Stock Market Analysis & Prediction

By: Seung Chi

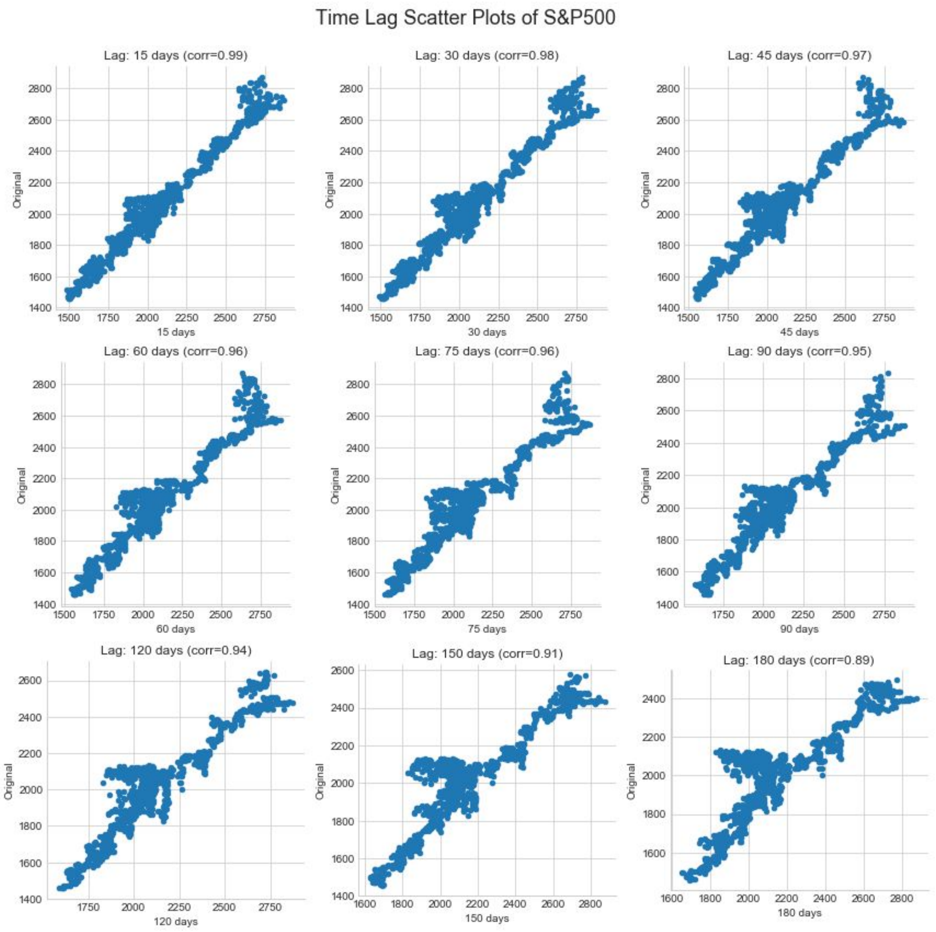
Malkiel's Monkey

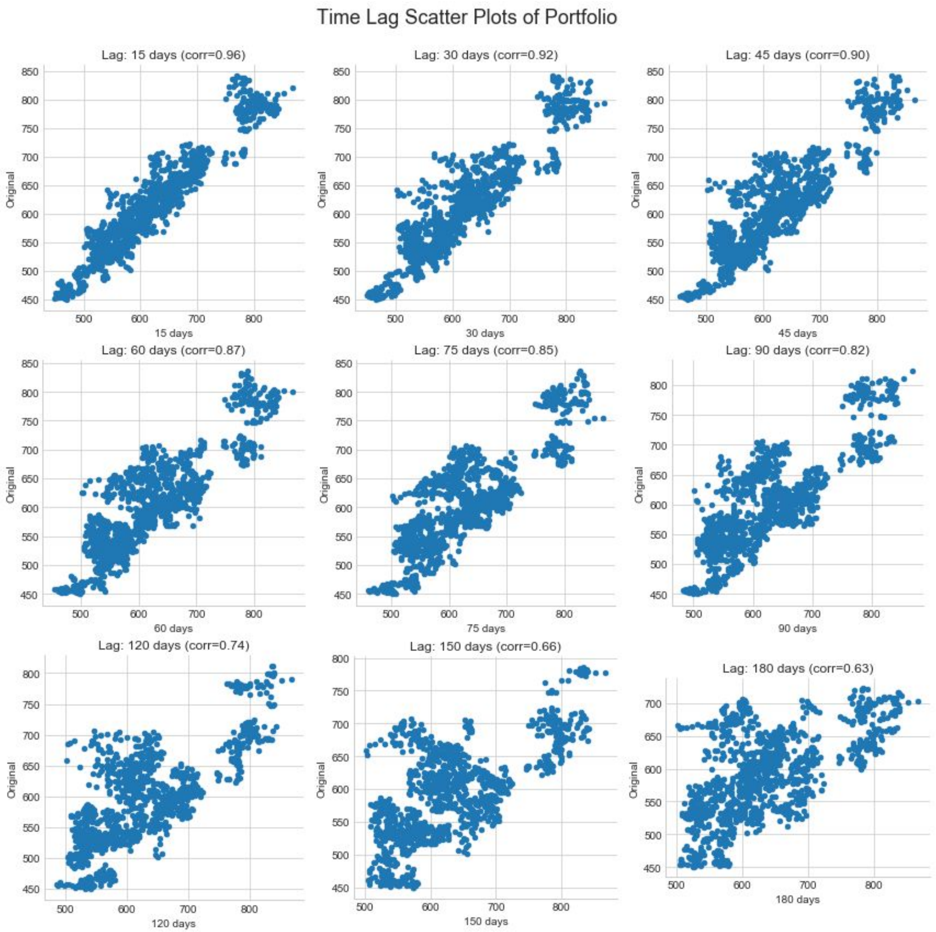
"A blindfolded monkey throwing darts at a newspaper's financial pages could select a portfolio that would do just as well as one carefully selected by experts." -Burton Malkiel in A *Random Walk Down Wall Street*

- Compare S&P 500 Index against a Portfolio of 20 randomly selected stocks
- Time span of 5+ years from 2013-01 to 2018-06

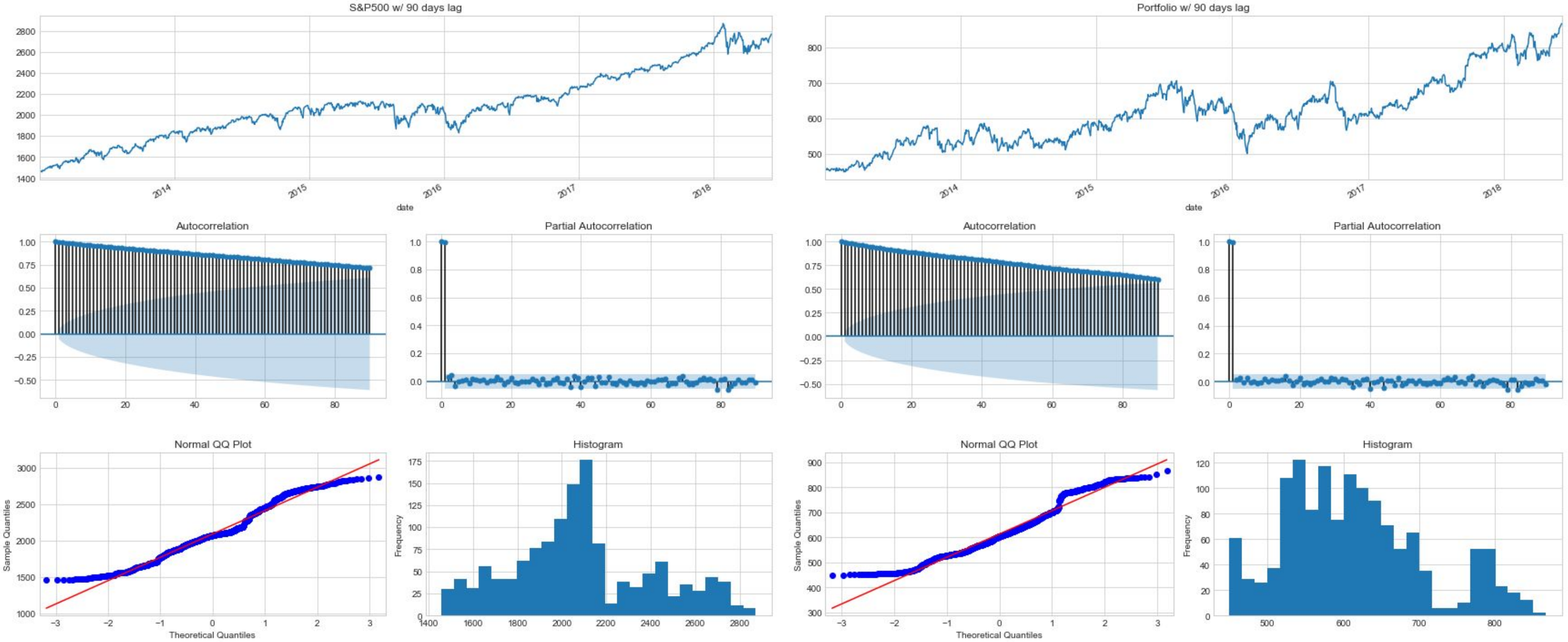
S&P 500 vs Portfolio: What would make me more money?

Scatter Plots Comparison of Autocorrelation with Time Lags

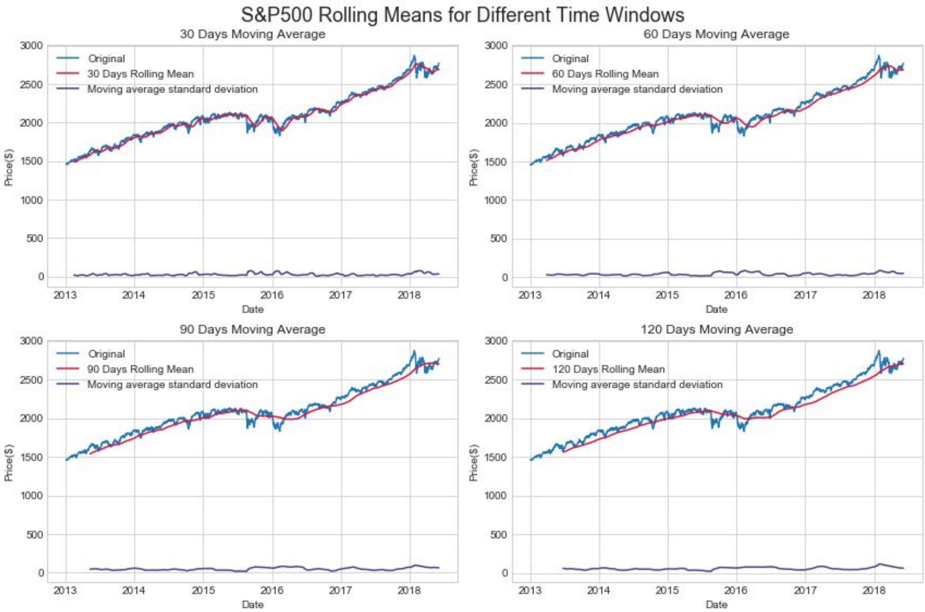


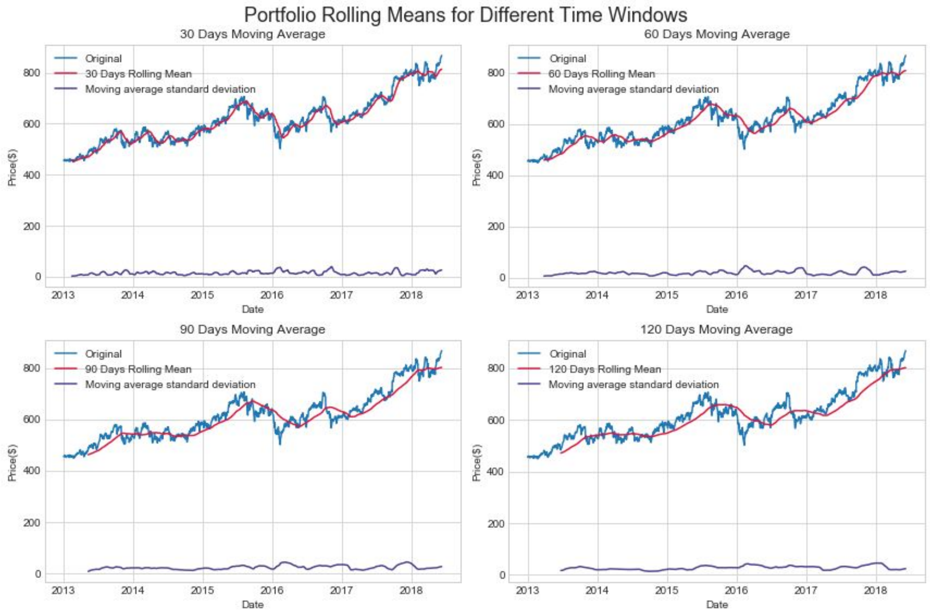


Random Walk Process: Non-stationary

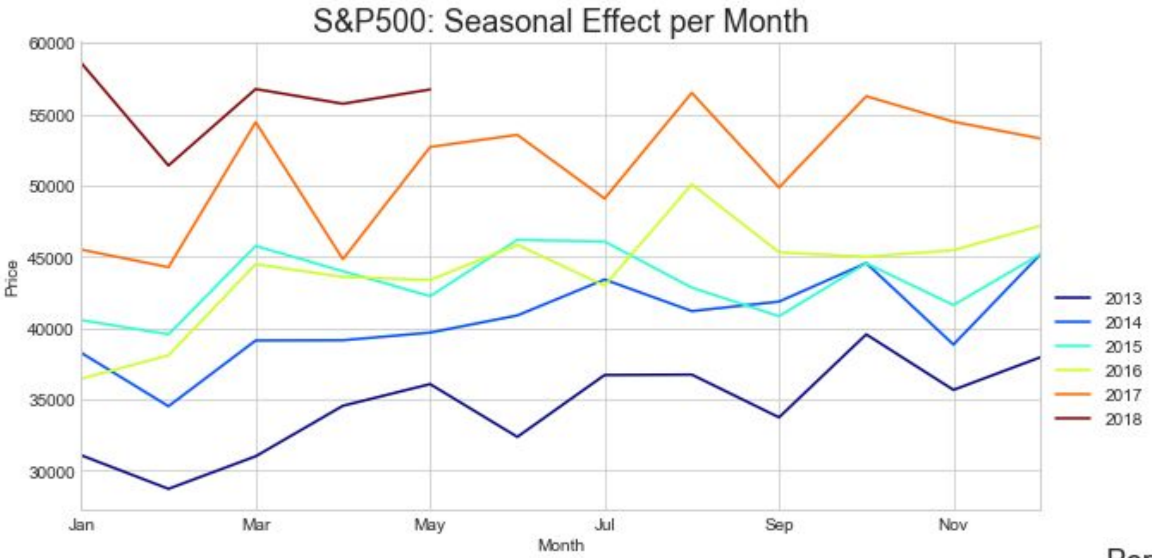


Rolling Means for Trend Visualization

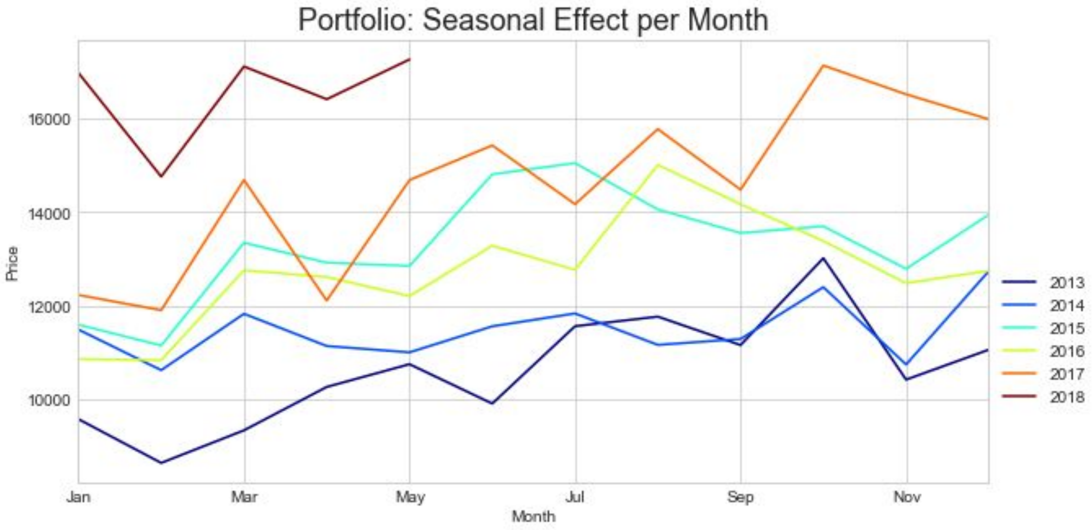


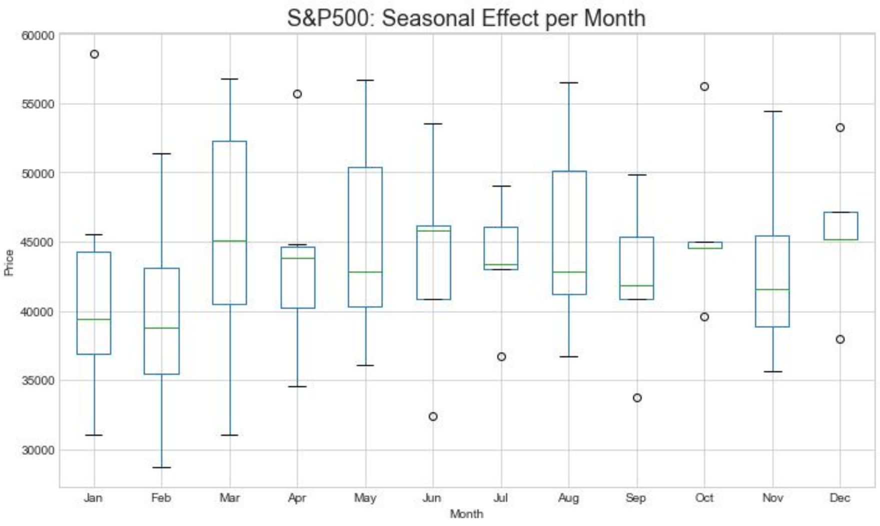


Seasonal Effect per Month for each Year



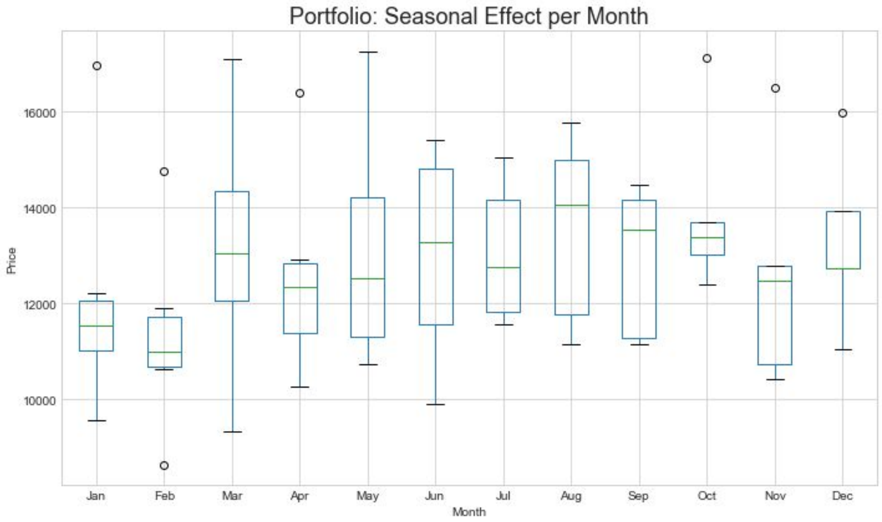
- Note quarterly earnings season: December, March, June, and September



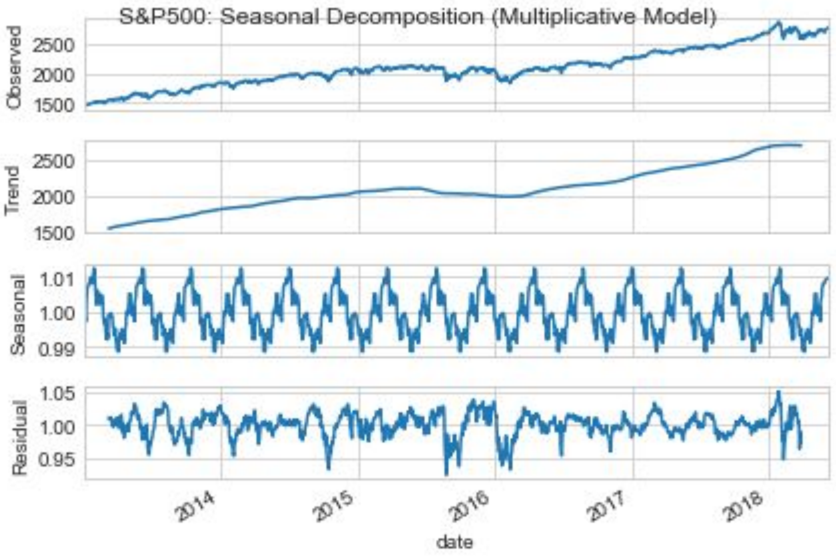


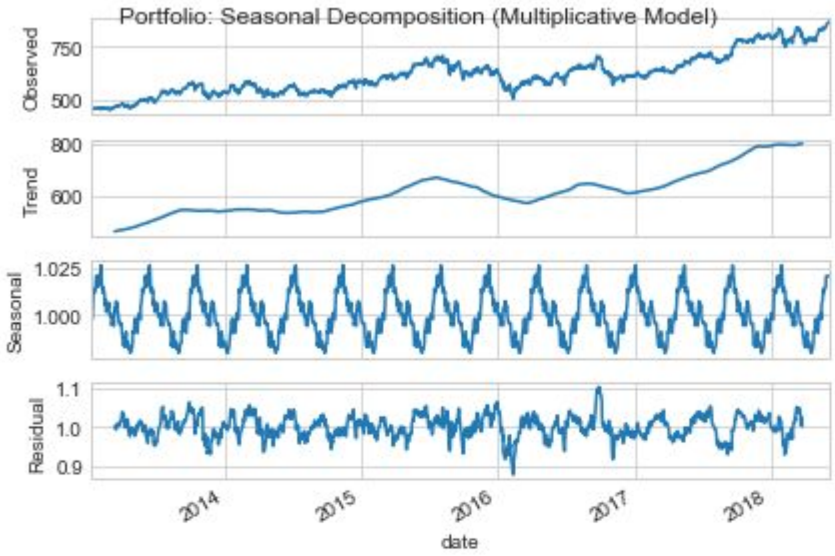
Seasonal Effect: Boxplots per Month

- Note quarterly earnings season: December, March, June, and September



Seasonal Decomposition for Noise





Augmented Dickey-Fuller Test

- **H0**: Unit root is present in the time series and thus is non-stationary.
- **H1**: The time series is stationary.
- **α**: 0.05

	Test Statistics	P-Value
S&P 500	-0.7115	0.8437
Portfolio	-0.7246	0.8403
S&P 500 (1st Diff)	-21.3979	0.0000
Portfolio (1st Diff)	-19.4453	0.0000

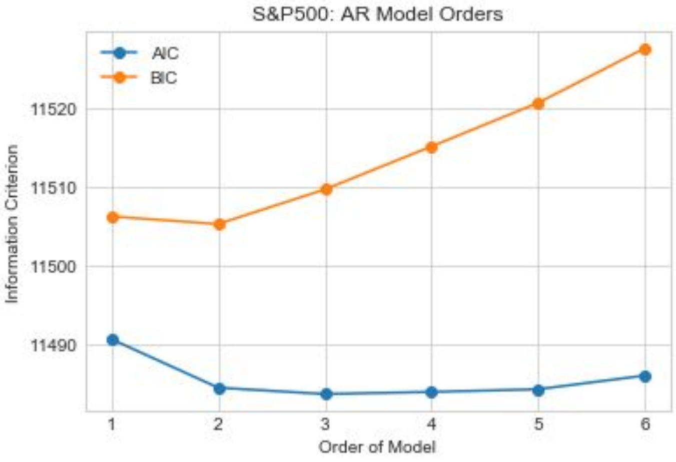
Critical Value (5%)	Critical Value (1%)
-2.8637	-3.4352

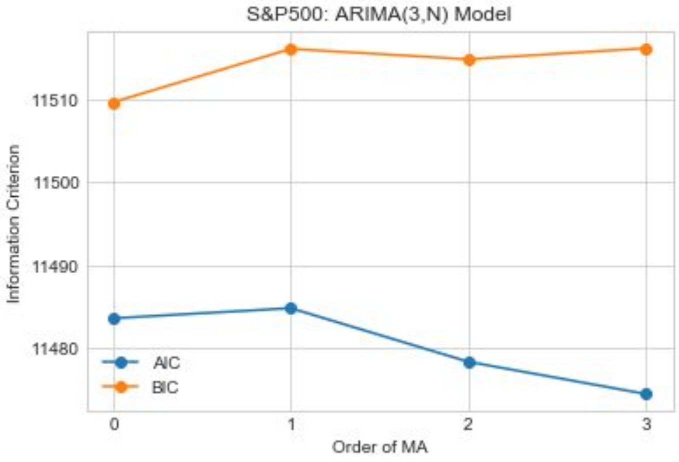
White Noise

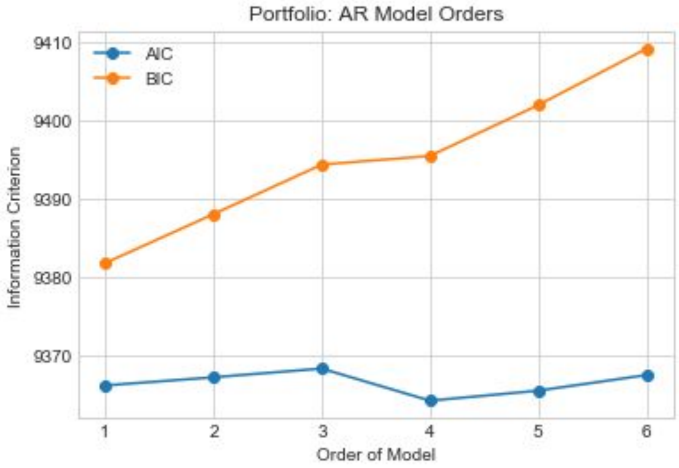
Stock Price First Order Differences
S&P500
75
50
25
0
−25
−50
−75
−100
2014
2015
2016
2017
2018
date
Portfolio
40
30
20
10
0
−10
−20
−30
−40
2014
2015
2016
2017
2018
date

ACF & PACF of First Order Difference

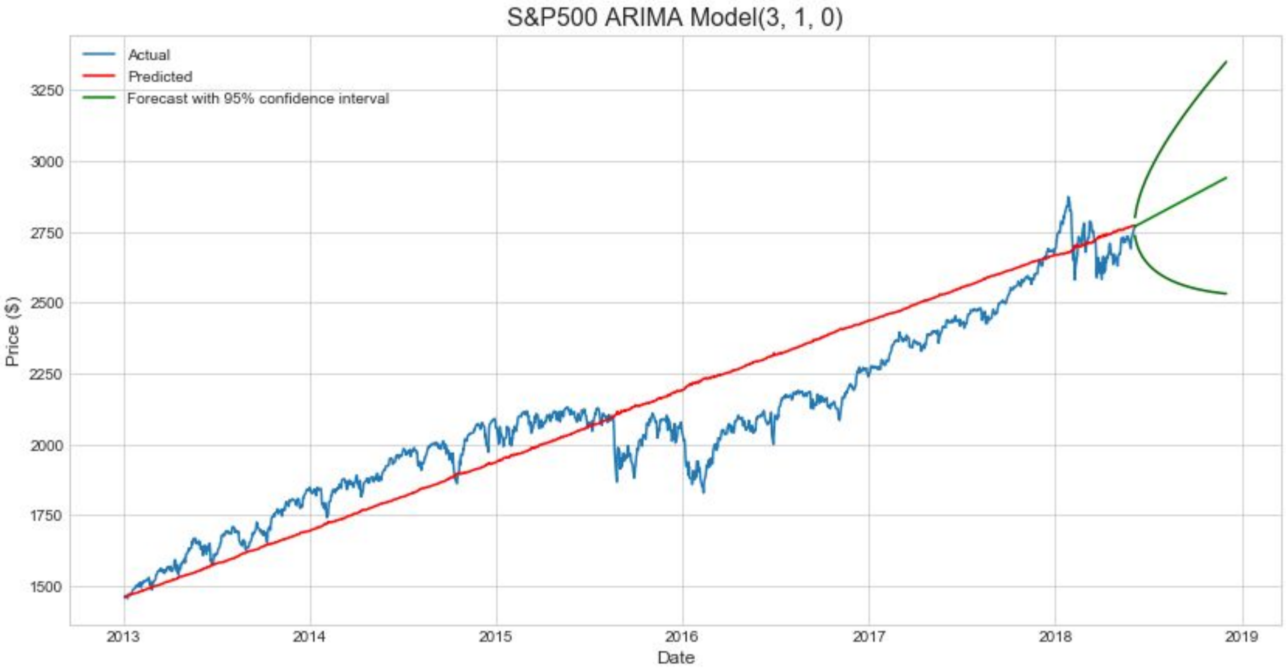
ARIMA Model Order Selection with AIC & BIC







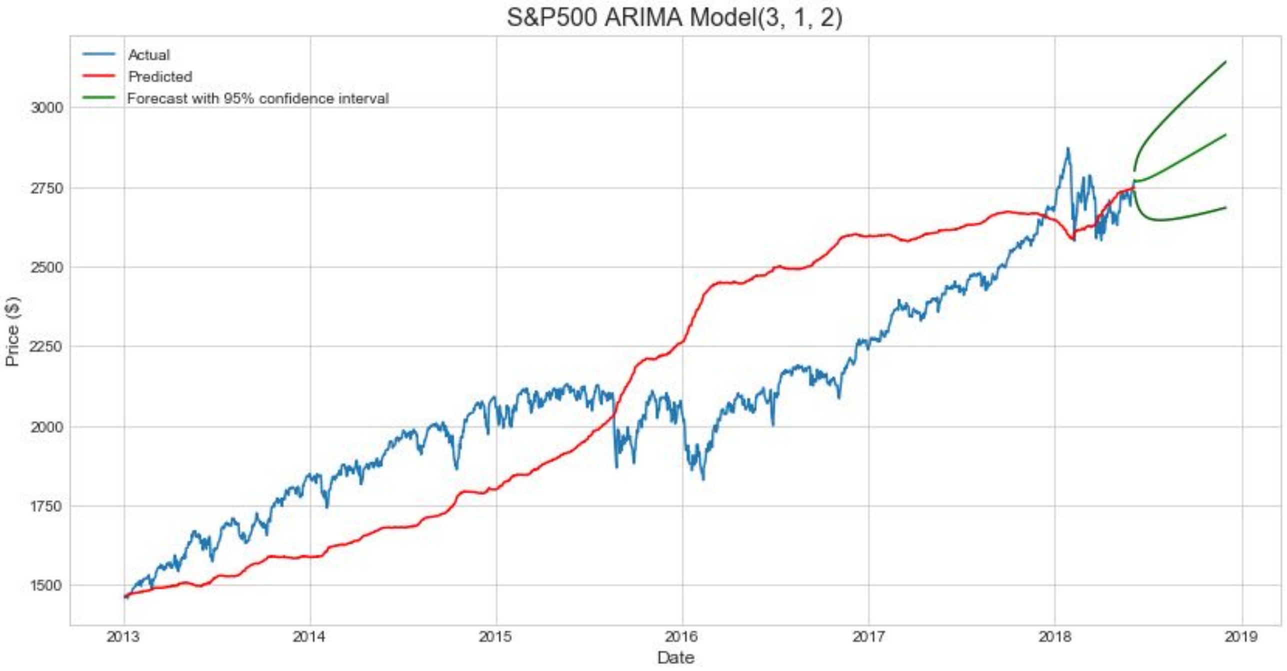
S&P 500 ARIMA Model (3, 1, 0)



Prediction from Jan 2018 to Jun 2018:

2836.67 Mean Squared Error

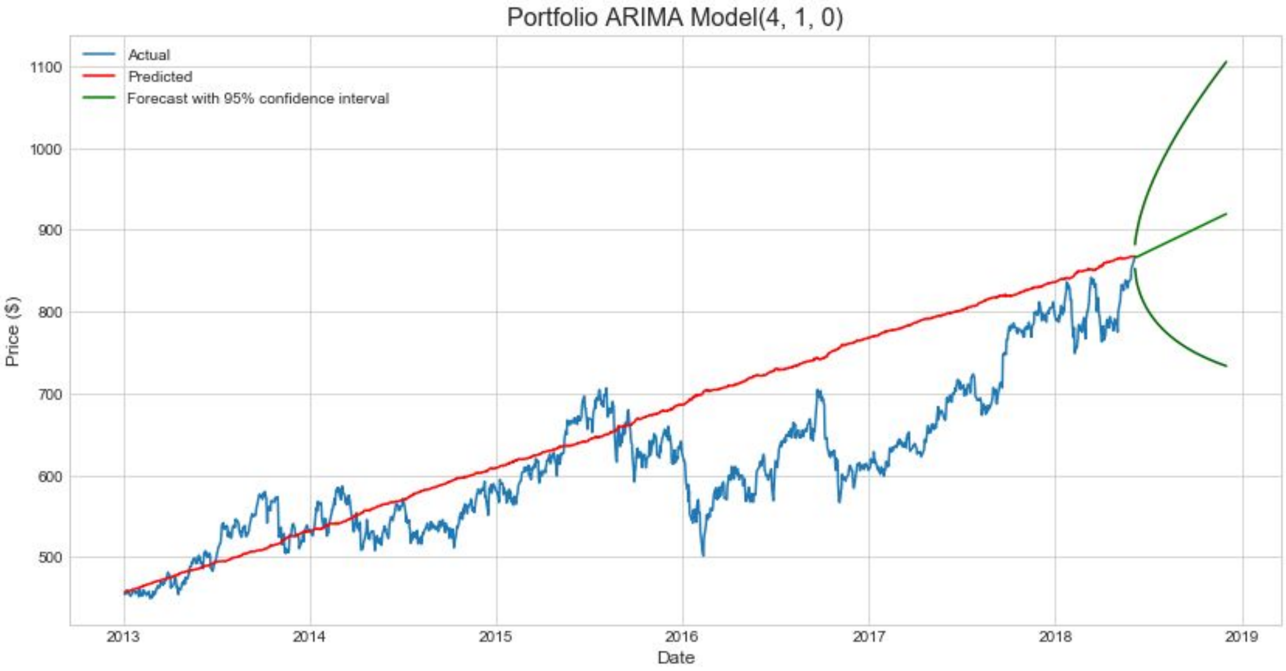
S&P 500 ARIMA Model (3, 1, 2)



Prediction from Jan 2018 to Jun 2018:

2547.11 Mean Squared Error

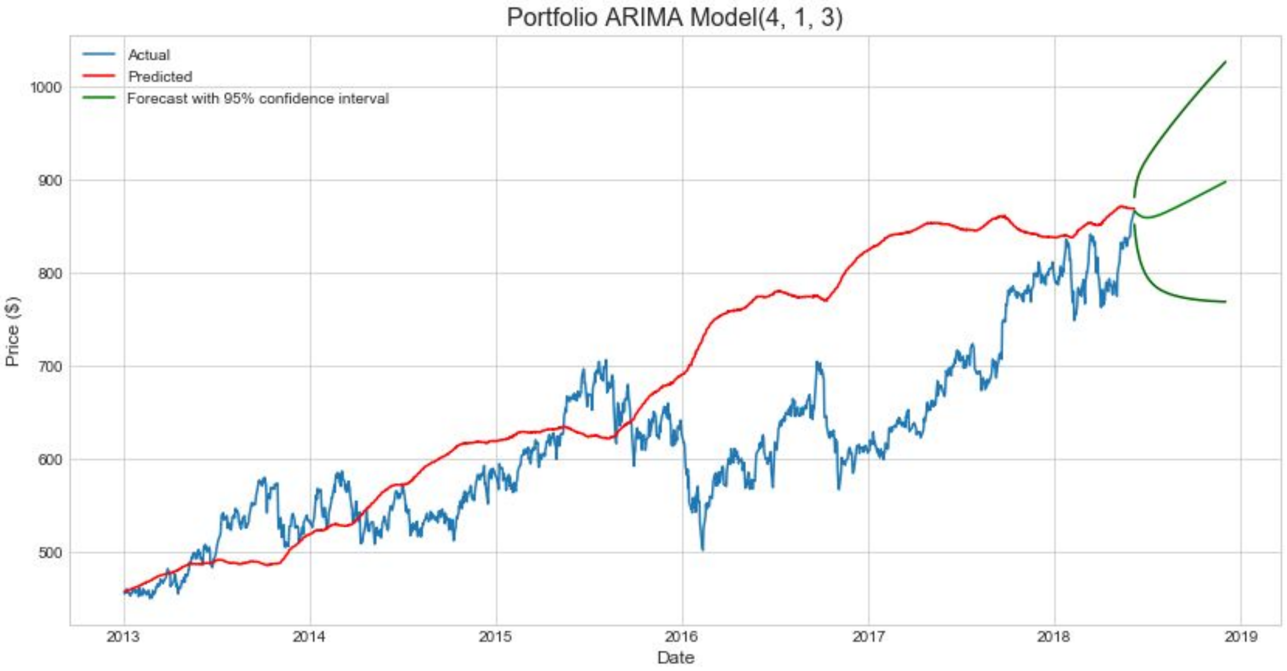
Stocks Portfolio ARIMA Model (4, 1, 0)



Prediction from Jan 2018 to Jun 2018:

676.02 Mean Squared Error

Stocks Portfolio ARIMA Model (4, 1, 3)



Prediction from Jan 2018 to Jun 2018:

620.93 Mean Squared Error

Beyond this Project

- Use different indexes and/or stocks for time series analysis and model performance
- SARIMAX
- RNN
- NLP for finance articles, social media feeds, quarterly earning reports, etc.