Examination of FOREX Market Through ARIMA

Purpose:

Before trading on the foreign exchange (FOREX) market, it is necessary to have a automated analysis protocol that has been tested with proven efficiency and accuracy. There are algorithms already created and services prepared to handle trading with real capital, but those services are expensive and leave the control and knowledge in someone else's hands. There needs to be an accessible, customizable and reliable application to classify the pair as "a good buy" or "not a good buy" given the trends and timing. The program aims to keep the user agile and able to adjust to the conditions as they see fit and predict a profit likelihood for the user, given the input. Sending the gathered data through the FOREX Analysis Programs (FAP) should be able to classify the pair as "a good buy" or "not a good buy" given the trends and timing.

Method:

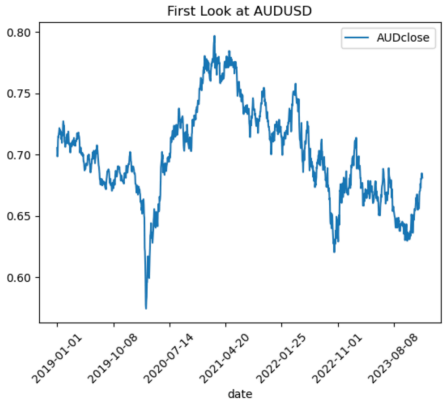
With a free API from https://tradermade.com/forex, as used in this investigation, data can be retrieved for a specified time period that contains a currency pair's historical closing difference. This 'close' is the trading day's end exchange rate between one currency and another.

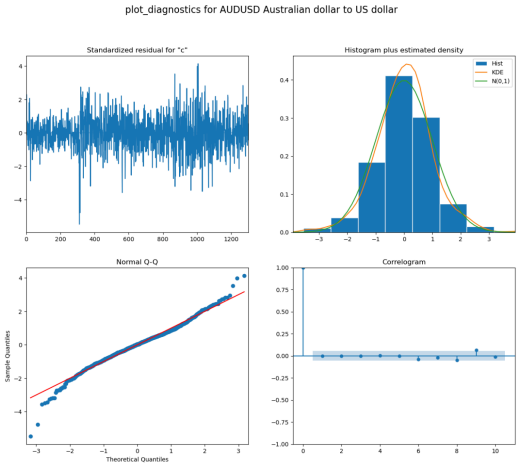
For this inquiry, 5 years of closing rates of the Australian dollar (AUD) to the United States dollar (USD) was retained and processed through what is a basic FAP structure. Written in Python, the FAP uses common packages like Pandas, and Numpy, it also uses more distinct packages as: from Statsmodels Time Series Analysis: ARIMA, adfuller, seasonal_decompose; from SKLearn Metrics: mean_squared_error, r2_score; for API functionality installing tradermade.

Data Processing:

Pulling the list of currency options, is the first check of connection and API functionality. The user input function getCurrencyPairDFs() has several tasks: It asks for for the trading pair, start year and end year of the data. Since every API has different rules, this function may have to have interchangeable ways to source data; for now we are sticking with Tradermade. If there are many requests for pairs, there are many opportunities to misalign single unnamed numbers and dates that are returned, this function assures that there will be no question as to which column of data belongs to which named pair and the year is displayed for a quick visual reference. For development it was also necessary to write the raw to the hard drive so if changes need to be made, there are not repeated calls for data and potentially breaking the API protocols.

Plotting the 5 years (*right*) of records per year and closing exchange rate, we assessed the overall performance of the pair. Calling the ARIMA method on the whole of the data, fitting it and looking at the goodness of the fit, we assessed the p,d,q parameters of the ARIMA analysis. From the summary considering the log likelihood is the most popular way of choosing which parameters perform better.

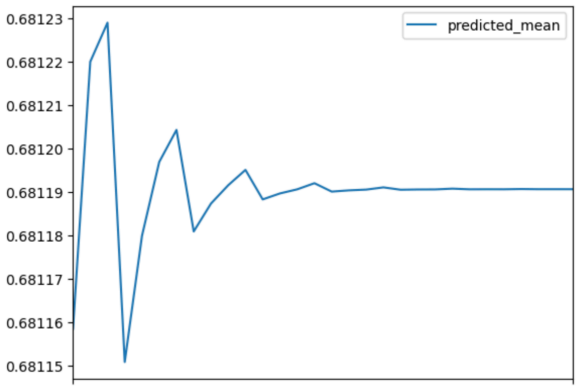


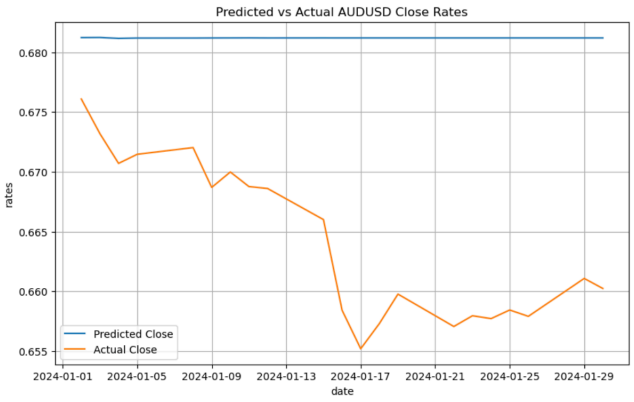


The plot_diagnostics function is indicative of the underlying data properties that ARIMA assumes it was given (*left*), like having a normal distribution and no correlation and it also gives an indication to the overall scale by showing a standardization of residuals for the “c” given. The data implied no skew or correlation for data with

very few outliers, and it most interestingly implied that the standardized residual for our closing numbers fit very closely to the initial line plot of the raw data. The standardized scale shows a relativity to the raw data, so scaling the data would not be fruitful as nothing is changing the bias but the FOREX highs and lows that should be an influence.

The forecast from ARIMA with the p,d,q parameters at (5,1,5) is not an accurate calculation. Although the predictions graph (*below, left*) looks like it might have the beginning of a promising trend, the resolution of the estimated results is dismal when it is overlaid by the actual next 30 days (*below, right*). The predicted values only vary by 0.00008 of a point and level off around 15 days at 0.68118, where the real figures vary by 0.02 and level off approximately at 0.660. This is a bit over 3% difference, but it is a loss of 3% and even if the FAP's stop-loss was set to avoid that much offset, it still could have been labeled a bad idea and no trading would have happened. The aim is a positive trading result.



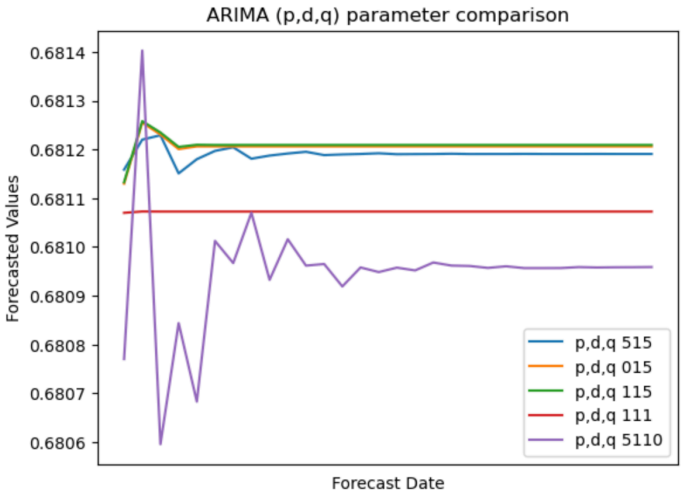


To change the parameters p,d,q and rerun the ARIMA model is simple. This changes the calculation window that ARIMA uses. As ARIMA stands for Auto Regressive Integrated Moving Average, to provide the results in the ARIMA summary, the parameter of p will have the model multiply the p number of data points before the current row value by coefficients that, summed up, capture the relationship between the current data point and those lagged values. This is the Auto Regressive part of ARMIA. To stabilize the mean over time of the window, the d

parameter, considers the differences inside the calculations window d times so that the amount of time in the calculation window is stationary—this way time has the same weight from point to point. With q, ARIMA will include q past data points worth of errors to serve as the predictor for the current point.

Because there can be so many combinations of the p,d,q input values, the most direct test for goodness of fit of ARIMA to the data would be to run the Dickey-Fuller Test (ADF). The ADF returns a value for the test statistic, p-value, number of rows used for calculation, a dictionary of percentages of test statistic significance thresholds, and the maximized information criterion (MIC). Considering the p-value when the p,d,q is significant and the selecting lower MIC values which indicate the best trade off between model fit and model complexity. For the FOREX application we do need the best model that can be calculated with the least expenditure of computing power.

The ADF indicated a p,d,q of (0,1,5). This produced a log likelihood of 5164.408 and 30 resolution was not much better than guessing at the ARIMA constraints. Compared to a methodical grid search result of (7,2,11), which produced a 30 day value of ~0.7 (*right*), it is clear that ARIMA is not able to explain FOREX data well enough for investment prediction.



Originally, ARIMA returned a SARIMAX summary. This means that the calculations made by the ARIMA discovered a seasonal pattern in the data, as well as exogenic unknown implied variables, like the state of global politics. It supposed to compensate for these found cycles, but for exhaustive testing, there is a separate method

specifically for data with a seasonal tendency. “pmdarima” is also an automated regressive model, but it provides specific hyperparameters that work more like a hidden grid search and uses tests, including, and beyond ADF and can expressly incorporate the seasonal and eXogenic variables. Even though it is more time consuming than the regular ARIMA method, what is necessary for ARIMA to succeed should be found.

The results of auto SARIMA or auto SARIMAX from pmdarima the did not produce a more accurate prediction, but they did increase a better scale resolution with a min/max of approximately 0.67 to 0.68 Neither showed a upward or downward trend that resembled the actual predictions with downward trend from 0.67 to 0.65 points.

Data Product:

There are ways to predict the FOREX market, but ARIMA is not able to take into account abstract or complex data. The exogenous feature is comparable to what physicists call “dark matter”. For the lack of concrete calculations that could be derived from particular data, we are essentially asking ARIMA to calculate a effective quantity from the shape of what is not present. These types of factors that change the course of FOREX trading must be able to customize a solid trade algorithm so the basic “banking” components like stop-loss, positioning and leverage parameters and geopolitical information, will be able to decrease the risk of live trading. An application that uses a Recursive Neural Network (RNN) is the next step to explore.

Conclusion:

Although RNNs are less explainable step by step as ARIMA is, they deal with the abstract components because they can look at the effective dynamics and imply explainability. This isn’t exactly the concrete logic that a board of directors like to base large decisions on, but if the results are better than standard statistical method results, consistently, then the effort of this type of data product will pay off.