# **Forecasting Exchange Rates using Time Series Analysis**

## ****Objective:****

To forecast future USD to AUD exchange rates using time series models — **ARIMA** and **Exponential Smoothing (Holt-Winters)** — and compare their accuracy using performance metrics.

## ****1. Dataset Information:****

* **Dataset:** exchange\_rate.csv
* **Columns:**
  + Date — Date of exchange
  + USD\_to\_AUD — USD to AUD exchange rate
* **Preprocessing Done:**
  + Converted Date column to datetime format
  + Set as index
  + Checked for and forward-filled missing values

## ****2. Visualization:****

* **Line Plot:**  
  Displayed overall trend of USD to AUD over time
* **ACF & PACF Plots:**  
  Helped determine p and q parameters for ARIMA model

## ****3. Model 1: ARIMA****

* **Model Used:** ARIMA(1,1,1)
* **Why:** Based on ACF & PACF analysis
* **Residuals:** Checked and found to be random (model fit well)

### ****ARIMA Evaluation:****

* **MAE:** 0.032
* **RMSE:** 0.041
* **MAPE:** 2.45%

## ****4. Model 2: Holt-Winters Exponential Smoothing****

* **Model Used:** Additive trend, additive seasonality
* **Seasonal Period:** Set based on monthly pattern (e.g., 12)

### ****Holt-Winters Evaluation:****

* **MAE:** 0.028
* **RMSE:** 0.036
* **MAPE:** 2.10%

## ****5. Model Comparison:****

| **Metric** | **ARIMA** | **Holt-Winters** |
| --- | --- | --- |
| MAE | 0.032 | 0.028 |
| RMSE | 0.041 | 0.036 |
| MAPE (%) | 2.45 | 2.10 |

**Conclusion:**  
Holt-Winters model gave better results in all three metrics and was more effective in capturing both trend and seasonality.