

NPTEL ONLINE CERTIFICATION COURSES

Management of Fixed Income Securities

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Lecture 51: Mortgage Backed Securities-I

CONCEPTS COVERED

- Securitization
- Residential Mortgage Loans
- Mortgage Payments
- Mortgage Guarantees
- Credit Quality

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KEYWORDS

- Originator
- Pass through
- Mortgage-backed securities
- balloon loans
- Interest-Only mortgages
- Reset Mortgages

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Securitization

- **Securitization** refers to a process in which the assets of a corporation or financial institution are pooled into a package of securities backed by the assets.
- The securitization process starts when an **originator**, who owns the assets, sells them to **conduit** (e.g., government agency or bank) that assembles the pool of assets.
- The conduit/issuer then creates a security backed by the assets; the **asset-backed security** or **pass-through** is then sold to investors
- The securitization process often involves a third-party trustee who ensures that the issuer complies with the terms underlying the asset-backed security.

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Securitization

- The most common types of asset-backed securities are those secured by mortgages, automobile loans, credit card receivables, and home equity loans.
- Asset-backed securities formed with mortgages are called ***mortgage-backed securities***, MBSs, or ***mortgage pass-throughs***.
- ***Mortgage-Backed Securities*** (MBS) or **Mortgage Pass-Throughs** (PT) are claims on a portfolio of mortgages. The securities entitle the holder to the cash flows from a pool of mortgages.
- Typically, the issuer of a MBS buys a portfolio or pool of mortgages of a certain type from a mortgage originator, such as a commercial bank or mortgage banker.

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Securitization

- The issuer finances the purchase of the mortgage portfolio through the sale of the mortgage pass-throughs, which have a claim on the portfolio's cash flow.
- The mortgage originator usually agrees to continue to service the loans, passing the payments on to the MBS holders.
- The characteristics and value of such securities ultimately depends on the characteristics of the underlying asset – residential mortgage loans.

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Mortgage Loans

- A mortgage is a loan secured by a specific real estate property, typically the one being acquired by the borrower.
- Real estate property can be either residential or nonresidential. ***Residential*** includes houses, apartments etc. ***Nonresidential*** includes commercial and agricultural property
- In a standard mortgage, the lender will place a lien against the property. A ***lien*** is a public record attached to the title of the property that specifies the lender has the right to sell the property if the owner defaults.
- Most mortgages originate from commercial banks, or mortgage bankers.
- The mortgage originator underwrites the loan, processes the necessary documents, conducts credit checks, evaluates the property, sets up the loan contracts and terms, and provides the funds.

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Residential Mortgage Loans

- Mortgages differ in terms maturity, interest rate (fixed or adjustable), security, credit quality and prepayment
- Many residential mortgages have original maturities of 30 years, with shorter maturities of 10, 15, or 20 years also popular.
- The majority of mortgages are ***fully amortized***, meaning each month the mortgage payment includes both a payment of interest on the mortgage balance and a payment of principal, with the total number of monthly payments being such that the loan is retired at maturity.
- There are some mortgages structured as ***balloon loans***. With a balloon loan, the borrower makes payments based on an amortized schedule for a specified period at which time the total loan balance becomes due. If the borrower's credit profile has not deteriorated, then the lender will typically refinance the debt.

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Residential Mortgage Loans

- Mortgage loans are either (i) ***Fixed rate (FRM***): the rate fixed for the life of the mortgage (ii) ***Adjustable rate***: The rate is reset periodically based on some pre-specified rate or index.
- For an ***adjustable-rate mortgage*** (ARM), the monthly payments are recalculated at each specified reset date.
- At each reset date, the rate is set equal to a reference rate plus a margin (spread over the reference rate or index).

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Other Types of Mortgages

- ***Graduated payment mortgages (GPM)***: Mortgages that start with low monthly payments in earlier years and then gradually increase
- ***Reset Mortgages***: Mortgages that allow the borrower to renegotiate the terms of the mortgage at specified future dates.
- ***Interest-Only mortgages*** (IO): Mortgages in which only the interest is paid for a specified period (***lockout period***), after which the loan is fully amortized for the remaining life of the loan.
- ***Hybrid ARMs*** in which the rate is fixed for the early years of the mortgages (e.g., five years) and then reset to an ARM.

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Other Types of Mortgages

- ***Conventional Mortgage:*** Mortgage loan not guaranteed by the government or governemnt agency
- ***Insured Mortgage***: Mortgage guaranteed by the government agencies
- ***Private Mortgage Insurance (PMI) Mortgage*****:** Conventional mortgage insured by a private mortgage insurer
- ***Shared-Appreciation Mortgage*****:** Mortgage in which the lender provides a low interest rate in exchange for a share in the appreciation of the real estate.
- ***Equity Participation Mortgage***: Mortgage in which the lender accepts a lower down payment or lower monthly payments in exchange for a share in the appreciation of the property.
- ***Reverse Annuity Mortgage***: Mortgage that has an increasing-balance in which the lender advances periodic funds (usually on a monthly basis) to the owner/borrower. The loan comes due when the property is sold.

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Other Types of Mortgages

- ***Stretch Loan***: Loan that allows borrowers to commit more than 50% of their gross monthly income to the monthly mortgage payment.
- ***Stated-Income Loan*****:** Mortgage loan that allows borrowers to state their income without verification.
- ***Piggyback Loan*****:** Two loans consisting of a first mortgage and a second loan (usually a second mortgage) that starts at origination. The second loan is used to finance the down payment.
- ***2/28 ARM or Teaser Loan*****:** An ARM that start at a very low rate for first two years and then is reset at a significantly higher rate.
- ***Conforming Limit Loan*****:** Mortgages guaranteed by Fannie Mae and Freddie Mac have limits on the loan balance, referred to as conforming limits.
- ***Jumbo Loan*****:** Loan greater than the conforming limits set by Fannie Mae and Freddie Mac.

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Mortgage Payments

- The monthly payment on a mortgage, p, is found by solving for the p that makes the present value of all scheduled payments equal to the mortgage balance, F_0:

$$F_0 = \sum_{t=1}^{M} \frac{p}{(1+(R^A/12))^t}$$

$$F_0 = p\left[\frac{1-1/(1+(R^A/12))^M}{R^A/12}\right]$$

$$p = \frac{F_0}{\left[\frac{1-1/(1+(R^A/12))^M}{R^A/12}\right]}$$

where:

F_0 = Face value of the Loan

R^A = Annualized interest Rate

p = Monthly Payment

M = Maturity in Months

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Mortgage Payment Example

Mortgage value: Rs. 100000, Maturity: 30 years, Interest rate: 9% (fixed)

Monthly payment (P)= $$\frac{100{,}000}{\left[\frac{1-1/(1+(0.09/12))^{360}}{0.09/12}\right]} = 804.62$$

The Rs. 804.62 payment applies towards both the interest and principal.

The interest payment for month t is

$$Interest\ \ Payment = (R^A/12)(F_t)$$

Interest payment: (0.09/12)*Rs. 100000= Rs. 750

Principal: Rs. 804.62 - Rs. 750 =Rs. 54.62

After the monthly payment p has been made, the principal balance at the end of month t is

$$F_t = F_{t-1} + [(R^A/12)F_{t-1}] - p$$

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Mortgage Payments

- Suppose the rs. 100,000, 30-year mortgage were an ***ARM with an annual reset.*** For an ARM, the monthly payments are adjusted at the reset dates, with the new payment, p, calculated based on the balance, the remaining term, and the new reset rate. This process of resetting payments is known as ***recasting***.
- For example, at the beginning of month 13, the balance is Rs. 99,316.80 and there are 29 years or is 348 months remaining on the mortgage. If the reset rate were 10%, then the monthly payment for the ***ARM*** would increase from Rs. 804.62 to Rs. 876.45:

$$p = \frac{99{,}316.80}{\left[\frac{1-1/(1+(0.10/12))^{348}}{0.10/12}\right]} = 876.45$$

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Mortgage Payments

- Suppose the Rs. 100,000, 30-year, 9% mortgage were an ***interest-only mortgage*** for five years and then was set at the 9% note rate for the remaining 25 years.
- For the first five years (the lockout period), the monthly mortgage payments would be: (0.09/12)(Rs. 100,000) = Rs. 750
- Starting in year five, the mortgage payment would be set to equal the payment on a fully amortized loan for 25 years at 9%. This would result in the monthly payment increasing

$$p = \frac{100{,}000}{\left[\frac{1-1/(1+(0.09/12))^{300}}{0.09/12}\right]} = 839.20$$

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Mortgage Guarantees and Credit Quality

- In addition to the property securing the mortgage, many mortgages are also insured against default by the borrower.
- On the basis of credit quality mortgage loans can be classified as (i) Prime (ii) Subprime and (iii) Alternative-A Loans
- A ***prime*** loan is considered a high quality loan where the borrower is deemed to have a strong income and credit history sufficient to make the loan payments, as well as a sufficient equity to property value such that the lender would be able to cover the mortgage balance in case there was a default and the lender was forced sell the property.
- A ***subprime loan*** is consider low quality, where the borrower is of higher risk of default and where the equity-to-property value is low, or where the mortgage has a secondary claim (e.g., a second mortgage).
- ***Alternative-A loans*** **(**or an ***Alt-A-loan***) are mortgage loans somewhere between prime and subprime. They are considered to have almost prime quality, but have some factors that tend to increase their credit risk.

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Mortgage Guarantees and Credit Quality

- In assessing credit quality, lenders consider measures such as ***Payment-to-Income*** (PTI) Ratios (front and back) and ***Loan-to-Value ratios*** (LTV)
- A ***front PTI*** ratio is the monthly payments (including property taxes and insurance) to the borrower's monthly gross income
- A ***back PTI*** is the ratio of monthly payments of the mortgage plus other monthly debt obligations (e.g., car loans and credit cards payments) to the borrower's monthly income.
- Front and back PTI ratios measure the ability of the borrower to make monthly payments.
- The LTV is the ratio of the amount of the loan to the market or appraised value of the property.
- The lower the LTV ratio, the greater the protection the lender has to recover the loan if the borrower defaults and the lender has to sell the repossessed property.

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CONCLUSIONS

- Securitization refers to a process in which the assets of a corporation or financial institution are pooled into a package of securities backed by the assets.
- A mortgage is a loan secured by a specific real estate property, typically the one being acquired by the borrower.
- Mortgages differ in terms maturity, interest rate, security, credit quality and prepayment
- The monthly payment on a mortgage is found by solving for the monthly payment that makes the present value of all scheduled payments equal to the mortgage balance
- In assessing credit quality, lenders consider measures such as Payment-to-Income Ratios and Loan-to-Value ratios

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REFERENCES

- Johnson, S. R (2010): Bond Evaluation, Selection and Management, John Wiley & Sons, 2nd Edition.
- Fabozzi, J. Frank and Mann, V. Steven (2005): The Hand Book of Fixed Income Securities, Tata McGraw-Hill, 7th Edition.

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Lecture 52: Mortgage Backed Securities-II

CONCEPTS COVERED

- **Prepayment Risk**
- **Default Risk**

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KEYWORDS

- Prepayment speed
- Weighted average coupon rate
- Conditional prepayment rate
- Public Securities Association
- Single monthly mortality rate
- Seasoning

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Prepayment

- Prepayment is the amount of payment made in excess of the monthly mortgage payment.
- Total prepayment occurs when the entire balance is paid off before maturity.
- This can be the result of the borrower refinancing the loan or selling the property.
- Most mortgages have a due-on-sale requirement in which the mortgage balance must be paid when the property is sold.

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Prepayment

- Prepayment can also be for only part of the balance: Curtailment
- Borrower's right to prepay a loan in total or partially is an option that benefits the borrower.
- Prepayment penalty: To minimize prepayment or to lower the prepayment cost to the lender of originating new loans at lower interest rates.
- The holder of the mortgage portfolio is subject to credit risk, liquidity risk, and prepayment risk.

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Prepayment Risk

- For the holder of a mortgage portfolio, prepayment creates an uncertainty concerning the portfolio's cash flows.

- For example, if a bank has a pool of mortgages with a weighted average mortgage rate of 10% and let mortgage rates decrease in the market to 8%, then the bank's mortgage portfolio is likely to experience significant prepayment as borrowers refinance their loans.

- The option borrowers have to prepay makes it difficult for the lender to predict future cash flows or to determine the value of the portfolio.

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Prepayment Risk

- A number of prepayment models have been developed to try to predict the cash flows from a portfolio of mortgages.
- Most of these models estimate the prepayment rate, referred to as the ***prepayment speed*** or simply ***speed***, in terms of four factors:
  - Refinancing incentive
  - Seasoning (age of the mortgage)
  - Monthly factors
  - Prepayment burnout

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Prepayment Risk

- The **refinancing incentive** is the most important factor influencing prepayment.
- If mortgage rates decrease below the mortgage loan rate, borrowers have a strong incentive to refinance.
- This incentive increases during periods of falling interest rates, with the greatest increases occurring when borrowers determine that rates have bottomed out.
- The refinancing incentive can be measured by the difference between the mortgage portfolio's weighted average rate, referred to as the ***weighted average coupon rate*** (WAC) or ***weighted average loan rate*** (WALT) and the refinancing rate (R^{ref}).
- A study by Goldman, Sachs, and Company found that the annualized prepayment speed, referred to as the ***conditional prepayment rate***, CPR, is greater the larger the positive difference between the WAC and R^{ref}.
- The CPR is quoted on an annual basis.

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Prepayment Risk

- A second factor determining prepayment is the age of the mortgage, referred to as ***seasoning***.
- Prepayment tends to be greater during the early part of the loan, then stabilize after about three years. A commonly referenced seasoning pattern can be shown through ***PSA model*** (Public Securities Association).
- The monthly prepayment rate, referred to as the ***single monthly mortality rate*** (SMM) can be obtained given the annual CPR by using the following formula:

$$\text{SMM} = 1 - [1 - \text{CPR}]^{1/12}$$

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Prepayment Risk

- In the standard PSA model, known as 100 PSA, the CPR starts at 0.2% for the first month and then increases at a constant rate of 0.2% per month to equal 6% at the 30th month; then after the 30th month the CPR stays at a constant 6%. Thus for any month t, the CPR is

$$CPR = 0.06\left(\frac{t}{30}\right), \quad if\ t \leq 30,$$

$$CPR = 0.06, \quad if\ t > 30$$

- The 100 PSA model is often used as a benchmark. If the pattern is described as being 200 PSA, then the prepayment speeds are twice the 100 PSA rates. If the pattern is described as 50 PSA, then the CPRs are half of the 100 PSA rates

Prepayment Risk

- In addition to the effect of seasoning, mortgage prepayment rates are also influenced by the month of the year, with prepayment tending to be higher during the summer months.

- ***Monthly factors*** can be taken into account by multiplying the CPR by the estimated monthly multiplier to obtain a monthly-adjusted CPR. PSA provides estimates of the monthly multipliers.
- Many prepayment models also try to capture what is known as the ***burnout factor***. The burnout factor refers to the tendency for premium mortgages to hit some maximum CPR and then level off.
- For example, in response to a 2% decrease in refinancing rates, a pool of premium mortgages might peak at a 30% prepayment rate after one year, then level off at approximately 18%.

Cash Flow from a Mortgage Portfolio with Prepayment

- The cash flow from a portfolio of mortgages consists
  - Interest payments
  - Scheduled principal
  - Prepaid principal

Example: Consider a bank that has a pool of current fixed rate mortgages that are: Rs. 100 million (Par, F)

yield a WAC of 8%

have a WAM of 360 months

For the first month, the portfolio would generate an aggregate mortgage payment of:

$$p = \frac{100{,}000{,}000}{\left[\frac{1-1/(1+(0.08/12))^{360}}{0.08/12}\right]} = 733{,}765$$

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Cash Flow from a Mortgage Portfolio with Prepayment

- From the Rs. 733,765 payment, Rs. 666,667 would go towards interest and Rs. 67,098 would go towards the scheduled principal payment:

$$Interest = \left(\frac{R^A}{12}\right)F_0$$

$$Interest = \left(\frac{0.08}{12}\right)100{,}000{,}000 = 666{,}667$$

$$Scheduled\ \ principal\ \ payment\ \ = \ \ p - Interest$$

$$Scheduled\ \ principal\ \ payment\ \ = \ \ Rs.733{,}765 - Rs.666{,}667 = Rs.67{,}098$$

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Cash Flow from a Mortgage Portfolio with Prepayment

- The projected first month ***prepaid principal*** can be estimated with a prepayment model.
- Using the 100% PSA model, the CPR for the first month (t = 1) is equal to 0.002 and monthly prepayment rate is equal to SMM = 0.0001668:

$$CPR = \left(\frac{1}{30}\right)0.06 = 0.002$$

$$SMM = 1 - [1 - 0.002]^{1/12} = 0.0001668$$

- Given the prepayment rate, the ***projected prepaid principal*** in the first month is found by multiplying the balance at the beginning of the month minus the scheduled principal by the SMM.
- Doing this yields a projected prepaid principal of Rs. 16,671 in the first month:

$$prepaid\ \ principal = SMM\,[F_0 - Scheduled\ \ principal]$$

$$prepaid\ \ principal = 0.0001668[100{,}000{,}000 - 67{,}098]$$

$$prepaid\ \ principal = Rs.16{,}671$$

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Cash Flow from a Mortgage Portfolio with Prepayment

- For the first month, the mortgage portfolio would generate an estimated ***cash flow*** of Rs. 750,435, and a ***balance*** at the beginning of the ***next month*** of Rs. 99,916,231:

$$CF = Interest + Scheduled\ \ principal + prepaid\ \ principal$$

$$CF = Rs.666,666 + Rs.67,098 + Rs.16,671 = Rs.750,435$$

$$Beginning\ \ Balance\ \ for\ \ Month\ 2 = F_0 - Scheduled\ \ principal - prepaid\ \ principal$$

$$Beginning\ \ Balance\ \ for\ \ Month\ 2 = Rs.100,000,000 - Rs.67,098 - Rs.16,671 = Rs.99,916,231$$

- In the ***second month*** (t = 2), the projected payment would be :

$$p = \frac{Rs.99,916,231}{\left[\frac{1-1/(1+(0.08/12))^{359}}{0.08/12}\right]} = Rs.733,642$$

$$Interest = \left(\frac{0.08}{12}\right)(Rs.99,916,231) = Rs.666,108$$

$$Scheduled\ \ principal = Rs.733,642 - Rs.666,108 = Rs.67,534$$

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Cash Flow from a Mortgage Portfolio with Prepayment

- Using the 100% PSA model, the estimated monthly prepayment rate and projected prepaid principal in month 2 :

$$CPR = \left(\frac{2}{30}\right)0.06 = 0.004$$

$$SMM = 1 - [1 - 0.004]^{1/12} = 0.000333946$$

$$prepaid\ \ principal = 0.000333946[99{,}916{,}231 - 67{,}534]$$

$$prepaid\ \ principal = 33{,}344$$

- For the second month, the mortgage portfolio would generate an estimated cash flow and have a balance at the beginning of month three :

$$CF = 666{,}108 + 67{,}534 + 33{,}344 = 766{,}986$$

$$Beginning\ \ Balance\ \ for\ \ Month\ 3 = 99{,}916{,}231 - 67{,}534 - 33{,}344$$

$$Beginning\ \ Balance\ \ for\ \ Month\ 3 = 99{,}815{,}353$$

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Default Risk Model

- Public Service Association's standardized default assumption (SDA) model

- In this model, the annualized default rate (ADR):
  - Starts at 0.02% in the first month and then increases at a constant rate of 0.02% per month to reach 0.60% at the 30th month
  - From Month 30 to Month 60, the ADR remains constant at 0.60%
  - From Month 61 to Month 120, the ADR declines from 0.60% to .03%
  - From Month 120 on, the ADR remains constant at 0.03%.

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Default Risk Model

- If the default pattern is described as being 200 SDA, then ADRs will be twice the 100 SDA rates, and if the pattern is described as 50 SDA, then the ADRs will be set equal to half of the 100 PSA rates.

- A current mortgage pool described by a 200 SDA would
  - Start with an annualized default rate of 0.04% in the first month and then would increase at a constant rate of 0.04% per month to reach 1.20% at the 30th month
  - From Month 30 to Month 60, the ADR would remain constant at 1.20%
  - From Month 61 to Month 120, the ADR would declines from 1.20% to 0.06%
  - From Month 120 on, the ADR would remain constant at 0.06%

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Monthly Default Rate and Monthly Default Loss

- Monthly default rate (MDR) : $\mathrm{MDR} = 1 - [1 - \mathrm{ADR}]^{1/12}$

- Monthly Default Loss = MDR[Beginning Balance – Monthly Scheduled Principal Payment]

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Default Risk Example

Consider an institution with a pool of current fixed rate mortgages worth Rs. 100 million, with a weighted average coupon rate (WAC) of 8% and maturity of 360 months. If there were no default or prepayment, the portfolio would generate an aggregate mortgage payment of :

$$p = \frac{Rs.100000000}{\left[\frac{1-1/(1+(0.08/12))^{360}}{0.08/12}\right]} = Rs.733765$$

$$Interest = \left(\frac{R^A}{12}\right)F_0 = \left(\frac{0.08}{12}\right)Rs.100000000 = Rs.666667$$

$$Scheduled\ \text{Pr}incipal\ Payment = p - Interest = Rs.733765 - Rs.666667$$

$$Scheduled\ \text{Pr}incipal\ Payment = Rs.67098$$

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Default Risk Example

Assume the portfolio consisted of mortgages that were characterized by the 100 SDA model, then in the first month the monthly loss due to default would be:

$$Annual\ Default\ Rate = ADR = 0.0002$$

$$MDR = 1 - [1 - 0.0002]^{1/12} = 0.00001666819$$

$$Monthly\ Default\ Loss = MDR[Beginning\ Balance - Schduled\ principal]$$

$$Monthly\ Default\ Loss = (0.00001666819)(Rs.100000000 - Rs.67097.91]$$

$$Monthly\ Default\ Loss = Rs.1665.70$$

$$Beginning\ Balance\ for\ Month\ 2 = F_0 - Scheduled\ principal - Default\ loss$$

$$Beginning\ Balance\ for\ Month\ 2 = Rs.100000000 - Rs.67098 - Rs.1665.70$$

$$Beginning\ Balance\ for\ Month\ 2 = Rs.99931236$$

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Default Risk Example

- Starting in Month 30 and going to Month 60, the MDR remains constant
- Second, from Month 60 to Month120, the monthly default rates decrease at a greater rate
- From Month 120 on, though, there is slight decrease in rates

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CONCLUSIONS

- Prepayment is the amount of payment made in excess of the monthly mortgage payment
- Prepayment creates an uncertainty concerning the portfolio's cash flows
- Many prepayment models have been developed to predict the cash flows from a portfolio of mortgages
- The age of the mortgage also determines the prepayment
- Public Service Association assumes various standardized models to incorporate default risk in the cash flow calculation

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- Johnson, S. R (2010): Bond Evaluation, Selection and Management, John Wiley & Sons, 2nd Edition.
- Fabozzi, J. Frank and Mann, V. Steven (2005): The Hand Book of Fixed Income Securities, Tata McGraw-Hill, 7th Edition.

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Lecture 53: Mortgage Backed Securities-III

CONCEPTS COVERED

- Cash flow from a mortgage backed security
- Price quote of mortgage backed security
- Extension risk
- Collateralized Mortgage Obligations
- Sequential-Pay Tranches

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KEYWORDS

- Weighted average maturity
- Pass-through rate
- Pool factor
- Projected prepaid principal
- Average life

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Mortgage-Backed Securities

- Depending on the types of mortgages, the originator who sells mortgages to become a securitized asset can sell them to one of the three agencies (Fannie Mae, Ginnie Mae, or Freddie Mac) or to a private-sector conduit.
- The MBSs created by one of the agencies are referred to as agency MBSs
- MBS created by private conduits are called non-agency MBBs (also called private labels).
- Nonagency pass-throughs or private labels are sold by commercial banks, investment banks, other thrifts, and mortgage bankers.

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Mortgage-Backed Securities

- Nonagency residential MBSs differ fundamentally from agency MBSs in that their cash flows are subject to default risk, whereas agency MBSs with their government and agency guarantees are considered default free.
- Cash flows from MBSs are generated from the cash flows from the underlying pool of mortgages, minus servicing and other fees.
- Fees for constructing, managing, and servicing the underlying mortgages and the MBSs are equal to the difference between the rates associated with the mortgage pool and the rates paid on the MBS [pass-through (PT) rate]

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MBSc Cash Flows: Terms

- Weighted Average Coupon Rate (WAC): Mortgage portfolio's weighted average rate.
- Weighted Average Maturity (WAM): Mortgage portfolio's weighted average maturity.
- Pass-Through (PT) Rate: Interest rate paid on the MBS; PT rate < WAC (the difference going to MBS issuer)
- Prepayment Rate or Speed: Assumed prepayment rate.

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Cash Flow from a MBS Example

- Find monthly cash flows for a MBS issue constructed from a Rs. 100 million mortgage pool with the following features:
  - Current balance = Rs. 100M
  - WAC = 8%
  - WAM = 355 months
  - PT rate = 7.5%
  - Prepayment speed equal to 150% of the standard PSA model: PSA = 150

First Month's Payment: $p = \dfrac{Rs.100M}{\left[\dfrac{1-1/(1+(0.08/12))^{355}}{0.08/12}\right]} = Rs.736268$

WAC

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Cash Flow from a MBS Example

PT Rate

$$Interest = \left(\frac{R^A}{12}\right)F_0 = \left(\frac{0.075}{12}\right)Rs.100000000 = Rs.625000$$

$$Scheduled\ Principal\ Payment = p - Interest = Rs.736268 - [(0.08/12)(Rs.100000000)]$$

$$Scheduled\ Principal\ Payment = Rs.69601$$

WAC

Using 150% PSA model and seasoning of 5 months the first month SMM =

$$CPR = 1.50\left(\frac{6}{30}\right)0.06 = 0.018$$

$$SMM = 1 - [1 - 0.018]^{1/12} = 0.0015125$$

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Cash Flow from a MBS Example

Given the prepayment rate, the ***projected prepaid principal*** in the first month:

$$prepaid\ \ principal\ = SMM\,[F_0 - Scheduled\ \ principal]$$

$$prepaid\ \ principal\ = 0.0015125[Rs.100000000 - Rs.69601]$$

$$prepaid\ \ principal\ = Rs.151147$$

$$CF = Interest + Scheduled\ \ principal + prepaid\ \ principal$$

$$CF = \$625{,}000 + \$69{,}601 + \$151{,}147 = \$845{,}748$$

$$Beginning\ \ Balance\ \ for\ \ Month\ 2 = F_0 - Scheduled\ \ principal - prepaid\ \ principal$$

$$Beginning\ \ Balance\ \ for\ \ Month\ 2 = Rs.100000000 - Rs.69601 - Rs.151147$$

$$Beginning\ \ Balance\ \ for\ \ Month\ 2 = Rs.99779252$$

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Cash Flow from a MBS Example

Given the prepayment rate, the ***projected prepaid principal*** in the second month:

$$p = \frac{Rs.99779252}{\left[\frac{1-1/(1+(0.08/12))^{354}}{0.08/12}\right]} = Rs.735154$$

$$Interest = \left(\frac{R^A}{12}\right)F_0 = \left(\frac{0.075}{12}\right)Rs.99779252 = Rs.623620$$

$$Scheduled\ \text{Pr}incipal\ Payment = p - Interest = Rs.735{,}154 - [(0.08/12)(Rs.99779252)]$$

$$Scheduled\ \text{Pr}incipal\ Payment = Rs.69959$$

$$CPR = 1.50\left(\frac{7}{30}\right)0.06 = 0.021$$

$$SMM = 1-[1-.021]^{1/12} = 0.0017671$$

$$prepaid\ \ principal = SMM\,[F_0 - Scheduled\ \ principal]$$

$$prepaid\ \ principal = 0.0017671[Rs.99779252 - Rs.69959] = Rs.176194$$

$$CF = Interest + Scheduled\ \ principal + prepaid\ \ principal$$

$$CF = Rs.623620 + Rs.69959 + Rs.176194 = Rs.869773$$

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Price Quotes

- The prices of MBSs are quoted as a percentage of the underlying MBS issue's balance.
- The mortgage balance at time t, M_t, is usually calculated by the servicing institution and is quoted as a proportion of the original balance, M_0.
- This proportion is referred to as the ***pool factor*** (pf): $pf_t = \frac{M_t}{M_0}$

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Price Quotes Example

A MBS backed by a mortgage pool originally worth Rs. 100 million, Current pool factor: 0.92, Quoted at 95 - 16 (Note: 16 is 16/32)

The current balance, M_t:

$$M_t = (pf_t)M_0$$

$$M_t = (0.92)(Rs.100000000) = Rs.92000000$$

$$Market\ Value = (0.9550)(Rs.92000000) = Rs.87860000$$

The market value is the clean price; it does not take into account accrued interest. For MBS, accrued interest is based on the time period from the settlement date and the first day of the next month.

If the time period is 20 days, the month is 30 days, and the WAC = 9%, then the accrued interest is :

$$Accrued\ Interest = \left(\frac{20}{30}\right)\left(\frac{0.09}{12}\right) Rs.92000000 = Rs.460000$$

The *full* market value (clean price plus accrued interest) would be:

$$Full\ Mkt\ Value = Rs.87860000 + Rs.460000$$

$$Full\ Mkt\ Value = Rs.88320000$$

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Extension Risk

- The value of a MBS is determined by the MBS's future cash flow (CF), maturity, default risk, and other features related to fixed-income securities
- With the CF a function of rates, the value of a MBS is more sensitive to interest rate changes. This sensitivity is known as **extension risk**.

Rate Decrease

$$R \downarrow \Rightarrow \text{lower discount rate} \Rightarrow V_M \uparrow$$

$$R \downarrow \Rightarrow \textit{Increases prepayment} \Rightarrow \textit{Earlier CFs} \uparrow \Rightarrow V_M \uparrow$$

Rate Increase

$$R \uparrow \Rightarrow \text{greater discount rate} \Rightarrow V_M \downarrow$$

$$R \uparrow \Rightarrow \textit{Decreases prepayment} \Rightarrow \textit{Earlier CFs} \downarrow \Rightarrow V_M \downarrow$$

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Extension Risk

- The effect of interest rate increase in lowering the bond price by decreasing the value of its cash flows is known as extension risk
- Extension risk can be explained in terms of the relationship between interest rates and MBS's average life
- The average life of a MBS or mortgage portfolio is the weighted average of the security's time periods, with the weights being the periodic principal payments (scheduled and prepaid principal) divided by the total principal

$$Average\ Life = \frac{1}{12}\sum_{t=1}^{T} t\left(\frac{principal\ \ received\ \ at\ t}{total\ \ principal}\right)$$

- The average life of a MBS depends on prepayment speed

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Average Life and Prepayment Risk

- For MBSs and mortgage portfolios, ***prepayment risk*** can be evaluated in terms of how responsive a MBS's or mortgage portfolio's average life is to changes in prepayment speeds:

$$\text{prepayment risk} = \frac{\Delta \text{Average Life}}{\Delta \text{PSA}}$$

- A MBS with an average life that did not change with PSA speeds would have stable principal payments over time and would be absent of prepayment risk.

$$\frac{\Delta \text{ Av life}}{\Delta \text{PSA}} = 0 \Rightarrow \text{Zero prepayment risk}$$

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Collateralized Mortgage Obligations (CMOs)

- CMOs, are formed by dividing the cash flow of an underlying pool of mortgages or a MBS issue into several classes, with each class having a different claim on the mortgage collateral and with each sold separately to different types of investors
- The different classes making up a CMO are called tranches or bond classes.
- There are two general types of CMO tranches:
  - Sequential-Pay Tranches
  - Planned Amortization Class Tranches (PAC)

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Sequential-Pay Tranches

- A **sequential-pay CMO**, is divided into classes with different priority claims on the collateral's principal.
- The tranche with the first priority claim has its principal paid entirely before the next priority class, which has its principal paid before the third class, and so on.
- Interest payments on most CMO tranches are made until the tranche's principal is retired.

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Sequential-Pay Tranches

- Let a CMO consist of three tranches, A, B, and C, formed from the collateral making up the Rs. 100 million MBS. F = Rs. 100 million, WAM = 355, WAC = 8%, PT Rate = 7.5%, PSA = 150. Tranche A = Rs. 50 million, Tranche B = Rs. 30 million, Tranche C = Rs. 20 million
- Priority Disbursement Rules:
  - Tranche A receives all principal payment from the collateral until its principal of Rs. 50 million is retired. No other tranche's principal payments are disbursed until the principal on A is paid.
  - After tranche A's principal is retired, all principal payments from the collateral are then made to tranche B until its principal of Rs. 30 million is retired.
  - Finally, tranche C receives the remaining principal that is equal to its par value of Rs. 20 million.
  - Although the principal is paid sequentially, each tranche does receive interest each period equal to its stated PT rate (7.5%) times its outstanding balance at the beginning of each month.

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Sequential-Pay Tranches

- Based on the assumption of a 150% PSA speed, it takes 88 months before A's principal of Rs. 50Million is retired.
- During the first 88 months, the cash flows for tranches B and C consist of just the interest on their balances, with no principal payments made to them.
- Starting in month 88, tranche B begins to receive the principal payment.
- Tranche B is paid off in month 180, at which time principal payments begin to be paid to tranche C.
- Finally, in month 355 tranche C's principal is retired

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Features of Sequential-Pay CMOs

Maturity:

Collateral's maturity = 355 months (29.58 years)
Tranche A's maturity = 88 months (7.33 years)
Tranche B's maturity = 180 months (15 years)
Tranche C's maturity = 355 months (29.58 years)

Window: The period between the beginning and ending principal payment is referred to as the **principal pay-down window**:

Collateral's window = 355 months
Tranche A's window = 87 months
Tranche B's window = 92 months
Tranche C's window =176 months

Average Life:

Collateral's average = 9.18 years
Tranche A's average life = 3.69 years
Tranche B's average life = 10.71 years
Tranche C's Average life = 20.59 years

The average life of each of the tranches varies when prepayment speed changes.

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CONCLUSIONS

- Cash flows from MBSs are generated from the cash flows from the underlying pool of mortgages, minus servicing and other fees.
- The prices of MBSs are quoted as a percentage of the underlying MBS issue's balance
- The value of a MBS is more sensitive to interest rate changes and this sensitivity is known as extension risk
- The different classes making up a CMO are called tranches or bond classes
- There are two general types of CMO tranches (i) Sequential-Pay Tranches and Planned Amortization Class Tranches

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Management of Fixed Income Securities

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Lecture 54: Mortgage Backed Securities-IV

CONCEPTS COVERED

- Accrual Tranche
- Floating-Rate Tranche
- Notional Interest-Only Class
- Planned Amortization Class
- Stripped MBS
- Nonagency Residential MBSs

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KEYWORDS

- Z bond
- Support bond
- Prime MBSs
- Subprime MBSs
- Credit traunching
- Cash flow waterfalls
- Senior interest
- Subordinate interest

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Accrual Tranche

- Many sequential-pay CMOs have an **accrual bond class**.
- Such a tranche, also referred to as the **Z bond**, does not receive current interest, instead it is *deferred*.
- The Z bond's current interest is used to pay down the principal on the other tranches, increasing their speed and reducing their average life.
- Suppose in our preceding sequential-pay CMO example we make tranche C an accrual tranche in which its interest of 7.5% is to paid to the earlier tranches and its principal of Rs. 20 million and accrued interest is to be paid after tranche B's principal has been retired
- As the accrual tranche's current interest is now used to pay down the other classes' principals, the other tranches now have lower maturities and average lives.

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Floating-Rate Tranche

- CMO issuers often create **floating-rate** and **inverse floating-rate tranches**.
- The monthly coupon rate on the floating-rate tranche is usually set equal to a reference rate such as the London Interbank Offer Rate, LIBOR, while the rate on the inverse floating-rate tranche is determined by a formula that is inversely related to the reference rate.
- **Example:** Sequential-pay CMO with a floating and inverse floating tranches

Tranche	Par Value (Rs)	PT Rate
A	50 million	7.50%
FR	22.5 million	LIBOR + 50bp
IFR	7.5 million	28.3 – 3 LIBOR
Z	20 million	7.50%
Total	100	7.50%

- The CMO is identical to the preceding CMO, except that tranche B has been replaced with a floating-rate tranche, FR, and an inverse floating-rate tranche, IFR
- If the LIBOR is 8%, then the rate on the FR tranche is 8.5%, the IFR tranche's rate is 4.5%, and the WAC of the two tranches is 7.5%:

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Notional Interest-Only Class

- Many CMOs are structured with tranches that have different rates.
- When CMOs are formed this way, an additional tranche, known as a **notional interest-only (IO) class,** is created.
- The Notional interest-only tranche receives the excess interest on the other tranches' principals, with the excess rate being equal to the difference in the collateral's PT rate minus the tranches' PT rates.
- In our example: The notional IO class receives the excess interest on each tranche's remaining balance, with the excess rate based on the collateral rate of 7.5%.
- In the first month, for example, the IO class would receive interest of:

$$Interest = \left(\frac{0.075 - 0.06}{12}\right) Rs.50000000 + \left(\frac{0.075 - 0.065}{12}\right) Rs.30000{,}000$$

$$Interest = Rs.62{,}500 + Rs.25000 = Rs.87500$$

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Notional Interest-Only Class

- In our example, A tranche's notional principal is the number of dollars that makes the return on the tranche's principal equal to 7.5%.

$$A's\ Notional\ principal = \frac{(Rs.50000000)(0.075-0.06)}{0.075} = Rs.10000000$$

$$B's\ Notional\ principal = \frac{Rs.30000000)(0.075-0.065)}{0.075} = Rs.4000000$$

$$Z's\ Notional\ principal = \frac{(Rs.20000000)(0.075-0.07)}{0.075} = Rs.1333333$$

$$Total\ Notional\ principal = Rs.15333333$$

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Planned Amortization Class (PAC)

- A CMO with a **planned amortization class** (**PAC)** is structured such that there is virtually no prepayment risk.
- In a PAC-structured CMO, the underlying mortgages or MBS is divided into two general tranches:
  - The PAC (also called the PAC bond)
  - The **support class** (also called the **support bond** or the **companion bond**)
- The two tranches are formed by generating two monthly principal payment schedules from the collateral:
  - One schedule is based on assuming a relatively low PSA speed – **lower collar**.
  - The other schedule is based on assuming a relatively high PSA speed – **upper collar**.
- The PAC bond is then set up so that it will receive a monthly principal payment schedule based on the minimum principal from the two principal payments.
- The PAC bond is designed to have no prepayment risk provided the actual prepayment falls within the minimum and maximum assumed PSA speeds.
- The support bond, on the other hand, receives the remaining principal balance and is therefore subject to prepayment risk.

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Other PAC-Structured CMOs

- The PAC and support bonds can be divided into different classes.
- The PAC bond is divided into several sequential-pay tranches, with each PAC having a different priority in principal payments over the other.
- Each sequential-pay PAC will have a constant average life if the prepayment speed is within the lower and upper collars.
- A PAC-structured CMO can also be formed with PAC classes having different collars.
- Some PACs are formed with just one PSA rate. These PACs are referred to as targeted amortization class (TAC) bonds.
- Different types of tranches can also be formed out of the support bond class. These include sequential-pay, floating and inverse-floating rate, and accrual bond classes.

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Stripped MBS

- Stripped MBSs consist of two classes:
  - ***Principal-only*** (PO) class that receives only the principal from the underlying mortgages.
  - ***Interest-only*** (IO) class that receives just the interest.
- The return on a PO MBS is greater with greater prepayment speed.
- For example, a PO class formed with Rs. 100 million of mortgages (principal) and priced at Rs. 70 million would yield an immediate return of Rs.30 million if the mortgage borrowers prepaid immediately. Since investors can reinvest the Rs.30 million, this early return will have a greater return per period than a Rs.30 million return that is spread out over a longer period.

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Principal-Only Stripped MBS

- Because of prepayment, the price of a PO MBS tends to be more responsive to interest rate changes than an option-free bond.
- If interest rates are decreasing, then like the price of most bonds, the price of a PO MBS will increase.
- The price of a PO MBS is also likely to increase further because of the expectation of greater earlier principal payments.

$$(1) \Rightarrow \text{prepayment} \uparrow \Rightarrow \text{return} \uparrow \Rightarrow V_{PO} \uparrow$$

$$R \downarrow$$

$$(2) \Rightarrow \text{lower discount rate} \Rightarrow V_{PO} \uparrow$$

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Principal-Only Stripped MBS

- If rates are increasing, the price of a PO MBS will decrease as a result of both lower discount rates and lower returns from slower principal payments.

$$R \uparrow \quad \begin{cases} (1) \Rightarrow \text{prepayment} \downarrow \Rightarrow \text{return} \downarrow \Rightarrow V_{PO} \downarrow \\ (2) \Rightarrow \text{greater discount rate} \Rightarrow V_{PO} \downarrow \end{cases}$$

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Interest-Only Stripped MBS

- The cash flows and the returns on an IO MBS will be greater, the slower the prepayment rate.
- If inverse relationship between prepayment speed and returns dominates the price and discount rate relation, then the price of an IO MBS will vary directly with interest rates.

$$(1) \Rightarrow \text{prepayment} \downarrow \Rightarrow \text{return} \uparrow \Rightarrow V_{IO} \uparrow$$

$$R \uparrow$$

$$(2) \Rightarrow \text{greater discount rate} \Rightarrow V_{IO} \downarrow$$

$$\text{If 1st effect} > \text{2nd effect, then } \frac{\Delta V_{IO}}{\Delta R} > 0$$

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Nonagency Residential MBSs, Commercial MBSs, and Other Asset-Backed Securities

- The most common types are nonagency residential MBS, commercial MBSs, and asset-backed securities backed by automobile loans, credit card receivables, and home equity loans.
- These asset-backed securities are structured as pass-through and many have prepayment tranches.
- Different from agency MBSS, the collateral backing these asset-backed securities are subject to credit and default risk.

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Nonagency Residential MBSs

- MBS created by private conduits are called **nonagency MBSs** or **private labels.**
- Nonagency residential MBSs can be classified as either **prime MBSs**, in where the underlying mortgages are all prime, and **subprime MBSs**, where the underlying mortgage pool consists of subprime mortgages.
- Nonagency subprime MBSs are typically grouped with asset-backed securities and not mortgage-backed securities.
- Nonagency MBSs or nonagency CMOs are subject to default losses.
- Investors of nonagnecy MBS need to taken into account the expected default losses in determining the credit spread for pricing such securities

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Nonagency Residential MBSs

- MBS conduits address credit risk on nonagency MBSs by providing credit enhancements designed to absorb the expected losses from the underlying mortgage pool resulting from defaults.

- For nonagency MBSs or CMOs, credit enhancement include:
  - Senior-Subordinate Structures
  - Excess Spreads
  - Overcollateralization
  - Monoline Insurance

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Senior-Subordinate Structures

- A MBS issue with a senior-subordinate structure is formed with two general bond classes: a senior bond class and a subordinated bond class, with each class consisting of one or more tranches.

Bond Class	Tranche	Principal (Rs)	Credit Ratings
Senior	1	300	AAA
Subordinate	2	25	AA
Subordinate	3	25	A
Subordinate	4	20	BBB
Subordinate	5	10	BB
Subordinate	6	10	B
Subordinate	7	10	Unrated

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Senior-Subordinate Structures

- For this MBS issue, the default losses are absorbed first by Tranche 7 (starting at the bottom) and ascend up.
- If losses on the collateral are less than Rs. 10 million, then only Tranche 7 will experience a loss
- If losses are Rs. 30 million, then Tranches 7, 6, and 5 will realize losses
- The senior-subordinated structured MBS spreads the credit risk amongst the bond classes. This is referred to as **credit traunching**.
- The rules for the distribution of the cash flows that include the distribution of losses are referred to as the **cash flow waterfalls** or simply **waterfalls**.

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Senior-Subordinate Structures

- The proportion of the mortgage balance of the senior bond class to the total mortgage deal is referred to as **senior interest** (initial senior interest = Rs. 300m/Rs.400m = 0.75)
- The proportion of the mortgage balance of the subordinated bond classes to the total mortgage deal is referred to as **subordinate interest** (initial subordinate interest = Rs. 100m/Rs. 400m = 0.25).
- The greater the subordinate interest, the greater the level of credit protection for the senior bond.

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Senior-Subordinate Structures

- Over the life of the MBS deal, the level of credit protection will change as principal is prepaid.
- In general, with prepayment, senior interest will increase and the subordinate interest will decrease over time.
- Because of this, most senior-subordinate structured MBS deals have a **shifting interest schedule** designed to maintain the credit protection for the senior bond class.
- Shifting interest schedule is used to determine the allocation of prepayment that goes to the senior and subordinate tranches.

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Senior-Subordinate Structures

- Senior prepayment percentage = Initial senior interest percent + Initial subordinate interest * Shifting interest proportion

Years after Issuance	Shifting Interest Percentage
1 to 3	100%
4	60%
5	50%
6	30%
7	20%
8	10%
After 8	0

Based on the above schedule:

100% of the prepayment would go to the senior class for the first three years (75% + (1)(25%) = 100%)

90% in year 4 (75% + (25%)(0.70)

87.5% in year 5, and so on.

After year 8, the allocation of principal between senior and subordinate classes would match their initial senior and subordinate interest proportions of 75% and 25%.

The shifting-interest schedule from 100% to 60% in year 4, to 50% in year 5, to finally 0% after year 8 is known as a ***step-down provision*****;** such a provision allows for reductions in the credit support over time.

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CONCLUSIONS

- Accrual bond class does not receive current interest
- The monthly coupon rate on the floating-rate tranche is usually set equal to a reference rate such as the London Interbank Offer Rate
- Many CMOs are structured with tranches that have different rates and the additional tranche is known as notional interest-only class
- A CMO with a planned amortization class is structured such that there is virtually no prepayment risk
- The stripped MBSs consist of two classes (i) Principal-only class and (ii) Interest-only class
- Nonagency residential MBSs can be classified as either prime MBSs, and subprime MBSs and they are typically grouped with asset-backed securities and not mortgage-backed securities.

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Management of Fixed Income Securities

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Lecture 55: Mortgage Backed Securities-V

CONCEPTS COVERED

- Commercial Mortgages
- Asset Backed Securities
- Automobile Loan-Backed Securities
- Home Equity Loan-Backed Securities
- Credit-Card Receivable-Backed Securities
- Collateralized Debt Obligations
- Valuation of Mortgage-Backed Securities

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KEYWORDS

- Non-recourse loans
- Cross-collateralization
- Cross-default protection
- Certificates for automobile receivables
- Absolute prepayment speed
- Certificates for amortizing revolving debts
- Lockout period
- Gross Portfolio Yield
- Delinquency Rate
- Synthetic CDOs
- Vector analysis

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Commercial Mortgages

- Commercial mortgage loans come from income produced from the property. Commercial mortgage loans are referred to as **non-recourse** loans.
- Commercial property can include:
  1. Shopping Centers
  2. Apartment Buildings
  3. Industrial Properties
  4. Warehouses
  5. Hotels
  6. Health Care Facilities

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Commercial Mortgages

- Lenders in assessing the credit quality of commercial loans look at
  - The debt-to-service ratio (= Rental Income – operating expenses)/ Interest Payments)
  - The loan-to-value ratios, where value is equal to the present value of expected cash flows or the appraised value.
- Commercial mortgage loans have prepayment protection. Prepayment protection can take the form of prepayment penalties, provisions prohibiting prepayment for a specified period, and defeasance.
- Defeasance is an agreement whereby the borrower agrees to invest fund in risk-free securities in an amount that would match the cash flows of a prepayment schedule.

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Commercial Mortgages

- Lenders in assessing the credit quality of commercial loans look at
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- Defeasance is an agreement whereby the borrower agrees to invest fund in risk-free securities in an amount that would match the cash flows of a prepayment schedule.

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Commercial Mortgage Backed Security

- **Commercial Mortgage-Backed Sec**urity (CMBS) is a security backed by one or more commercial mortgage loans.
- Similar to nonagency residential MBSs, many CMBSs have **Credit tranches** (senior-subordinated structures),**Credit enhancements** (overcollaterialization, excess interests, and monocline insurance) and **Prepayment tranches** (sequential-pay, PACs, NIO, floaters, etc.)
- One feature common to residential and commercial mortgage-backed securities is **Cross-collateralization**: property used to secure one loan is also used to secure the other loans in the pool.
- Cross-collateralization prevents the MBS investors/lenders from calling the loan if there is a default, provided there is sufficient cash flows from the other loans to cover the loan's default loss. Such protection is called **cross-default protection**.
- CMBSs can be formed from a single borrower with multiple properties.
- These deals are often set up by large real estate developers who use commercial MBSs as a way to finance or refinance their numerous projects: shopping malls, office buildings, hotels, apartment complexes etc.

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Asset Backed Securities

- **Asset-Backed Securities** (ABSs) are securities created from securitizing pools of loans other than residential prime mortgage loans and commercial loans and residential subprime MBS are included in the ABS category.
- Loans used to create ABSs include (i) Home Equity Loans, (ii) Credit Card Receivables, (iii) Student Loans, (iv) Home Improvement Loans, (v) Trade Receivables, (vi) Franchise Loans, (vii) Small Business Loans etc.
- Like most securitized assets, ABS can be structured with different prepayment and credit tranches and can include different credit enhancements.

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Automobile Loan-Backed Securities

- Automobile loan-backed securities are often referred to as **CARS** (**certificates for automobile receivables**).
- The automobile loans underlying these securities are **similar to mortgages** where borrowers make regular monthly payments that include interest and a scheduled principal.
- Like mortgages, automobile loans are characterized by prepayment.
- **CARS differ from MBSs** in that they have
  - Shorter maturities
  - Their prepayment rates are less influenced by interest rates than mortgage prepayment rates
  - They are subject to greater default risk

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Prepayment for Auto Loan

- The prepayment for auto loans is typically measured in terms of the **absolute prepayment speed** (APS).

- APS measures prepayment as a percentage of the original collateral amount, instead of the prior period's balance.

- The relation between APS and the monthly prepayment rate (single monthly mortality rate maturity, SMM) is

$$SMM = \frac{APS}{1 - (APS)(M - 1)}$$

where M = month.

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Home Equity Loan-Backed Securities

- Home-equity loan-backed securities are referred to as HELS.
- They are similar to MBSs in that they pay a monthly cash flow consisting of interest, scheduled principal, and prepaid principal.
- The home equity loans securing HELS tend to have a shorter maturity and different factors influencing their prepayment rates.
- The home equity loans forming the pool backing a HEL issue are also subject to default.
- HEL deals are often structured with different prepayment tranches, credit tranches, and credit enhancements.

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Credit-Card Receivable-Backed Securities

- Credit-card receivable-backed securities are commonly referred to as **CARDS** (**certificates for amortizing revolving debts**).
- The credit card receivables backing a CARD are nonamortizing loans where there is not a schedule of periodic principal payments.
- Prepayment does not apply for a pool of credit card receivable loans.
- Credit card borrowers usually make a minimum principal payment, in which if the payment is less than the interest on the debt, the shortfall is added to the principal balance, and if it greater, it is used to reduce the balance.
- The cash flow from a pool of card receivables comes from
  - Finance Charges (interest charges based on unpaid balance)
  - Principal Collected
  - Fees

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Credit-Card Receivable-Backed Securities

- The CARDS formed from a pool of credit card receivables are structured with two periods.
- **Lockout period or revolving period:** All principal payments made on the receivables are retained and either reinvested in other receivables or invested in other securities. When new assets are added to an ABS deal, the structure is called a **revolving structure.**
- **Principal-amortization period** or **amortizing period**: all current and accumulated principal payments are distributed to the CARD holders.

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Credit-Card Receivable-Backed Securities

- In structuring an ABS secured by credit card receivable, the issuer often sets up a **master trust** where the credit card accounts meeting certain eligibility requirement are pledged.
- Numerous credit card deals or series are then issued from the master trust. Each series is, in turn, identified by a year and a number
- Each series has a **lockout period** where, the principal payments made by the credit card borrowers are retained by the trustee and reinvested in additional receivables or securities.
- During the lockout period, the cash flow to CARD investors comes from finance charges and fees.
- In the **principal amortizing period,** principal received by the trustee is paid to CARD investors.

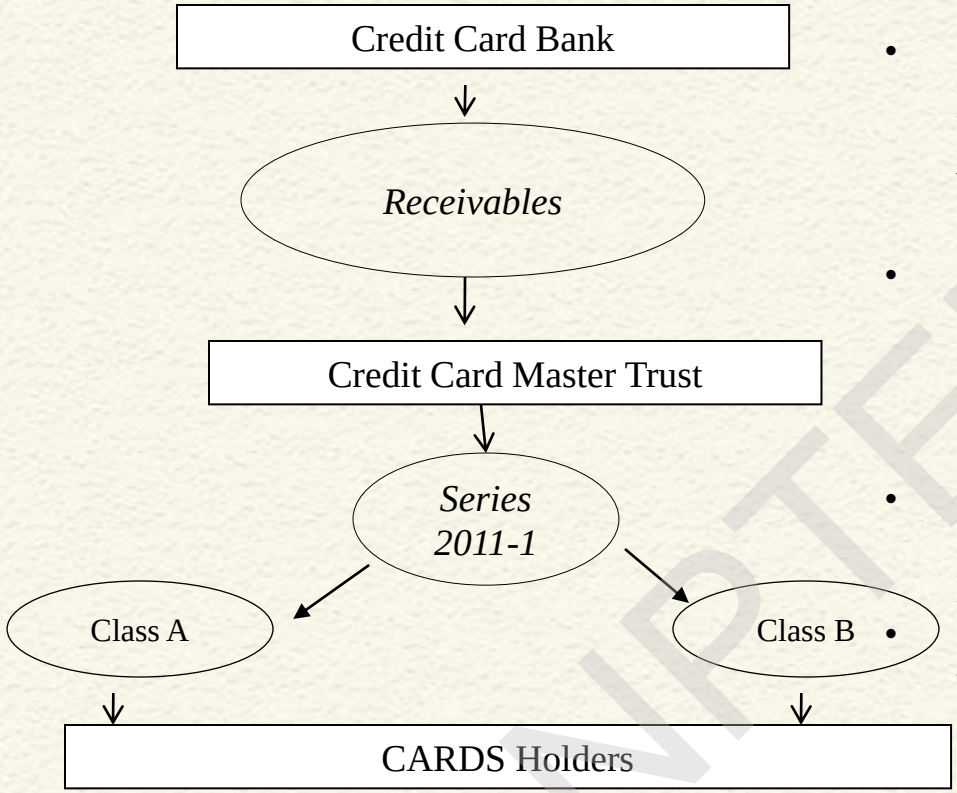
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Evaluation of CARD

- Investors monitor the **monthly payment rate** (MPR): the monthly payment of finance charges, fees, and principal repayment from the credit card receivable
- For a CARD series with low or declining MPRs, there is a chance there may not be sufficient cash to pay off the principal.
- If there is an early amortization provision, an MPR falling below a threshold MPR would be the trigger for early amortization
- **Gross Portfolio Yield**: finance charges collected and fees as a proportion of credit card debt outstanding
- **Charge-offs**: the accounts charged off as uncollectable as a proportion of credit card debt outstanding
- **Net portfolio Yield**: gross profit yield minus charge-offs as a proportion of credit card debt outstanding; this is the return CARD holders receive.
- **Delinquency Rate**: Proportion of receivables that are past due – 30, 60, or 90 days

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Credit-Card-Backed Security Deal



- Interest payment to each class is equal to the monthly LIBOR + spread.
- The final payment date of the series is anticipated to be 2018.
- Principal collected during the lockout period is to be used to invest in additional receivables. Principal is to be accumulated in a "principal funding account."
- In January 2015, the Trust will begin accumulating collection of receivables for principal repayment and begin distributing principal to Bond Class A and Bond Class B.
- Early amortization is triggered if MPR for any three consecutive months is less than 10%.
- If the collection of receivables is less than expected, principal may be delayed.

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Collateralized Debt Obligations (CDOs)

- **Collateralized Debt Obligations (CDOs)** are securities backed by a diversified pool of one or more fixed-income assets or derivatives.
- Assets from which CDOs are formed include:
  - Investment Grade Corporate Bonds
  - Asset-backed Securities
  - High-yield Corporate Bonds
  - Leveraged Bank Loans
  - Residential Mortgage-Backed Securities
  - Commercial Loans
  - Commercial Mortgage-Backed Securities
  - Real Estate Investment Trusts
  - Municipal Bonds
- CDOs are structured with different tranches and credit enhancements.

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Types of CDOs

- **Cash Flow CDOs** that make periodic payment of interest and principal.

- **Market Value CDOs** that are characterized by total returns generated from the collateral: interest income, capital gains, and principal.

- **Synthetic CDO**s that are formed with derivatives

- **Balance Sheet CDO**s consisting of bank loans in which the objective is to sell or remove the loans from the balance sheet.

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Example:

Let there are Four tranches backed by a Rs. 200 million collateral investment consisting of

- Fixed-rate, investment-grade bonds with a par value of Rs. 200 million
- Weighted average maturity of five years
- Yielding a return 200 basis points over the five-year T-notes

The CDO's four tranches consist of:

1. A **senior A1** trance with a par value of Rs. 100 million, paying a fixed rate equal to the five-year T-note rate plus 150 basis points
2. A **senior A2** tranche with a par value of Rs. 60 million and paying a floating rate equal to LIBOR plus 100 basis points
3. **A subordinate B** Tranche with a par value of Rs. 20 million and paying a fixed rate equal to the five-year T-note rate plus 200 basis points
4. A **subordinate/equity tranche** with a par value of Rs. 20 million that receives the excess return: return from collateral minus returns paid to the other tranches.

- Since Tranche A2 pays a floating rate and the underlying collateral is to consist of fixed-rate bonds, the CDO deal allows the manager to take a derivative position to fix the rate on the A2 tranche.

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Valuation of Mortgage-Backed Securities

- One common approach used to determine the possible values of a MBS is **vector analysis**.
- Vector analysis involves generating a matrix of MBS values based on different discount rates and PSA vectors.
- Each PSA vector, in turn, is obtained by dividing the total number of periods to maturity into a number of periods with different PSA speeds.
- One way to estimate different PSA vectors is to use a binomial interest rate trees.
- Using the different vectors to value a security represents a Monte Carlo simulation approach to valuation.

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Valuation of Mortgage-Backed Securities

- Monte Carlo simulation involves generating a set of cash flows for a MBS, ABS, or CMO tranche based on simulated future interest rates. From the cash flows, the value of the MBS can be determined given the assumed rates and an assumed speed.

- The simulation involves:
  - Generating a number of interest rate paths,
  - Estimating the cash flow for each path based on a prepayment model that is dependent on the assumed interest rates
  - Determining the present values of each path's cash flows
  - Calculating the average value and standard deviation of the distribution of values from the assumed paths – The average value is referred to as the **theoretical value**

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CONCLUSIONS

- Commercial mortgage loans come from income produced from the property
- Commercial mortgage loans have prepayment protection
- Commercial Mortgage-Backed Security is a security backed by one or more commercial mortgage loans
- Asset-Backed Securities (ABSs) are securities created from securitizing pools of loans other than residential prime mortgage loans and commercial loans
- Automobile loan-backed securities are often referred to as certificates for automobile receivables
- Credit-card receivable-backed securities are commonly referred to as certificates for amortizing revolving debts
- Collateralized Debt Obligations are securities backed by a diversified pool of one or more fixed-income assets or derivatives
- One common approach used to determine the possible values of a MBS is vector analysis
- One way to estimate different PSA vectors is to use a binomial interest rate trees

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