Lending Relationships and the Collateral Channel

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Note: The views presented are those of the authors and do not necessarily reflect those of the Bank of England.

Motivation

1. The Collateral Channel
   - Collateral can mitigate agency problems
   - Movements in collateral prices can generate booms and busts in corporate investment (Chaney et al. 2012; Bahaj et al. 2017)
2. Relationship Lending
   - Lending relationships can also mitigate agency problems

- **Do lending relationships amplify or moderate the collateral channel?**
  - *Moderation*: reduction in information asymmetries (Boot 2000)
  - *Amplification:* private information may help monitor collateral (Rajan and Winton 1995)

Which Lending Relationships?

- Relationships can occur between multiple actors:
  1. Relationship between bank and company
  2. Relationship between bank and company executives
  3. *Personal* banking relationship of company executives
- **Result: each type of relationship mitigates information frictions**

Main Results

- Empirical findings for panel of U.K. firms over 2002-2013:

1. **Corporate Collateral Channel**: for every £1 increase in corporate property values the firm increases investment by 4p
2. **Firm-Bank Relationships Matter:**
   - ★ Firm at 25th %ile of relationship length increases investment by 5p
   - ★ Firm at 75th %ile of relationship length increases investment by 2.5p
3. **Board-Bank Relationships Matter:**
   - ★ Director-bank relationships can dominate firm-bank relationships
4. **Personal Banking Relationships Matter:**
   - ★ Collateral channel not sensitive to firm-bank relationship length when director has a mortgage with the firm's bank

Contribution

- **New Result: relationships insulate investment from fluctuations in collateral values**

1. **Direct Test of Conflicting Theories**
   - Disentangle relationships from proxies like age/size
   - Focus on real economic outcomes
2. **Novel Measures of Relationship Length**
   - Add to nascent literature on relationships between executives and banks (Karolyi 2018)
   - Novel evidence on personal banking relationships
3. **Implications for Future of Collateral Channel**
   - Financial innovation could decrease importance of relationship lending
   - Could increase strength of Collateral Channel

Data

Data: Overview

1. Corporate data from Bureau van Dijk (BVD) for 2002-2013
   - Annual data on public and private UK firms from Companies House
   - Information on secured company borrowing
   - Information on all company directors including appointment dates
   - BVD is a live database: **no historical information on directors**
   - $\Rightarrow$ use archived data on 21 vintages at 6 month frequency
2. Banking Data from Bank of England
   - Confidential Historical Banking Regulatory Database (HBRD) (see de Ramon et al. 2017)
3. Land Price Data
   - House price indices for 204 (of 205) British regions
4. Mortgage Data from FCA
   - Administrative data on the universe of regulated mortgage originations

Data: Corporate Collateral

- Use property as measure of corporate collateral
  - 75% of bank loans to SMEs and Mid-Size Corps. secured on property
  - Plausibly exogenous variation in collateral values
- Corporate collateral-balance sheet item "Land and Buildings"
  - Collateral for firm i in region j at time t is computed using *intensive* margin of collateral:

$$Collateral_{i,t} = L^{B}_{i,2002} \frac{L^{P}_{j,t}}{L^{P}_{j,2002}}$$

  - where $L^{B}_{i,2002}$ is the book value of land and buildings in base year (2002)
  - $L^{P}_{j,t}$ is the house price index in region j at time t
- Robustness:
  - Commercial real estate price index

Data: Corporate Banking Relationships

- Lenders typically require companies to provide security against a loan
- Firms report secured borrowing to Companies House within 21 days
- Includes date of borrowing, identity of the lender (in textual form)
- Textual algorithm used to match lender names to banks in the HBRD
- For outstanding relationships between firm i and bank b:

$$Relationship\,Length_{i,b,t} = log\left(1 + Months_{i,b,t}\right)$$

where $Months_{i,b,t}$ is the number of months since relationship began

Summary Statistics

	No. Banking Rel.		
	One	**Multiple**	**All**
Firm-year observations	101649	13635	115284
Turnover (£000s, median)	1400	3571	1574
Investment rate (median)	.0086	.012	.009
Profit rate (median)	.032	.028	.032
Collateral (median)	.011	.084	.018
Short term debt (£000s, median)	89	232	100
Long term debt (£000s, median)	151	376	175
Age (months, median)	196	249	204
Relationship length (months, median)	106	98	104

Baseline Results

Baseline Specification

- Baseline specification: firm i, region j, with bank k, at time t

$$Inv_{i,t} = \alpha_i + \delta_{j,t} + \mu_{k,t} + \phi \times Firm\,Controls_{i,t} + \beta \times Collateral_{i,t} + \delta \times Collateral_{i,t} \times Relationship\,Length_{i,t} + \varepsilon_{i,t}$$

- Inv_{it} is investment (change in fixed assets plus depreciation)
- Accounting variables scaled by the lag of firm turnover and winsorized at 1/99%
- α_i is a firm fixed effect
- $\delta_{j,t}$ is a region-time fixed effect to capture aggregate and region-specific factors
- $\mu_{k,t}$ is a bank-combination-time fixed effect to control for e.g. impact of real estate prices on bank balance sheets
- β measures the strength of the corporate collateral channel
- δ measures the impact of *Relationship Length* on the collateral channel

Table : Baseline model

	(1)	(2)
Dependent Var:		Investment
Included Firms:		All
Collateral	0.0389***	0.0350***
	(0.003)	(0.003)
Cash Ratio		0.1142***
		(0.011)
Profit Margin		-0.0043
		(0.014)
Firm Age		-0.0106
		(0.012)
Credit Rating		-0.0000
		(0.000)
R'ship Length		-0.0344***
		(0.003)
Collateral x R'ship Length		
Firm FE	yes	yes
Region-Time FE	yes	yes
Bank-Time FE	yes	yes
H.P. Controls	no	no
Adjusted R^2	0.21	0.23
Observations	107,649	107,649

Table : Baseline model

	(1)	(2)	(3)	(4)
Dependent Var:			Investment	
Included Firms:			All	
Collateral	0.0389***	0.0350***	0.0381***	0.0381***
	(0.003)	(0.003)	(0.003)	(0.003)
Cash Ratio		0.1142***	0.1185***	0.1182***
		(0.011)	(0.011)	(0.011)
Profit Margin		-0.0043	0.0011	0.0014
		(0.014)	(0.014)	(0.014)
Firm Age		-0.0106	-0.0166	-0.0129
		(0.012)	(0.011)	(0.011)
Credit Rating		-0.0000	-0.0001	-0.0001
		(0.000)	(0.000)	(0.000)
R'ship Length		-0.0344***	-0.0243***	-0.0524***
		(0.003)	(0.003)	(0.008)
Collateral x			-0.0180***	-0.0182***
R'ship Length			(0.002)	(0.002)
Firm FE	yes	yes	yes	yes
Region-Time FE	yes	yes	yes	yes
Bank-Time FE	yes	yes	yes	yes
H.P. Controls	no	no	no	yes
Adjusted R^2	0.21	0.23	0.23	0.23
Observations	107,649	107,649	107,649	107,649

Banking Relationships Dampen Collateral Channel

- A £1 increase in corporate property increases investment by around 4p for firms with *average relationship length*
- A doubling of relationship length (100% increase) reduces this responsiveness by 1.8p
- Sensitivity of investment to collateral values decreases from
  - 4.8p for 25th percentile of relationship length (4.2 years) to
  - 2.5p for 75th percentile of relationship length (15.4 years)
- Consistent with collateral substituting for bank monitoring

Table : Baseline model

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Var:			Investment					
Included Firms:			All			Private	Public	
Collateral	0.0389***	0.0350***	0.0381***	0.0381***	0.04***	0.05**		
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.02)		
Cash Ratio		0.1142***	0.1185***	0.1182***	0.12**	0.11**		
		(0.011)	(0.011)	(0.011)	(0.01)	(0.05)		
Profit Margin		-0.0043	0.0011	0.0014	-0.01	0.05		
		(0.014)	(0.014)	(0.014)	(0.01)	(0.05)		
Firm Age		-0.0106	-0.0166	-0.0129	-0.01	-0.04		
		(0.012)	(0.011)	(0.011)	(0.01)	(0.08)		
Credit Rating		-0.0000	-0.0001	-0.0001	-0.0001*	0.0001		
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		
R'ship Length		-0.0344***	-0.0243***	-0.0524***	-0.03***	-0.03***		
		(0.003)	(0.003)	(0.008)	(0.003)	(0.01)		
Collateral x			-0.0180***	-0.0182***	-0.02***	-0.01		
R'ship Length			(0.002)	(0.002)	(0.003)	(0.01)		
Firm FE	yes	yes	yes	yes	yes	yes		
Region-Time FE	yes	yes	yes	yes	yes	yes		
Bank-Time FE	yes	yes	yes	yes	yes	yes		
H.P. Controls	no	no	no	yes	no	no		
Adjusted R^2	0.21	0.23	0.23	0.23	0.24	0.22		
Observations	107,649	107,649	107,649	107,649	99,014	7,634		

Table : Baseline model

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Var:				Investment			Short-T Debt	Long-T Debt
Included Firms:				All		Private	Public	All
Collateral	0.0389***	0.0350***	0.0381***	0.0381***	0.04***	0.05**	0.0107***	0.0118**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.02)	(0.002)	(0.005)
Cash Ratio		0.1142***	0.1185***	0.1182***	0.12**	0.11**	0.1599***	-0.0082
		(0.011)	(0.011)	(0.011)	(0.01)	(0.05)	(0.019)	(0.028)
Profit Margin		-0.0043	0.0011	0.0014	-0.01	0.05	0.0231	-0.0000
		(0.014)	(0.014)	(0.014)	(0.01)	(0.05)	(0.017)	(0.024)
Firm Age		-0.0106	-0.0166	-0.0129	-0.01	-0.04	-0.0147*	0.0034
		(0.012)	(0.011)	(0.011)	(0.01)	(0.08)	(0.008)	(0.015)
Credit Rating		-0.0000	-0.0001	-0.0001	-0.0001*	0.0001	-0.0012***	-0.0000
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
R'ship Length		-0.0344***	-0.0243***	-0.0524***	-0.03***	-0.03***	-0.0038**	-0.0158***
		(0.003)	(0.003)	(0.008)	(0.003)	(0.01)	(0.001)	(0.002)
Collateral x			-0.0180***	-0.0182***	-0.02***	-0.01	-0.0001	-0.0199***
R'ship Length			(0.002)	(0.002)	(0.003)	(0.01)	(0.002)	(0.003)
Firm FE	yes	yes	yes	yes	yes	yes	yes	yes
Region-Time FE	yes	yes	yes	yes	yes	yes	yes	yes
Bank-Time FE	yes	yes	yes	yes	yes	yes	yes	yes
H.P. Controls	no	no	no	yes	no	no	no	no
Adjusted R^2	0.21	0.23	0.23	0.23	0.24	0.22	0.07	0.08
Observations	107,649	107,649	107,649	107,649	99,014	7,634	56,601	56,601

Robustness

Table : Additional Interactions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Baseline							
X is:		Firm Age	Small	Credit Rating	Bank Size	Bank Leverage	Bank Losses	Multiple Bank
Collateral	0.04***	0.04***	0.05***	0.04***	0.04***	0.04***	0.04***	0.04***
	(0.003)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
R'ship Length	-0.02***	-0.03***	-0.02***	-0.03***	-0.03***	-0.02***	-0.02***	-0.02***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Collateral x	-0.02***	-0.02***	-0.02***	-0.02***	-0.02***	-0.02***	-0.02***	-0.02***
R'ship Length	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Collateral * X		-0.004	-0.03***	-0.0001*	-0.01***	0.0003	0.003	-0.004
		(0.004)	(0.004)	(0.000)	(0.002)	(0.002)	(0.003)	(0.006)
R'ship Length*X		0.03***	-0.01***	0.0002***	0.008***	0.0001	0.0003	0.003
		(0.003)	(0.001)	(0.000)	(0.002)	(0.001)	(0.001)	(0.007)
Firm FE	yes	yes	yes	yes	yes	yes	yes	yes
Region-Time FE	yes	yes	yes	yes	yes	yes	yes	yes
Bank-Time FE	yes	yes	yes	yes	yes	yes	yes	yes
Adjusted R^2	0.23	0.23	0.24	0.23	0.23	0.23	0.23	0.23
Observations	107,649	107,649	107,649	107,649	107,649	107,649	107,649	107,649

Table : Robustness

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Baseline	IV	*Collateral* Measure		Lag R'ship	*Investment* Measure		Subset of Firms		
			$t-5$	CRE Prices		ex-Dep.	Tangibles	Single Region	UK Focused	Tradable
Collateral	0.04***	0.06***	0.01***	0.06***	0.03***	0.02***	0.03***	0.04***	0.04***	0.03***
	(0.00)	(0.02)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)
Collateral x	-0.02***	-0.02***	-0.01***	-0.03***	-0.01***	-0.02***	-0.02***	-0.02***	-0.02***	-0.01*
R'ship Length	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)
Adjusted R^2	0.23	0.23	0.22	0.25	0.22	0.15	0.24	0.24	0.25	0.20
Observations	107,649	97,989	76,239	49,909	94,347	117,967	107,347	78,919	33,510	22,421

Personal Relationships And The Collateral Channel

Relationship With Company Or Its Board?

- Results suggest banking relationships mitigate information frictions
- However, information frictions arise between *individuals*
- Relationship between the bank and the company board should matter
- We test this using the appointment dates of the company directors
- Construct two alternative measures of relationship length
- Length of relationship between bank and firm where:
  - At least one of the current directors was present
  - A majority of the current directors were present

Table : Banking Relationships With the Board

	(1)	(2)	(3)
Board Measure:		Longest Serving	Majority
Collateral	0.0381***	0.0374***	0.0370***
	(0.003)	(0.003)	(0.003)
Collateral x Firm R'ship Length	-0.0180***		
	(0.002)		
Collateral x Board R'ship Length		-0.0193***	-0.0162***
		(0.002)	(0.002)
Adjusted R^2	0.23	0.23	0.23
Observations	107649	107518	107518

Table : Banking Relationships With the Board

	(1)	(2)	(3)	(4)	(5)
Board Measure:		Longest Serving	Majority	Longest Serving	Majority
Collateral	0.0381***	0.0374***	0.0370***	0.0376***	0.0379***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Collateral x Firm R'ship Length	-0.0180***			-0.0031	-0.0136***
	(0.002)			(0.005)	(0.004)
Collateral x Board R'ship Length		-0.0193***	-0.0162***	-0.0164***	-0.0053
		(0.002)	(0.002)	(0.005)	(0.004)
Adjusted R^2	0.23	0.23	0.23	0.23	0.23
Observations	107649	107518	107518	107518	107518

Relationship With Company Or Its Board?

- Results show that relationships between the bank and the board matter
- Consistent with relationships mitigating information frictions
- Comparing firm and board relationships:
  - Relationship with longest-serving director more important than firm
  - Relationship with firm more important than with majority of current board
- Importance of continuing relationship with longest serving director, not the whole board

Personal Banking Relationships

- What if the firm's executives have a *personal* banking relationship with the firm's bank?
- Personal banking relationships could mitigate corporate borrowing constraints:
  - Reduce information frictions
  - Facilitate borrowing against director's house
- Measure personal banking relationship by identifying director's residential mortgage provider
  - Match director address with universe of UK regulated mortgages
  - Identify a *common* relationship when director has their residential mortgage with firm's bank

Table : Personal Relationships And The Collateral Channel

	(1)	(2)
Dependent Var:	Investment	
Included Firms:	All	
Collateral	0.04***	0.04***
	(0.003)	(0.003)
Collateral * R'ship Length	-0.02***	-0.02***
	(0.002)	(0.002)
Collateral * Director R'ship		-0.01
		(0.01)
R'ship Length * Director R'ship		0.001
		(0.001)
Collateral * R'ship Length * Director R'ship		0.02***
		(0.006)
Adjusted R^2	0.23	0.23
Observations	107,649	107,649

Adjusted R^2	0.24	0.22	
Observations	99,014	7,634	

Table : Personal Relationships And The Collateral Channel

	(1)	(2)	(3)	(4)
Dependent Var:		Investment		
Included Firms:		All	Private	Public
Collateral	0.04***	0.04***	0.04***	0.05**
	(0.003)	(0.003)	(0.003)	(0.02)
Collateral * R'ship Length	-0.02***	-0.02***	-0.02***	-0.02
	(0.002)	(0.002)	(0.002)	(0.011)
Collateral * Director R'ship		-0.01	-0.01	-0.01
		(0.01)	(0.01)	(0.01)
R'ship Length * Director R'ship		0.001	0.001	0.001
		(0.001)	(0.001)	(0.001)
Collateral * R'ship Length * Director R'ship		0.02***	0.02***	-0.04
		(0.006)	(0.007)	(0.06)
Adjusted R^2	0.23	0.23	0.24	0.22
Observations	107,649	107,649	99,014	7,634

Personal Banking Relationships

- Interaction of collateral and relationship length is substantially smaller when director has common banking relationship
  - Without a common relationship a doubling of corporate relationship length reduces collateral responsiveness by around 2p
  - With a common relationship, corporate relationship length has little impact on sensitivity of investment to collateral
- Information frictions or facilitating borrowing?
- $\Rightarrow$ Examine the relative response of director-shareholders

Table : Personal Relationships And The Collateral Channel

	(1)	(2)	(3)	(4)	(5)
Dependent Var:			Investment		
Included Firms:		All		Private	Public	All
Collateral	0.04***	0.04***	0.04***	0.05**	0.04***
	(0.003)	(0.003)	(0.003)	(0.02)	(0.003)
Collateral * R'ship Length	-0.02***	-0.02***	-0.02***	-0.02	-0.02***
	(0.002)	(0.002)	(0.002)	(0.011)	(0.003)
Collateral * Director R'ship		-0.01	-0.01	-0.01	0.05
		(0.01)	(0.01)	(0.01)	(0.06)
R'ship Length * Director R'ship		0.001	0.001	0.001	-0.003
		(0.001)	(0.001)	(0.001)	(0.004)
Collateral * R'ship Length * Director R'ship		0.02***	0.02***	-0.04	0.02***
		(0.006)	(0.007)	(0.06)	(0.006)
Collateral * R'ship Length * Director R'ship * Shareholder					-0.01
					(0.01)
Adjusted R^2	0.23	0.23	0.24	0.22	0.23
Observations	107,649	107,649	99,014	7,634	107,649

Personal Banking Relationships

- Impact of personal banking relationships doesn't depend on whether director is a shareholder
- Non-shareholders unlikely to risk their house for the firm
- Suggests personal banking relationships mitigate information frictions
- Personal relationships seem to substitute for corporate relationships

Summary

- **Relationships insulate investment from fluctuations in collateral values**

1. **Corporate Collateral Channel**: for every £1 increase in corporate property values the firm increases investment by 4p
2. **Firm-Bank Relationships Matter:**
   - Firm at 25th %ile of relationship length increases investment by 5p
   - Firm at 75th %ile of relationship length increases investment by 2.5p
3. **Board-Bank Relationships Matter:**
   - Director-bank relationships can dominate firm-bank relationships
4. **Personal Banking Relationships Matter:**
   - Collateral channel not sensitive to firm-bank relationship length when director has a mortgage with the firm's bank

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