

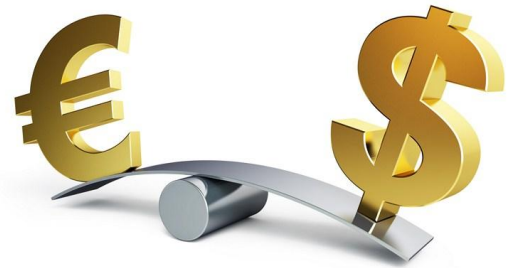
EUR/USD Forecasting



By : Roshan Khemlani (DSI 14)

Contents

- Problem Statement
- Overview / Target Audience
- Datasets
- Exploratory Data Analysis
- Modeling
- Conclusions & Recommendations



Problem Statement

- Build a model to predict the future price of EUR/USD currency pair using historical close price data along with various variables such as economic and financial indicators.



Overview / Target Audience

Overview – Forex Market

- According to a recent triennial report from the Bank for International Settlements (aka the Bank for the National Central banks) the average daily forex trading volume is around USD 5.1 Trillion.
- This is due to the rise of globalization, which saw an increase in trade, commerce and finance all across the world.
- Forex can be traded in Spot. Forward and Futures.
- EUR/USD is one of the most traded currency pair in the forex market.
- Europe is one of America's largest trading partner, accounting for \$806 billion worth of goods traded in 2018.

Target Audience

This model is targeted to Hedge Funds, Financial Institutions and Multinational Corporations with investments/businesses in both United States and Europe. It allows them to mitigate their risk from market volatility by hedging against their open positions/obligations.



Datasets

Economic Indicators - Monthly (252 days of Data)

- Retail Sales
- Consumer Price Index
- Unemployment Rate
- Industrial Production
- Interest Rates
- Core Consumer Price Index

Financial Indicators - Daily (5,559 days of Data)

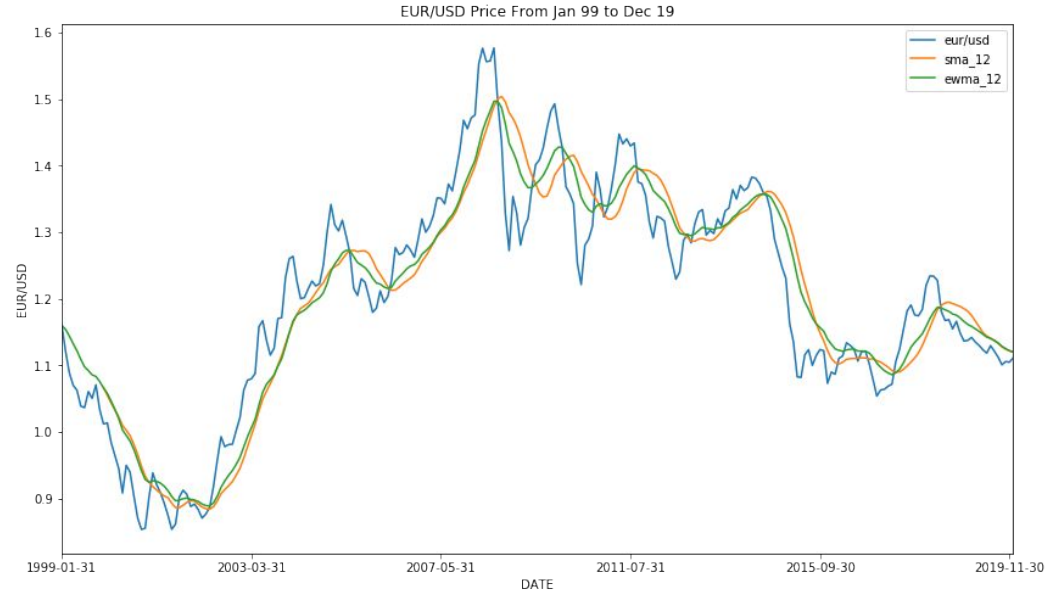
- Major Currency Pairs
- Equity Indices (Nasdaq, DAX)
- Dollar Index
- Commodities (Oil, Gold)



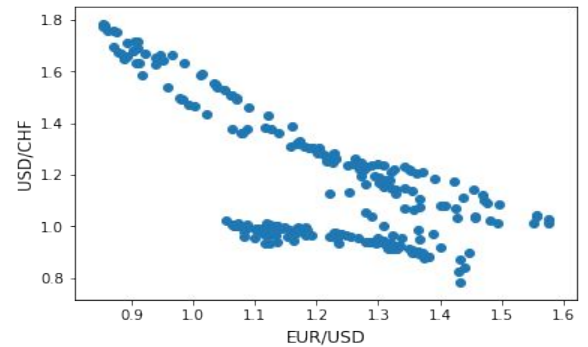
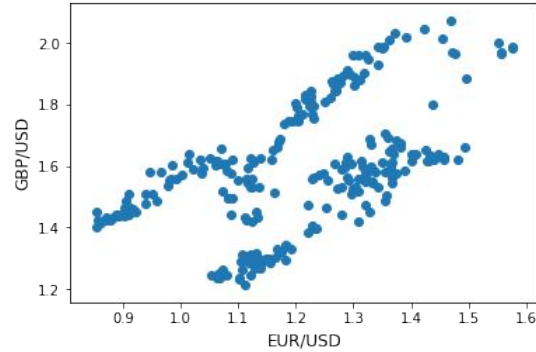
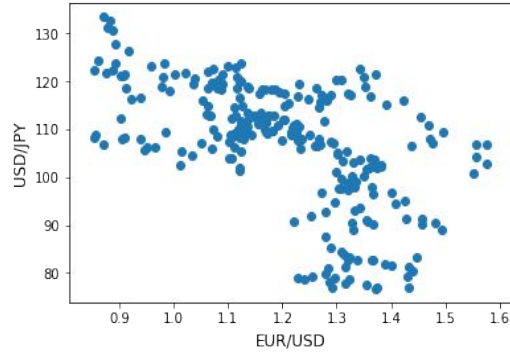
Exploratory Data Analysis

EDA – EUR/USD

- EUR/USD Monthly Price from Jan 99 to Dec 19
- With Simple Moving Average and Exponential Weighted Moving Average

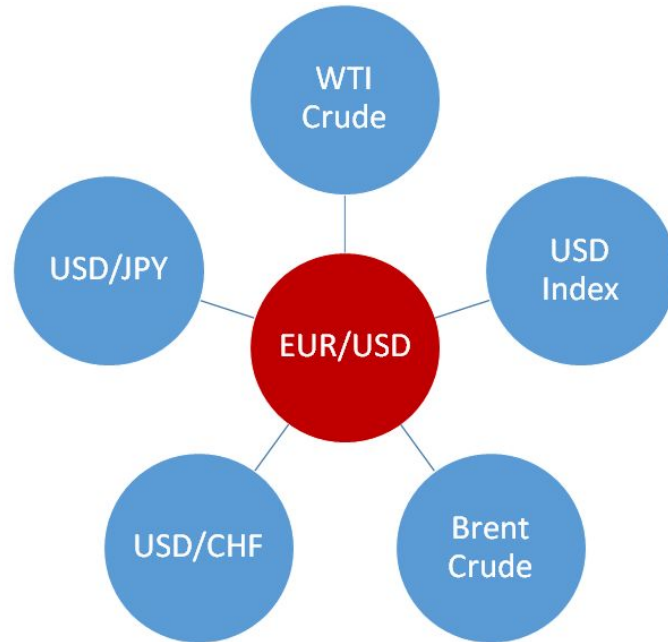


EDA – Currency Pairs



Overview of the relationship between target variable EUR/USD and other major currency pairs

EDA - Top 5 Features

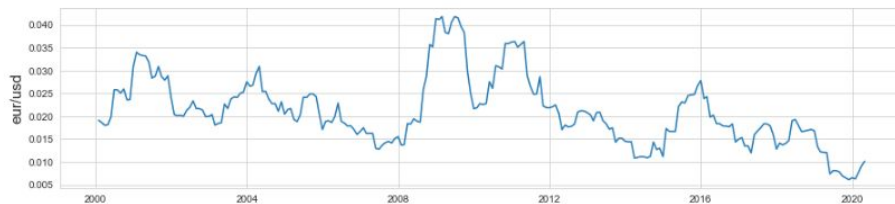
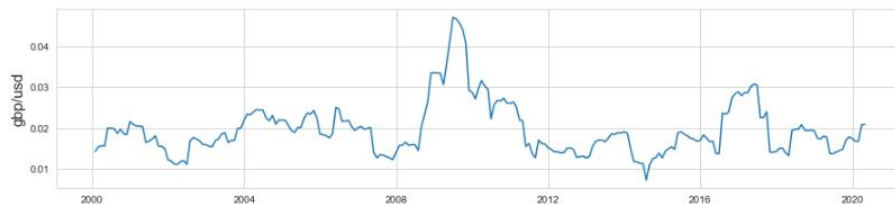


EDA – Volatility

Looking at the volatility graph, we could identify how major events affect the price movement.

Both GBP and EUR saw a sharp jump in volatility in 2009, during the financial crisis.

Another point was in 2016, where Britain had voted to leave the European Union.



Modelling

Time Series Models

I will be using a regression model to predict the price of EUR/USD currency pair.

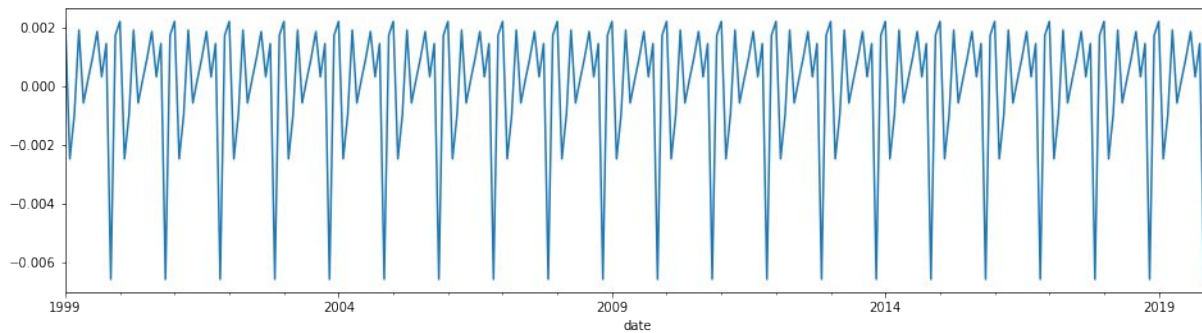
1. ARIMA Model
2. SARIMAX Model (Including Exogenous Variables)

Stationarity

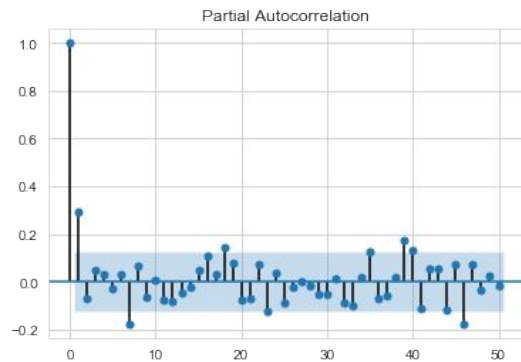
- Before loading the data for modeling, we performed an Augmented Dickey-Fuller Test to test for stationarity.
- Notice all columns apart from Fed Rate, US Retail, US Indus, EU Indus and US CPI are non-stationary.
- In order to convert the remaining columns to stationary, I difference the dataset by 1.

Seasonality

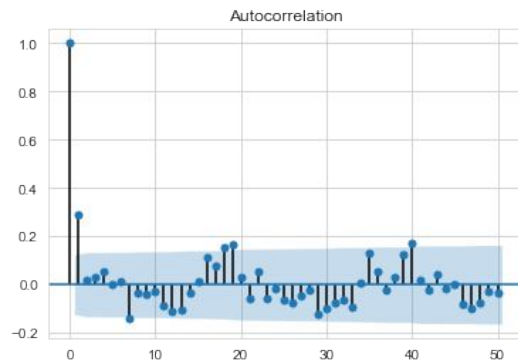
Seasonal Decomposition



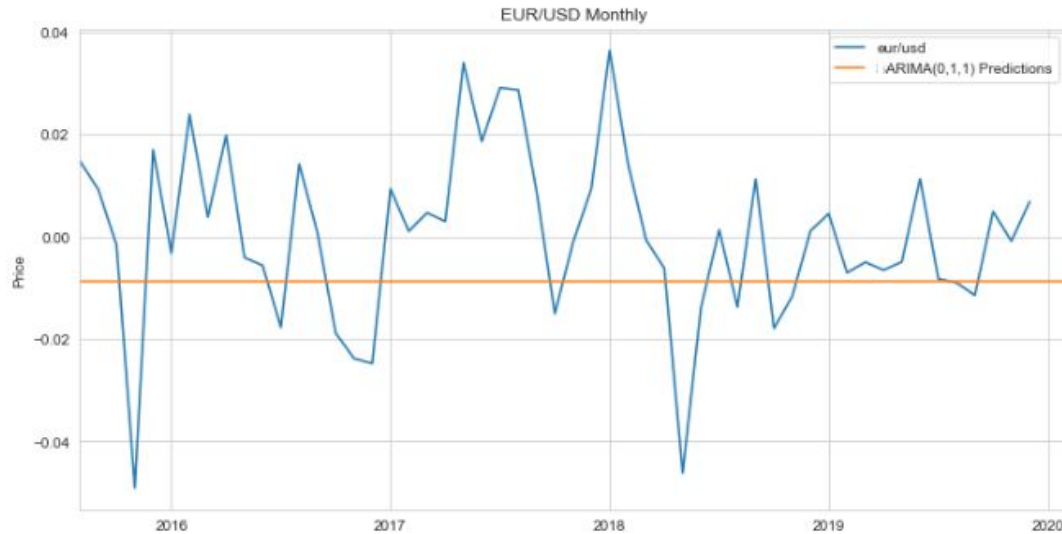
PACF



ACF

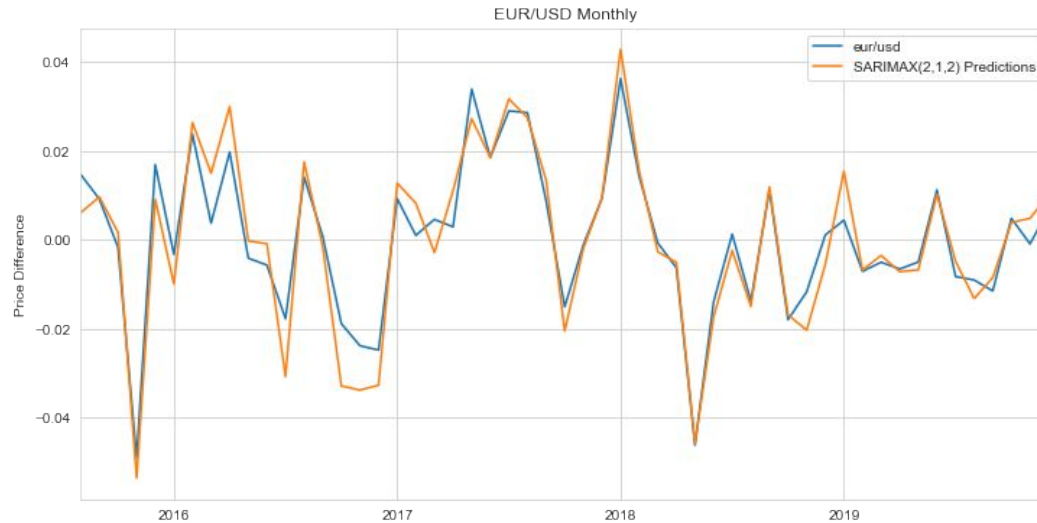


ARIMA – Model



Arima model shows us how financial data in today's time is more reliant on exogenous variables in order to perform.

SARIMAX – Model

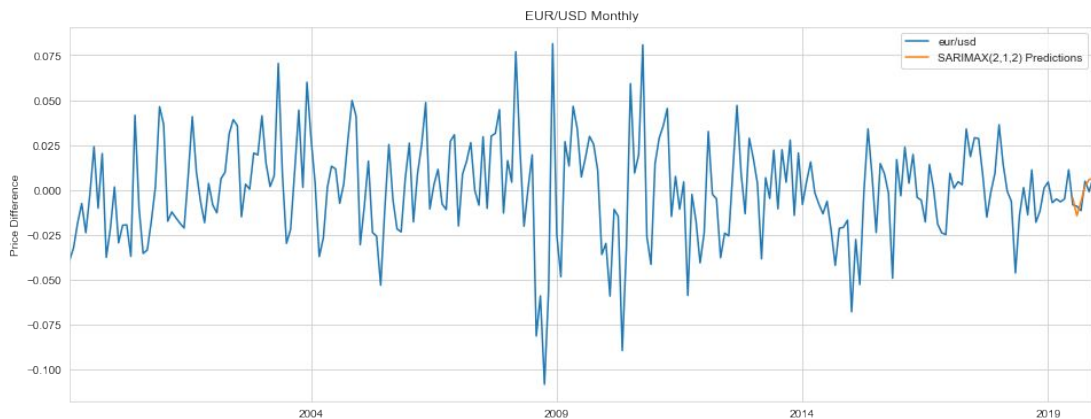


Added Exogenous variable, WTI Crude, USD_Index and USD/CHF to the model.

Evaluation

Model	ARIMA	SARIMAX
p,d,q	0, 1, 1	2,1,2
MSE	0.0002801	0.000032695
RMSE	0.0167356	0.005717974

Forecast – July till Nov 2019



	eur/usd	SARIMAX(2,1,2) Predictions	difference
date			
2019-07-31	-0.008249	-0.004461	0.003788
2019-08-31	-0.009032	-0.014339	0.005307
2019-09-30	-0.011492	-0.006487	0.005005
2019-10-31	0.004868	0.002061	0.002807
2019-11-30	-0.000906	0.005841	0.006747

Conclusion

By looking at the Arima model, we can conclude that financial data cannot be predicted just by using the endogenous variables as they tend to be more sensitive with exogenous features as well.

This was further confirmed by the MSE and RMSE score, where SARIMAX model performed way better than ARIMA.

I feel that this can be further improved if feature selection was used to help identify variables with higher coefficient.