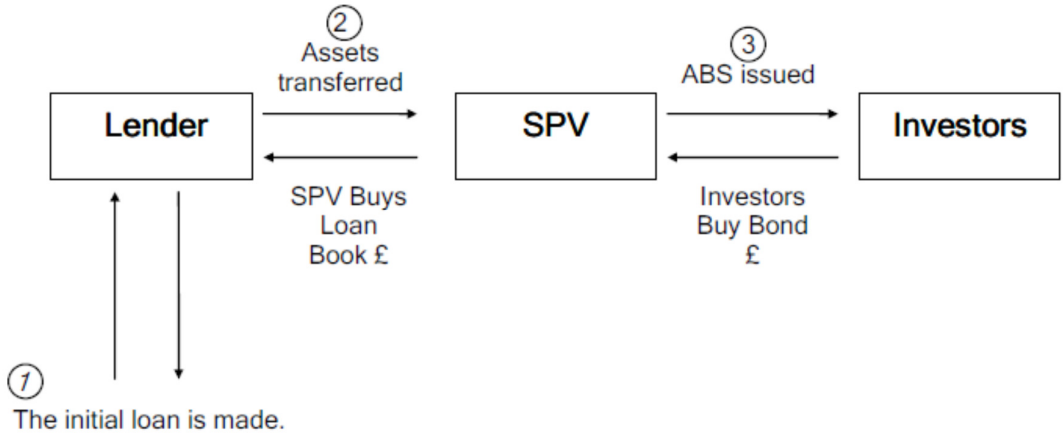
*The Big Short – Question & Answer*

**So what did Lou Raineri of Salomon Brothers invent at the beginning of the movie and why was that significant?**

**Mortgage Backed Securities (MBS)** are **bonds**. Bonds are also referred to **as fixed interest or fixed income securities**. A **security** is a financial instrument which can come with its own certificate that grants beneficial ownership to the holder (nowadays they are often simply held electronically). Usually, it can be traded—they are **negotiable instruments** meaning that ownership can be changed. A company issues a security (such as a bond or share) to an investor in return for a sum of money (that's called **primary issuance or the primary market**). Subsequently, the investor may decide to sell the security to another investor at a price which is higher or lower than the price paid originally (that's called the **secondary market** i.e. between holders of a security rather than between the issuing company and an investor). This is called **liquidity** – a **liquid** asset is one which can be more easily converted into cash by the holder because it is easy to sell.

A **bond** is an IOU, specifying an amount the borrower has to repay (the **principal** of the loan called the **face value** or **par value**), the date of repayment (**maturity or redemption date**) and the interest that will be paid periodically (usually fixed and called **the coupon**). Investors in bonds are always balancing credit or default risk (the risk of not being repaid) against yield or return (**Yield To Maturity/ YTM** or **Gross Redemption Yield/ GRY)**




The diagram above shows the process of **securitisation (or securitization)** by which an **Asset Backed Security (ABS)** or bond is created—an MBS is an example of an ABS. In step 1 the **Lender (originator)** makes a mortgage loan to a homebuyer. In stage 2 the lender sells a package of mortgage loans to an **SPV (Special Purpose Vehicle)** which is a legal structure created for the specific purpose of this transaction. In stage 3 the SPV sells bonds to investors in return for cash. The bonds the investors hold will then receive the interest payments and principal repayments from the original borrowers. The Lender may or may not remain in the **servicer** role—collecting the payments and managing the relationship with the original borrower.

BPP offers a number of courses on bonds and fixed income, including **Securitisation – an Introduction**

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The Government National Mortgage Association (**GNMA ("Ginnie Mae")**, a corporation owned by the US government), issued its first MBS in 1968. The bond is known as a **pass-thru security**—because principal and interest payments from borrowers are "passed thru" to bondholders. The issuer creates a **Special Purpose Vehicle (SPV)** or trust, which receives all the interest and principal repayments from a defined group of mortgages that have been lent by a financial institution called the originator. The trust then issues bonds to investors in return for cash. The investors then received principal and interest payments from the cash flows of the mortgages. Although US mortgages are typically 20 to 30 years at a fixed rate, most borrowers will either repay earlier than that (e.g. when they move home or to refinance ("**refi"**) if a lower interest rate becomes available).

The market for MBS issued by US government agencies or former agencies amounted to trillions of dollars. **Agency** (mortgage) bonds included those issued by GNMA and two privatised entities which were then nationalised in August of 2008, **FNMA ("Fannie Mae")** and **FMAC ("Freddie Mac").** By investing in these bonds, investors were getting a higher yield (YTM) or return than they would by investing in US Treasury Bonds (i.e. ones issued by the US government) of the same maturity. But they also believed that they would experience no more credit risk than for a US Treasury bond. This was legally the case for GNMA and some other bonds that were still issued by US government entities, but was in fact not legally the case for FNMA and FMAC—the market relied upon a belief that the US government would bail out these two companies in the event of any significant risk of default.

A **private label MBS** is one that is not issued by a US government agency, i.e. is not an Agency bond and carries no guarantee from the US government. Bank of America issued the first private label MBS in 1977. It was this private label MBS market that Raineri drove.

**What happens to the homeowner whose mortgage is securitised?**

Usually not much. The **originator** bank becomes simply the mortgage **servicer**: collecting the payments and issuing any paperwork with regard to the mortgage. The homeowner is unaware (or only dimly aware) that her payments no longer stay with the originator bank but are sent on to a securitisation vehicle (the SPV).

The problems come if the homeowner falls behind on their payments or has other issues with the mortgage. Then, it can become impossible to find out who has the legal ability (and desire) to negotiate with the homeowner. The chains of ownership and responsibility became impossibly complex.

**Why was there a market for private label MBS?**

The US government had fairly strict underwriting requirements as to the home mortgage loans they would buy from originator banks. For mortgages that were larger than those limits **(jumbo** mortgages) or where the documentation of the borrower was less complete or the borrower did not meet the minimum underwriting standards (**sub prime** and **Alt A** mortgages). Private label MBS provided a way for mortgage lenders to securitise those mortgages.

**Why do lenders want to securitise mortgages?**

Banks are regulated institutions. For each dollar they lend to a mortgage borrower, they are required to have a certain amount of **regulatory capital** that they keep on the balance sheet i.e. equity. The amount is governed by both international regulatory agreements such as **Basel III** as well as by their own domestic regulations. As well as many other courses on financial regulation BPP offers a specific course on Basel III:

https://www.bppprofessionaldevelopment.com/course-directory.aspx?group=3&category=26#c26

If a bank needs say $1.00 of equity capital to support $10.00 of mortgages, say, then it cannot use that equity for other purposes (to support other lending activities). And a key performance ratio by which banks are measured against each other, **Return on Equity** (ROE = net income after tax/ total equity on balance sheet) falls. So banks seek to get their mortgage lending **"off the balance sheet"** via securitisation. Then it can use the $1.00 of equity to, for example, originate another $10.00 of mortgages.

If the bank can securitise the mortgages, then this releases the $1.00 of equity capital for other uses. It usually retains a small fee as a servicer, (although it can sell that responsibility on to another company), and sheds itself of the credit risk of the mortgages.

An important difference of MBS from the most common securitisation product in Europe which is called the **covered bond,** is that final liability for a default in one of the issued covered bonds lies with the financial institution that securitised the underlying asset to get it off its balance sheet.

**Who buys these things? And why?**

Essentially most of the world's institutional fixed income investors. The bonds appeared to offer higher returns than government bonds and low credit risk. Agency bonds were all credit rated by the main **rating agencies** at the highest possible scores (lowest risks of default) AAA by Standard & Poor's, and Aaa by Moody's.

**The ratings agencies seem to play a critical role in the film. Why?**

Most investors are required by regulators or their fund management agreements to invest in bonds which are **investment grade.** Investment grade bonds are those which are rated BBB- or above on the S&P scale. As MBS became more complex, it was important to keep the ratings agencies "on side" with the investment grade ratings. A particularly important development was the application of the **Gaussian Copula**, a particular mathematical technique which allowed the creators of the bonds, and the rating agencies, to make assumptions about the likelihood of more than one mortgage in a particular bond defaulting at the same time.

**A comparison of Moody's and Standard & Poor's rating scales**

| Standard & Poor's | Moody's | Grades | |
|---|---|---|---|
| AAA | Aaa | Prime, maximum safety | Investment grade bonds |
| AA+ | Aa1 | High grade, high quality | |
| AA | Aa2 | | |
| AA– | Aa3 | | |
| A+ | A1 | Upper medium | |
| A | A2 | | |
| A– | A3 | | |
| BBB+ | Baa1 | Lower medium | |
| BBB | Baa2 | | |
| BBB– | Baa3 | | |
| BB+ | Ba1 | Speculative | Non-investment grade, high-yield or 'junk' bonds |
| BB | Ba2 | | |
| BB– | Ba3 | | |
| B+ | B1 | Highly speculative | |
| B | B2 | | |
| B– | B3 | | |
| CCC+ | Caa1 | Substantial risk | |
| CCC | Caa2 | In poor standing | |
| CCC– | Caa3 | | |
| CC | Ca | Extremely speculative | |
| C | C | May be in default | |
| D | | Default | |

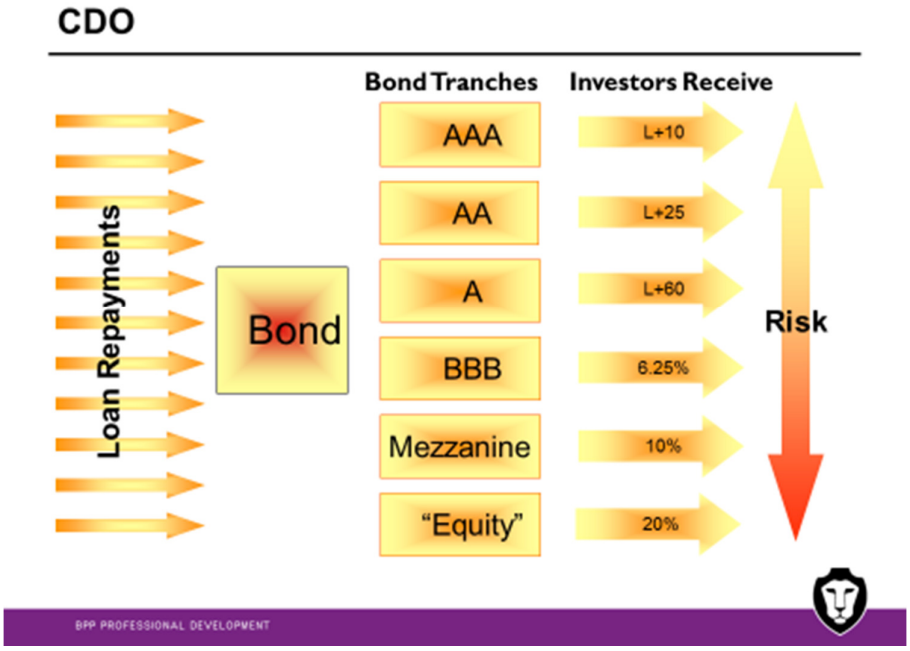
**But they weren't betting against MBS bonds in the film, they were betting against "tranches" of CDOs?**

Yes. The MBS market became well understood and efficient, and therefore offered little opportunity for profits for financial firms. To meet new client needs, the first CDO (**Collateralized Debt Obligation**) was created in 1987 by the investment bank Drexel Burnham Lambert, on behalf of the Imperial Savings Association.

With an MBS, the credit rating of the bonds is essentially the credit rating of the underlying mortgages. Individual, named mortgages are attached to each bond. If the mortgages are of good quality: employed homeowners with good credit history and mortgages below say 90 per cent. of home value, then the bonds will be of good quality.

There exists more demand in fixed income credit markets for AAA and other highly rated bonds than the market can supply. There are just not that many non governmental good credit risks out there and not enough high quality mortgage borrowers.

What a CDO does is **"tranche"** the payments of interest and principal from the mortgage borrowers to the bondholders. The SPV issues a series of different bonds of successively lower credit ratings. This is the illustrated by the tower of blocks in the movie—rather like the game Jenga™. The tranching is achieved by a legal rewiring of the interest and principal repayments coming from the mortgages in the pool. This creates a **payment waterfall,** an ordering of cash flows by credit rating: until the AAAs have received all the interest and principal repayments that they are due, the AA tranche gets nothing, and so on down the structure. A default on any one tranche of the bonds means that all bonds below that tranche will also default.




At the bottom of the stack is at least one tranche of below investment grade (below BBB-). That tranche, known as the **unrated** tranche or the **equity** tranche, was either sold to a hedge fund or kept on the balance sheet of the investment bank that sold the bonds in the first place. It also became known as the **toxic waste**.

**All this sounds like alchemy: turning lead into gold. So what's the magic?**

By the structure of a CDO, the credit rating of the bonds issued (the tranches) has been separated from the credit rating of the underlying mortgages. This allowed MBS backed by low quality **sub prime and Alt A mortgages** to be created and sold to investors who would normally not be interested in assets of such low credit quality. Sub prime were to become known as **"liar loans"** because of the lack of documentation surrounding the borrowers.

Following the 2000-01 dot com recession, the Chairman of the **Federal Reserve Board** (the governing body of the Federal Reserve, the US central bank) Alan Greenspan lowered interest rates sharply. This kicked off a housing boom which became self perpetuating. As double digit p.a. housing price rises occurred in many American cities everyone wanted in on the game. And the sub prime mortgage provided the mechanism for new home buyers to get on the ladder despite bad credit and income histories.

Getting rich on the way were the mortgage brokers and the Wall Street financiers. Banks such as Countrywide Financial were anxious to increase loan volumes. Mortgage brokers began to introduce business from lower and lower quality borrowers. Because of the magic of securitisation the game became **pass-the-parcel** on credit risk. The originator bank sells off the risk to the SPV created by the investment bank, which in turn sells on the risk to the investors. The investors rely on the ratings agencies and the credit rating. In the movie, Baum interviews a CDO fund manager—his fund is buying bonds from Merrill Lynch and it is abundantly clear he has no deep idea of what he is buying.

The boom turned into a bubble. Cheap mortgage finance drove housing prices up further, sucking in more buyers (some buying multiple homes). Wall Street firms acquired originators to try to increase volume. The **Fixed Income Commodities and Currency (FICC)** divisions of many of the investment banks become more than 50 per cent. of total firm profits. That increased the incentive to not look too deeply at the underlying risks. And so we have the plot of **Margin Call**, which is a bank very much like Bear Sterns or Lehman Brothers.

The situation became so absurd that a pool of sub prime mortgages could be securitised with 80 per cent. of the bonds issued being AAA. Practically that's nearly impossible—you cannot turn high risk mortgages into a pool of bonds which is 80 per cent. risk free. The magic of securitisation and pass-the-parcel on risk had created a situation with far more risk than the AAA ratings of the highest tranches implied.

The quality of home loans originated also fell with the availability of plentiful cheap credit. Whereas good credit rating borrowers usually borrow on fixed rates for up to 30 years, many of the subprime borrowers were borrowing on **Adjustable Rate Mortgages (ARMs)** which vary with the prevailing interest rates. These are normal in the UK but were quite rare in the US. After an initial period with a **"teaser rate"** which was lower than current borrowing rates, the loans would "**reset"** to a higher rate. The expectation was that the borrowers would then refinance to new mortgages (earning a second commission for their mortgage broker).

What no one seemed to realise was that when the housing boom ended, and the tide started to recede, there would be defaults far in excess of what had been expected and refinancings would become impossible. Mackenzie (2011) shows that default rates for the higher tranches were as much as 1000 times what had been forecast at issue. Note that a default of the AAA tranche means a default of all the lower credit rated tranches of bonds issued by the SPV.

## CDO meltdown – estimated and actual default rates

| Rating | Forecast default rate | Actual default rate |
|---|---|---|
| AAA | 0.001 | 0.10 (1000x) |
| AA+ | 0.01 | 1.68 (168x) |
| AA | 0.04 | 8.16 (404x) |
| ..... | | |
| BBB | 0.49 | 56.10 (114x) |
| BBB- | 0.88 | 66.67 (75.8x) |
| | | |

Source: Donald Mackenzie, U of Edinburgh, CDOs sub prime MBS issued 2005-07



**So the "heroes" in the movie separately realise what is going on. How do they try to profit from it?**

It begins with Dr Michael Burry, neurologist and hedge fund manager. He starts reading the actual mortgage prospectuses, and checking on the underlying mortgages. He finds that arrears and defaults are much higher than had been forecast when the bonds were issued. His detachment from the world of finance and conventional opinion allows him to see that the Emperor Has No Clothes.

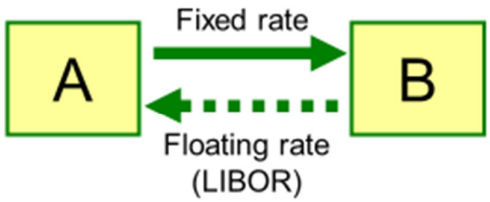
And so he goes in search of a way to construct **The Big Short**. To short these mortgages—in effect, bet on their default—he has to find a counterparty to write him a **Credit Default Swap (CDS).**

**A CDS? More TLAs (Three Letter Acronyms)!**

A CDS is a type of a **derivative** security—a contract on something else. A swap is an agreement between two parties to exchange payments. In an example of the classic **plain vanilla interest rate swap**, the swap buyer agrees to pay 5.75% p.a. fixed for 5 years—also said as 575 **basis points or bips** where one b.p. = $1/100^{th}$ of 1% or 0.01%. In return the swap seller (or writer) will pay 5.70% variable with reference to an external interest rate like **LIBOR (London Interbank Offer Rate)**.

## Interest Rate Swaps

- Plain vanilla fixed/floating single currency
  = Coupon swap




- Fixed rate reflects average expected LIBORs
  - A benefits if LIBOR fixings are higher than expected
  - B benefits if LIBOR fixings are lower than expected

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If interest rates go to 6.0% say then the buyer has the following payoff:

| | |
|---|---|
| Receive | +6.0% |
| Pay | (5.75%) |
| Profit | +1.25% |

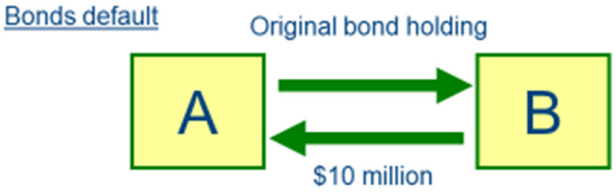
If interest rates go to 4.0% then

| | |
|---|---|
| Receive | +4.0% |
| Pay | (5.75%) |
| Loss | (1.75%) |

So an interest rate swap is a bet on interest rate directions: one side wins, one side loses. A CDS is a bet on a default. The buyer pays a regular premium to the seller and in return if there is an **event of default**, the buyer receives payment for the full amount insured.

## Credit Default Swaps

- Investor with $10million of a 5 year bond buys a CDS from a seller at a spread of 70 basis points


In the movie, Michael Burry, in his discussions with Goldman Sachs, asks them to be the seller of credit protection on certain lower tranches of bonds that he has identified as being of significantly higher risk. Since no one expects these bonds to default, they warn Burry that he could lose his money. They are also concerned about **counterparty risk**. Counterparty risk is the risk in the transaction that the other party fails to deliver on its side of the bargain e.g. due to insolvency.

At this time the CDS contract was an **Over-The-Counter (OTC)** contract – one negotiated between two parties without an exchange. The terms of the contract are thus specific to this agreement and are not public.

The Goldman Sachs bankers are concerned about counterparty risk with Michael Burry's fund. So they require Burry's fund to be "**marked to market**". If the price of the bonds that the CDS guarantees rose, reducing the probability of a pay-out, then Burry must make cash payments each month to Goldman. Thus, for the buyer of a CDS contract, it's quite possible to be right in the long term, but to go bankrupt before that happens, because of cash calls on the contract. This is called a **margin call—**a requirement to cover losses on existing contracts that have not yet expired. In such a scenario, the other party may offer to buy the contracts back from the buyer, thus letting them off the hook before expiry, but conversely crystallising what is at that point only a paper loss.

Much of the movie revolves around the problem of being right too early, and experiencing cash outflows on the fund which will drive the fund into bankruptcy or liquidation due to losses.

**OK. So the heroes buy CDS on bonds their detailed analysis shows will default. And there are also CDO-squareds, CDO-cubeds and synthetic CDOs. What are they and what does that have to do with a card game in Vegas?**

A **CDO-squared** is a CDO whose input, rather than being a bunch of mortgages, is a tranche of bonds from another CDO.

**My head just exploded. Why? Why do this?**

Creating CDOs was very lucrative business for the investment banks and the rating agencies, and there was a ready market for the highly rated tranches. But there were not enough mortgages, even in the heavily inflated US housing market. So the CDO-squared creates a whole new set of bonds to sell to investors, without increasing the size of the mortgage market. And so the CDO-cubed.

These instruments became incredibly complex and their successful marketing all depended on the credit rating agencies. **Rating shopping** is when the creator of a CDO (or any borrower) goes to more than one agency seeking a rating. As there are three major agencies (S&P, Moody's, and Fitch) and most bonds need only one or two ratings, this is always an implicit threat against any one rating agency, that they would lose lucrative business. In any case it is clear in retrospect that the agencies lacked the data and tools to properly assess the risks of the bonds even if there was no deliberate malfeasance.

**And synthetics?**

A derivative is a contract on something else. So it became possible to create **synthetic CDOs**. In a synthetic CDO a financial institution holds on to the original mortgages, but sells the upside and downside off to third parties (such as hedge funds) using interest rate swap and CDS transactions. This may be cheaper than actually creating the SPV and helped in the magical alchemy of turning a bunch of high credit risk mortgages into a structure which was say 80 per cent. AAA rated.

**And cards at Vegas?**

What that scene graphically shows is that because swaps are pure win-lose transactions, it's possible to have bets on many times the actual amount of debt. One bet, one card hand is equivalent to one MBS, but tens or hundreds of people can bet against each other on the outcome of that hand. The problem is if there is a default (the buyers win) or no default (the sellers win) it's possible for one or more of the counterparties to go broke, and fail to pay off on the contracts. At which point the whole thing can collapse like a house of cards, as it's very unlikely that the bankrupt players only have one bet in the market. Lehman Brothers was that defaulting counterparty. If AIG had not been rescued by the US government, the CDS that it had written would probably have put it into insolvency (due to the falling prices of the underlying bonds).

On Behavioural Finance, discussed in the casino, we have **Behavioural Finance- Introduction**

https://www.bppprofessionaldevelopment.com/financial-services/productdetails.aspx?product=20587&sitting=DEFAULT&location=UK

**So basically the world took a financially leveraged bet on US housing prices? When those started to fall and after the bankruptcy of Lehman Brothers the whole thing collapsed like a giant row of dominos. How could finance have been allowed to do something that caused such huge harm in the real world: to ordinary people buying homes, to whole countries like Iceland?**

That is the question the movie asks. Go and see the movie, read the book, and see what you think.

The last time this happened on this scale in world history was the Wall Street Crash of 1929 and the ensuing **Great Depression,** which was global. A US recession, even a bad one, was probably inevitable in 2008-09, but the financial shockwaves from these financial innovations propagated the damage around the planet. What has happened since 2008 has been called the **Great Recession**. It was swift action by the world's central banks, plus a government bailout of financial institutions that probably saved us from a repeat of the Great Depression.

The political consequence of the Great Depression was widespread political unrest culminating in the appointment of Adolf Hitler to the Premiership of Germany in 1933. Germany, one of the worst hit nations by the financial crisis, then had a strong economic recovery due to a huge rearmament programme. And the fuse was lit which would in 1939 explode into the biggest war in human history.

So far we have avoided that last fate.

**Where can I learn more about this?**

The two Michael Lewis books are indispensable and are better read in chronological order. Nouriel Roubini's book gives a less entertaining but very clear description of the crisis. He was one of the few people who foresaw the crisis. A list of sources is included below.

**What courses does BPP offer that cover this material?**

BPP Professional Development offers a number of courses, both full day PD courses and online modules.

See https://bppprofessionaldevelopment.com/financial-services/ for more details.

Our course **The City and Financial Markets - An Introduction** gives a general overview of financial markets and the different products traded

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And the course **Capital Markets – Introduction** gives an overview of the main forms of capital market instrument (bonds, equities, derivatives)

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We have a number of courses on bonds and fixed income:

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**Bond Markets- Introduction** and **Bond Markets- Advanced** introduce the delegates to bonds and key bond concepts like duration and convexity

https://www.bppprofessionaldevelopment.com/course-directory.aspx?group=3&category=31

https://www.bppprofessionaldevelopment.com/financial-services/productdetails.aspx?product=17711&sitting=DEFAULT&location=UK

**Raising Debt and Debt Finance** covers the actual mechanisms by which bonds are created and sold to investors

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**Securitisation- an Introduction** takes you through the technicalities and jargon of financial markets, bonds and securitisation.

https://www.bppprofessionaldevelopment.com/financial-services/productdetails.aspx?product=20335&sitting=DEFAULT&location=UK

We also have a number of courses on derivatives:

https://www.bppprofessionaldevelopment.com/course-directory.aspx?group=3&category=32#c32

**Credit Derivatives- introduction** examines the world of the CDS

https://www.bppprofessionaldevelopment.com/financial-services/productdetails.aspx?product=3489&sitting=DEFAULT&location=UK

And there is also **Advanced Interest Rate Derivatives**:

https://www.bppprofessionaldevelopment.com/financial-services/productdetails.aspx?product=6866&sitting=DEFAULT&location=UK

We also have a number of courses on the regulation of financial institutions:

https://www.bppprofessionaldevelopment.com/course-directory.aspx?group=3&category=26#c26

These include our course on **Basel III**

https://www.bppprofessionaldevelopment.com/financial-services/productdetails.aspx?product=8867&sitting=DEFAULT&location=UK

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