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Credit markets

- We will here look at two of the key financial instruments used to manage exposure to credit risk, that is the risk of defaults on loans.
- While instruments had been around for a longer period of time, they were only used more widely in the early 2000s anf they played a key role in Great Financial Crisis is 2007/8.

Transferring credit risks

- Financial innovations seeking to transfer credit risk have a long history
- Early innovations saw the securitisation of loans, especially mortgages into mortgage-backed securities
- Since the 1980s new instruments have been developed that allow to transfer credit risk more specifically
- Collaterised debt obligations were first used by Drexel Burnham Lambert Inc. in about 1987
- Credit default swaps were used by J.P. Morgan & Co in 1994

Transferring credit risks

→ One of the ideas behind the development of financial instruments in credit markets was to transfer credit risk from banks to other investors who might want to seek exposure to such risks as a means to diversify their portfolio.

- The transfer of credit risk, although having become widespread in the early 2000s, have been available for a long period of time/
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  - Early examples are the securitisation of loans, where loans given by banks are sold to a legally independent Special Purpose Vehicle (SPV) which then issues a bond that is colalterised by the loans it has obtained from the bank.
  - This procedure mainly applied to mortgages in mortgage-backed securities. The German 'Pfandbriefe' are part of the bond markets since the 19^{th} century.
- While in securitised loans credit risk is transferred, the bonds were mainly seen as fixed income securities and not primarily as a way to transfer specific credit risk. More such instruments have been developed since the 1980s.
- One of the first was the collaterised debt obligation (CDO) in 1987, but it was not in more widespread use until the late 1990s and early 2000s. We will look at this instrument in more detail here.
- The Credit default swap explicitly allows to hedge against defaults of a single entity, or take on the default risk from a single entity. Developed in 1994, such derivatives were quickly adapted widely in the years after their development. We will also look at these in detail.

→ Financial instruments in credit markets are not new, but their use has become much more widespread in the early 2000s and they were an important factor in the Great Financial Crisis of 2007/8.

Challenges in credit markets

- The use of credit markets is the domain of institutional investors and knowledge about the evolution of credit risk over time is limited
- Determining the value of these instruments can be difficult if properties of the underlying credit risk is not known
- Often new instruments are used before they are fully understood

Challenges in credit markets

→ Credit markets are generally to well udnerstood by many investors, whose main focus is on stock, bond, and foreign exchange markets,a nd in some instances commodities.

- Credit markets are dominated by large institutional investors, such as banks, insurance companies, pension funds, and hedge funds, thus expertise is not very widespread and any employee in these organisations will generally have to learn about such instruments while employed.
- data on credit markets is also not widely available, unlike stock prices, for example. With credit derivatives only being introduced relatively recently and with few underlying assets, any price history in a liquid market that can be used to assess their risks are limited. Thus information in credit markets is much less transparent than other markets.

- To assess the value of credit derivatives, we need to establish the underlying credit risk, but there is limited information available.
- In the early 2000s (and on many other occasions before and since), new financial instruments were developed and sold to investors, even though their properties and pricing were not well understood.

→ It is thus that credit markets are quite opaque and information that allows the valuation of financial instruments based on credit risk is limited.

Hedging credit risk

- Banks or investors into bonds can hedge credit risk if they make an insurance payment in case the loan or bond is not repaid
- As the payment is to be made on default, the credit risk is transferred to the seller of this instrument
- We will see how such credit default swaps can be priced

Hedging credit risk

→ We will first consider an instrument that works similar to an option, a swap, or a futures in that it allows credit risk to be transferred from the seller to the buyer of the financial instrument.

- The for such an instrument motivation is that banks or an investor into a bond is exposed to the risk of the company not being able to repay its loans, thus they are exposed to credit risk, can transfer this risk to another party willing to take it on by buying a credit default swap. If the loan is not repaid, the buyer of the financial instrument obtains compensation from the seller.
- This payment is made on default of the underlying entity and thus the seller pays the buyer in case of default, effectively bearing the credit risk.
- We will now determine how such a financial instrument is priced, that is how the payment the buyer makes, is determined.

→ We will here use a simple model to obtain the this payment to the seller, in reality the details of the contract, which is not always standardised, will need to be considered. Differences might arise from the precise timing of any payments, but also the definition of a default.


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Credit default swaps
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→ The model we will be looking at will alloow us some insights into the value of credit default swaps, despite the simplifications which we make.

Credit default swaps as insurance

- Credit default swaps are similar to insurance with a premium (spread) paid until the insurance event (default)
- The spread reflects the default risk, taking into account any partial payment that may be made in default

? Will buying credit default swaps guarantee you to eliminate any credit risk?

! The credit risk on the entity the CDS is based on, is eliminated, but a new credit risk is entered as the seller of the CDS might not be able to make the payment; assuming the seller has a low default risk, the CDS should provide good coverage

Credit default swaps as insurance

→ We can now summarise some key results about credit default swaps.

- We have seen that credit default swaps are comparable to an insurance premium that is paid until the insurance event is observed (the default). It is thus different to option premia, which are payable upfront for the entire duration of the contract.
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  - The payment (spread) reflects the default risks the seller incurs.
  - This default risk is adjusted by any partial repayments from the defaulting company, to take properly into account the losses a seller makes when paying out its compensation to the buyer.
- [?] If you buy a CDS, are you completely free of any credit risk?
- [!] In principle you have transferred the credit risk from the underlying entity, but you have to rely on the seller of the CDS to be able to make the agreed payment. this you now are exposed to credit risk to the seller of the CDS. If the seller is a renowned bank or similar institution, the credit risk should be substantially reduced compared to the original credit risk.

→ Credit default swaps can be used to eliminate credit risk by transferring the risk to the seller.

Tailoring the amount of credit risk transferred

- Banks have sought to raise additional funds by selling their loan books, but the market for loans is limited
- Collaterised debt obligations allow banks to sell loans with varying degrees of credit risk
- Some parts (senior tranches) are nearly free of credit risk, while other parts (equity tranches) retain the credit risk fully
- Investors can choose the level of credit risk they are comfortable with
- We will discuss the difficulties in valuing collaterised debt obligations

Tailoring the amount of credit risk transferred

→ We can now turn to another type of financial instrument that doe snot simply transfer the credit risk from one party to another, but tailors the amount of credit risk that is transferred to the requirements of the buyer and seller.

- banks may face demand for loans they cannot meet due to limitations on minimum capital requirements. They could generate more loans if they were able to sell existing loans to other investors, thereby freeing up resources for these additional loans.
- Given the large amount of loans banks provide, the amount other investors are willing to purchase is relatively small, not allowing banks to expand their business substantially.

- For this reason banks have developed financial instruments that allow them to sell of their loans, but do so in a way that makes it attractive to those investors they are targeting, such as investors seeking only a small exposure to credit risks, or others that would prefer a larger exposure. This has been achieved with collaterised debt obligations (CDOs).

- They are constructed such that some elements are deemed to be virtually free of credit risk,
- but other parts retain the credit risk or have an even larger exposure than normal loans. This is achieved by separating the securitised loans into different so-called 'tranches'.

- By offering tranches with different levels of credit risk, banks can meet the demands of a wider variety of investors, increasing the market and their ability to sell loans.
- We will here discuss such collaterised debt obligations and how difficult their valuation is.

→ Given the complexity and the reliance on numerical methods to determine the value of CDOs, we will only discuss the general properties of these financial instruments and how they they are principle valued, before discussion the results and their rationale.


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→ We are also restricting ourselves to the most basic form of CDos, but note that many variations exist, each requiring their individual approach to determine their value.

The importance of default correlations

- The risk of CDOs depend on the default rates of the entities included and their correlations
- Information about the correlation of defaults in loans is difficult to obtain and access to data is limited

? During financial crises, the default rates and correlations of defaults typically increase, why can this be problematic for the holders of CDOs?

! If the default rate increases, the spread will increase, reducing the present value of the CDO tranche, this is exacerbated by the increase in correlation which increases losses to those holding 'safe' senior tranches; this combination can cause significant losses on what is regarded as very safe securities

The importance of default correlations

→ Default correlations were shown to be an important factor in the valuation of CDOs.

- The effect of the default probabilities on the spread of CDOs was intuitive and straightforward to explain and analyse.
- We have seen that the complexity in the valuation of CDOs arise from the importance of default correlations and their non-trivial impact.

- The spread of a CDO will be affected by the default probabilities of the loans included, as well as the correlations between them. In addition to the already discussed complexity of relationships depending on the seniority of the tranches, it is difficult to determine the probabilities of default of the loans included with investors having to rely mostly on the assessment of the bank selling the loan (a potential adverse selection problem). This is further complicated by difficulties in assessing the correlation of defaults, information which even the bank selling the loans might not have assessed properly.
- [?] We often observe that in time of economic crisis, companies or individuals struggle to repay theur loans, default rates increase; we also observe that correlations increase during such time epriods. Why can this be a problems for those holding a CDO?
- [!] Higher default rates increase the spread, thus for a given coupon payment reduce the value of the CDO. If the correlation increases, the spread of senior tranches also increases, increasing the loss in value of the CDO's senior tranche. It is then that while in normal times with low correlations, losses to the senior tranches are very unlikely and value are high, they can suffer a significant loss in such crises times. This was one of the key contributors that increased losses by banks significantly as they were holding other banks CDOs, mostly senior tranches, and they made significant losses on these positions.

→ CDOs are complex to value and the importance of default correlations can make adverse market developments more severe. It is for this reason that CDOs (and credit derivatives in general) ha]ve been called 'weapons of mass destruction'. The negative effect was mainly the result of a lack of understanding of these instruments.

Summary of key results

- Credit markets allow to transfer credit risk between investors, either in the form of insurance or through selling/purchasing securities that have exposure to credit risk
- Securities might be tailored to the extent that credit risk is sought by an investor
- Information about credit risk of individual entities is limited and data about default correlation is even more difficult to obtain
- The pricing in credit markets depends on this information and hence mispricing can be expected frequently

Summary of key results

→ We may now summarize the key results about the two instruments in credit markets we have discussed.

- We have seen that credit markets allow to transfer credit risk from banks and holders of loans or bonds to other investors.
  - This might take the form of insurance (credit default swaps)
  - or the creation of bonds that provide such exposure to credit risk (collaterised debt obligations).
- CDOs, but also other instruments, can be tailored to meet the demands of such investors. A consequence of such tailored approach is that each instrument needs to be evaluated and priced individually.
- Assessing credit risk, and hence the pricing of these financial instruments, is made more difficult by a lack of data defaults and for CDOs especially default correlations. Such information would be needed at the time of purchasing the instrument, but looking forward it would also be important to know how these are likely to develop in the future.
- The price that is paid for these instruments requires such information and not having access to it can give rise to mispricing, causing potentially large losses to either party. We have seen the large impact such losses can have on banks during the Great Financial crisis 2007/8.

→ Credit markets are difficult to assess and even if all required is information available, difficult to understand due to complex interactions between a range of parameters. A lack of understanding of these instruments can result in significant losses.

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