The link between the S&P 500 index and crime rates

Course: CPS 803
Professor: Neil Bruce
Name: Daniel Gomez
Student #: 500449117
Date: November 20th 2018
Pages: 10

Abstract:

The S&P 500 index tracks the stock prices of the top 500 companies in the world. This has been used as a method to track the economic status of the stock market. Making the assumption that crime increases as the economic status of companies decreases, we can come to the conclusion that the S&P 500 and crime rates should be correlated in someway. By plotting the data we saw that there is an inverse correlation, as price increased crime rates went down. The data was then plotted individually to see if by tracking both we can see more clear connections. From the two graphs we see that crime is decreasing over time while the S&P 500 increased. Yet this can be explained by improving conditions in the world overall and might not mean direct correlations. So the data was checked to see how the response was during the 2008 stock market crash. During this time there is a dip in the Crime Vs. Price graph as well as a dip in crime during this time. This can show that the S&P 500 is closely correlated with crime rates.

Intro:

The S&P 500 index describes the state of the stock market by showing a combination of the performances of the top 500 companies. This index can thus show a representation of recessions hitting the stock market. Through the article “Do recessions increase crime?”, we have learned that recession can increase long term and short term crime rates. We will therefore be testing if the S&P 500 can help us track crime rates throughout the world but for this experiment only the US. For this report we will be looking at the S&P 500 stock data and criminal data collected by the NYPD.

Materials and Methods:

Stock Market information was taken from the yahoo website:
https://finance.yahoo.com/quote/%5EGSPC/history?p=%5EGSPC

A copy of the data used can be found at:
https://data.cityofnewyork.us/Public-Safety/NYPD-Arrests-Data-Historic-/8h9b-rp9u#

Note: New York was used as it is famous for its high crime rates, thus if there was even a small correlation it would be most noticeable in this data set.

To start finding similarities the data first needed to be processed. This was done by finding which dates overlapped in crime records and stock prices. This was then put into a new text file with three columns: Closing Day Price of S&P 500, number of crimes, and date (day/month/year).

This data was then read into Jupyter notebook. To start the analysis both pieces of information were put on a graph to see if there were any similarities at first glance.

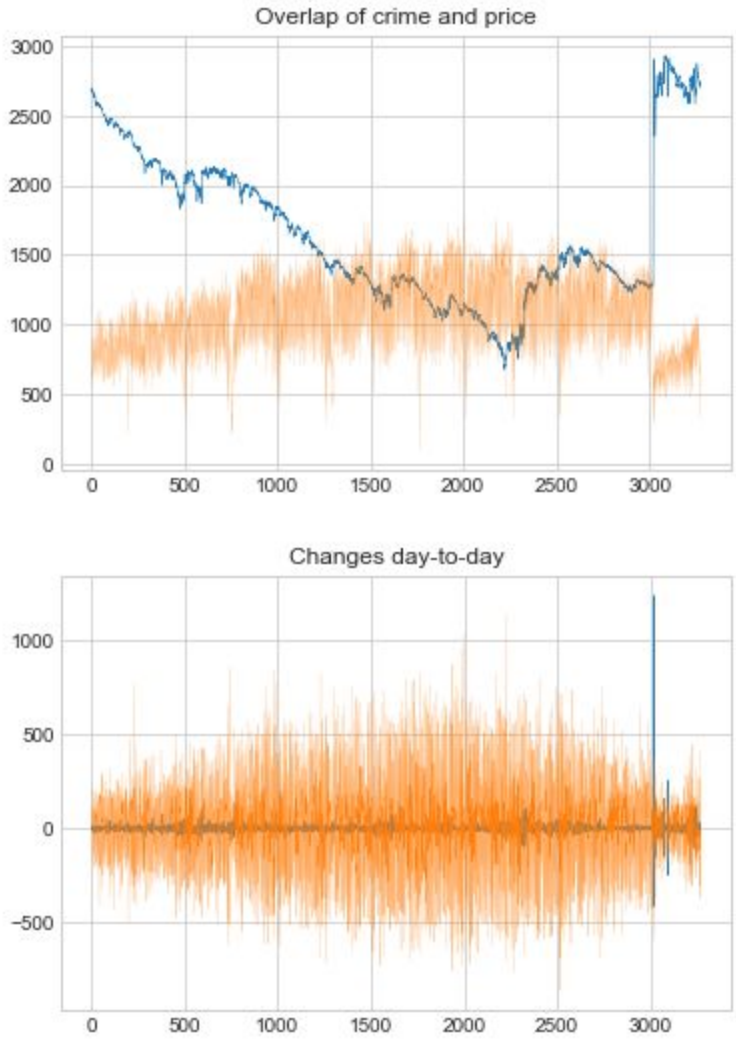

Figure 1: Crime and Price data overlap (2006-2018)

From the first graph in the figure above we can see that at the end there is an opposite reaction. As price shoots up dramatically, crime shoots down similarly. This shows that the two charts seem to be mirror images of each other. As one goes down the other goes up. To see more changes the data was checked to see if they rose and decreased in opposite directions as well. Unfortunately this data did not give useful information. It did show that in the midsection of this data there was higher crime rates which then began to stabilize in the later years. As well as showing there is a huge amount of fluctuation of crime rates constantly.

To clear up the confusion created by the changes day-to-day chart we zoomed into it by taking a random sample of the data.

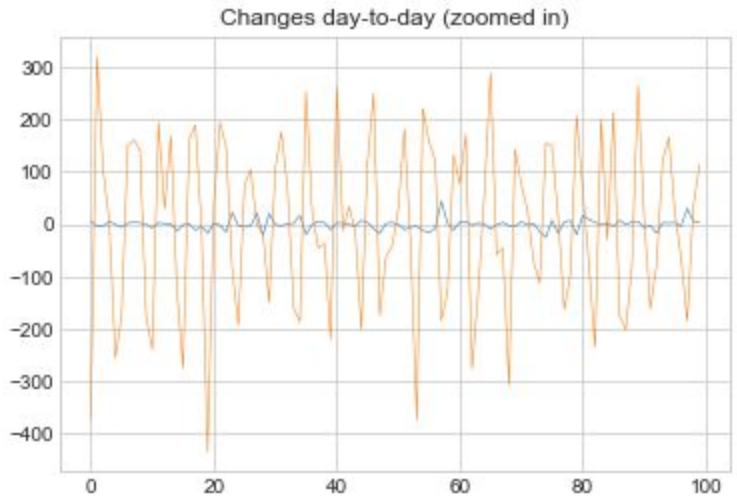

Figure 1.2 Changes day-to-day

The figure 1.2 above shows a random sample of the data used. In this data we can see that there are some peaks in one set of data that has an opposite response in the other data. To get a better view of this the peaks were changed to have a max value of 1 (rising) and minimum value of -1 (falling).

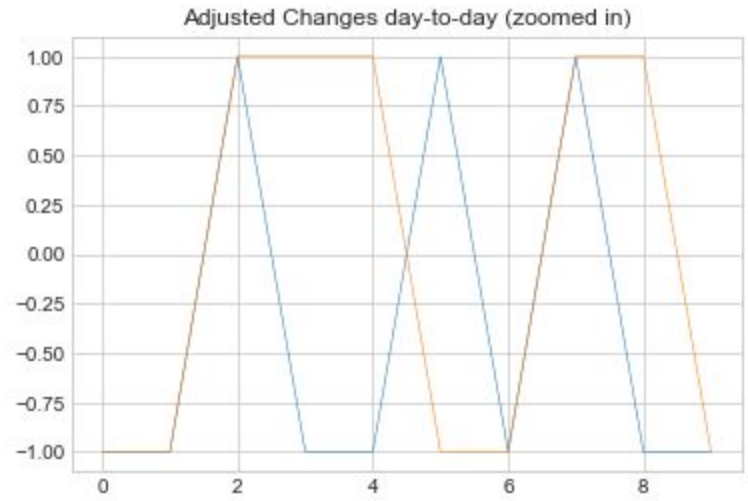

Figure 1.3 Adjusted Changes

In figure 1.3 we can see that the peaks are generally opposite of each other. This gives a possibility to the two data sets being inverse of each other and thus having an inverse correlation.

Since we could see there looked to be some correlation between S&P 500 prices and crime, it was attempted to see if crime rates were predictable based on S&P 500 prices.

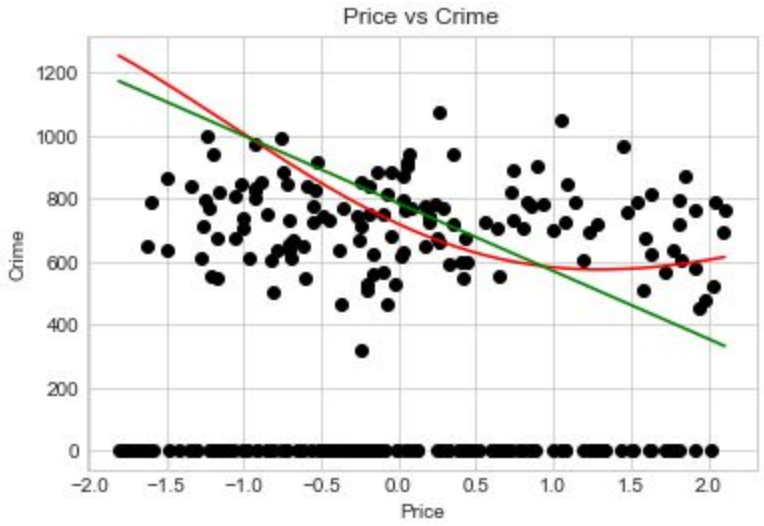

Figure 2: S&P 500 prices vs number of crimes in NYPD (2006-2018)

Using Support Vector Regression we are able to see that the prediction line created shows a negative correlation between the two bits of data. From the linear line we see as price increases there is a decrease in crime rate. From the rbf line we see that it does decrease but then it seems to stabilize at the end and almost starts to increase.

This information does not give us a clear enough indication of correlation between the two data sets. These results could be independent of one another since as companies grow their prices will increase and as things improve in society crime rates decrease. So each data set was separately checked.

First we see S&P 500 prices by itself. For this the whole dataset of S&P 500 was used (1927 - 2019).

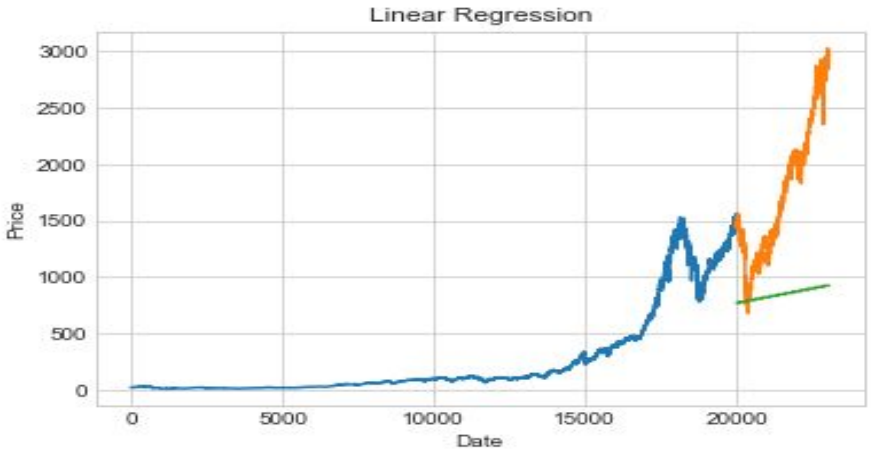

Figure 3: S&P 500 linear regression.

From the graph it can be seen a sharp increase as time goes on with only minor dips in price. The line in this figure is separated as blue (training) and orange (testing) which would be used in the next prediction. The linear regression line (green) does show us that the price is increasing but it doesn't track the values well enough so again Support Vector Regression was used for a more dynamic fit.

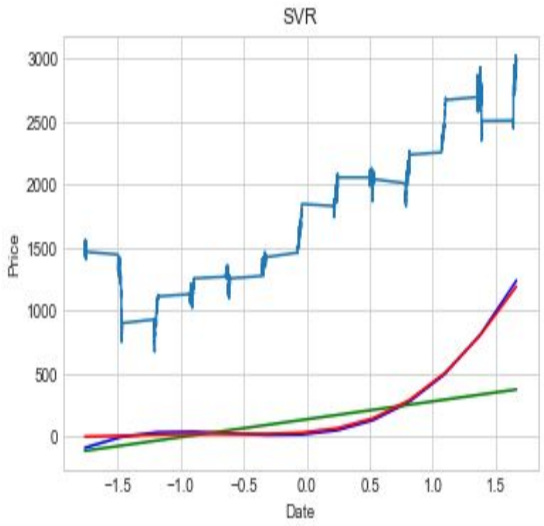

Figure 4: S&P 500 SVR

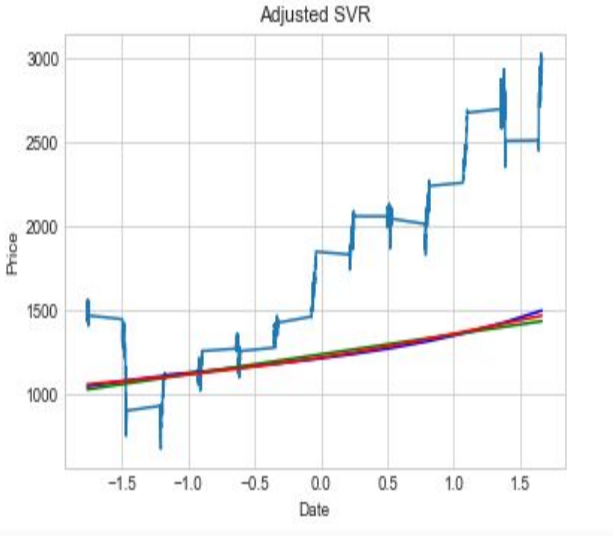

Figure 5: Adjusted S&P 500 SVR

The SVR lines created seem to track the test data well enough but the training data set lags for a bit at the beginning which causes a gap between the line and the data. From the adjusted we still can't make accurate predictions on where the price will be next but we can see that it gradually increases over time. This error would most likely come from the erratic behavior of the stock market as random unpredictable events can occur that can affect the stock market (Ex. China trade wars).

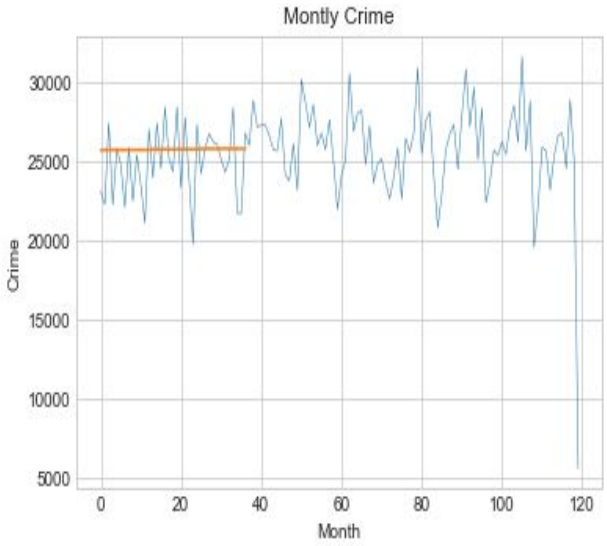

Figure 6: Monthly Crime and Linear regression.

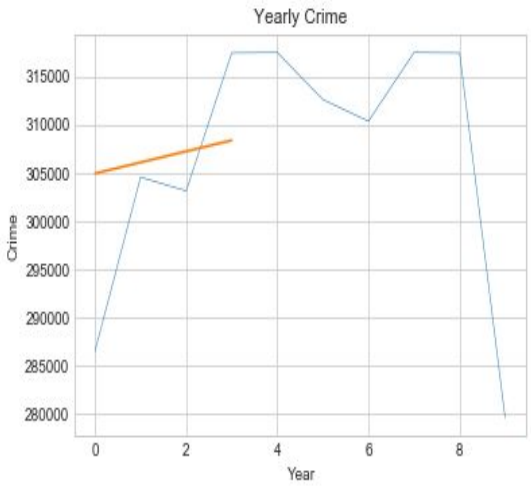

Figure 7: Yearly crime rates

Next we analyzed daily data of crimes which didn't give accurate data. So the data was compressed to monthly and yearly crime rates for easier analysis. The monthly crime graph shows that recently there was a sharp drop in crime rates when compared to previous months. In the yearly graph the climb of crime becomes more clear reaching its peak in the 2008 stock market crash and then decreasing rapidly.

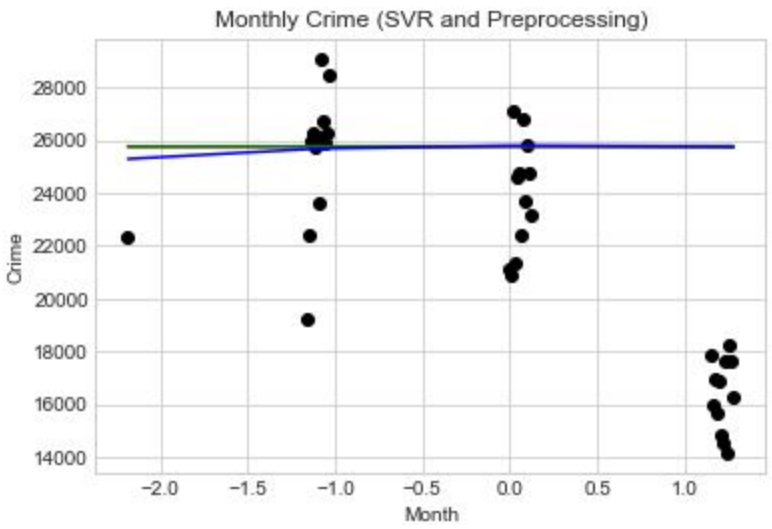

Figure 8: Monthly Crime with SVR

Next it was attempted to predict expected crime but the line expected crime to stay in the same area as the months before. Instead crime was much lower which shows some external force is having some effect on the data. This could be the economic status of the United States. To make an even clearer picture we will examine the extreme circumstance of the 2008 stock market crash.

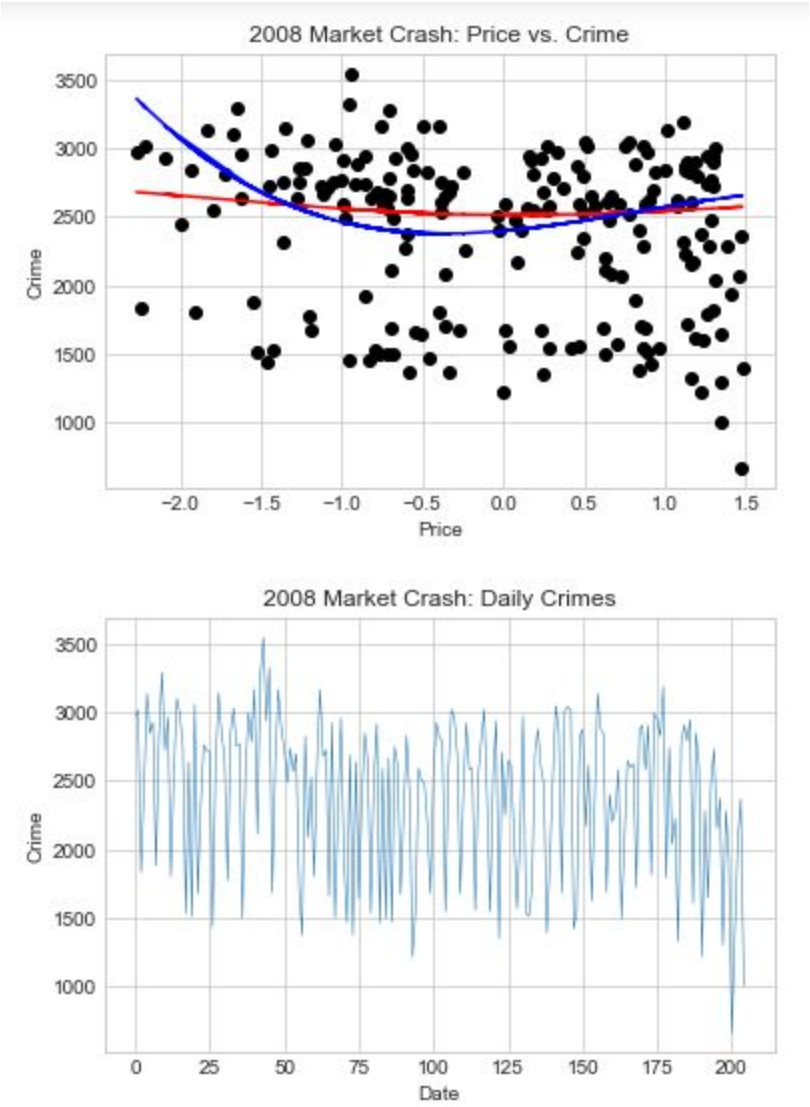

Figure 9: 2008 Market crash (2008-2010)

At the beginning of both graphs in the figure above we see that crime was at its highest at the beginning of the crash and then as the recovery happened there was a reduction in crime rates. In the second graph there is a noticeably lower crime rate at the end of the graph when compared to the rest of the graph. While in the first graph we see that the prediction line expects crime rates to start climbing again or possibly stabilize. This information is slightly contradictory to what was expected but there seems to be clear evidence showing higher crime rates happen during lower price ranges during the 2008 stock market crash.

Figure 10: Monthly Crime and Price

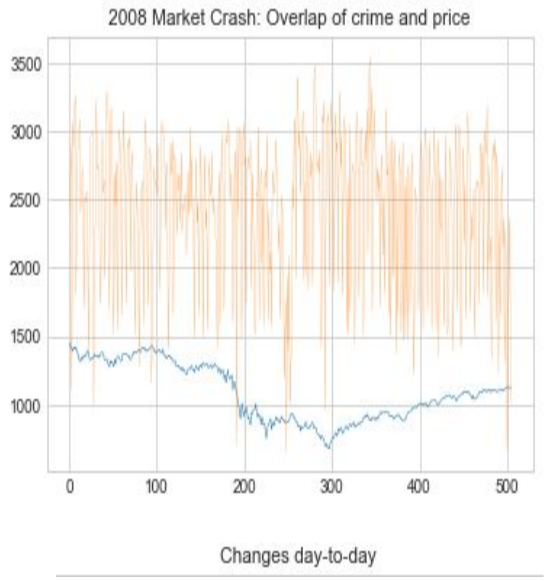

Figure 11: Daily Crime and Price

The data from the 2008 stock market crash was then cleaned up slightly to see if there was more evidence to what happened during this time. In the daily graph there isn't much information except the peaks of increase happen during drops in price and the drops in crime happen during stabilizing moments of price. In the first graph we see the two lines side by side which shows crime climbing initially while price drops, which was then followed by a unison drop in crime, and then crime begins to drop as the price begins to climb again.

Results:

The data collected and shown above gives a possible correlation between the two datasets. This shows that as the prices of the S&P 500 index increase then crime rates drop in most cases. There are outlier events in crime which seem to throw off the data but overall crime rate follows the S&P 500 prices in some way. This shows that when the S&P 500 drops in price there can be expected an increase in crime, at least in New York.

Conclusions:

The S&P 500 index prices is inversely correlated to crime rates. This is connected by the claims that recessions see more crimes because of economic uncertainty. This data shows that it is also true outside of recessions as crime rates seem to mirror the S&P 500 data. Although there can be no accurate predictions made, this model can predict in what way crime rates will respond to the current price of the S&P 500 index.

References:

Bell, B., & LSE Centre for Economic Performance. (n.d.). “Do recessions increase crime?“ Retrieved from https://www.weforum.org/agenda/2015/03/do-recessions-increase-crime/.

The S&P 500 And Recessions. (2012, August 8). Retrieved from https://www.investing.com/analysis/the-s-p-500-and-recessions-132409.