

## i Candidate instructions

### ECON4335 – The Economics of Banking - home exam

**Exam date and time:** Thursday, 2 December, 2021 from 09.00 – 14.00 (five hours)

**Language:** The examination text is given in English, and you must submit your answer in English.

**Guidelines: You should answer Question 1a)-d) verbally in Inspera. For questions 2a)-c) and 3a)-c) applies:** You should upload your text in pdf format - **one pdf per problem**. You can scroll back and forth in the problem set.

You should familiarize yourself with the rules that apply to [the use of sources and citations](#).

The answers to your exams are not expected to meet the formal requirements for references and citations in the fall 2021 exam. However, you should make references by indicating the source in the text. Creating a bibliography is not required. Whether you choose to do so, or not has no impact on your grade. The purpose of a reference is that the examiner should be able to look up the source him/herself, either to read it or to evaluate your interpretation. If you are referring to a limited part of the source, the reference should indicate which part of the source you refer to by using page numbers. If you are quoting directly from a source, follow the normal citation practice – with quotations marks and references to the source.

The exam lasts for only five hours. We recommend that you use the available time to work on the problem set, as well as allocate time to scan attachments with graphs and/or equations.

**The problem set:** The problem set consists of three questions, with several sub-questions. They count as indicated. Start by reading through the whole exam, and make sure that you allocate time to answering problems you find easy.

**Digital hand drawings/graphs/equations:** You will find information about options for hand drawings on this website: <https://www.uio.no/english/studies/examinations/submissions/options-for-hand-drawings.html>

#### Submission in Inspera

- Read more about exam and submission in Inspera. <https://www.uio.no/english/studies/examinations/submissions/>.
- Remember: It is your responsibility to upload the **correct version of the correct answer**.  
Tips & Warnings: Use the course code in the file name to avoid uploading the wrong answer.
- When your answer is uploaded, you will see that the exam is uploaded and saved.
- To submit your answer, please see [https://www.uio.no/english/studies/examinations/submissions/submit\\_answer/](https://www.uio.no/english/studies/examinations/submissions/submit_answer/). You can either choose the “submit now” or the “Automatic submission”.
- You can make changes in your exam until the deadline.
- You will find the answer under Archives (Check that this is the right answer).

#### Do you need technical support, or do you have any questions during the exam?

Please send an e-mail, titled “ECON4335” to [hjemmeeksamen@sv.uio.no](mailto:hjemmeeksamen@sv.uio.no) from your university email.

**Grading:** The grades given: A-F, with A as the best and E as the weakest passing grade. F is fail.

**Grades are given:** 20 December 2021

## 1 Question 1(a)

**Weight: 10 points**

Is the following statement true, false, or uncertain? Briefly explain verbally.

"For a central bank that conducts monetary policy using corridor system, when it purchases securities in its open market operation, it will increase total supply of non-borrowed reserves in the interbank market for reserves, and the market interest rate will fall."

**Fill in your answer here**

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Maximum marks: 10

## 2 Question 1(b)

**Weight: 10 points**

Is the following statement true, false, or uncertain? Briefly explain verbally.

"Because of credit rationing in the credit market, some borrowers cannot obtain credit even if they are willing to pay higher loan rates. In order to improve social welfare, policy maker shall encourage banks to issue loans at higher loan rates to those borrowers who can afford higher interest rates."

**Fill in your answer here**

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Maximum marks: 10

### 3 Question 1(c)

**Weight: 10 points**

Is the following statement true, false, or uncertain? Briefly explain verbally.

"Equity holders often require fairly high return on equity, so that equity is a very costly funding source for banks. Therefore, to improve banks' efficiency, regulators shall allow banks to use more debt funding (which is considerably cheaper) and less equity funding."

**Fill in your answer here**

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Maximum marks: 10

### 4 Question 1(d)

**Weight: 10 points**

Is the following statement true, false, or uncertain? Briefly explain verbally.

"Stronger competition in banking sector reduces banks' profit, which will force banks to take more risks."

**Fill in your answer here**

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Maximum marks: 10

## 5 Question 2(a)

**Weight: 10 points**

Consider a risk-neutral entrepreneur with limited liability that wants to finance a project at a fixed cost of 1. The project takes one period to complete. The entrepreneur has no initial wealth so that she has to borrow 1 from a monopolistic, profit-maximizing bank to start the project, and repay  $R$  after the project returns. The entrepreneur can choose between two projects:

- Good project, which yields a gross return  $G$  with probability  $p$  and 0 otherwise at the end of the period. The probability  $p$  with  $0 < p < 1$  is a random variable; its exact value is revealed before the entrepreneur borrows, and is known to the public;
- Bad project, which yields a gross return  $B$  with probability  $pq$  (with  $0 < q < 1$ ) and 0 otherwise at the end of the period. If a bad project is chosen, the entrepreneur will receive a private benefit  $b$  (with  $b > 0$ ): That is, if the project returns, the entrepreneur receives a benefit of  $b$  on top of her profit from the project; even if the project fails, the entrepreneur receives a benefit of  $b$ , too.

It is known that  $G < B$  and  $pG > 1 > pqB + b$ . Suppose that the bank can only observe whether the entrepreneur's project returns or not, but it cannot observe which project the entrepreneur chooses.


The bank has no capital. It collects deposits from depositors in order to issue the loan to the entrepreneur. There is no deposit insurance.

Provide a graphical illustration of how the payoffs of the two projects to the entrepreneur vary with  $R$ , and derive a critical value of  $R$ , denoted by  $\hat{R}$ , such that the bank cannot charge any gross loan rate that is strictly higher than  $\hat{R}$ .



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Maximum marks: 10

**6 Question 2(b)****Weight: 5 points**

Remember that the bank is a monopoly and there is no deposit insurance, so that depositors are happy as long as they receive an expected repayment of 1 for each unit of deposit. What loan rate  $R$  is required so that the bank's profit is non-negative? Combining your finding in Question 2(a), show that, after observing  $p$  in the beginning, the bank is able to provide intermediation service only if  $p \geq \frac{1-q+b}{G-qB}$  (we assume that the parameter values ensure that  $\frac{1-q+b}{G-qB} < 1$ ).



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Maximum marks: 5

## 7 Question 2(c)

**Weight: 10 points**

Technological progress helps the bank better monitor its borrowers. Now suppose the bank has invested a fixed cost  $c$  in a technology before it issues the loan, which allows the bank to perfectly detect which project is chosen by the entrepreneur, **after** the project's return is materialized. If the bank finds that the bad project is chosen by the entrepreneur, then the entrepreneur's private benefit becomes  $\beta$ , with  $0 < \beta < b$ .

Suppose  $c$  is very small (indefinitely close to 0). Show that, compared with the results in Question 2(b), the bank is now able to provide intermediation service under a wider range of  $p$ ; and when the bank is able to provide intermediation service, it is also able to charge a higher interest rate  $R$ .



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Maximum marks: 10

## 8 Question 3(a)

Weight: 15 points

Consider a one-good, three-date economy: There are many ex ante identical consumers whose population is normalized to be 1. Each consumer is endowed with one unit of resource in  $t = 0$ . A consumer's consumption may take place either in  $t = 1$  or  $t = 2$ , while the consumer's preference on the timing of her consumption is only revealed in  $t = 1$ . With probability  $p$ , a consumer is an impatient one, who only values consumption in  $t = 1$ , while with probability  $1 - p$ , a consumer is a patient one, who only values consumption in  $t = 2$ . Although the value of  $p$  is publicly known, a consumer's type is her private information and cannot be observed by anyone else. A consumer's utility from consuming  $c_t$  in date  $t$  ( $t$  is either 1 or 2) is  $\ln(c_t)$ .

The economy has two technologies of transferring resources between periods: Storage technology with gross return equal to 1, and a long-term investment technology with a constant gross return  $R$  (with  $R > 1$ ) in  $t = 2$  for every per unit invested in  $t = 0$ . If necessary, an on-going long-term project can be liquidated, or, stopped prematurely in  $t = 1$ , with a return  $0 < \delta < R$ .

In this economy, only banks own the long-term investment technology, so that consumers have to deposit in the banks in  $t = 0$  if they want to benefit from the long-term investment. When a consumer deposits her endowment at a bank in  $t = 0$ , she makes a deposit contract with the bank that states:

- If she claims to be an impatient consumer in  $t = 1$ , she will be repaid  $c_1$  by the bank in  $t = 1$ ;
- Otherwise if she claims to be a patient consumer, she will be repaid  $c_2$  by the bank in  $t = 2$ .

After collecting deposits in  $t = 0$ , banks invest a share  $\alpha$  (with  $0 \leq \alpha \leq 1$ ) of their funds in storage and a share  $1 - \alpha$  of their funds in the long-term investment. Banks engage in perfect competition so that they maximize consumers' expected return in  $t = 0$  and make zero profit. Specify a bank's maximization problem in  $t = 0$  and compute its optimal  $c_1$ ,  $c_2$ , and  $\alpha$ . Explain why the deposit contract can be correctly implemented, i.e., consumers choose the timing of withdrawing from banks according to their preferences, even if their preferences are not observed by banks.



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Maximum marks: 15

## 9 Question 3(b)

Weight: 10 points

Suppose banks have collected deposits from consumers in  $t = 0$ , under the deposit contract that is specified in Question 3(a). Now in the very beginning of  $t = 1$ , a recession in the economy (assume the return of bank assets is not affected by the recession) makes patient consumers panic, so that the patient consumers start to consider whether they shall withdraw in  $t = 1$  (i.e. run on the bank) or not.

Show patient consumers only run on the bank if  $\delta$  is below a threshold  $\hat{\delta}$ . Compute the threshold  $\hat{\delta}$ .



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Maximum marks: 10



**10 Question 3(c)****Weight: 10 points**

Following Question 3(b), suppose  $\delta < \hat{\delta}$  so that patient consumers will indeed run on the banks once the banks open in  $t = 1$ . However, at the time when banks open in  $t = 1$ , the policy maker announces that, during  $t = 1$ , after banks pay out  $\alpha$  (the same  $\alpha$  that is computed in Question 3(a)), banks will be closed for the rest of the date and reopen in  $t = 2$ .

Show that such policy will prevent patient consumers from running on the banks in  $t = 1$ .



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Maximum marks: 10