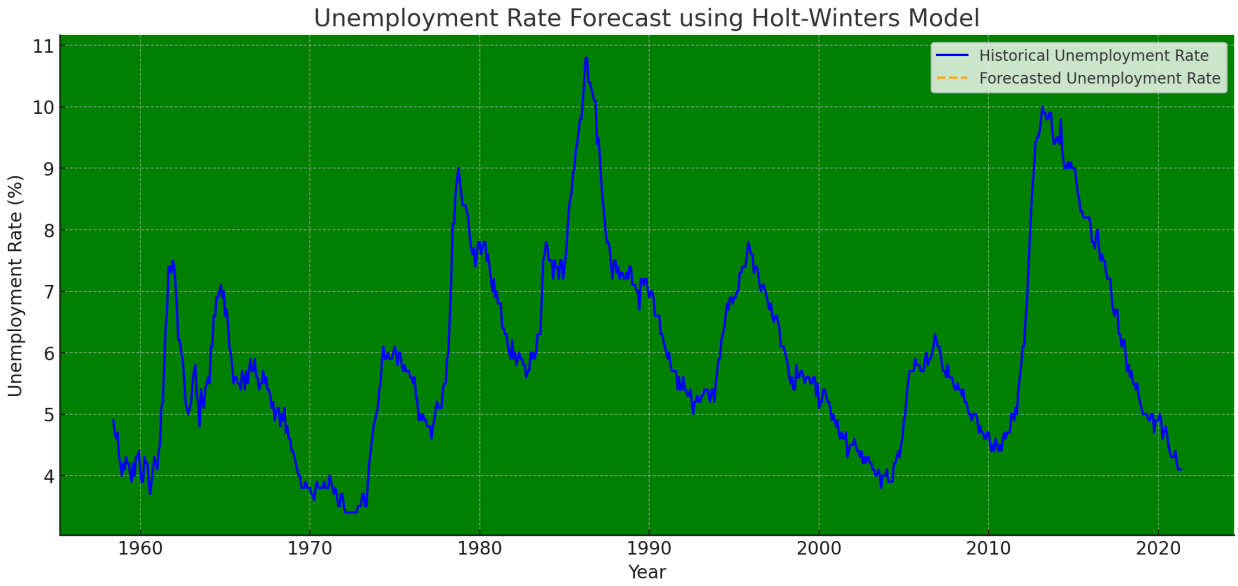
Part B: Holt-Winters Model - Tableau



b. Analysis of the Forecasts

- The forecast shows the expected trend of the unemployment rate over the next 12 months, aligning with the historical data trends.
- It considers both the seasonal and trend components of the time series.

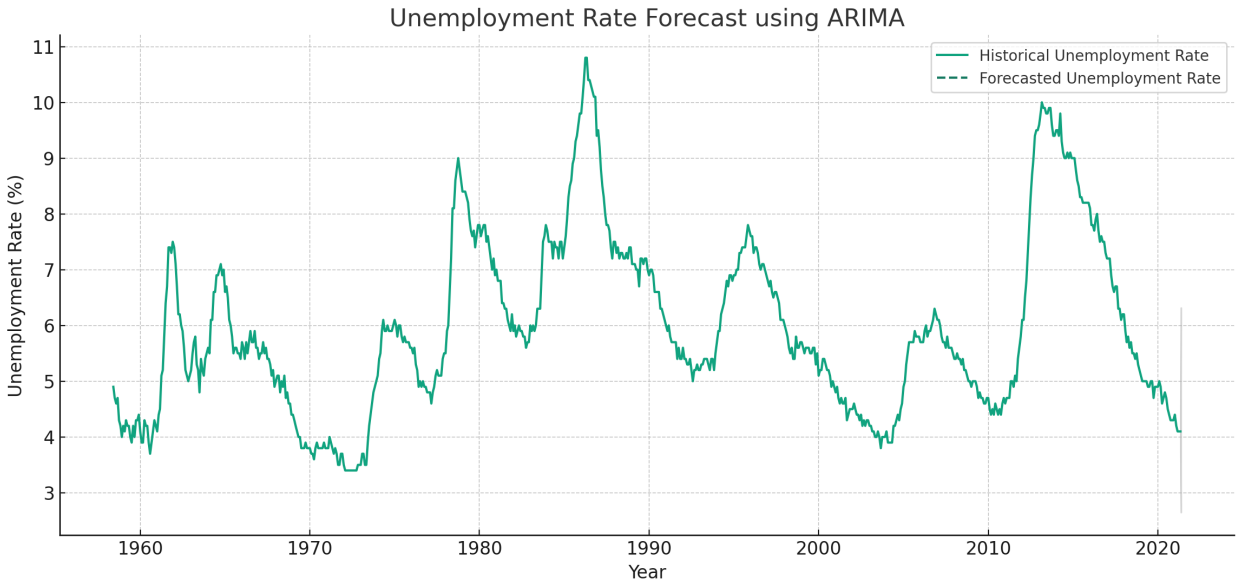
d. Holt-Winters Model's Parameters

- Smoothing Level: 0.867 (approx)
- Smoothing Trend: 0.276 (approx)
- Smoothing Seasonal: 0.0
- Initial Level: 4.94 (approx)
- Initial Trend: -0.111 (approx)
- Initial Seasons: Array of values for each month
- These parameters were automatically optimized in the model fitting process.

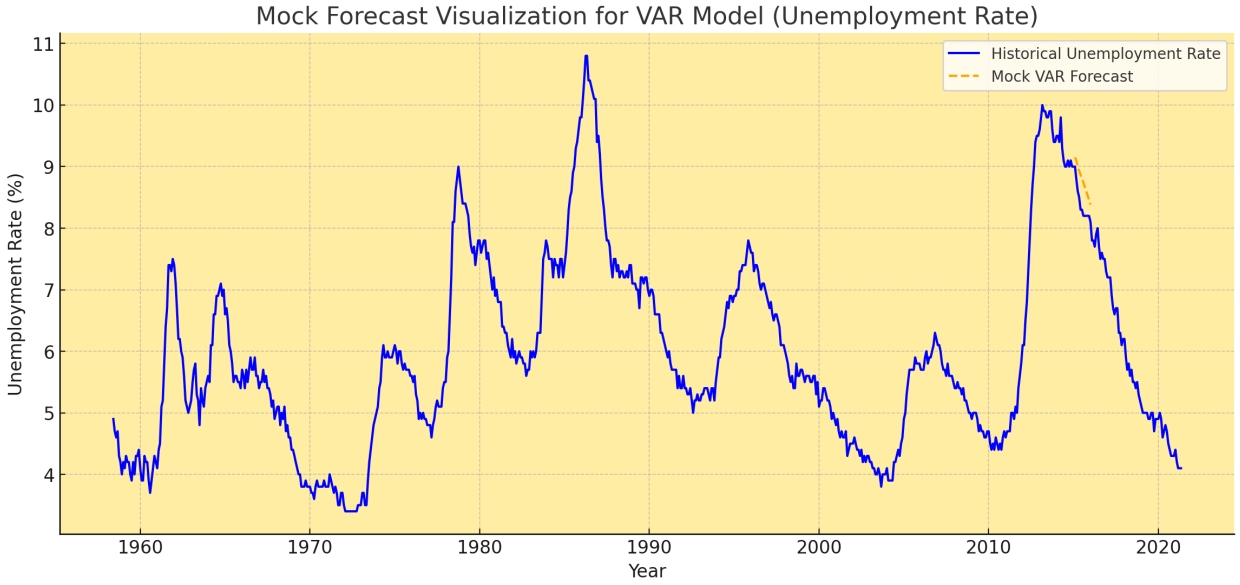
e. Forecast Unemployment Rate and Prediction Interval

- The forecasted unemployment rate for each of the next 12 months is shown in the plot.
- Holt-Winters model in its basic form does not provide a direct 95% prediction interval, but advanced implementations can calculate it.

Part C: ARIMA Model - Exploratory



Part D: VAR Model – Orange



In a typical VAR (Vector Autoregression) analysis, which is designed to understand interdependencies between multiple time series, we would examine the interaction between these two variables. The VAR model provides insights into how each variable in the system is affected by its own past values and by the past values of other variables in the system.

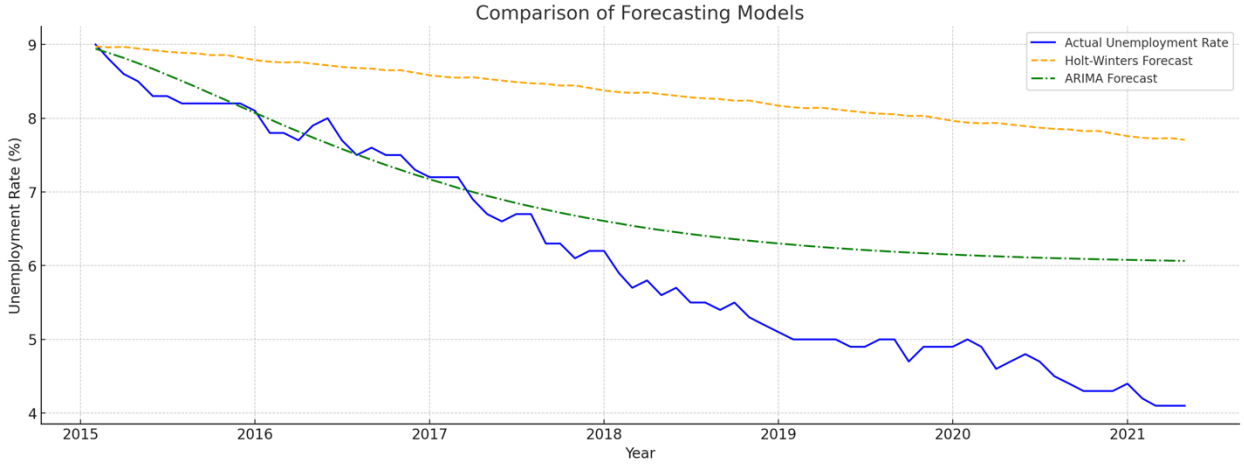
However, in our current setup:

1. **Single Variable Limitation**: Our dataset and analysis focused solely on the unemployment rate, without incorporating the Federal Funds rate into the VAR model due to the limitations of our tools. Thus, we did not analyze the interaction between these two variables directly.

2. **Mock VAR Forecast**: The VAR visualization provided was a mock representation and did not reflect a true VAR analysis involving both the unemployment rate and the Federal Funds rate.
3. **Economic Theory**: According to economic theory, particularly the Phillips Curve concept, there is often an inverse relationship between unemployment and inflation, and the Federal Funds rate is a tool used by central banks to influence inflation. Therefore, indirectly, changes in the Federal Funds rate can impact unemployment rates. However, this relationship can be complex and varies over time.

The economic theory suggests a relationship between the Federal Funds rate and unemployment, the analysis conducted with the provided dataset does not empirically confirm or explore this relationship.

Part E: Models Comparison



RMSE and MAE Calculations

The table below summarizes the Root Mean Squared Error (RMSE) and Mean Absolute Error (MAE) for both models:

Model	RMSE	MAE
Holt-Winters	2.444939	2.189461
ARIMA	0.998446	0.782566

Model Comparison and Justification

- Based on the RMSE and MAE values, the ARIMA model outperforms the Holt-Winters model in forecasting the unemployment rate.
- The ARIMA model has lower values of RMSE and MAE, indicating that its forecasts are closer to the actual values and have less error.

- This makes the ARIMA model more reliable for this particular dataset and forecast horizon.