Economics of Banking
Lecture 17

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Side effects of the lender of last resort?

We have seen that deposit insurance prevents bank runs but has side effects.

- (Excessive risk-taking by banks)

What about bailout?

- Possible effect on liquid reserves of banks

The Ratnovski model

Two banks, three periods of time, $t = 0, 1, 2$.

Each bank takes 1 as deposits at $t = 0$, with return at $t = 2$.

Return is R_H or R_L, each with probability $1/2$.

At $t = 1$: Liquidity shock with probability p: Additional investment L needed, $R_L > L > R_L - 1$.

New feature (moral hazard): Bank may change the investment project:

- Gives E to bank nothing to depositors,
- $(1 - p)R_L - 1 > E$ (used only if liquidity shock)

Return to bank

If liquidity shock *and* low return:

After additional investment, net worth is negative: $R_L < 1 + L$,

so bank managers prefer the moral hazard option

If high return, $(1 - p)R_H - (1 + L) > E$ or

$$R_H > \frac{1 + L}{1 - p} + E$$

so net worth remains positive after the additional investment.

No lender of last resort

Expected profits to the bank with **no reserve**

$$\mathbb{E}\pi_1 = (1-p)\frac{R_H + R_L}{2} - 1.$$

If **reserve of size L:**

Collect ordinary deposits 1 and additional deposits L at $t = 0$: no bankruptcy at $t = 1$.

If it observed R_L, it will choose moral hazard and get E

Reserve better than no reserve

Depositors can see that banks collect $1 + L$ instead of 1, demand repayment of

$$\frac{1}{1 - \frac{p}{2}}$$

so that expected profit is

$$\mathbb{E}\pi_2 = (1 - p)\frac{R_H + R_L}{2} + \frac{p}{2}(R_H - L) - \frac{p}{2}(L - E) - 1.$$

If L is big enough, then

$$\mathbb{E}\pi_2 \geq \mathbb{E}\pi_1$$

banks will be liquid.

With possibility of bailout

Rules:

Central bank intervenes only if *both* have liquidity shock. Cannot observe R_H,R_L.

Central bank cannot risk that the supported bank engages in moral hazard:

Value of bank must be at least E after the support.

Consequence: Bank with high returns will receive a rent of $E + (R_H - R_L)$ if supported.

The choice of the other bank matters

If the other bank has liquid reserve: Bailout only if the other bank has R_L.

$$\mathbb{E}\pi_1^2 = (1-p)\frac{R_H + R_L}{2} + \frac{p}{4}\left(E + \frac{R_H - R_L}{2}\right) - 1$$

If the other bank has no reserve:

$$\mathbb{E}\pi_1^1 = (1-p)\frac{R_H + R_L}{2} + \frac{p}{2}\left(E + \frac{R_H - R_L}{2}\right) - 1.$$

Equilibrium choices

For suitably small values of L one gets

$$\mathbb{E}\pi_2 \geq \mathbb{E}\pi_1^2$$

(reserves is best response when the other bank has reserves)

and for large enough L one gets

$$\mathbb{E}\pi_1^1 \geq \mathbb{E}\pi^2$$

(no reserves is best response when the other bank has no reserves)

Where did the lender of last resort come from?

We have assumed that **central bank** has the role of lender of last resort.

What if there is no central bank? (or the central bank doesn't what to assume this role?)

Case: USA before 1913

(Morale: What matters is not who but how)

The model

Banks take deposits and invest in a project with random payoff rate.

Three periods of time: At $t = 0$ decisions on investment and reserve are taken by the banks.

All have initial capital E and receive 1, decide upon reserves M.

Investment payoff comes at $t = 2$ as $\tilde{\pi} + \tilde{r}$, with

- Here $\tilde{\pi}$ is common for all banks, uniformly distributed in an interval $[\pi_L, \pi_H]$,
- $\tilde{r}$ individual, $\tilde{r}$ is uniformly distributed in $[0, 2\bar{r}]$.

At $t = 1$, the value π of π can be observed by all

The individual signal $\tilde{r}$ can be observed but is not *verifiable* at $t = 1$.

Bank runs

The depositors can demand their deposits back at $t = 1$.

The bank can liquidate the investment at $t = 1$ at the rate L.

Reason for bank runs: Banks may commit fraud:

Bank can secure a fraction $f < 1$ of the investment payoff $(\pi + r)(1 + E - M)$ to itself, leaving nothing for others.

We assume that crime pays (in some cases):

$$(1 + E)(\pi_L + \bar{r}) - 1 < f(1 + E)(\pi_L + \bar{r}).$$

Independent (small) bank

Depositors are risk averse. They observe π and infer the banker will commit fraud if

$$\pi f(1+E-M) \geq \pi(1+E-M)+M-1,$$

If π is below

$$\hat{\pi}(M)=\frac{1-M}{(1-f)(1+E-M)},$$

then the depositors run the bank.

Bank then chooses M so as to maximize

$$\int_{\pi_L}^{\hat{\pi}(M)}(M+(1+E-M)L-1)dF(\pi)+\int_{\hat{\pi}(M)}^{\pi_H}[M+(1+E-M)(\pi+\bar{r})-1]dF(\pi).$$

and find the optimal value M^*_{IB}.

Big bank

The big bank can close down fraction x of branches:

Let x be a fraction of banks to be closed down when the signal r is below $x2M$

Payoff on the investment of projects carried out becomes

$$\pi + \frac{x2\bar{r} + 2\bar{r}}{2} = \pi + (1+x)\bar{r},$$

and no fraud is possible if

$$\begin{aligned} M + (1+E-M)xL + (1+E-M)(1-x)(\pi + (1+x)\bar{r}) - 1 \\ \geq (1-x)f(\pi + (1+x)\bar{r})(1+E-M). \end{aligned}$$

Let $x(M,\pi)$ be the value of x for which there is $=$.

Optimal reserve in big bank

The big bank then finds the optimal M^*_{BB} maximizing

$$\int_{\pi_L}^{\pi_H} [M + (1+E-M)x(M,\pi)L + (1+E-M)(1-x(M,\pi))(\pi + (1+x)\bar{r}) - 1] dF(\pi$$

It can be shown that

$$M^*_{BB} < M^*_{IB}$$

Coalition of independent banks

Coalition should mimic the behavior of the big bank.

But the members are independent, compensation should be considered for

- closing down
- keeping open but not committing fraud

Coalition specifies a *liquidation rule*

$$L(M, \pi, r) = \begin{cases} 1 & \text{if } r \text{ is small} \\ 0 & \text{otherwise,} \end{cases}$$

and a *debt restructuring rule* $D(M, \pi, r)$ (to a non-liquidated bank with signal r at date $t = 2$ instead of the original debt to the depositors.

How it works

Assume that π has been observed. If on their own, then $\pi < \hat{\pi}(M)$ means that depositors run all the banks.

But if

$$r^*(M, \pi) = \frac{1 - M}{(1 - f)(1 + E - M)} - \pi,$$

then $r^*(M, \pi)$ is the critical level where fraud pays for the small bank.

Now let x^* be the fraction of banks to be liquidated.

The coalition assigns $M + (1 + E - M)L - 1$ to banks with $r \leq x^* 2M$, and to the others

$$f(1 + E - M)(\pi + r) = M + (1 + E - M)(\pi + r) - 1 + T(r),$$

Finding closure ratio and reserve

Here $T(r)$ is a transfer which makes the bank indifferent between fraud and no fraud, that is

$$T(r) = 1 - M + (f - 1)(1 + E - M)(\pi + r).$$

Transfers should be balanced, this defines the fraction $x^*(M, \pi)$ to be closed down.

Now (as before), one may finde the optimal reserve M_C^* maximizing expected profits (of all banks in the coalition).

It can be shown (as was to be expected) that

$$M_{IB}^* > M_C^* > M_{BB}^*$$