Lecture 15:
Liquidity crises and shadow banks; deposit insurance

We begin with the section on financial contagion which was left over in the last lecture since the HHH-model was a natural continuation of the interbank market story. This section explains why it is so important to prevent bank runs, also if they occur randomly, since they can spread to other parts of the financial sector and through this to society as a whole.

The Diamond-Rajan model was among the first to outline exactly how this spreading of a liquidity crisis can occur. Essentially this is just another variation over the Diamond-Dybvig model, this time less simple, but try to follow, at least in outline, what is going on:

First of all, we need some randomness of investments in the model, and this is done by assuming that investment projects usually ripe after one year, but occasionally they take one year more. Investment projects are managed by entrepreneurs, banks can become investment managers (if they take over projects of some entrepreneur) but they are less skilled, so the return is somewhat smaller. Entrepreneurs have no funds of their own, so they borrow everything in the bank, to be paid back after one year. If the project drags out, the bank may call back the loan and take over the project, or it may reschedule the loan under the new circumstances.

The information on whether an investment project is short or long is made available half-way to $t = 1$, so we have a further date $t = 1/2$. Banks are in their turn financed by deposits, and if have many borrowers with long projects, they may not be able to pay back the depositors. Fortunately, there is also an interbank market, where such banks can borrow from other banks and (notice this!) from entrepreneurs with short projects who have earned money and need somewhere to place it. If the interbank rate is not too big, then this will work since the depositors of the bank are confident that they get their money back.

Now (at last) we come to the point (last half of p.289): If suddenly the fraction of long projects financed by a bank is larger than expected, then it would not get enough interbank loans, and the depositors become afraid of losing money, so they run the bank at $t = 1/2$. The bank defaults, and all its loans to entrepreneurs are called in. The entrepreneurs of short projects (which are still the majority) lose their profits, and then there will be much less funds for interbank loans. Consequently some banks having otherwise no problems will experience higher interest rates, their depositors may demand their money back, now we have several bank defaults, and this may proceed. Thus the original minor bank run is transformed to a major bank crisis.

The story in Section 14.7 takes the Diamond-Dybvig model into the framework of shadow banking. Since it looks (and is) rather technical, it is better to begin with the simple Diamond-Dybvig story to see where it makes a difference that we have a shadow bank: Suppose that for some reason, there is a shock in the sense that some of the patient depositors want their money at $t = 1$ (in the shadow framework, this means that they demand that the bank should buy back the securities). The bank has no money for this (all has been used to pay the impatient according to the plan), so what can it do?

Well, here it matters that we have a shadow bank and not a traditional bank: If the depositors of a traditional bank are worrying about getting their money, then the bank would typically not get new depositors. But the depositors in a shadow bank want their money because they are worried about the securities that they hold as collateral, not because of the bank as such. Therefore the shadow bank can arrange new repo trades with other securities, using the amount to pay the depositors running the bank. Clearly they have now contracted new debt which must be paid off, but since they can make the same arrangement, paying debt by contracting new debt, at later dates, it can push the debt ahead while slowly paying it off, of course provided that the original run was not all too big.

You may pass quickly through the first two subsections, which make sure that the model is consistent, and then go to subsection 14.7.3, the main story is on p.296 ("New funding also at runs"). Here it is of course a little tricky to read the formalism without turning back to the first subsections, but give it a try and stick to the intuitive content.

Deposit insurance. As it was mentioned in the discussion of bank runs, one of the ways of avoiding bank panics is to have a system of *deposit insurance* – since the deposits are insured, there is no need to worry for depositors about whether they can get their money back, and therefore there will be no runs on the bank.

This would solve the problem of bank runs, if it there were no side effects, but there are, and this is what Chapter 15 is about. Here is an overview of the chapter:

(i) The cost of deposit insurance, what should be the premium, sections 15.1-2.

(ii) Deposit insurance makes the banks care less about risks, section15.2-3.

(iii) Finer details about the insurance premium, section 15.3

(iv) Who should pay the premium? section 15.4.

In the discussion of (i), the natural point of departure would be that the cost of insurance is the average loss, known in insurance theory as the fair premium. This however turns out not to be a very useful approach, as we shall see in (ii). Therefore we change focus and look at principles for pricing, in particular the Merton approach, seeing the deposit insurance as a put option – the bank can "sell" its assets (loans) at some date T at the price $De^{r_D T}$ (value of deposits plus interest payment on deposits).

This makes it possible to use option pricing to assess the value of the insurance, and in this way one gets a proposal for what should be paid. The idea is more important than the formula, since anyway the BS formula depends on its assumptions, in particular that the assets follow a geometric Brownian motion, which is not a good description of reality.

The problem with the fair premium is outlined in section 15.2. The section has two parts: In the first part, ending on mid page 301 around, illustrates the moral hazard problem in a very simple setup – the bank will prefer the most risky engagement since expected profit is maximal here. Intuitively, when the risk is covered by the insurance and all engagements have the same average payoff, then the bank will prefer the risky engagement since average repayment of debt is small since the insurance pays in many cases. The second part, from mid-page 301 and onwards, is slightly more tricky: Here we take into account that premium is fair, determined by expected loss, but that deposits depend on the riskiness of the bank's assets. Using fairness in (3) together with the assumption that for each choice of p the bank chooses the amount of deposits so that it maximizes profits (the equations below (3)), we get a contradiction (on p.302). This means that fair pricing and profit maximization of banks given that depositors cannot observe p are incompatible principles. The conclusion would be that fair pricing doesn't work in practice.

We read: Chapter 14, sections 5 and 7. Chapter 15, sections 1 and 2.