

Lecture 5: The loan contract

We just started up on the discussion of the loan contract. The first part of this discussion deals with a loan contract *under perfect information*: There is uncertainty about the future outcome of the project financed by the loan, but both parties can observe this outcome. This has consequences for the form of the repayment (as a function of the outcome) which differs considerably from the intuitive standard contract. The comments on this first part were in the handout for the previous lecture-

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 can 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. The intuition behind the weird form of the contract is that it is constructed as a lottery for the borrower (whose effort matters), and the prize to be gained is possibility of retaining all the outcome. This will induce the borrower to deliver the optimal amount of effort, and the interests of the bank are taken care of as well, since the happy event of no repayment will happen only when the outcome is sufficiently high, otherwise it is just bad luck for the borrower and the bank cashes in.

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: To find the optimal contract, one must solve a maximization problem (formulated as an integral) under constraints. However, only what is inside the integral matters for the maximum, and since it is linear in the repayment, the solution is of the “all-or-nothing” type (it is a nice showcase of mathematical reasoning, where the problem is solved not by tedious computation but just by inspection of what is going on – unfortunately there has probably been too little of that in your previous mathematical training). Anyway, we do this only to explain why the result has the somewhat unexpected form, you are not supposed to reproduce the proof at exam.

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. The loss of the collateral will clearly make it less desirable to repudiate the debt, and loans with collateral are so widespread as to be the rule rather than the exception.

Collateral should of course be handled with some care. The value of the collateral may change before the repayment is due, and if this value gets small enough, the borrower will be better off leaving the collateral with the lender than paying back the debt. In practice, this is typically taken care of by *overcollateralization*, so that the value of the collateral should exceed the amount of the debt with a certain percentage (known as the haircut), and there may even be provisions in the contract for change of collateral in the period.

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 of investor-borrowers are observable* to the lender, what is hidden is the subsequent effort on the project. (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.