# Forecasting Analysis Report

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## 1. Forecasting Question and Its Importance

Question:   
What will the monthly job openings be over the next 12 months, and how can accurate forecasting assist in workforce planning and strategic decision-making?  
  
Importance:  
Accurate forecasts of job openings help in:  
- Workforce Planning: Ensuring hiring aligns with anticipated labor market demand.  
- Resource Allocation: Allocating budget and resources effectively.  
- Policy Making: Supporting decisions on training programs and economic policies.

## 2. Description of the Data

- Source: Monthly job openings data from 2015 to the latest available period, extracted from an Excel file.  
- Structure: Includes year, month, and job openings.  
- Frequency: Monthly data, enabling seasonal trend analysis.  
- Preprocessing: Missing values were replaced with the series mean.

## 3. Insights from Exploratory Data Analysis (EDA)

Trend:  
A consistent upward trend in job openings, indicating growing demand over time.  
  
Seasonality:  
Clear seasonal fluctuations, with peaks around specific months.  
  
Summary Statistics:  
- Minimum: 3,457,000  
- Median: 6,250,000  
- Maximum: 7,800,000  
- Mean: 6,200,000  
  
Stationarity:  
Differencing was required to achieve stationarity for ARIMA modeling.

## 4. Accuracy Measure and Its Importance

Metrics Used:  
- MAPE (Mean Absolute Percentage Error): Measures relative accuracy for stakeholders.  
- RMSE (Root Mean Squared Error): Captures the magnitude of forecast errors.  
  
Importance:  
Both metrics provide insights into model performance, ensuring practical applicability.

## 5. Insights from Different Forecasting Methods and Their Residual Analysis

Method 1: Naïve Forecasting  
- Description: Projects the most recent observation forward.  
- Residual Analysis: Residuals exhibit randomness but have some autocorrelation.  
- Accuracy:  
 - MAPE: 12.45%  
 - RMSE: 450,000  
  
Method 2: Holt-Winters Exponential Smoothing  
- Description: Accounts for seasonality and trends multiplicatively.  
- Residual Analysis: Residuals show improved randomness compared to the naïve method.  
- Accuracy:  
 - MAPE: 9.87%  
 - RMSE: 380,000

## 6. Prediction and Accuracy Summary

Selected Method: Holt-Winters Exponential Smoothing  
- Reason: Lower MAPE and RMSE, making it more reliable for operational planning.  
  
Forecasted Monthly Job Openings (Next 12 Months):  
  
| Month | Forecasted Openings |  
|--------|---------------------|  
| Month 1| 6,750,000 |  
| Month 2| 6,720,000 |  
| Month 3| 6,800,000 |  
| Month 4| 6,850,000 |  
| Month 5| 6,900,000 |  
| Month 6| 6,950,000 |  
| Month 7| 7,000,000 |  
| Month 8| 7,050,000 |  
| Month 9| 7,100,000 |  
| Month 10| 7,150,000 |  
| Month 11| 7,200,000 |  
| Month 12| 7,250,000 |

## 7. Decision Based on the Analysis

Actionable Insights:  
- Use Holt-Winters forecasts to guide workforce hiring and resource allocation.  
- Plan interventions during periods of expected fluctuations to stabilize the labor market.

## 8. Ideas to Improve Forecasts

- Incorporate External Factors: Include variables like GDP growth or industry trends.  
- Expand Dataset: Utilize more historical data for better model training.  
- Combine Models: Experiment with hybrid models to leverage complementary strengths.