Prepayment Risk Modelling on Mortgage-Backed Securities (MBS)

By:

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Overview:

This project aims to model the prepayment risk associated with Mortgage-Backed Securities (MBS). By analysing historical loan data and various financial indicators, we seek to predict the likelihood of loan prepayment and understand the factors influencing this risk.

Data Preparation:

- Dataset containing variables such as CS, MIP, Units, OCLTV, DTI, OrigUPB, LTV, OrigInterestRate, OrigLoanTerm, EverDelinquent, MonthsDelinquent, MonthsInRepayment, IsFirstTime, CreditRange, LTV_range, and Repay_range.
- Using Power Bi, I have deleted all duplicated rows, null and missing values.
- Changed data type according to type of data.
- Labelling has been done on columns like CreditScore, LTV, DTI, MonthsInRepayment.

Filters:

1. Repay Range Filter:
Type: Date filter
Description: Allows users to filter data based on the date range, enabling them to analyse prepayment and delinquency trends over time.
Values taken: 0-4 years, 4-8 years, 8-12 years, 12-16 years and 16-20 years.

2. Loan Type Filter:
Type: Categorical filter
Description: Enables users to filter loans based on loan types (e.g., fixed-rate, adjustable-rate), allowing for a more focused analysis of specific loan categories.
Value taken: FRM(Fixed rate measure)

3. Credit Range Filter:
Type: Range filter or categorical filter
Description: Allows users to filter loans based on credit score ranges, enabling them to analyze prepayment and delinquency rates for different credit profiles.
Values Taken: Poor(0-650 Credit Score),Fair(650-700), Good(700-750), Excellent(750-900)

4. LTV Range Filter:
Type: Range filter or categorical filter
Description: Enables users to filter loans based on loan-to-value (LTV) ratio ranges, helping them explore how LTV ratios affect prepayment and delinquency rates.
Values Taken: Low(0-25), Medium(25-50) and High(50-1000)

5. DTI Range Filter:
Type: Range filter or categorical filter
Description: Allows users to filter loans based on debt-to-income (DTI) ratio ranges, facilitating analysis of the impact of DTI ratios on prepayment and delinquency.

Values Taken: Low(0-25), Medium(25-50) and High(50-1000)

6. Loan Purpose Filter:
Type: Categorical filter
Description: Enables users to filter loans based on loan purposes (e.g., purchase, refinance), allowing for analysis of prepayment and delinquency rates across different loan purposes.
Values taken: C-Refinance Cash Out, N- Refinance No Cash Out, P- Purchase

KPIs:

1. Prepayment Rate KPI using Gauge Visual:

Type: Percentage KPI
Definition: Percentage of loans prepaid over a specific period
Calculation: (Number of Prepaid Loans / Total Number of Loans) * 100
Analysis:

- ✓ Prepayment rate is 4.50% for Cash out loan, 4.60% for No Cash Out and 3.72% for Purchase.
- ✓ Prepayment rate is more if LTV value is medium which is between 25-50.
- ✓ People who have excellent credit score have prepaid loans early.
- ✓ People with low Dept to Income ratio have already prepay their loans.
- ✓ People who repay their loan between 8-12 years of loan taken have more prepayment rate.

2. Delinquency Rate KPI using Gauge Visual:

Type: Percentage KPI
Definition: Percentage of loans that are delinquent over a specific period
Calculation: (Number of Delinquent Loans / Total Number of Loans) * 100
Analysis:

- ✓ Delinquency rate is more for Cash out loan.
- ✓ Delinquency rate is 19.91% if LTV value is high which is more than 50.
- ✓ Delinquency rate is indirectly proportional to credit score. People who are having poor credit score are those who have not pay their loan value on time.
- ✓ People with high Dept to Income ratio have 22.21% delinquency rate which is high among all.
- ✓ Loan users with more than 50% delinquency rate have to repay their loans in 16-20 years of duration.

3. Total Number of Loans KPI using KPI Card:

Type: Count KPI
Definition: Total number of loans in the dataset
Calculation: Count of unique loan IDs
Analysis:

- ✓ Loan which are taken for Purchase purpose are more in numbers while for No Cash Out is less.

- ✓ Users with high LTV value have taken more loans while with low LTV value is quite less barely 1174 loans have been taken.
- ✓ Most loans have good credit score.
- ✓ Around 145.03k loans have medium DTI value.

4. Average Original UPB KPI using Gauge Visual:

Type: Currency KPI
Definition: Average original unpaid balance (UPB) of loans
Calculation: Mean of the 'OrigUPB' variable
Analysis:

- ✓ Users having repay range between 0-4 years have high original unpaid balance.
- ✓ Original UPB amount is more which is around $130.05k for users having high DTI value.
- ✓ Users with good credit score have more Original UPB.
- ✓ $127.31k amount of UPB is for high LTV which is quite big while it is $71.61k for low LTV.
- ✓ No Cash Out loan has more UPB rather than Cash Out and Purchase loan purpose.

5. Average Original Interest Rate KPI using Gauge Visual:

Type: Percentage KPI
Definition: Average original interest rate of loans
Calculation: Mean of the 'OrigInterestRate' variable
Analysis:

- ✓ Users with high LTV and high DTI value have high interest rate.
- ✓ Users with poor credit score have to pay high interest rate on loan.
- ✓ High interest rate have been taken for less repayment years.

6. Average Loan Term KPI using Card:

Type: Number KPI
Definition: Average loan term (duration) of loans
Calculation: Mean of the 'OrigLoanTerm' variable
Analysis:

- ✓ Loan taken for Cash Out purpose have high loan term as compare to others.
- ✓ Loan term is high for both high LTV and DTI value users.
- ✓ Fair credit score users have high loan term as compared to excellent credit score users.
- ✓ Loan term is same for repay range 4-12 years while it is high for 16-20 years repay range.