Asymmetric Information and Imperfect Competition in Lending Markets

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Motivation

How adverse selection and imperfect competition affects lending market?

- Adverse selection and market structure affect each other
- Theoretical research finds market power mitigates adverse selection
- Empirically asymmetric info difficult to measure

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Demand

Stage 1: Demand, choose which lender to borrow from (0=no credit line)

$$U_{ij}^D = \alpha_0^D + X_j'^D \beta^D + \xi_j^D + \alpha^D P_{ij} + Y_{ij}'^D \eta^D + \varepsilon_i^D + \nu_{ij}$$

Stage 2: Choose amount of credit to use

$$U_{ij}^L = \alpha_0^L + X_j'^L \beta^L \qquad + \alpha^L P_{ij} + Y_{ij}'^L \eta^L + \varepsilon_i^L$$

Stage 3: Choose whether to default

$$U_{ij}^F = \alpha_0^F + X_j'^F \beta^F \qquad + \alpha^F P_{ij} + Y_{ij}'^F \eta^F + \varepsilon_i^F$$

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Amount of credit granted is exogenous: convex pricing is not likely

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Supply

$$\max_P \Pi = PQ(P)(1 - F(P)) - MCQ(P)$$

FOC

$$Q(1 - F) + PQ'(1 - F) - PQF' = MCQ'$$

Without default $F = 0$

$$P = MC + \overbrace{\frac{Q}{-Q'}}^{Markup}$$

With default

$$P = \underbrace{\frac{MC}{1 - F + F'\frac{Q}{-Q'}}}_{\text{Effective Marginal Cost}} + \underbrace{\frac{(1 - F)\frac{Q}{-Q'}}{1 - F + F'\frac{Q}{-Q'}}}_{\text{Effective Markup}}$$

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Challenges

Challenges:

- We only observed info for matched firm-bank pairs but not unmatched
- Some info observable to banks but not to econometrician (soft info)

Potential Solutions

- Survey shows large banks rely more on hard info
- Focus on the first year: banks unlikely to have soft info
- Use multiple banking relationships to identify firm fixed effect observable only to banks
- Test whether the residual from the pricing regression is correlated with default

Price Prediction Model

TABLE 2—PRICE REGRESSIONS

Variables	(1)	(2)	(3)	(4)
Amount granted	−2.37	−2.39	—	—
	(0.07)	(0.07)		
50,001–100,000	—	—	−1.47	−0.92
			(0.07)	(0.09)
100,001–150,000	—	—	−2.44	-1.55
			(0.08)	(0.09)
150,001–200,000	—	—	−2.77	−1.98
			(0.10)	(0.10)
200,001–300,000	—	—	−3.18	−2.19
			(0.10)	(0.10)
300,001–400,000	—	—	−3.72	−2.63
			(0.11)	(0.10)
400,001–500,000	—	—	−3.99	−2.88
			(0.12)	(0.11)
500,001–1,000,000	—	—	−4.37	−3.06
			(0.12)	(0.10)
1,000,001-3,000,000	—	—	−5.02	−3.44
			(0.13)	(0.12)

Price decreases in amount: no convex pricing as screening device

Price Prediction Model

Distance to branch	−0.94	−0.70	−1.33	−0.40
	(0.21)	(0.20)	(0.20)	(0.30)
Constant	16.80	15.53	17.52	15.49
	(0.18)	(0.13)	(0.15)	(0.81)
Firm controls	Yes	Yes	Yes	No
Bank fixed effects	Yes	No	No	No
Area fixed effects	Yes	No	No	No
Year fixed effects	Yes	No	No	No
Bank-area-year fixed effects	No	Yes	Yes	Yes
Firm fixed effects	No	No	No	Yes
R^2	0.294	0.319	0.365	0.717
Observations	92,596	92,596	92,596	92,602

R^2 jumps when firm fixed effect added: evidence of soft info

Price Prediction Model

- For borrowing firms
  - The residuals from the regression above is used as explanatory variables

$$P_{ij} = \gamma_0 + \gamma_1 \text{Dist}_{ij} + \gamma_2 \text{Size}_{ij} + \lambda_j + \omega_i^P + \text{PredErr}_{ij}$$

- For non-borrowing firms,
  - Propensity Score Matching
  - Match on observables
  - Randomly assign the fixed effects of borrowings to non-borrowings
  - Randomly assign the granted loan amount to non-borrowings

Econometric Model

Maximum Simulated Likelihood and Instrumental Varables Estimation

1. Estimate $\eta = \{\alpha^L, \alpha^F, \eta^D, \eta^L, \eta^F\}$, $\beta^{LF} = \{\alpha_0^L, \alpha_0^F, \beta^L, \beta^F\}$ and the var-cov structure $\Sigma = \{\sigma_D, \sigma_L, \rho_{DF}, \rho_{DL}, \rho_{LF}\}$
2. Recover $\delta_j^D = \alpha_0^D + X_j'^D \beta^D + \xi_j^D$ using contraction method in BLP
3. Use the estimated δ_j^D as dependent var to estimate $\{\alpha^D, \beta^D, \alpha_0^D\}$

Step 1

- Estimating the usage and default equations is easy: we can use observed price
- Demand equation is more difficult
  - ω_i^P not observed: We use $\tilde{\omega}_i^D$ as proxy
  - Same covariates used in price prediction: both direct/indirect effects
  - Error term is a composite of structural demand and prediction error
  - Cannot identify α_0 in the first stage
- Maximize the joint simulated log-likelihood

Step 2

- Use the following iteration to find $\tilde{\delta}_j^D$

$$\tilde{\delta}_j^{D,r+1} = \tilde{\delta}_j^{D,r} + \ln\left(\frac{MktShr_j}{\widehat{MktShr}_j(\tilde{\delta}_j^{D,r})}\right)$$

- Use estimated $\hat{\tilde{\delta}}_j^D$ as dependent var, cost shifter as IV to estimate $\alpha^D, \beta^D, \alpha_0^D$

$$\hat{\tilde{\delta}}_j^D = \alpha_0^D + \alpha^D \tilde{P}_j + X_j'^D \beta^D + \xi_j^D$$

Identification

- Use household deposits as IV to account for the correlation between interest rates and bank-market-year specific errors.
  - Banks unobserved chars ξ_j^D affects lending interest
  - Households have different demand chars but incorporate same bank chars
- Use prices in other markets as IV in loan usage and default equation
  - To correct bias from soft information, we need price variation orthogonal to soft info
  - Cost to banks are common across markets and reflected in the prices.

Results

	Demand	Loan use	Default
Firm level			
Price			
Interest rate	−1.45	−0.01	1.06
	(0.62)	(0.00)	(0.02)
Assets			
Total assets	5.84	0.09	−0.04
	(0.08)	(0.00)	(0.03)
Intangible/total assets	−0.82	−0.01	0.08
	(0.05)	(0.01)	(0.05)
Profitability			
Profits	1.12	0.01	0.03
	(0.05)	(0.00)	(0.02)
Cash flow	−0.93	−0.05	−0.12
	(0.05)	(0.00)	(0.02)
Sales	7.16	−0.01	−0.34
	(0.07)	(0.00)	(0.04)
Debt			
Trade debit	−3.44	−0.04	0.12
	(0.05)	(0.00)	(0.02)
Others			
Firm's age	0.23	0.00	0.02
	(0.03)	(0.00)	(0.03)
Distance to branch	−1.22	−0.01	−0.04
	(0.03)	(0.01)	(0.06)

Results

Covariance matrix (Σ)

	$\sigma_D = 0.34$ (0.00)		
	$\rho_{DL} = 0.10$ (0.00)	$\sigma_L = 0.30$ (0.00)	
Adverse selection	$\rho_{DF} = 0.16$ (0.00)	$\rho_{LF} = 0.14$ (0.00)	$\sigma_F = 1$

- Adverse selection: more likely to borrow, more likely to default
- Unexpected high usage $\Longrightarrow$ more likely to default

Counterfactuals

- Double the estimated correlation coefficient of unobs. det.
  - Increasing adverse selection reduce supply and increase price
  - Great market power mitigates this effect
- Simulate financial crisis: increase bank's cost of capital
  - Banks with greater market power more likely to raise price
- Simulate a merger between two largest local banks
  - Prices decline as concentration rises