Economics of Banking
Lecture 6

February 2025

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Remaining discussion of loan contracts:

- Collateral and its use in loan contracts
- Microfinance
- Credit rationing: The general explanation

What is collateral?

- Borrower with outcome y has pledged a collateral of size C.
- If borrower reports $y = 0$, then gain is only $R - C$.
- No gain at all if $C > R$ – typically the case.

Consequence: No problems of asymmetric information if contract with collateral

Collateral may change in value

Suppose that value of collateral is random, $f(C)$. The probability of default

$$p = \mathrm{P}\left\{\tilde{C} < R\right\} = \int_{-\infty}^{R} f(C)\,dC,$$

is in R, and $\dfrac{dp}{dR} = f(R)$. Given default, expected value of collateral is

$$\frac{1}{p}\int_{-\infty}^{R} Cf(C)\,dC < R,$$

so expected repayment is

$$\int_{-\infty}^{R} Cf(C)\,dC < pR.$$

Thus, collateral induces moral hazard: incentive to strategic default.

Consequence: *over-collaterization.*

The BTU model

Investment project: Outcome y with probability $p_\theta(e)$, otherwise 0, where

$$\theta = \begin{cases} B \\ G \end{cases}$$

is investor type and

$$e = \begin{cases} e_H \\ e_L \end{cases}$$

is the effort of the borrower-investor with cost $V(e_L) < V(e_H)$.

Intuitively, the model should be such that

$$p_B(e_H) - p_B(e_L) > p_G(e_H) - p_G(e_L)$$

(Effort matters more for the bad than for the good borrower)

Optimum for society

Chooe $e \in \{e_L, e_H\}$ maximize

$$p_\theta(e)y - V(e) - \rho,$$

with ρ is the repayment for society.

For $\theta = G$, e_L is optimal if

$$p_G(e_L)y - V(e_L) - \rho \geq p_G(e_H)y - V(e_H) - \rho$$

or

$$p_G(e_H) - p_G(e_L) \leq \frac{V(e_H) - V(e_L)}{y},$$

and for $\theta = B$, e_H is optimal if

$$p_B(e_H) - p_B(e_L) \geq \frac{V(e_H) - V(e_L)}{y},$$

Optimum for society II

If we assume:

$$[p_B(e_H) - p_B(e_L)]\, y \geq V(e_H) - V(e_L) \geq [p_G(e_H) - p_G(e_L)]\, y,$$

(ranking of expected gain from more effort and cost of more effort)

then first-best optimum is where G uses e_L and B uses e_H.

Can this optimum be sustained by financial intermediation?

Moral hazard

Suppose that B is offered an unsecured loan with repayment $\frac{\rho}{p_B(e_H)}$

If failure, B pays nothing.

But then e_L is better for B when when

$$p_B(e_L)\left(y-\frac{\rho}{p_B(e_H)}\right)-V(e_L)\geq p_B(e_H)\left(y-\frac{\rho}{p_B(e_H)}\right)-V(e_H),$$

or equivalently, when

$$[p_B(e_H)-p_B(e_L)]\left(y-\frac{\rho}{p_B(e_H)}\right)\leq (V(e_H)-V(e_L)).$$

(net expected gain from extra effort not big enough to cover increase in cost)

Introducing collateral

We look for a second-best equilibrium:

Bank proposes a contracts (R_θ, C_θ) with collateral depending on types.

Expected borrower payoff is

$$p_\theta(e^*)[y - R_\theta] - (1 - p_\theta(e^*))C_\theta - V(e^*)$$

subject to the constraints

$$p_\theta(e^*)R_\theta + (1 - p_\theta(e^*))C_\theta \geq \rho,$$
$$e^* \in \text{argmax}_{e \in \{e_L, e_H\}} p_\theta(e)[y - R_\theta] - (1 - p_\theta(e))C_\theta - V(e)$$

.

The second-best contract

In the second best equilibrium, G-investors get an unsecured loan with repayment

$$\rho(G) = \frac{\rho}{p_G(e_L)}, \ \ C_G = 0.$$

If $(p_B(e_H) - p_B(e_L))y - (V(e_H) - V(e_L)) \geq 0$*, then B-investors get the contract*

$$\begin{aligned} R_B &= \frac{\rho}{p_B(e_H)} - (1 - p_B(e_H))\frac{C_B}{p_B(e_H)}, \\ C_B &= -p_B(e_H)y + \rho + \frac{p_B(e_H)[V(e_H) - V(e_L)]}{p_B(e_H) - p_B(e_L)}. \end{aligned}$$

Sketch of proof:

We are maximizing expected payoff of B under the given constraints, so repayment R_B and collateral C_B should be as small as possible under these constraints.
From the participation constraint

$$p_B(e_H)R_B + (1 - p_B(e_H))C_B = \rho$$

which gives R_B for given C_B. From incentive compatibility,

$$p_B(e_H)(y - R_B) - V(e_H) - (1 - p_B(e_H))C_B \overset{(\geq)}{=} p_B(e_L)(y - R_B) - V(e_L) - (1 - p_B(e_L))C_B$$

we get that $(p_B(e_H) - p_B(e_L))[y - R_B + C_B] = V(e_H) - V(e_L)$ or

$$C_B = -y + R_B + \frac{V(e_H) - V(e_L)}{p_B(e_H) - p_B(e_L)}.$$

Inserting R_B and solving gives the solution.

A formal model of group lending

Borrowers can choose one of two projects, with outcome (if success)

$$y_G(L) \text{ or } y_B(L) \qquad \text{(depending on } L!\text{)}$$

The probabilities of π_G and π_B are such that $\pi_G > \pi_B$ and

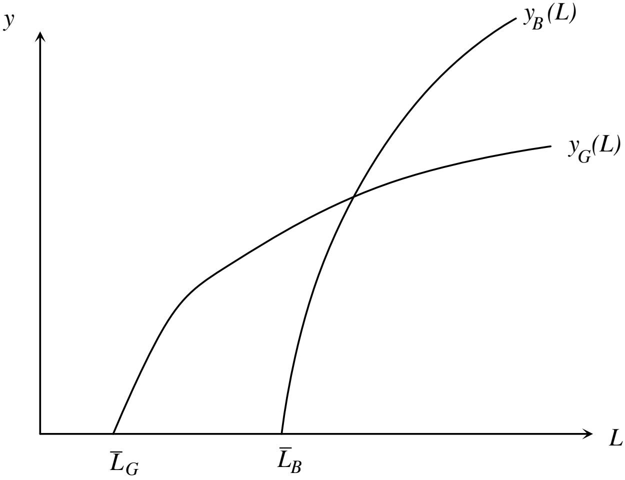
$$\pi_G y_G(L) > \pi_B y_B(L), \text{ all } L$$

Initial fixed cost $\bar{L}_j$ such that $y_j(L) = 0$ for $L \leq \bar{L}_j$,

$$\bar{L}_G < \bar{L}_B \quad \text{but} \quad \frac{dy_G}{dL} < \frac{dy_B}{dL} \text{ for } L \geq \bar{L}_B.$$

Risky project has a higher fixed cost and marginal product. There is an effort cost $\nu(L)$ with $\nu' > 0$.

Production functions



Equilibrium 1

Consider pairs (L, R) where

$$U_G(L, R) = U_B(L, R).$$

Then

$$\begin{aligned}\frac{\partial U_G}{\partial L} &= \pi_G u'(y_G(L) - RL)\left[\frac{dy_G}{dL} - R\right] - \nu'(L) \\ &< \pi_B u'(y_B(L) - RL)\left[\frac{dy_B}{dL} - R\right] - \nu'(L) = \frac{\partial U_B}{\partial L}:\end{aligned}$$

Increasing the loan and project size slightly $\Rightarrow$ borrowers choose B.

Equilibrium 2

Zero profit contracts satisfy

$$\pi_G R = r \text{ or } R = \frac{r}{\pi_G}, \qquad R = \frac{r}{\pi_B}$$

where r is the funding t rate

The equilibrium contract (L^*, R^*) must be on the boundary of the G-region.

Improvement 1

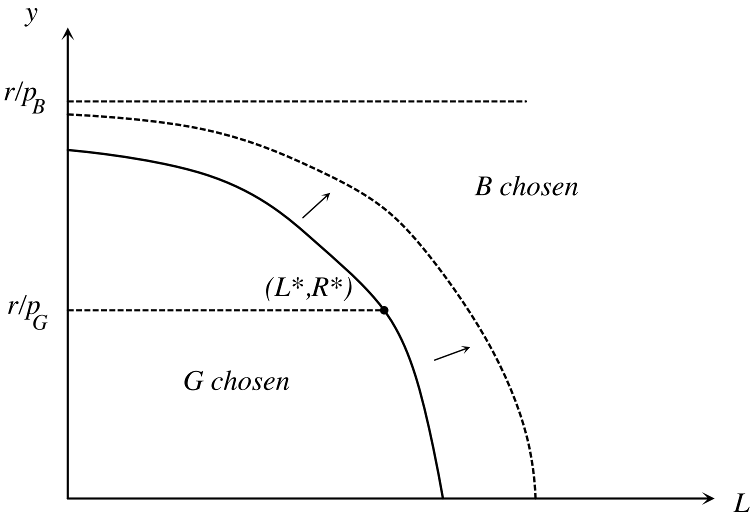
What happens if we introduce *joint liability?*

- Repayment rates can be lowered since probability of default decreases, but:
- Each individual must pay also if other individuals default

The two effects cancel out each other, BUT:

The boundary between G and B moves outward!

Improvement 2

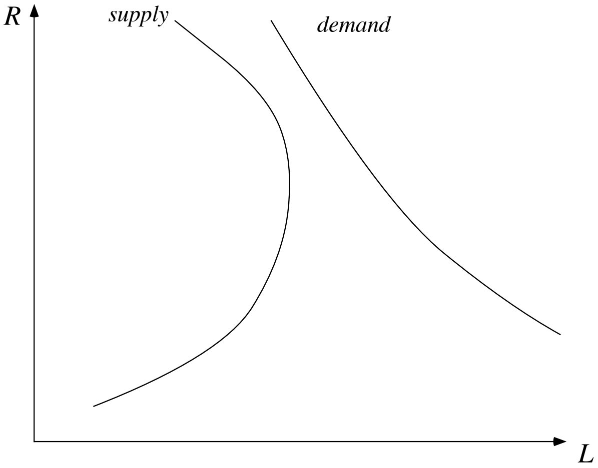


Demand and supply for credits

- The price mechanism doesn't work for the credit market:
- Individuals may agree to pay arbitrary high interest rates but cannot get loans

A possible explanation: Backward-bended supply?

Backward-bending supply



But why?

So far, so good, but:

Why should the supply of credits be backward-bending?

One rather obvious possibility: Relationship between nominal and expected repayment

We shall be interested in explanations of this phenomenon in 3 different ways:

- Adverse selection
- Costly monitoring
- Moral hazard

Nominal and expected repayment