Lecture 5:
The loan contract

One of the central topics of the (newer) banking theory is the contract between lender and borrower. On the face of it, there is nothing to discuss – a contract just stipulates how much should be paid back and when. And if the borrower cannot pay the full sum we let him pay what he has.

As a beginning, we look closer at the ideal case where there are no complications in the form of asymmetric information.This is classical economics, actually economics of insurance, searching for the efficient insurance contract. The results of the section are due to Arrow and emerged in connection with considerations of health insurance contracts. You don't need to bother too much about the details of the proof, but the result is interesting.It tells us that the slope of the repayment function depends on the second derivatives of the utility functions of borrower and lender, respectively. This second derivative expresses the attitude towards risk. The particular case where it is zero occurs when the individual is risk neutral, and this could happen if the lender is a bank with many borrowers. In this case the slope is 1, meaning that if outcome for the borrower increases by some amount, the repayment increases by the same amount, in other words, the borrower delivers everything to the lender except possibly for a constant sum which is independent of the outcome. If the lender is risk averse as well, the contract is one of risk-sharing where any increase in outcome is divided between borrower and lender in a way which depends on the degree of risk aversion.

We then turn to the case of asymmetric information, which as always has two different forms, namely

(1) hidden information,

(2) hidden action.

In (1) the lender cannot observe the true outcome for the borrower. If no information whatsoever can be obtained, then there is little the lender can do to get any repayment at all, and consequently there would be no loan contract in the first place. We therefore look at several special circumstances under which contracting is nevertheless possible.

The first of the is the case of *costly monitoring:* The lender can inspect the outcome if desired, however this inspection is costly to the lender, so that it be used as little as possible. We consider now a contract which is such that the borrower reports

truthfully (not due to ethical concerns, those having had a look at mechanism theory will know that we are just using what is called the revelation principle – if some desirable properties can be obtained with contracts, it can also be obtained in contracts where truth is optimal report). Using this property (truth is the smartest report that the borrower can make) some properties an be deduced: Introducing an inspection region (reports which will give rise to inspection) one sees that the repayment function is constant outside this region, and that inspection will be made only for reports below a certain limit. If a no-waste-of-inspection condition is added, one gets the *standard* contract.

Returning to the case of no information whatsoever, another way of keeping the borrower to the agreement – at least to some extent – is to threaten with termination of possible future relationships. This of course presupposes that the two parties deal with each other over more than one period. The first small model shows how this may work in a very simple setup. There are two periods, the same investment project with random outcome can be carried out in each period. In the second and last period, nothing prevents the borrower from reporting low outcome, so this is what will happen. If bank lending should be at all possible, the bank must earn its profit in the first period, and we check whether this is sustainable when the bank uses the rule that a new loan is granted only if the investor reported a success in the first period.

A second model which also uses the threat of no renewal has to do with sovereign lending. The model is very simple, using a standard Solow growth model for a country which borrows abroad to invest and then repays the loan from the output obtained in the next period. Repudiating debt (that is not paying back) increases the current payoff to the country, but it loses the possibility of borrowing in all future. The analysis shows that, depending on parameter values, it may happen that the optimal size investment is such that not paying back is better than paying back, which indicates that international lending has some inherent instability (which by the way is wellknown from history).

Turning then to (2), we consider a case where the outcome of the investment project may be perfectly observable, but the probability of getting a good outcome depends on the activity of the borrower, and this activity cannot be observed, so we have a case of *moral hazard.*

The optimal contract takes a form which is quite surprising since nothing is paid when the investment is really successful. This is a type of contract which is not observed in real-life loan contracts between banks and borrowers, meaning that real-world actors do not always act to their best interest. Basically the contract is constructed as a lottery for the borrower (whose effort matters), and this will induce the borrower to deliver the optimal effort

We run quickly through the proof which is perhaps slightly more complicated than what is standard, the morale is that one should always avoid unnecessary

computation, since in many cases problems that look formidable turn out to have easy solutions once you look closer into what is going on. Also, knowing he argumentation which is behind, at least in outline, helps understanding why we get the seemingly mystical result.

So far, we have looked at situations where the loan contract consisted only of a repayment function. Adding other features may be helpful in cases of asymmetric information, and *collateral* is one such additional feature. A collateral is an asset which will be left to the disposal of the lender in the case that the borrower doesn't fulfil the engagement.

We consider the use of collateral in the context of a specific model of moral hazard model. In this model, there are two types of borrowers, namely (1) good investors having a high probability of success even when doing very little, and (2) bad investors who will have a smaller probability of success unless they put up considerable effort. Notice that *types are observable* to the lender, what is hidden is the *effort.* (We shall later consider a model, also with two types of borrowers, where the lender cannot observe the type, this gives rise to different – though with some similarities – contract structures.)

We begin the treatment of this model (if time permits) and finish the treatment in the next lecture.

We read:

Chapter 5, Sections 1–3, beginning of Section 4.