Economics of Banking
Lecture 19

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Banks acting strategically

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

Two banks A and B. Take deposits 1 and invest over 1 period.

Outcome y with probability π, 0 otherwise.

Non-banks get a net payoff of $y - \Delta$ from investment

Bank's payoff is reduced by Δ_1 if it invests in the same industry as the other bank.

– but bank *managers* get benefit b from investment in the same industry

Incentives for managers

Bank managers get a share θ of the profits.

To induce investment in different industries, we must have

$$\pi\theta(y-1) \geq \pi[\theta(y-\Delta_1-1)+b]$$

Gives minimal share $\overline{\theta} = \dfrac{b}{\Delta_1}$ for avoiding moral hazard

After one period, some of the banks may have had failure F, others success S.

If banks are bailed in, regulator demands a share β of next-period profits. There are three cases to be considered:

What happens at $t = 1$?

1. SS: both banks proceed to the next period, repeating the investment..

2. SF or FS: Assume SF. Then A may buy the assets of B.

The price at least $P = \pi(y - \Delta) - 1$ (non-bank's net payoff minus reimbursement of depositors from 0).

If this is < 1 regulator will prefer that A buys B (since otherwise it must reimburse depositors), and A can afford this since

$$y - 1 > \pi(y - \Delta) - 1$$

Bail-out

3. *FF*: Again three possibilities:

(a) Both are sold: Non-banks pay $2P$ and deposit insurance: $2-2P$,

Net result for society is $2P - c(2-2P)$, where c is cost of public intervention.

(b) One bank sold, the other bailed out: Net result for society is $\pi y - 1 + P - c(2-P)$.

(c) Both are bailed out, net result $2(\pi y - 1) - 2c$.

First result:

Let $\Delta^* := \dfrac{c(\pi y - 1)}{\pi(1 + c)}$.

If $\Delta \geq \Delta^*$*, then both banks are bailed out,*

If $\Delta < \Delta^*$*, both are sold.*

Consider now the *next* period: either there are no banks or both survive.

Surviving banks can choose fully correlated ($\rho = 1$) or uncorrelated ($\rho = 0$) investment.

Optimal choice of bank

Checking the expected payoff in both cases, one can summarize all findings as follows:

Let $\beta^* = 1 - \frac{\pi\Delta}{\pi y - 1}$. *Then:*

If $\Delta < \Delta^*$*, both banks are liquidated in FF, and the new investments are uncorrelated.*

If $\Delta \geq \Delta^*$*, both are bailed out, and*

- *for* $\beta^* \leq 1 - \overline{\theta}$*, banks choose* $\rho = 0$ *for* $\beta^* \leq \beta \leq 1 - \overline{\theta}$*, and* $\rho = 1$ *for* $\beta < \beta^*$*,*
- *for* $\beta^* > 1 - \overline{\theta}$*, banks will always choose* $\rho = 1$*.*

Measuring TBTF

Given n banks, state of bank i described $\tilde{x}_i$ (
A crisis level of $\tilde{x}_i$ could be $\hat{x}_i = \mathrm{VaR}_{1-p}(\tilde{x}_i)$, for p either 1% or 0.1%.

This gives an indicator of the systemic importance of bank i: The conditional probability that some other bank fails given that i is in trouble,

$$\mathrm{PO}_i(p) = \mathrm{P}\left\{\exists j \neq i : \tilde{x}_j > \mathrm{VaR}_{1-p}(\tilde{x}_j) \,\middle|\, \tilde{x}_i > \mathrm{VaR}_{1-p}(\tilde{x}_i)\right\}.$$

This measure may however be insufficient: Banks may influence each other in many ways.

We would need to know how many of the other banks could get into trouble.

Systemic impact

A measure which takes this into account is the *systemic impact index* (SII)

$$\mathrm{SII}_i(p) = \mathrm{E}\left[\sum_{j=1}^{n} 1_{\tilde{x}_j > \mathrm{VaR}_{1-p}(\tilde{x}_j)} \middle| \tilde{x}_i > \mathrm{VaR}_{1-p}(\tilde{x}_i)\right],$$

(the expected number of banks that will fail as a consequence of the failure of bank i)

Alternatively, one may consider interdependence of banks from the opposite angle,

Define the *vulnerability index* VI for bank i,

$$\mathrm{VI}_i(p) = \mathrm{P}\left\{\tilde{x}_i > \mathrm{VaR}_{1-p}(\tilde{x}_i) \,\middle|\, \exists j \neq i : \tilde{x}_j > \mathrm{VaR}_{1-p}(\tilde{x}_j)\right\},$$

(the conditional probability that i gets in trouble given that some other bank is in crisis).

Regulation versus no regulation

One period investment with payoff is y if success, otherwise 0.

Loan contract: Repayment r_L;

Loan market is competitive, borrower receives any surplus.

Bank chooses equity k which costs $r_E \geq 1$, $1 - k$ at deposit rate r_D.

Bank also chooses probability of success (monitoring) at a cost $q^2/2$.

No regulation

The level of monitoring is set so as to maximize expected profits

$$\Pi = q(r_L - (1-k)r_D) - kr_E - \frac{1}{2}q^2,$$

with 1st order conditions

$$q = \min\{r_L - (1-k)r_D, 1\}.$$

Monitoring effort is increasing in r_L and k but decreases in r_D.

If depositors expect q, then $qr_D = 1$. Maximize $B = q(y - r_L)$ subject to

$$q = \min\{r_L - (1-k)r_D, 1\},$$
$$qr_D = 1.$$

Equilibrium value of k

Assume $r_E \geq 1$:

When $q \neq 0$, we have that $r_L \leq y$.

If $q < 1$, then $q = r_L - (1-k)r_D$ means that $q \uparrow$ gives $\Pi \uparrow$ without $B \downarrow$, and reducing $r_L \downarrow$ implies $B \uparrow$, so $q = 1$, $r_D = 1$
Participation constraint becomes

$$r_L - 1 + k - kr_E - \frac{1}{2} = 0.$$

From $1 = q \leq r_L - (1-k)$ follows $r_L \geq 2 - k$, inserting gives $k \geq \dfrac{1}{2r_E}$.

(In order to have low r_L but zero profits, the bank owners must take the gain out as payment for equity use)

With regulation

Introduce regulator: Set k so as to maximize a social welfare

$$B+\Pi = q(y-r_L)+q(r_L-(1-k)r_D)-kr_E-\frac{1}{2}q^2 = q(y-(1-k)r_D)-kr_E-\frac{1}{2}q^2.$$

For $y \geq 2$, the capital ratio k may be chosen as 0,

(Banks' gain with $r_E = 2$ is large enough to induce $q = 1$)

If $y < 2$, capital ratio is > 0, but q may be ≤ 1.

Conclusion: *The market will force a higher capital ratio on the banks than that determined by a welfare maximizing regulator. Without regulation, equity is a cost to the bank which must be paid by too high loan rates, so it is kept*