Economics of Banking
Lecture 18

May 2023

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Closing or reorganizing banks

Firing the manager?

When banks have serious problems (wrt. liquidity *or* solvency:)

First line of defence: Than bank itself – what can it do?

The Dewatripont-Tirole model investigates whether trouble should give rise to

- Reorganization?
- Closure?

The model

Three periods, $t = 0, 1, 2$.

At $t = 0$, it uses deposits and equity to finance loans.

Quality of loans depends on manager effort $e \to \begin{cases} e_H \\ e_L \end{cases}$ cost: $C(e)$.

At date $t = 1$, first repayment $\tilde{v}$ of loan *and* signal $\tilde{u}$ about final repayment.

The two random variables $\tilde{v}$ and $\tilde{u}$ are independent, but depend on e, densities $h(v|e), g(u|e)$. At $t = 2$, final repayment $\tilde{v} + \tilde{\eta}$. Manager get a bonus B.

Close down at $t = 1$?

Probability of η given u is $F_d(\eta|u)$, $d = 1$ (continue) or $d = 0$ (stop).

$$\begin{aligned}\Pi(u) &= \int_0^\infty \eta\, dF_1(\eta|u) - \int_0^\infty \eta\, dF_0(\eta|u) \\ &= \int_0^\infty \left[F_0(\eta|u) - F_1(\eta|u)\right]\, d\eta,\end{aligned}$$

(after integration by parts,

$$\int_0^\infty \eta\, dF_d(\eta|u) = \left[\eta F_d(\eta|u)\right]_0^\infty - \int_0^\infty F_d(\eta|u)\, d\eta,$$

$d = 0, 1$). The decision $d = 1$ is best if $\Pi(u) \geq 0$.

If $\Pi(u)$ is increasing in u, then there is $\hat{u}$ so that bank continues if $u > \hat{u}$.

With manager incentives

Decision rule $x(u,v)$ (probability of continuing). Expected profit is now

$$\int_{-\infty}^{\infty}\int_{-\infty}^{\infty} x(u,v)\Pi(u)g(u|e_H)h(v|e_H)\,du\,dv$$

under constraint

$$B\int_{-\infty}^{\infty}\int_{-\infty}^{\infty} x(u,v)[g(u|e_H)h(v|e_H)-g(u|e_L)h(v|e_L)]\,du\,dv \geq h(e_H)-h(e_L).$$

The Lagrangian is (except for a constant)

$$\int_{-\infty}^{\infty}\int_{-\infty}^{\infty} x(u,v)\left[(\Pi(u)+\mu B)g(u|e_H)h(v|e_H)-\mu B g(u|e_L)h(v|e_L)\right]\,du\,dv,$$

and maximum is attained by

$$\begin{aligned} x(u,v) &= 1 \text{ if } \Pi(u)+\mu B \geq \frac{g(u|e_H)h(v|e_H)}{g(u|e_L)h(v|e_L)}, \\ x(u,v) &= 0 \text{ otherwise.} \end{aligned}$$

Characterizing the optimum

Continuation is optimal if

$$\frac{g(u|e_H)}{g(u|e_L)}\left[1+\frac{\Pi(u)}{\mu B}\right] \geq \frac{h(v|e_L)}{h(v|e_H)}.$$

If equality, then u is an implicit function u^0 of v.

We let $\tilde{v}$ be the value of v such that $\hat{u} = u^0(\hat{v})$.

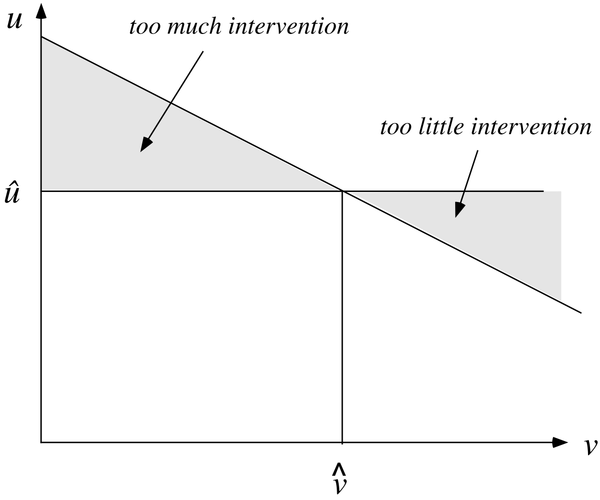
If we assume:

$$\frac{g(\cdot|e_H)}{g(\cdot|e_L)}, \ \frac{h(\cdot|e_H)}{h(\cdot|e_L)}$$

are increasing functions, then:

$u^0(v)$ is decreasing in v.

Figure



Who should close the bank

When it is no longer enough to reorganize:

Who should decide?

- Central bank?
- Deposit insurer?

... and what is best for society?

The model

Bank obtains deposits 1 at $t = 0$, invested over two periods.

At $t = 1$, two signals are received:

- v: withdrawals of depositors e at $t = 1$
- u: probability of success of the investment

Investment has random payoff

$$\tilde{R} = \begin{cases} R & \text{with probability } u, \\ 0 & \text{with probability } 1 - u. \end{cases}$$

Liquidation value is $L < 1$ liquidation cost c.

Society's point of view

The bank should be liquidated when value of continuing

$$uR - (1 - u)c$$

is smaller than the value if liquidated,

$$L - c.$$

Gives a threshold value

$$u^* = \frac{L}{R + c}$$

for liquidation.

Central bank

Central bank covers only the fraction β of the liquidation costs.

Then it will offer a loan v, if expected values of losses is $\leq$ loss from liquidating now:

$$(1 - u)(v + \beta c) \leq \beta c.$$

Threshold for u now depends on v:

$$\hat{u}(v) = \frac{v}{v + \beta c},$$

if $u < u(v)$ the central bank will close down the bank.

Deposit insurance

Deposit insurer covers fraction γ of the liquidation cost

It will close down if costs of closing now are smaller than cost of continuing:

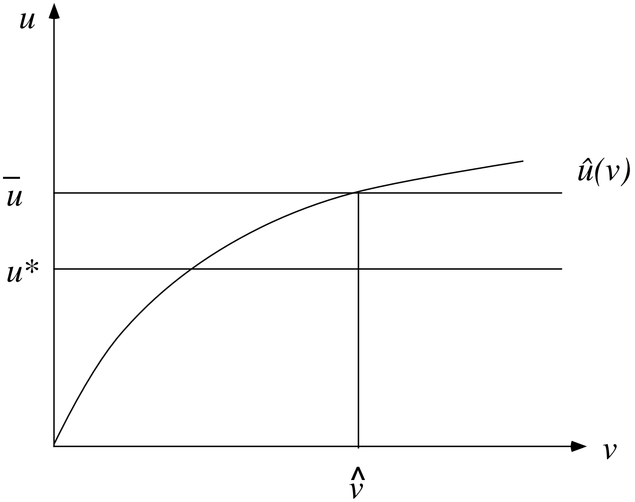
$$\gamma c + 1 - L \leq (1 - u)(1 + \gamma c).$$

This gives threshold value

$$\bar{u} = \frac{L}{1 + \gamma c},$$

below which the deposit insurer will liquidate the bank.

Figure



Decision maker depends on signal

For large v deposit insurer is closer to social optimum than central bank.

For small v the central bank is closer than the deposit insurer.

The competence to close a bank should therefore depend on v!

Why are regulators reluctant to close banks?

In many cases, banks should have been closed down but remain open.

This may be a caused by the high cost of closing a bank.

If banks know this, they may get away with acting in a way which would otherwise lead to closure.

The model

There are two rounds with start $t = 0$, $t = 1$.

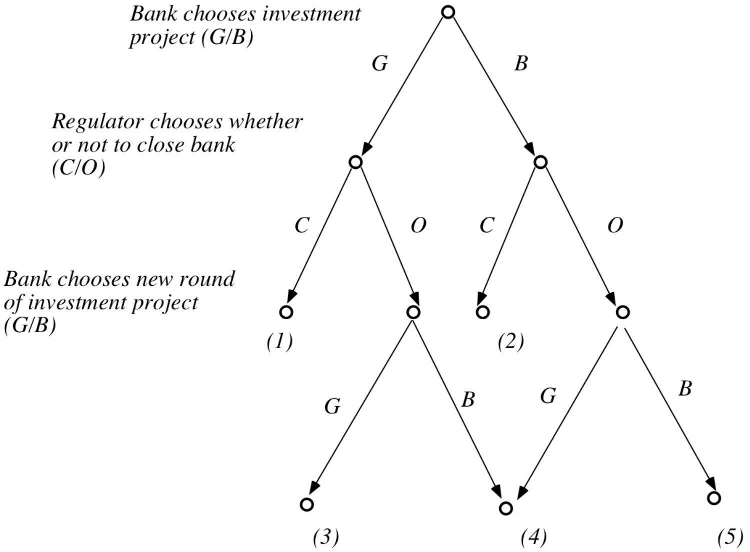
Bank receives deposit 1 and invests in project, either

- safe (G) with payoff $1 + r$ with certainty, or
- risky (B), with random payoff $\begin{cases} 1+\rho & \text{with probability } p, \\ 0 & \text{otherwise,} \end{cases}$ $\rho > r$ but $p(1 + \rho) < 1 + r$.

Once the investment has been chosen, regular observes type and decide between closing the bank (C) or leaving it open (O).

Regulator must reimburse losses to the creditors of the bank pay the cost C of liquidation.

Game tree


Bank chooses investment project (G/B)
Regulator chooses whether or not to close bank (C/O)
Bank chooses new round of investment project (G/B)
G
B
C
O
C
O
G
B
G
B
(1)
(2)
(3)
(4)
(5)

Payoffs in game tree

(1) there is a gain r to the bank and a cost C to the regulator.

(2) payoff to the bank is $p\rho$ and cost to the regulator $C + (1 - p)$.

(3) payoff to bank is $2r$ and cost to regulator 0.

(4) payoff to bank is $p(\rho + r)$, cost to regulator $(1 - p)[C + (1 - r)]$.

(5) payoff is $p^2(2\rho)$ and cost is $(1 - p^2)C + (1 - p)^2 2 + 2p(1 - p)[1 - \rho]$.

Equilibrium I

Case 1. Bank prefers one risky and one safe to two risky:

$$p(\rho + r) > 2p^2\rho \text{ or } p < \frac{\rho + r}{2\rho} \; (= p_1)$$

If bank has chosen B, then kept open it will choose G, and then better to keep the bank open.

If the bank has chosen G, then again cost is bigger if closing down now than if waiting, so bank is kept open.

Equilibrium II

Case 2: Bank prefers two risky to one risky and one safe.

Bank chooses B if it gets to the second round. If first choice was B, then better to close only if

$$C + (1 - p) < C(1 - p^2) + 2(1 - p)^2 + 2p(1 - p)(1 - \rho)$$

or, equivalently, if $C < \frac{(1-p)(1-2p\rho)}{p^2}$.

If bank chooses G initially, then regulator will keep the bank open unless

$$C < C(1 - p) + (1 - p)(1 - r),$$

which can also be stated as $C < \frac{1-p}{p}(1 - r)$.

Equilbrium III