

## **i Candidate instructions**

### **ECON4335 - The Economics of Banking**

This is some important information about the written exam in ECON4335. Please read this carefully before you start answering the exam.

**Date of exam:** Tuesday, November 26, 2019

**Time for exam:** 2.30 p.m. – 5.30 p.m.

**The problem set:** The problem set consists of three questions, with several sub-questions. They count as indicated.

**Sketches:** In this exam, you may use sketches on questions questions 2 and 3 with sub-questions. You are to use the sketching sheets handed to you. You can use more than one sketching sheet per question. See instructions for filling out sketching sheets below. It is very important that you make sure to allocate time to fill in the headings (the code for each problem, candidate number, course code, date etc.) on the sheets that you will use to add to your answer. You will find the code for each problem under the problem text. You will NOT be given extra time to fill in the headings on the sketching sheets. Do NOT hand in sketches on other questions than questions 2 and 3. **Sketches handed in for question 1, will not be included in the assessment.**

**Resources allowed:** No written or printed resources - or calculator - is allowed (except if you have been granted use of a dictionary from the Faculty of Social Sciences).

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

**Grades are given:** Tuesday, December 17, 2019

**1(a) Question 1(A): 12 points**

Is the following statement true, false, or uncertain? Briefly explain (12 points)

"When a central bank reduces the interest rate paid on reserves, it will be less attractive for banks to deposit in the central bank. As a result, they will increase interbank lending and the interbank lending rate will fall, implying an expansionary monetary policy."

**Fill in your answer here**

---

Maximum marks: 12

**Attaching sketches to this question?**

Use the following code:

**XXXXXXXX**

**1(b) Question 1(B): 12 points**

Is the following statement true, false, or uncertain? Briefly explain (12 points)

"Credit rationing must be a temporary phenomenon, because once there is a shortage in the credit supply, interest rate in the credit market will rise to clear the market."

**Fill in your answer here**

---

Maximum marks: 12

**Attaching sketches to this question?**

Use the following code:

**XXXXXXXX**

**1(c) Question 1(C): 12 points**

Is the following statement true, false, or uncertain? Briefly explain (12 points)

"To maximize utility from consumption, people shall always borrow until their borrowing constraints are binding, at any time."

**Fill in your answer here**

---

Maximum marks: 12

**Attaching sketches to this question?**

Use the following code:

**XXXXXXXX**

**1(d) Question 1(D): 12 points**

Is the following statement true, false, or uncertain? Briefly explain (12 points)

"Tighter competition in the deposit market leads to an increase in the deposit rate and forces banks to take more risk in their own investments, destabilizing the banking system."

**Fill in your answer here**

---

Maximum marks: 12

**Attaching sketches to this question?**

Use the following code:

**XXXXXXXX**

- 2 Consider an economy that is populated by a large number of risk-neutral entrepreneurs who are protected by limited liability, and have no initial wealth. The entrepreneurs undertake projects at a cost 1. The financing of each project is done by a monopolistic and risk-neutral bank. Projects can be of two types: good and safe (undertaken by good entrepreneurs), or bad and risky (undertaken by bad entrepreneurs). The type of an entrepreneur is known only to the entrepreneur himself. The population of good entrepreneurs in the economy is normalized to be  $\frac{1}{2}$ , and the population of bad entrepreneurs in the economy is also  $\frac{1}{2}$ . The good project has a gross return equal to  $2$  with probability  $p$ , and a gross return equal to  $0$  with probability  $1 - p$ . The bad project has a gross return equal to  $3$  with probability  $q$ , and a gross return equal to  $0$  with probability  $1 - q$ . Assume that  $1 > p > q > 0$  and  $2p > 3q > 1$ . All agents know the probability distributions. Assume that the bank does not have deposit insurance so that depositors require that they receive a gross expected return no lower than 1. In addition, assume that the bank's participation constraint is always fulfilled.

(a) **Question 2(A): 13 points**

Suppose first that the bank can perfectly see the true types of the entrepreneurs. Show that the bank can offer loan contracts that depend on the types of the entrepreneurs and extract full returns of both good and bad projects. Compute the interest rate that is charged from each type of entrepreneurs. (10 points)

**Give your answer here, or you can hand in sketches. Use the sketching paper handed to you in the examination venue. See instructions for filling out sketching sheets below.**

---

Maximum marks: 13

Attaching sketches to this question?

Use the following code:

**XXXXXXXX**

(b) **Question 2(B): 13 points**

From now on, suppose that the bank cannot observe the true types of the entrepreneurs so that the bank can only offer a loan contract with one gross loan rate  $R$ .

(B) Show that there is a gross loan rate  $R$ , under which both good and bad entrepreneurs are willing accept the loan contract. In this case, if the bank can choose the value of  $R$ , what  $R$  will the profit-maximizing monopolistic bank set? Compute the bank's expected return under its optimal choice of  $R$ . (13 points)

**Give your answer here, or you can hand in sketches. Use the sketching paper handed to you in the examination venue. See instructions for filling out sketching sheets below.**

---

Maximum marks: 13

Attaching sketches to this question?

Use the following code:

**XXXXXXXX**

(c) **Question 2(C): 13 points**

Show that there is a gross loan rate  $R$ , under which only bad entrepreneurs are willing to accept the loan contract. In this case, if the bank can choose the value of  $R$ , what  $R$  will the profit-maximizing monopolistic bank set? Compute the bank's expected return under its optimal choice of  $R$ . (13 points)

**Give your answer here, or you can hand in sketches. Use the sketching paper handed to you in the examination venue. See instructions for filling out sketching sheets below.**

---

Maximum marks: 13

**Attaching sketches to this question?**

Use the following code:

**XXXXXXXX**

(d) **Question 2(D): 13 points**

Show that the bank only wants to serve bad entrepreneurs if  $2p - 1 < q$ . Briefly explain why the bank prefers to serve the bad entrepreneurs only, instead of both types of entrepreneurs. (13 points)

**Give your answer here, or you can hand in sketches. Use the sketching paper handed to you in the examination venue. See instructions for filling out sketching sheets below.**

---

Maximum marks: 13

**Attaching sketches to this question?**

Use the following code:

**XXXXXXXX**

- 3 Consider a one-good, three-date economy: there are infinitely many ex ante identical consumers (whose population is normalized to 1), each endowed with one unit of resource at  $t = 0$ . Consumption takes place either at  $t = 1$  or  $t = 2$ , while the preferred timing of each consumer's consumption is only revealed at  $t = 1$ . With probability  $p$  a consumer is an impatient one (type 1 consumer), who only values consumption at  $t = 1$ , while with probability  $1 - p$  a consumer (type 2 consumer) is a patient one, who only values consumption at  $t = 2$ . A consumer's type is private information.

Let  $c_i$  denote the consumption of a type  $i = 1, 2$  consumer. At  $t = 0$ , without knowing her type, a consumer's expected utility from consumption is  $u = p \frac{1}{1-\gamma} c_1^{1-\gamma} + (1-p) \frac{1}{1-\gamma} c_2^{1-\gamma}$  with  $\gamma > 1$ .

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  $R > 1$  at  $t = 2$  for every per unit invested at  $t = 0$ . If necessary, an on-going long-term project can be liquidated, or, stopped prematurely at  $t = 1$ , with a return  $0 < \delta < 1$ .

(a) **Question 3(A): 14 points**

Specify the social planner's problem, who observes the types of consumers and wants to maximize each consumer's expected utility at  $t = 0$  by allocating her endowments between two technologies: at  $t = 0$  the planner collects  $0 \leq \alpha \leq 1$  from each consumer and invest in the storage technology, and the rest  $1 - \alpha$  from each consumer will be invested in the long-term technology. At  $t = 1$  the total proceeds from the storage technology will be evenly distributed among type 1 consumers, and at  $t = 2$  the total proceeds from the long-term technology will be evenly distributed among type 2 consumers. Compute the optimal consumption for each type's consumer, denote the solution as  $(c_1^*, c_2^*)$

(14 points)

**Give your answer here, or you can hand in sketches. Use the sketching paper handed to you in the examination venue. See instructions for filling out sketching sheets below.**

Maximum marks: 14

**Attaching sketches to this question?**

Use the following code:

**XXXXXXXX**

(b) **Question 3(B): 14 points**

Suppose there is a competitive banking sector in the economy, in which banks take consumers' endowments as deposits at  $t = 0$  and allocate between the two technologies. Consumers withdraw  $c_i$  at  $t = i$  according to their type  $i$ . **However, banks cannot observe the true types of consumers.** Show that banks can implement the same optimal solution achieved in question 3 (A) by investing a share of deposits in storage technology, the rest of deposits on long-term technology and offering a contract  $(c_1^*, c_2^*)$  such that type 1 consumers withdraw  $c_1^*$  at  $t = 1$  and type 2 consumers withdraw  $c_2^*$  at  $t = 2$  without their types being observed by the banks. (14 points)

**Give your answer here, or you can hand in sketches. Use the sketching paper handed to you in the examination venue. See instructions for filling out sketching sheets below.**

Maximum marks: 14

**Attaching sketches to this question?**

Use the following code:

**XXXXXXXX**



**(c) Question 3(C): 11 points**

In the economy with a banking sector that is specified in question 3(B), show that bank run is another equilibrium outcome, i.e., all depositors, despite of their true types, demand repayment at  $t = 1$ . Compute the expected payoff of each depositor in such equilibrium. (11 points)

**Give your answer here, or you can hand in sketches. Use the sketching paper handed to you in the examination venue. See instructions for filling out sketching sheets below.**

---

Maximum marks: 11

**Attaching sketches to this question?**

Use the following code:

**XXXXXXXX**

**(d) Question 3(D): 11 points**

Now we exclude the possibility of the sunspot bank run equilibrium that is characterized in question 3(C), and assume that type 2 consumers only withdraw at  $t = 1$  if their expected return at  $t = 2$  is too low.

Suppose at  $t = 0$  banks start their operation by offering deposit contract  $(c_1^*, c_2^*)$  --- same as is specified in question 3(B). However, at  $t = 1$  there is news, which is known to the public, that a population  $f$  (with  $0 < f < 1 - p$ ) of type 2 consumers become panicking and want to withdraw at  $t = 1$ . Show that there will only be a bank run, that all consumers demand repayments at  $t = 1$ , if  $f$  is above a certain threshold. (11 points)

**Give your answer here, or you can hand in sketches. Use the sketching paper handed to you in the examination venue. See instructions for filling out sketching sheets below.**

---

Maximum marks: 11

**Attaching sketches to this question?**

Use the following code:

**XXXXXXXX**