Lecture 9:
Securitization, Credit Risk

We stopped last Monday in the chapter on securitization, leaving over the Plantin model (note) and the sections 5 and 6, so this is where we begin:

Section 3 in Chapter 8 describes one of the early models of shadow banking (by Gennaioli e.a.). We skip this section and replace it by a note on a somewhat newer model due to Plantin which, in continuation of the Gorton-Souleles story, stresses the impact of regulatory arbitrage – shadow banking to a large extent arises because of the constraints which capital regulation puts on traditional banking. The Plantin model sets up a simple economy with one consumer, one producer, one bank and one additional financial intermediary, here a trust fund. It is seen that shadow banking will occur when it gives the banks additional possibilities of profitable business, and that capital regulation matters both for welfare in general and the emergence of shadow banking.

The next Section 4 – which we skip – addresses a problem which was much debated following the financial crises 2007-8. Ratings agencies are an important ingredient in the securitization process, and their performance up to the financial crisis was far from impressive, since they kept rating securities as AAA before they turned out to be junk. The services of the rating agency are usually paid by the issuer of the securities, and this gives rise to some doubts about their sincerity. Explaining the overrating is not altogether easy, and there are several possible approaches to this. We skip the section since by now it has mainly historical interest.

Section 5 in Chapter 8 deals with the by now almost classical model by Kiyotaki and Moore, which shows that there is a built-in tendency to economic instability in the workings of the financial sector. We consider a dynamical model with one good (“consumption”) in each period. There an asset (“land”) which can in production together with the consumption good as input for producing consumption good in the next period ($k$ units of land and 1 unit of the good yields $y$ units of the good – assume that $k < 1$). Land not used for production can be rented out.

The financial sector enters since entrepreneurs (landowners) need consumption good for production, and so they borrow in the banks. They need full collateral for the loan, and the amount depends on the expected value of the land when the loan is paid back. Land not used in production is rented out, the rent is assumed to determined by a standard (linear) demand curve.

The model is simple once you follow these ideas, and it is given on the first half
of p.166. The equation (16) expresses that selling a piece of land right away should give the same as keeping it and using it for production and renting. This gives us today’s price as a second degree polynomial in next period’s price, with a graph as in Fig.8.3. Check that it results in two-period cyclical movements in equilibrium prices of land, so one gets a simple explanation of the movements in the housing market leading up to 2007-8 with the subsequent downturn (and the beginning of a similar development over the last years).

The model in Section 6 deals with leverage. The morale (which he have seen several times already) is that excessive borrowing has consequences for the stability of financial markets. The present version differs somewhat from what we have seen and will see, since all probabilities are subjective (they are beliefs): There is a given asset which may have payment 1 or it may have payment 1/4, and there are no objective probabilities of these outcomes, everything depends on the beliefs. In the model, these beliefs are very widely dispersed.

You don’t need to follow every detail, but check your understanding of the model by reading Subsection 8.6.1. So far, it is only about trading, optimistic agents buy the security from pessimistic agents, and demand = supply determines its price.

In the next subsection, we add the possibility that optimists can borrow money to buy even more securities. Since the lenders are pessimists, they want full collateral in the worst case (this means that you need 4 securities to guarantee a loan of 1). Now the equilibrium is changed, there is a new (higher) price on securities, and we have introduced leverage, holding of assets for borrowed money.

In the third section, look at the figure and skip details: We have added one period, where we branch so that either the security will always yield 1, or it will be of the type just considered. It is shown (and you need not follow the details) that the leverage is mush higher at \( t = 0 \) than at \( t = 1 \) – when moving from \( t = 0 \) to \( t = 1 \), where next to nothing happens, a large number of agents will be bankrupt if we go to \( D \) (the lower branch in the figure), even though the security may still come out with 1, namely agents who have borrowed to buy the security. And all this happens in well-functioning markets without any external disturbances, just as a part of the normal workings of the markets.

In our discussion of risk management we have now come to credit risk. The chapter can be organized as follows:

(a) Theory
(b) Regulation: The Basel II approach
(c) Examples of internal measurement approaches
(d) Other forms of credit risk: Consumer credits

Read (a) (see below what may skipped) and (b) in detail, run quickly through (c) and take a very superficial glance at (d) (which will not be relevant for exam).
(a) Here we begin with the subdivision into

(i) reduced form methods (where losses are seen as events coming to the bank from an uncertain outside world), and

(ii) structural form models (where losses come from business problems of the borrowers).

The basic reduced form model is the Poisson process where events happen with a certain intensity, independent from each small time interval to another. This is a very simple and tractable method, the loss intensity enters a formula for present expected value in the same way as the interest rate, so it can be seen as an uncertainty-generated markup to the interest rate, known as a *spread*.

The structural models are based on the approach initiated by Merton, where loans are seen as the combination of two transactions, namely (1) the purchase by the bank of the assets of the firm and (2) giving the firm an option on buying back these assets (by paying back the loan). The value of the loan can then be found by assessing each of the two parts, that is the value of the assets of the firm and the value of the option. The section uses option pricing and the formalism may be somewhat tough. You are not supposed to memorize the formula, what matters is understanding basic principles of the Merton approach and the difference between this and the reduced model approach.

For your own understanding, you should read pp.128-129 (look also at the Box about the Z-score, which we shall not need but which is often mentioned in other contexts). On p.130, read the first half, down to formula (2) where you need only the first line. Then have a look at the beginning of subsection 7.3.2, up to the first 10 lines of p.131, just to compare the spread here with that of the Poisson model. Skip the rest of the section from “We now use Itô’s lemma...” (unless of course you like stochastic calculus, then feel free to continue!).

(b) Section 4 is a brief account of the Basel II rules, the main point is the choice between standard approach using fixed percentages and the internal ratings based approach, where the banks use their own data to determine losses from their borrowers. The Basel II rules have later been supplemented by Basel III (to be mentioned later, in Chapter 18), among other things with the so-called countercyclical buffer, which has been in the media in connection with the covid-19 problems, and by the more recent Basel IV rules, which will also be mentioned at a later stage.

(c) Section 5 goes into more detail about the methods which the banks can use if they choose the internal rates based approach. Since the methods used by the banks must be approved by the national financial supervision authorities, you cannot use just any method, and the four methods considered were proposed by consulting firms at an early date, thereby indicating the relevant versions of internal methods. You don’t need to memorize any details here, it is enough to know the main ideas
of the models (KMV uses a modified Merton approach, Creditmetrics uses survival tables for loans based on credit assessments, CreditRisk+ uses reduced form models, and CreditPortfolioView uses an econometric approach, inspired by the Z-score).

(d) This section can be skipped since it is not in the curriculum. If you have spare time under the actual circumstances, then you may still have a look at it, since the underlying problem is challenging, namely that of determining whether to accept or reject borrowers about which you know nothing. But anyway I leave it to possible individual reading.

We read: Note on shadow banking (homepage), Chapter 8, sections 5 and 6 (section 6 only in outline). Chapter 7 except sections 3.2 and 3.3.