

# The Effects of Informational Frictions on Credit Reallocation

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# Introduction

Frictions behind lending relationships stickiness

- Bank distress affect borrowers and real economy

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Informational friction: **information gap** between existing and potential new lenders

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This paper: **quantify** effects of information gap

- How many creditworthy borrowers of a distressed bank cannot find new lender because of informational friction?

# Contributions

- ① Identify empirical challenge to estimate private information
  - Threat: common information unobservable to econometrician
- ② Method to isolate effect of private information
  - Use supply shocks to lending relationships
  - Estimate two-stage model with intuitive identification
- ③ Application: US corporate loan market after financial crisis
  - Large effects of info friction: \$14 bn loans not made

# Related literature

## Banking relationships/credit supply shock

- Theory: Sharpe (1990), Rajan (1992), Petersen and Rajan (1994), Detragiache et al. (2000)
- Empirics: Peek and Rosengren (2000), Chava and Roberts (2008), Ivashina and Scharfstein (2010), Khwaja and Mian (2008), Jimenez, Mian, Peydro and Saurina (2011), Chodorow-Reich (2014), Chernenko and Sunderam (2014)

## Empirics of informational frictions

- David, Hopenhayn, Venkateswaran (2015), Dickstein and Morales (2015), Einav, Jenkins and Levin (2012), Einav, Finkelstein and Levin (2010), Einav, Finkelstein and Schrimpf (2010)

## Heterogeneous information

- Mian (2006), Drucker and Mayer (2008), Liberti and Mian (2009), Hertzberg, Liberti and Paravisini (2010), Stroebel (2014), Stroebel and Kurlat (2014), Foucault and Fresard (2014), Botsch and Vanasco (2015), Becker, Bos and Roszbach (2015)
- In labor: Kahn (2014), Gibbons and Katz (1997)

# Application: the U.S. corporate loan market

Dealscan dataset: US. syndicated corporate loan market

- Loan-level data  $\implies$  identify banking relationships.
- U.S. non-financial firms borrowing to finance operations

$\approx$  4,100 firms received a loan pre-crisis (Jan 2004-Aug 2008)

$\implies$  Only 25% received a new loan during crisis (Oct 2008-June 2010)

Key fact: **relationships are sticky**

- 21% renew their relationship
- 4% find a new lender

Did information gap prevent firms that **did not renew** from forming a new relationship?

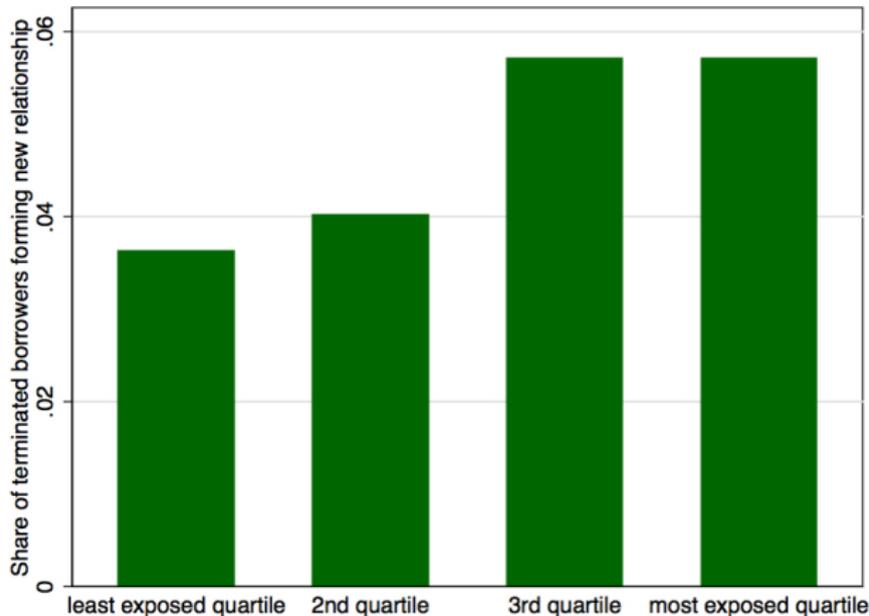
# Estimating info friction from new relationships

Information gap  $\implies$  new lenders **learn** from relationship ending

- Size of shock to previous bank matters
- Borrowers coming from *more* affected lenders face *less* stigma

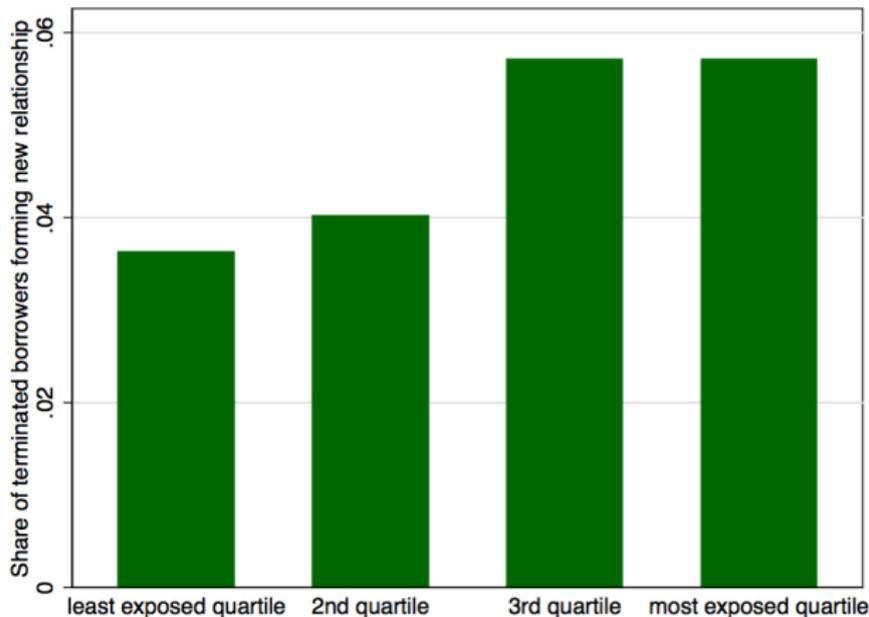
## Previous bank's shock and new relationships

U.S. application: crisis exposure  $\delta^b = 1 - \frac{\# \text{post-crisis loans}}{\# \text{pre-crisis loans}}$



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Bias: **common information** unobservable to the econometrician

# Empirical challenge: private vs. common information

Two channels:

- ① Learning about **private information**
- ② Mechanical selection on **common information**

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Solution to disentangle the two:

- Exploit the data on **renewal** of relationships: these lenders are **informed**
- Estimate a two-stage discrete choice model of renewal and new relationship ⇒ add a second regression

# Two-stage model setup

## Timing:

- 1 First stage: firm and bank bargain to renew pre-crisis relationship
- 2 Second stage: if no renewal, bargain with new bank to form new relationship

**Information:** firm crisis type characterized by  $\{x^f, \nu^f\}$

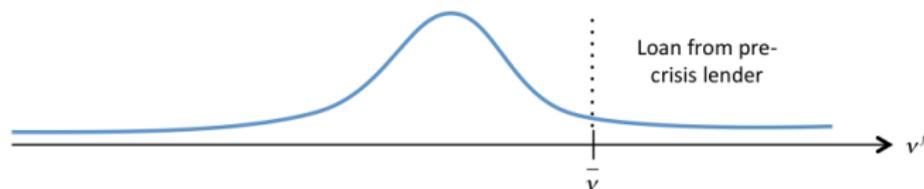
- 1  $x^f$ : observable characteristics
- 2  $\nu^f$ : unobservable to econometrician =  $\nu_1^f + \mathcal{W}\nu_2^f$ 
  - $\nu_1^f$ : common information to all lenders
  - $\nu_2^f$ : private information of pre-crisis lender
  - $\mathcal{W}$  = information gap

Bank idiosyncratic shock  $\delta^b \implies$  different propensity to lend

## Stage 1: relationship renewal

Bank  $b$  renews with if firm  $f$  if surplus in lending is high enough

$$\nu^f \geq \bar{\nu}(\mu_0, x^f, \delta^b) \implies \bar{\nu}: \text{informed lender decision rule}$$



Linear-Normal example:  $\nu^f \geq -\delta^b \beta - x^f \mu = \bar{\nu}(\delta^b, x^f)$   
 $\implies$  probit

$$\mathbb{P}(f \text{ renews from } b) = \Phi(x^f \mu + \delta^b \beta)$$

Identification assumption: supply shock  $\delta^b \perp \nu^f$

## Stage 1 estimates

	Outcome: Borrow from pre-crisis lender		
Pre-crisis lender's exposure	-3.86*** (0.61)	-3.52*** (0.63)	-3.02*** (0.67)
Public		4.54** (1.45)	2.96** (1.46)
High sales		5.82** (1.48)	3.87** (1.59)
Existing loan covers the crisis		-1.78 (1.31)	-1.09 (1.33)
Multiple pre-crisis loans		9.95*** (1.30)	8.83*** (1.32)
Manufacturing		0.98 (1.33)	0.77 (1.32)
Pre-crisis loan terms	-	-	Yes
Mean of dependent variable	21.17%	21.17%	21.17%
R squared	0.00%	4.17%	5.59%
Number of observations	4,044	4,044	4,044

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## Stage 2: formation of new relationships

New bank  $b'$  forms new relationship if *expected* lending surplus large enough

- New bank observes common info  $\nu_1^f$
- *Previous* bank shock  $\delta^b$  is signal about private info  $\nu_2^f$

$\implies$  new relationship if  $\nu_1^f \geq \nu^*(x^f, \delta^b)$

$\nu^*$ : **uninformed lender decision rule**  $\neq \bar{\nu}$  [▶ In picture](#)

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$\mathbb{P}(f \text{ forms new relationship} \mid \text{no renewal with } b)$

$$= \underbrace{\int_{\nu^f \leq \bar{\nu}(\delta^b)}}_{\text{selection}} \Phi \left( \frac{1}{\sqrt{\mathcal{W}}} \underbrace{(\nu^f - \nu^{*f}(\delta^b))}_{\text{lending rule}} \right) \frac{\phi(\nu^f)}{1 - P_1^f} d\nu^f$$

$\implies \bar{\nu}$  estimated in stage 1,  $\mathcal{W}$  estimated by NLLS

## Stage 2 estimates

	Main model	Lehman exposure	ABX loading	Chargeoffs
Information gap $\mathcal{W}$	<b>15.13%</b>	17.94%	8.67 %	12.81 %
90% confidence int.	[8.3%, 38.6%]			

New lenders know *less* than existing lenders  
but *more* than the econometrician

### Alternative specifications

- Cross-section: 30% lower  $\mathcal{W}$  for public firms
- Other measures of bank shocks
- Other classification of new lenders
- Fewer controls

# Aggregate effects of information gap

**Quantify effect of friction: how many loans not made after crisis because of info gap?**

Counterfactual lending with  $\mathcal{W} = 0$

- Other parameters fixed
- Firm level:  $\mathbb{P}(\text{new relationship}) = \mathbb{P}(\nu_1^f \geq \bar{\nu}(\delta^{b'}) | \nu_1^f \leq \bar{\nu}(\delta^b))$

Large effects in the U.S. during crisis

- Firms 30% more likely to find new lender after breakup
- Aggregate: 10% of drop in lending at the extensive margin
- Dollar amount: multiple by post-crisis median loan size  
 $\implies$  \$14 bn of loans not made

▶ Table

▶ Ignoring common info

▶ Policy experiment

# Final thoughts

Empirical challenge to isolate effects of private information

- **Solution:** Empirical model jointly explaining multiple moments of the data
- **Quantification:** how much do informational frictions matter?
- Relevant in/applicable to many markets

**Credit reallocation** drives effects of bank distress:

- Aggregate lending  $\neq$  bank-level lending
- Supporting weak lenders can backfire  $\implies$  more stigma
- Open question: can other policies help?

# Appendix

## Ignoring common information

$\mathbb{P}(f \text{ forms new relationship} \mid \text{denied by } b)$

$$= \int_{\underbrace{\nu^f \in \mathbb{R}}_{\text{no selection}}} \Phi \left( \frac{1}{\sqrt{\mathcal{W}}} \underbrace{(\nu^f - \nu^{*f}(\delta^b))}_{\text{lending rule}} \right) \phi(\nu^f) d\nu^f$$

	Main model	Naive model
Information gap	15.13%	55.65%
Counterfactuals		
<i>Lending rate</i>	0.68	0.74
<i>Increase in lending (\$ bn)</i>	14	44

**Large bias:** overestimate information gap + aggregate effect

# Policy intervention in the banking sector

Public support for most affected lenders: impact on aggregate lending?

Counterfactual intervention: ↓ lender crisis exposure faced by 25% most affected firms

Compare with reduced-form model (Chodorow-Reich 2014)

$$P(\text{borrow}) = \gamma \times \text{Pre-crisis lender's exposure} + \text{Firm controls} + \epsilon$$



# Fostering credit reallocation

## ① Effects of transparency

- Public firms:  $\mathcal{W}=13.3\%$  vs  $16.3\%$  for private firms
- If as transparent as public firms  $\implies$  \$4bn more loans

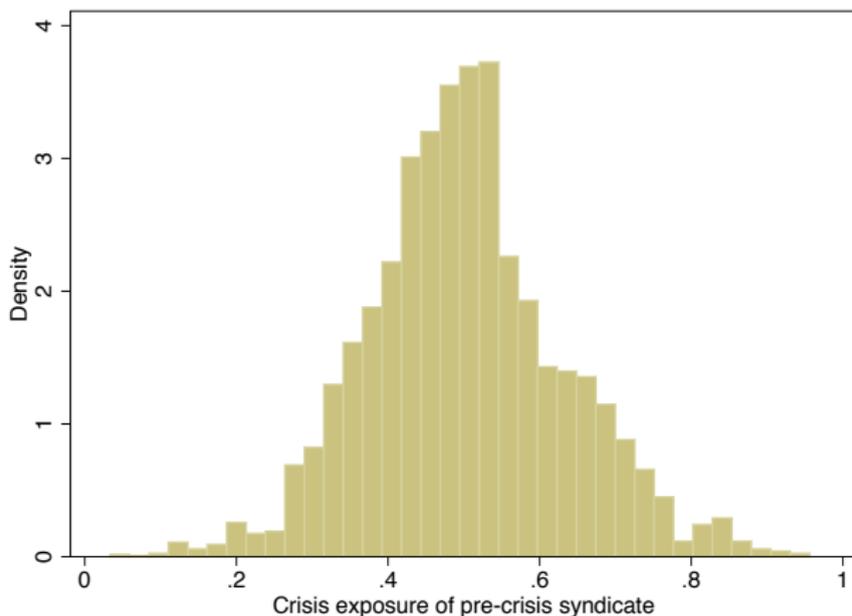
## ② Subsidizing new bank customers

- Spirit of 2012 UK Funding for Lending Scheme (FLS)
- Make lending cheaper for borrowers coming from *other* banks
- Directly counteract adverse selection

## Summary statistics: loan terms

	Pre-crisis (04-Sept 08)	Post-crisis (Oct 08-2010)	% change
Loan size (\$mn)	441	459	4.1%
Spread (bp)	158	294	86.1%
Maturity (years)	3.8	3	-21.1%
#Lenders in syndicate	4.9	5.3	8.2%

# Bank crisis exposure



Mean: 52.24%, Median: 49.67%, Std. dev: 12.94%

# Supporting identification assumption

- 1 First evidence on new relationships [▶ Graph](#)
- 2 Comparing FE and OLS in loan-level regressions:

	Outcome: % change in lending after the crisis	
	(1) FE	(2) OLS
Pre-crisis lender's health	2.28*** (0.12)	2.35*** (0.45)
Borrower fixed effects	Yes	No
Firm characteristics	No	Yes
Pre-crisis loan terms	No	Yes
R squared	7.67%	10.31%
N. obs.	4,649	4,649

- 3 Balancing on covariates [▶ Table](#)
- 4 Robustness to other measures of supply shock

## Balancing on covariates

Outcome: Pre-crisis lender's health

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<i>Firm characteristics</i>	
Public	0.03
High sales	0.01
Existing loan covers the crisis	0.03
Multiple pre-crisis loans	0.03
Manufacturing	-0.11**
<i>Last pre-crisis loan terms</i>	
Pre-crisis loan spread	-0.00***
Pre-crisis loan size	0.00
Pre-crisis loan maturity	-0.00***
Secured by collateral	-0.13**
Two or less participants	-0.10
R squared	6.96%
Number of observations	4,044

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## Effect of previous bank shock

Outcome: Borrow from a new lender,  
conditional on not borrowing  
from pre-crisis lender

	(1)	OLS (2)	(3)	IV (4)
Pre-crisis lender exposure	0.52 (0.47)	0.62 (0.41)	0.69** (0.35)	3.26** (1.29)
Firm characteristics	No	Yes	Yes	Yes
Pre-crisis loan characteristics	No	No	Yes	Yes
N	3,188	3,188	3,188	3,188
R-squared	0.01%	0.70%	1.57%	0.26%

Note: Coefficients are multiplied by 100, and double clustered  
at the lead lenders level of the pre-crisis syndicate.

Instruments for bank health: fraction of loans co-syndicated with Lehman,  
stock price loading on ABX index, real estate charge-offs over assets.

# Aggregate effects of information gap

	Lending rate	Increase in lending(\$bn)
Data	0.65	-
Counterfactual	0.68	14
90% confidence interval	[0.65,0.70]	[2.3,54]
95% confidence interval	[0.65,0.72]	[1.5,76]

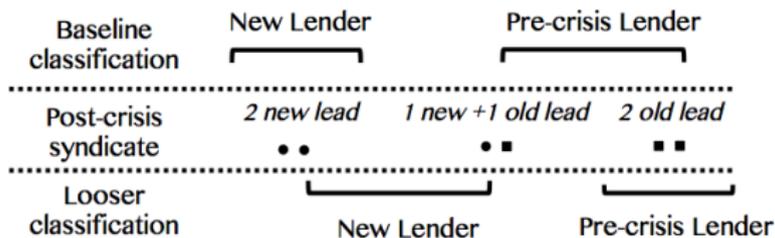
▶ More specifications

▶ Extra

# Information sharing across lenders

How easily can lenders communicate information?

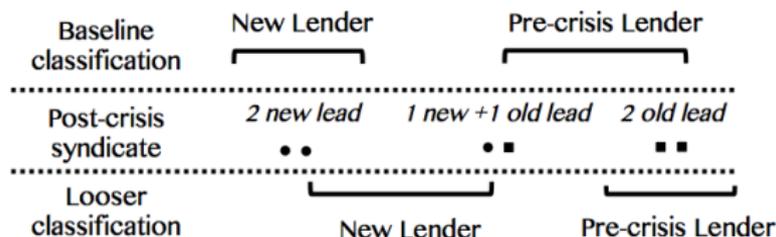
Test using syndicate composition  $\implies$  reclassify "new lender"



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Looser classification  $\implies$  larger info gap: 15% vs. 23%

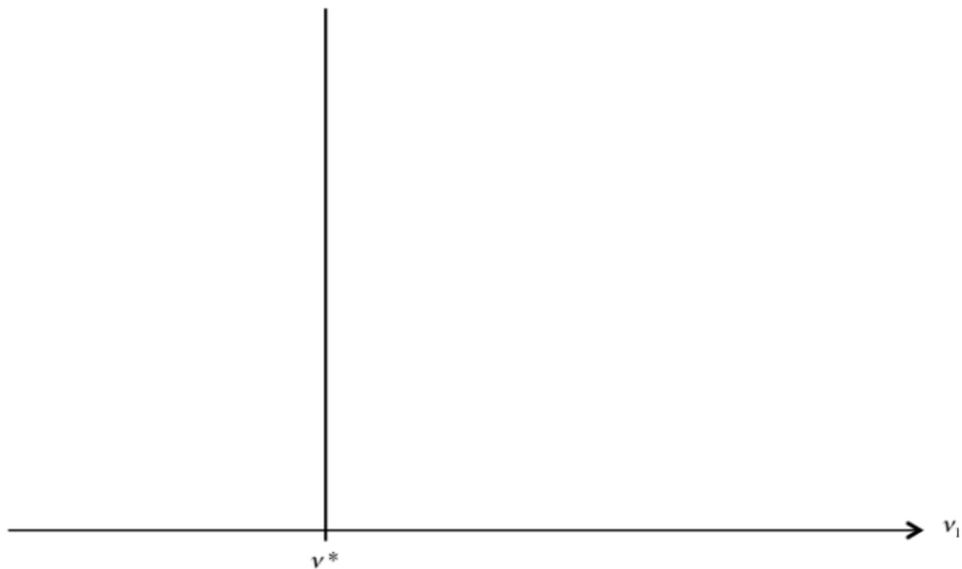
Hard to credibly share information:

- Syndicates with 1 new + 1 old lenders know less than syndicates with 2 old lenders

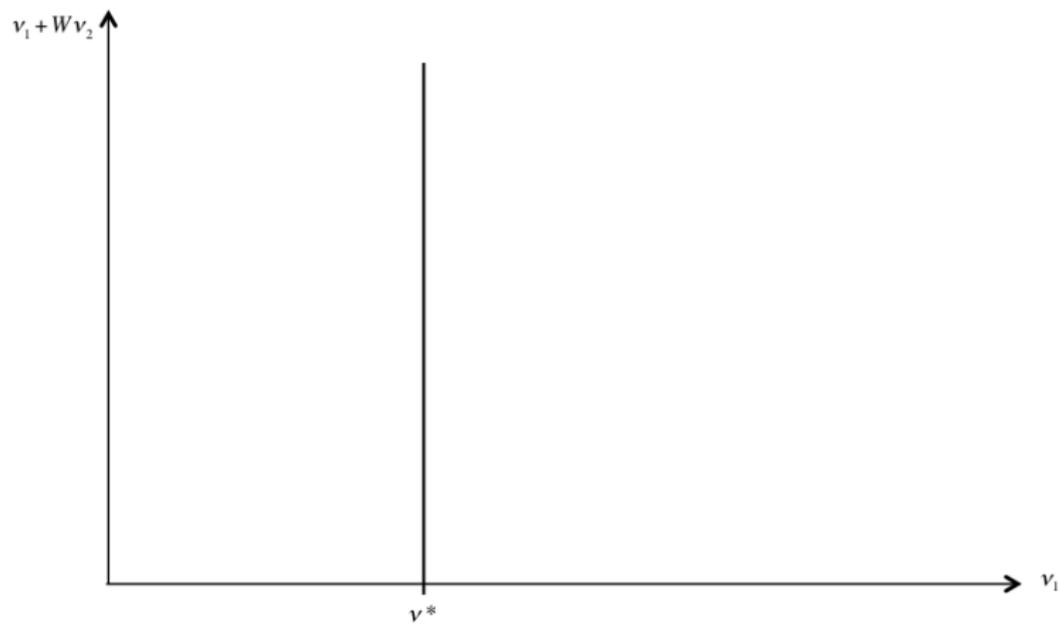
## Aggregate effects: other specifications

	Lending rate	Increase in lending(\$bn)
Data	0.65	-
Counterfactuals (no info gap)		
Main model	0.68	14
Lehman exposure	0.69	19
ABX loading		3
RE chargeoffs	0.67	10

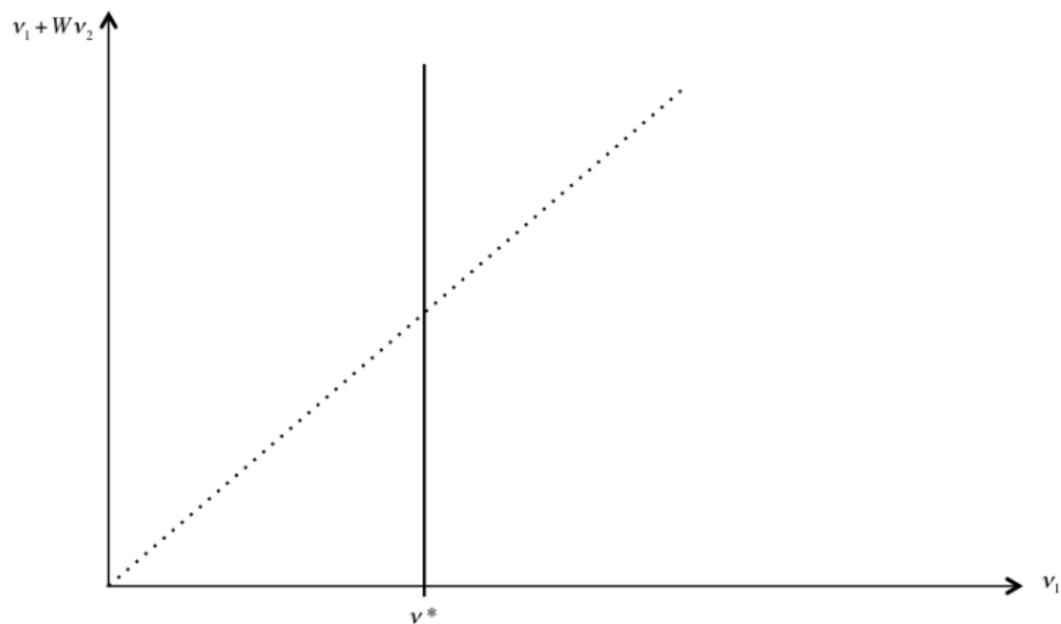
# Effect of information gap on lending



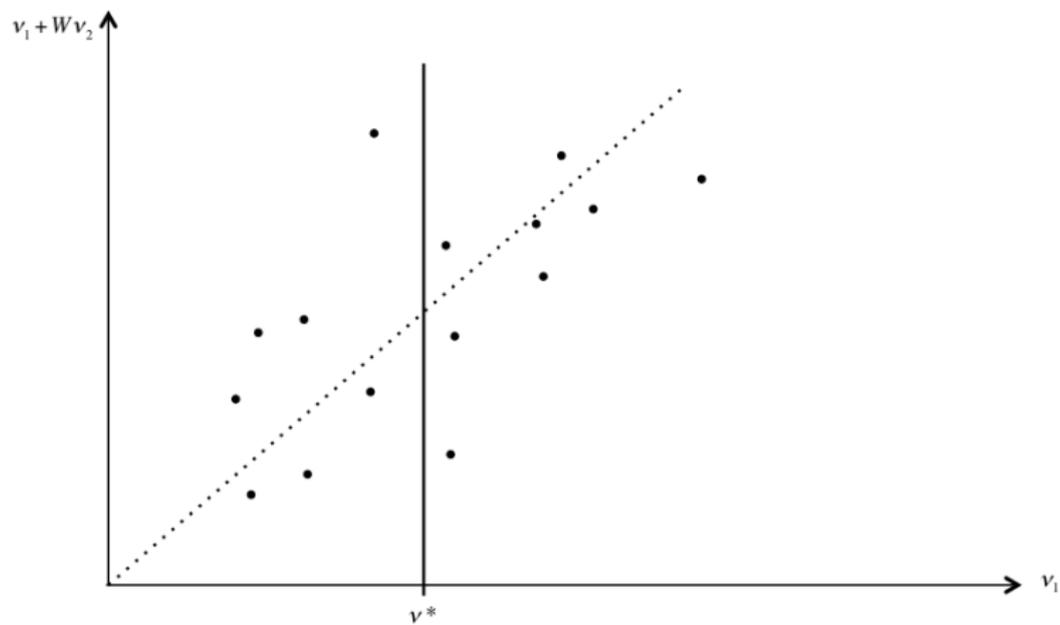
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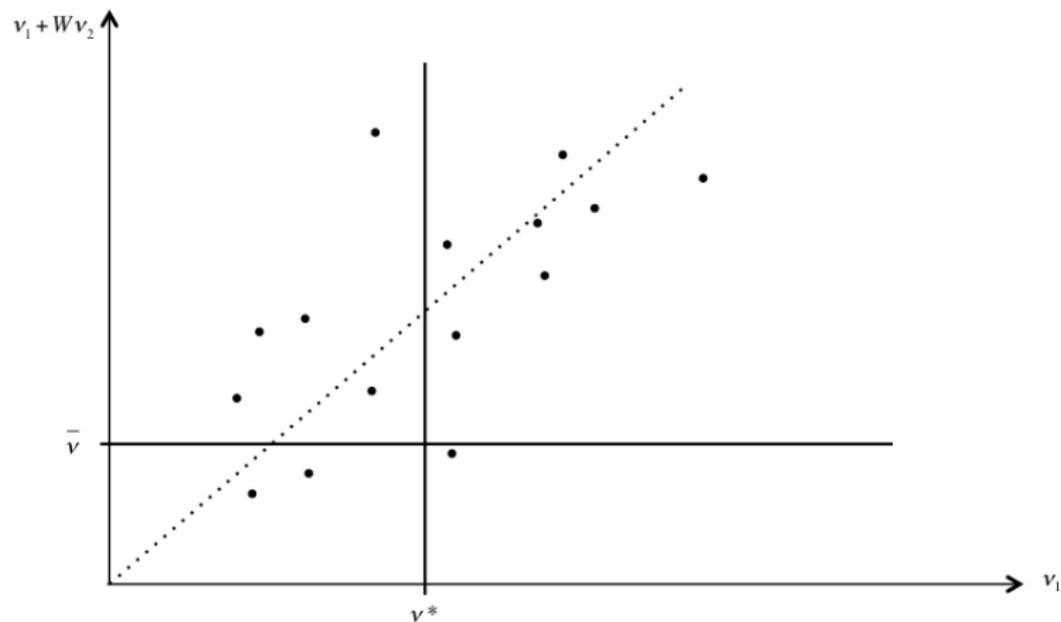
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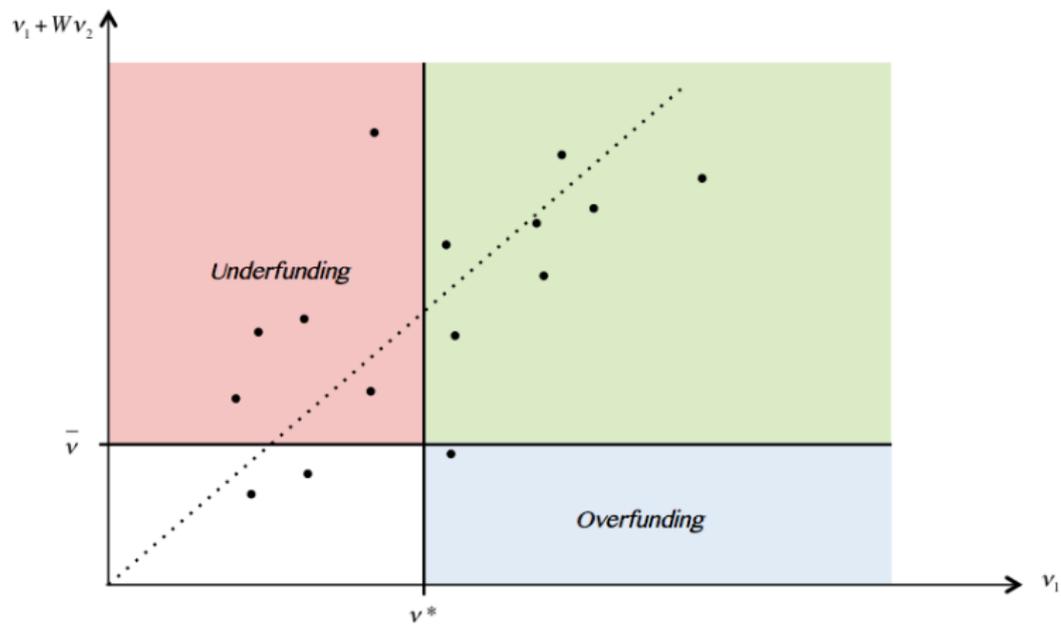
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# Effect of information gap on lending



# Effect of information gap on lending



▶ Back

## Second stage estimating: intuition

- 1 First stage: estimate renewal

$$\mathbb{1}[f \text{ renews with } b] = \underbrace{\delta^b \beta}_{\text{pre-crisis lender's exposure}} + \underbrace{x^f \mu}_{\text{firm observables}} + \nu^f$$

- 2 Second stage:

- Predict new relationship if no info gap

$$\hat{P}_2^f = \delta^{b'} \beta + x^f \mu + \mathbb{E}[\nu^f | f \text{ not renew, } \delta^b]$$

- Construct  $residual^f = \mathbb{1}[f \text{ forms new relationship}] - \hat{P}_2^f$

- Run  $residual^f = c + \underbrace{\gamma \delta^b}_{\text{info gap} \implies \gamma \neq 0} + \varepsilon$

Compute  $\mathbb{E}[\nu^f | f \text{ not renew, } \delta^b]$  with parametric assumption

# Benchmark: zero reallocation frictions

Reduced-form estimate:

① Run

$$P(\text{borrow}) = \underbrace{\gamma * \delta^b}_{\text{Pre-crisis lender's exposure}} + \text{Firm controls} + \epsilon$$

② Counterfactual with zero reallocation friction:

$$P(\text{borrow})^{CF} = \hat{P}(\text{borrow}) + \hat{\gamma} * (\delta_{MIN} - \delta^b)$$

=all firms had relationship with least affected lender

Difference with previous: not just informational friction

## Informational vs. other reallocation frictions

Post-crisis outcome	Baseline	Counterfactual	
		No reallocation friction	No information gap
Lending rate	0.65	0.72	0.68
Increase in lending (\$ bn)		34	14

⇒ Info gap key reallocation friction = half of total effects

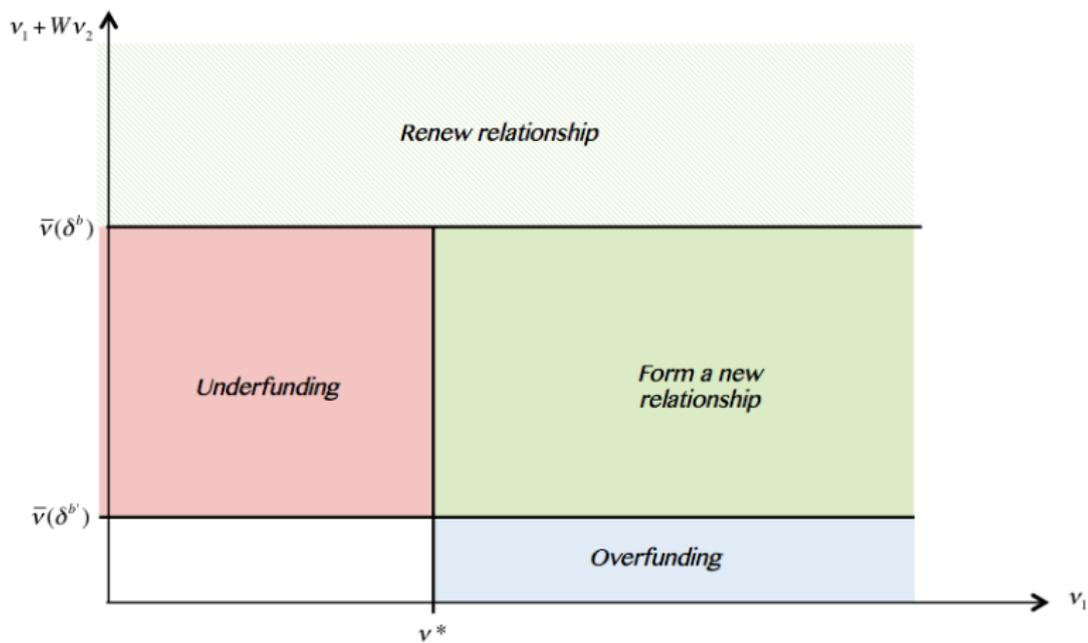
Fall in lending = 80% agg. shock + 20% imperfect reallocation

▶ Back

# Policy intervention

% fall in worst lenders shock	Lending rate			
	Info gap model		Reduced-form model	
	Old	New	Total	Total
0% (Baseline)	54.74	13.02	64.84	64.84
5%	56.22	10.51	63.33	65.92
10%	57.82	9.45	64.86	67.11
15%	59.56	9.45	66.60	68.36
20%	61.42	9.45	68.46	69.65

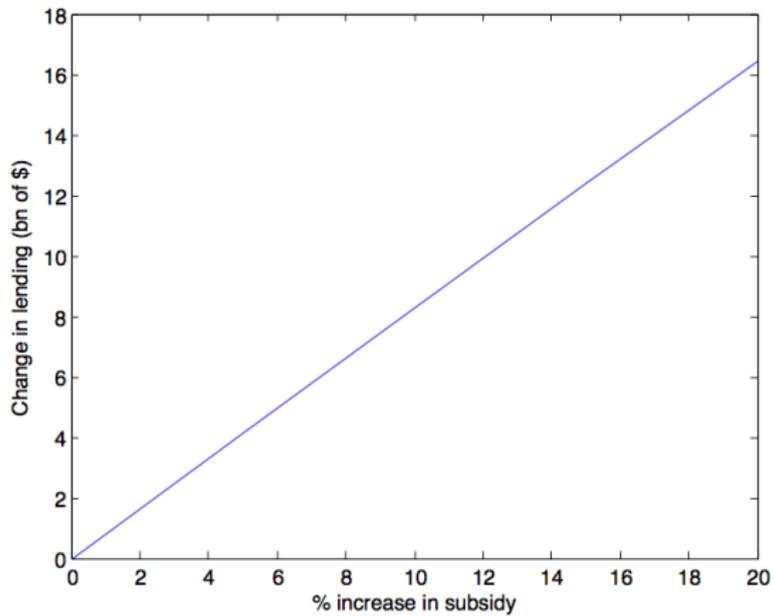
# Unintended consequences



▶ Back



# Subsidizing new bank customers



## Fewer controls

Information gap is relative: lower if econometrician knows less

Exclude past loan data from  $x^f$ :

→ 33% drop in information gap, from 15.13% to 13.52%

Omitted controls now part of common information  $\nu_1^f$

→ information of existing and new lenders overlap more

Robustness: omitted info (weakly) underestimate information gap

## Comparison with reduced-form counterfactual

Second stage regression:

$$P(\text{borrow from a new lender}) = \beta * \text{Pre-crisis lender's health} \\ + \text{Firm controls} + \epsilon$$

Use  $\hat{\beta}$  and fitted probabilities  $\{\hat{P}_{fit}\}$  to find the counterfactual probability of forming a new relationship:

$$P_{CF} = \hat{P}_{fit} + \hat{\beta} * (\text{Minimum lender's health} - \text{Pre-crisis lender's health})$$

→ estimate  $\approx$  \$9 billion

- cross-sectional comparison naturally underestimates true total effect