General Assembly SF 17 – Purchasing Power of Currency

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This project aims to analyze and predict the purchasing power of currency.

Background Information:

Currency data are collected from Oanda.com with 5 years and 6 months worth of value based on the price of gold (XAU). I am analyzing the following currencies: US Dollar, Euro, British Pound, Canadian Dollar, and Swiss Franc. The goal is to track the purchasing power of different currencies to determine whether a given currency is gaining or losing value.

The main idea is to leverage the purchasing power of different currencies to our advantage in order to maximize the value of international traveling expenses.

There are four ways to forecast possible currency changes:

1. Purchasing Power Parity (PPP): an economical theory in which countries determine the exchange rates between currencies to ensure equivalences so that the purchasing power amounts to the same value in each country.
2. Relative Economic Strength Approach: explore the strength of economic growth in different countries in order to forecast the direction of exchange rates.
3. Econometric Models

**USD/EUR(1-year) = z + a(INT) + b(GDP) + c(IGR)**

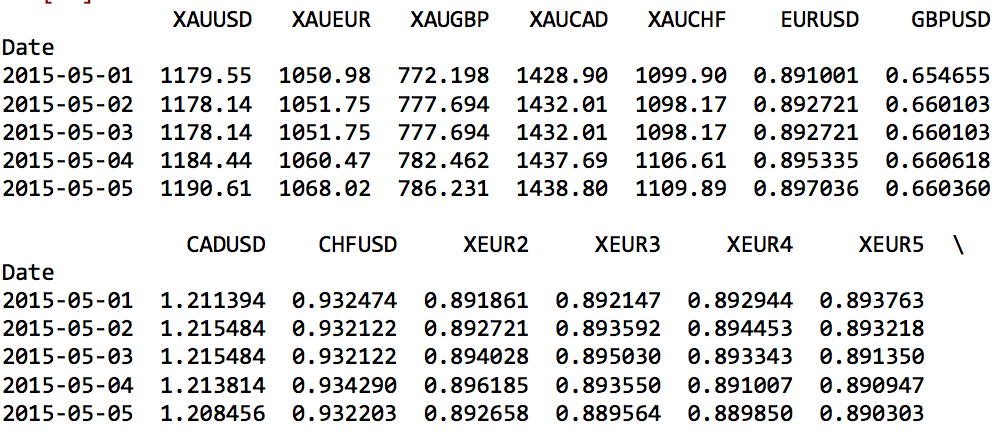
**z, a, b, c**: coefficients on how much a certain factor can affect the exchange rate and direction of the effect (positive or negative)

**INT**: interest rate differential between US and EUR

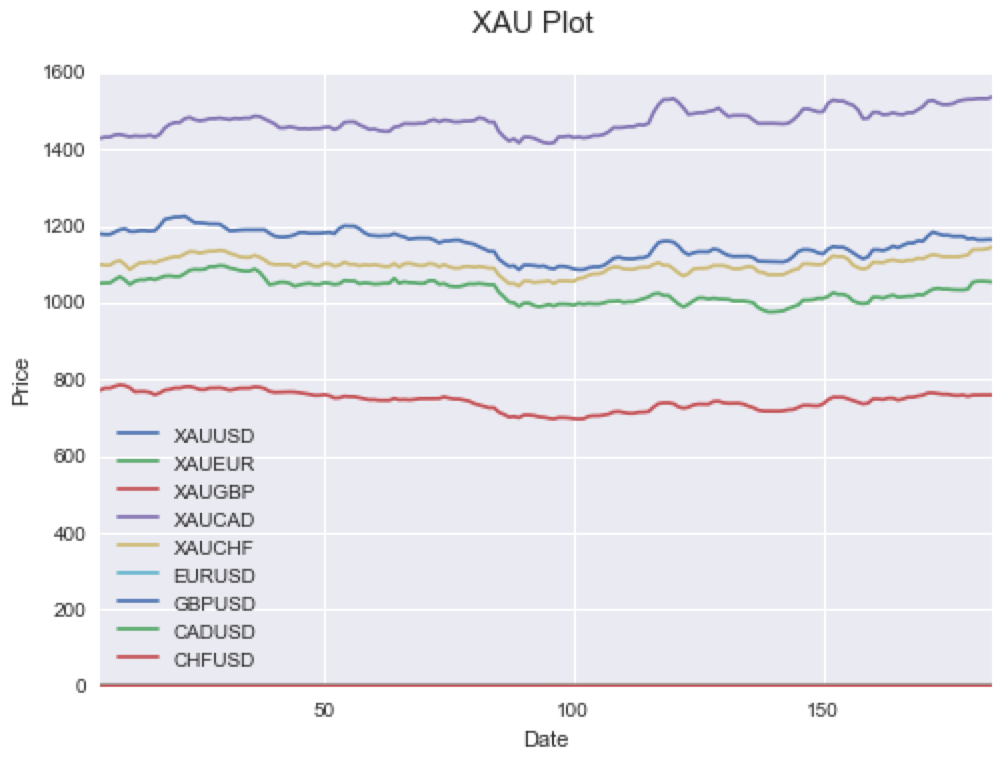
**GDP**: GDP growth rate

**IGR**: Income growth rate

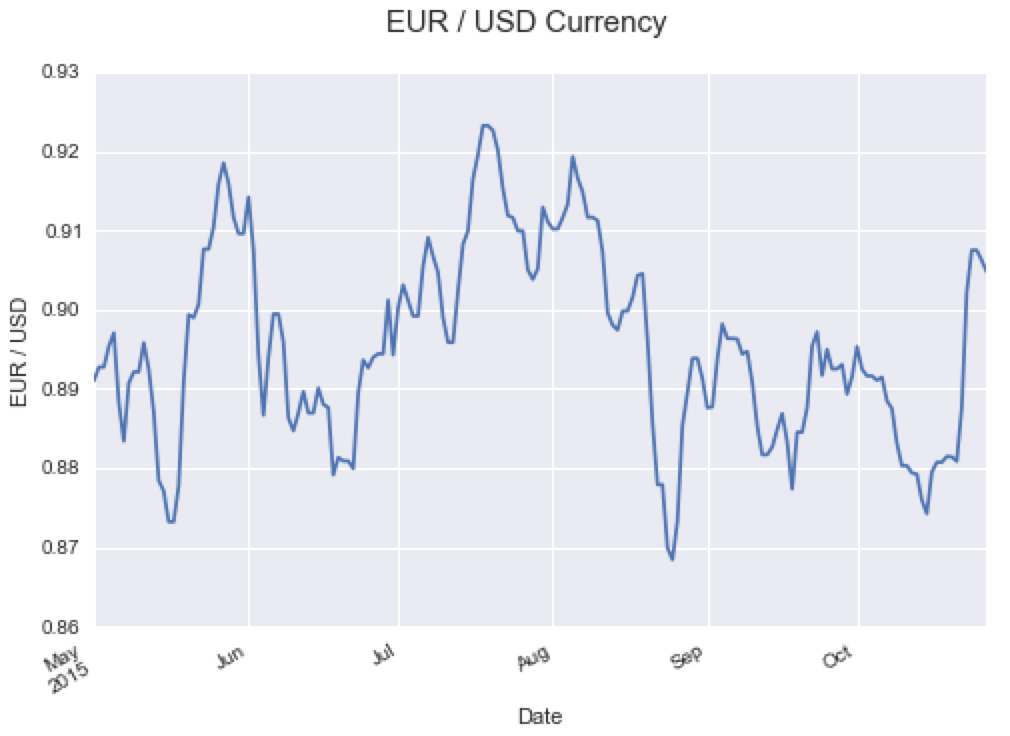
1. Time series model: a sequence of data points over a specified time interval that can expose meaningful statistics and other characteristics of a given data set



The data table above shows high-level overview of data, calculated currency rates, and calculated moving averages. I learned that null values appear when calculating moving averages over a span of 2 to 5 days (XEUR2 – XEUR5) so I utilized the last calculated data for each time series respectively. XEUR2 and XEUR3 provided close correlations for the linear regression and cross validation models. For your information, XEUR2 is the average of two days in sequential order.

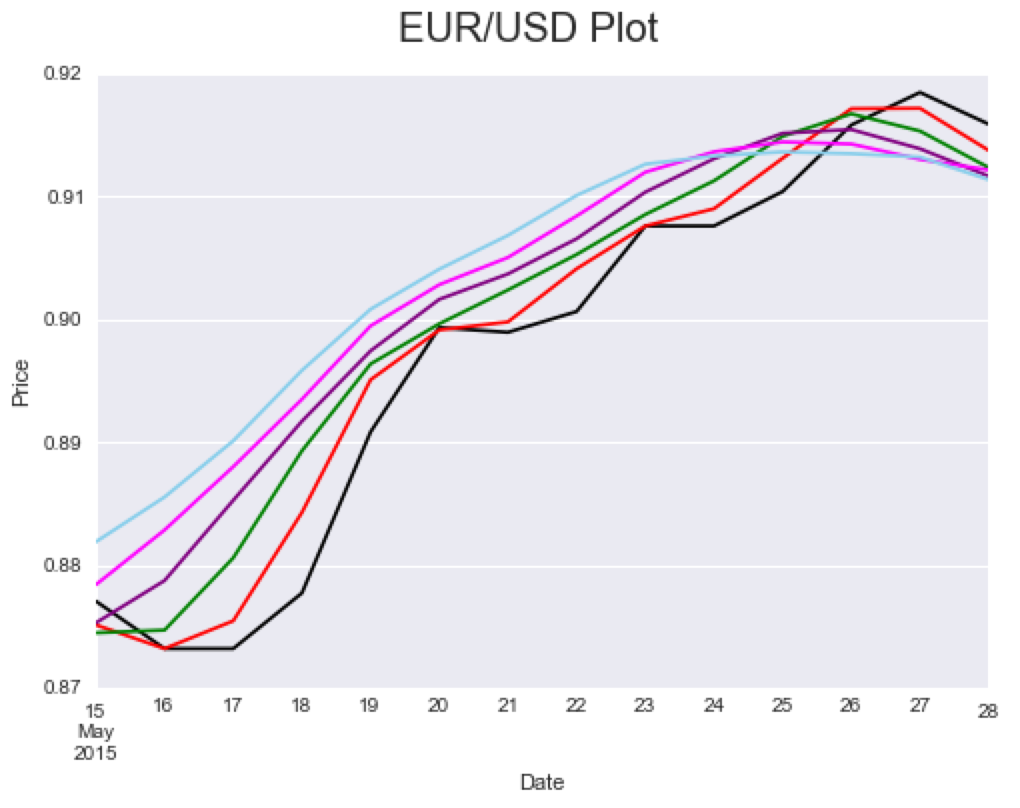


The XAU plot graph shows an overview of all XAU based currencies. Additional graphs listed below will explore how the fluctuations present in the XAU plot graph may be the result of different key events that affected the purchasing power of currency, such as Federal Open Market Committee announcements, changes in interest rates, or economic shocks to global markets.

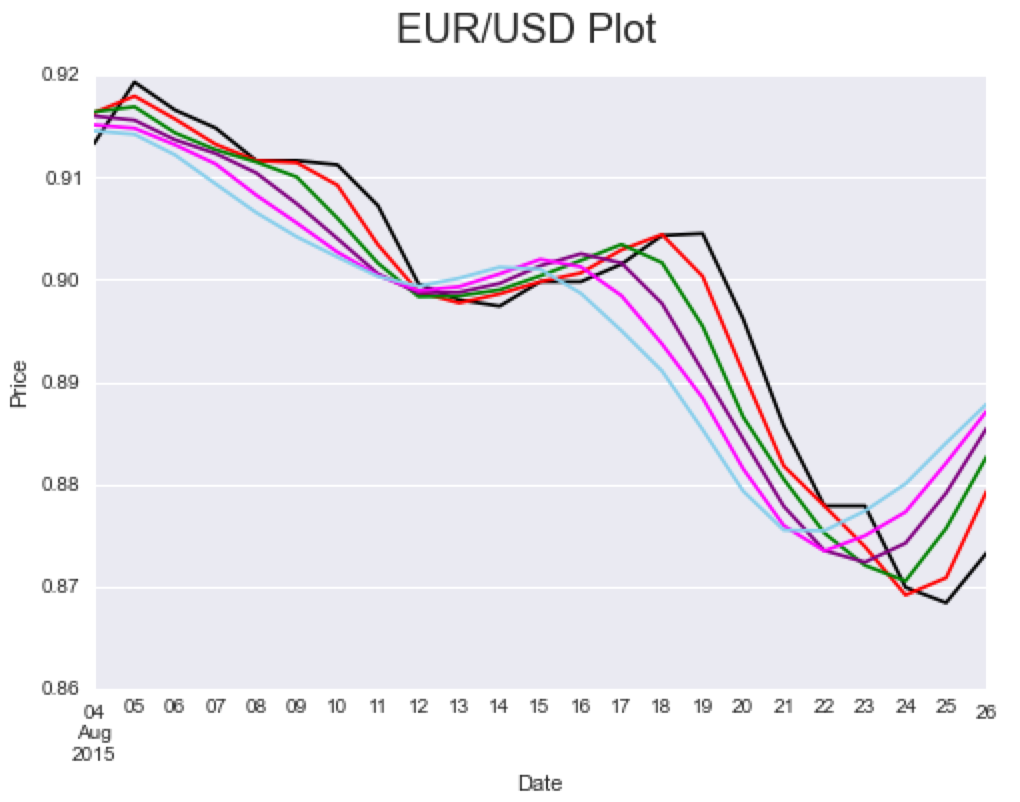


I derived the value of the EUR/USD currency over a period of 6 months to explore fluctuations that may correlate with key events that affected the direction of said currency.

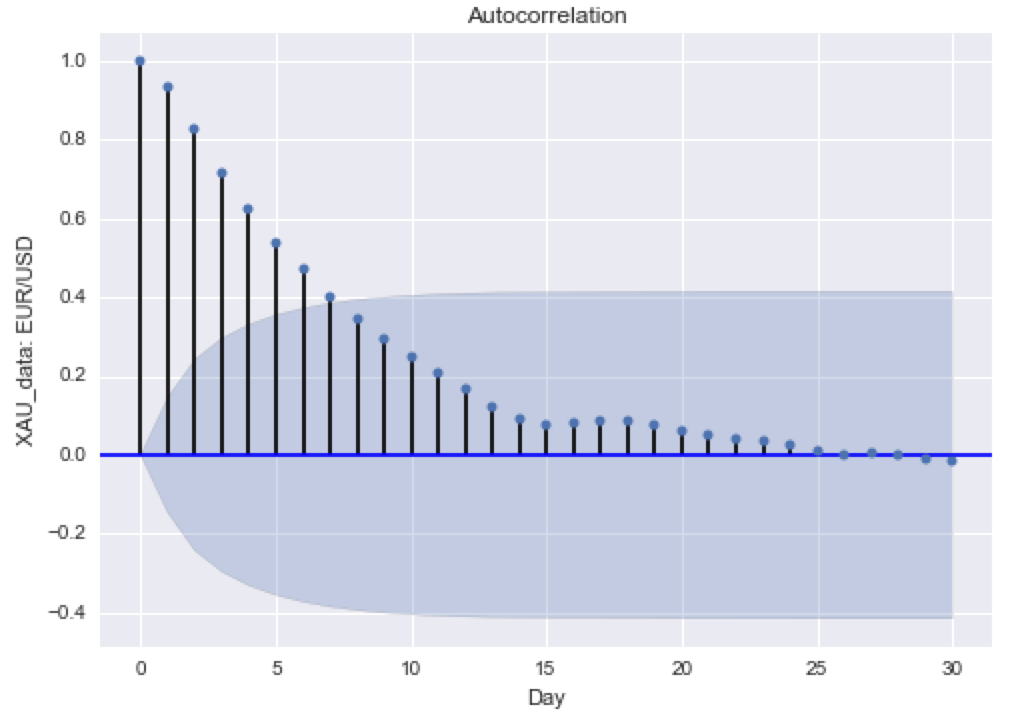
I snippet out May and August EUR/USD data sets to run statistical analyses on whether there were significant gains or losses in the purchasing power of the EUR/USD.



The black line represents the original data set of the EUR/USD value while the colored lines represent the moving averages of said value over a range of 2 to 6 days. The month of May’s EUR/USD plot line correlates with the value of the EUR/USD rate weakening in response to the Greek Debt Crisis, mixed US Economic Data, and the 0.7% decline of the US GDP’s first quarter performance.



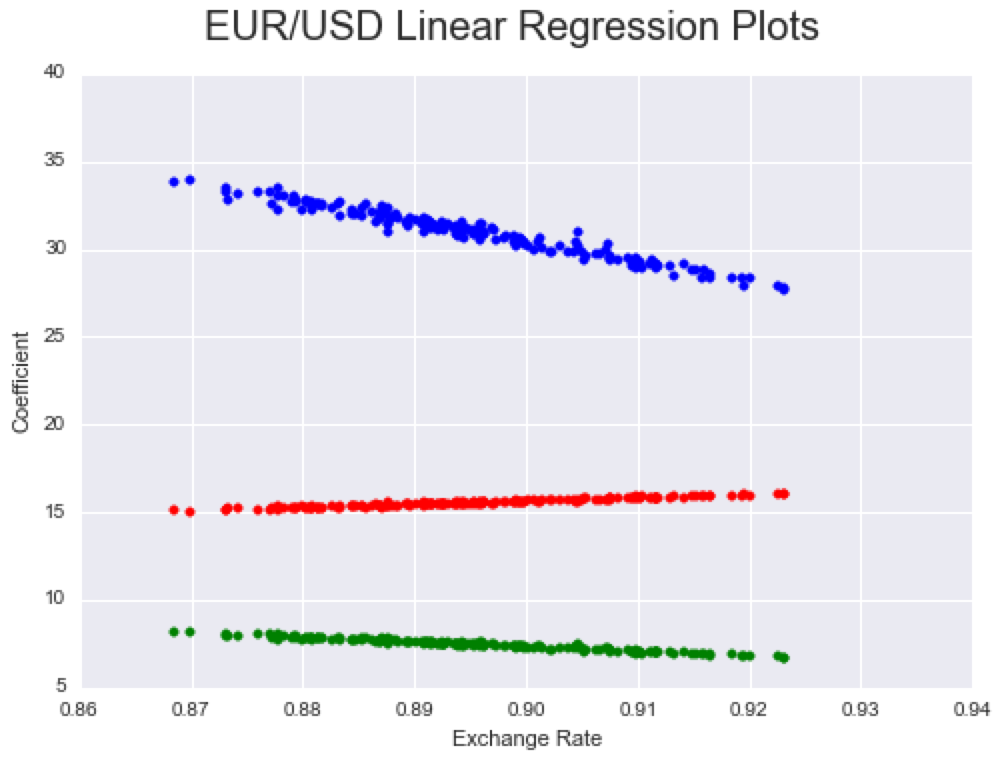
The month of August’s EUR/USD plot line correlates with the value of the EUR/USD rate gaining in response to the European Central Bank Chief Mario Draghi announcing the Euro stimulus and 3rd Bailout repayment of the Greece Debt Crisis by Aug 20, 2015.



This graph demonstrates the autocorrelation between different days and random signals that impact the analyzed data. Ultimately, the smaller the plot is, the weaker the autocorrelation signal will be.

I applied the following models: Cross Validation, Linear Regression, and

Random Decision Forest. I investigated for the Root Mean Squared Error (RMSE) between the Linear Regression and Random Decision Forest. The linear regression model was determined to be better model for analyzing the purchasing power of currency due to its stronger RSME value.



The EUR/USD Linear Regression Plots demonstrate the different linear regression prediction between days, weeks, or months. The red plot represents linear regression by days, blue by weeks, and green by months.

Conclusion:

Forecasting the exchange rate is a challenging task because the value of a given currency is sensitive to unexpected external events and can become difficult to measure.

The following predictive application models are suggested for gathering stronger analysis over the purchasing power of currency:

* Smoothing with Exponentially Weighted Moving Average (EWMA)
* Time Series and Holt-Winters Forecasting
* Holt-Winters Second Order EWMA
* Autoregressive Integrated Moving Average (ARIMA)