Optimal Contracting and Spatial Competition among Financial Service Providers

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January 4, 2019

Reduced Form Evidence

- What are the effects of introducing a:
  1. Financial Service Provider in a region?
  2. New screening system to remove selection on observables?

- Data on $\approx$ 500 villages, half randomly receive a new FSP
  - 70 Small and Medium Enterprises per village, $\approx$ 35,000 HHs
  - $\approx$ 100 in both Control and Treatment had no FSP before intervention.

- For those with some FSP in baseline (300 Villages), half randomly receive the screening system

Reduced Form Evidence

- What are the effects of introducing a FSP in a region?

Table: Outcomes: Treatment - Control

	No FSP baseline	Had FSPs baseline
Δ Avg. Consumption	-0.0745***	
	(0.0216)	
Δ Std. Dev. of Consumption	0.2810***	
	(0.0290)	
Δ Avg. Production	3.8775***	
	(0.0652)	
Δ Std. Dev. of Production	4.4624***	
	(0.0839)	

- Consumption-Production puzzle.

Reduced Form Evidence

- What are the effects of introducing a FSP in a region?

Table: Outcomes: Treatment - Control

	No FSP baseline	Had FSPs baseline
Δ Avg. Consumption	-0.0745***	0.6098***
	(0.0216)	(0.0074)
Δ Std. Dev. of Consumption	0.2810***	0.6169***
	(0.0290)	(0.0088)
Δ Avg. Production	3.8775***	0.0176
	(0.0652)	(0.0250)
Δ Std. Dev. of Production	4.4624***	-0.0055
	(0.0839)	(0.0323)

- Consumption Puzzle?

Reduced Form Evidence

- What are the effects of introducing village wide a screening system?
- Given previous table, model of welfare based on consumption-production.
- Two subsamples of villages that had at least one FSP initially: got new FSP / did not get New FSP of those with at least one in the baseline (300 villages)
  - Four subsets, $\approx$ 75 villages: New FSP/Screening System treatments.
- Difference is in screening system.

	Got new FSP	Didn't get new FSP
Δ Welfare	0.0940***	
	(0.0106)	

Reduced Form Evidence

- What are the effects of introducing village wide a screening system?
- Given previous table, model of welfare based on consumption-production.
- Two subsamples: New FSP Treatment/Control, Screening Treatment/Control.
- Difference is in screening system.

	Got new FSP	Didn't get new FSP
Δ Welfare	0.0940***	-0.2662***
	(0.0106)	(0.0113)

- Information Structure puzzle.

Puzzles Resolved

- Experiment is done in the environment of a model.
- Consumption-production Puzzle
  - Puzzle: contracts with one FSP different than autarky
    - Average consumption $\downarrow$: SMEs get insurance, pay premium
    - Std. Deviation $\uparrow$: comes from heterogeneity in productivity, not risk.
  - No puzzle: with one FSP, the introduction of a new one does not change contracts, only intermediation costs, benefits HHs.
  - Inference is difficult and depends on whether experiment varying competition is changing contracts, or not.
- Information Structure Puzzle
  - Differences in welfare due to competition in intermediation.
  - Screening with little competition allows FSPs to extract rents, welfare of HHs $\downarrow$.s
  - FSPs does not know how to differentiate agents, it cannot extract rent $\rightarrow$ AdS is welfare improving.
  - Experiment changing obstacles, the information structure for contracts, depends on existing degree of competition.
- **This paper adds both ingredients: contracting + market structure model**

Conceptual Framework, Model

- Change in competition space: utilities (not contracts), u. Consumption c, production q, effort z and type θ. Ex:

$$U(c(q), z\,|\theta) = \frac{c^{1-\sigma}}{1-\sigma} - \theta z^{\varphi}$$

- Risk-averse SMEs want to borrow, produce and consume. Production function with capital $k^{'}$ given by probabilities:

$$P(q|k^{'}, \theta, z)$$

- FSPs (b): risk neutral offer credit, insurance s.t. financial constraints (MH, LC, AdS). Profits:

$$q - c(q) + (1+r)\left[(1-\delta)k - k^{'}\right]$$

- Structure on utility and production functions is not at all essential to our method.

Conceptual Framework, Model

- SMEs/FSPs spatially separated, travel cost from FSP b to village v: $\psi t(x_v, x_b)$.
  - $t(x_v, x_b)$ measured through road network, actual travel times between points in map.
- Building Blocks: frontier + mkt structure

$$\Pi^b \equiv \underbrace{S(u_b)}_{\text{Surplus per unit } u_b} \quad \underbrace{\mu\left(u_b, u_{-b}, u_0, x_b, x_{-b}, \{x_v\}_v\right)}_{\text{Demand at } u_b}$$

- FOC:

$$-\frac{\partial_{u_b} S(u_b^*)}{S(u_b^*)} = \frac{\partial_{u_b} \mu\left(u_b^*, u_{-b}, u_0, x_b, x_{-b}, \{x_v\}_v\right)}{\mu\left(u_b^*, u_{-b}, u_0, x_b, x_{-b}, \{x_v\}_v\right)}$$

- Variation in one ingredient in cross section and fixing the other, e.g.: can identifier surplus frontier with variations in supply side.

Frontier: Contracting Building Block

- Given utilities, varying parametrically.
- Linear Programming given contracting frictions, chooses distribution $\pi(c, z, q, k^{'}|k, u)$. Let $\mathcal{C} = \{c, z, q, k^{'}\}$:

$$\mathcal{S}(u \mid \theta) \equiv \max_{\pi(.)} \sum_{\mathcal{C}} \pi\left(\mathcal{C}|k, u\right) \left[q - c + (1 + r) \left[(1 - \delta)k - k^{'}\right]\right]$$

- s.t.: promised utility constraint

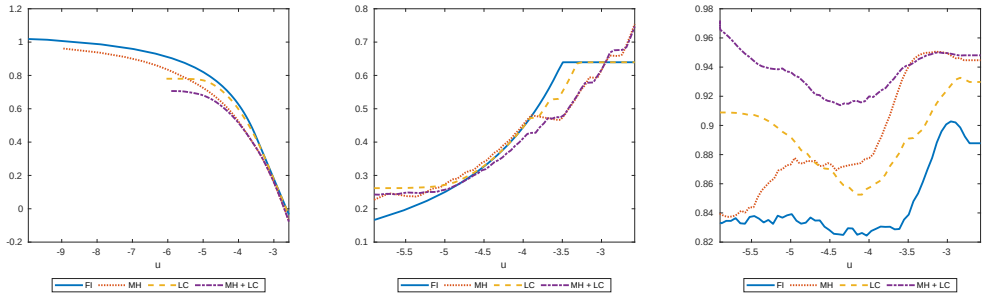
$$\sum_{\mathcal{C}} \pi(\mathcal{C}|k, u) U(c, z|\theta) = u$$

- and financial frictions of the form

$$\Gamma(\theta, u)\pi(\mathcal{C}|k, u) \leq 0$$

- Encompasses FI, MH, LC, AdS*

Frontier: Example



(a) Frontier (b) $E(c)$ (c) Std. Dev. C

Figure: Frontier and Consumption Moments

- Observing frontier (if identified) and observing movement in variables with utility (estimated as unobserved distribution with moments or using market structure) allow inference of obstacles.

Market Structure: Second building block

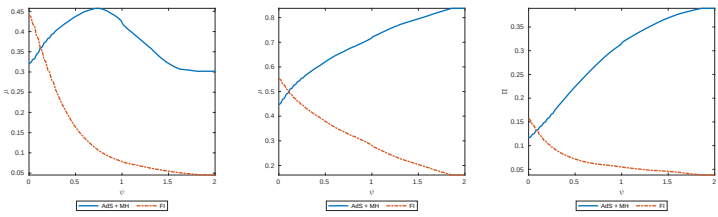
- Demand system: spatial + logit: $u - \psi t(x_v, x_b) + \varsigma$

$$\mu_{v,b} \equiv \sum_{v=1}^{V} N_v \left\{ \frac{e^{\sigma_L^{-1}[u_b - \psi t(x_b, x_v) - u_0]}}{1 + \sum_{\hat{b}=1}^{B} e^{\sigma_L^{-1}[u_{\hat{b}} - \psi t(x_{\hat{b}}, x_v) - u_0]}} \right\}$$

  in village v for bank b, competitors $-b$, outside option u_0.
- Nash Equilibrium in utilities among FSPs.
- Under some conditions, NE exists, is unique, can be computed iteratively.
- $\{\psi, \sigma_L\}$ affect eq. utilities. E.g. $\psi \uparrow$:
  - Non-Monotone effect of ψ: initially increases profits (household welfare dropping) but further increases decrease profits
  - Larger effects with more competition.
- In some respects translate utility into price and we have standard methods, except we do not require quasi linear utility.
  - The problem we have is that with contracting and fin frictions, we dont know how what production surplus looks like (the frontier) and must estimate it.

Adverse Selection: Relationship Lending

- $\mathbb{U}(c, z|\theta) = (1-\sigma)^{-1}c^{1-\sigma} - \theta z^{\varphi}$, $\theta = L, H$. (Low = Good).
- Hotelling line, local FSP at 0 with FI (can distinguish types, observe effort), National at 1 s.t. MH + AdS, spatial cost ψ only for Local (national is more convenient).
- Equilibrium computed with distance to Nash.



(a) μ, θ_L (b) μ, θ_H (c) Profits

Figure: Relationship Lending: Market Shares (μ_b) and Profits (Π), changes in ψ

Taking to the Data

- Model has implications for $\mu_{v,b}$, SME $\{c, q, k\}$ data.

- $\mu_{v,b}$ data
  - Usual IO toolbox (logit regression)
  - Variation in competition allows for non-parametric identification of S, tracing out the frontier
  - no need to figure out obstacles: frontier is what it is for supply side counterfactuals:
    - Changes in ψ, road structure, number of FSPs (as in consumption-production example)

- $\{c, q, k\}$ data
  - Surplus Frontier + market structure $\rightarrow$ distribution of utilities and market shares $\rightarrow$ $\{c, q, k\}$ distribution by village and bank
  - Mapping depends on frictions + parameters.
  - Only need c, q, k data to determine friction and utility levels.
  - With full structure: can also do counterfactuals changing contracting frictions (information structure changes as in example), and σ_L (logit var)

Applied: Townsend Thai Data

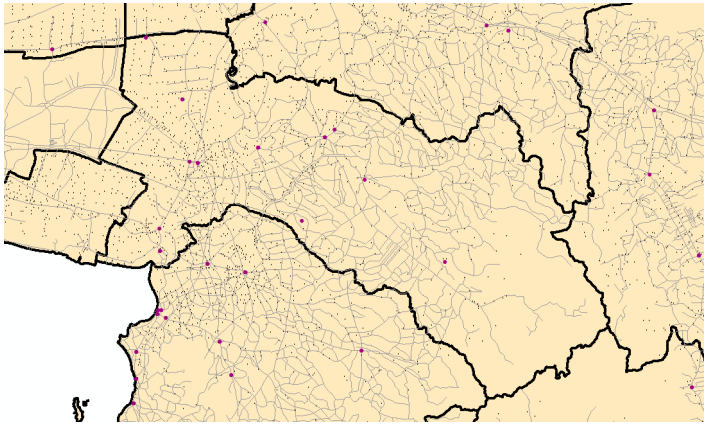


Figure: Villages and Banks in Chacheongsao Province

Note: Chacheongsao province in terms of villages and Banks overall. Pink dots represent bank branches, black dots are villages and grey lines are the roads in 1999. Horizontal distance from extremes in the figure corresponds to ≈ 80 miles.

Estimation: Townsend Thai Data

- $\{c, q, k\}$ distribution by village and bank, bank market shares and profits implied by equilibrium.
- Extend Karaivanov and Townsend (2014) to include market shares and different utilities in c, q, k distribution.
  - Likelihood by village based on bank market shares and equilibrium utilities in each.
- From FSP Profits: extra FSP should have negative profit in potential locations
  - Bresnahan and Reiss (1991) entry model.

Counterfactuals: Townsend Thai Data

- Baseline: parameter estimates.
- Consumption vs Welfare, as in the example in the beginning.
- Policy: focus on inducing FSPs to compete, rather than increasing players.

Table: % Change from baseline

	$.5\hat{\psi}$	$.75\hat{\psi}$	$.5\hat{\sigma}_L$	$.75\hat{\sigma}_L$	Bank Entry
Welfare (Cons. Equiv.)	4.85	1.37	9.21	3.70	2.20
Average Consumption	-1.97	-0.70	0.89	1.05	-2.72
Std. in Consumption	-8.33	-2.78	5.46	1.43	-12.33

Conclusion

- Interpreting reduced form evidence challenging with contracting + competition.
- Two building blocks: frontier + market structure.
- Flexible contracting specification, can be taken to the data $\rightarrow$ empirical toolkit.
- Depending on the effects or counterfactuals of interest, do not need to specify structure on both ingredients