ECON 4335 The economics of banking

Lecture 7, 6/3-2013: Deposit Insurance, Bank Regulation, Solvency Arrangements

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*Views and conclusions are those of the lecturer and can not be attributed to Norges Bank

Today two topics:

- Deposit insurance and moral hazard

- Solvency arrangement, for a bank with unsophisticated creditors.

Deposit insurance

- Can prevent bank run from depositors (Lecture 3).
- Consumer protection, protects uninformed depositors.
- Usually operated by governments, banks have to pay a premium to a fund (ex.ante or ex.post)
- Coverage varies
  - Before crisis: €20,000, $100,000, NOK 2 mill, coinsurance.
  - After crisis: €100,000 , $250,000, NOK 2 mill, no coinsurance.

Distortion from deposit insurance: Moral hazard (F&R Ch. 9.3)

- Basic model setup
- Moral hazard
- Risk related premiums
- Charter value

Entrepreneurial bank

- A bank where the managers and shareholders are the same.
- Shareholders have limited liability $\implies$ convex payoff
- Due to convex pay off, this bank has incentive to invest risky, at least if creditors do not demand compensation for the increased risk.
- When discussing deposit insurance assume banks are entrepreneurial.

Basic model setup

$t = 0$

Assets	Liabilities
Loans L	Deposits D
Insurance premium P	Invested equity E

$t = 1$

Assets	Liabilities
Loan repayment $\widetilde{L}$	Deposits D
Insurance payments $\widetilde{S}$	Net value $\widetilde{V}$

$$L + P = D + E \qquad\qquad \widetilde{V} = \widetilde{L} - D + \widetilde{S}$$

Deposit insurance pays only when $\widetilde{L} < D$, $\widetilde{S} = \max(0, D - \widetilde{L})$

Net value for bank owners $\widetilde{V} = \widetilde{L} + \widetilde{S} - D = E + (\widetilde{L} - L) + \Big(\max(0, D - \widetilde{L}) - P\Big)$

Whenever $\widetilde{L} < D$, $\widetilde{V} = 0$.

If $\widetilde{L} < L$, but $\widetilde{L} > D$, then $\widetilde{S} = 0$ and $0 < \widetilde{V} = E + (\widetilde{L} - L) - P < E$.
I.e., the bank's stock holders the first to shoulder losses.

Moral hazard

- Assume:
  - $\widetilde{L} = X$ with prob θ, or 0 with prob $1 - \theta$.
  - Risk neutral bank determines X and θ, s.t. $\mathsf{E}(\widetilde{L}) = A$ constant.
  - P and D are independent of the bank's choice of X and θ.

- The bank's problem:
  $\max_{\theta} \mathsf{E}(\widetilde{V}) - E = (\theta X + (1-\theta)0 - L) - \theta D + (1-\theta)0 - P + D$
  s.t. $\theta X = A$. I.e., $\max_{\theta} ((A - L) + (1-\theta)D - P)$.
  Solution: $\theta \to 0$, $X \to \infty$. In a mean-preserving spread, as high spread or risk as possible.

- The moral hazard problem of deposit insurance: the bank has incentive to take as high risk as possible, a high gain if success, most of the downside risk shifted to the deposit insurer.

- This distortion occurs because P and D are independent of the risk in the bank's assets.

- In a world with symmetric information without deposit insurance, depositors would require compensation for the bank's risk taking. That would balance the bank's incentive to take risk.

- With deposit insurance risk based insurance premium can do the same under symmetric information between bank and deposit insurer.

- But a perfectly risk based premium is not possible in practice due to asymmetric information.

- Note that the deposit insurance payment $\widetilde{S} = \max(0, D - \widetilde{L})$ increases partially in D.

- I.e., for a given L (and hence given $\widetilde{L}$) the lower is E the more value the bank gets from the deposit insurance.

- An argument for capital requirements on banks.

Risk based deposit insurance premium

- For the bank's owner, the deposit insurance $\widetilde{S} = \max(0, D - \widetilde{L})$ is equivalent to a put option on the bank's assets $\widetilde{L}$ at a strike price D.

- A put option gives the right to sell an underlying asset at a specified time T at a specified price – the strike price. If at T, $D > \widetilde{L}$ this put option is in the money, if $D \leq \widetilde{L}$ it is out of the money.

- To find the value of a put option before T one can use Black Schole's formula.

Assume $\widetilde{L}$ follows the following random walk:

$\frac{d\widetilde{L}}{\widetilde{L}} = \mu dt + \sigma dZ$, where $dZ \sim N(0,1)$, σ is the volatility of the bank's assets

Assume the bank is liquidated at T, denote the Black and Scholes value of this put option, i.e., the true value of the deposit insurance to the bank with P^*. Then the actuarial rate of deposit insurance

$$\frac{P^*}{D} = p(\underset{+}{\sigma}, \underset{+}{d}), \text{ where } d = \frac{D}{L}.$$

I.e., if the bank pays a constant premium P independent of σ and d, the bank can increase the value of the deposit insurance by

- increasing the risk of its assets (σ), risk shifting

- increasing its leverage. This is an argument for a minimum capital ratio for banks with deposit insurance.

Risk based deposit insurance premium

- If a bank pays the premium $\frac{P^*}{D}$ then net value of deposit insurance to the bank is always 0, and the moral hazard problem is solved.

- Possible in practice?

  - Risk based deposit insurance premiums introduced in many countries during 1990s. Typically the premium increases in $\frac{D}{L}$.

  - But asymmetric information problem regarding the true σ.

A problem with the moral hazard theory of deposit insurance:

- When the true σ is not observable in practice banks would take maximum risk and operate at a minimum capital ratio (bang-bang equilibrium)

- We would observe bank failures as the norm.

- But we do not.

- Why not?

- What is balancing the moral hazard and tendency towards a bang-bang equilibrium?

One answer: The charter value theory.

- Charter value of a bank is the value to the bank's share holders of future discounted net profits that they are entitled to if the bank keeps its charter. Denote the value C.

- If the bank fails, the shareholders lose the charter to operate the bank, i.e., C is lost.

- Hence, by taking high risk, the bank increases the probability of losing C as well as the original invested E. The cost of risk taking that can balance the moral hazard in deposit insurance.

- Hence, an argument both for requiring banks to hold more capital E, and for allowing them future profits for instance through some market power.

Solvency arrangements in general (Dewatripont & Tirole, 1994)

- 3 agents (stake holders) in a firm:
  - management: decides the firm's portfolio, dislikes direct intervention
  - outside shareholders (convex payoff, favour risky decisions by management)
  - debt holders (concave payoff, risk averse).

- When firm goes well, shareholders and management in control. Shareholders may align managers' incentives with their own through e.g. options.

- When solvency is bad, the risk averse debt holders take control. Disliked by managers, provides them an incentive to avoid getting towards insolvency.

- In most firms debt holders are banks or agents representing bond holders. All professional. Able to take control of the firm in a credible way when solvency is bad.

- Taken care of by agents in the market and ordinary bankruptcy laws.

- No need for a specific regulator.

- Most banks, like most large firms, owned by a large amount of outside shareholders.

- In banks, however, debt holders are *unprofessional and uninformed* depositors.

  $\Downarrow$

  When solvency is critically low in a bank, *financial regulator* representing unprofessional depositors take control. Disliked by bank managers, provides incentive to avoid insolvency. *Representation hypothesis* for bank regulation.

Solvency arrangement – Representation Hypothesis, Dewatripont & Tirole (1994) (F&R Ch. 9.4.4)

- Three parties, shareholders, depositors and managers.

- Bank widely held by outside shareholders, so no longer entrepreneurial bank.

- The running of the bank delegated to a manager.

- Three periods:

  - at $t = 0$ $\quad L_0 = D_0 + E_0$ and the managers can exert costly effort

- at $t = 1$ first period repayment v of loans is realized, and a signal u about the bank's value η at $t = 2$ is received.
  The controlling party – the shareholders if they are in control, or regulators on behalf of depositors – decides whether to stop (S) and liquidate the bank at the certain value $L_0 + v$ or let the bank continue (C) to period 2 and earn η.

- If C in $t = 1$, then at $t = 2$ the bank is liquidated at value $v + \eta$, depositors are paid and shareholders receive the net value.

• v, u, and η are stochastic. v and u are independently distributed, but u and η are positively correlated.

- Manager's effort is either $\underline{e}$ (low effort (shirking), and no cost to the manager) or $\overline{e}$ (high effort at a cost c to the manager). If $\overline{e}$ rather than $\underline{e}$ the distributions of v and u (and hence η) shifts to the right. I.e., higher effort means higher probability of realizing higher values of v and u.

- Assume first, effort is observable and can be stated in a contract with the manager, first best situation

- Define $D(u)$ as the net expected value of C rather than S is chosen at $t = 1$.

$$D(u) = \eta|_u - (L_0 + v)$$

Assume $D'(u) > 0$, and define $\widehat{u}$ such that $D(\widehat{u}) = 0$.

- Then the first best decision is C if $u \geq \widehat{u}$ and S if $u < \widehat{u}$. v does not matter, uncorrelated with u.

- Assume, more realistically, manager's effort is unobservable and hence uncontractable. Manager cannot be given pecuniary incentives (simplification). 2nd best situation.

- Manager enjoys a private benefit B if the controlling party decides C.

- In deciding on C or S at $t = 1$, the controlling party observes v and u.

- The optimal decision rule maximizes $D(u)$ given the incentives of the managers. I.e., the rule must be such that the manager increases the probability of C by choosing $\overline{e}$ rather than $\underline{e}$.

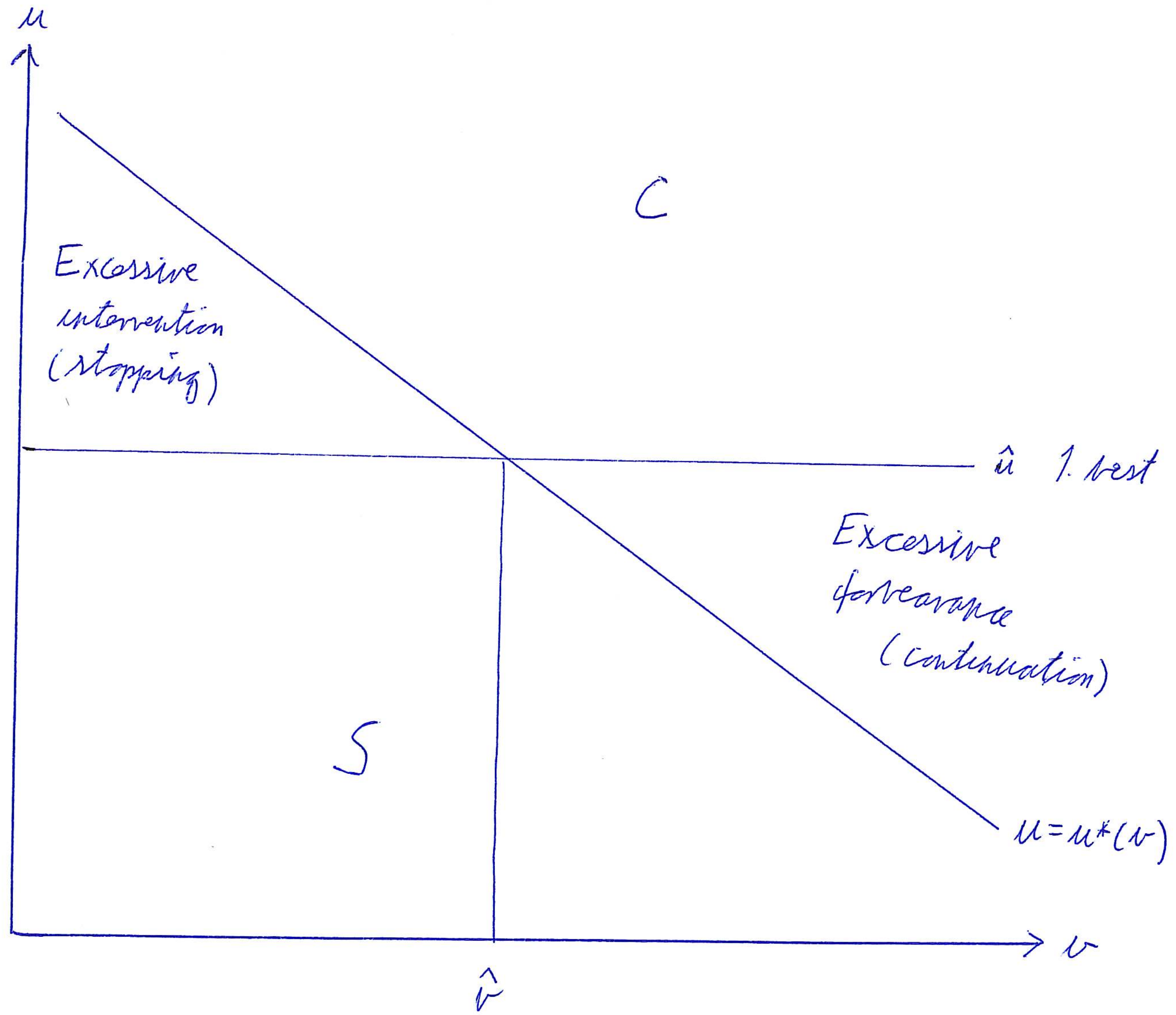
- If high value of both u and v, high effort is more likely and manager should be awarded with C.

- If low value of both u and v, low effort is more likely and manager should be punished with S.

- Exists at least one combination of u and v where $C \sim S$.

- If from this point $u \nearrow$ then $C \succ S$. But if from the new point $v \searrow$ then more likely that manager has shirked. If the fall in v is sufficiently large, we are back at a point where $C \sim S$.

- Hence there exists a locus $u = u^*(v)$ along which $C \sim S$ and $\partial u^*(v) / \partial v < 0$.



u
C
Excessive intervention (stopping)
û 1. best
Excessive forbearance (continuation)
S
u = u*(v)
v
v̂

- In the 2nd best situation where effort cannot be observed, the optimal decision implies:

  - In situations with $u > \widehat{u}$ and low v, S is chosen over C, because the low v may be due to shirking and the high u be due to good luck. Distortion relative to the first best (excessive intervention) in order to punish the manager for possibly shirking.

  - In situations with $u < \widehat{u}$ and high v, C is chosen over S, because the high v may be due to high effort and the low u due to bad luck. Distortion relative to the first best (excessive forbearance) to reward the manager for possibly choosing high effort.

- How to implement this 2nd best optimal decision rule?

- Since at $t = 1$ η is stochastic, C is more risky than S (liquidating the bank at a certain value)

- Shareholders have convex payoff function (risk lovers).

- Depositors have concave payoff function (risk averse).

- Leave shareholders in charge when $v \geq \widehat{v}$, excessive forbearance.

- Leave depositors, i.e., regulators in charge when $v < \widehat{v}$, excessive intervention.

- This is how control is passed over from shareholders to creditors at management run widely held firms with professional creditors. Bankruptcy procedures.

- At banks with unprofessional creditors, i.e., depositors, the regulators, representing the depositors, stop the bank when its current repayments (v) is critically low.