Loan Guarantees and Incentives for Information Acquisition

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Motivation

Information asymmetries prevalent in small-business lending, contribute to credit constraints

- Lack long repayment history
- Heterogeneous projects

Government intervention is common

- Aims to address credit constraints, realize employment externalities
- Frequently loan guarantees

Asymmetric information and market power can influence policy transmission

- Source of asymmetric information matters
- Information-acquisition decisions may respond to policy changes

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This Paper

1. Develops empirical model of lending with endogenous information acquisition

2. Quantifies effect of the SBA 7(a) guarantee program on lenders' information acquisition

3. Alternative policy (less generous guarantee + lender-side subsidy) $\rightarrow$ borrower surplus $\uparrow$

How Do Guarantees Affect Rates?

Channels for rate effects:

- **Guarantee pass-through**: default less costly to lender; lender faces less adverse selection
- **Information effect**: incentives to gather noisier information

Aggregate borrower-surplus effect ambiguous

Better outcomes under alternative policy?

Research Questions

1. Does $\uparrow$ guarantee generosity lead to $\uparrow$ borrower surplus, on average?
   - Yes, but effect magnitude is small
2. Do all borrowers (across risk) benefit, and what is the role of the information effect?
   - High-risk borrowers benefit, low-risk borrowers do not
   - Information effect plays a role
3. Does an alternative policy design lead to $\uparrow$ borrower surplus?
   - Yes, hybrid policy (less generous guarantee + subsidy) $\rightarrow$ borrower surplus gains
   - Mitigates redistribution from low- to high-risk borrowers

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Related Literature

Empirical Models of Asymmetric Information

Yannelis and Zhang (2023), Ioannidou et al. (2022), Kawai et al. (2022), Cuesta and Sepulveda (2021), Wang (2020), Crawford et al. (2018), Einav et al., (2013), Einav et al. (2012)

Bank Moral Hazard

D'Acunto et al. (2017), Rajan et al. (2015), Keys et al. (2010), Manove et al. (2001), Holmstrom and Tirole (1997), Gorton and Pennacchi (1995)

Efficacy of Guarantee Schemes

Cox et al. (2022), Bachas et al. (2021), Gonzalez-Uribe and Wang (2021), Ioannidou et al. (2018), Brown and Earle (2017), Lelarge et al. (2010), Gale (1991), Gale (1990)

SBA 7(a) Program

SBA's main loan guarantee program, established in 1953

- Guaranteed loans worth total of $25.4 billion in 2018
- Expand credit to businesses with "sufficient cash flow to repay the loan but may not have the necessary collateral or history required by a bank's lending policy."

Process overview

- Lender applies to SBA, who accepts/rejects (scrutiny differs by lender type)
- Loan can be canceled prior to disbursement or originated, pay guarantee and closing fees
- Borrower defaults → SBA covers portion of remaining balance

Preferred Lenders Lender Oversight Price Caps

Guarantee Expansions

Two legislative acts increased maximum guarantee percentage

- March 16, 2009 – May 31, 2010
- September 27, 2010 – January 3, 2011

	Maximum Guarantee Percentage	
Loan Size	Non-Expansion	Expansion
$\leq$ \$150,000	85%	90%
$>$ \$150,000	75%	90%

Data

SBA 7(a) Loan Data Reports

- Loan-level information for loans approved from 1990 onward
- Includes cancelled applications
- Restrict to loans $\leq$ \$2 million approved within 42 days of guarantee rate changes

FFIEC Bank Call Reports

- Match with bank names in loan data reports

Zip-code and county-level demographics

- Census Bureau, Bureau of Labor Statistics, FHFA

Summary Statistics

Lenders Respond to Guarantee Expansion

When guarantees are higher:

- Interest rates $\downarrow$, loan amounts $\uparrow$, maturities $\uparrow$ (**guarantee pass-through**)
- Weaker relationship between characteristics and ex-post default (**information effect**)

Lending over Time | Δ Characteristics | Pricing/Information

Preferred Lenders Drive the Response

Changes to loan characteristics stronger for preferred lenders Preferred Lender Characteristics

- More autonomy → better equipped to respond to policy variation

Preferred lenders price risk less precisely Preferred Lender Pricing

- Better able to adjust information-acquisition practices

Need for a Model

Higher guarantees:

- Lenders issue observably more generous loans
- Lenders price risk less precisely

Borrower surplus effects depend on:

- Distribution of borrower risk and willingness-to-pay
- Guarantee pass-through
- Information effect

Model $\rightarrow$ quantification of each component, alternative policy design

Model - Timing

1. Borrower i paired with lender j, risk private information
2. Lender chooses signal precision, receives signal of borrower i's risk, offers loan of price p_{ij}
3. Borrower i chooses whether to accept
4. Accepts $\rightarrow$ decides to repay or default

Competition Appendix

Model - Repayment and Acceptance

Utility of repayment:

$$u_i^R = \underbrace{X_i^R \beta^R}_{\text{Borrower covariates}} + \underbrace{\xi_i^R}_{\text{Private-information propensity to repay}}$$

Key assumption: repayment does not depend on prices, given covariates and propensity to repay

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Utility of acceptance:

$$u_{ij}^A = \underbrace{X_i^A \beta^A}_{\text{Borrower covariates}} - \underbrace{\alpha_i p_{ij}}_{\text{Borrower-specific price responsiveness}} + \underbrace{\epsilon_{ij}}_{\text{T1EV shock}}$$

Key assumption: no advantageous selection

Model - Signal Structure and Pricing

Signal of borrower's risk:

$$s_{ij} = \underbrace{\xi_i^R}_{\text{Propensity to repay}} + \underbrace{\sigma_\gamma(H_{ij})}_{\text{S.D. of signal noise}} \epsilon_{\gamma,ij}$$

Model - Signal Structure and Pricing

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$$s_{ij} = \underbrace{\xi_i^R}_{\text{Propensity to repay}} + \underbrace{\sigma_\gamma(H_{ij})}_{\text{S.D. of signal noise}} \epsilon_{\gamma,ij}$$

Sets price offer to solve:

$$\max_{p_{ij}} \int \underbrace{P^A(\alpha, p_{ij}, X_i^A)}_{\text{Prob. acceptance}} \left[\underbrace{(1-(1-M_{ij})P^D(\alpha, X_i^R))p_{ij}}_{\text{Repayment amount}} - \underbrace{\zeta_{ij}}_{\text{M.C.}} \right] f_{\alpha|s_{ij}}(\alpha) d\alpha$$

Price Calculation

Model - Information Acquisition

Sets signal precision by solving:

$$\max_{\sigma_\gamma} \sum_{ij \in \mathcal{J}_{\tilde{H}}} \iint P^A(\alpha, p_{ij}, X_i^A)[(1-(1-M_{ij})P^D(\alpha, X_i^R))p_{ij} - \zeta_{ij}]\, f_{\alpha,s}(\alpha, s; \sigma_\gamma) d\alpha ds - \kappa_{\tilde{H}} \cdot \frac{1}{\sigma_\gamma^2}$$

- Lender types (size $\times$ preferred $\times$ period) set precision of information jointly
- Pay cost $\kappa_{\tilde{H}}$ per unit of precision

Identification

Selected Parameter Estimates - Signal Precision

Parameter	Estimate (S.E.)		
	Assets $< \$10B$	Assets $\in [\$10B, \$100B)$	Assets $\geq \$100B$
S.D. of Signal Distribution: σ_γ			
Non-Preferred, Baseline	0.882	1.037	0.726
	(0.106)	(0.240)	(0.227)
Preferred, Baseline	0.951	0.692	1.005
	(0.130)	(0.198)	(0.131)
Non-Preferred, SBA Recovery	0.995	0.904	1.165
	(0.105)	(0.237)	(0.341)
Preferred, SBA Recovery	1.667	1.152	0.814
	(0.152)	(0.159)	(0.128)
Difference Across Periods (SBA Recovery - Baseline):			
Non-Preferred	0.113	-0.134	0.439
	(0.103)	(0.321)	(0.398)
Preferred	0.716	0.460	-0.192
	(0.142)	(0.202)	(0.138)

Parameterization

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Parameterization

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Disentangling Guarantee Pass-Through and Information Effect

Baseline: guarantee of 0.9, fix covariates.

Consider rates $\tilde{M} \in \{0.5, 0.6, 0.7, 0.8, 1\}$.

1. Hold information precision fixed at baseline, reprice $\rightarrow$ guarantee pass-through
2. Reoptimize information precision $\rightarrow$ information effect

Compute borrower surplus under each scheme.

Borrower Surplus Calculation

Effect of Guarantees on Borrower Surplus

Outcome	Guarantee Rate 50%	60%	70%	80%	90%	100%
Signal-to-Noise Ratio	0.433	0.422	0.415	0.410	0.407	0.405
	(+6.466%)	(+3.629%)	(+1.893%)	(+0.762%)	-	(-0.519%)
Price	1.147	1.147	1.147	1.147	1.147	1.146
	(+0.055%)	(+0.034%)	(+0.019%)	(+0.009%)	-	(-0.007%)
SD(Price)	0.063	0.062	0.062	0.061	0.061	0.061
	(+2.879%)	(+1.696%)	(+0.959%)	(+0.424%)	-	(-0.352%)
Borrower Surplus	1.169	1.170	1.171	1.171	1.172	1.172
	(-0.212%)	(-0.130%)	(-0.074%)	(-0.032%)	-	(+0.026%)

Borrower surplus $\uparrow$ (small magnitude) with generosity of guarantees

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Information precision $\downarrow$, price dispersion $\downarrow$ with generosity of guarantees

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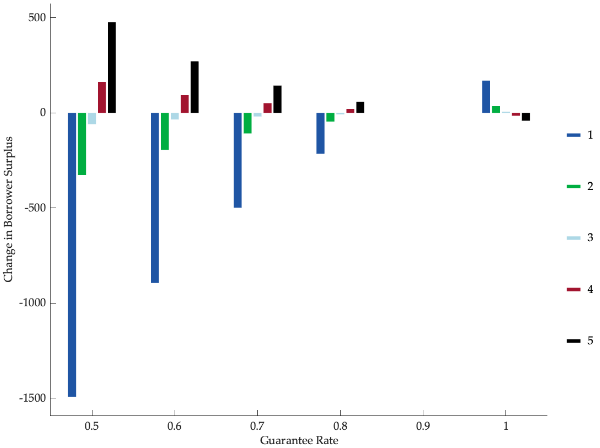
Effects Across the Distribution of Risk



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Hybrid Policy Design: Subsidy and Guarantee

Results so far tell us:

1. Program has stark distributional impact
2. Information effect plays a role

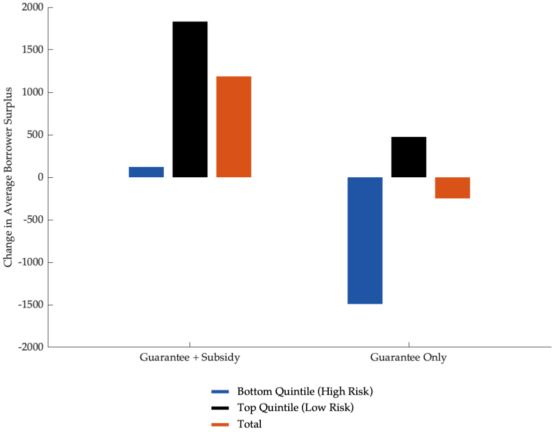
Policy that leaves lenders more exposed to risk could $\uparrow$ average borrower surplus

Idea: Guarantee of 50% $+$ subsidy set w/ expected government spending fixed

Subsidy Calculation

Hybrid Policy Outcomes

Relative to 90% Guarantee and No Subsidy



Conclusion

Bank moral hazard amplifies heterogeneous impact of guarantees

In total, when guarantees increase from 50% to 90%

- Borrower surplus $\uparrow$ by small amount, on average
- Heterogeneous impact across the risk distribution

Room in policy design to expand credit while limiting moral-hazard effects

- Hybrid policy (subsidy + guarantee) leads to aggregate borrower-surplus gains
- Gains to low-risk borrowers outweigh losses faced by high-risk borrowers

Lender Oversight

"...[the SBA's Office of Inspector General and the U.S. Government Accountability Office] have reported deficiencies in the SBA's administration of its loan guaranty programs that they argue need to be addressed, including issues involving the oversight of 7(a) lenders and the lack of outcome-based performance measures."

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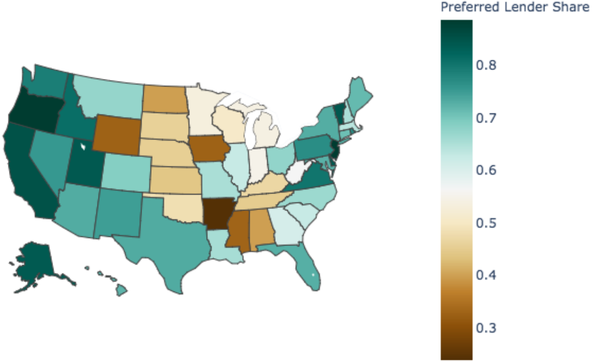
Interest Rate Caps

Loans subject to interest-rate caps that vary by loan size:

- Base Rate plus 2.25% for amounts $> \$50,000$, term < 7 years
- Base Rate plus 2.75% for amounts $> \$50,000$, term ≥ 7 years
- Additional 1% for loans between 25,000 and 50,000 and 2% for loans below 25,000

Back

Geographic Distribution of Preferred Lenders



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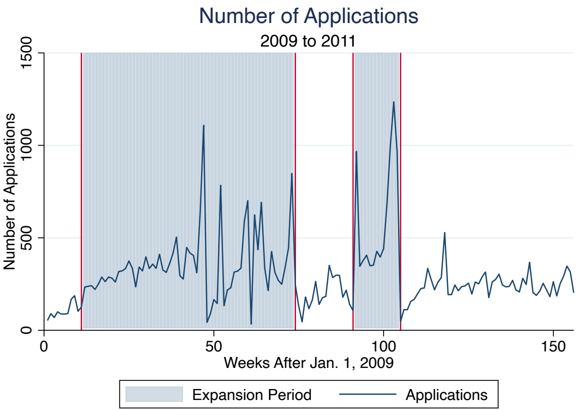
Summary Statistics

	Mean	S.D.	Min.	25th Pct.	Median	75th Pct.	Max.
All Loans							
Interest Rate (Pct.)	5.86	0.57	2.25	5.5	6	6	9.23
Term (Months)	164.35	88.46	7	90	120	244	318
Amount Borrowed (Thousands)	557.78	487.28	6.5	200	400	772	2,000
Guaranteed Pct.	0.86	0.06	0.32	0.85	0.9	0.9	0.9
Acceptance	0.87						
Loan Size $>$ 150,000	0.81						
Preferred Lender	0.71						
Observations	13,994						
Accepted Loans							
Default	0.07						
Observations	12,159						

Lending Activity Over Time



Descriptives capture: Δ composition, guarantee-pass through, information effect

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Loan Price Calculation

Denote r_{ij} the interest rate, T_{ij} the term (in months), and B_{ij} the amount borrowed. I assume that, each period, the borrower pays the monthly interest rate $\frac{r_{ij}}{12}$ on the remaining balance each period plus an equal share of the principal. In any given month, the remaining loan balance is

$$B_{ij} - (t-1)\frac{B_{ij}}{T_{ij}}.$$

The associated monthly payment at time t is given by

$$\frac{B_{ij}}{T_{ij}} + \frac{r_{ij}}{12}\left(B_{ij} - (t-1)\frac{B_{ij}}{T_{ij}}\right).$$

Loan Price Calculation

I discount each cash flow using the zero-coupon Treasury yield to the maturity t. That is, I compute the yield, normalizing by the size of the loan. This yield takes the form:

$$R_{ij} = \frac{1}{B_{ij}} \sum_{t=0}^{T_{ij}} \frac{\frac{B_{ij}}{T_{ij}} + \frac{r_{ij}}{12}\left(B_{ij} - (t-1)\frac{B_{ij}}{T_{ij}}\right)}{(1+\delta_{ij,t})^{t}},$$

where $\delta_{ij,t}$ is the zero-coupon Treasury yield at the time of loan approval for the lender-borrower pair ij to maturity t.

Back to Descriptive Back to Model

Changes to Loan Characteristics

$$Y_{ijt} = \alpha + \delta \mathbb{I}(t = \text{SBA Recovery}) + \beta X_{ijt} + \epsilon_{ijt}$$

	(1) Interest Rate (Pct.)	(2) Amt. Borrowed ($ Thousands)	(3) Loan Term (Months)
Loans Issued Within 42 Days of Events			
SBA Recovery	-0.0418***	56.29***	4.169***
	(0.0161)	(10.86)	(0.936)
Mean Outcome	5.86	557.78	164.35
Observations	13,994	13,994	13,994
Zip Code Dem. Controls	✓	✓	✓
Business Type FE	✓	✓	✓
NAICS (Two-Digit) FE	✓	✓	✓
Real Estate FE	✓	✓	✓
Event Date FE	✓	✓	✓

Standard errors are clustered by lender.

* $p<0.1$, ** $p<0.05$, *** $p<0.01$

Higher guarantees $\rightarrow$ more generous loan offers

Pricing and Lender Information

Stage 1: Flexible mapping from loan characteristics to prices

$$p_{ijt} = f(M_{ijt}, B_{ijt}) + X_{ijt}\beta + \epsilon_{ijt}$$

Pricing and Lender Information

Stage 1: Flexible mapping from loan characteristics to prices

$$p_{ijt} = f(M_{ijt}, B_{ijt}) + X_{ijt}\beta + \epsilon_{ijt}$$

Stage 2: Relationship between ϵ_{ijt} and borrower default

$$d_{ijt} = \gamma_1 \epsilon_{ijt} + \gamma_2 \mathbb{I}(t = SBA) + \gamma_3 \epsilon_{ijt} \times \mathbb{I}(t = SBA) + g(M_{ijt}, B_{ijt}) + X_{ijt}\delta + e_{ijt}$$

Back Price Calculation

Pricing and Lender Information

	(1) Default	(2) Charge Off
ϵ	1.990	1.216
	[1.649,2.343]	[1.003,1.452]
$\mathbb{I}(t = SBA)$	-0.031	-0.027
	[-0.060,-0.002]	[-0.046,-0.008]
$\epsilon \times \mathbb{I}(t = SBA)$	-0.550	-0.379
	[-0.926,-0.202]	[-0.631,-0.147]
Raw Correlation	0.239	0.213
SD(ϵ)	0.038	0.038
Observations	12,159	12,159

Block-bootstrapped (by lender) 95% confidence intervals are displayed in brackets; N=1,000.

Back Interest Rate

Changes to Loan Characteristics

14-Day Window

	(1) Interest Rate (Pct.)	(2) Amt. Borrowed ($ Thousands)	(3) Loan Term (Months)
Loans Issued Within 14 Days of Events			
SBA Recovery	-0.0753***	59.61***	6.826***
	(0.0264)	(19.10)	(1.651)
Mean Outcome	5.87	585.29	168.22
Observations	5,028	5,028	5,028
Zip Code Dem. Controls	✓	✓	✓
Business Type FE	✓	✓	✓
NAICS (Two-Digit) FE	✓	✓	✓
Real Estate FE	✓	✓	✓
Event Date FE	✓	✓	✓

Standard errors are clustered by lender.

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Back

Event Study Robustness

Within-Lender Results - Loan Characteristics

	(1) Interest Rate (Pct.)	(2) Amt. Borrowed ($ Thousands)	(3) Loan Term (Months)
Loans Issued Within 42 Days of Events			
SBA Recovery	-0.0241	40.65***	2.303**
	(0.0164)	(10.02)	(1.007)
Mean Outcome	5.85	558.21	165.46
Observations	13,465	13,465	13,465
Zip Code Dem. Controls	✓	✓	✓
Business Type FE	✓	✓	✓
NAICS (Two-Digit) FE	✓	✓	✓
Real Estate FE	✓	✓	✓
Event Date FE	✓	✓	✓
Lender FE	✓	✓	✓

Standard errors are clustered by lender.

* $p<0.1$, ** $p<0.05$, *** $p<0.01$

Back

Event Study Robustness

Lapses Only

	(1) Interest Rate (Pct.)	(2) Amt. Borrowed ($ Thousands)	(3) Loan Term (Months)
Loans Issued Within 42 Days of Events			
SBA Recovery	-0.0424*	82.86***	7.578***
	(0.0232)	(14.74)	(1.396)
Mean Outcome	5.87	572.99	165.92
Observations	7,267	7,267	7,267
Zip Code Dem. Controls	✓	✓	✓
Business Type FE	✓	✓	✓
NAICS (Two-Digit) FE	✓	✓	✓
Real Estate FE	✓	✓	✓
Event Date FE	✓	✓	✓

Standard errors are clustered by lender.

* $p<0.1$, ** $p<0.05$, *** $p<0.01$

Back

Macroeconomic Indicator Balance

	No Event FE	Event FE	Mean
Federal Funds Rate	-0.006	-0.005	0.185
	(0.006)	(0.006)	
One-Month LIBOR	-0.009	-0.012*	0.336
	(0.027)	(0.007)	
Market Yield on U.S. Treasuries (10-Year Constant Maturity)	0.019	-0.001	3.048
	(0.104)	(0.052)	
Market Yield on U.S. Treasuries (3-Year Constant Maturity)	-0.020	-0.042	1.086
	(0.082)	(0.039)	
Bank of America Closing Stock Price	0.507	0.544	12.152
	(1.068)	(0.379)	
JPMorgan Chase Closing Stock Price	1.433	1.568*	36.624
	(1.996)	(0.818)	
Citigroup Closing Stock Price	2.139	2.269*	38.706
	(2.358)	(1.257)	

Standard errors are clustered by week.

* $p<0.1$, ** $p<0.05$, *** $p<0.01$

Back

Pricing Regression Robustness

$$d_{ijt} = \gamma_1 \epsilon_{ijt} + \gamma_2 \mathbb{I}(t = SBA) + \gamma_3 \epsilon_{ijt} \times \mathbb{I}(t = SBA) + g(M_{ijt}, B_{ijt}, T_{ijt}) + X_{it}\delta + e_{ijt}$$

	(1) Default	(2) Charge Off
ϵ	0.026	0.021
	[0.008,0.046]	[0.009,0.034]
$\mathbb{I}(t = SBA)$	-0.039	-0.031
	[-0.068,-0.009]	[-0.051,-0.010]
$\epsilon \times \mathbb{I}(t = SBA)$	-0.016	-0.014
	[-0.035,0.003]	[-0.028,-0.001]
Raw Correlation	0.034	0.039
SD(ϵ)	0.568	0.568
Observations	12,159	12,159

Block-bootstrapped (by lender) 95% confidence intervals are displayed in brackets; N=1,000.

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Changes to Loan Characteristics

Preferred Lender Heterogeneity

	(1) Interest Rate (Pct.)	(2) Amt. Borrowed ($ Thousands)	(3) Loan Size > 150,000	(4) Loan Term (Months)
Loans Issued Within 42 Days of Events				
SBA Recovery	-0.00205	27.12	0.0230*	0.759
	(0.0220)	(16.72)	(0.0131)	(1.381)
Preferred Lender	-0.0634	-112.6***	-0.0809***	3.422
	(0.0399)	(18.40)	(0.0199)	(2.511)
SBA Recovery × Preferred Lender	-0.0449**	58.58***	0.0599***	4.169**
	(0.0225)	(20.20)	(0.0184)	(1.892)
Mean Outcome	5.86	557.78	0.81	164.35
Observations	13,994	13,994	13,994	13,994
Zip-Code Dem. Controls	✓	✓	✓	✓
Business Type FE	✓	✓	✓	✓
NAICS (Two-Digit) FE	✓	✓	✓	✓
Real Estate FE	✓	✓	✓	✓
Event Date FE	✓	✓	✓	✓

Standard errors are clustered by lender.

* $p<0.1$, ** $p<0.05$, *** $p<0.01$

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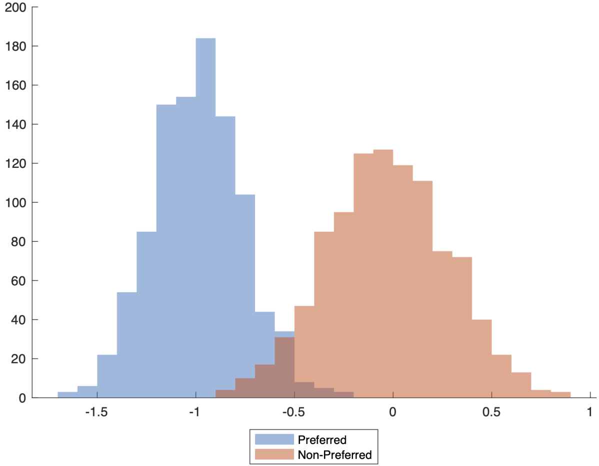
Pricing Response

Bootstrap Distribution of Interaction Coefficient by Lender Type



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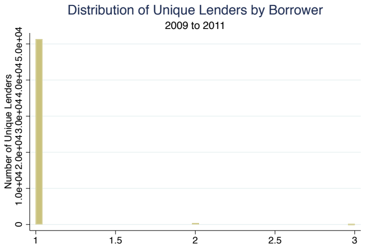
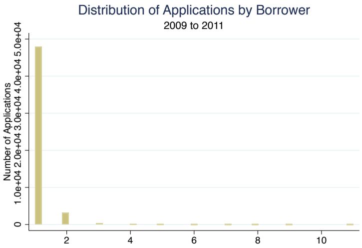
Borrower Applications and Lender Relationships





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Parameterization and Estimation

Category	**Parameterization**
Repayment	Constant, loan amount bins, real-estate, event-date, two-digit NAICS, business type FEs, zip code demographics, SBA Recovery
Acceptance	Same as Repayment
Cost	Constant, loan amount bins, cost-shifters
Information	Preferred lender $\times$ Lender size $\times$ SBA Recovery
ξ_i^R, α_i	Joint normal, correlation positive
$\epsilon_{\gamma,ij}$, ω_{ij}	Normal

- Estimation by maximum likelihood

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Identification

Borrower-side challenge: p_{ij} set with knowledge of s_{ij}

- Analogous to standard problem in IO
- Cost shifters that vary across banks, within bank across states

Lender-side challenge: disentangle signal noise from unobservable cost shocks

- Leverage ex-post outcomes (i.e., default decisions)

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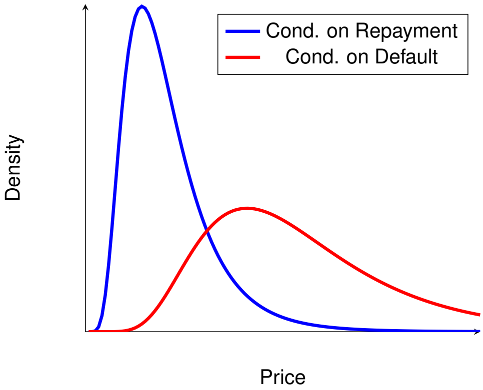
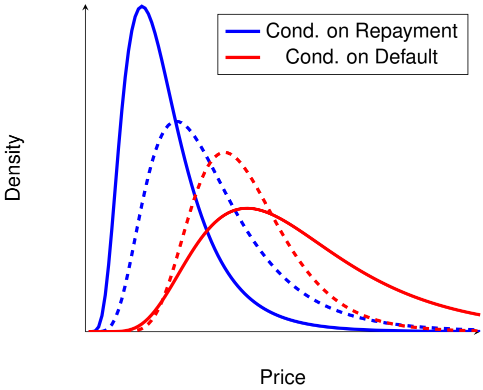
Signal Precision Informed by Prices Conditional on Ex-Post Outcomes

Informative signals $\rightarrow$ separation between distributions.



Signal Precision Informed by Prices Conditional on Ex-Post Outcomes

Decline in signal precision $\rightarrow$ less able to distinguish between distributions.



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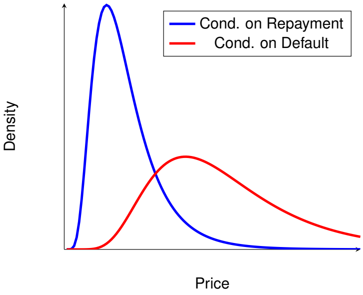
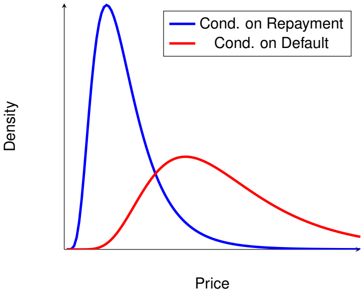
Signal Precision Confounded by Marginal Cost Variation



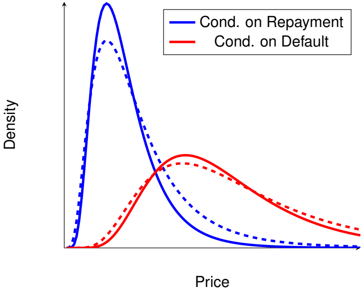
Part of variation across ex-post outcomes could be due to cost shocks.

Signal Precision Confounded by Marginal Cost Variation



But cost shocks are **independent** of borrower risk.

Signal Precision Confounded by Marginal Cost Variation



Suppose lender has precise information.

$\uparrow$ cost variance implies

$\uparrow$ width of both distributions

Signal Precision Confounded by Marginal Cost Variation

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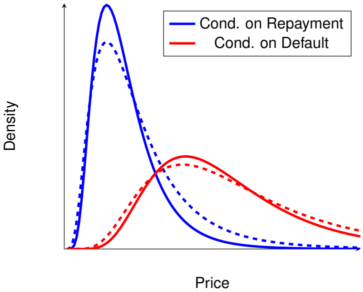
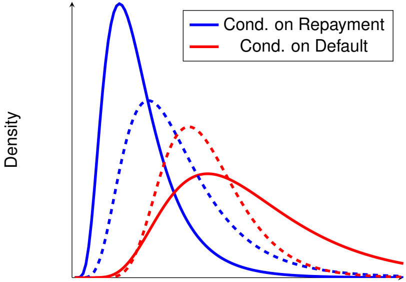


Suppose lender has precise information.

↑ cost variance implies

↑ width of both distributions



Suppose the variance of costs is low.

↓ information precision implies

location shift of both distributions

Borrower Surplus Calculation

Compute borrower surplus using standard log-sum formula (see, e.g., Train (2009)), and scale by α_i so units are equivalent to those for prices:

$$\text{Borrower Surplus}_{ij} = \frac{1}{\alpha_i} \log\left(1 + \exp(X_i^A \beta^A - \alpha_i p_{ij})\right).$$

Multiply by loan amount, b_{ij}, to scale to dollars over normalized ten-year loan term.

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Subsidy Calculation

Compute the subsidy, $S(0.5)$, by solving:

$$\sum_{ij} B_{ij} P^A(p_{ij}(0.9), \alpha_i, X_i^A) \left[0.9 \cdot P^D(\alpha_i, X_i^R) \cdot p_{ij}(0.9) \right] =$$

$$\sum_{ij} B_{ij} P^A(p_{ij}(\tilde{M}), \alpha_i, X_i^A) \left[\tilde{M} \cdot P^D(\alpha_i, X_i^R) \cdot p_{ij}(\tilde{M}) + S(\tilde{M}) \right].$$

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