A Technical Approach to Sector Rotation

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May 24th, 2024

Introduction

Sector rotation strategies have been utilized for several decades, gaining prominence from the late 20th century onwards. These strategies are based on the observation that different sectors of the economy perform differently during various stages of the economic cycle. Essentially, the goal is to anticipate market changes and reallocate into sectors that are most likely to perform the best in the next phase. To be successful in the construction of these portfolios, one must be able to have a deep understanding of how sectors perform in different stages of the economic cycle or in changing market conditions. Additionally, one must be able to confidently and accurately anticipate the next phase of the cycle and reallocate accordingly. Traditionally, these strategies take a macroeconomic approach, and use variables such as GDP, interest rates, inflation rates, employment data, and consumer confidence indexes to be able to determine market phases.

A paper that was referenced and heavily researched before the construction of the following portfolio was "The CROCI Focus - The Sector Rotation Story" outlining the performance of a sector rotation strategy based on economic valuations, implemented by DWS. The strategy which involves identifying and investing in the three economically cheapest sectors, has been historically successful in generating alpha. The strategy focuses on the economic price to earnings ratio of sectors to determine if they are overvalued or undervalued, and invest accordingly. For instance, the portfolio identifies the three cheapest sectors that have the lowest median economic PE, and are invested in because they are deemed economically undervalued, holding the highest potential for economic value growth. Despite the strategy generating a significant excess return of 5.7% since November of 2015, the strategy exhibits risk levels and drawdowns comparable to the broader market.

The constructed strategy took more or a technical approach than traditional sector rotation strategies, and was created in an attempt to improve upon the above portfolio's downsides. In other words, the goal was to decrease risk during periods of market downturn while increasing exposure to higher return assets during times of market uptrend, maximizing sharpe ratio while decreasing maximum drawdown. In other words, during bullish market periods, the algorithm attempts to prioritize allocation into assets that have historically performed well during market uptrends, while prioritizing allocation into safer sectors and assets during bearish markets. This is done through the model outputting signals based off of a combination of indicators that will be discussed further below. These signals take the formats of 1 for bullish, -1 for bearish, and 0 for neutral, or neutral asset weights.

The goal of this portfolio is to decrease overall risk while prioritizing achieving sustainable high returns. In addition, by increasing exposure to safe haven assets during market downturns, the model hopes to achieve a lower max drawdown than that of its comparison portfolios. For this portfolio, the included assets or sectors are communication service, consumer discretionary,

consumer staples, energy, financials, health care, industrials, materials, technology, and utilities..
A cumulative returns chart of all the sectors have been included below to help visualize their
returns from 2008 to 2013. It is important to note that the following portfolio will be backtested
from 2013 to 2024, so any potential forward looking bias must be avoided in order to maintain
validity.

Performance of S&P 500 Sector ETFs and Other Asset Classes (2008-2013)
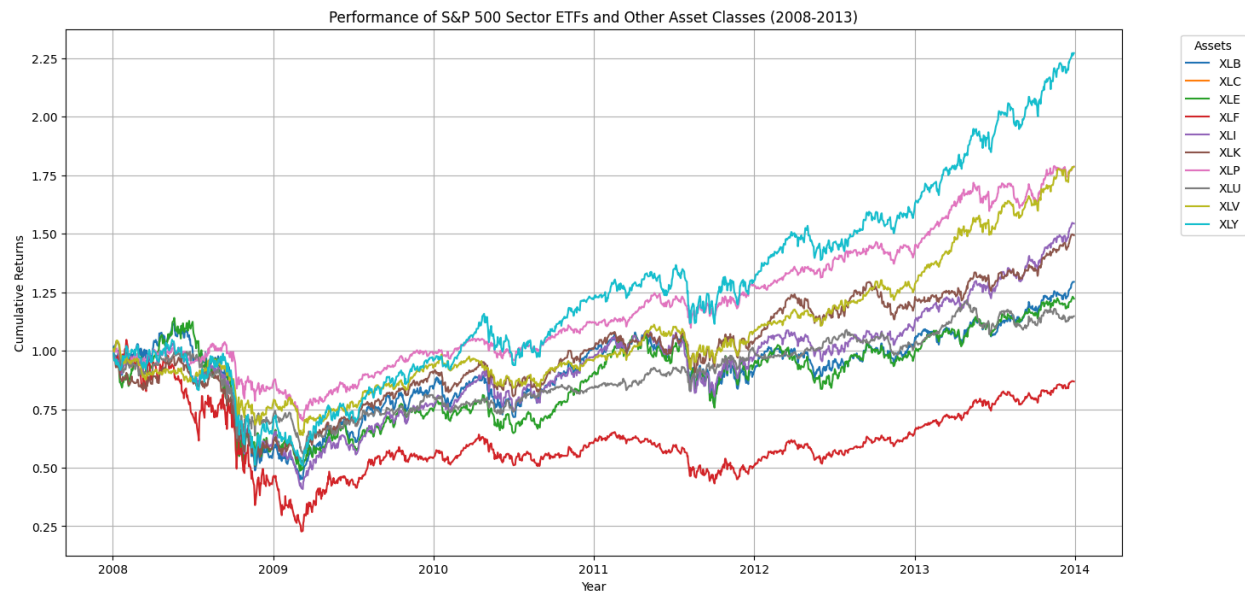
Before discussing the model, it is first important to understand what information was utilized to
quantify the defensive sectors that the portfolio allocates into when given a bearish signal, and
the aggressive sectors given a bullish signal. According to the SSGA Sector Business Cycle
Analysis, from an economic standpoint, sectors such as consumer staples, utilities, and
healthcare perform better than other sectors during bearish markets, hence a heavy weight
towards them when given a bearish signal. This is because consumer staples, utilities, and
healthcare are mandatory for people to pay for, regardless of the state of the economy. In other
words, these sectors do not rely on discretionary income for their success. Specifically, since
people still need essential goods regardless of economic conditions, consumer staples tend to be
more resilient during recessions. Similar to consumer staples, utilities provide essential services
that people need in any economic climate, and must be a payment priority for individuals.
Healthcare shows relative stability as demand for medical services remains steady, regardless of
economic conditions.

Sectors such as consumer discretionary, financials, and technology, will be heavily weighted in
the portfolio when given bullish signals. Historically, these assets have performed well during
bull markets due to their high sensitivity to economic cycles and consumer confidence. In bull
markets, as economic conditions improve and consumer spending increases, these sectors have
historically benefitted from heightened demand. Specifically, consumer discretionary tends to

outperform in promising market conditions as consumer spending increases with economic optimism. For example, automobiles, consumer durables, apparel, and luxury goods are all industries operating under the consumer discretionary sector. These industries experience heightened demand in promising market conditions, mainly due to consumers being confident in disposing discretionary income. During healthy market conditions, businesses and individuals tend to borrow more to invest and grow. This increased demand for loans enables financial institutions to benefit from an increase in profits. Technology has also been a consistent outperformer during expansions, driven by innovation, growth, and access to cheaper debt for research. Individuals and institutions are also more confident in investing into risky assets like technology during expansion periods.

Codebase & Data Workflow

Before proceeding with the description of the model and its results, it's first important to have an understanding of the codebase and the data workflow used. To start, all data was imported directly from Yahoo finance. The included sectors' price data and the necessary components for the indicators were imported and calculated (these indicators will be discussed in detail further below). The portfolio allocations were determined by researching sector performance during different market cycles. In essence, fundamental macroeconomic reasoning as well as sector performance from 2000 - 2014 was used to determine the optimal weights for each of the signals, as discussed above. The portfolio was then backtested with signals generated from just one indicator to verify that each individual indicator was providing value in generating alpha. This process was crucial in determining how each indicator would complement one another during the final composite score signal algorithm, which combines all the indicators together through a strategically implemented weighting system. This final sector rotation portfolio was then backtested from 2014 - 2024 and compared to a 60 / 40 benchmark portfolio as well as a portfolio with all the sectors equally weighted. This visual below is simply a light overview of the work process to construct this portfolio, everything will be explained in thorough detail below.
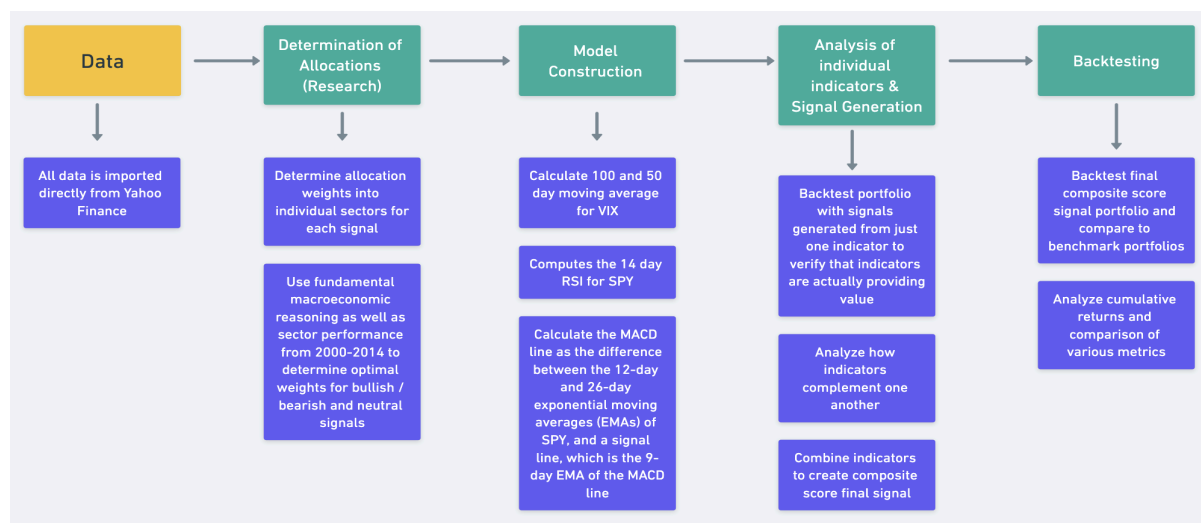
Rotation Signal Algorithm

The rotation signal algorithm used to determine market movements is constructed using three key indicators. To start, the VIX was used to measure market volatility. Commonly referred to as the "fear gauge", the VIX allows the determination of market sentiment and uncertainty revolving investors' decisions. For instance, a rising VIX suggests increased volatility and uncertainty, potentially signaling a shift towards more defensive sectors while a declining VIX indicates decreasing fear, often correlating with bullish conditions. The Relative Strength Index (RSI) is also used to be able to gauge market direction. RSI measures the speed and change of price movements, and can help in determining whether the market is overvalued or undervalued. An asset can be considered overbought when its RSI is above 70 and can be considered oversold when it is below 30. Moving Average Convergence / Divergence (MACD) is a momentum indicator that illustrates the relationship between two moving averages of a securities price. A positive MACD indicates that the short term average is above the long term average, which can be an indicator of upward momentum and a potential bullish phase.

The algorithm computes the 50-day and 100-day moving average for the VIX, essentially being utilized to track short-term as well as long-term trends within the market. The RSI is being used as a momentum oscillator, measuring the speed and change of price movements. For the algorithm's context, it oscillates between 0 and 100. The indicator is useful in predicting potential market reversals. MACD (Moving Average Convergence Divergence) works in conjunction with RSI in the algorithm, illustrating the relationship between two moving averages of a security's price. It is computed by taking the difference between the 12-day and 26-day exponential moving averages of the S&P. It is used in conjunction with the 9-period estimated moving average of the MACD itself, which is considered the 'Signal line'. Potential buy or sell opportunities are indicated when the two lines cross. In addition, a 3% buffer zone is defined to determine significant crossovers between the 50-day and 100-day moving averages of the VIX.

If the 50-day average exceeds the 100-day average by more than 3%, it signals a potential increase in market volatility, suggesting a sell signal. On the other hand, if the 50-day average falls below the 100-day average by more than 3%, it suggests decreased volatility, indicating a buy signal.

All the signals mentioned above are combined to produce a final signal. This final signal is based off of a composite score, weighting the three indicators outputs differently. If the combined score is positive, the final signal is a buy. Conversely, if the combined score is negative, the final signal is a sell. A final score of 0 implies a neutral weight allocation. The determination of the weights for the three indicators in the composite score will be explained further below.

Results

Before discussing the final constructed portfolio's results, it is first important to explain how the composite score was constructed utilizing the indicators. Due to its unparalleled ability to be able to gauge market sentiment, the intention was to treat VIX as the pilot or the main driver of the signal. However, using the VIX as a standalone indicator can be unreliable due to its often sporadic behavior and tendency to exhibit extreme volatility. A graph of the VIX from 2000 - 2014 has been included below to demonstrate these periods of extreme volatility. Moreover, if VIX were to be used on its own, then there would be many instances of unreliable signals, especially in periods where high drawdowns occur, which is what this portfolio is attempting to limit.
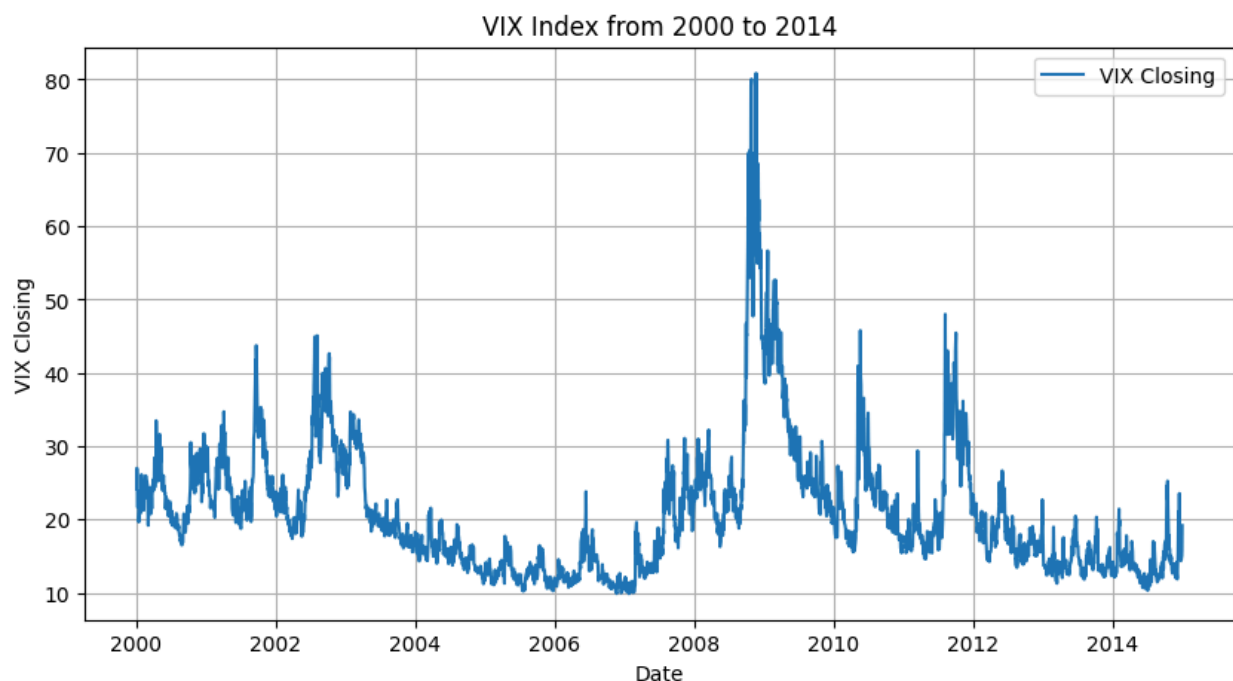
Based on the chart above, it can be determined that during periods of high economic uncertainty, such as during the 2008 financial crisis, the VIX demonstrates volatility that is simply too high to be trusted on its own. If the portfolio's goal is to minimize maximum drawdown while maintaining relatively high returns, then sporadic behavior during times of extreme uncertainty needs to be minimized to allow the technical sector rotation portfolio to perform better than other strategies during times of market turmoil. The chart below represents the cumulative returns of the portfolio with 100% VIX signals, backtested from 2013 to 2024. As visualized, the portfolio has extremely large drawdowns, specifically during the COVID period. The points of interest have been circled on the chart.

100% VIX Crossover Sector Rotation Portfolio:

Annual Return: 14.73%
Annual Volatility: 17.90%
Sharpe Ratio: 0.82
Max Drawdown: -30.71%
Beta: 1.53
Alpha: 5.79%
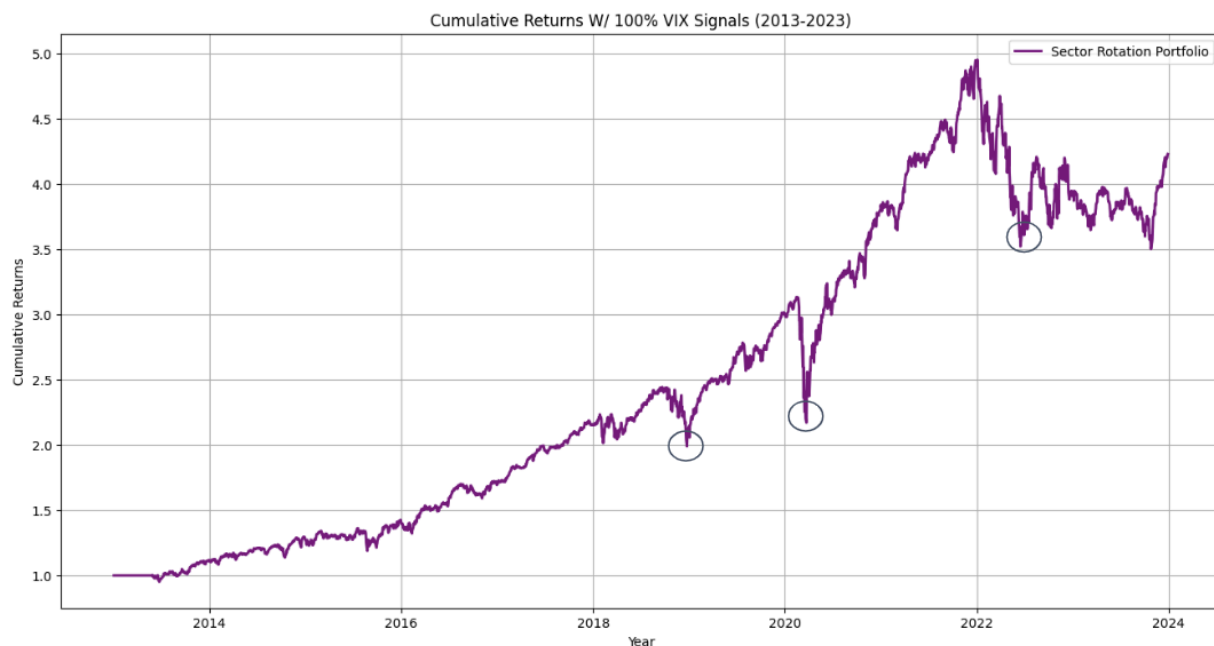
A sector rotation portfolio with 100% MACD signals was also created, in an attempt to improve upon certain downfalls of the 100% VIX signal portfolio. Since VIX provides immediate insights into market sentiment and thus performs more erratically, MACD can be used to provide a more defensive approach. MACD's profound ability to provide both leading signals and lagging

confirmations gives it the unique ability for providing perceived stability in trend analysis. Both indicators are extremely valuable and provide information regarding different perspectives of the market. A chart illustrating the cumulative returns of the portfolio with 100% MACD signals has been included below. As visualized, despite exhibiting lower returns, the portfolio performs similarly to the 100% VIX portfolio as it demonstrates just as large of drawdowns. Despite a lower sharpe ratio, the 100% MACD portfolio offers a slightly lower volatility and beta. Additionally, the portfolio has a less sporadic approach to its signals, and if weighted in conjunction with VIX in the signal algorithm, the portfolio can benefit from the exceptionalities of both indicators.
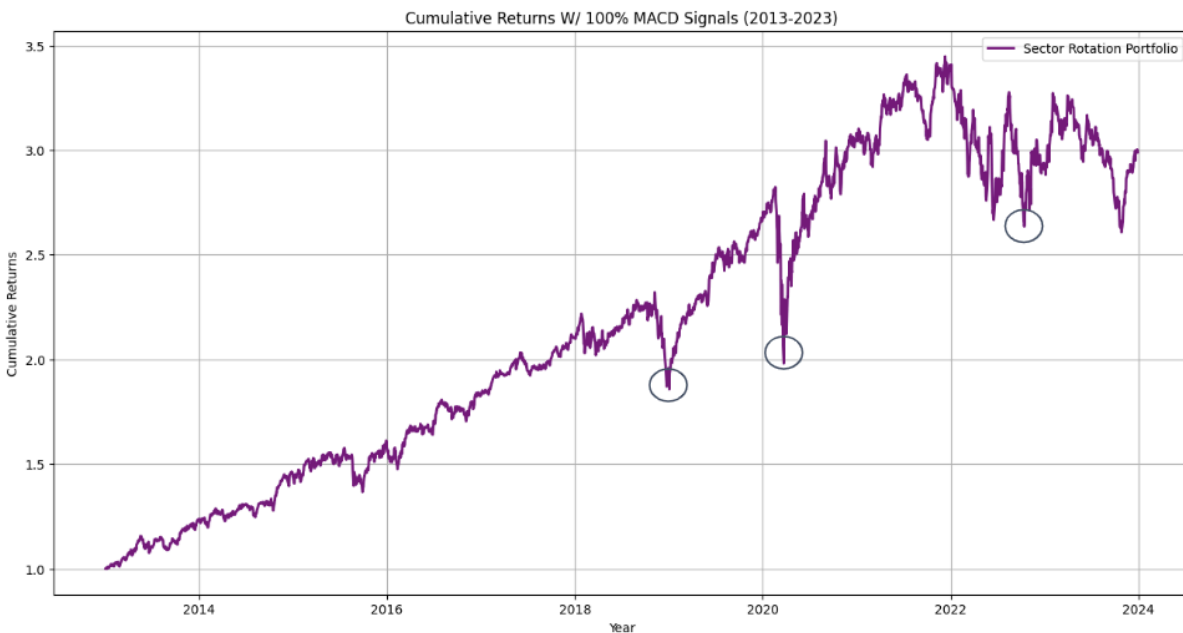
100% MACD Signals Sector Rotation Portfolio:

Annual Return: 11.37%
Annual Volatility: 16.70%
Sharpe Ratio: 0.68
Max Drawdown: -29.83%
Beta: 1.39
Alpha: 2.33%

The indicator that adequately tied VIX and MACD together was RSI. On its own, RSI cannot perform the task of signaling for sector rotations, however, as mentioned earlier, the indicator provides a different perspective to the market than those of VIX and MACD. This unique perspective is whether the market is perceived to be overvalued or undervalued. While VIX provides a perspective into market sentiment and MACD can analyze momentum pushes, RSI

can help boost the portfolio's performance by giving the algorithm a more refined approach. This refined approach includes a perspective into an overbought or oversold market. Because the intention was to have VIX and MACD be the main drivers of the portfolio and because of their strong ability to complement each others' capabilities, they were both given weights of 40% in the final composite score signal portfolio. RSI was given a weight of 20% because its role was to simply act as a confirmation towards whatever signal VIX and MACD were pushing towards.

Overall, the portfolio utilizing the final composite score algorithm boasted impressive results. Two portfolios were used as comparisons to the sector rotation portfolio. The first comparison portfolio was a traditional 60 / 40 portfolio (60% Bonds / 40% Equities) and was constructed to be a benchmark. In addition, an equal weight portfolio (equal weights for the assets) was also constructed for comparison. The performances of all three portfolios have been assessed quantitatively and have been included below.

Performance Metrics Comparison:

60 / 40 Benchmark Metrics:
Annual Return: 9.04%
Annual Volatility: 10.56%
Sharpe Ratio: 0.86
Max Drawdown: -21.72%

Equally Weighted Portfolio Metrics:
Annual Return: 11.29%
Annual Volatility: 14.17%
Sharpe Ratio: 0.80
Max Drawdown: -31.40%

Sector Rotation Portfolio Metrics:
Annual Return: 13.67%
Annual Volatility: 14.01%
Sharpe Ratio: 0.98
Max Drawdown: -18.60%
Beta: 0.94
Alpha: 4.6%

Comparison of Cumulative Returns: Sector Rotation Portfolio vs. Benchmarks (2013-2023)
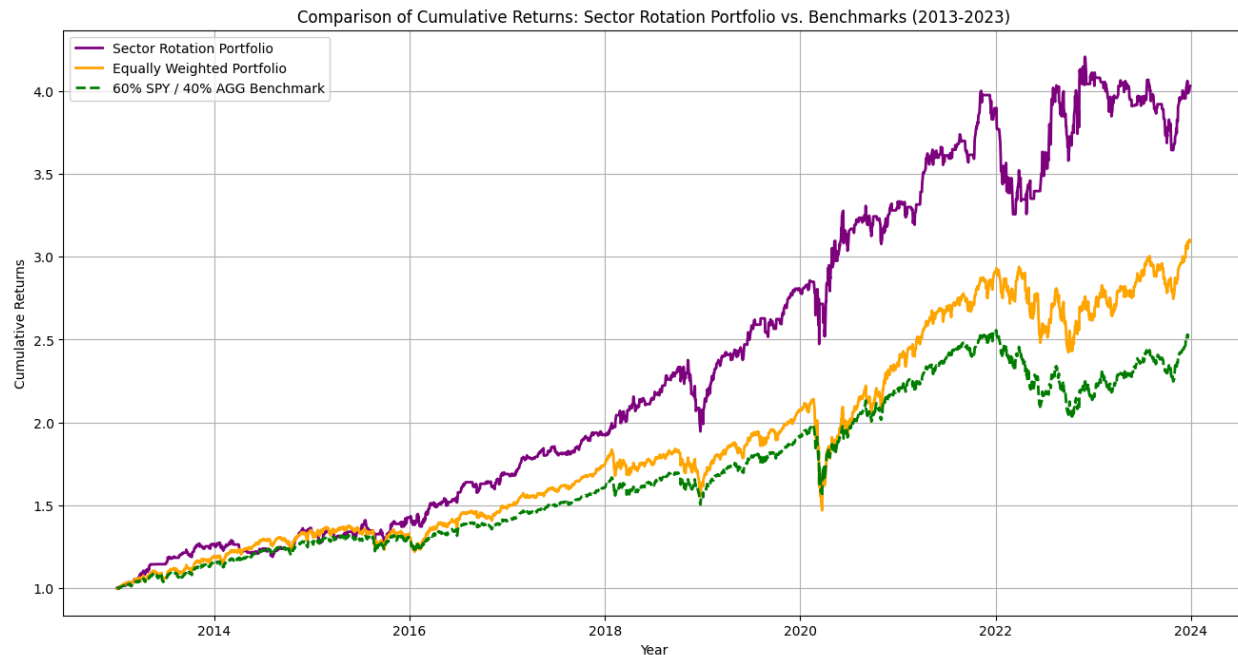
The cumulative returns chart above as well as the metrics compared to the 60 / 40 portfolio and the equally weighted portfolio portrays promising results. The portfolio boasts higher annual returns than its competitors, as well as a lower volatility than the equally weighted portfolio. Most impressively, it demonstrates a low max drawdown of -18.60%, lower than that of even the 60 / 40. Having a lower max drawdown than that of a 40% bond portfolio, while maintaining almost 4% higher annual returns is extremely impressive. The portfolio also exhibits a beta much lower than the portfolios constructed with signals generated from the indicators individually. It was mentioned in the introduction of this report that the goal of this portfolio was to achieve higher returns than that of its competitors, while maintaining a low maximum drawdown, and clearly this has been achieved.

This final composite score algorithm provides a balance between maintaining high returns and limiting drawdowns. This is due to its unique ability to anticipate market movements and allocate into the appropriate sectors. By visualizing the chart above, it can be seen that during the 2020 COVID period, the crash is heavily minimized, with barely any drawdown at all. This concludes that the three indicators work extremely well in conjunction with each other, because as visualized earlier, VIX and MACD signals on their own produced portfolios with large COVID drawdowns. The sector rotation portfolio also boasts a higher sharpe ratio than those of its competitors, indicating a more efficient management of risk versus returns.

Areas For Further Development

Although impressive and successful, the constructed sector rotation strategy has a few areas that can be further developed. To start, transaction costs were not taken into consideration during the interpretation of this portfolio. It goes without saying that constant shifts in asset allocations will result in high amounts of transactions, and the current model's results may be skewed due to failure in representing these costs. In addition, although mostly successful, there are rare times when market bottoms have a bearish signal while market tops have a bullish signal. Inevitably, the algorithm will never be perfectly accurate with its signals, but a further developed strategy can lead to even better results.

Also, although the constructed portfolio's maximum drawdown is much lower than that of its competitors, referencing the cumulative returns chart, it can be seen that the portfolio still faces a relatively large downturn in 2022. This is largely due to the different sectors' performance in 2022 rather than the signals themselves. If maintaining allocation into specifically equities was not a priority, then the portfolio can be constructed to diversify into other asset classes as well. These other asset classes can provide better diversity by enabling accessto a wide variety of markets. However, this portfolio was built specifically for equity managers, and other asset classes were not taken into consideration. Additionally, if returns were not a high priority, then a more defensive approach can be taken to even better weather the downturns. Whether this consists of allocating a higher weight towards specific sectors during bearish markets, or taking a safer approach in the algorithm, it can be possible to achieve an even lower max drawdown. Despite this, the portfolio still delivers extremely promising results, providing equity managers with an opportunity to anticipate market movements and reallocate appropriately.

References

The Business Cycle Approach to Equity Sector Investing,
www.fidelity.com/bin-public/060_www_fidelity_com/documents/fixed-income/Business_Cycle_
Sector_Approach.pdf . Accessed 24 May 2024.

Fernando, Jason. "Relative Strength Index (RSI) Indicator Explained with Formula."
Investopedia, Investopedia, www.investopedia.com/terms/r/rsi.asp . Accessed 23 May 2024.

Learn, Fidelity. "Sector Rotation Strategies." *Fidelity*, 17 Apr. 2024,
www.fidelity.com/learning-center/trading-investing/markets-sectors/intro-sector-rotation-strats .

McKenzie, Colin. *The Sector Rotation Story*,
www.dws.com/AssetDownload/Index?assetGuid=1dd7da24-b4e2-4797-89af-13fd57cb9bee&con
sumer=E-Library . Accessed 24 May 2024.

Schlossberg, Boris. "How to Trade the MACD." *Investopedia*, Investopedia,
www.investopedia.com/articles/forex/05/macddiverge.asp . Accessed 23 May 2024.

Sector Business Cycle Analysis - State Street Global Advisors ...,
www.advisorperspectives.com/commentaries/2019/01/30/sector-business-cycle-analysis .
Accessed 24 May 2024.

Team, The Investopedia. "How to Trade the VIX: 4 Ways Explained." *Investopedia*,
Investopedia,
www.investopedia.com/stock-analysis/2012/4-ways-to-trade-the-vix-vxx-vxz-tvix-xxv0504.aspx
#:~:text=The%20primary%20way%20to%20trade,Term%20Futures%20ETF%20(SVXY) .
Accessed 23 May 2024.

Wealth, Avior. "Avior Insights - How Stock Market Sectors Depend on the Business Cycle."
Avior Wealth Management, 5 Jan. 2024,
avior.com/insights/avior-insights-how-stock-market-sectors-depend-on-the-business-cycle/ .