# Forecasting Analysis Report

Alfaz Khan  
Rutgers University  
Business Forecasting (22:544:608)

**1. Forecasting Question and Its Importance**  
**Question:**  
How will monthly job openings change over the next 12 months, and how can understanding these trends aid a graduating student in navigating the job market?

**Importance:**  
Forecasting job openings helps:

* **Job Search Strategy:** Identifying months with higher job opportunities to focus applications.
* **Preparation Planning:** Anticipating peak hiring seasons to align with company timelines.
* **Career Insights:** Understanding labor market trends to make informed career decisions.

## 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.

## 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.

**Stationarity:**  
Differencing was required to achieve stationarity for ARIMA modeling.

**Summary Statistics:**  
- Minimum: 3,457,000  
- Median: 6,250,000  
- Maximum: 7,800,000  
- Mean: 6,200,000

## 4. Accuracy Measure and Its Importance

Metrics Used:  
- **MAE** (Mean Absolute Error): Measures relative accuracy.  
- **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 as the forecast for all future values.  
  - **Residual Analysis:** Residuals show clear patterns and autocorrelation, indicating that the naive model is not suitable for data with trends or seasonality.  
  - Accuracy:  
   - **MAE**: 615.1223  
   - **RMSE**: 806.7805
* **Method 2: Holt-Winters**  
  - **Description:** Accounts for seasonality and trends multiplicatively.  
  - **Residual Analysis:** Residuals show improved randomness compared to the naïve method.  
  - Accuracy:  
   - **MAE**: 281.2627  
   - **RMSE**: 476.2847
* **Method 3: Exponential Smoothing**  
  - **Description:** Forecasts future values using weighted averages of past observations, emphasizing more recent data.  
  - **Residual Analysis:** Residuals show improved randomness compared to the naive model but do not fully account for seasonality, making it less accurate for this dataset.  
  - Accuracy:  
   - **MAE**: 387.3978  
   - **RMSE**: 775.9446

## 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 | 6,750,000 |
| Month3 | 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 identify months with higher job openings and strategically target job applications during these periods.
* Align preparation, such as resume updates and interview readiness, with peak hiring months predicted by the forecast.

## 8. Ideas to Improve Forecasts

* **Incorporate External Factors:** Include variables like industry growth, economic indicators, or hiring trends in specific sectors of interest.
* **Expand Dataset:** Analyze more historical data to capture long-term trends and refine predictions.
* **Combine Models:** Leverage ensemble approaches to compare and validate forecasts, ensuring greater reliability for career planning.