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EE431/438 Economics of Financial Markets and Institutions

Exercise 6 : Theory of Financial Intermediation

Please submit at the BE office, 5th floor department of Economics building.

Deadline of submission : Friday, November 23, 2012, before 15.00 hrs.

Late submission will not be accepted.

Consider an economy in which n identical firms seek to finance projects.

- Each entrepreneur owns a firm and each firm requires an investment of m = 100 units of capital.
- The returns of each firm are identically independently distributed.
- The total number of lenders is 100n, each lender owns 1 unit of capital to lend out.
- The project's realized value is a random variable with realization denoted by $\tilde{y}$.
- $\tilde{y} = 160$ with probability 0.75 and 80 with probability 0.25.
- The distribution of $\widetilde{y}$ is known to all borrowers and lenders
- The realization of $\widetilde{y}$ is observed freely by the owner of the firm.
- The other cannot observe the total output of the project without paying a cost.

Answer the following questions.

1. Let X denote actual repayment which depends on the outcome of the project reported by the entrepreneur. L denote total loan repayment(principal + interest) promised by each firm. Is an entrepreneur willing to speak the truth about the outcome of his/her project? Describe the moral hazard problem in this economy.

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2. If we impose a punishment system such that the borrower will be forced liquidation if he/she pay equal to or lower than a specified amount. Assume that liquidating gives no proceeds to the lenders and the borrower. Each lender needs a repayment of at least 1.05. What should be the value of L?

   - Any L between 80 and 160 forces the borrower into liquidation when the project returns 80 and is paid in full when the project returns 160.
   - This gives the lender an expected return of ....., because nothing is received when liquidation.
   - Solving for the minimum value of L , L = ...

3. Decribe how the punishment system in question 2 help solving the moral hazard problem.

   - When $Y = 80$, the entrpreneur can pay ..... L. The entrepreneur will be forced liquidation.
   - When $Y = 160$, the entrepreneur will pay ..... and keep the rest.
   - The expected return to the 100 lenders is equal to ..... which is ..... 105. The rate of returns from lending is ..... the required rate.
   - After we impose the punishment system, whenever the entrepreneur has enough money to repay the debt, they will always repay.
   - This is because the entrepreneur will get nothing after liquidation. If the entrepreneur has enough to repay the debt, it is better to repay and keep the rest than not to repay and get nothing.
   - Hence, once we impose "the punishment", the truth about their project's outcome will be revealed.

4. How many entrepreneurs we have to punish?

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5. Let the cost of punishment is equal to P per one entrepreneurs. π is the probability of borrower default. Define the value of π and calculate total punishment cost of this economy for the two financial system (i) direct finance and (ii) indirect finance.

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6. Suppose that a lender observe the entrepreneur's output by paying a monitoring cost. Then, in stead of liquidating when less than L is paid, the lender who monitors can use the threat of liquidation and offer to refrain from liquidation as long as the borrower repays as much as possible. Monitoring cost is paid ex ante. Lenders must learn in advance about the borrower's business to properly interpret any data about the project returns. Let K be the cost of montoring a borrower's project and $K = 0.1$. The lenders then can verify the true outcome of the project. Calculate total cost of monitoring entrepreneurs in this economy for the two financial system (i) direct finance and (ii) indirect finance.

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7. Assume that the number of borrowers n is large enough. The law of large numbers (LLN) can be used. L = 140. What is the maximum deposit rate the bank can offer to its depositors? Discuss the economies of scale and the benefits of diversification in the banking sector.

   - $nK < nmK$ due to economies of scale. Efficiency is improved by an increase in the loan size. The monitoring cost per one borrower is fixed. It does not vary with the loan size. A bank collects deposits from many savers and lends to entrepreneurs. The monitoring cost per unit of fund is lower for a bank than for an individual saver.

- nL is the total loan repayment promised to the bank. The actual repayment the bank received is less than nL because some borrowers will fail to repay. Let Y_i is the actual realization value of borrower i's project. X_i is the actual repayment the bank recieve from borrower i.
- With monitoring, $X_i = \min(L, Y_i)$. $E(X_i) = E[\min(L, Y_i)] < L$.
- If $Y_i = 160, X_i =$ .....
  If $Y_i = 80, X_i =$ .....
  Then, $E(X_i) =$ .....which is < 140.
- Bank's total income from lending is equal to $\sum_{i=1}^{n} X_i$.
- $\frac{\sum_{i=1}^{n} E(X_i)}{n} = E(X_i)$ when n is sufficiently large.
- Thus, the bank's total income from lending is equal to $\sum_{i=1}^{n} X_i = nE(X_i) =$ ..... (for certain)
- The bank's total income from lending net of monitoring cost is equal to $nE(X_i)-$monitoring cost = ...
- As long as the bank can promise its depositors ex ante at most (in total amount) $nE(X_i) - nk=$ ..... (or ..... for each depositor), the bank will have enough money to repay their depositors.
- As long as, the deposit rate, r_d, $r_d \leq$ ....., the bank will be able to repay the depositor the promised amount with certainty.
- Deposits are asymptotically riskless because of diversification.
- We can always trust the bank. The bank has no incentive to misreport.
- If the bank underreports its income and refuse to pay the amount promised to its depositors, the bank will be forced into liquidation. The bank will get nothing.
- There will be no punishment to the bank because the bank will never default.
- We do not have to pay any cost to punish the bank.