Results Appendix

I. Preprocessing Figures

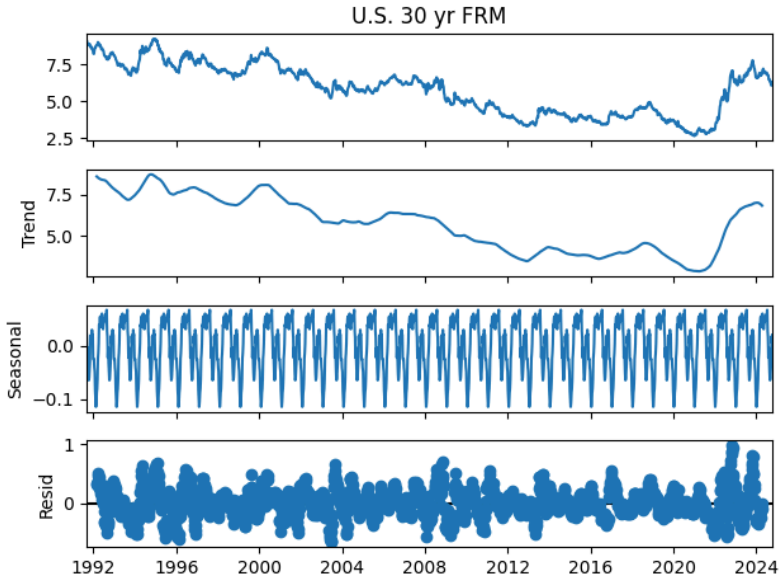

Figure 1. Seasonal Decomposition of 30-yr FRM

The graph shows the seasonal decomposition of the 30-year FRM data. The observed series indicates a long-term decline from 1992 to around 2020, followed by a sharp rise until 2024. The trend component highlights this overall pattern, while the seasonal component shows consistent yearly fluctuations, confirming the presence of seasonality in the data. Since the data exhibits clear seasonality, a SARIMA model is appropriate moving forward to capture both the trend and seasonal patterns for more accurate forecasting.

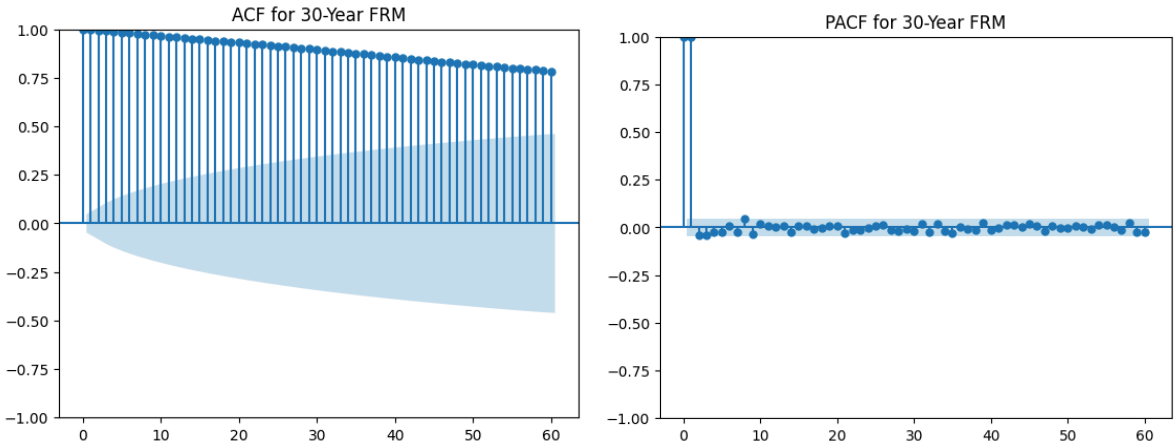

Figure 2. ACF and PACF Plots for 30-yr FRM

Based on the ACF and PACF plots, the suggested SARIMA model parameters for forecasting the 30-year fixed mortgage rates are as follows. For the non-seasonal components (p, d, q), the PACF plot shows

significant spikes at lags 1 and 2, indicating that the autoregressive term should be p=2. The data is non-stationary, so d=1 is applied for first-order differencing, and the slow decay in the ACF plot suggests that the moving average term should be q=1. For the seasonal components, P=1, D=1, and Q=1 are chosen to account for yearly seasonal patterns, even though there is no clear seasonal spike at lag 52, a common starting point for yearly data. The seasonal period is set to m=52, reflecting 52 weeks in a year.

II. SARIMA Forecasting Figures

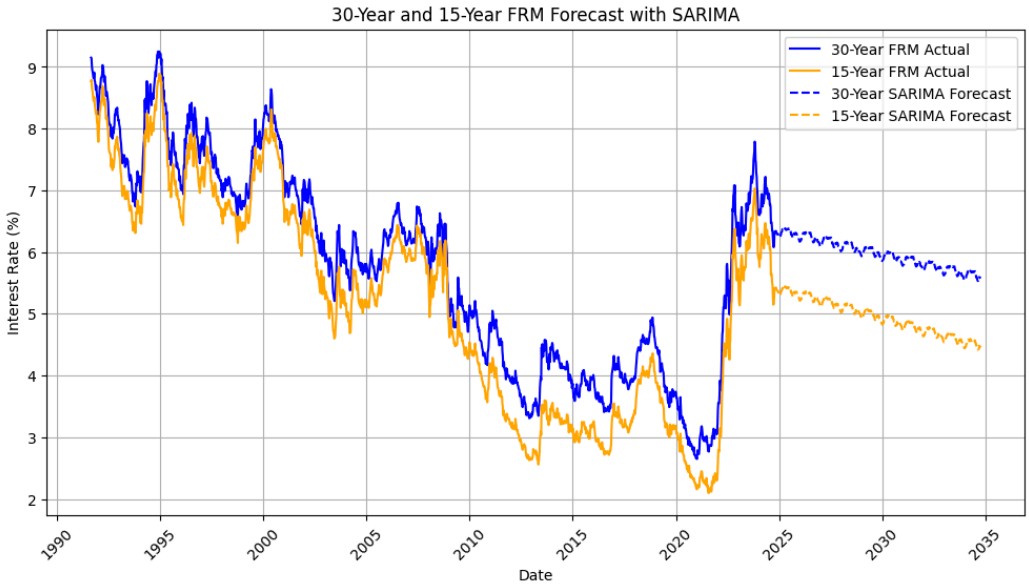

Figure 3. 30-yr and 15-yr FRM 10 year Forecast

The graph shows the historical and SARIMA forecast for both the 30-year and 15-year FRM. The actual data shows a long-term decline in rates, followed by a sharp rise after 2020. The SARIMA model predicts a gradual decline in rates over the next decade for both mortgage types, with slight seasonal fluctuations. The forecast suggests that while seasonal variations will continue, mortgage rates are expected to decrease but not return to pre-2020 lows. The patterns in the forecasts reflect the seasonality captured by the SARIMA model.

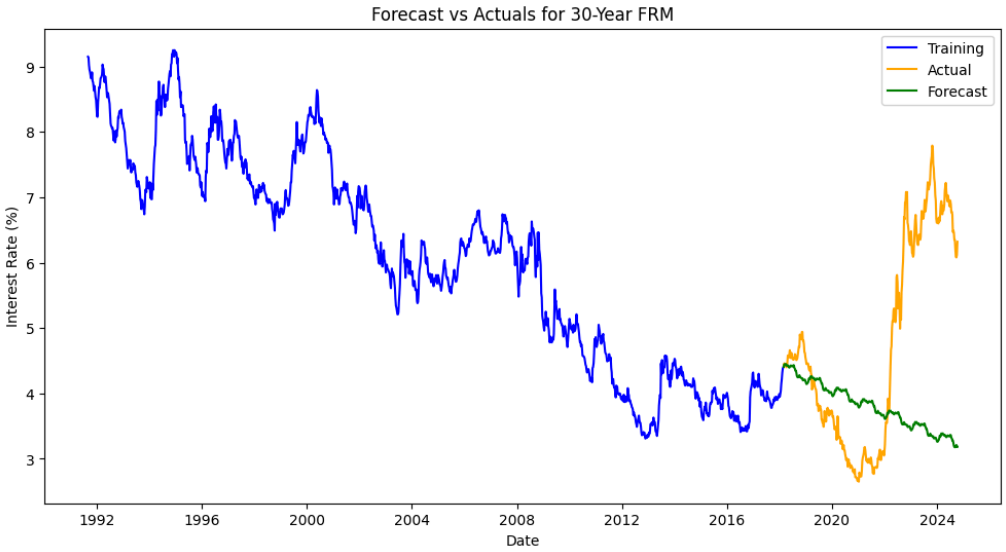

Figure 4. Forecast vs. Actual Data

This graph compares the SARIMA model's forecast (green line) with the actual data (orange line) and training data (blue line) for 30-year mortgage rates from 1992-2024 to assess the accuracy of the model. While the model fits the training data well, recognizing the general decline, the forecast underestimates the sharp rise in rates post-2020, indicating that the model struggles to account for sudden economic shifts. In stable conditions, the forecast is accurate, but it did not fully capture unexpected trends or spikes.

III. Model Evaluation

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Mean Absolute Error (MAE): 1.512
Root Mean Squared Error (RMSE): 2.009
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Figure 5. MAE and RMSE Significance Testing

The Mean Absolute Error (MAE) of 1.512 means that, on average, the SARIMA model's mortgage rate forecasts differ from the actual rates by about 1.5 percentage points. The Root Mean Squared Error (RMSE) of 2.009 shows that larger errors exist, but they aren't significantly bigger, indicating that the model is reasonably accurate, with errors typically between 1.5% and 2%. MAE and RMSE give a sense of forecast accuracy by showing how much the predictions deviate from actual values, but they don't indicate whether the model coefficients are statistically significant.