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## BANKING AND FINANCIAL INTERMEDIATION

### EXERCISE SET 2: OCTOBER 24, 2018

#### LOGISTICS:

The exercise report must be EITHER sent electronically on the course website OR placed in the course box on the fifth floor of LSK building (course box is under the name of *CHOI, Katy*) by 10:30 AM *sharp* on Wednesday (October 24). Please make sure that your name and student number are included on the report that is submitted.

#### STUDENT HONOR CODE:

Collaboration between individuals is prohibited; this means that all work must be done by you.

#### FORMATTING:

- The absolute maximum length for any answer is 5 pages.
- Be brief and to the point: use a “.22-caliber rifle” instead of “10-gauge shotgun” in your answers.
- The questions require you to think rather than copy text from the course material. In numerical problems, you must also show all relevant work, not just the final answers.
- The answers may be handwritten, but a computer printout is better because poor appearance will make your report difficult to understand and grade.
- Please highlight your final answer when possible.
- In the problems, every player is risk neutral unless otherwise stated.

#### PROBLEM 1

1.5p

There are 100 identical individuals on an island. At date 0, each individual has 1 dollar. 50 of them are early consumers and they would like to consume at date 1. The rest are late consumers who would like to consume at date 2. Individuals learn whether they are early or later consumers only at date 1. That is, at date 0, each individual only knows that there is 50% chance that she will be a late consumer. There are two investment projects in this economy. First project generates 1.4 dollars at date 2 for each dollar invested at date 0. The liquidation value of this project at date 1 is 1 dollar. In the case of liquidation, the project does not generate anything at date 2. The second project also requires 1 dollar investment at date 0 and it generates 1.5 dollars at date 2. This project has no liquidation value at date 1. In addition to these investment projects, each individual can also carry cash in his pocket from date 0 to date 1 or from date 1 to date 2.

- a) Describe each individual’s optimal investment decision at date 0. What is the welfare (*i.e.*, sum of payoffs of everyone) on the island?
- b) A penniless banker just landed on the island. At date 0, he collects individuals’ money under the following contract: for each dollar collected he promises to pay 1.1 dollars if withdrawn at date 1 or “*r*” dollars if withdrawn at date 2. To be able to pay the required amount at date 1, the banker keeps 55 dollars ( $= 50 \times 1.1$ ) as cash at date 0 and she invests the remaining funds in one of the projects. What is the interest rate on this deposit contract (*i.e.*, what is *r*)? Calculate banker’s profit. Assume that the banker has the bargaining power (*i.e.*, if a depositor is indifferent between bringing his money to the banker or making the investment himself, he prefers bringing to the banker).

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c) What is the welfare in the economy now.

d) At date 1, it turns out that the number of early consumers is 30 instead of 50. Moreover, suppose that you learned that you are a late consumer and you know that other late consumers are not withdrawing their money early. Would you withdraw your money at date 1? Show your calculations. Assume that at date 2, if there is more demand than the cash available in the bank, existing cash will be distributed equally to depositors.

#### PROBLEM 2

1p

Consider the environment in slides 19-22 in Lecture notes 3. Assume that at date 0, banker is expecting the fraction of early consumers to be 0.5. Calculate banker's profit if the fraction of early consumers on date 1 turns out to be

a) 0.4

b) 0.52

#### PROBLEM 3

1p

X, Y, and Z all deposited their money to a bank. Each one of them decides, simultaneously whether to wait till maturity or withdraw early (*i.e.*, run). The table below summarizes their payoffs under different scenarios. Find all (pure strategy) equilibria.

ACTIONS			PAYOFFS		
X	Y	Z	X	Y	Z
Wait	Wait	Wait	1	2	1
Wait	Wait	Run	1.5	1	0.75
Wait	Run	Wait	1.5	1	0.5
Wait	Run	Run	0.25	0.75	0.75
Run	Wait	Wait	2	1	0.5
Run	Wait	Run	0.75	0.25	0.75
Run	Run	Wait	0.75	0.75	0.25
Run	Run	Run	0.5	0.5	0.5

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#### PROBLEM 4

2p

A banker has just opened a bank with 1 million dollars equity in a country where there is government guarantee on deposits (covering both principal and the interest). He immediately collected 9 million dollars deposits. Because there is government guarantee, currently the banker doesn't offer any interest payment to depositors (*i.e.*, gross interest rate is 1). Below is the balance sheet of the bank at date 0.

Active	Passive
Cash 10 million dollars	Deposits 9 million dollars
	Equity 1 million dollars

The banker has three investment opportunities. For each dollar invested, the first option yields either 2 or 0.5 with equal probability, the second option yields 1.4. And finally, the third option yields 3 with probability 0.25 and nothing with probability 0.75. These investment projects are available only to the banker and he can invest only in one of these projects.

- Which project will be taken by the banker?
- Suppose now that a bank with the same equity was opened in a country where there is no government guarantee. To collect 9 million dollars deposit what should be the interest rate on deposits? Assume that the bank in this new country still faces the same three investment opportunities and the depositors' outside option is risk-free asset that generates zero net return.

#### PROBLEM 5

2p

At date 0 (and also later at date 1), there are equal fractions of “*type 1*”, “*type 2*”, and “*type 3*” firms in the economy. Each type has one project to invest which requires 1 dollar investment at date 0. *Type 1*’s project generates 2 dollars in the next period. *Type 2*’s project generates either 2 with probability 75% or nothing with probability 25%. Finally, *type 3*’s project generates either 2 or nothing with equal probability. Only firms know their own type. Outside investors cannot distinguish them.

- There are identical banks, each of which has 1 dollar to lend at date 0. Suppose banks at date 0 are competing in the credit market so that each bank is at the break-even. What is the bank’s break-even interest rate on a loan?
- Now introduce another date, date 2. Assume that **i**) firms have still an access to their own projects (*i.e.*, firms keep their types) at date 1, **ii**) proceeds of the investment are fully consumed by the firm at date 1 (if the project is successful), **iii**) each bank has again 1 dollar to lend at date 1, **iv**) just after lending at date 0, if the firm is *type 1*, the bank perfectly learns the type of the firm. Otherwise, the bank only learns that the firm is not *type 1*. In that case banker thinks that the firm is equally likely to be *type 2* or *type 3*. What will the interest rates be at date 0 and 1?

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#### PROBLEM 6

1.5p

There are two types of firms in the economy: *safe* and *risky* ones. When a *safe* firm invests 1 dollar in its project, it receives 1 or 2 dollars in the next period with equal probability. When a *risky* firm invests 1 dollar in its project, it receives nothing or 2.2 dollars with equal probability. Firms do not have any money, so if they would like to start their project they need to apply for a loan. To cover possible losses, owners of all firms offer their houses as collateral. The market value of each collateral is 0.4 dollars.

There is a recently established an all-equity bank which has 1 dollar to lend. Bank has the bargaining power in credit interest rate negotiations. Assume that half of the firms in the economy are *safe* and the rest are *risky*. What will the credit interest rate be?



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