A Better Hedge between Gold and VIX to US Equities under Different Volatility Regimes

Introduction:

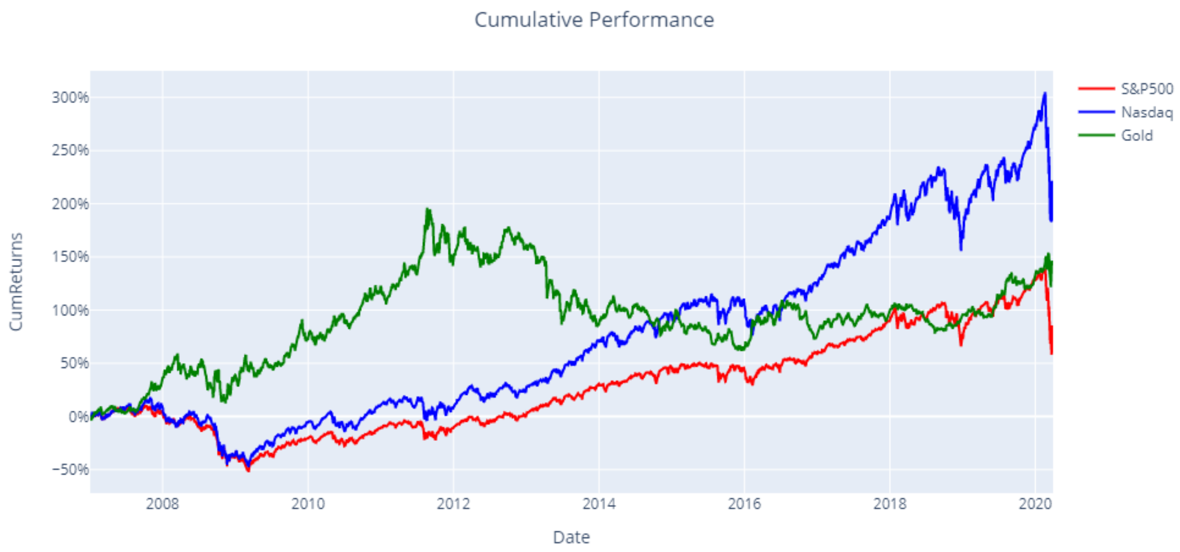
The goal for this project is to evaluate the performance of Gold and VIX, and to find out which one is a better hedge to US stock market under different volatility regimes. Our analysis will include data from 01-01-2007 until 03-31-2020. We will choose S&P500 (Ticker: ^GSPC) and Nasdaq (Ticker: ^IXIC) indices to represent the US stock market, Gold (Ticker: GLD) and VIX (Ticker: ^VIX) to represent the possible hedges.

We will use three periods in our analysis:

- 2007-2009 Bear Market (2007-01-01 until 2009-03-31)
- 2009-2020 Bull Market (2009-03-31 until 2020-01-31)
- Covid19 Crisis (2020-02-01 until 2020-03-31)

Cumulative Performance of Each Asset:

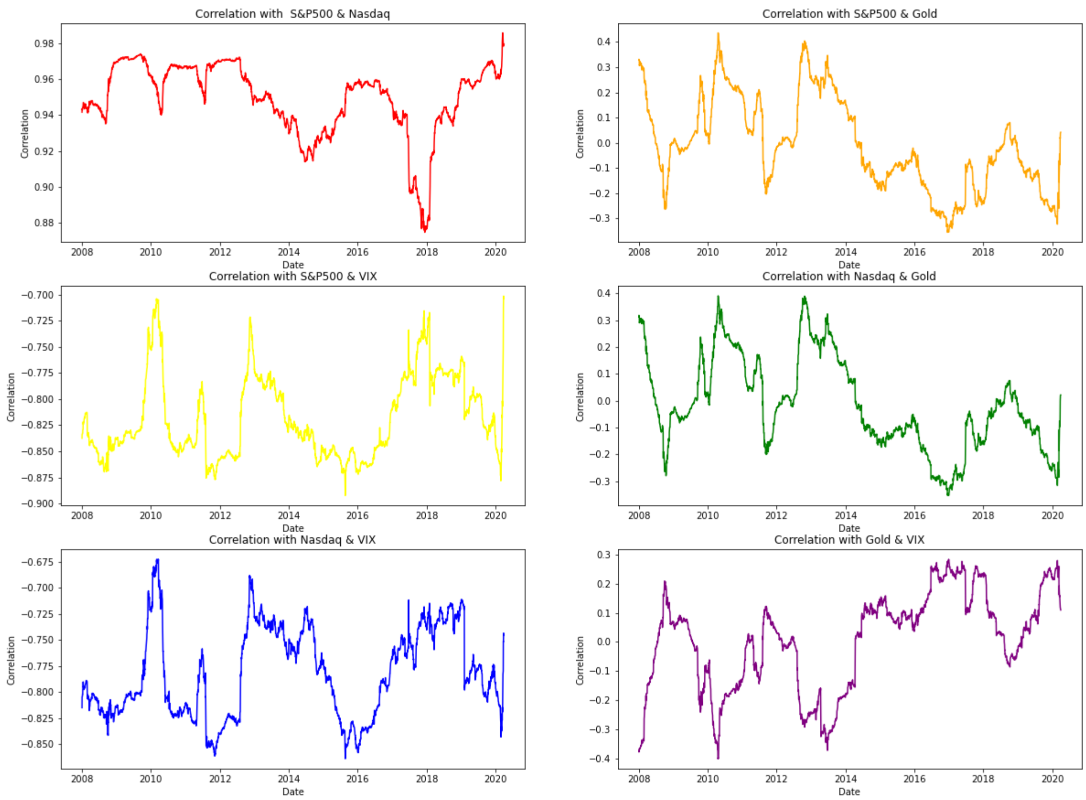
First, we will look at the following chart which shows the cumulative performance of S&P500, Nasdaq, and Gold for the period from 2007-01-01 to 2020-03-31.



Graph 1: Cumulative Performance of S&P500, Nasdaq, and Gold, from 2007/01/01 to 2020/03/31

From Graph 1, Nasdaq achieved the best cumulative performance among the three assets from the beginning of 2007 to March 2020 with the highest cumulative return of 220.8%. Gold has the second-highest cumulative performance for the same time periods with the highest cumulative return of 146%. And the S&P500 has the lowest with 85.7%.

Correlation Analysis:



Graph 2: Correlation Plots from 2007 to 2020

Looking at Graph 2, the correlation with S&P500 and VIX is always negative, and so does Nasdaq and VIX. The always-negative correlation indicates that VIX will move in the opposite direction against S&P500 and Nasdaq. Then, VIX could balance the possible loss and reduce the risks of holding US equities. However, the correlation with S&P500 and Gold, Nasdaq and Gold, and VIX and Gold are moving between positive and negative. Therefore, for S&P 500 and Nasdaq, Gold is more volatile than VIX. Finally, due to the always-positive correlation, S&P500 and Nasdaq have a close performance.

During the Bear Market (2007-2009), we could notice that the correlation with S&P500 and VIX was down at around -0.85, and Nasdaq and VIX was down at around -0.825. Since the stock of S&P500 and Nasdaq were weak during the period of Bear Market, the negative correlation with VIX and these two stocks indicated that VIX was strong and went to the opposite direction against S&P500 and Nasdaq. Whereas, during the same period, Gold and VIX, Nasdaq and Gold, and S&P500 and Gold were moving between positive and negative correlation, which showed a high risk of buying Gold as hedge to S&P500 and Nasdaq. Hence, VIX was a good choice as a hedge than Gold to alleviate the loss of the stock market.

During the Bull Market (2009-2020), VIX is also a better choice as a hedge than Gold since the correlation remains negative. During the COVID19 Crisis (2020-02 to 2020-03), it was similar as the Bull Market, VIX is a better choice since the correlation was always negative.

Beta Analysis:

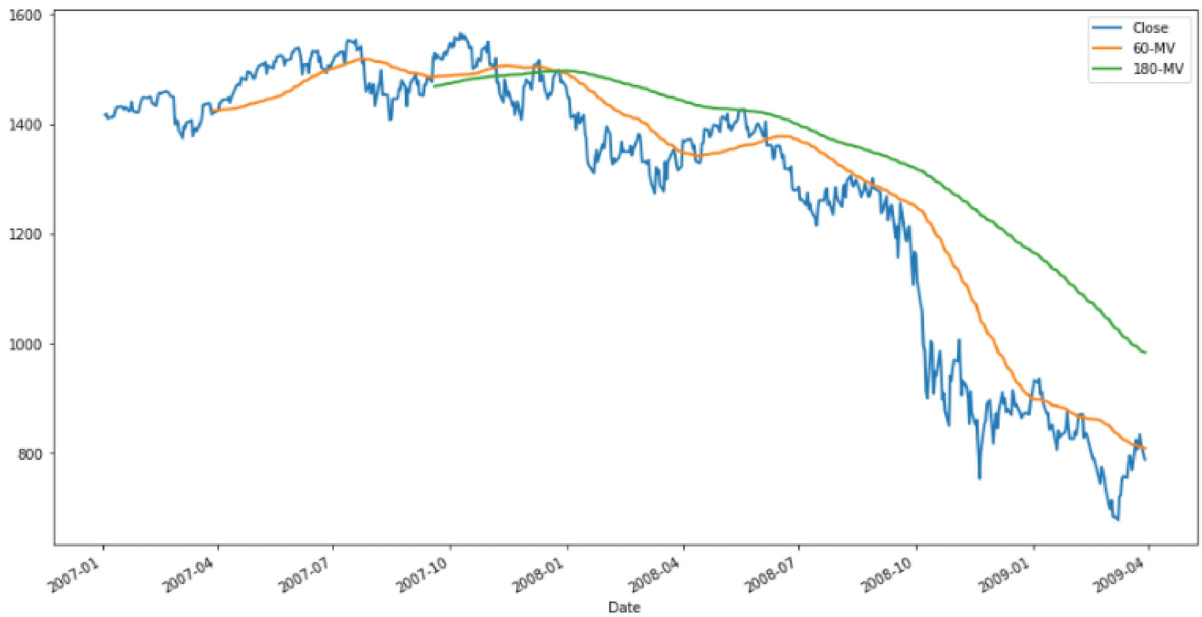
While we are analyzing the hedge, correlation and beta are the two to look at. Correlation shows the linear relationship between two assets, whereas beta tells the return of one asset against another asset.

	Bear Market (2007-2009)	Bull Market (2009-2020)	COVID19 Crisis (2020-02 until 2020-03)
Beta of GLD	0.02	0.0124	0.0719
Beta of VIX	-3.038	-6.4557	-2.8917

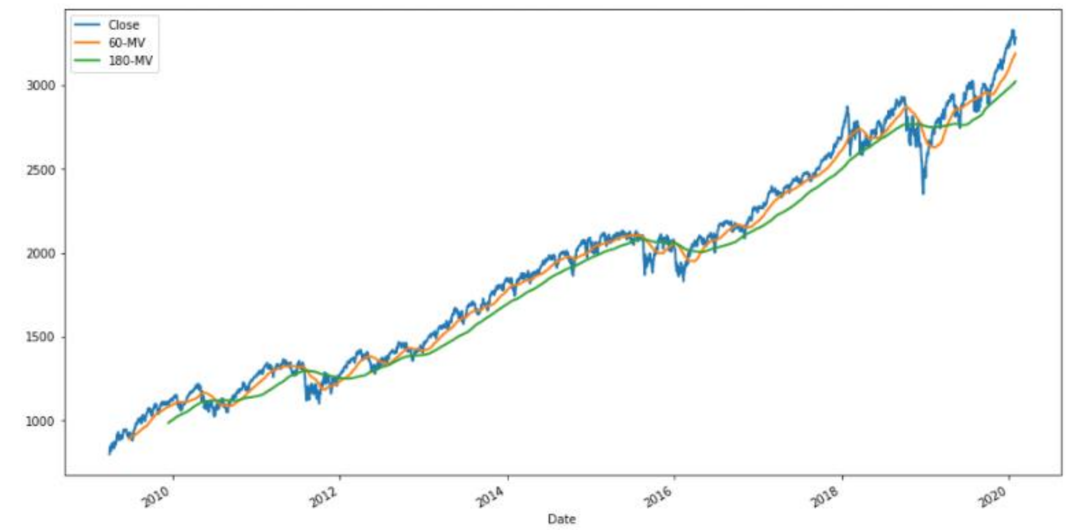
From the chart, the betas of GLD during all time periods were close to zero. This brings a small return of GLD against the US equities. However, beta of VIX during Bear Market period was -3.038, during Bull Market period was -6.4557, and during COVID19 Crisis period was -2.8917. This tells us that when the US equities drops by 10%, then the return will increase during all periods for VIX by 30.38%, 64.557%, and 28.917%, respectively. Hence, VIX is a better hedge than GOLD. Then, in terms of correlation and beta, VIX will be a better hedge for equity markets.

Moving Averages:

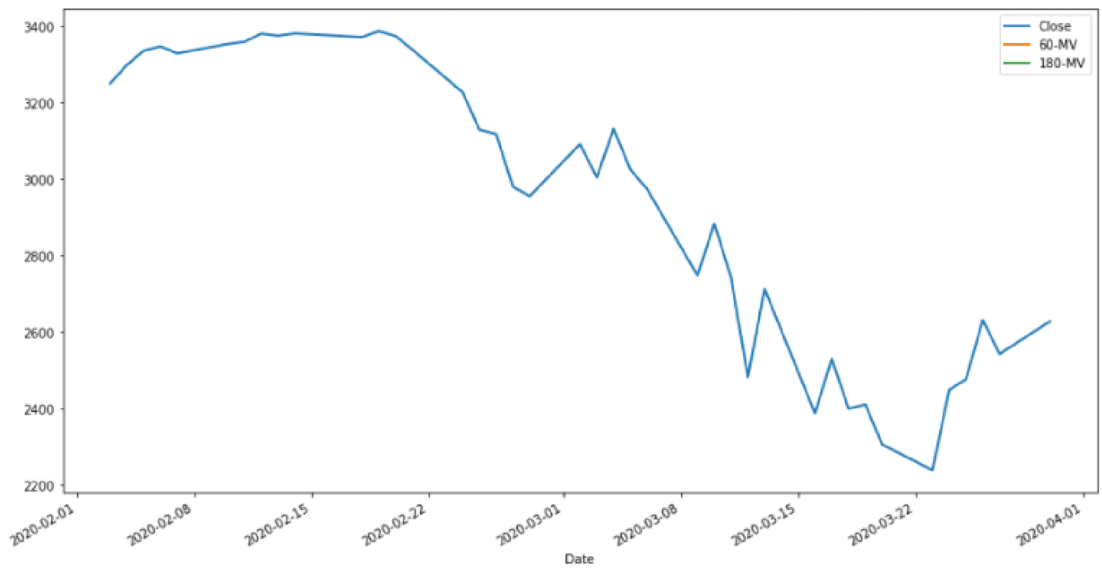
To learn about whether the stock is cheaper or more expansive than its historical price, we need to analyze its moving averages. Thus, we calculated 60-day moving averages and 180-day moving averages in this mini project.



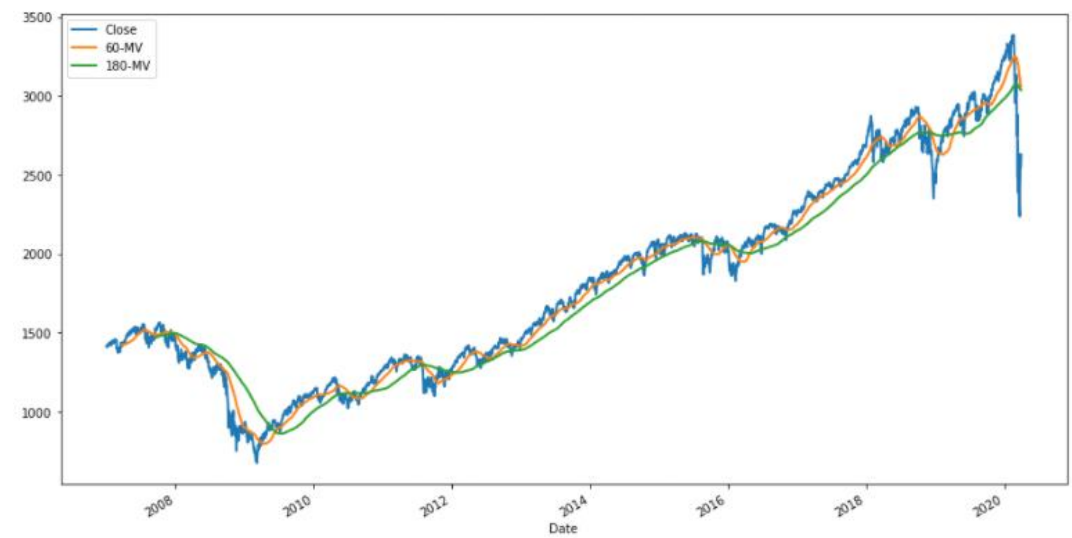
Graph 3: Close price, 60-day MA, and 180-day MA during Bear Market with 42 times above 180-day MA



Graph 4: Close price, 60-day MA, and 180-day MA during Bull Market with 2154 times above 180-day MA



Graph 5: Close price, 60-day MA, and 180-day MA during Covid 19 Crisis with 0 times above 180-day MA



Graph 6: Close price, 60-day MA, and 180-day MA from 2007 to 2020 with 2360 times above 180-day MA

Under Bear Market period, there were 42 times that the closing price was above the 180-day moving averages out of total 252*2+21*3=567 days. Therefore 42/567*100=7.41% of the time the prices of the index is above its moving average under the Bear Market period. There were 2154 times that the closing price was above the 180-day moving averages out of total 252*10+21*10=2730 days. Therefore, 2154/2730*100=78.9% of the time the prices of the index is above its moving average under the Bull Market period.

While we are looking at the graph of COVID19 Crisis, we will notice that there is no 60-day or 180-day moving averages. This is because the COVID19 Crisis period only lasts for 2 months, which are 42 days. Therefore, there will be no 60-day or 180-day moving averages under this period. Then, the time above 180-moving average will be 0 under this period.

In total, we have 2360 time above 180-day moving average out of 567+2730+42=3339 days. Hence, 2360/3339*100=70.68% of the time the prices of the index is above its moving average under the whole periods from the beginning of 2007 until the end of March 2020. Therefore, we could understand the stock market is growing and getting more expensive at the end of March 2020 comparing to the beginning of 2007.

Conclusion:

After analyzing the correlation and beta, we are more confident to say that VIX is a better hedge for S&P500 and Nasdaq in either the Bear Market or the Bull Market, or even in COVID19 Crisis. With negative correlation and strong negative beta with S&P500 and Nasdaq, if S&P500 and Nasdaq drops by 10%, VIX will increase by more than 10% percent due to the absolute value of VIX's beta is greater than 1. Hence, VIX is a better hedge of US stocks under different volatility regimes than Gold.