Approach

Construct **novel data** with three key ingredients: time-varying bank level cross-border interbank exposures, bank-firm lending relationships, double match with bank and firm financial information

- Exploit data from the market on large bank loans (largely syndicated); interbank loans account for 10% of the market
- The data on exposures spans 15 years (1997-2012) for more than 6,000 banks
- Combine the exposures with bank and firm financial information
- Define crisis vs. non-crisis exposures, direct vs. indirect exposures

Results

1. Direct crisis exposures are associated with lower bank profitability, lower volume of new loans, and higher spreads on new loans
2. This base effect is *higher* for banks that have more indirect *crisis* exposures
3. This base effect is *lower* for banks that have more indirect *non-crisis* exposures
4. Firms in lending relationships with crisis-exposed banks have lower asset growth and investment
5. Heterogeneity: Real effects of cross-border interbank crisis exposures are stronger for foreign firms and small firms

Contribution to the Literature

- International financial contagion Karolyi (2003); Claessens and Forbes (2001)
  - Role of global banks in transmitting financial shocks to the real economy Iyer et al (2014), de Haas and van Horen (2013); Cetorelli and Goldberg (2011), Ivashina and Scharfstein (2010)
  - Asset-side balance sheet shocks Ongena et al (2016), de Haas and van Horen (2012)
  - **Contribution**: Emphsize the role of **international interbank connections** in propagating financial distress from banks in a crisis country to banks in ex-ante healthy countries
- Shock transmission among financial firms
  - "Credit contagion" from bank failures to their creditors Jorion and Zhang (2009)
  - "Counterparty contagion" and "information contagion" from bank failures to other financial firms Helwege and Zhang (2016)
  - **Contribution**: We analyze credit risk exposures among banks in a **global** context, impacts not only on returns, but also on **lending and the real economy**
- Shock transmission to the real economy
  - Italian interbank market Cingano et al (2016)
  - Indian interbank market Iyer and Peydro (2011)
  - **Contribution**: We highlight **international** dimension of standard bank lending channel of shock transmission, flexible set-up that looks both crisis and non-crisis exposures.

Hypotheses

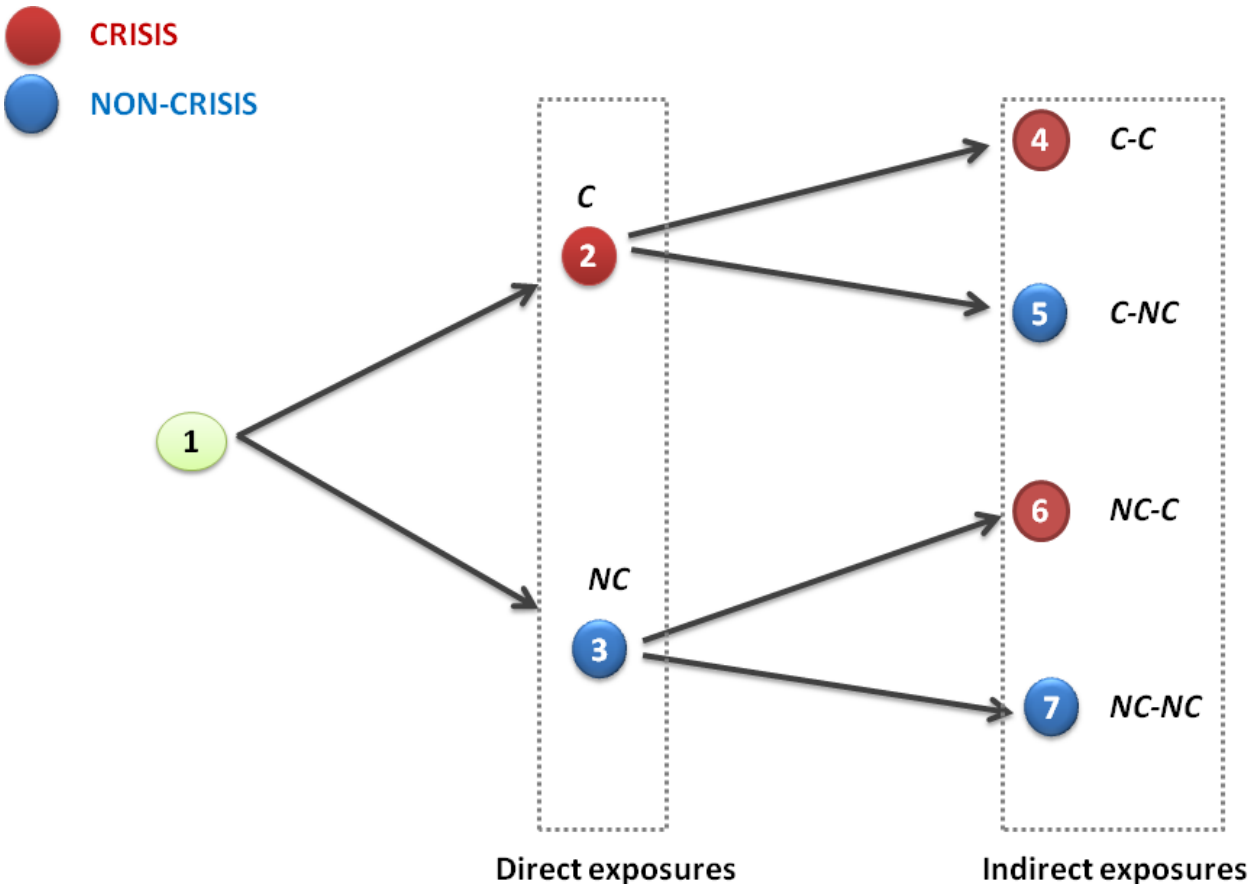
Examine the impact of loan exposures to foreign banks on bank profitability, lending decisions, and the real economy:

- Two types of exposures: direct and indirect exposures to banks in crisis (and non-crisis) countries

Hypotheses:

- **H1**: Crisis exposures have a negative effect on bank earnings, reducing returns (valuation effects, write-downs, loss of business)
  - Cascading effects are possible (indirect exposures)
  - Indirect exposures through crises may amplify effects, those through non-crises may dampen them
  - Agnostic about impact of non-crisis exposures (syndication is low-profit business)
- **H2**: Crisis exposures negatively affect banks' lending decisions (capital erosion, rise in banks' cost of funds)
- **H3**: Crisis exposures negatively affect the performance of financially-constrained, bank-dependent borrowing firms

Direct and Indirect Cross-border Interbank Exposures



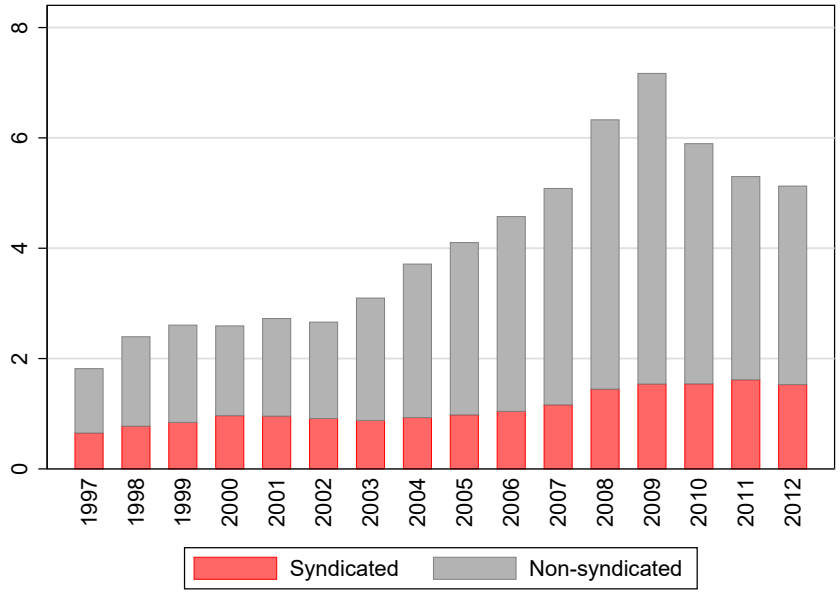
Notes: The figure visualizes direct (first-order, one step away) and indirect (second-order, two steps away) cross-border interbank exposures: crisis exposures (C), non-crisis exposures (NC), crisis exposures through crises (C-C), non-crisis exposures through crises (C-NC), crisis exposures through non-crises (NC-C), and non-crisis exposures through non-crises (NC-NC).

Data

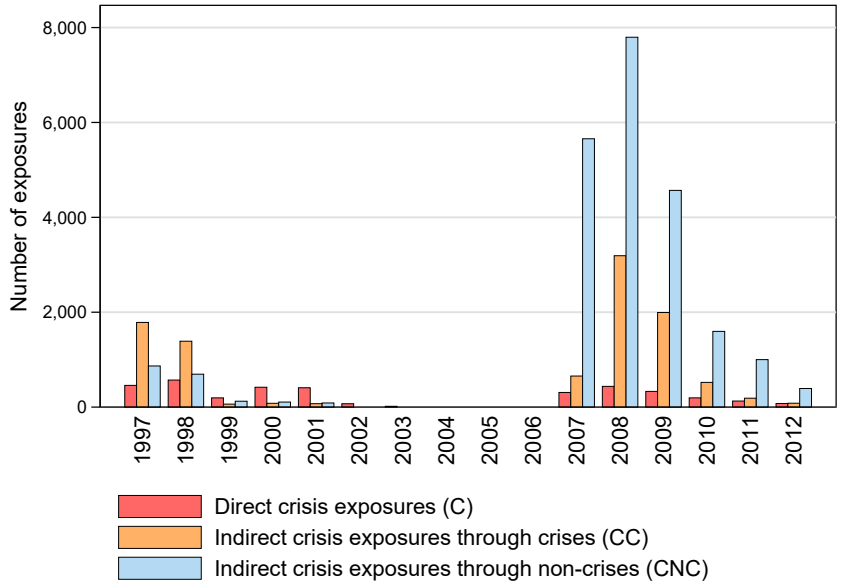
- **Cross-border interbank exposures**:
  - 170,000+ loans (of which 75% syndicated) during 1990-2012 from Dealogic Loan Analytics
  - Clean up bank names, adjust for bank name changes, M&As (locational approach)
  - Count the **number** of cross-border interbank exposures (**crisis exposures**) using bank and firm identifiers, loan amount and maturity (bullet loans))
- **Bank balance sheets**: Merge by name and nationality with balance sheet information from Bankscope
- **Bank loans**: Data on individual corporate loans to banks and non-banks from Dealogic Loan Analytics
- **Firm performance**: Merge with firm financials from Thomson Reuters Worldscope
- **Systemic banking crises**: Incidence of banking crises from Laeven and Valencia (2013)

Cross-border Interbank Market and Bank Exposures

- Cross-border interbank market: 10% of total syndicated loan counts and deal volume, 30% of total cross-border interbank exposures of BIS reporting banks



Cross-border interbank loan claims



Direct and indirect crisis exposures

Notes: LHS panel shows cross-border interbank loan claims (1997-2012) in trillions of U.S. dollars at 2005 prices, broken down into claims that are formed through syndicated loas and claims that are formed through single-lender loans. Claims that are formed through intergroup transactions are excluded. RHS panel shows the number of direct crisis exposures (C), indirect crisis exposures through crises (C-C), and indirect non-crisis exposures through crises (C-NC) in regression sample (1997-2012).
Sources: Bankscope, BIS locational banking statistics, Dealogic Loan Analytics, Laeven and Valencia (2013).

Empirical Specifications

Datasets:

- **Bank profitability**: bank-year dataset
- **Bank lending**: loan facility-bank-borrower-year data for loan shares; bank-borrower-year data for loan spreads
- **Real effects**: firm-year data

Workhorse specification:

OUTCOME = FIXED EFFECTS (as appropriate)
+ **DIRECT CRISIS EXPOSURES**
+ DIRECT NON-CRISIS EXPOSURES
+ **INDIRECT CRISIS EXPOSURES**
+ INDIRECT NON-CRISIS EXPOSURES
+ BANK CHARACTERSTICS
+ DIRECT AND INDIRECT EXPOSURES TO REAL ECONOMY
+ LOAN CONTROLS (if applicable)
+ FIRM CONTROLS (if applicable)
+ ERROR

Crisis Exposures and Bank Profitability

Dependent variable: bank ROA, ROE, NIMs

	ROA	ROA	ROE	ROE	NIM	NIM
# direct C exp.	-0.0309***	-0.0227**	-0.2938**	-0.2194*	-0.0306***	-0.0259***
	(0.009)	(0.009)	(0.126)	(0.119)	(0.009)	(0.009)
# direct NC exp.	0.0002	0.0011	-0.0238	-0.0163	-0.0019	-0.0013
	(0.002)	(0.002)	(0.024)	(0.025)	(0.003)	(0.003)
# indirect C-C exp.		-0.0076***		-0.0988**		-0.0036*
		(0.003)		(0.043)		(0.002)
# indirect C-NC exp.		0.0042***		0.0496**		0.0024***
		(0.001)		(0.019)		(0.001)
# indirect NC-C exp.		0.0009		0.0053		0.0017
		(0.002)		(0.033)		(0.003)
# indirect NC-NC exp.		-0.0008*		0.0003		-0.0005
		(0.000)		(0.005)		(0.000)
Control for bank characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Control for bank exposures to firms	Yes	Yes	Yes	Yes	Yes	Yes
Control for total indirect exposures	Yes	No	Yes	No	Yes	No
Bank country × year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	14,448	14,448	14,445	14,445	14,135	14,135
R-squared	0.440	0.441	0.345	0.346	0.659	0.659

Notes: Controls include bank size, capital, business model, entity type, and the no. of direct C and NC exposures to non-banks. The data are at the bank-year level over 1997-2012.

Crisis Exposures and Bank Lending: Volume & Spreads

Dependent variable: loan share (%) and log(1+loan spread)

	Share	Share	Spread	Spread
# direct C exp.	-0.0697***		0.0011***	
	(0.023)		(0.000)	
# direct C exp. × Non-Financial firm		-0.0830***		0.0017***
		(0.031)		(0.000)
# direct C exp. × Financial firm		0.0656		0.0005
		(0.097)		(0.000)
# direct NC exp.	0.0184*	0.0214*	-0.0006***	-0.0006***
	(0.011)	(0.012)	(0.000)	(0.000)
# indirect C-C exp.	-0.0056	-0.0059	0.0004**	0.0004***
	(0.012)	(0.012)	(0.000)	(0.000)
# indirect C-NC exp.	0.0121	0.0113	-0.0000	-0.0001
	(0.008)	(0.007)	(0.000)	(0.000)
# indirect NC exp.	0.0022	0.0017	-0.0002***	-0.0002***
	(0.002)	(0.002)	(0.000)	(0.000)
Control for bank characteristics	Yes	Yes	Yes	Yes
Control for bank exposures to real economy	Yes	Yes	Yes	Yes
Control for loan deal characteristics	Yes	Yes	No	No
Bank FE	Yes	Yes	No	No
Year FE	Yes	Yes	Yes	Yes
Bank country×Year FE	No	No	Yes	Yes
Borrower country×Year FE	No	No	Yes	Yes
Observations	319,267	319,267	134,461	134,461
R-squared	0.487	0.488	0.388	0.389

Notes: Controls include bank size, capital, business model, entity type, no. of direct C and NC exposures to non-banks, in cols 1-2 also loan deal characteristics (no. of banks in syndicate, dummy for lead banks, credit lines, and deal currencies). The data are at the loan facility-bank-firm-year level over 1997-2012 in cols 1-2, at the bank-firm-year level in cols 3-4.

Crisis Exposures and Bank Lending: Heterogeneity

Dependent variable: loan share (%) and log(1+loan spread)

	Share	Spread
# direct C exp. × Domestic × Small firm	-0.0658*	0.0030***
	(0.037)	(0.000)
# direct C exp. × Foreign × Small firm	-0.1008***	0.0076***
	(0.028)	(0.001)
# direct C exp. × Domestic × Large firm	-0.0201	-0.0003
	(0.049)	(0.000)
# direct C exp. × Foreign × Large firm	-0.0300*	-0.0002
	(0.016)	(0.001)
# direct NC exp.	0.0155	-0.0005***
	(0.012)	(0.000)
Control for bank characteristics	Yes	Yes
Control for bank exposures to real economy	Yes	Yes
Control for loan deal characteristics	Yes	No
Control for bank indirect exposures	Yes	Yes
Bank FE	Yes	No
Year FE	Yes	Yes
Bank country×Year FE	No	Yes
Borrower country×Year FE	No	Yes
Observations	256,632	120,773
R-squared	0.488	0.365

Notes: Controls include bank size, capital, business model, entity type, no. of direct C and NC exposures to non-banks, in col 1 also loan deal characteristics (no. of banks in syndicate, dummy for lead banks, credit lines, and deal currencies). The data are at the loan facility-bank-firm-year level over 1997-2012 in col 1, at the bank-firm-year level in col 1. Non-financial firms only.

Crisis Exposures and Bank Lending: Shock Transmission to Third Countries

Dependent variable: loan share (%) and log(1+loan spread)

	Share	Spread
# direct C exp. × Domestic × Small firm	-0.0700*	0.0043***
	(0.042)	(0.001)
# direct C exp. × Foreign × Small firm	-0.1351***	0.0074***
	(0.042)	(0.001)
# direct C exp. × Domestic × Large firm	-0.0358	-0.0008
	(0.046)	(0.001)
# direct C exp. × Foreign × Large firm	-0.0484	-0.0018
	(0.031)	(0.002)
# direct NC exp.	0.0180	-0.0008***
	(0.012)	(0.000)
Control for bank characteristics	Yes	Yes
Control for bank exposures to real economy	Yes	Yes
Control for loan deal characteristics	Yes	No
Control for bank indirect exposures	Yes	Yes
Bank FE	Yes	No
Year FE	Yes	Yes
Bank country×Year FE	No	Yes
Borrower country×Year FE	No	Yes
Observations	241,664	89,466
R-squared	0.490	0.319

Notes: Same as previous table. The sample further excludes bank-firm pairs for which the firm is in the shock origin country.

Real Effects of Crisis Exposures: Firm Investment & Growth

Dependent variable: investment ratio and asset growth

	Investment ratio		Asset growth	
# direct C exp.	-0.0216**		-0.1129**	
	(0.008)		(0.034)	
# direct C exp. × Small firm [1]		-0.0431**		-0.1498**
		(0.018)		(0.053)
# direct C exp. × Large firm [2]		-0.0228*		-0.1124*
		(0.011)		(0.054)
# direct NC exp.	-0.0089	-0.0056	-0.0469	-0.0031
	(0.007)	(0.005)	(0.040)	(0.032)
Control for bank characteristics	Yes	Yes	Yes	Yes
Control for firm characteristics	Yes	Yes	Yes	Yes
Control for bank exposures to real economy	Yes	Yes	Yes	Yes
Control for bank indirect exposures	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Firm country×Industry×Year FE	Yes	Yes	Yes	Yes
p-value t-test [1]<[2]		0.000		0.000
Observations	10,151	10,151	10,148	10,148
R-squared	0.827	0.827	0.583	0.584

Notes: Controls include average bank size, capital, business model, and entity type, no. of direct C and NC exposures to non-banks for the banks lending to each firm (all weighted by lagged share of loan volume), firm Tobin's q, cash flow (% assets), and firm size. The data are at the firm-year level over 1997-2012. Non-financial firms only. Industry based on 1-digit SIC classification.

Falsification Tests

- Rule out **prior trends**: Confirm that the results are due to banking network itself and not pre-existing trends in bank profitability. No effects if we lag the profitability dependent variables by 2, 4, or 6 years prior to the shock.

- Ensure we capture **real shocks & interbank linkages**: Confirm that the results are driven by systemic banking crises and not spurious events, and by cross-border loan exposures and not spurious interbank linkages.

  1. randomize the shocks (crisis dates) across countries every year
  2. randomize the network links (cross-border interbank connections) across banks every year
  3. randomize both the shocks and the network structure

Conclusions

- To date, the **real effects of interbank networks remain understudied**, especially in the international context
- We construct and assemble **novel data** to shed light on this issue by looking at the network of cross-border interbank exposures of 6,000+ banks over 1997-2012
- Results:
  1. A larger number of **crisis exposures**—exposures to banks in countries hit by systemic banking crises—reduce banks' returns and profit margins.
  2. Affected banks cut bank corporate loan volume and charge higher spreads on new loans, especially to foreign and small firms
  3. Both **direct and indirect shocks** matter, but the latter have significantly smaller effect than the latter
  4. There are **spillovers of crisis exposures to the real sector**, even in countries that are not experiencing banking crises themselves