Seminar Problem in ECON 4335 Economics of Banking, Fall 2016

Problem set 2 (September 16, 2016)

Problem 1

In an economy there is 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 $I = 1$. The financing of each project is done by a monopolistic and risk-neutral bank. Projects can be of two types: good/safe (undertaken by good entrepreneurs), or bad/risky (undertaken by bad entrepreneurs). The type of an entrepreneur is known only to the entrepreneur himself. The fraction of good entrepreneurs in the economy is a with $0 < a < 1$. The good project has a gross return equal to G with probability p, and a gross return equal to 0 with probability $1-p$. The bad project has a gross return equal to B with probability q, and a gross return equal to 0 with probability $1-q$. Assume that $1 > p > q > 0$, $B > G$ and $pG > qB > 1$. All agents know the probability distributions.

(1) First, assume complete information. Show that the bank can extract all profits by extending loans at terms that depend on the type of the entrepreneur.

(2) Suppose next that only the entrepreneurs know their own type. Illustrate how the mixture of loan applicants will change as the gross rate of return demanded by the bank changes. Explain how the bank's *expected* return will vary with the gross rate of return demanded. Is there a gross rate of return for which only good entrepreneurs demand a loan?

(3) Which gross rate of return will a profit-maximizing monopolistic bank choose? What is critical to your answer?

(4) Assume now that all entrepreneurs have wealth W such that $1 > W > 0$ and $W < \frac{B-G}{\frac{1}{q}-\frac{1}{p}}$. Which gross rate of return will a profit-maximizing monopolistic bank choose?

Problem 2

Consider a risk-neutral firm, protected by limited liability, that wants to finance a project at a cost $I = 1$. The project takes one period to complete. The firm has no initial wealth; hence to undertake the project the firm has to borrow. There are many households with enough asset to finance the project. If the firm and a household sign a contract (claiming that the household lends x, and R is to be repaid per unit lent if the project succeeds), the household grants a loan and the firm takes an action that affects the riskiness of the project. The firm has two options. The first option is to take a safe project, as given by the lottery $\{(p, G); (1-p, 0)\}$. This project returns G with probability p, and returns 0 with probability $1-p$. The other option is a risky project, as given by the lottery $\{(pq, B); (1-pq, 0)\}$. The household cannot observe the action taken. The risk-free rate of return available to the household is normalized to 1.

We assume that $pG > 1 > pqB$, and $B > G$. The two inequalities can be satisfied at the same time only if $1 > q > 0$. Hence, the risky project has a higher gross return in case of success than the safe project ($B > G$), but succeeds less often ($q < 1$). Suppose that the household observes whether the project succeeds or fail (but in case of success the household does not observe whether the return is G or B).

(1) Provide a graphical illustration of how the payoffs to the firm vary with R, and derive a critical value of R, denoted $\hat{R}$, below which the firm chooses the safe project and above which the firm chooses the risky project.

(2) Which conditions have to be satisfied in a (competitive) credit market equilibrium?

Let's introduce banks. Banks have a monitoring technology. By incurring a monitoring cost, c, a bank is able to prevent the firm from undertaking the risky project, and to induce the firm to choose the safe project. A bank monitors whenever it finances a project. Suppose that the banking sector is competitive.

(3) Derive the conditions for a competitive equilibrium if banks are the only lenders available.

(4) For which values of p will we have only direct finance, only bank lending, and no lending, respectively?