Forecasting Apple Inc's Quarterly Net Sales

A Time Series Analysis by Nicole Burns

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Introduction

- MSDA Student

- B.S. in Accounting—Purdue University

- Former Derivatives Trader

- Interested in Data Science in Finance

Problem Statement

The first company with a 3 trillion dollar market value.

Their financial performance and growth trajectory are of interest to stakeholders.

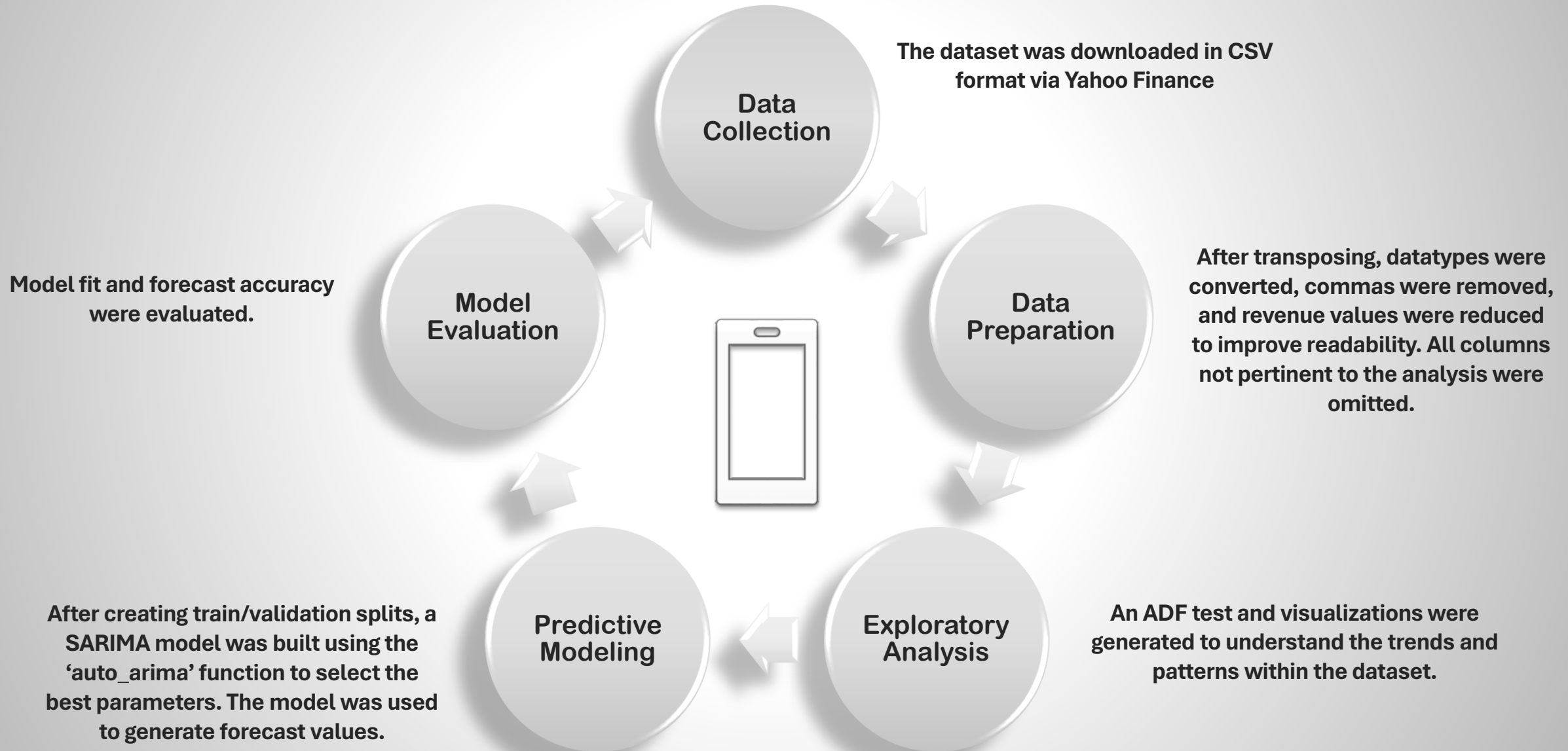The ability to forecast future sales with a high level of accuracy is essential.

Hypothesis

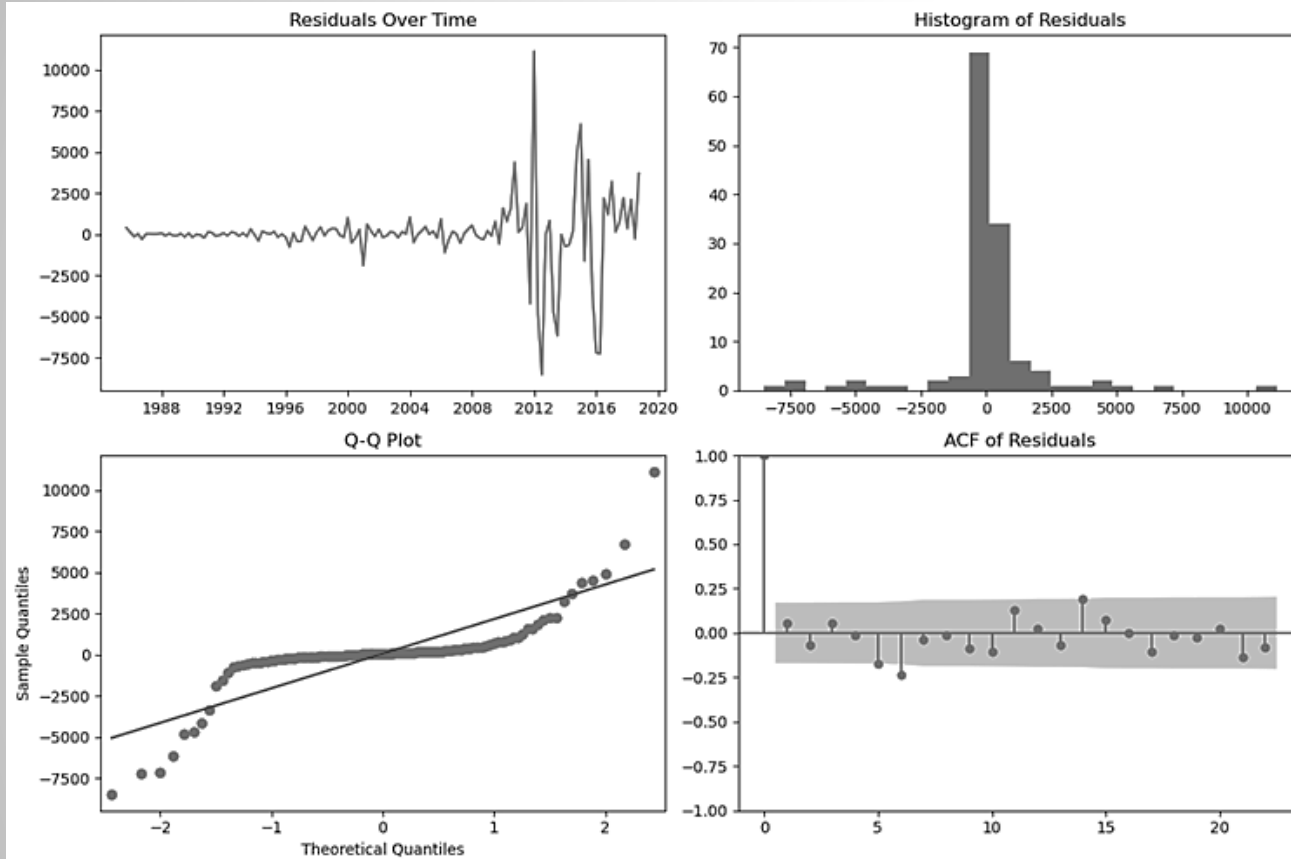Can a SARIMA model effectively forecast Apple's quarterly revenue with > 80% accuracy?

H_0: A SARIMA model can't effectively forecast Apple's quarterly revenue at a model accuracy of > 80%.

H_1: A SARIMA model can effectively forecast Apple's quarterly revenue at a model accuracy of > 80%.

The Data Analysis Process

Data Collection

The dataset was downloaded in CSV format via Yahoo Finance

Data Preparation

After transposing, datatypes were converted, commas were removed, and revenue values were reduced to improve readability. All columns not pertinent to the analysis were omitted.

Exploratory Analysis

An ADF test and visualizations were generated to understand the trends and patterns within the dataset.

Predictive Modeling

After creating train/validation splits, a SARIMA model was built using the 'auto_arima' function to select the best parameters. The model was used to generate forecast values.

Model Evaluation

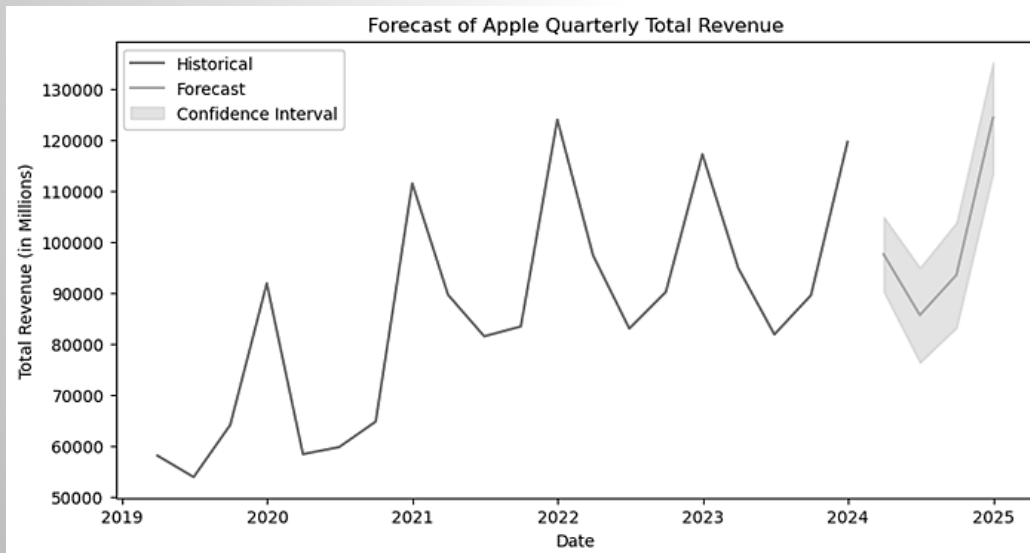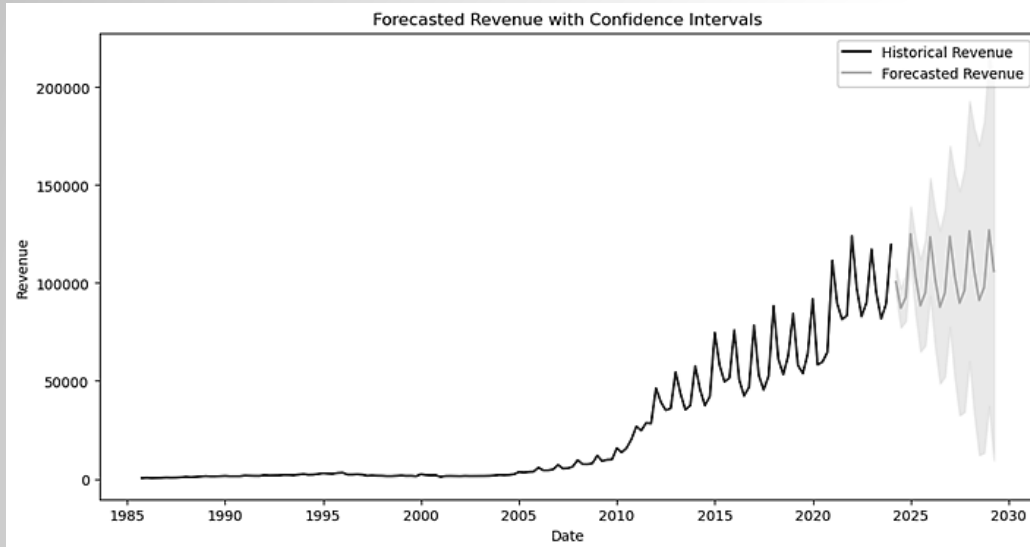Model fit and forecast accuracy were evaluated.

The Results

Model Fit

The model managed to account for a significant amount of the data's autocorrelation, which is a positive outcome.

The distribution and extreme values in the residuals suggest that the model could be improved.

The spikes in residuals over time, the skewed histogram, and the deviations from normality of the tails in the Q-Q plot indicate that the model may not be fully capturing all the data's underlying patterns.

Results cont.

Forecasted Revenue with Confidence Intervals

Forecast of Apple Quarterly Total Revenue

Forecast

Long Term—Projections spanning 21 quarters into the future display wide confidence intervals suggesting that there is uncertainty in the forecast as time increases. MAPE yielded moderate results at 33%, inferring a 67% accuracy.

Short Term—Utilizing the last 5 years of historical quarterly revenue and projecting 1 year into the future, showed a significant improvement with a MAPE of ~3.97% and ~96% accuracy.

Limitations

Revenue is only recorded annually and quarterly, limiting the amount of data the model is trained on. The more data for training, the more reliable the prediction accuracy is.

Much of the dataset is considered irrelevant due to time frames. Years like 1985 aren't comparable to recent times economically or regarding Apple's current consumer sentiment. This is also why forecasting too far into the future creates uncertainty.

Proposed Actions

Employ the SARIMA model primarily for short-term revenue forecasting, treating it as an informative tool rather than a prediction.

Future research should include external factors to build a model that better accounts for external influences and trends.
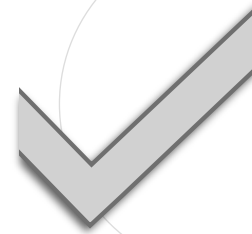
Pair SARIMA with other forecasting methods or machine learning models to enhance prediction accuracy.

Expected Benefits

The analysis revealed that a SARIMA model is capable of utilizing Apple's short-term historical quarterly revenue to effectively forecast future quarterly revenue with over 90% accuracy.

This insight enables stakeholders interested in Apple's future performance to use this information as a foundation for strategic decisions.

Counter in external factors and utilize a combination of forecasting methods to validate the results obtained in this study.

Sources

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