ECON 4335 Economics of Banking, Fall 2021

Final Exam: Grading Guidance

Working Draft *24 November 2021*

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

(a) (10 points) Uncertain. Usually, when a central bank purchases securities in open market operation, it increases non-borrowed reserves in the banking sector, which shifts the supply curve to the right and reduces the equilibrium interest rate in the market for reserves. (6 points for explaining how security purchase in open market operation may shift market equilibrium) However, if the initial market equilibrium is on the "ceiling" (i.e. market interest rate equals the discount rate) or on the "floor" (i.e. market interest rate equals the interest rate paid on reserves), central bank's purchasing securities in open market operation may not affect the market interest rate. (4 points for explaining the special cases)

(b) (10 points) False. 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 low to maintain less risky borrowers and ration credit in order to reduce credit risks. (6 points for explaining why credit rationing is a market equilibrium under adverse selection) Therefore, in the presence of credit rationing, issuing loans with higher loan rates to borrowers are willing to pay higher interest rates will only attract more risky borrowers, increase banks' credit risks and make banks worse off. (4 points for explaining what happens under issuing loans at higher interest rates)

(c) (10 points) False. Banks have limited liability so that a bank's owners (equity holders) only bear the bankruptcy cost up to their equity holdings if the bank fails, while they claim the entire profit of the bank in normal times. Especially, banks are highly leveraged, implying that the majority of bankruptcy cost is borne by the debt holders. For this reason, banks tend to focus on the profit in the head, neglect the loss in the tail, and take more risks to increase equity holders' return. Allowing banks to reduce the share of equity funding will increase banks' leverage and further encourage banks' risk-taking.

(d) (10 points) Uncertain. 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. 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.

2. Shorter Analytical Questions: Moral Hazard and FinTech (25 points)

(a) (10 points) Under loan rate R, the good project yields a payoff of

$$p(G - R)$$

for the entrepreneur, while the bad project yields a payoff of

$$pq(B - R) + b$$

for the entrepreneur. The payoffs are illustrated in Figure 1.

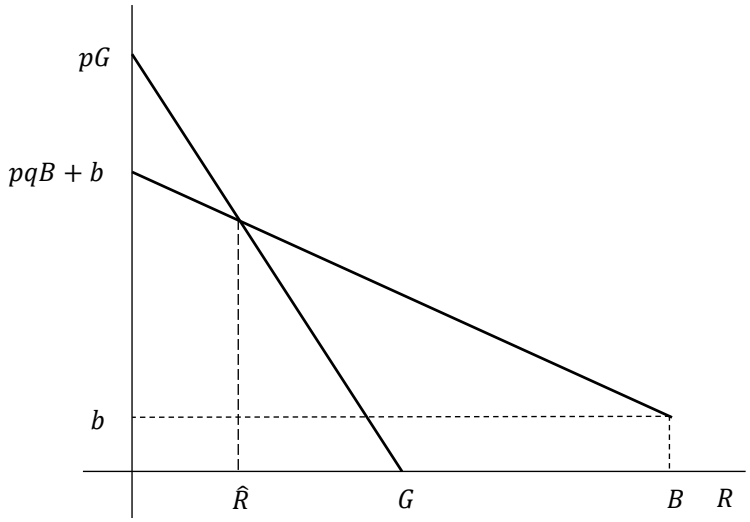

Fig. 1. Payoffs of projects

The cutoff value $\hat{R}$ is solved under

$$p(G - \hat{R}) = pq(B - \hat{R}) + b,$$
$$\hat{R} = \frac{pG - pqB - b}{p - pq}.$$

If the profit-maximizing bank provides intermediation service, it will set R as high as possible, i.e. R shall be smaller, but indefinitely close to $\hat{R}$

$$R \to \hat{R} = \frac{pG - pqB - b}{p - pq}. \tag{1}$$

(b) (5 points) The bank only provides intermediation service if it ensures the entrepreneur to choose the good project (which is guaranteed by (1)) and makes non-negative profit after repaying the depositors, i.e.

$$pR - 1 \geq 0,$$

$$R \geq \frac{1}{p}. \tag{2}$$

Combining (1) and (2) leads to

$$p \geq \frac{1-q+b}{G-qB}. \tag{3}$$

(c) (10 points) Under the new technology, to ensure the entrepreneur to choose the good project, the loan rate R needs to fulfill

$$\begin{aligned} p(G-R) &\geq pq(B-R)+\beta, \\ R &\geq \frac{pG-pqB-\beta}{p-pq}, \end{aligned}$$

so that the profit-maximizing bank will set its loan rate

$$R \to \hat{R} = \frac{pG-pqB-\beta}{p-pq} \tag{4}$$

which is higher than the interest rate in (1), because $\beta < b$.

The bank makes non-negative profit if

$$\begin{aligned} pR-1-c &\geq 0, \\ R &\geq \frac{1+c}{p}. \end{aligned} \tag{5}$$

Combining (4) and (5), under $c \to 0$, leads to

$$p \geq \frac{1-q+\beta}{G-qB} \tag{6}$$

which is lower than the p in (3) because $\beta < b$, i.e. the bank is now able to provide intermediation service under a wider range of p.

3. Longer Analytical Questions: Bank Run and Suspension of Convertibility (35 points)

(a) (15 points) A bank's optimization problem in $t = 0$ is characterized by

$$\begin{aligned}\max_{\alpha,c_1,c_2}\ & p\ln(c_1)+(1-p)\ln(c_2),\\ s.t.\ & pc_1=\alpha,\\ & (1-p)c_2=(1-\alpha)R,\\ & c_1\le c_2.\ \text{(5 points)}\end{aligned}$$

Solve to get $\alpha = p$, $c_1 = 1$, and $c_2 = R$. (5 points)

The deposit contract is implementable because the incentive compatibility constraint $c_1 \le c_2$ holds: Should a truly patient consumer mimic an impatient one, she would only receive a lower payoff c_1 in $t = 1$ which makes her worse off. (5 points)

(b) (10 points) Bank run is not an equilibrium if it is profitable for a patient consumer to deviate from bank run. That is, suppose bank run happens, if, after repaying all consumers in the bank run, the bank still has some remaining long assets, then a patient consumer will be better off if she does not join the bank run (in which she will receive $c_1 = 1$) and instead waits until $t = 2$ for a higher payoff $c_2 = R$. If this is the case, bank run will never happen. Therefore, the no-bank-run condition is that the bank's liquidation value in $t = 1$ exceeds total withdrawal demand under bank run

$$\begin{aligned}\alpha+(1-\alpha)\delta &> c_1,\\ \delta &> \hat{\delta}=1\end{aligned}$$

under $c_1 = 1$ and $\alpha = p$. Bank run happens only if δ is below 1.

(c) (10 points) Given that banks are only allowed to pay out α in $t = 1$, if a population f (with $0 \le f \le 1 - p$) of patient consumers join bank run in $t = 1$, the expected return for a withdrawing consumer in $t = 1$ is

$$\tilde{c}_1=\frac{\alpha}{p+f}=\frac{p}{p+f}\le 1.$$

However, the convertibility suspension policy also means that banks do not need to liquidate any long asset. That is, if a patient consumer waits until $t = 2$, she will receive $c_2 = R > \tilde{c}_1$ for sure. Therefore, patient consumers will have no incentive to run on the bank.