

Exchange Rate Forecasting Project Report

Case Study: Ghana Cedi (GHS) to US Dollar (USD)

1. Introduction

This project focuses on forecasting the exchange rate between the Ghanaian Cedi (GHS) and the US Dollar (USD). Exchange rate forecasting is a critical task for businesses, policymakers, and investors, as fluctuations in currency value directly affect trade, investment, and financial stability. The analysis relied on historical exchange rate data obtained from Yahoo Finance. The main objective was to build, test, and deploy forecasting models that can project future exchange rate movements with a focus on professional and academic use cases.

2. Methodology

2.1 Data Collection and Cleaning

- Data was sourced from Yahoo Finance.
- Time series was resampled into **weekly and monthly averages** to smooth out short-term volatility.
- A major challenge encountered was **data quality issues**. For instance, on 31st March 2020, Yahoo Finance recorded the exchange rate as **573.00** instead of **5.73**. This extreme outlier distorted both visualization and model training.
- The issue was resolved by manually correcting the error and validating the corrected series.

2.2 Modeling Approaches

Attempt 1: Linear Regression

- A linear regression model was initially used to predict future exchange rates based on historical trends.
- **Failure Observed:**
 - The model assumed a linear relationship over time, which is unrealistic for currency markets.
 - Residual plots showed strong autocorrelation, indicating the model ignored time-dependent patterns.
 - Forecasts were unstable and deviated significantly from real observations, especially in volatile periods.
- **Conclusion:** Linear regression failed to capture seasonality and volatility, making it unsuitable for this forecasting task.

Attempt 2: Time Series Forecasting (ARIMA/Prophet)

- Transitioned to specialized **time series forecasting models** (Prophet in this case).
- Advantages:
 - Captured trend and seasonality components.
 - Produced more realistic forecasts for 6–12 month horizons.
- Limitations:
 - Forecast accuracy still depends heavily on data quality.
 - Model assumptions may underperform during periods of economic shock (e.g., pandemics, inflation surges).

3. Results and Findings

- The cleaned dataset provided stable and interpretable time series patterns.
- A **6-month forecast** showed a mild upward drift in the GHS/USD rate, reflecting continued depreciation of the Cedi.

- The forecasts aligned with economic expectations but highlighted sensitivity to external shocks.

4. Challenges and Solutions

Challenge	Solution
Erroneous data point (573.00 vs 5.73)	Manually corrected with domain knowledge.
Model failure using Linear Regression	Switched to time series models better suited for non-stationary financial data.
Forecast horizon selection (6 vs 12 months)	Compared both; shorter horizon (6 months) proved more reliable for stakeholders.

5. Way Forward

- **Model Improvement:** Explore advanced models such as GARCH (for volatility), LSTM (for deep learning), and Bayesian forecasting methods.
- **Data Integrity:** Automate outlier detection and correction mechanisms to prevent manual intervention.
- **Deployment:** Cleaned and modularized code will be uploaded to a GitHub repository for professional and academic use.
- **Policy Relevance:** Forecasting outputs can guide businesses and policymakers in currency risk management.

6. Conclusion

This project demonstrated the importance of careful **data cleaning**, **model selection**, and **validation** in exchange rate forecasting. The failure of the linear regression model highlighted the dangers of oversimplification, while time series approaches provided a stronger framework for capturing dynamic currency movements.

The work underscores that exchange rate forecasting is inherently challenging, but with the right tools and methods, useful insights can be extracted for decision-making in finance, policy, and academia.

■ **Repository Update:** All source code, including cleaned scripts and modular functions, will be maintained in a dedicated GitHub repository for transparency, reproducibility, and continuous improvement.