Solutions to Exercises in

Economics of Banking
Chapter11

1. The case described can be modelled as a monopolistic bank (the Monti-Klein model) with explicit provision for the additional cost of short-term liquidity problems. It may be noticed that even if there is not a monopoly in the strict sense, the results will be similar for an oligopol af Cournot type (quantity adjustment). In the model, the liquidity planning is treated as an inventory problem. The main result of the model is that liquidity cost, measured as penalty interest cost multiplied by probability of getting illiquid at the optimal inventory level, enters the determination of optimal interest rates in the same way as does other marginal cost.

A tax added to the penalty interest rate will change the optimal liquidity reserve in upwards direction, which can be considered as an intentional effect of the tax, but it will also change the marginal cost of the bank and through the adjustment of the market interest rates lead to higher loan rates, in contrast to the intentions behind the tax.

2. Since the value of the assets of the bank $\tilde{R}$ is normally distributed with mean ρ and variance σ^2, the probability that this value exceeds 0.9 equals the probability that a standardized normal variable exceeds $\dfrac{0.9-\rho}{\sigma}$, which is

$$P_s = 1 - \Phi\left(\frac{0.9-\rho}{\sigma}\right)$$

with Φ the probability distribution function of a standardized normal variable. If for example $\rho = 1.2$ and $\sigma = 0.5$, the this probability is 0.726. The probability that equity constitutes at least 1/10 of assets is identical to the probability that debt is at most 9/10 of the assets, which is the same event as considered above.

When the N small banks merge to a single bank with independent projects, the total repayment is now normal with mean $N\rho$ and variance $N\sigma^2$, and the probability of solvency, which again equals the probability that the capital requirements are satisfied, is therefore

$$P_l = 1 - \Phi\left(\frac{0.9N - N\rho}{\sqrt{N}\sigma}\right) = 1 - \Phi\left(\sqrt{N}\frac{0.9-\rho}{\sigma}\right).$$

In the example above, and with $N = 9$ it is 0.964.

The overall expected profit per unit capital invested is the same in the two banks, but the probability of being closed down differs. However, with 1/10 available, the small bank can invest only one unit, and the expected profit is therefore

$$\int_{0.9}^{\infty}(R-0.9)\phi\left(\frac{R-\rho}{\sigma}\right)dR,$$

which is the expected value of net income, given that the bank is not closed down (here ϕ is the density of the standardized normal distribution). For the large bank, we get a similar expression for expected profits,

$$\int_{0.9}^{\infty}(R-0.9)\phi\left(\frac{R-\rho}{\sigma/\sqrt{N}}\right)dR,$$

which is larger since the density is mor concentrated around ρ.

3. The obvious candidate for a model of the situation described is the Salop model for a circular city, where it is assumed to be so easy to establish new banks that the profit (net of fixed costs) is zero in equilibrium. In this case the market will lead to over-establishment as compared to the socially optimal situation. The further discussion pertains to the effect of deposit rate restriction in the form of an upper bound for interest rate offered to depositors. Under normal circumstances the deposit and loan business of banks will be mutually independent, and the deposit rate will not immediately lead to lower loan rates as intended by this policy measure. If however it is allowed that banks demand from their costumers to collect all their deposits and loans in the same bank, then deposit rate restriction will have the desired effect, showing that methods which are generally frowned upon as restricting competition may have a positive social effect.

4. The problem outlined has no exact counterpart in the text, but topics related are described in the chapter on competition and risk taking. The particular choice between two types of investments is also described repeatedly in connection with borrower's moral hazard, but in the present case it is the bank which decides upon the type of investment.

Big and small banks are not in exactly the same situation if they choose the investment of type 2. For the small bank, having a small number of these investeringer, the variance on the payoff of any single investment is greater than for the big bank with many of these investments, where the number of failures can be foreseen with almost certainty. If we assume that the banks have limited responsibility in case of default, the risky investment will be more interesting for the small bank than it is for the big bank (intuitively the big bank will get losses that must be covered from earnings more often than the small bank, which will default in case of such losses). Since it is easy to set up new banks, it must be assumed that the incentive to avoid defaults is small.

If the big banks can engage in very large projects of type 2, they can match the small banks wrt. to earnings on this projects. On the other hand they will now be more risky.

5. In the Monti-Klein model of a monopolistic bank, the loan rates satisfy the first order condition

$$\frac{r_L-(r+c_L'}{r_L}=\frac{1}{\varepsilon_L},$$

and this equation is influenced by what happens in the deposit department of the bank only to the extent that marginal cost $c_L'(L,D)$ depends on the quantity of deposits received. If for example cost $C(D, L)$ is separable in D and L, then r_L is independent of D and therefore the loan rate is not influenced by a deposit rate ceiling.