Bank Supply Shock and Firm Investment:
A Granular View from the Thai Credit Registry Data

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What this paper does

Main research questions:

- Does finance matter for real economic activity?
  - Bernanke, et al. (1999), Kiyotaki and Moore (2008), Gabaix (2011)

  ➢ Do bank supply shocks affect firm-level investment?

  ➢ How much do bank shocks matter for economy-wide investment?

Problems in past literature:

- How to disentangle bank-loan supply shocks from firm-demand shocks

- Fixed-effects approach has several limitations and drawbacks

New methodology (Amiti and Weinstein, 2018)

- Exploits micro-level, matched bank-firm loan data

- Exactly decomposes bank- and firm-level loan growth into 4 components:
  (1) Bank shock (2) Firm shock (3) Industry shock (4) Common shock

Data Overview

1. BOT's Loan arrangement database (LAR)

2. Ministry of Commerce's Corporate Profile and Financial Statement (CPFS)

Number of firms (Matched LAR-CPFS)

LAR-CPFS	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Small	10,340	11,210	11,152	11,805	12,407	11,841	12,252	13,130	14,037	15,371	16,931
Medium	3,864	4,199	4,303	4,568	4,968	4,942	5,143	5,210	5,465	5,922	6,449
Large	2,361	2,557	2,617	2,797	3,089	3,097	3,336	3,360	3,628	4,071	4,326
Total	16,565	17,966	18,072	19,170	20,461	19,880	20,731	21,700	23,130	25,364	27,688

Number of banks (LAR)

|	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
All financial institutions	55	47	43	41	41	38	38	41	40	41	40	44
Banks only	33	33	33	33	34	32	32	35	35	35	34	38

Aggregate loans vs. LAR data

- LAR data covers 75-90 percent of aggregate corporate lending
- LAR loan growth rate traces closely the aggregate lending growth
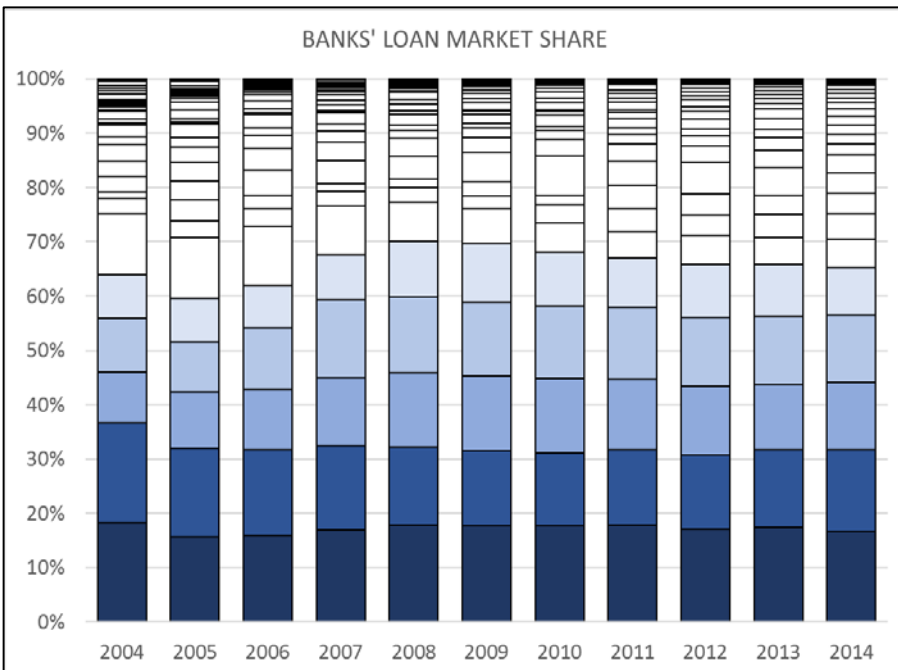
Loan Outstanding

Loan Growth

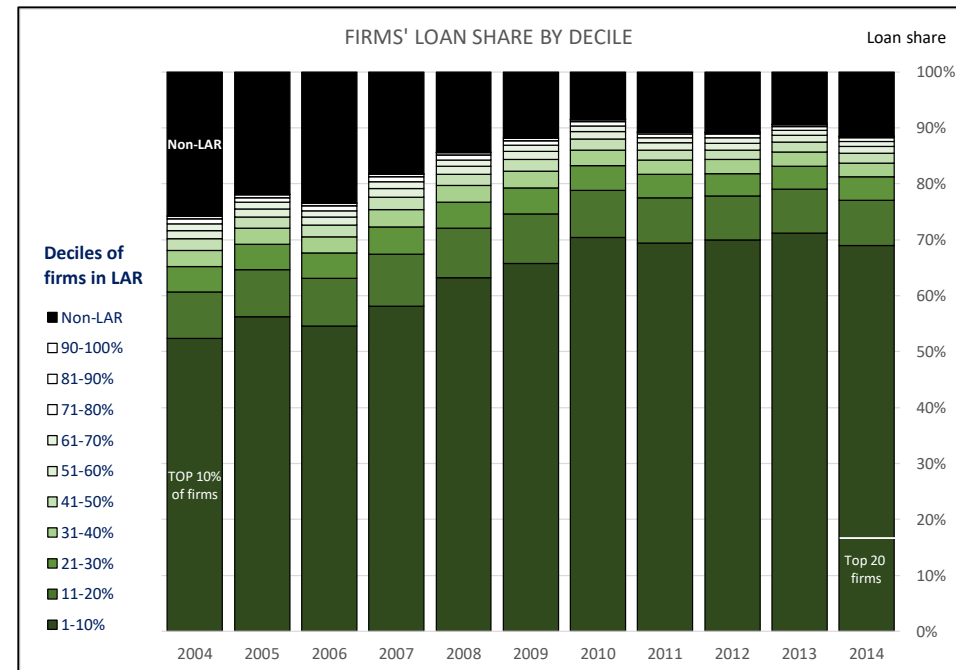| Introduction | Stylized Facts | Methodology | Main Results | Conclusion |
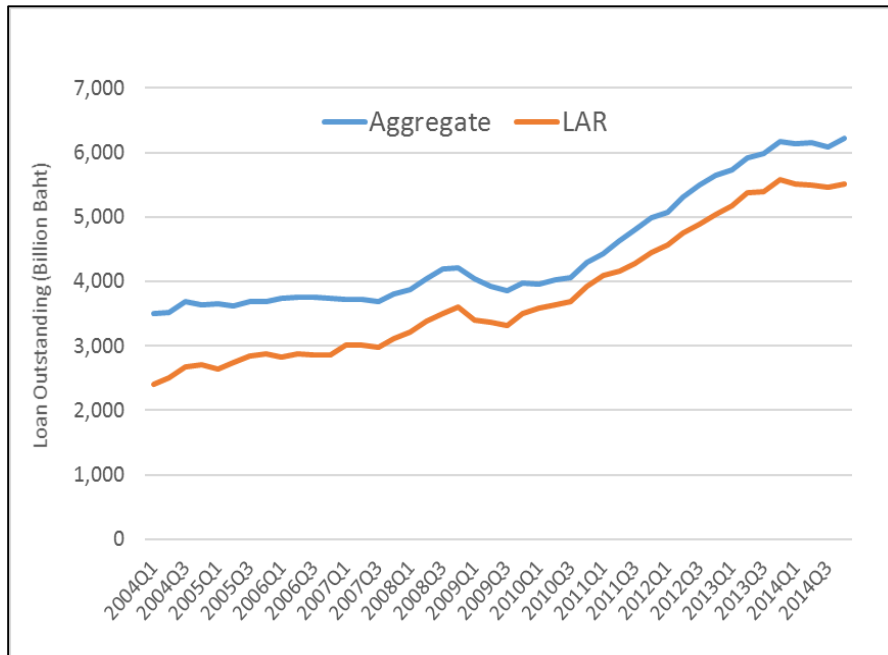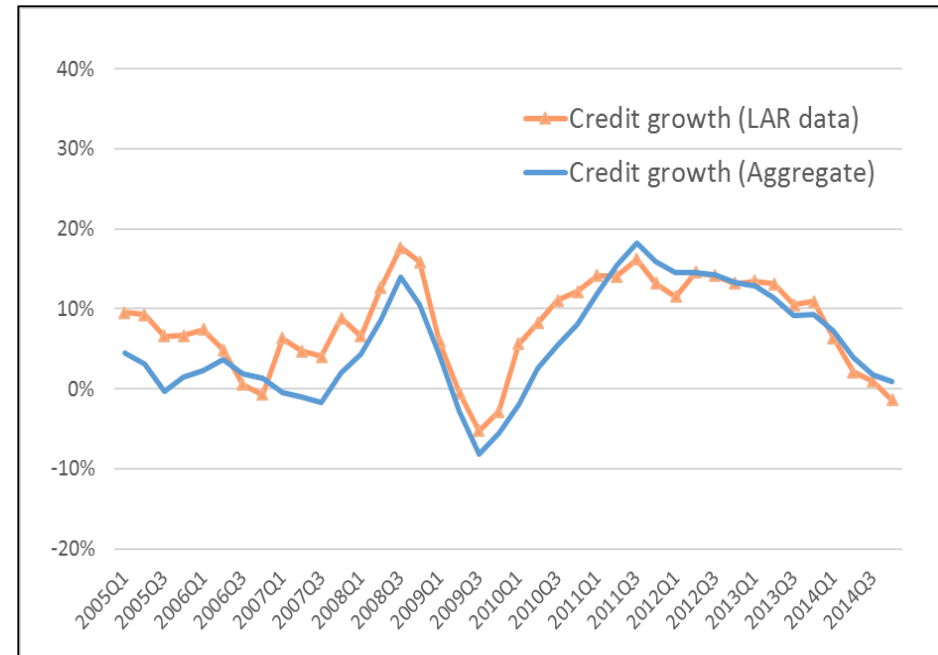
Credit Market Concentration

- Thai credit market highly concentrated from bank's perspective
- But even higher concentration from borrower's perspective

Bank's perspective

Borrower's perspective

Firm-Bank Relationships

- The majority of firms (2/3) have a *single-bank* borrowing relationship
  - ➢ But these firms account for only 1/3 of total loan amount

Number of bank relationships	Percentage share by firm size			
	Small	Medium	Large	*All firms*
1	75.5	62.6	38.7	*66.1*
2	17.4	22.5	24.0	*19.8*
3	4.6	8.5	14.8	*7.3*
4	1.5	3.5	8.5	*3.2*
5	0.6	1.6	4.9	*1.6*
>5	0.4	1.2	9.2	*2.1*
Total	100.0	100.0	100.0	*100.0*
Memo: Number of firms	*11,793*	*5,285*	*3,406*	*20,484*

- In addition, 60% of firms *never switched* to a new bank over their lifetime
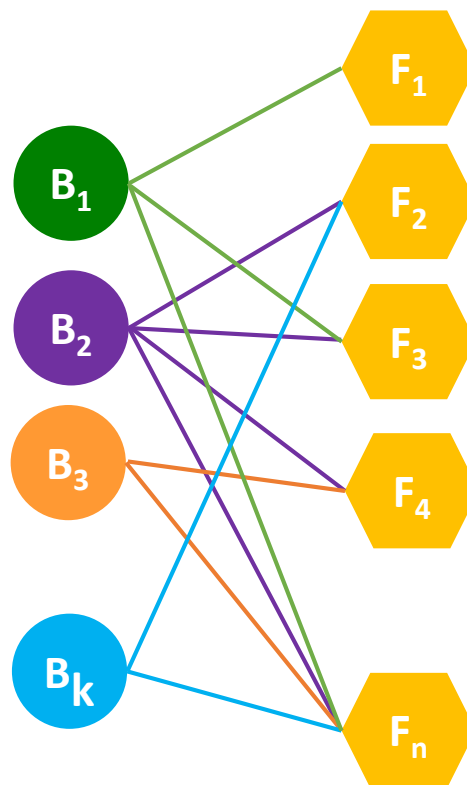
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Loan growth decomposition

Data input:
Loan growth and loan portfolio
of each bank and firm

1. **Common shocks**

2. **Industry shocks**

3. **Bank shocks** (idiosyncratic)

4. **Firm shocks** (idiosyncratic)

Shock Decomposition: A Matrix Form

Input:

Each firm's total loan growth

$$\hat{\boldsymbol{D}}_{Ft} \equiv \begin{pmatrix} D_{2t}^F - D_{1t}^F \\ \vdots \\ D_{Ft}^F - D_{1t}^F \end{pmatrix}$$

Each bank's total loan growth

$$\hat{\boldsymbol{D}}_{Bt} \equiv \begin{pmatrix} D_{2t}^B - D_{1t}^B \\ \vdots \\ D_{Bt}^B - D_{1t}^B \end{pmatrix}$$

Each bank's share in a firm's total loan

$$\hat{\boldsymbol{\Theta}}_t \equiv \begin{pmatrix} \hat{\theta}_{22t} & \dots & \hat{\theta}_{2Bt} \\ \vdots & \ddots & \vdots \\ \hat{\theta}_{F2t} & \dots & \hat{\theta}_{FBt} \end{pmatrix}$$

Each firm's share in a bank's total loan

$$\hat{\boldsymbol{\Phi}}_t \equiv \begin{pmatrix} \hat{\phi}_{22t} & \dots & \hat{\phi}_{F2t} \\ \vdots & \ddots & \vdots \\ \hat{\phi}_{2Bt} & \dots & \hat{\phi}_{FBt} \end{pmatrix}$$

Output:

Firm shocks

$$\hat{\boldsymbol{A}}_t \equiv \begin{pmatrix} \alpha_{2t} \\ \vdots \\ \alpha_{Ft} \end{pmatrix}$$

Bank shocks

$$\hat{\boldsymbol{B}}_t \equiv \begin{pmatrix} \hat{\beta}_{2t} \\ \vdots \\ \hat{\beta}_{Bt} \end{pmatrix}$$

$$\hat{\boldsymbol{D}}_{Ft} = \hat{\boldsymbol{A}}_t + \hat{\boldsymbol{\Theta}}_{t-1} \hat{\boldsymbol{B}}_t$$

$$\hat{\boldsymbol{D}}_{Bt} = \hat{\boldsymbol{B}}_t + \hat{\boldsymbol{\Phi}}_{t-1} \hat{\boldsymbol{A}}_t.$$

Shock Decomposition

- After obtaining firm and bank shocks, we extract common and industry shock as follows:

$$Commonshock_t \ = \text{median}(Firmshock_{f,t}) + \text{median}(Bankshock_{b,t})$$

$$Industryshock_{n,t} = \text{median}(\widetilde{Firmshock}_{f,t})_{f \in N}$$

and the residual firm and bank shocks:

$$Firm\text{--}specific\ shock_{f,t} = Firmshock_{f,t} - \text{median}(Firmshock_{f,t}) - IndustryShock_{n,t}$$

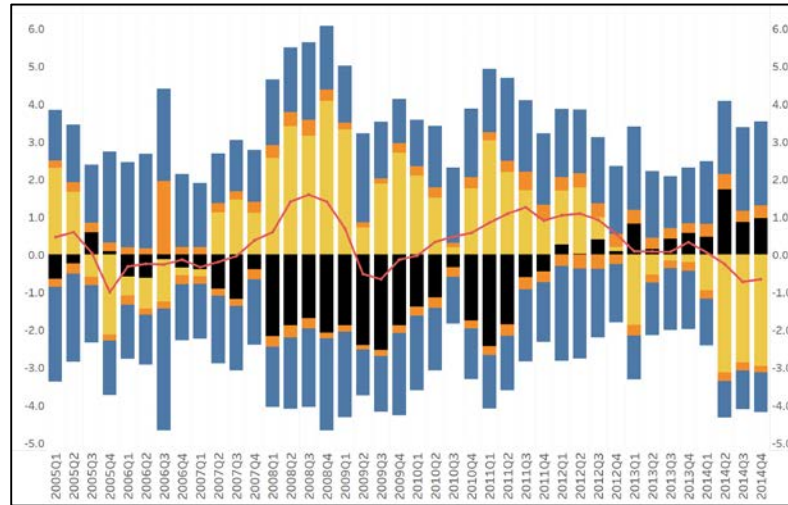$$Bank\text{--}specific\ shock_{b,t} = Bankshock_{b,t} - \text{median}(Bankshock_{b,t})$$

That is, each bank's aggregate lending can be exactly decomposed into four terms:

$$D_{b,t} \ = \ \ Commonshock_t + Bank\text{--}specific\ shock_{b,t}$$
$$+ \sum \phi_{fb,t-1}\ Industry_{n,t} + \sum \phi_{fb,t-1}\ Firm\text{--}specific\ shock_{f,t}$$

# Loan Growth Decomposition: Selected Banks

A representative Thai local bank

A representative foreign subsidiary

Legend:
- Firm Shock
- Industry Shock
- Bank Shock
- Common Shock
- Bank loan growth
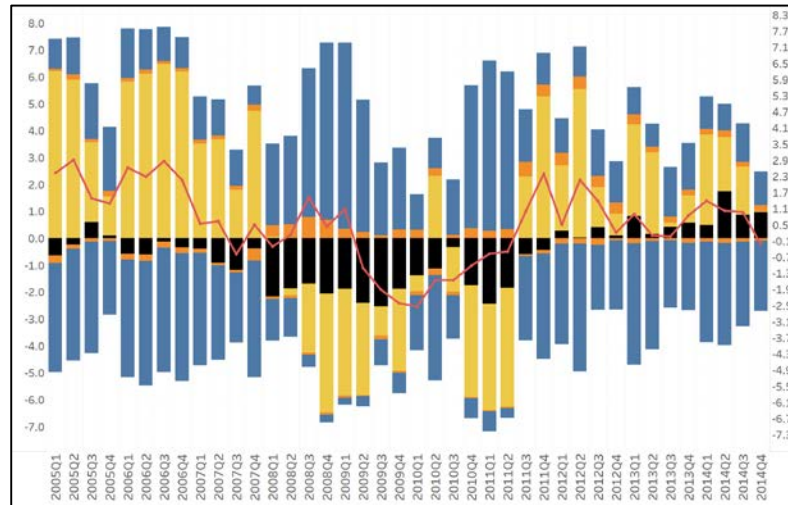
Aggregate-Level Granular Shocks

- Country-level loan growth can be decomposed into the four shock components, calculated as the weighted average of individual bank, firm, and industry shocks
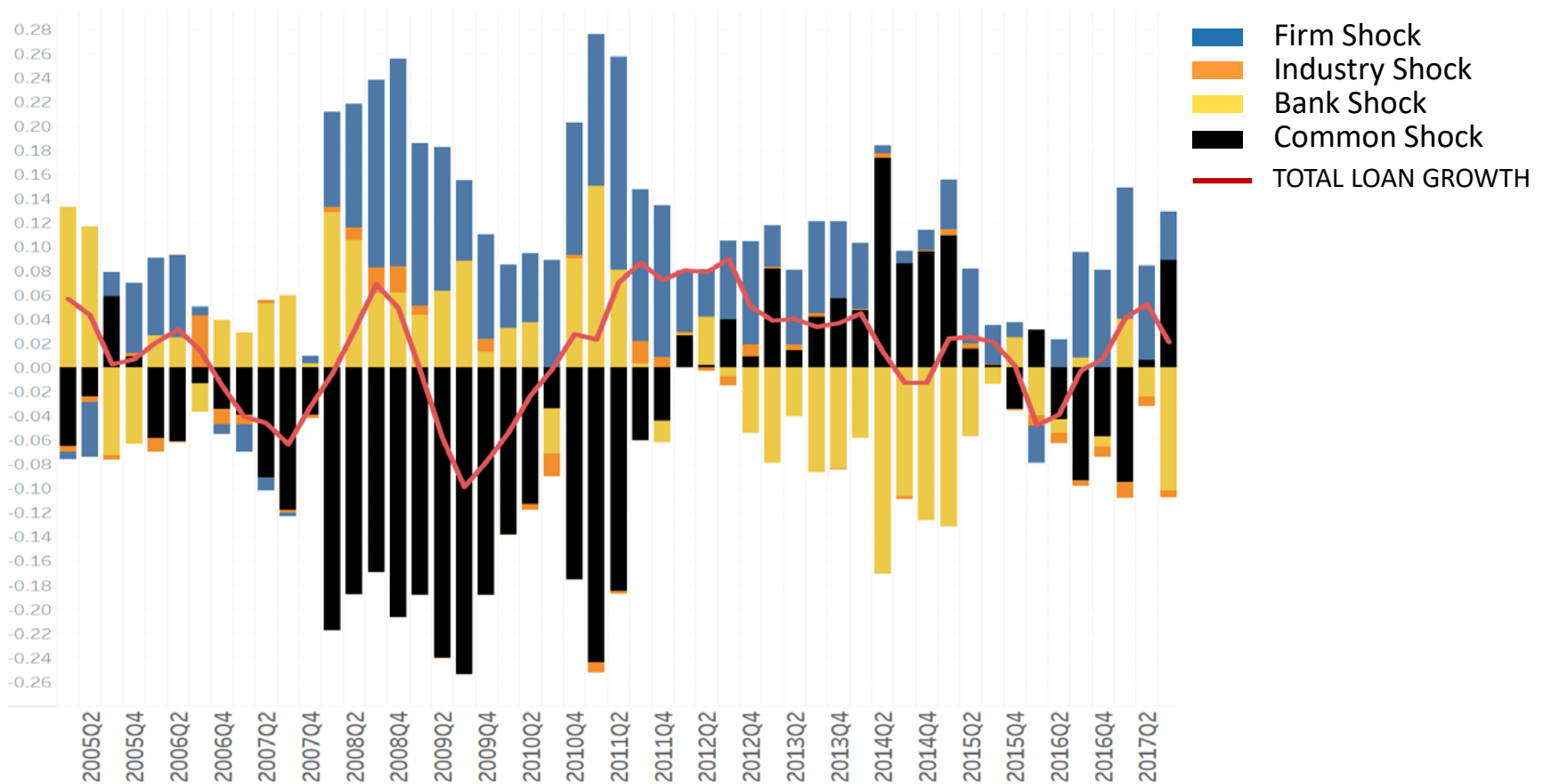
Regression Analysis

Aggregate-level regression:

$$LoanGrowth_t = \alpha + \beta_1 BankShock_t + \beta_2 FirmShock_t + \beta_3 IndusShock_t + \beta_4 CommonShock_t + \varepsilon$$

$$InvestGrowth_t = \delta + \gamma_1 BankShock_t + \gamma_2 FirmShock_t + \gamma_3 IndusShock_t + \gamma_4 CommonShock_t + \omega$$

Firm-level regression:

$$\frac{Investment_{ft}}{Capital_{ft-1}} = \alpha_f + \alpha_t + \delta_1 BankShock_{ft} + \delta_2 FirmShock_{ft} + \delta_3 IndusShock_{ft} + \theta Controls_{ft}$$

$$+ \tau_1 BankShock_{ft} * LoanToAssets_f + \tau_2 BankShock_{ft} * MoreThanOneBank_{ft}$$

Control variables include: $\dfrac{NetIncome_{ft}}{Capital_{ft-1}}$, $\dfrac{CurrentAsset_{ft}}{Capital_{ft-1}}$, ROA_{ft-1}

Result 1: Bank Shocks and Aggregate Investment

- Bank shock has significant influence on aggregate-level outcomes
  - Accounting for about 40 percent of the variance in aggregate lending growth
  - Explaining 16 percent of aggregate investment fluctuations

Variable	Aggregate loan growth		Aggregate investment growth	
	(1)	(2)	(3)	(4)
Common shock$_t$	0.372 ***	1.145 ***	0.047	0.732 ***
Firm shock$_t$	0.985 ***	1.436 ***	-0.201	0.199
Industry shock$_t$	0.115	0.895 ***	-1.603 **	-0.912
Bank shock$_t$		1.108 ***		0.982 ***
Constant	0.019 *	0.024 ***	0.056 ***	0.060 ***
Observations	40	40	40	40
R^2	0.508	0.875	0.085	0.248

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Result 2: Bank Shocks and Firm-Level Investment

- Bank shocks do matter for firm investment, particularly for:
  - ➢ firms with greater reliance on bank loans
  - ➢ firms with single bank relationship

Dependent var: Investment$_{f,t}$ / Capital$_{f,t-1}$	(1)
Bank Shock$_{f,t}$	0.070***
Bank Shock$_{f,t}$ * Loan-to-Asset Ratio$_t$	0.081***
Bank Shock$_{f,t}$ * More than one bank$_{f,t}$	-0.036***
Observations	145,823
R-squared	0.104
Number of firms	32,353

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$
Firm-level panel regressions with firm and time fixed effects.
Results on other control variables are omitted here.

Result 3: Asymmetric Effects of Bank Shocks

- The effects of negative bank shocks are milder in the case of large firms
- Multiple relationships help mitigate impact of negative bank shocks for small and medium firms
- However, multiple relationships do not appear benefit large firms

| Dependent var: Investment$_{f,t}$ / Capital$_{f,t-1}$	Small & Medium Firms (1)	Large Firms (2)
Bank Shock$_{f,t}$	0.063***	0.144***
Bank Shock$_{f,t}$ * NegativeShocks$_{f,t}$	0.007	-0.153**
Bank Shock$_{f,t}$ * More than one bank$_{f,t}$	0.005	-0.101***
Bank Shock$_{f,t}$ * More than one bank$_{f,t}$ * NegativeShocks$_{f,t}$	-0.078**	0.130**
Observations	121,102	24,721
R-squared	0.094	0.288
Number of firms	28,787	5,621

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$
Firm-level panel regressions with firm and time fixed effects.
Results on other control variables are omitted here.

Result 4: Differential Bank Shocks within a Bank

- Bank appear to have different lending policy towards different customer groups
- Bank shocks to 'unhealthy' firms more volatile than those faced by 'healthy' firms

Avg bank shock for 'unhealthy' firms
Avg bank shock for 'healthy' firms

Local banks : Large
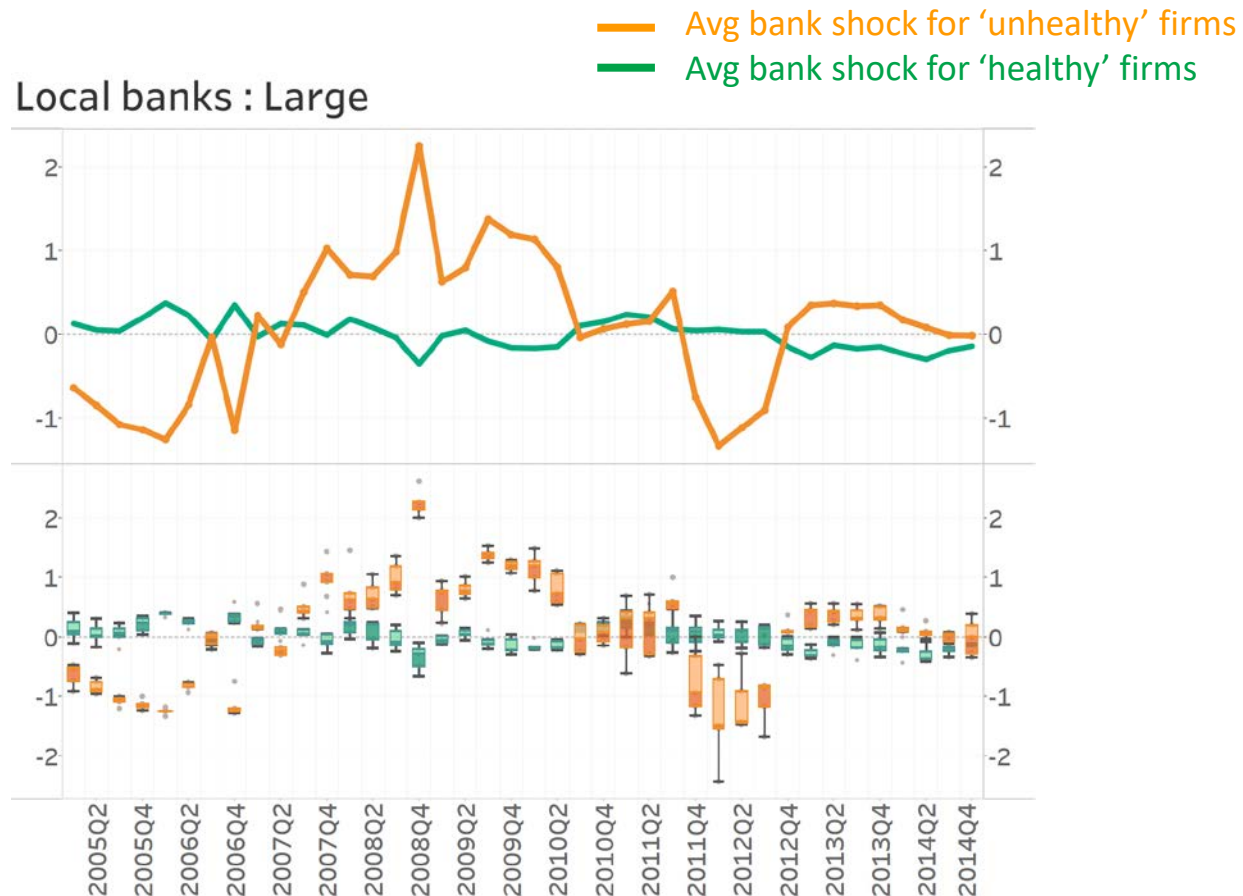
Conclusion

1. Bank supply shocks matter for firm investment activity

➤ Effects more pronounced in the case of small firms with single bank

➤ Bank supply shocks to unhealthy firms more volatile

2. Importance of idiosyncratic shocks

Idiosyncratic shocks from large individual players can drive macroeconomic fluctuations given the high concentration of loan market structure

3. Aggregate data not enough

Micro-level data important for understanding distributional effects of shocks

➤ Across-bank heterogeneity

➤ Within-bank (across-customer) heterogeneity