

# Single Family Mortgage Prepayments

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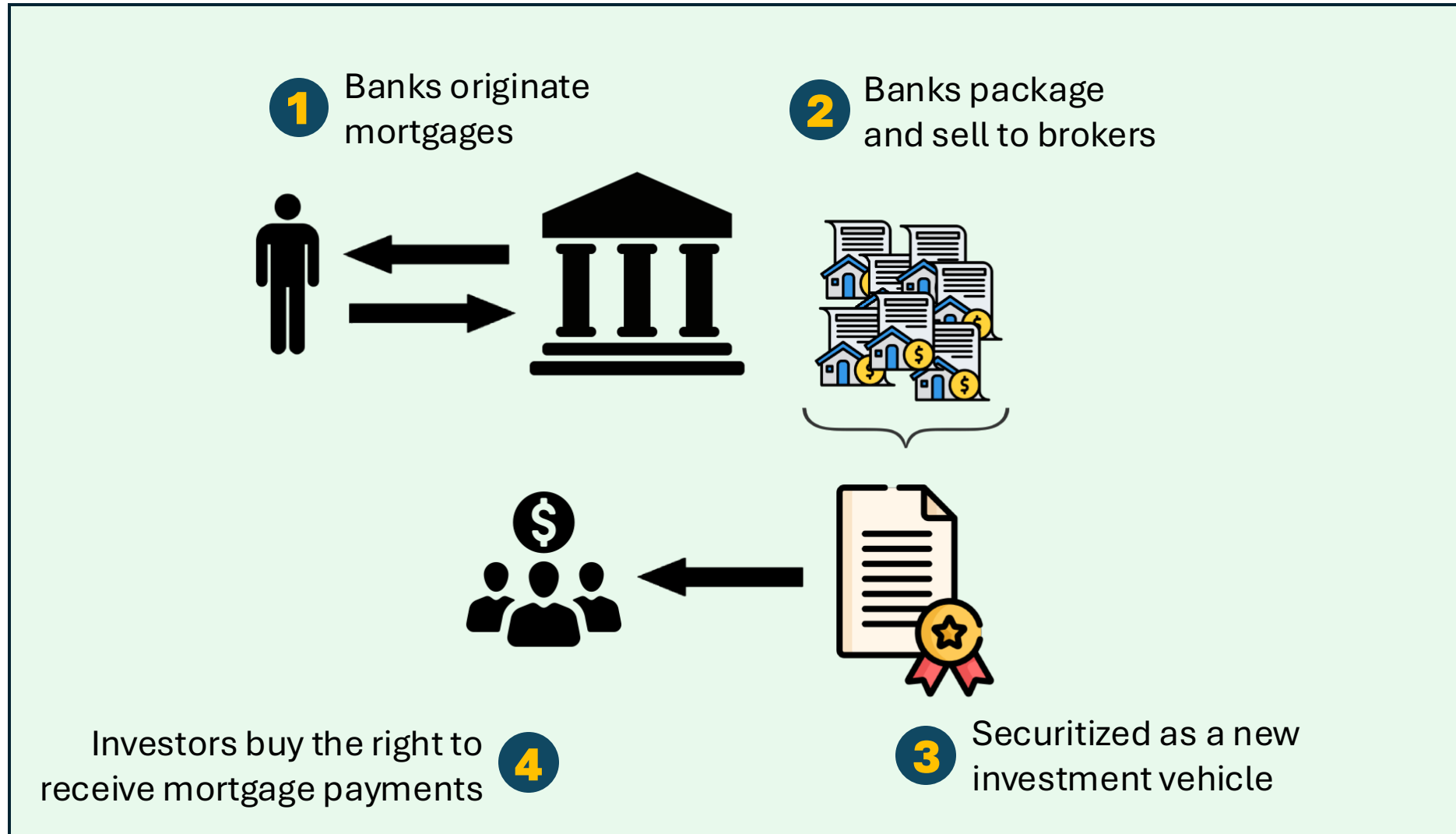


The College of William & Mary  
BUAD-492 Finance and Data Analytics  
Professor Brett Hammond  
November 2, 2024

# Outline

- Mortgaged-Backed Basics
  - Securitization
  - Timing of Cash Flows
  - Premiums
- Data Sources
- Geographic Trends
- Statistical Analysis
- Time Trends
- Refinancing and Coupon Rates
- Investment Strategy

## Securitization turns mortgages into investment vehicles



## 1. MBS Basics

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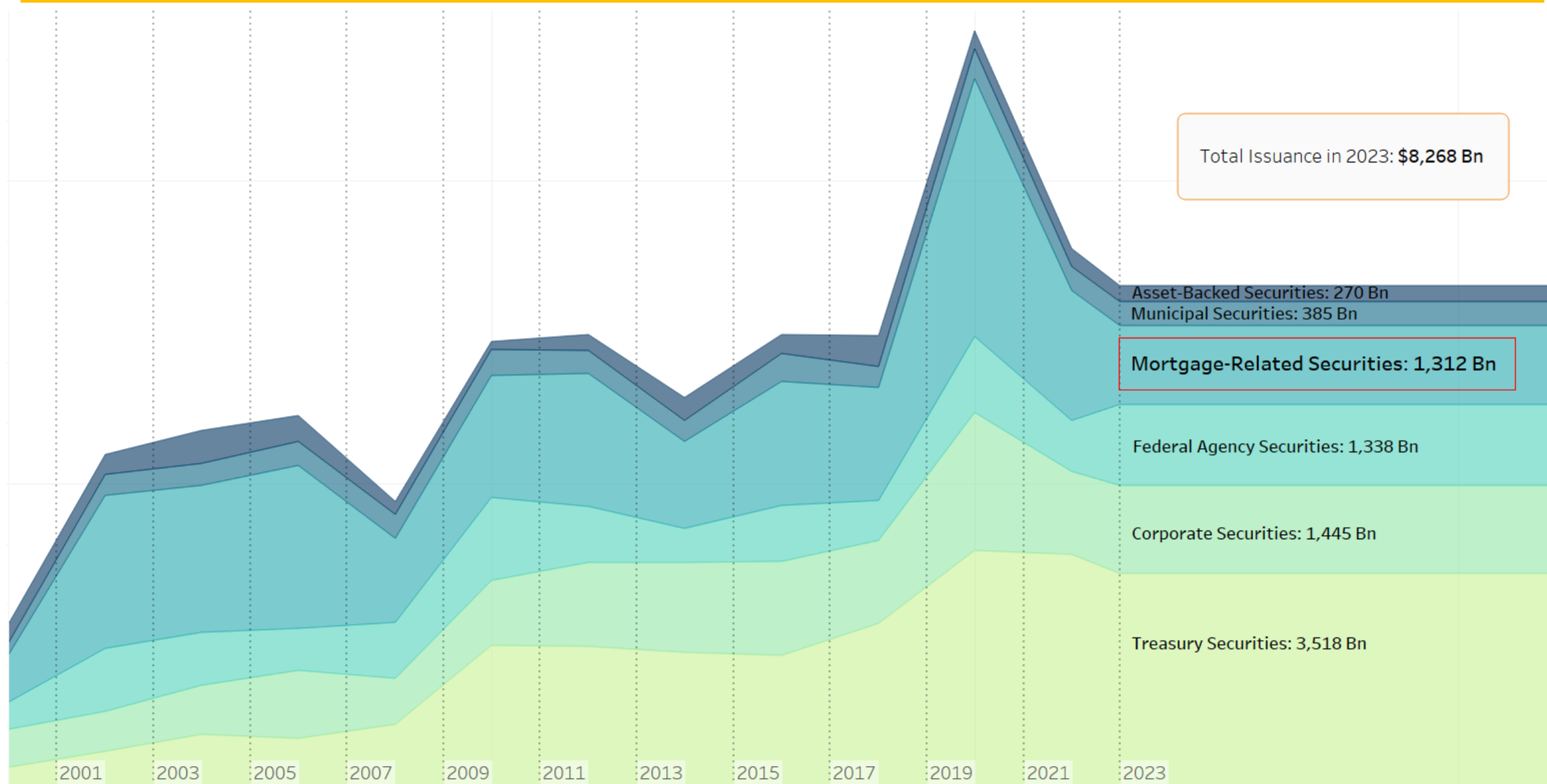
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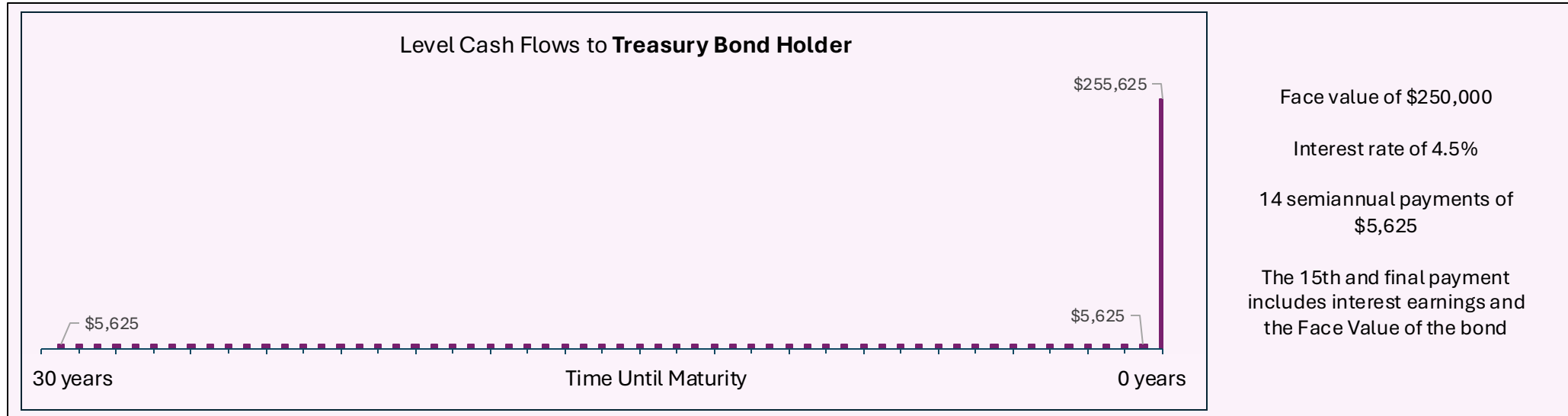
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Mortgage markets are among the deepest and most liquid



## The timing of cash flows for mortgages is unique in fixed income



## The timing of cash flows for mortgages is unique in fixed income

### Level Cash Flows to **Treasury Bond Holder**



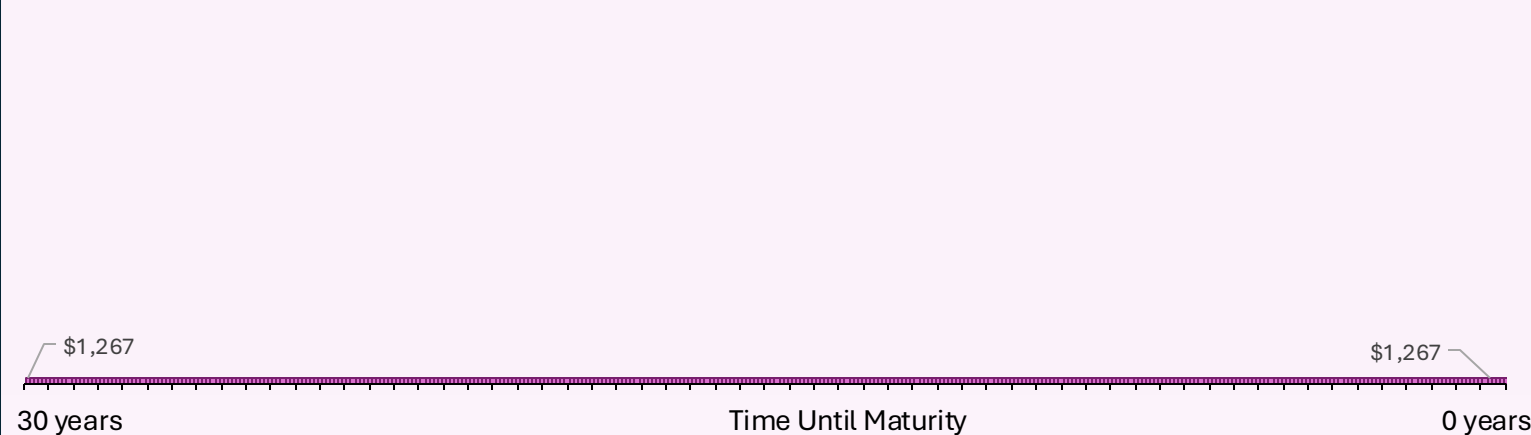
Face value of \$250,000

Interest rate of 4.5%

14 semiannual payments of  
\$5,625

The 15th and final payment  
includes interest earnings and  
the Face Value of the bond

### Level Cash Flows to **Mortgage Holder**

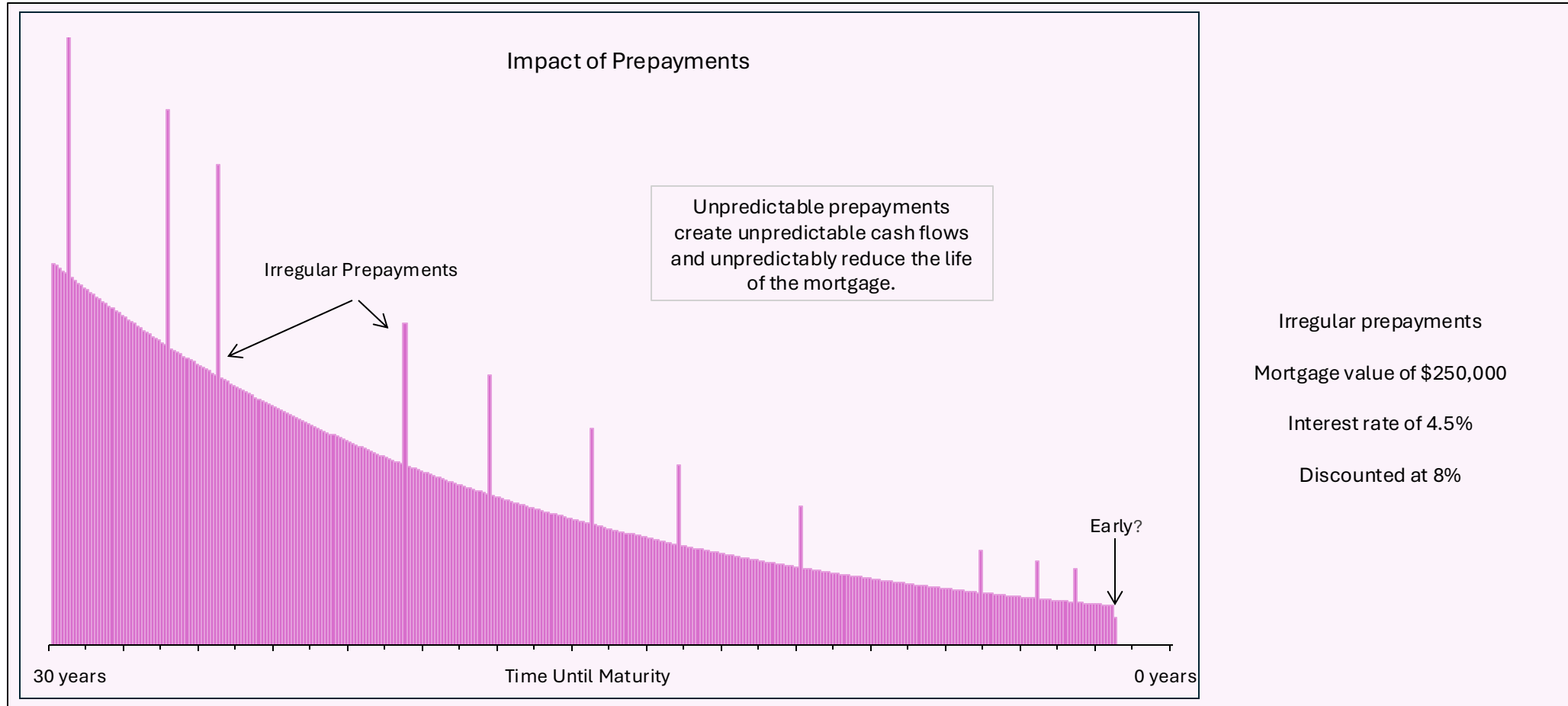


Mortgage value of \$250,000

Interest rate of 4.5%

360 monthly payments of  
\$1,267

## Prepayments make duration unpredictable



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2. Premiums

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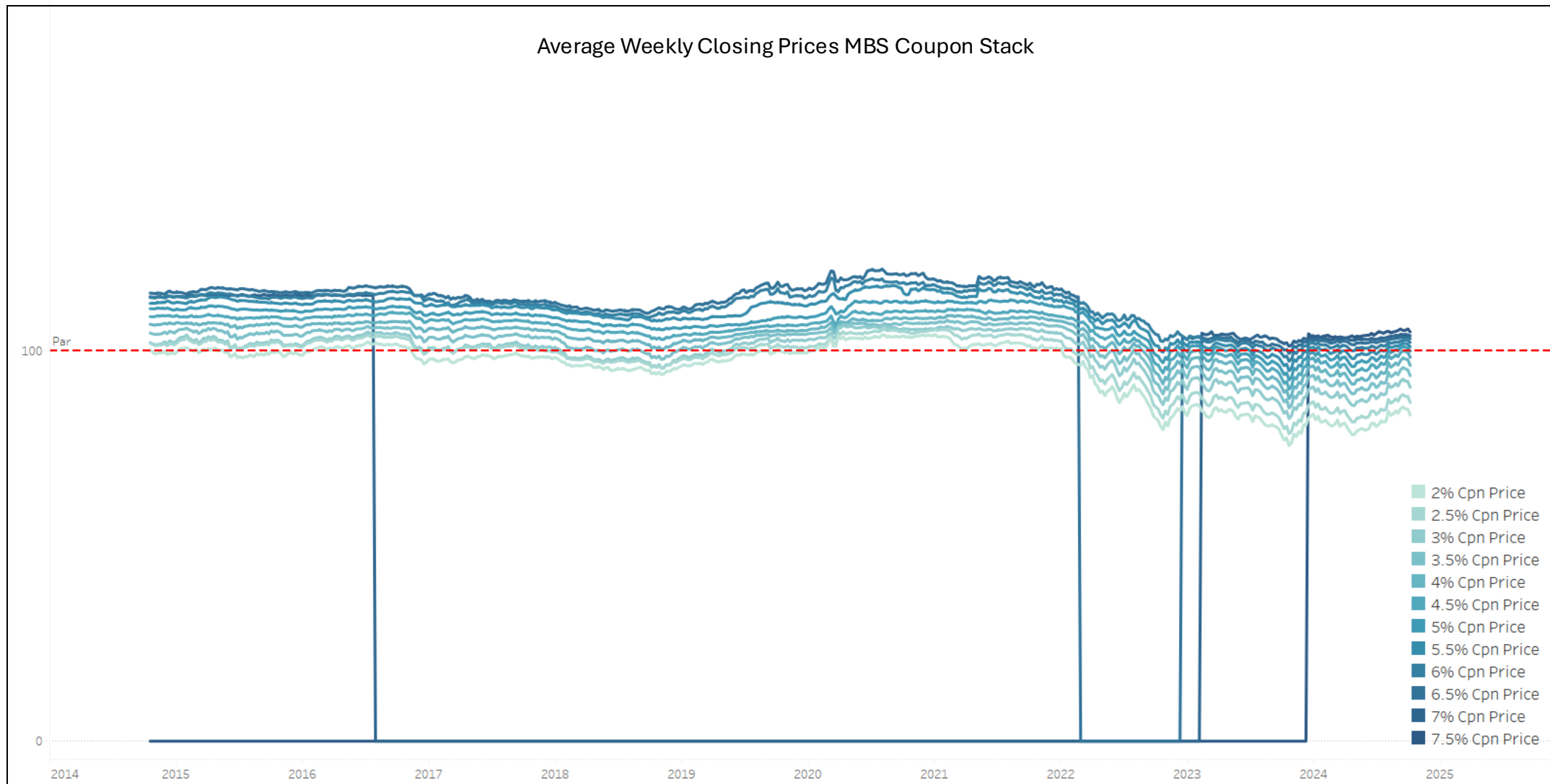
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Investors pay a premium for many mortgage securities





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## 2. Premiums

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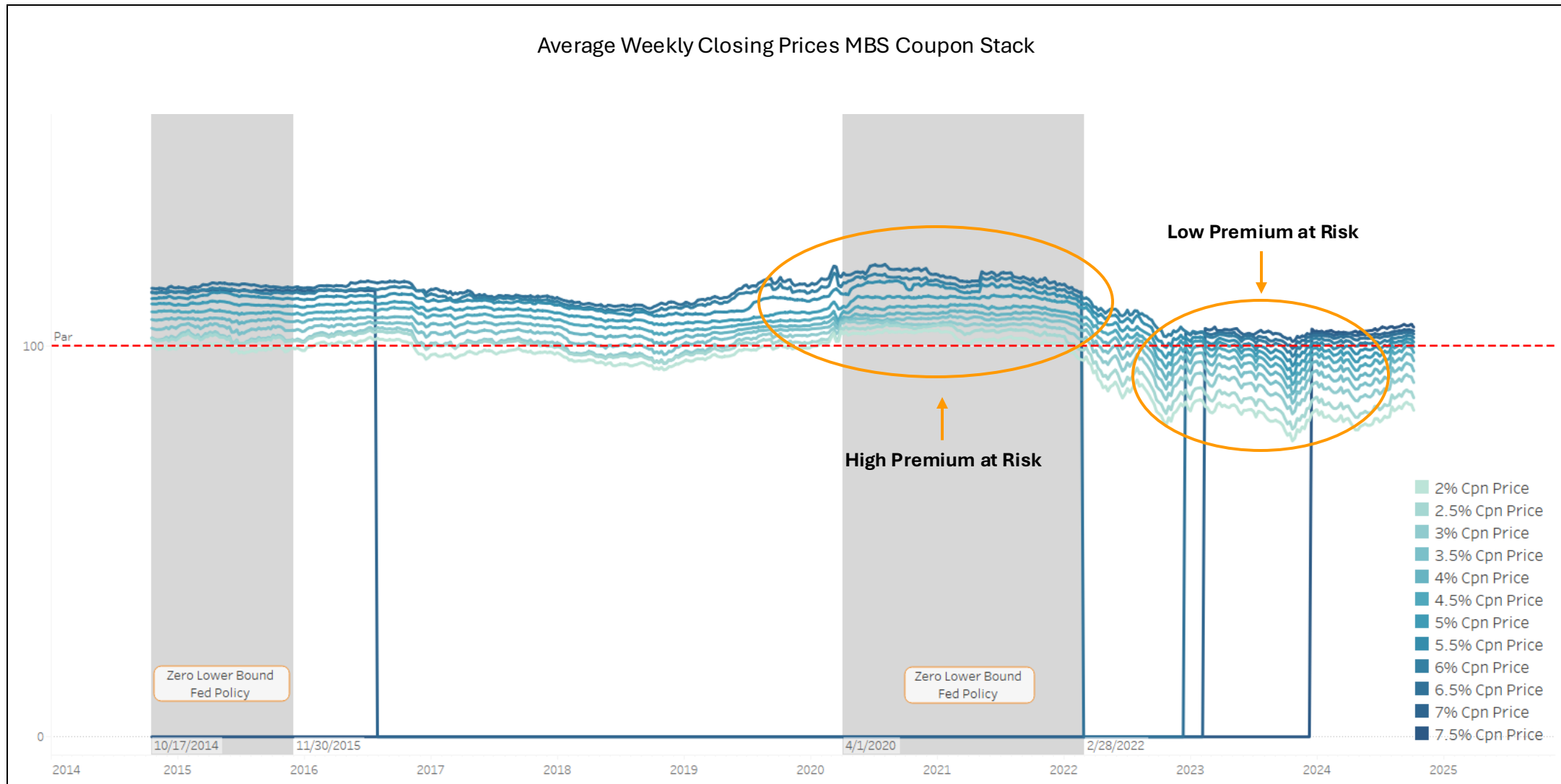
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Premiums are highest when interest rates are low



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## 2. Premiums

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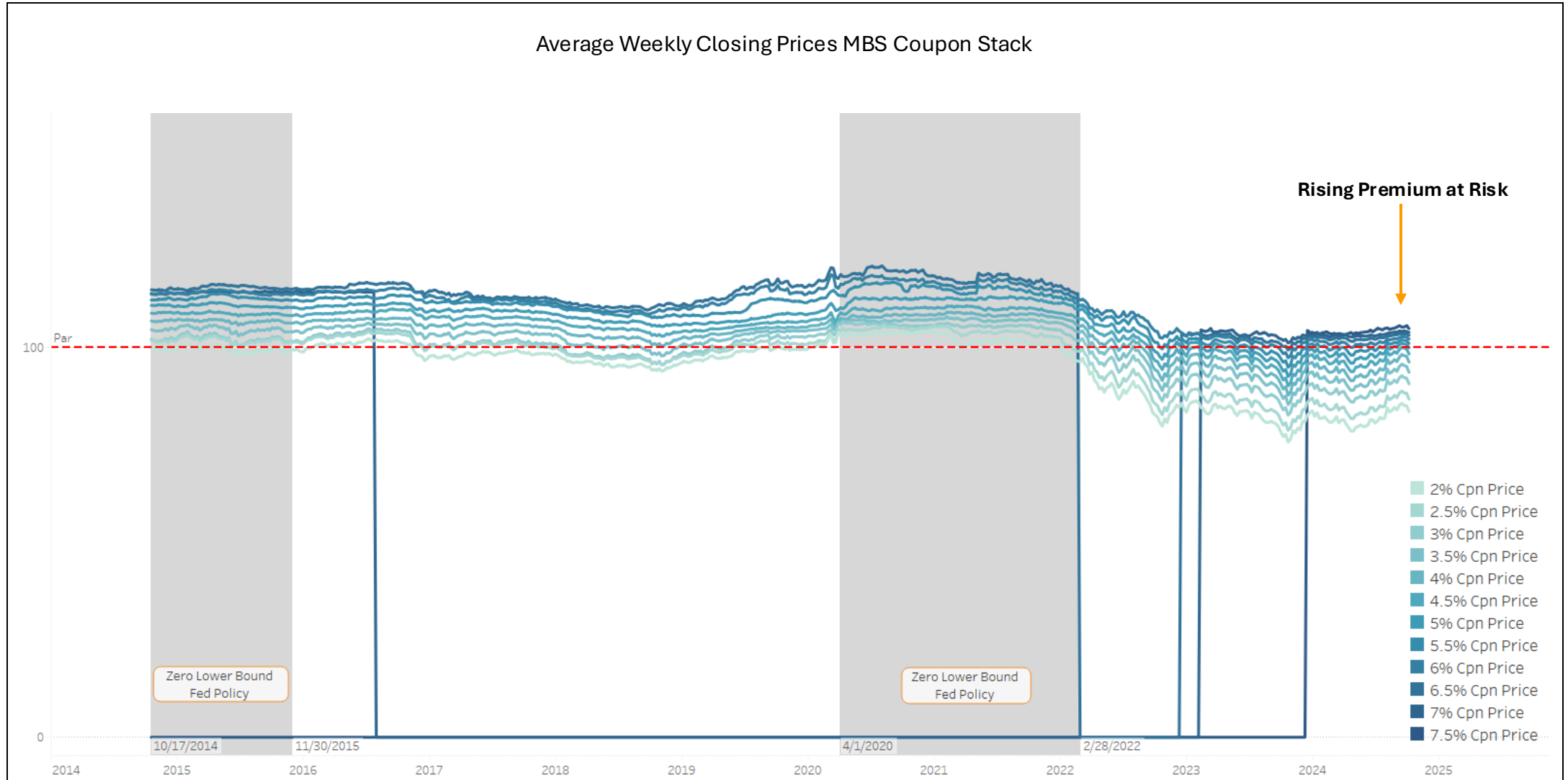
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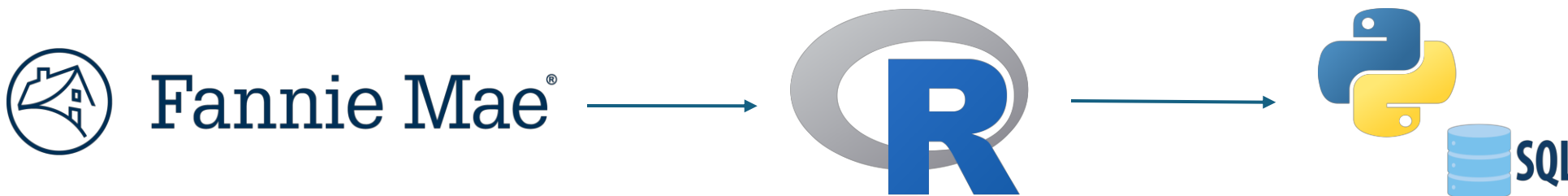
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Lately, premiums are on the rise

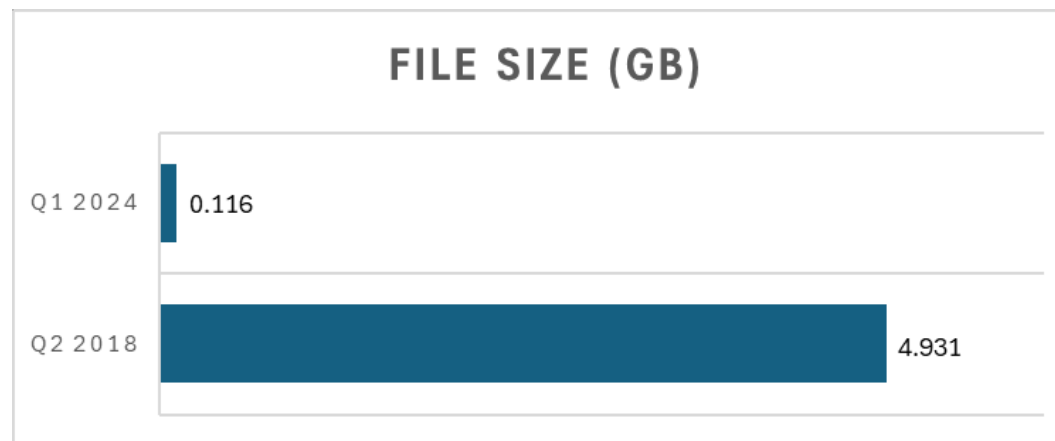


Millions of loans makes analysis difficult



loan id	credit score	DTI	LTV	rate	borrowers	state	msa	original value	zero-balance flag
1	754	49	70	6.5	2	PA	29540	500000	0
2	731	48	80	7.3	1	OH	18140	400000	1
3	689	20	95	5.9	2	TN	16860	300000	0

**6,550,191 loans**  
**110 variables**  
**monthly data**



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4. Geographical trends

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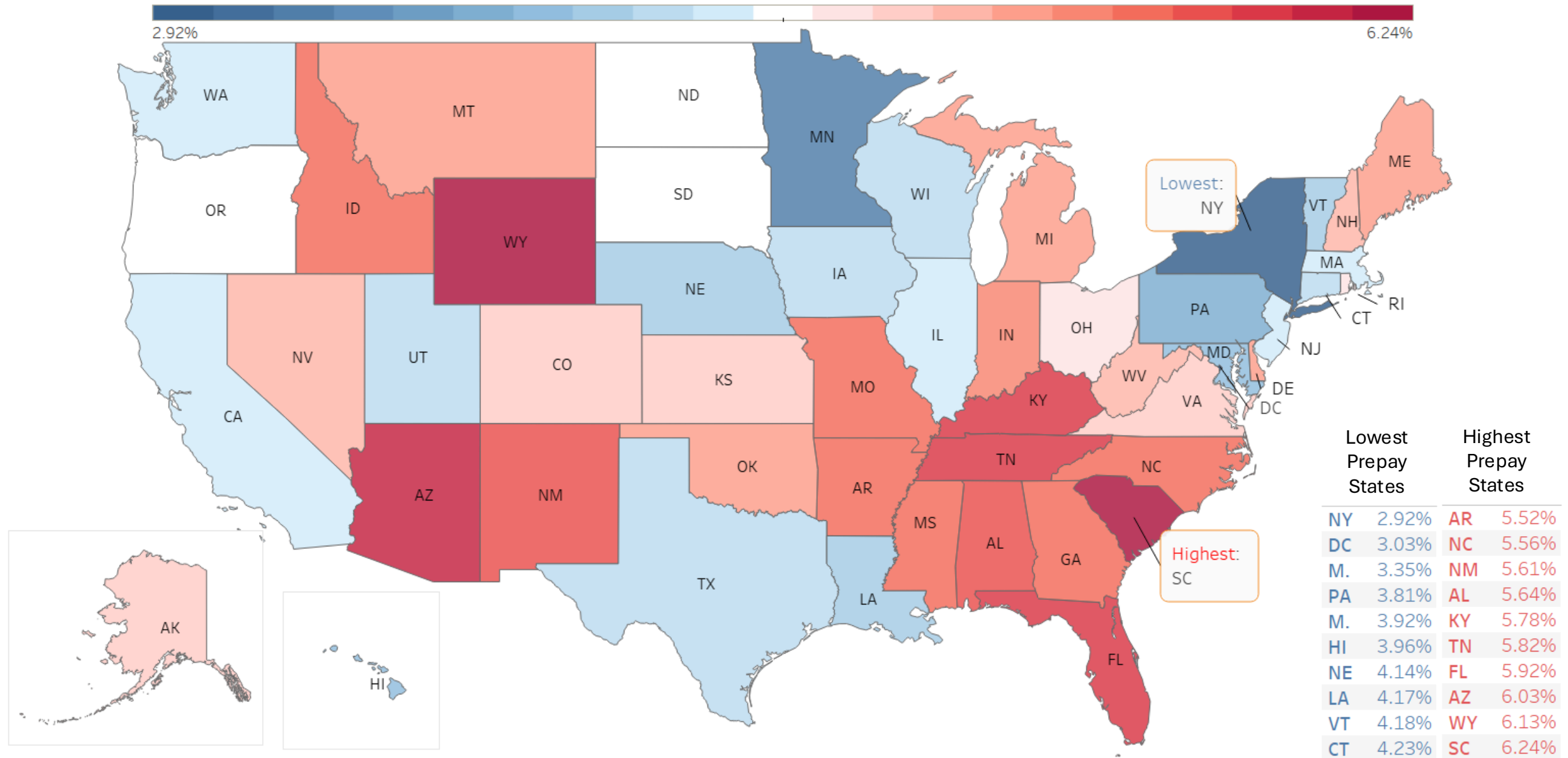
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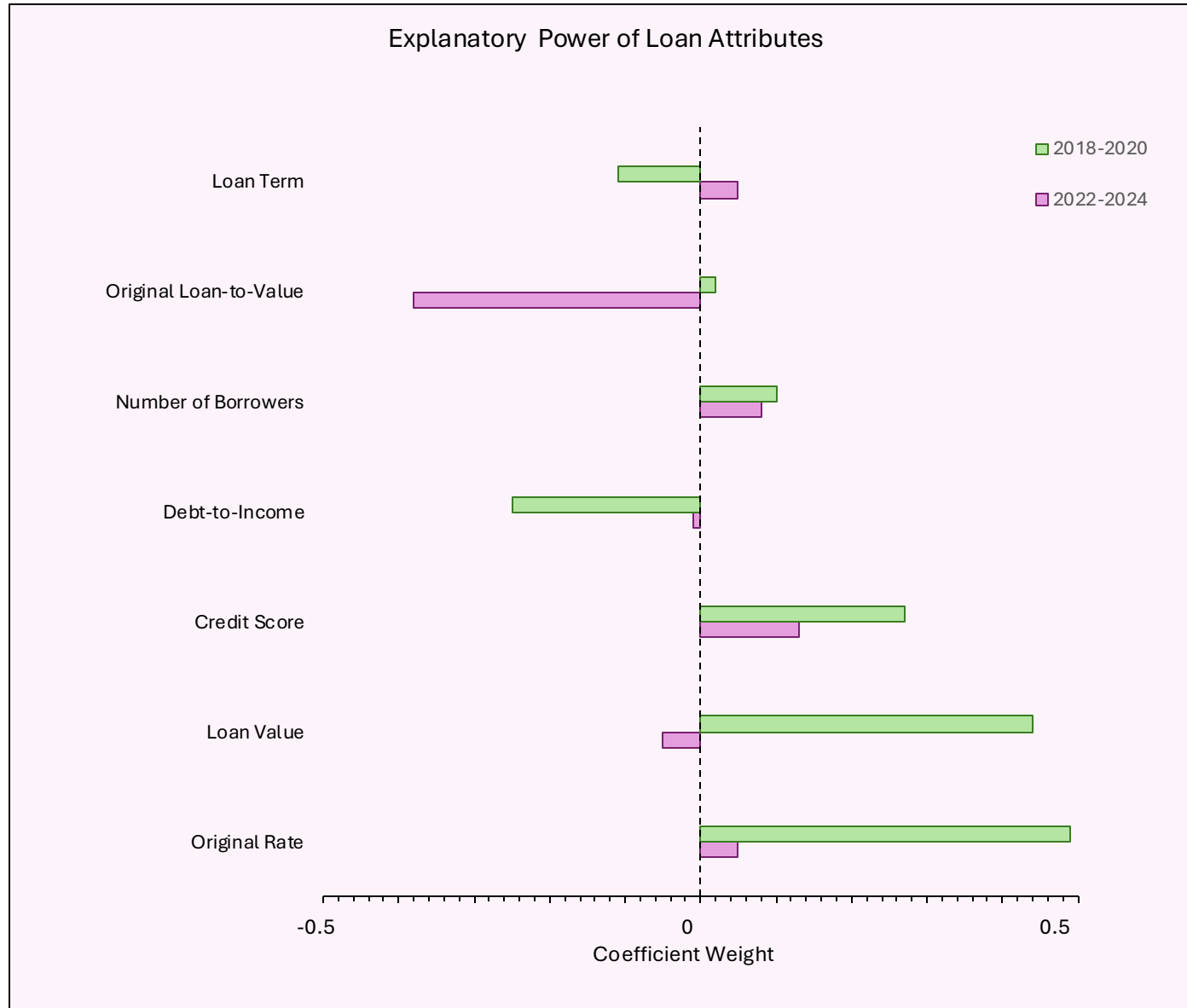
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## State policy and borrower behavior impacts prepayment rates





## The factors that influence prepayment rates change over time



Standard scaled, logistic regression classifies loans as prepaid or not

Classification accuracy 0.86, 0.94

Coefficients describe the magnitude and direction of effect

Answers the question of **what factors influence prepayments**

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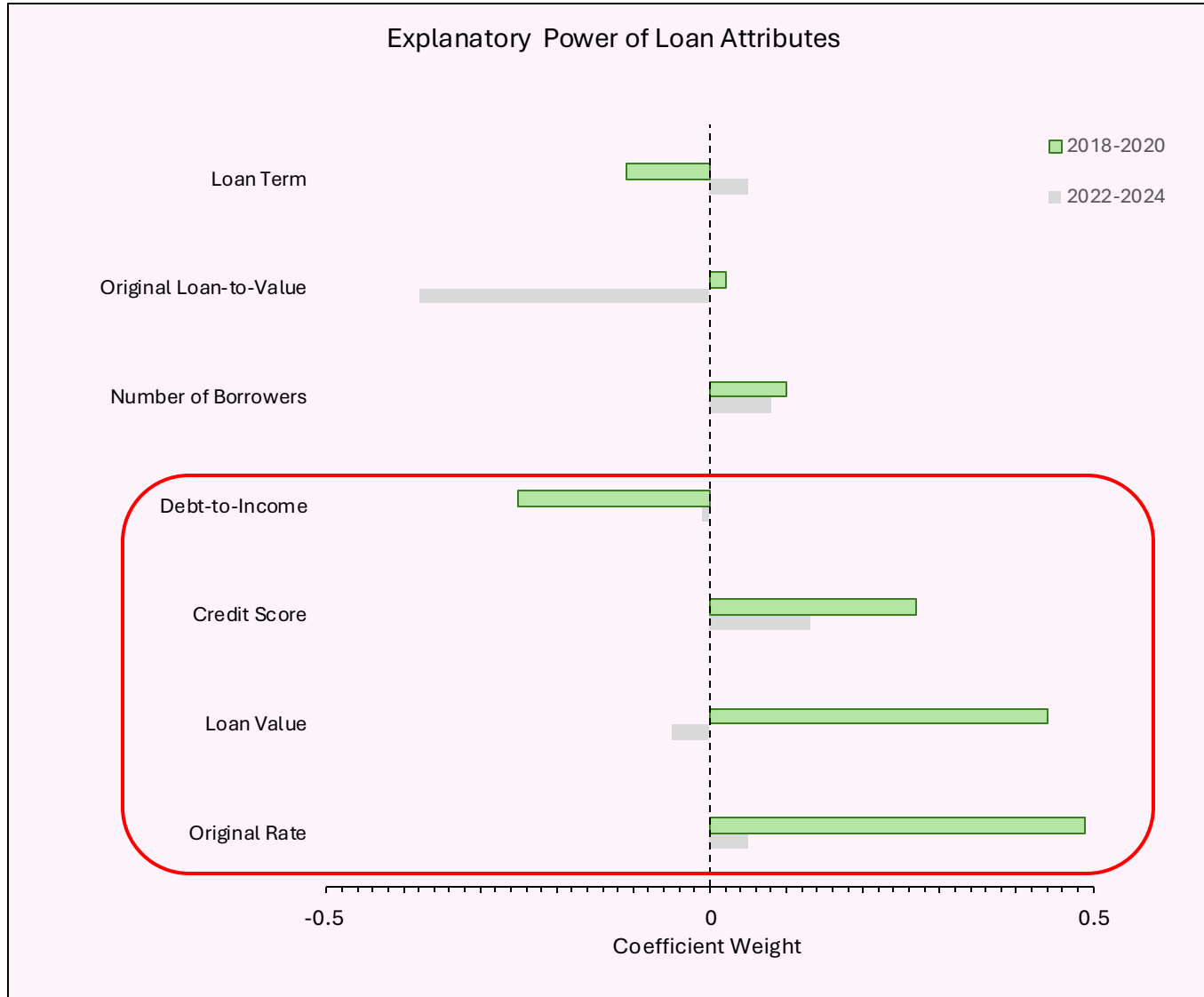
5. Statistical Analysis

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## The factors that influence prepayment rates change over time



In 2018-2020, higher interest rates, loan values, and credit scores prompt **higher** prepayment rates

Higher debt to income prompts **lower** prepayment rates

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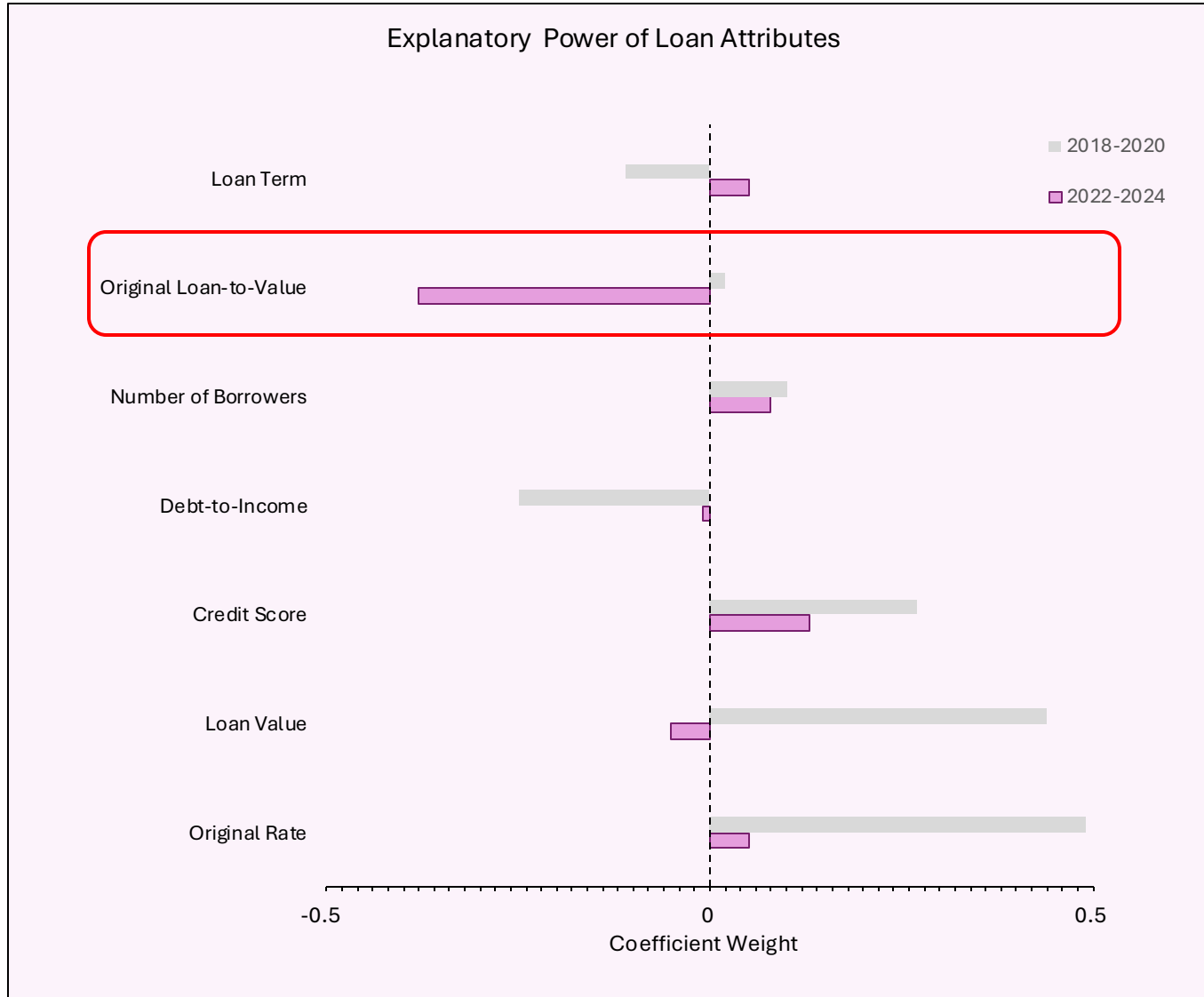
5. Statistical Analysis

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## The factors that influence prepayment rates change over time



In 2022-2024, the most significant factor by far is the Loan-to-Value ratio

Higher Loan-to-Values prompt **lower** prepayment rates



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6. Trends Over Time

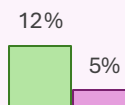
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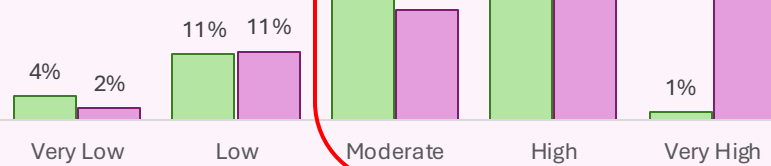
Prepayment rates have declined significantly post COVID-19

Prepayments by **Loan Attributes** Over Time

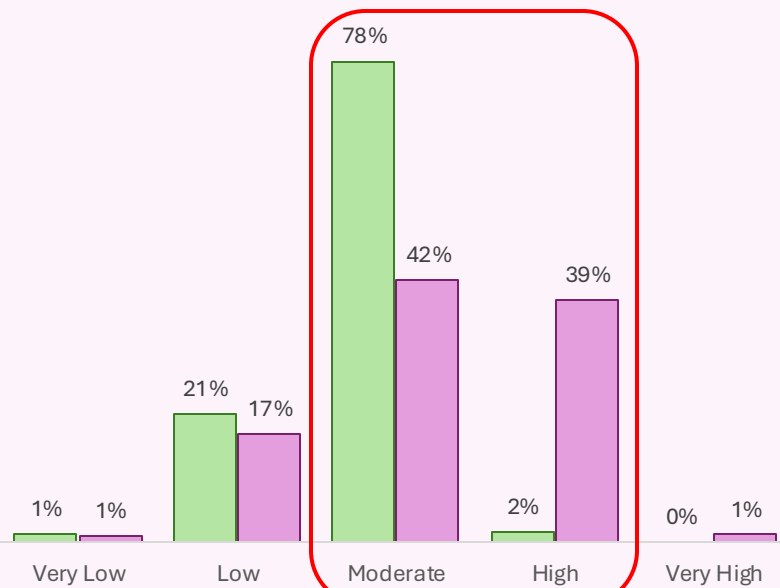
Overall  
Prepayment Rate



Loan-to-Value Ratio



Mortgage Rate



■ 2018-2020 ■ 2022-2024

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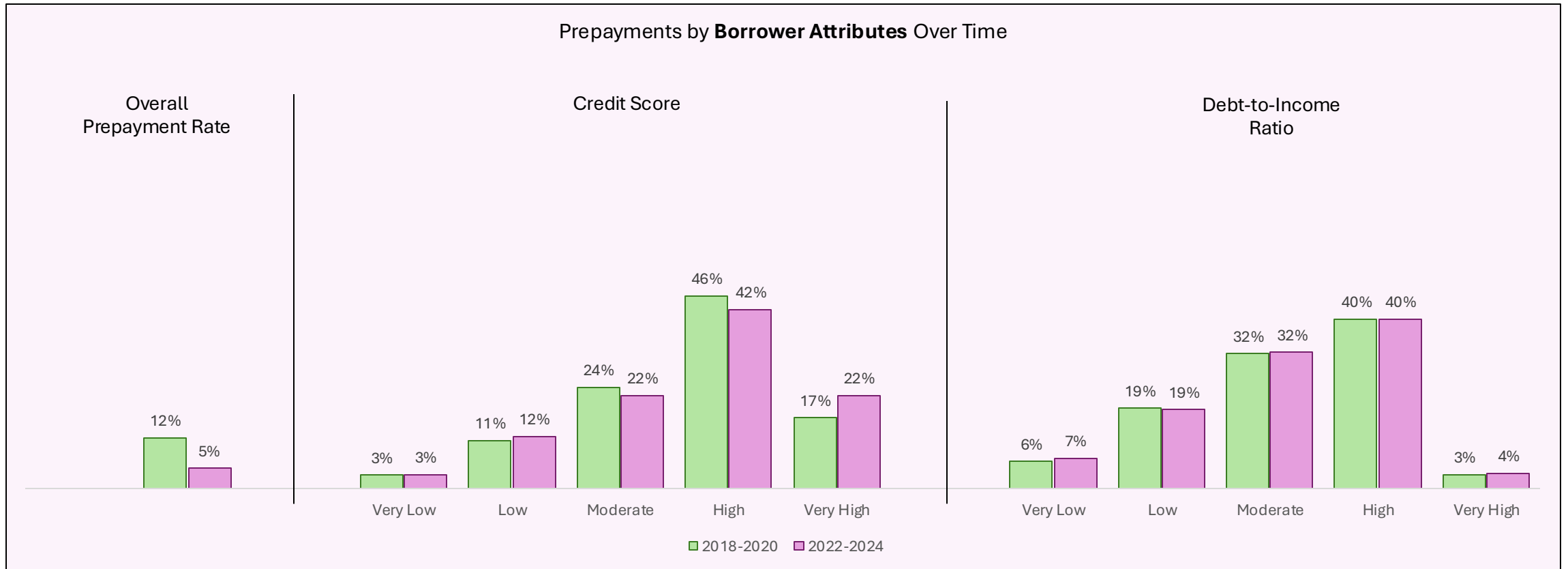
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6. Trends Over Time

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Prepayment rates have declined significantly post COVID-19



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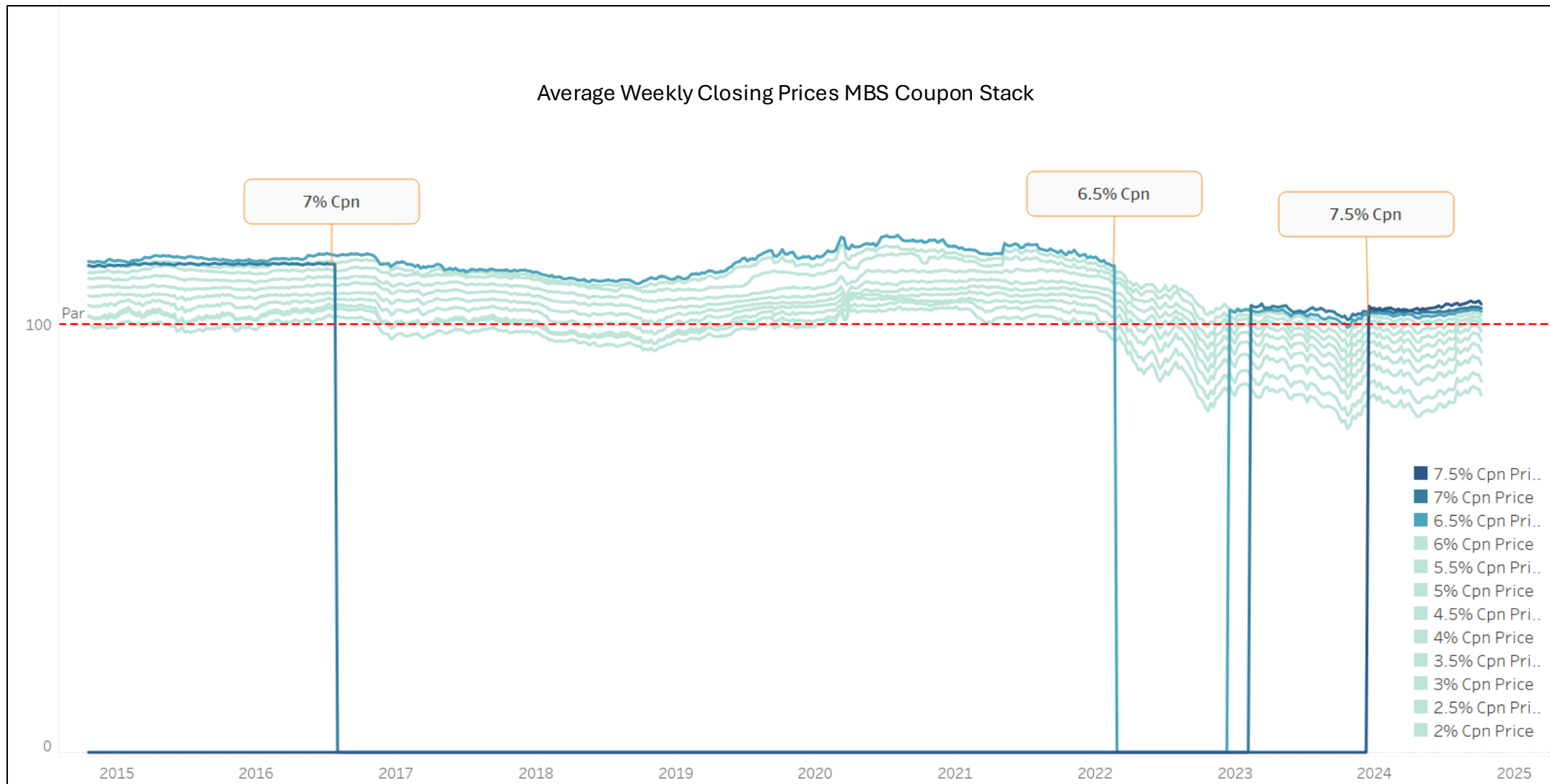
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7. Refinancing

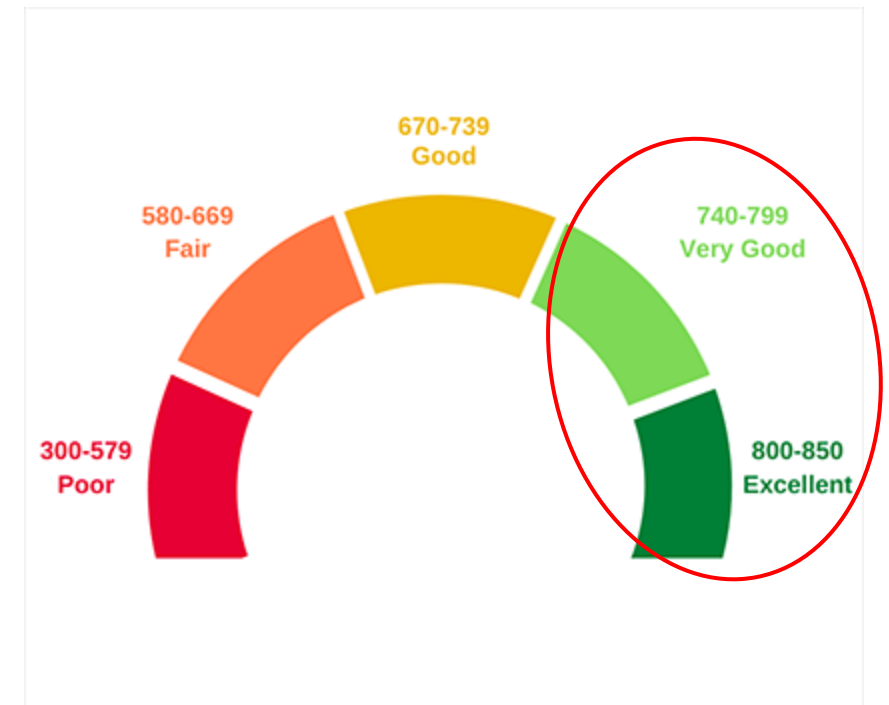
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Refinancing is a good reason to avoid higher coupon securities



The "best" mortgage-backed security as defined by our model should be three things:

≤ 6%



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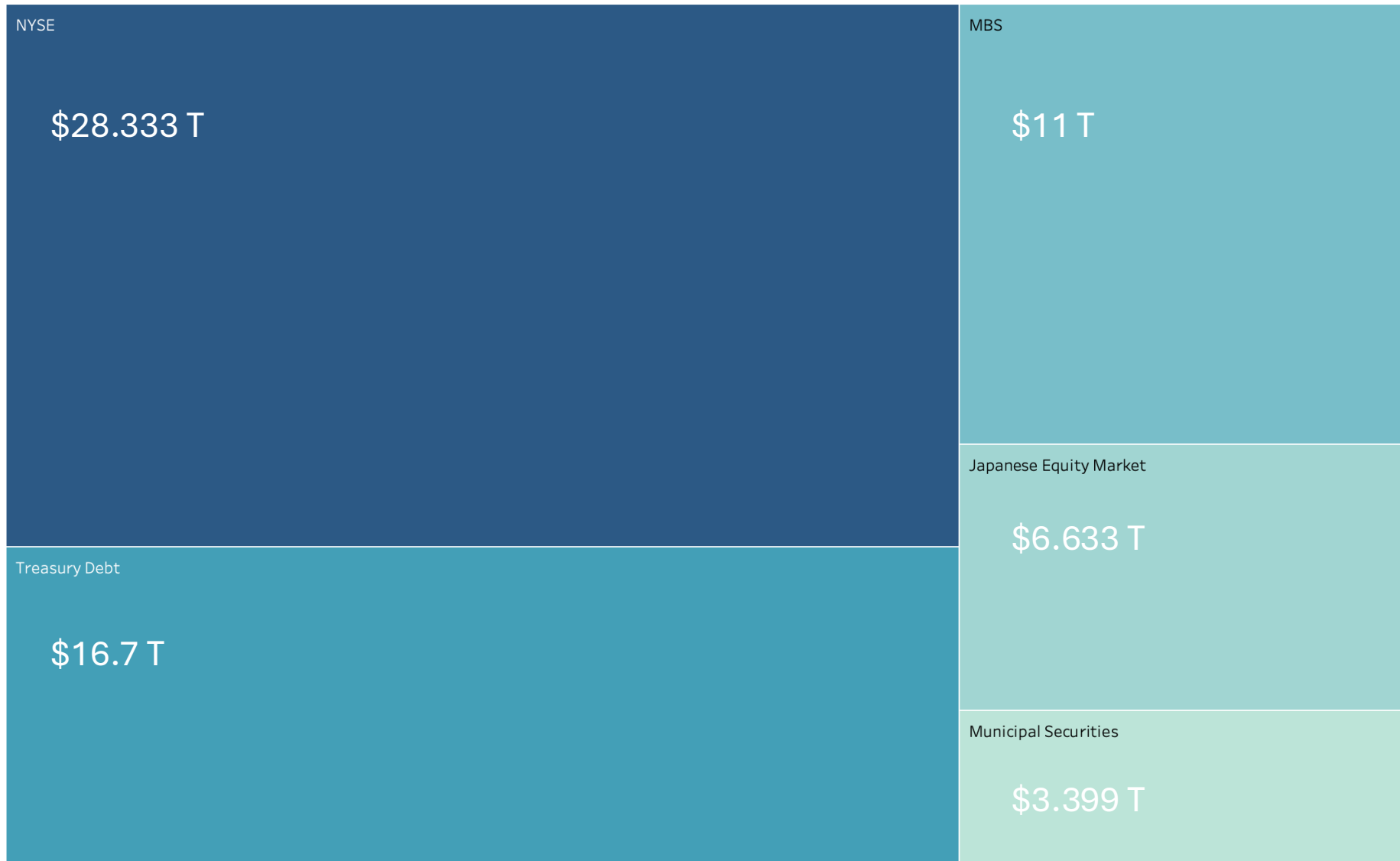
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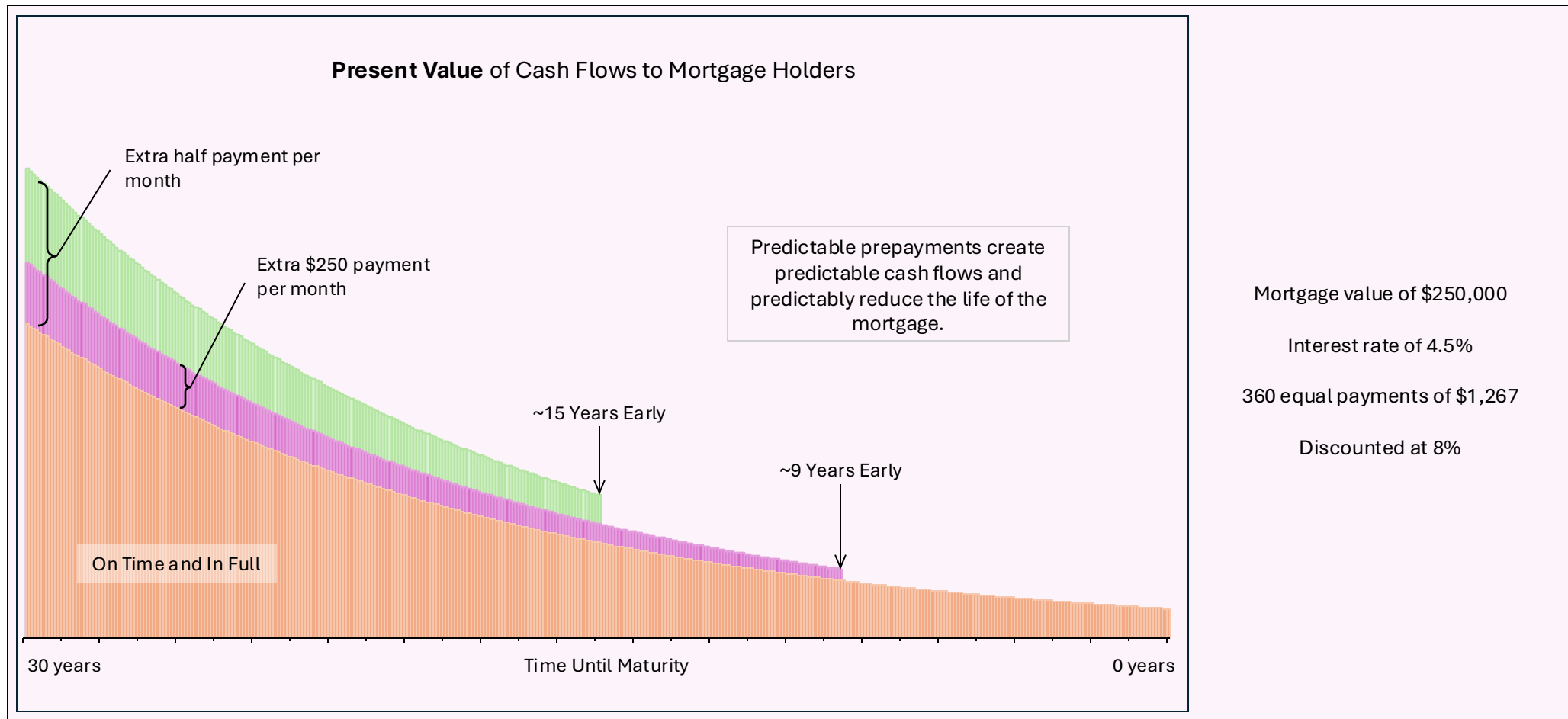
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Appendix

## Mortgage markets in context

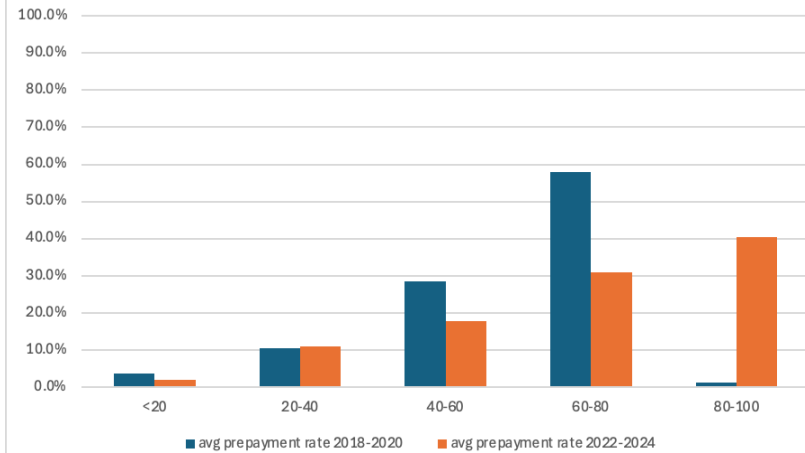


## Prepayments shorten the life of the mortgage

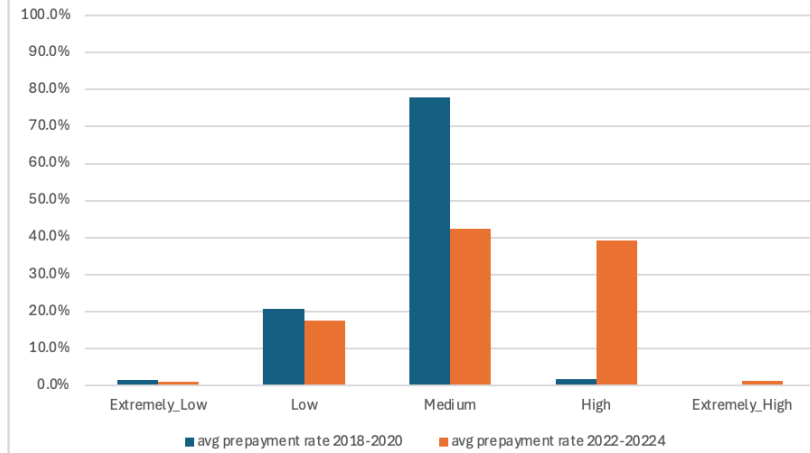


## Changes in Variables Over Time

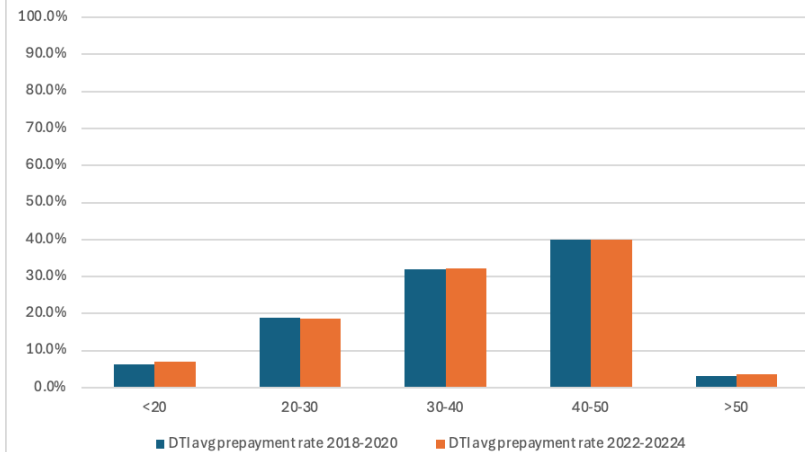
### Prepayment Rate by Original LTV



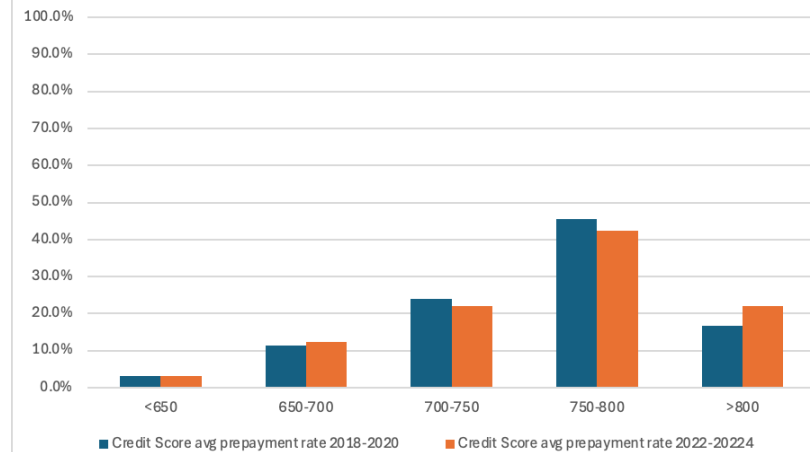
### Prepayment Rate by Original Rate of Loan



### Prepayment Rate by Debt to Income

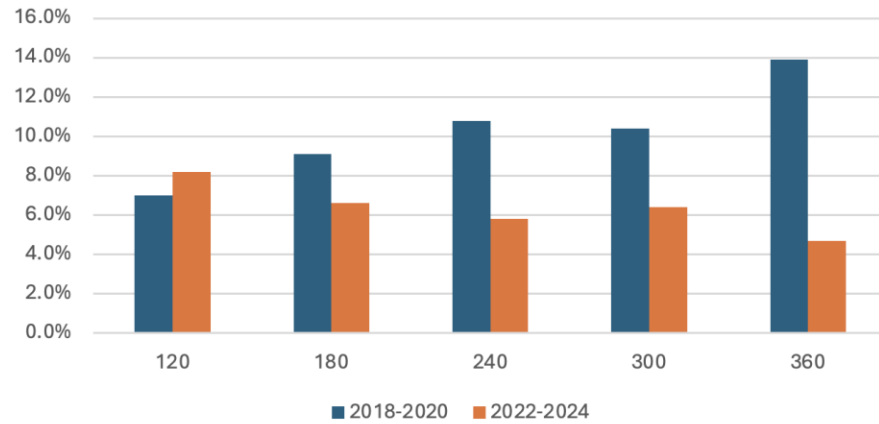


### Prepayment Rate by Credit Score

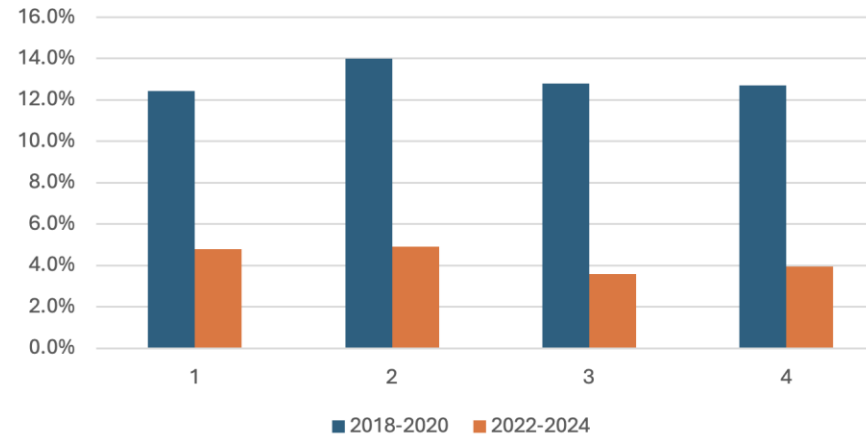


## Changes in Variables Over Time

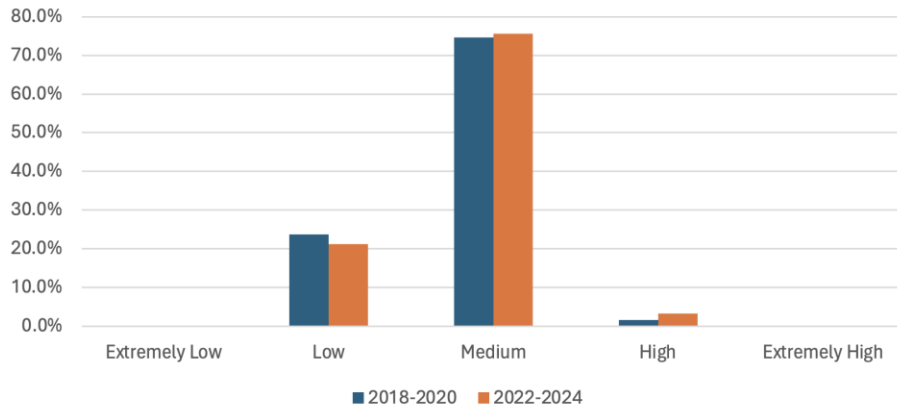
### Prepayment Rate by Loan Term (months)



### Prepayment Rate by Number of Borrower



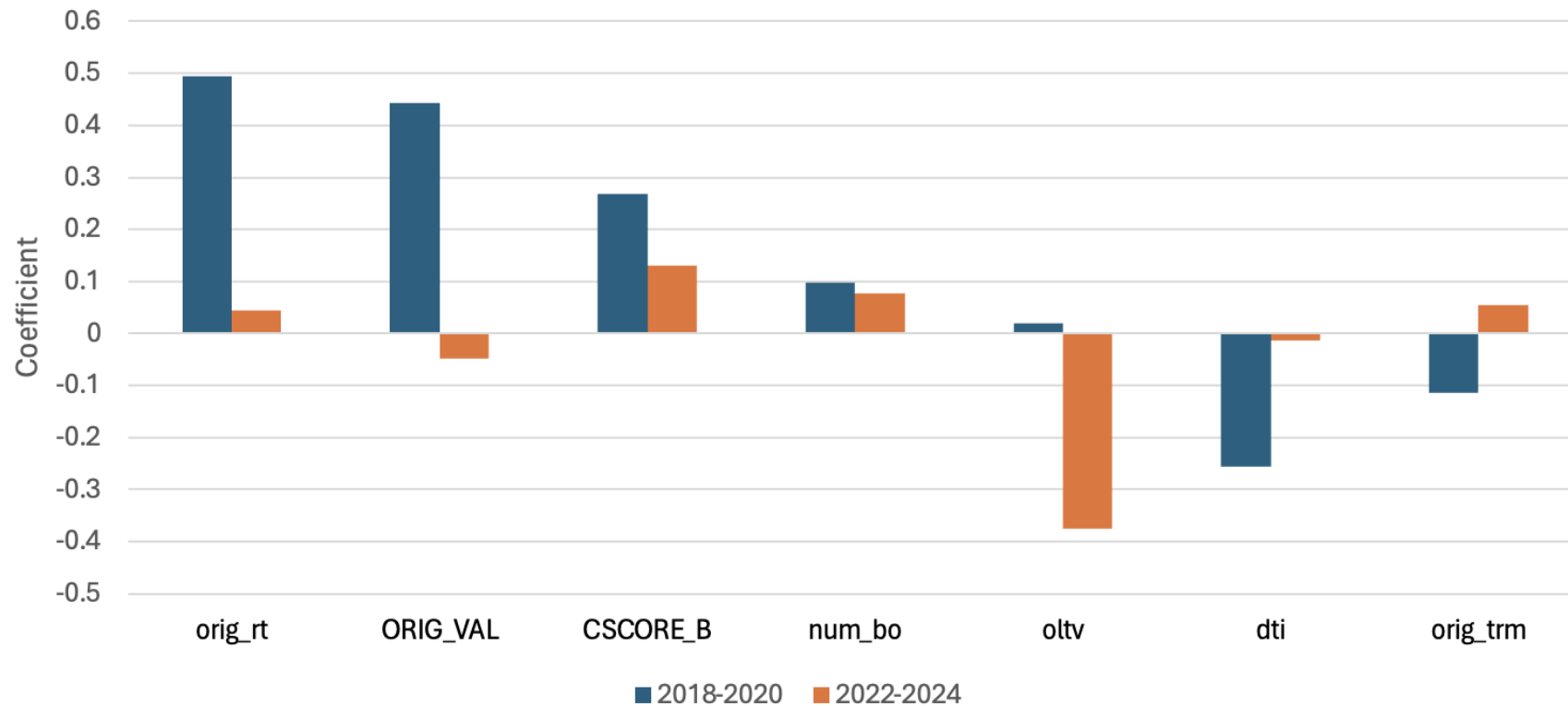
### Prepayment Rate by Original Value of the Property





## What Factors Influence Prepayment Rates?

### Importance of X-Variables in Explaining Prepayment Behavior

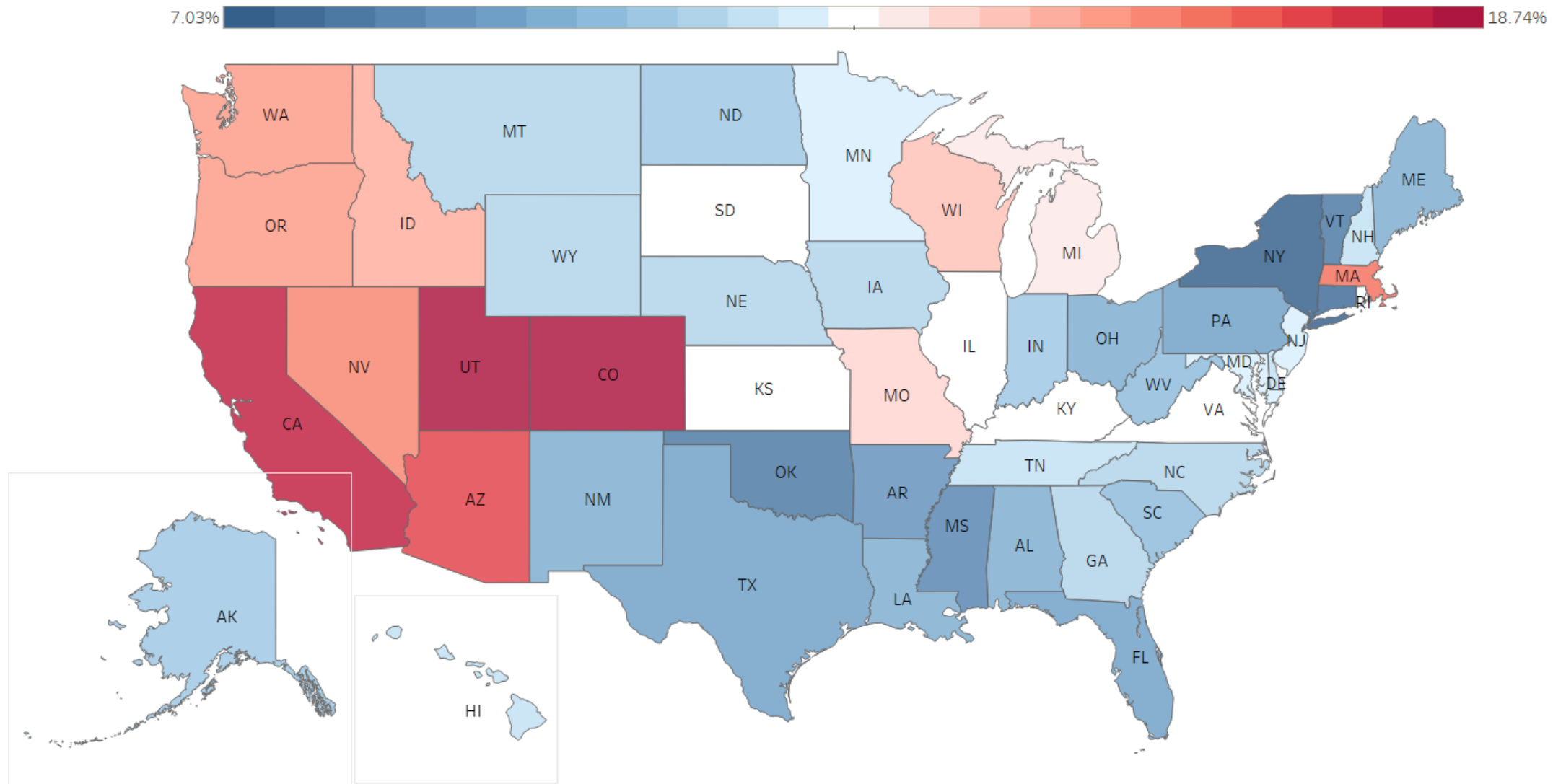


orig_rt:	Original Loan Interest Rate
ORIG_VAL:	Original Value of the Property
CSCORE_B:	Borrower Credit Score
num_bo:	Number of Borrower
orig_trm:	Original Loan Term
dti:	Debt to Income Ratio
oltv:	Original Loan to Value Ratio

Absolute value tells the magnitude of importance;

Sign (direction) tells whether positive or negative influence on prepayment behavior.

## State Prepayment Rates 2018-2020



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## 4. Geographic Trends

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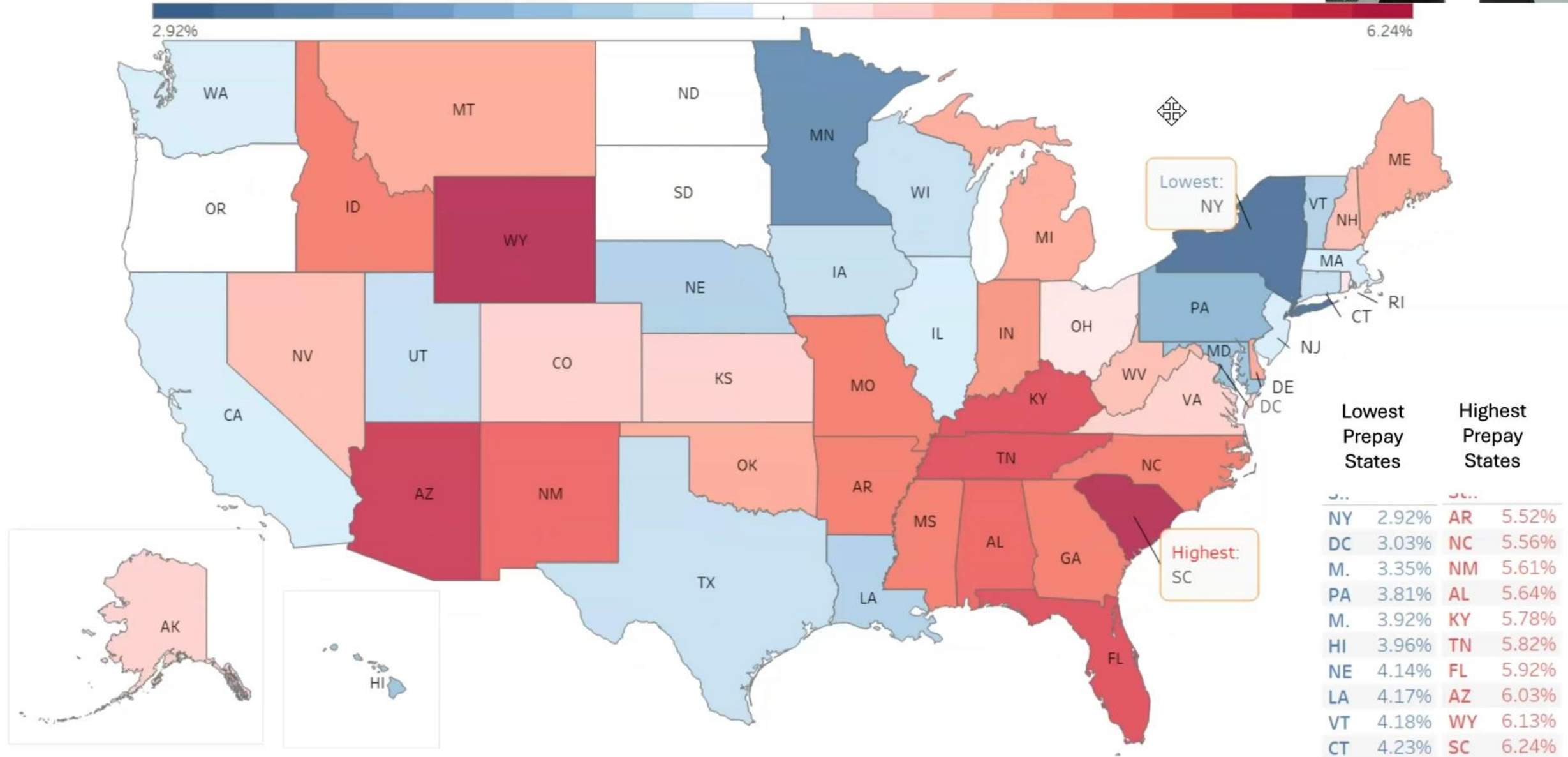
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State policy and borrower behavior impacts prepayment rates

Timothy Ieh



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2. Premiums

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## Contextualizing the changes in premiums over time

