Food Commodity Prices Analysis and Forecasting in Kenya

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PROJECT OVERVIEW

This project aims to analyze and predict wholesale prices in Nairobi, Kenya, harnessing historical data to develop predictive models.

The project's overarching goal is to **contribute to poverty alleviation, improved nutrition,** and the realization of the UN Sustainable Development Goal of **zero hunger in Kenya.**

Business Problem

Focused on Nairobi County's volatile food market, this project addresses the challenge of price unpredictability that affects various sectors.

The main challenge is developing a reliable forecasting model capable of accurately predicting prices, crucial for effective planning and strategizing at the government and consumer level.

Top Most Frequent Commodities in Nairobi

Top 10 Most Frequent Commodities
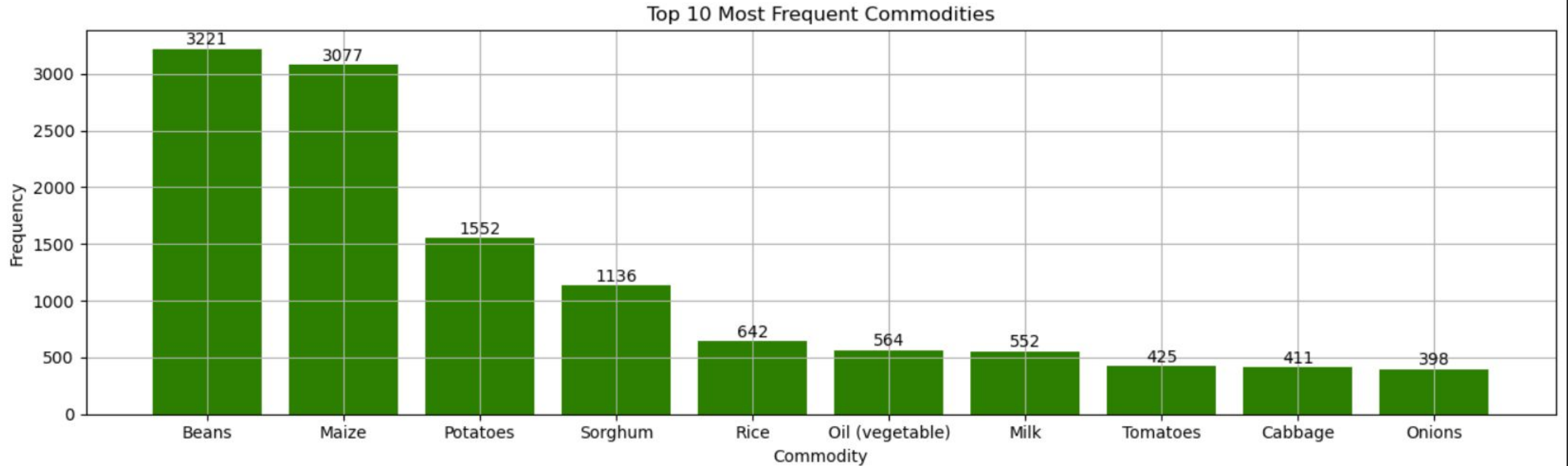
1. The primary commodities consumed in markets within the Nairobi district are **beans, maize, and potatoes.**

2. This distribution provides insights into the preferences of customers within the district.

3. Additionally, this pattern may be attributed to the affordability of these products and their versatility.
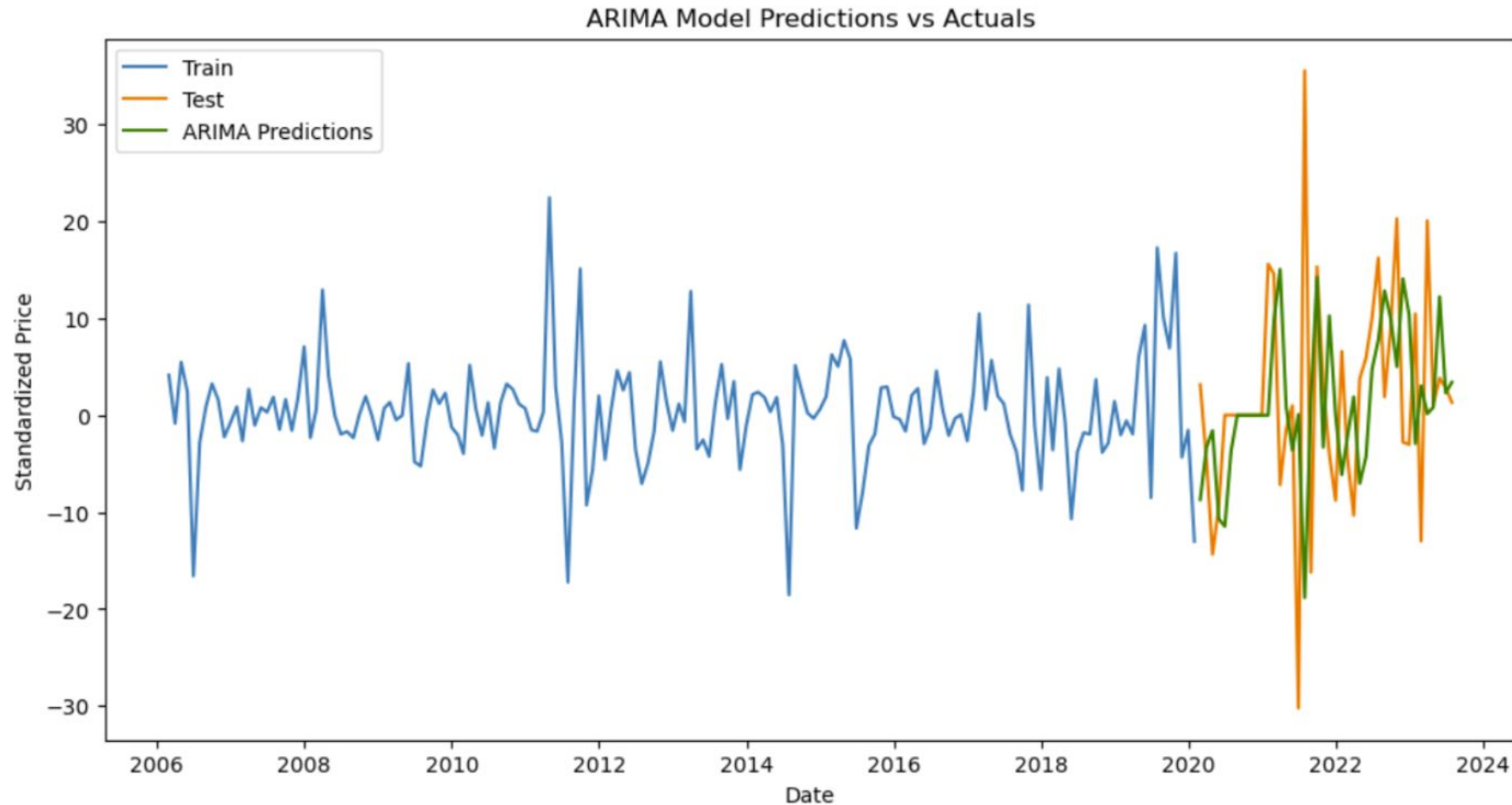
Top Most Frequent pricetype in Nairobi
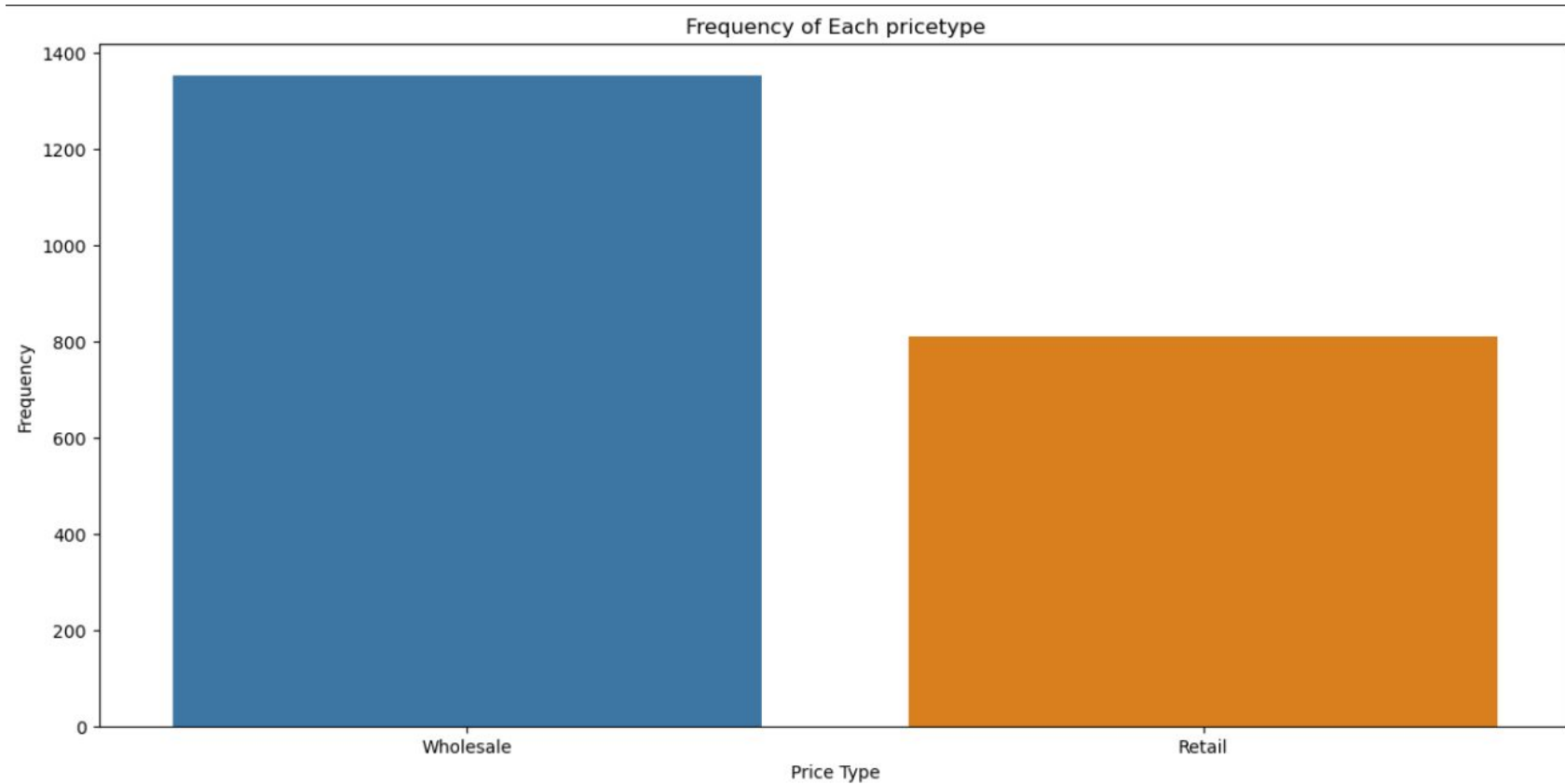
1. Wholesale emerges as the predominant price type in the Nairobi district.
2. This prevalence may stem from a higher concentration of data collection in markets where small-scale traders procure goods for subsequent retail sales.
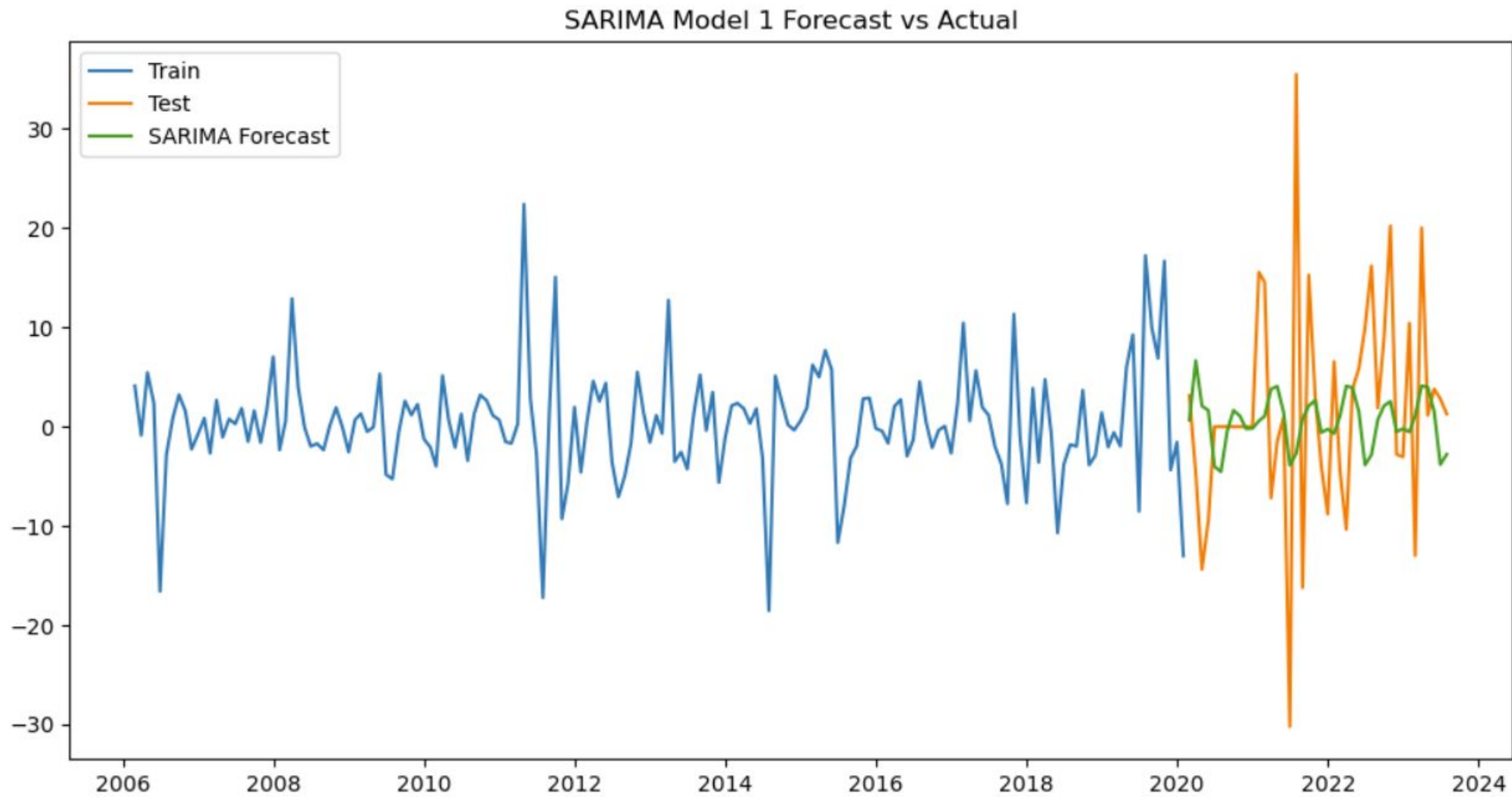
MODELING AND EVALUATION

ARIMA | SARIMA
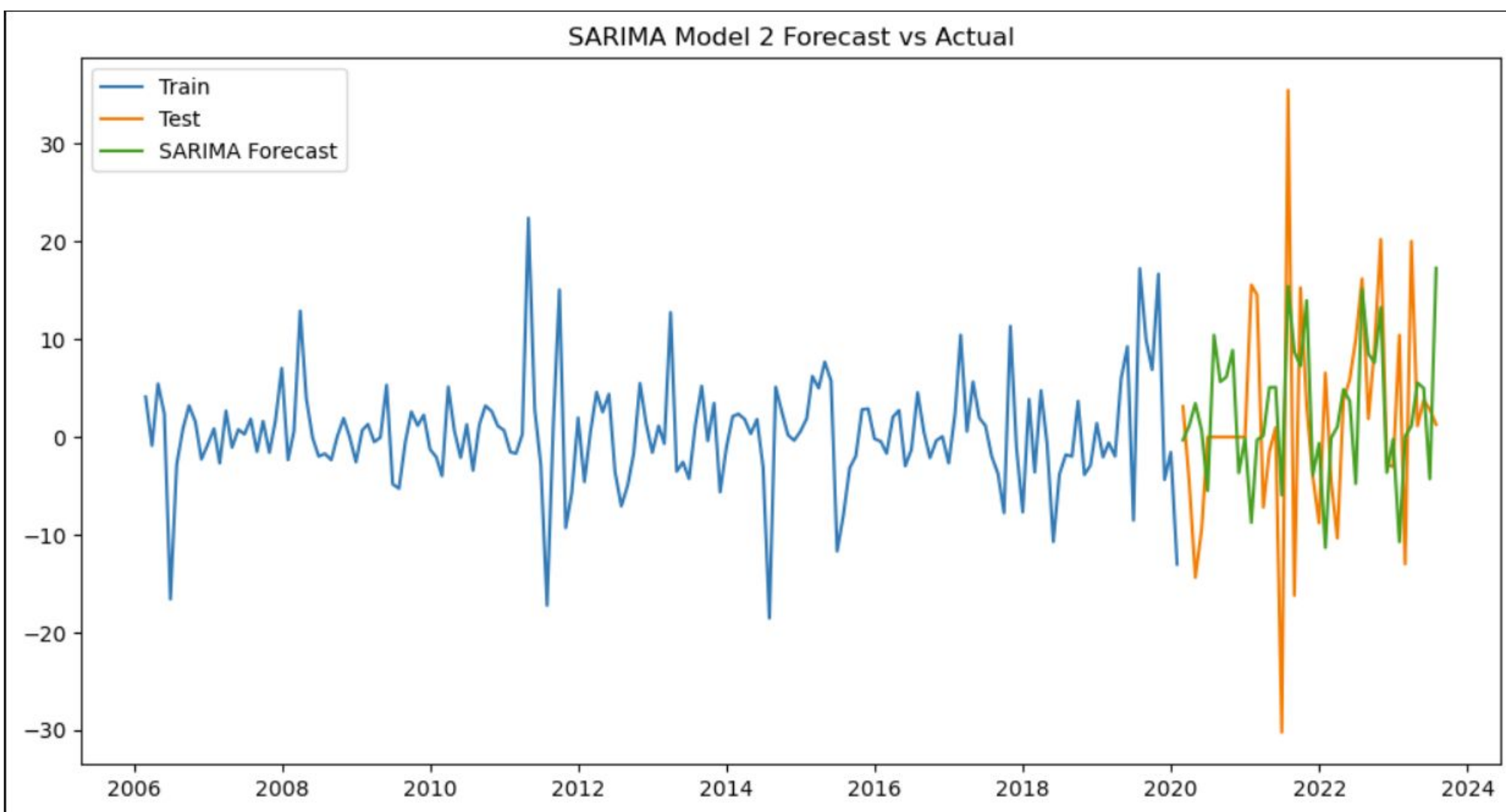
ARIMA Model Predictions vs Actuals

Baseline ARIMA Model | RMSE: 13.8997

The baseline ARIMA model did not incorporate seasonality, which was a crucial aspect of our dataset.

SARIMA Model 1 Forecast vs Actual

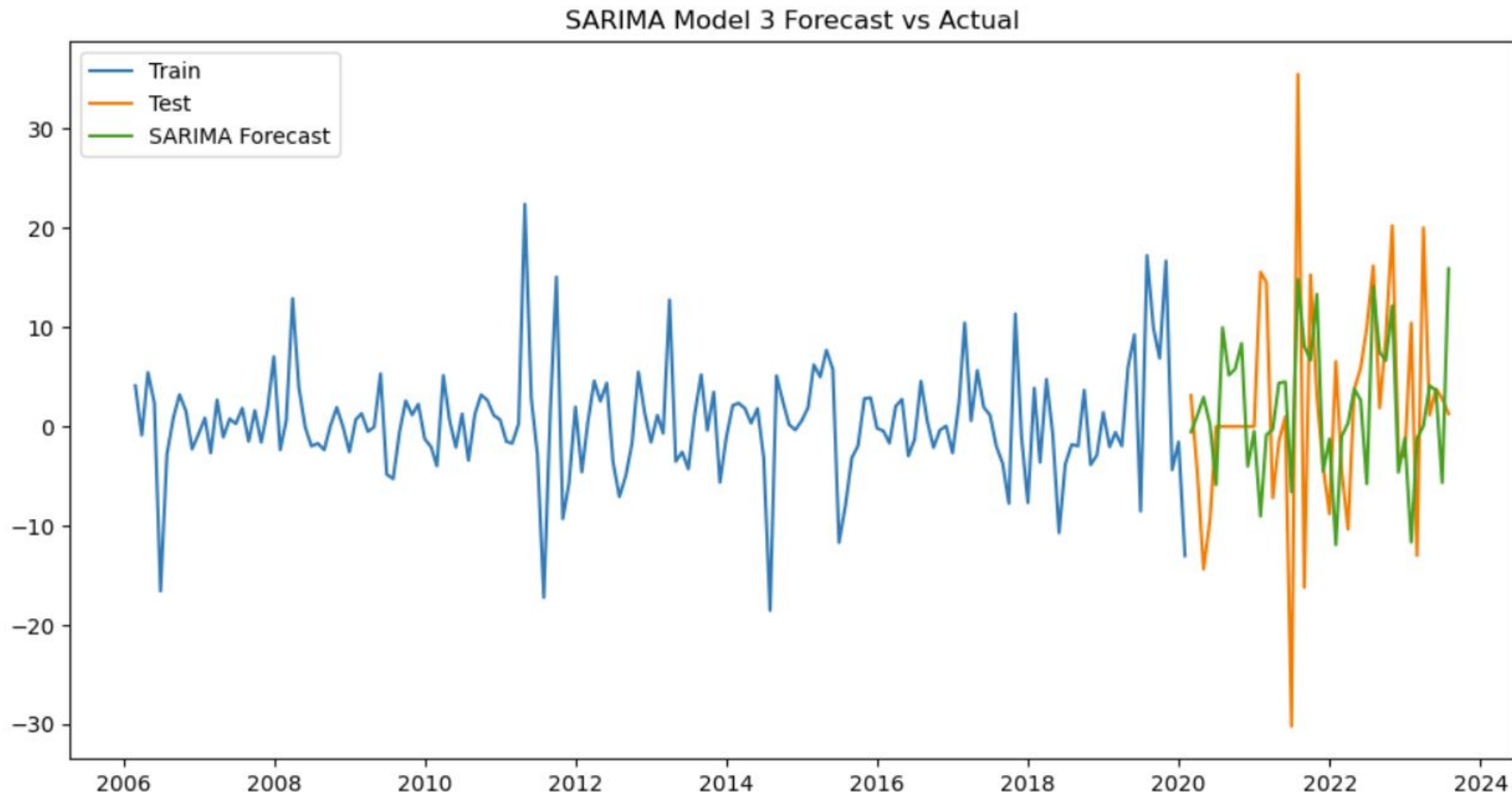**SARIMA Model 1** | **RMSE: 11.66**

Introducing seasonality into the model improves accuracy as evidenced by a lower RMSE.

SARIMA Model 2 Forecast vs Actual

SARIMA Model 2 | RMSE: 11.60

SARIMA Model 2 showed a small improvement over SARIMA Model 1.

SARIMA Model 3 Forecast vs Actual

SARIMA Model 3 | RMSE: 11.58
SARIMA Model 3 achieved **the lowest RMSE** among the models we tested, indicating the highest forecasting accuracy.

The slight improvement over SARIMA Model 2 suggested that the changes in the model parameters were capturing the underlying seasonal patterns just a bit more closely.

Conclusions

- Throughout our analysis, we observed the impact of incorporating seasonality into our time series models.

- The improvement in RMSE from the Baseline ARIMA model to the SARIMA models validated our hypothesis that seasonality is a significant component of our dataset.

- The Baseline ARIMA model, without accounting for seasonality, had the highest RMSE, indicating a less accurate model. Each subsequent SARIMA model, which incorporated seasonal elements, showed a decrease in RMSE, underscoring the importance of capturing seasonal patterns.

- Despite the progressive enhancements, the RMSE differences between the SARIMA models were relatively minor. SARIMA Model 3, while yielding the lowest RMSE, offered only a slight improvement over SARIMA Model 2. This marginal gain needs to be considered in the context of model complexity and operational efficiency.

Recommendations

Nairobi County Government:

- **Market Regulation and Support:** Implement regulatory measures to prevent market manipulation and ensure fair pricing for both farmers and consumers.

- **Infrastructure Development:** Invest in infrastructure improvements, like better storage facilities and transportation networks, based on predicted high-demand areas and times.

- **Community Support Programs:** Develop programs to support low-income communities during periods when commodity prices are forecasted to rise, ensuring food security.

Cont...

Retailers and Distributors:

- **Inventory Management:** Adjust purchasing and stocking strategies based on price trend forecasts to maximize profits and reduce waste.
- **Dynamic Pricing Strategies:** Implement dynamic pricing models that reflect the predicted fluctuations in commodity prices, enhancing profitability.
- **Supply Chain Optimization:** Use insights to streamline the supply chain, improving logistics and reducing costs during predicted low-demand periods.

Kenyan Ministry of Agriculture:

- **Policy Formulation:** Utilize the predictive model's insights to develop policies that stabilize commodity prices and support farmers during low-profit periods.
- **Subsidy Allocation:** Allocate subsidies and resources more effectively, targeting areas and times when the market predicts a downturn.
- **Agricultural Training Programs:** Implement training programs for farmers based on identified trends, focusing on crop diversification and modern farming techniques to mitigate risks.

Thank You

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