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# Seminar 4

## Question A

**1.** Charter value of a bank is the net present value of the expected future profits that the shareholders of the bank are entitled to, if the bank continues to operate.

Following factors may contribute to creation of the charter value:

- Regulatory barriers to entering the bank industry limit the competition among financial institutions, which enables banks to set advantageous rates and earn profits
- Implicit government guarantee can contribute to the charter value of a bank, if the "cost" of it is less than the received benefit
- Technology innovations can give the opportunity to the banks to make efficiency gains and widen the range of services, something that may add to the value of expected future profits
- Strong, stable customer base, relationships that rely on customers' private information may increase the charter value (as such relationships are usually difficult to transfer)
- Bank's reputation, brand name may contribute to the charter value of a bank as those are the factors that may distinguish the bank from the competition

**2.** Since Project A has the highest expected return $p_A R_A > p_B R_B$ , while project B has the highest return in case of success $R_B > R_A$, that means that $p_A$ must be sufficiently higher than $p_B$ for the two inequalities to hold. This implies that project B is more risky, since $p_B < p_A$.

**3.** We know that:

- the size of a loan required is L = 1,
- the share k is financed by equity
- the share (1-k) is financed by the deposits
- each project yields $R_A$, $R_B$, if success; 0 otherwise

Assuming deposit insurance, we can write expressions for the expected profits of the bank from each of the two projects $\Pi_A$ and $\Pi_B$ in the following way:

$$\Pi_A = p_A(R_A - (1-k)R_D - kR_E) + (1-p_A)(0 - (1-k)R_D + (1-k)R_D - kR_E) =$$
$$p_A(R_A - (1-k)R_D) - kR_E$$
$$\Pi_B = p_B(R_B - (1-k)R_D - kR_E) + (1-p_B)(0 - (1-k)R_D + (1-k)R_D - kR_E) =$$
$$p_B(R_B - (1-k)R_D) - kR_E$$

In order to show that $\Pi_A>0$ if $p_AR_A>R_E\geq R_D$, we rewrite the expected profit the following way:

$$\Pi_A = p_A(R_A - (1-k)R_D) - kR_E = p_AR_A - p_A(1-k)R_D - kR_E > 0$$
$$p_AR_A > p_A(1-k)R_D + kR_E$$

Now we recall the fact that $0\leq k\leq 1$. For k=1,

$$p_AR_A > R_E$$

and for k=0,

$$p_AR_A > p_AR_D$$

and for the values in the interval $0\leq k\leq 1$ their sum is going to be a weighted average of the two expressions, thus making $p_AR_A > p_A(1-k)R_D + kR_E$ hold.

**4.** As it was pointed out earlier, project B is riskier than project A, but has a higher return in case of success. From the profit function from the project B we see that in order for this project to be more profitable than A bank has to choose k sufficiently low and $R_D$ sufficiently high:

$$p_B(R_B - (1-k)R_D) - kR_E > p_A(R_A - (1-k)R_D) - kR_E$$
$$p_B(R_B - (1-k)R_D) > p_A(R_A - (1-k)R_D)$$
$$p_BR_B - p_B(1-k)R_D > p_AR_A - p_A(1-k)R_D$$
$$(1-k)R_D(p_A-p_B) > p_AR_A - p_BR_B \text{ or}$$

$$R_D > \frac{p_AR_A - p_BR_B}{(1-k)(p_A-p_B)}$$

and

$$k < 1 - \frac{p_A R_A - p_B R_B}{R_D(p_A - p_B)}$$

which confirms our conjecture that $R_D$ should be above and k should be below a certain level.

For the project B to be profitable and A not, the following inequalities must be satisfied:

$\Pi_B = p_B(R_B - (1-k)R_D) - kR_E > 0$

$\Pi_A = p_A(R_A - (1-k)R_D) - kR_E < 0$

From the first inequality we have:

$p_B R_B - p_B (1-k)R_D > kR_E$

$p_B R_B - p_B R_D + p_B kR_D > kR_E$

$k(R_E - p_B R_D) < p_B R_B - p_B R_D$

$$k < \frac{p_B R_B - p_B R_D}{R_E - p_B R_D}$$

From the second inequality we have:

$k(R_E - p_A R_D) > p_A R_A - p_A R_D$

$$k > \frac{p_A R_A - p_A R_D}{R_E - p_A R_D}$$

Now we need to show that $\frac{p_B R_B - p_B R_D}{R_E - p_B R_D} > \frac{p_A R_A - p_A R_D}{R_E - p_A R_D}$

Since we know that $p_B < p_A$, $R_E - p_B R_D > R_E - p_A R_D$. For the inequality still to hold, that implies that $p_B R_B - p_B R_D > p_A R_A - p_A R_D$ (the left-hand expression must be *sufficiently* higher than the right-hand expression), so it doesn't hold strictly.

**5.** Now we assume that $R_D<p_AR_A<R_E$

For the project A alone to be profitable for the bank, we need to reverse the inequality signs in the profit expressions:

$\Pi_A = p_A(R_A – (1\text{-}k)R_D) - kR_E > 0$

$\Pi_B = p_B(R_B – (1\text{-}k)R_D) - kR_E < 0$

From the first inequality:

$k(R_E - p_AR_D) < p_AR_A - p_AR_D$

$$k < \frac{p_AR_A - p_AR_D}{R_E - p_AR_D}$$

From the second inequality:

$k(R_E - p_BR_D) > p_BR_B - p_BR_D$

$$k > \frac{p_BR_B - p_BR_D}{R_E - p_BR_D}$$

Now we need also need to know if the following inequality is satisfied:

$$\frac{p_BR_B - p_BR_D}{R_E - p_BR_D} < \frac{p_AR_A - p_AR_D}{R_E - p_AR_D}$$

Since $R_E - p_BR_D > R_E - p_AR_D$, the inequality is going to be satisfied *unless* $p_BR_B - p_BR_D$ is significantly larger than $p_AR_A - p_AR_D$, so that the effect in the numerator outweighs the effect in the denominator. So *unless*

$p_B (R_B - R_D)> p_AR_A - p_AR_D$

the inequalities above are going to be satisfied.

The last inequality again assumes that the left-hand side must be sufficiently higher than the right-hand side for the interval *not* to exist.

Optimally the regulator will need to know all of the parameters above ($p_B$, $p_A$, $R_A$, $R_B$, $R_E$) in order to draw quantitative conclusions.

**6.** According to the charter value theory, the bank's charter value may serve as a counterbalancing force to the incentives created by deposit insurance, i.e. incentives to invest in risky projects. Knowing that in case of default both the charter value and the originally invested capital will be lost, the bank will choose to invest to a less risky project, which is project A in our case.

**Question B.**

Contagion in banking industry can be described as a situation when financial difficulties of one bank spill over to a number of other banks or the financial system as a whole.

Contagion happens because the banking system is built in such a way that its sectors or regions have overlapping claims on one another. As long as there is enough liquidity in the system the inter-regional cross holdings of deposits work fine, as they make it possible to distribute liquidity among banks in case if one of them is facing difficulties. The problem is that the amount of liquidity in the system remains the same. If a bank cannot meet the demand for liquidity from its depositors it has to liquidate some of its long assets. This situation may cause a run on this bank, thus forcing it into bankruptcy. As a result, the other banks that have deposits in the failing bank will lose their capital and possibly the ability to provide liquidity in their region. With a strong enough "spillover effect" the whole interbank system may become threatened.

Contagion can also be indirect through so called fire sales. When the failing bank starts selling its assets at low prices this may cause the decrease of the market value of the similar assets at other banks, which are not necessarily directly exposed to the troubled bank.

Indirect contagion may also occur if the failing bank reduces its lending and as a result reduces the supply of funding through the interbank market. This will tighten the funding supply to other banks which may reduce the lending from these banks as well.

What can be done?

One solution to a liquidity shortage problem is to liquidate long assets. The effectiveness of this solution, however, will depend on the interbank network, i.e. whether it is complete or incomplete. The interbank network is complete if each region/sector is connected to all the other regions/sectors in the system, and all the interbank deposits are evenly spread over a large number of banks. If there is a financial crisis in one of the banks in the system, all the other banks may liquidate a small amount of their long assets, thus avoiding the global crisis by absorbing the liquidation shock. The interbank network is incomplete if each region/sector is connected to a small number of other regions/sectors. If a crisis occurs in one of the banks, only the "connected" banks will liquidate the long asset, leaving banks in other regions exposed to contagion. It has also been argued (by, for instance, Allen and Gale) that complete interbank networks are the most stable ones, so creating or extending interbank network (through the Central Bank, for instance) that can trade liquidity and absorb shocks more effectively will prevent contagion. The Central Bank can also impose liquidity regulations by obliging banks to hold liquidity reserves in order to make the system cope with liquidity shocks. Since contagion always starts with a single or a series of bank runs, strategies that can prevent a bank run can indirectly prevent a contagion. Suspension of convertibility has been mentioned as one possibility. However, in order to use this option properly, the fraction of consumers that wish to consume early must be known. Finally, deposit insurance has also been mentioned as a possible solution to bank runs and thus contagion. However, this alternative is costly and distorts incentives (creating, for instance, moral hazard).