

# Mortgage Backed Securities

## Prepayment Risk Analysis Report



# Mortgage-Backed Securities (MBS)

- ❖ A mortgage-backed security (MBS) is an investment similar to a bond that is made up of a bundle of home loans bought from the banks that issued them.
- ❖ In this system, the loans issued by the bank is in turn sold to investors at a discounted rate to free up the bank funds.
- ❖ These loans are sold in the form of bonds by investment banks wherein loans are grouped together according to their type and quality.
- ❖ For the investor, an MBS is as safe as the mortgage loans that back it up.

# Prepayment Risk

- ❖ Prepayment risk is the risk involved with the premature return of principal on a fixed-income security. When debtors return part of the principal early, they do not have to make interest payments on that part of the principal.
- ❖ This means that if the loan issuer prepays the loan, the investors will stop receiving interest on those bonds.
- ❖ Hence, it is important to evaluate the prepayment risk on the MBS.

# Data

- ❖ The data is obtained from Freddie Mac official portal for home loans.
- ❖ The size of the home loans data is (291451 x 28).
- ❖ It contains 291451 data points and 28 columns or parameters which denote different features of the data.

## Project Objective

To Summarize key findings from the analysis by creating a dashboard and provide actionable recommendations for prepayment risk mitigation based on the insights gained.

# Data Preprocessing

- ❖ The first step involves the data preprocessing step where raw data has been cleaned by removing null values and also those columns which are not useful in the further data analysis.
- ❖ It also involves data encoding of some of the columns like 'IsFirstTiime'.
- ❖ New columns such as 'CreditRange', 'LTV\_range', and 'Repay\_range' are created which contains categories.

# Data Modelling and Dashboard Design

- ❖ The processed and cleaned data is then exported to power bi to create KPIs and visualizations.
- ❖ New measures for 'Prepayment Rate', 'Delinquency Rate', 'Average Months Delinquent' and 'Total Number of Loans' are created using DAX queries.
- ❖ New Group for DTI having categories High, Medium and Low is created using DAX query.
- ❖ New Maturity Date column having date format is created using the following DAX query:  
MaturityDateFormatted =  
DATE(  
LEFT([MaturityDate], 4),  
RIGHT([MaturityDate], 2),  
1)

# DAX Queries

## **Delinquency Rate =**

```
VAR NumDelinquentLoans = CALCULATE(COUNTROWS('LoanExport(Cleaned)'),  
'LoanExport(Cleaned)'[EverDelinquent] = 1)  
VAR TotalLoans = COUNTROWS('LoanExport(Cleaned)')  
RETURN  
DIVIDE(NumDelinquentLoans, TotalLoans, 0) * 100
```

## **Prepayment Rate =**

```
VAR NumPrepaidLoans = CALCULATE(COUNTROWS('LoanExport(Cleaned)'),  
'LoanExport(Cleaned)'[MonthsInRepayment] = 1)  
VAR TotalLoans = COUNTROWS('LoanExport(Cleaned)')  
RETURN  
DIVIDE(NumPrepaidLoans, TotalLoans, 0) * 100
```



# DAX Queries

**Average Months Delinquent** = AVERAGE('LoanExport(Cleaned)'[MonthsDelinquent])

**Total Number of Loans** = COUNTROWS(DISTINCT('LoanExport(Cleaned)'[LoanSeqNum]))

**DTI(Group)** = IF(  
    [DTI] <= 10,  
    "Low",  
    IF(  
        [DTI] <= 40,  
        "Medium",  
        "High"))

# Prepayment Risk Analysis of Mortgage Backed Securities

210K

Total Number of Loans

0.15

Prepayment Rate

19.48

Delinquency Rate

2

Average Months Delinquent

Total Number of Loans by CreditRange

Good

72K

Excellent

56K

Fair

54K

Poor

DTI(Group)

High

Low

Medium

LTV\_range

High

Low

Medium

Year

All

Month

All

Repay\_range

All

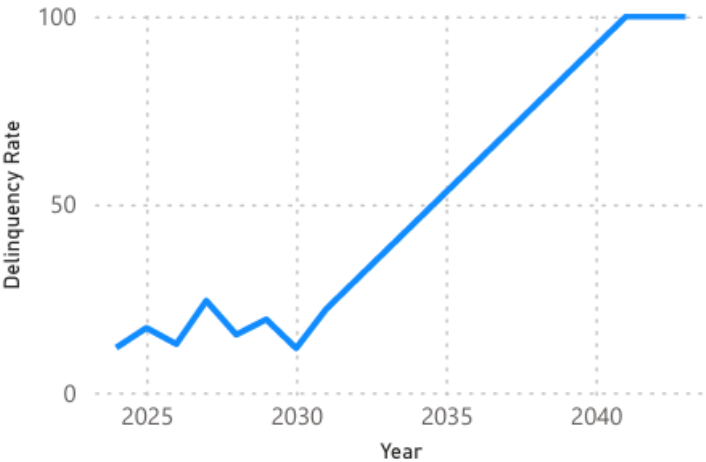
PropertyState

All

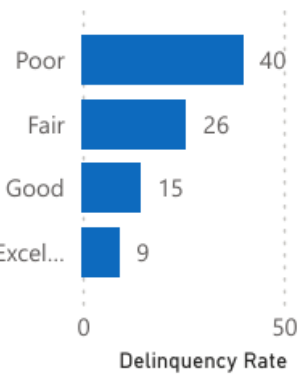
Prepayment Rate by PropertyState



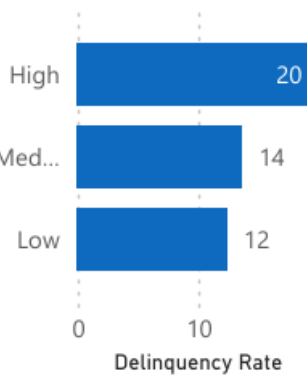
Delinquency Rate by Year



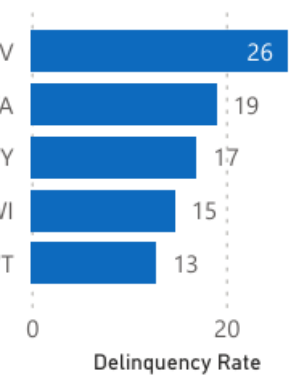
Delinquency Rate by CreditRange



Delinquency Rate by LTV\_range



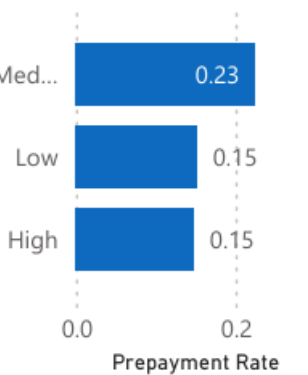
Delinquency Rate by PropertyState



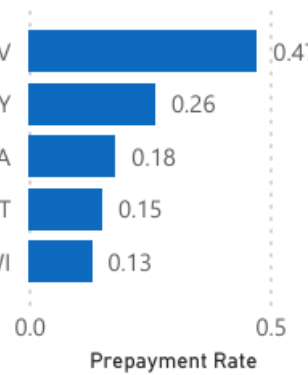
Prepayment Rate by CreditRange



Prepayment Rate by LTV\_range



Prepayment Rate by PropertyState



# Project Insights and Recommendations

- ❖ The Delinquency Rate data reveals significant fluctuations over the years, with extreme spikes in 2041 and 2043 at 100%. To mitigate prepayment risks, it's crucial to investigate these fluctuations and address underlying causes. Diversifying the loans and strengthening the risk management framework are also essential.
- ❖ The Prepayment Rate data reveals that borrowers with higher credit scores (Excellent: 0.20, Good: 0.16) have higher prepayment rates compared to those with lower scores (Fair: 0.11, Poor: 0.10). To mitigate prepayment risks, lenders should offer special loan features and incentives to keep high-credit-score borrowers. They can also use penalties for early payoffs, offer refinancing options, and use data to predict who might pay off early.

# Project Insights and Recommendations

- ❖ The bar chart between Delinquency Rate and LTV\_Range shows that as Loan-to-Value (LTV) ratios increases, delinquency rates also go up: 12.41% for low LTV, 13.65% for medium LTV, and 19.91% for high LTV. This suggests higher risk for borrowers with higher LTV ratios, possibly due to financial challenges or changes in property values. To reduce the risk of missed payments, lenders should carefully assess borrowers with high LTV ratios, offer flexible loan options, provide financial education, monitor loans closely, and adjust pricing strategies based on the level of risk. These steps can help maintain loan stability and lower delinquency rates.
- ❖ The bar chart between Prepayment Rate and LTV\_Range shows that borrowers with medium Loan-to-Value (LTV) ratios (25-50) are more likely to pay off their loans early compared to those with low ( $< 25$ ) or high (50-1000) ratios. To manage this prepayment risk, lenders should offer flexible loan options, consider penalties for early repayment, educate borrowers on financial planning, and monitor trends to adapt their strategies accordingly for each LTV range.

**Dashboard Link:** <https://app.powerbi.com/groups/me/reports/7659b691-7da1-4174-9382-8938de910278/ReportSection9e0343c25ec9e96adc2f?experience=power-bi>