ECON 4335 Economics of Banking, Fall 2022

Final Exam: Grading Guidance

Working Draft *23 November 2022*

1. Are the following statements true, false, or uncertain? Briefly explain (40 points)

(a) (10 points) Uncertain/false. How competition affects bank risk depends on in which market banks compete and who are taking the risks. If banks compete in deposit market and take risks themselves, stronger competition will force banks to increase deposit rates, this will increase banks' funding cost and decrease their profit. In order to maintain their franchise value, banks with limited liabilities will take more risks ("charter value hypothesis"). In this case, pushing banks towards perfect competition makes the banking system less stable. In contrast, if banks compete in credit market and borrowers decide on risk-taking, stronger competition will force banks to reduce loan rates for borrowers. This will reduce borrowers' moral hazard incentive on risk-taking, hence reduces bank risk ("moral hazard hypothesis"). In this case, pushing banks towards perfect competition makes the banking system more stable. As the reality is rather a mixture of these two cases, it is uncertain that pushing banks towards perfect competition makes the banking system more stable.

(b) (10 points) True. During crises, the liquidation value of illiquid, long assets affects the likelihood of bank runs. If banks face higher than expected withdrawal demand from depositors, in order to supply enough cash to fulfill the demand, banks have to liquidate the long assets at a discount. If the discount is too high, or, the long assets' liquidation value is too low, banks have to liquidate too much of the long assets, implying a too low return on the long-term, patient depositors' deposits. Knowing this, even the patient depositors will withdraw from the banks before their deposits mature, resulting in a bank run. Central bank's large-scale purchases of illiquid assets can increase the market price, or, the liquidation value of banks' long assets, so that banks do not need to liquidate too much of their long assets; the high return on patient depositors' deposits will thus be maintained. Knowing this, patient depositors will not withdraw from the banks before their deposits mature, so that bank runs will be prevented.

(c) (10 points) False. Even with rational expectation on a forthcoming bank run, banks only prepare sufficient liquidity buffer to avoid the run if they fully internalize the cost of bank failure. Unfortunately, this is usually not possible due to various financial frictions. For example, limited liability implies that banks do not borne full cost of bank failure, this encourages banks to bet for the upside and neglect the downside, leading to insufficient investments in liquidity buffer. The positive externality in banks' holding liquidity buffer (such buffers can benefit other banks who have liquidity shortages, but the opportunity cost of holding such buffers is fully borne by the bank) also prevent banks from holding sufficient liquidity buffer. Because of the market failure in building liquidity buffer within the banking system, regulatory liquidity requirements are thus necessary to maintain sufficient liquidity buffer in the system and avoid bank runs. (Note: It is sufficient for the examinee to mention one of the frictions.)

(d) (10 points) False. The persistent shortage in banks' credit supply, known as credit rationing, is caused by adverse selection: Without being able to distinguish between prudent and risky borrowers, when a bank attempts to increase its profit by raising loan rate, higher loan

rate also drives out prudent borrowers and makes the average remaining borrowers riskier; this increases the probability of borrowers' default and reduces the bank's profit. As a result, the bank would rather keep loan rate relatively low to maintain some of the less risky borrowers and ration credit in order to reduce credit risks, resulting in a persistent shortage in banks' credit supply. (6 points for explaining why credit rationing is a market equilibrium under adverse selection) Therefore, in the presence of credit rationing, encouraging banks to issue loans with higher loan rates to clear the market and to satisfy those riskier borrowers who have the willingness to pay higher interest rates on their loans will only attract riskier borrowers, increase banks' credit risks and make banks worse off. (4 points for explaining what happens under issuing loans at higher interest rates)

2. Shorter Analytical Questions: Adverse Selection and Credit Supply (25 points)

(a) (5 points) An entrepreneur with safe project is willing to borrow as long as

$$(2 - R) \times 0.85 \geq 0,$$

i.e., $R \leq 2$.

An entrepreneur with risky project is willing to borrow as long as

$$(4 - R) \times 0.4 \geq 0,$$

i.e., $R \leq 4$.

Under any R with $2 < R \leq 4$, only entrepreneurs with risky projects are willing to borrow from the bank.

(5 points) Although entrepreneurs with safe projects are willing to borrow when $R \leq 2$, within the same range of R, entrepreneurs with risky projects are willing to borrow from the bank, too. Without the bank's being able to distinguish the types of entrepreneurs, there is no R under which only entrepreneurs with safe projects are willing to borrow from the bank.

(b) (4 points) If the bank offers an R with $R \leq 2$, both types of entrepreneurs will borrow. To maximize its profit, the bank chooses an R such that

$$\max_{R \leq 2} 0.5 \times 0.85 \times R + 0.5 \times 0.4 \times R - 1. \tag{1}$$

The optimal solution is $R = 2$, and the bank's profit is 0.25.

(4 points) If the bank offers an R with $2 < R \leq 4$, only entrepreneurs with risky projects will borrow. To maximize its profit, the bank chooses an R such that

$$\max_{2<R\leq 4} 0.5 \times (0.4 \times R - 1). \tag{2}$$

The optimal solution is $R = 4$, and the bank's profit is 0.3.

(2 points) Given that $0.3 > 0.25$, in equilibrium, the bank lends only to entrepreneurs with risky projects at $R = 4$.

(c) (5 points) To attract both types of the entrepreneurs, the cap, call it $\overline{R}$, needs to be $\overline{R} \leq 2$. In addition, the bank's participation constraint needs to hold, i.e.

$$0.5 \times 0.85 \times \overline{R} + 0.5 \times 0.4 \times \overline{R} - 1 \geq 0, \tag{3}$$

i.e. $\overline{R} \geq \frac{1}{0.625} = 1.6$. Overall, $1.6 \leq \overline{R} \leq 2$.

If the regulator cares about the bank's profit, it can set a $\overline{R}$ that maximizes the bank's profit, i.e., $\overline{R} = 2$.

Note: Since the regulator's welfare objective is not specified in the question, the examinee should get all the points by either arriving at $1.6 \leq \overline{R} \leq 2$ or $\overline{R} = 2$.

3. Longer Analytical Questions: Debt and the Amplification of Macroeconomic Shocks (35 points)

(a) (10 points) The representative consumer's life-time optimization problem under budget and borrowing constraints is

$$\begin{aligned}
\max_{c_0^T, c_0^N, c_1^T, b_1} \quad & \ln\left(c_0^T\right) + \ln\left(c_0^N\right) + \ln\left(c_1^T\right), \\
s.t. \quad & b_1 + c_0^T + P_0^N c_0^N = b_0 + y_0^T + P_0^N y_0^N, \\
& b_2 + c_1^T = b_1 + y_1^T, \\
& b_2 = 0, \\
& b_1 = -\kappa\left(y_0^T + P_0^N y_0^N\right).
\end{aligned}$$

(b) (5 points) Set up Lagrangian

$$L = \ln\left(c_0^T\right) + \ln\left(c_0^N\right) + \ln\left(c_1^T\right) - \lambda_1\left(b_1 + c_0^T + P_0^N c_0^N - b_0 - y_0^T - P_0^N y_0^N\right)$$
$$-\lambda_2\left(c_1^T - b_1 - y_1^T\right) - \nu\left[b_1 + \kappa\left(y_0^T + P_0^N y_0^N\right)\right].$$

First-order conditions with respect to c_0^T and c_0^N are

$$\frac{\partial L}{\partial c_0^T} = \frac{1}{c_0^T} - \lambda_1 = 0$$

and

$$\frac{\partial L}{\partial c_0^N} = \frac{1}{c_0^N} - \lambda_1 P_0^N = 0.$$

(5 points) Combine the two first-order conditions to get

$$P_0^N = \frac{c_0^T}{c_0^N}.$$

(c) (5 points) Combine the budget and borrowing constraints, using $P_0^N = \frac{c_0^T}{c_0^N}$, to get

$$c_0^T = \frac{b_0 + (1+\kappa)y_0^T}{1-\kappa}.$$

(5 points) In the normal time

$$c_0^T = \frac{b_0 + (1+\kappa)\overline{y}}{1-\kappa}.$$

In the crisis

$$c_0^T = \frac{b_0 + (1+\kappa)(\overline{y} - 1)}{1-\kappa}.$$

(5 points) In the crisis, given one unit drop in oil income y_0^T, the drop in consumption c_0^T compared with the normal state is

$$\frac{1+\kappa}{1-\kappa} > 1$$

under $0 < \kappa < 1$. The drop in oil income y_0^T forces the consumer to cut back b_1 under the binding borrowing constraint. With rising b_1, from the budget constraint in $t = 0$, c_0^T must fall more than 1 to compensate the drop in y_0^T. However, the drop in c_0^T leads to falling house price P_0^N because of $P_0^N = \frac{c_0^T}{c_0^N}$. This leads to an even more binding borrowing constraint and forces the consumer to further cut back b_1, resulting in a further fall in c_0^T... a downward spiral that leads a higher cut in c_0^T with respect to the fall in oil income.