**Time Period:**

* The Bear Market of 2007-2009 (January 1, 2007, to March 31, 2009)
* The Bull Market of 2009-2020 (March 31, 2009, to January 31, 2020)
* The Covid-19 Crisis Period (January 31, 2020, to March 31, 2020)

**U.S. equities Market and hedging instruments:**

* S&P 500 (GSPC), NASDAQ (IXIC), Gold (GLD), VIX

**Performance of Each Assets:**

**Entire Period: (January 1, 2007, to March 31, 2020)**

图表, 直方图

描述已自动生成

This graph illustrates a consistent upward trend in the NASDAQ and S&P 500 over time. In contrast, the value of Gold remained relatively stable throughout the observed period. Notably, the NASDAQ outperformed both the S&P 500 and Gold, emerging as the best performer, while Gold stands out as the least performing asset among the three throughout the entire reviewed timeframe.

**Bear Market: (January 1, 2007, to March 31, 2009)**

图表, 直方图

描述已自动生成

As depicted in the figure, both the S&P 500 and NASDAQ underwent substantial downturns. In contrast, Gold demonstrated its effectiveness as a hedge against the U.S. market downturn. This resilience could be explained by the commonly held perception of gold as a safe-haven asset during economic recessions. Consequently, during the Bear Market, Gold emerged as the top-performing asset.

**Bull Market: (March 31, 2009, to January 31, 2020)**

图表, 直方图

描述已自动生成

During the Bull Market, the S&P 500 and NASDAQ shows a remarkable growth. In contrast, Gold's value remained relatively stable, indicating a lack of correlation with the U.S. equity market during this period. This stability suggests that Gold's performance is not correlated with the fluctuations in the U.S. equity market, especially during bull market period.

**COVID-19 Crisis: (January 31, 2020, to March 31, 2020)**

图表

描述已自动生成

When the time goes to the Covid-19 period, the stock market underwent a swift decline. Both the S&P 500 and NASDAQ experienced great losses. However, Gold still remained unscathed by the crisis, sustaining a stable performance throughout. This resilience helps to imply that Gold’s value was unaffected by the economic crisis, further emphasizing its potential role as a safe-haven asset during periods of market instability.

**Correlation Analysis:**

应用程序, 表格

描述已自动生成 应用程序, 表格

描述已自动生成 应用程序, 表格, Teams

描述已自动生成

The S&P 500 (GSPC) and NASDAQ (IXIC) consistently show a strong positive correlation, indicating a tendency to move together.

Gold (GLD) exhibits a notably low correlation with both the S&P 500 and NASDAQ, suggesting its movements are largely independent of these U.S. equity markets.

Conversely, VIX demonstrates a strong negative correlation with the market. This suggests that VIX typically moves in the opposite direction to the S&P 500 and NASDAQ, proposing a potential strategy for mitigating risks associated with market fluctuations.

**Beta Analysis:**

表格

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In the table, the value of Beta serves as a metric offering insights into the extent of an asset's linear relationship with the S&P 500.

The data in the table above reveals that while Gold maintains a value close to zero, suggesting a lack of correlation with the S&P 500, VIX shows a strong negative correlation with the S&P 500 during all time periods.

Thus, the data suggest that while gold is a stable hedge for U.S. equity market, VIX works more effective when encountering a volatility for the equity market.

**Build Portfolios**

Our investment strategy is validated through the construction of two portfolios, each specified volatility regimes—low and high. In the low volatility regime, characterized by a realized standard deviation below the predicted volatility plus 2%, Strategy 1 allocates 100% of the portfolio to S&P 500 shares. Conversely, in the high volatility regime, defined by a realized standard deviation exceeding the predicted volatility by more than 2%, the allocation adjusts to 75% in S&P 500 shares and 25% in VIX for Strategy 1.

Contrastingly, Strategy 2 maintains a 100% allocation to S&P 500 shares during low volatility periods. However, in times of high volatility, it adjusts holdings to a 50% allocation in S&P 500 shares and a 50% allocation in GLD.

The comparison of the performance of these two strategies against the S&P 500 is visually represented in the subsequent graph. This visual analysis serves as a comprehensive illustration of the effectiveness of our investment strategy under varying volatility conditions. The graph enables a clear understanding of how our portfolio allocations respond to and perform in different market environments, providing valuable insights into the adaptability and performance of our strategies.

图表, 直方图

描述已自动生成

图片包含 文本

描述已自动生成

The annualized reverts for the S&P 500 (GSPC) were 9.04%. However, out designed portfolios (portfolio1 and portfolio2) outperformed these indices, bringing annualized reverts of 14.9% and 10.1% respectively.

Regarding volatility, a key degree of risk, the S&P 500 exhibited annualized volatilities of 17.75%. In contrast, portfolio1 exhibited higher volatility at 34.55%, denoting that portfolio1 is riskier. Portfolio2, on the other hand, exhibited lower volatility at 15.9%, representing a safer choice.

The Sharpe Ratio measure risk-adjusted returns and underscore e fine efficiency of portfolios. The S&P 500 had annualized Sharpe ratios of 0.51, while portfolio1 boasted significantly lower Sharpe ratios of 0.43 and portfolio2 boasted significantly higher Sharpe ratios of 0.63.

Given these results, we choose portfolio1 in bull market and portfolio2 in bear market. Portfolio1 provided higher returns than the S&P 500, but they did so with more volatility, indicating a less efficient and safer performance. On the other hand, portfolio2 provided lower returns than the S&P 500, but they did so with less volatility, indicating a more efficient and safer performance. This demonstrates that our strategy in optimizing returns should shift between two portfolios while we experience a period of changing market volatility.