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HEDGE PERFORMANCE OF DIFFERENT ASSET CLASSES IN VARYING ECONOMIC CONDITIONS

In the realm of long-term investment, strategic portfolio allocation is an essential tool, especially in relation to risk management and return optimisation. There are many ways to pursue optimal portfolio composition, and their effectiveness depends on many factors, including the investor's goals, risk appetite, and investment horizon. One of the primary means of portfolio optimisation is diversification. The core idea of diversification is to maintain a diverse portfolio with weakly correlated assets that can vastly reduce portfolio exposure to different market stress factors. Diversification is a fundamental strategy in investment and portfolio management that is essential for mitigating risk and enhancing potential returns over the long term. By spreading investments across various asset classes, sectors, geographies, and investment styles, diversification helps reduce the volatility of the overall portfolio. ***The main subject of this study*** *is the theoretical basis of portfolio diversification and the analysis of historical data to derive optimal strategies for using uncorrelated assets to improve portfolio performance.* ***This paper examines*** *the correlation dynamics between different asset classes, such as stocks, bonds, and alternative investments, and their response to changes in inflation, interest rates, and market volatility, and tests it with historical data to deduce the optimal strategies for using uncorrelated assets to improve portfolio performance.* ***The findings of this study*** *prove the variable relationship between asset classes under specific economic conditions. This study uses historical data to show how different asset classes can be optimally leveraged or adjusted to mitigate risks and capitalise on opportunities presented by shifting economic indicators. This reveals that the hedging benefits of equities, bonds, and gold depend greatly on interest rates, market volatility, and inflation. It also provides guidelines for investors on optimal portfolio allocation and risk management.* ***In conclusion,*** *dynamic portfolio management is an essential tool for reducing the portfolio's overall volatility while maximising returns. The diversification performance of different financial asset classes depends on major economic indicators such as inflation, interest rates, and market volatility. Investors seeking to optimise their portfolios in anticipation of or in response to economic changes, aiming to maximise returns while controlling for risk, can leverage these results.*

Keywords: *Portfolio Hedging; Diversification; Economic Conditions; Asset Correlation; Inflationary Impact; Market Volatility; Strategic Asset Allocation; Risk Management.*

Introduction

Motivation for Research

In an increasingly interconnected financial world, understanding the relationships between asset classes has become vital for investors, especially for portfolio management and risk reduction. Market volatility, influenced by factors such as inflation, interest rates, and sentiment, requires a strategic investment approach. This study explores asset class correlation dynamics under different economic conditions, focussing on key indicators such as Core Inflation data, Federal Funds Rate, and market sentiment.

This study highlights the importance of understanding how asset classes interact in various market conditions. Interactions between assets influence portfolio performance, particularly for long-term investors. With traditional paradigms constantly challenged by uncertainties, this study seeks insights to help investors make informed decisions, particularly in building a resilient, diversified portfolio.

The Role of Asset Correlations in Portfolio Optimisation

Optimization of an investment portfolio is a fundamental aspect of modern portfolio theory, which was introduced by Harry Markowitz in the 1950s. This theory provides a quantitative framework for assembling a portfolio of assets such that for a given level of risk, the portfolio's expected return is maximized, or conversely,

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for a given expected return, the risk is minimized. The formal presentation of portfolio optimization involves several key concepts: expected portfolio return, portfolio risk, usually described through portfolio variance, and efficient frontier.

Because of the linearity of a mathematical expectation, the **expected return** of a portfolio $R_{portfolio}$ can be expressed as a weighted sum of the expected returns of the individual assets in the portfolio:

$$R_{portfolio} = \sum_{i=1}^{n} w_i R_i , \quad (1)$$

where R_i is the expected return of asset i;

w_i is the weight of asset i in the portfolio (i.e., the proportion of the portfolio's total value that is invested in asset i);

where n is the number of assets in the portfolio.

The **portfolio variance** $\sigma^2_{portfolio}$ can be expressed as:

$$\sigma^2_{portfolio} = \sum_{i=1}^{n}\sum_{j=1}^{n} w_i w_j cov(i,j) , \quad (2)$$

where cov(i, j) is the covariance between the returns of assets i and j.

As

$$cov(i,j) = \sigma_i \sigma_j \rho_{ij} . \quad (3)$$

The portfolio variance can be expressed as

$$\sigma^2_{portfolio} = \sum_{i=1}^{n}\sum_{j=1}^{n} w_i w_j \sigma_i \sigma_j \rho_{ij} . \quad (4)$$

The **efficient frontier** is a concept in modern portfolio theory that refers to the set of portfolios that offer the highest expected return for a given level of risk or the lowest risk for a given level of expected return.

Mathematically, finding the efficient frontier involves solving an optimization problem to minimize the portfolio's variance $\sigma^2_{portfolio}$ for a given expected return $R_{portfolio}$:

$$\begin{aligned} &\operatorname{argmin}_w \left(\sum_{i=1}^{n}\sum_{j=1}^{n} w_i w_j \sigma_i \sigma_j \rho_{ij} \right), \\ &\text{s.t.} \quad \sum_{i=1}^{n} w_i R_i = R_{portfolio} , \\ &\qquad \sum_{i=1}^{n} w_i = 1 . \end{aligned} \quad (5)$$

There are numerous methods to solve the portfolio optimization problem, such as quadratic programming, Monte Carlo simulations, genetic algorithms, and machine learning approaches. The effectiveness of these methods depends on the various assumptions and conditions of each problem.

As can be seen from (5), the portfolio optimization problem has 3 sets of inputs: asset returns R, standard deviations σ, and correlation matrix ρ.

The former two are the instrument level input of the portfolio assets, which depend only on the asset itself. However, the correlation term is much trickier because it describes the relationship between pairs of assets, and thus, it has much higher dimensionality.

For instance, if we try to build the optimal portfolio from S&P500 stock index constituents, we would need to estimate 500 stock returns, 500 stock standard deviations, and 500 * 499 / 2 = 124750 correlation values. Because of this, the correlation estimation is the hardest part of the portfolio optimization input data generation. As the accuracy and validity of the portfolio optimization solution depends on the accuracy of the input data (as with any optimization problem), research on asset correlation dynamics has a huge importance for portfolio theory overall.

Objectives of the research

The main research objectives are as follows:

1. Analyze correlation patterns between major asset classes such as equities, bonds, and alternatives in response to the CPI (Consumer Price Index), Federal Funds Rate, and implied market volatility (as a marker of the market sentiment).

2. Evaluate diversification's effectiveness as a risk tool under different scenarios.

3. Offer strategic portfolio allocation and hedging recommendations based on observed correlations.

This research employs a quantitative approach to analyse how different investment types relate to the economic environment. The analysis includes reviewing existing research, collecting and statistically examining data, and interpreting the results.

The discoveries made in this research can advance the field of investment management, particularly in terms of learning market dynamics to make decisions that are more informed. For both individual investors and finance professionals, the insights presented in this study are invaluable in creating robust investment plans that align with risk attitudes and financial goals.

Through the combination of theoretical expertise and evidence-based analysis, this research aims to provide a better understanding of how asset correlations work, empowering individuals to make more deliberate and strategic investment decisions.

The paper structure

In **Section 1, "Current Research Analysis"**, the paper begins with a detailed examination of the current research landscape. We analyse the existing literature regarding the importance of hedging, sources of market risk and portfolio hedging strategies. In addition, we summarise the literature findings about assets' hedging performance and its dependence on economic indicators, such as inflation, federal funds rate, and market sentiment measures.

The methodology used in this study is outlined in **Section 2: "Materials and Methods of Research"**, which describes the data acquisition, preprocessing, and statistical analysis processes. The techniques used for the visualisation and interpretation of the results are also detailed here.

Section 3, "Results of Analysis of Correlations Between Asset Classes", presents the core findings of the research, delving into time-varying correlations between asset classes.

It explores the historical effectiveness of different strategies for hedging equity market risk with other equity sectors, bonds, gold, and alternative investments, such as VIX. In addition, we analyse how changes in market regimes and large financial disruptions, such as the Dot-com bubble, the 2008 crisis, and COVID-19, changed the hedging landscape.

Section 4: Correlation Analysis Based on Economic Conditions extends the results from Section 3 by analysing the correlations in the context of prevailing economic conditions. The impacts of CPI, the Federal Funds Rate, and the VIX on asset class correlations are systematically explored.

In the **Discussion** section, we discuss the implications of the findings and the strategic insights that can be drawn from them for portfolio management. In addition, we outline the future research directions needed to further extend portfolio risk understanding and mitigation.

The paper ends with the **Conclusions section,** which summarises the findings of the paper and highlights the novel insights that contributed to the field of portfolio optimisation.

1. Current Research Analysis

1.1. Portfolio hedging strategies and challenges

The study of asset allocation in relation to economic conditions is a fundamental aspect of portfolio management and financial research. The objective is to understand how different asset classes respond to changes in economic indicators and leverage this understanding to optimise portfolio performance while managing risk. This literature review critically examines the existing body of work on the subject, focussing on investors' hedging strategies against various economic risks.

The paper "Inflation hedging portfolios in different regimes" by Marie Brière and Signori (2011) [Ombretta Signori, 2011 [1] discusses the strategic allocation of assets for investors looking to protect against the risk of inflation across various economic conditions. It uses a Vector Autoregression (VAR) model to analyse the interplay between asset returns, inflation, and other economic indicators over different investment horizons.

This study explores how an investor aiming for certain real returns within specific risk parameters might allocate assets differently depending on the economic climate. During periods of economic instability, the research suggests that a mix of inflation-linked bonds, equities, commodities, and real estate is necessary for hedging against inflation. Conversely, nominal bonds, equities, and commodities perform better in a stable economic period.

The research further proposes that investors with higher real return goals should lean more towards riskier assets to meet their objectives. This paper outlines optimal investment strategies for individuals based on their expected real returns and willingness to accept risk. This study provides a framework for understanding how asset allocation can be adjusted to manage inflation risk in response to the changing economic landscape.

The paper "On the Measurement of Hedging Effectiveness for Long-Term Investment Guarantees", 2023, by Maciej Augustyniak, Alexandru Badescu, and Mathieu Boudreault [2] studies the hedging difficulties and approaches in long-term portfolio management. The authors developed a statistical framework based on regression analysis to quantify the effectiveness of dynamic hedges.

Another important paper, "Investing in an Overvalued Market and Tail-Risk Hedging" by Michael Ning and Michael DePalma, 2017 [3], discusses the relevance and strategies of tail-risk hedging within investment portfolios, particularly in the context of a potential economic slowdown following a significant period of the US economic expansion.

The authors offer a comprehensive approach to tail-risk hedging, which includes understanding the macroeconomic environment, exploring multiple asset classes, and implementing cost-effective strategies. The aim is to allow investors to remain engaged with the market's potential while safeguarding against sudden downturns, which was increasingly relevant given the high market valuations and the low volatility environment in 2017 and is relevant now, at the beginning of 2024.

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Additionally, the paper emphasises the importance of having a disciplined rebalancing and monetization process to effectively manage the tail-risk hedge. By incorporating such a hedging strategy, investors can increase their allocation to risk assets, reaping potential benefits while being protected from extreme adverse events.

The paper "Forecasting Output and Inflation: The Role of Asset Prices" by James H. Stock and Mark W. Watson, 2003 [4], delves into the predictive power of asset prices on inflation and economic output. An empirical examination in this paper utilises quarterly data on a selection of potential indicators, primarily from the asset price category, for seven nations from The Organization for Economic Cooperation and Development over a period stretching up to four decades (1959–1999).

This study confirms that some asset prices can occasionally forecast inflation or output growth in certain countries during specific intervals. However, it also underscores the unpredictability inherent in these indicators, as the forecasting accuracy of any indicator within one timeframe bears no relation to its predictive utility in subsequent periods.

The 2004 study "The Role of Real Estate in an Institutional Investor's Portfolio Revised" [5] offers a profound exploration into strategic asset allocation, researching returns across diverse asset classes, such as commodities, precious metals, equity REITs, and their performance during economic downturns.

Chun et al. research reveals the diversification benefits of incorporating a broader array of assets beyond traditional equities and bonds. Their empirical findings suggest that certain asset classes, such as commodities and precious metals, improve portfolio performance and deliver gains most opportunistically during economic contractions, thus offering insurance against adverse economic shocks. This empirical evidence substantiates the theory of intertemporal portfolio choice and highlights the essential metrics for portfolio assets, such as the dependence of returns on economic conditions.

Evaluating the literature, it becomes evident that including tangible assets such as commodities provides a strategic advantage in portfolio diversification. Their performance across various economic states, especially during adverse conditions, positions commodities as strategic assets rather than short-term tactical portfolio adjustments. This is particularly relevant in the increasing globalisation of financial markets and the interconnection of economies, which necessitate a more sophisticated and dynamic approach to portfolio management.

The paper "On Hedging Properties of Infrastructure Assets during the Pandemic: What We Learn from Global and Emerging Markets?" by Bambang Susantono et al. [6] studies the globalisation effects during periods of extreme market stress, shows the emerging markets infrastructure indices' hedging advantages when used in a portfolio with USD-denominated assets, especially in periods of market stress.

The existing research also offers empirical support for the enhanced role of alternative investments in portfolio management, especially in a volatile macroeconomic environment.

For example, the paper "Evaluating the Efficiency of Financial Assets as Hedges against Bitcoin Risk during the COVID-19 Pandemic", 2023, by Li Wei et al. [7] examines Bitcoin behaviour during COVID-19, risks associated with cryptocurrency investments, and possible hedges. It concludes that the commodities had the best hedging potential under pandemic conditions.

These findings underscore the necessity for investors to evaluate not only the returns but also the timing and conditions under which these returns are realised to optimise portfolio performance and risk mitigation.

Another prominent direction of research is the interplay between institutional investors, such as hedge funds, and other market participants. The paper "Volatility Spillovers between Stock Market and Hedge Funds: Evidence from Asia Pacific Region", 2022, [8] by Sameen Fatima, Christopher Gan, and Baiding Hu shows that stock market and hedge fund risks are mostly independent, with stock market volatility not affecting hedge fund returns.

1.2. Asset Class Performance and Economic Indicators

The interplay between asset class hedging and economic indicators has been a focal point in financial research. We will synthesise key findings from various studies, offering insights into how asset classes interact under different economic conditions influenced by factors such as inflation, interest rates, and market volatility.

The work by Longin and Solnik, 2001, "Extreme Correlation of International Equity Markets" [9], highlights that correlations between equities and other asset classes such as bonds and gold vary over time and are influenced by market conditions. They noted that correlations tend to increase during market downturns, challenging the effectiveness of diversification as a risk mitigation strategy.

1.3. Inflation

Studies examining the relationship between inflation and asset class performance, such as "Asset returns and inflation" by Fama and Schwert (1977) [10],

have identified that inflation adversely affects real stock returns. However, its impact on bonds can be more pronounced because of fixed interest payments. The role of gold as an inflation hedge has been debated, with Baur and McDermott (2010) [11] finding that gold can act as a hedge and haven during extreme market conditions.

1.4. Federal Funds Rate

The sensitivity of various asset classes to changes in interest rates, particularly the Federal Funds Rate, has also been extensively studied. Bernanke and Kuttner (2005) [12] found a significant relationship between unexpected changes in the target Federal Funds Rate and stock prices. Their findings suggest that monetary policy actions can affect equity markets immediately and noticeably.

The inverse relationship between bond prices and interest rates is well established in the financial literature. Research by Gürkaynak, Sack, and Wright [13] demonstrates how bond yields respond to monetary policy, highlighting the importance of interest rate movements in bond investment strategies.

1.5. Market Sentiment

In the paper "Performance of volatility asset as hedge for investor's portfolio against stress events: COVID-19 and the 2008 financial crisis", 2022, by Chinnaraja Chendurpandian and Piyush Pandey [14], the authors evaluate the usage of volatility assets as a hedge for extreme historical market conditions, such as 2008 crisis and COVID-19. They found that even an allocation of 5% of the portfolio to these assets significantly improves the portfolio return-to-risk profile.

The paper "The Investor Fear Gauge" by Whaley (2000) [15] established it as a critical measure of market risk and investor sentiment. Subsequent studies have shown that high VIX levels are often associated with high market stress, which can lead to increased correlations among equities and between equities and other asset classes.

The research paper "Stock Market Uncertainty and the Stock-Bond Return Relation" by Connolly, Stivers, and Sun, 2005 [16] also indicates that the VIX can predict time-varying equity market correlations. Their findings suggest that during periods of high VIX, the benefits of diversification may diminish as assets tend to move more closely together.

1.6. Summary

Asset classes such as equities, bonds, commodities, and real estate respond differently to economic variables such as inflation, interest rates, and market sentiment. The literature reveals a complex relationship between these asset classes and economic indicators, suggesting varied implications for asset allocation and portfolio diversification strategies.

The existing research also establishes a foundational understanding of how economic indicators affect asset class hedging efficiency and correlations. Empirical studies provide a foundation for understanding the efficacy of various strategies involving inflation-linked bonds, equities, commodities, and real estate. The literature also offers insights into asset classes traditionally serving as market downturn hedges and their sensitivity to interest rate changes and economic cycles.

However, there remains a gap in exploring these relationships in the context of newer market dynamics, such as quantitative easing and emerging market integration. Additionally, the evolving nature of financial derivatives and their impact on traditional asset classes warrant further investigation. This study builds on the existing literature, providing updated insights and exploring unaddressed areas in modern financial markets.

2. Materials and Methods of Research

This study uses an empirical, quantitative approach to explore the correlation dynamics between asset classes and economic indicators under different economic conditions.

This methodological framework bridges theory with practical application, providing a comprehensive strategy for hedging portfolios against economic risks.

2.1. Data acquisition and preprocessing

Asset price histories were obtained from Yahoo Finance, and economic indicator data were sourced from Federal Reserve Economic Data (FRED, https://fred.stlouisfed.org).

The collected data were processed for consistency, with date alignment, and missed data were filled with the last available values. Different assets and economic indicators have different periods and update frequencies (e.g., inflation is updated monthly, and interest rates are updated up to 8 times per year), so the data were preprocessed to use the most extended possible intervals for every subset of data analysed.

2.2. Statistical analysis

Daily asset returns were computed using the logarithmic return formula, defined as follows

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$$R_t = \ln\left(\frac{P_t}{P_{t-1}}\right), \quad (6)$$

where R_t represents the return at time t;

P_t is the price at time t;

P_{t-1} is the price at time t-1.

The Pearson correlation coefficient, which is a measure of the linear correlation between two variables, X and Y, is calculated as

$$r_{xy} = \frac{\sum(X-\overline{X})(Y-\overline{Y})}{\sqrt{\sum(X-\overline{X})^2\sum(Y-\overline{Y})^2}}, \quad (7)$$

where $\overline{X}$ is the mean of X;

$\overline{Y}$ is the mean of Y.

A rolling correlation was applied using a specified window size to assess the changing relationship over time, providing a time series of correlation coefficients.

Fisher's z-transformation was used to transform the Pearson correlation coefficients into a normally distributed variable, enabling the computation of confidence intervals. The Fisher z-value is calculated as follows:

$$z = \frac{1}{2}\ln\left(\frac{1+r}{1-r}\right), \quad (8)$$

and the corresponding confidence intervals were derived using the following formula:

$$CI_z = z \pm \left(\frac{z_{a/2}}{\sqrt{n-3}}\right), \quad (9)$$

where CI_z is the confidence interval on the Fisher z-scale;

$z_{a/2}$ is the critical value from the standard normal distribution for $a/2$ (e.g., 1.96 for a 95% confidence interval);

n is the sample size.

The inverse Fisher transformation

$$r = \frac{e^{2z}-1}{e^{2z}+1} \quad (10)$$

was used to interpret the results and to convert the confidence intervals to the original correlation scale.

2.3. Visualisation and interpretation of results

Statistical and graphical analyses were synthesised to determine the hedging potential of different asset classes and the impact of economic indicators on asset performance.

Graphical representations were generated using Python's matplotlib library to visually convey the data trends and correlation dynamics.

Based on the findings, policy implications are discussed, and strategic recommendations for portfolio hedging are described.

This study offers valuable insights into strategic asset allocation through this comprehensive methodological framework, particularly the hedging capabilities of various asset classes in response to economic shifts.

3. Results of Analysis of Correlations Between Asset Classes

3.1. Time-Varying Correlations Between Asset Classes

In this chapter, we examine how the correlation between the S&P 500 stock index returns and various other asset classes changes over time. The rolling 10, 50, and 250 trading days (2 weeks, 2.5 months, and one year) will be plotted. These data will provide insights into how the assets return's dynamic changes over short-, medium-, and long-term periods.

The 10-day correlations are volatile and show short-term diversification performance. 50-day and 250-day correlations reveal more sustained trends of particular interest to longer-term investors.

The historical correlation dynamics of other US equity indices, such as the Dow Jones Industrial Average, NASDAQ Composite, NYSE Composite, and Russell 2000, will be examined. These indices are especially attractive because they allow investors to achieve some measures of hedging and diversification without using alternative low-risk asset classes.

Then, gold and bond indices will be investigated as non-equity asset classes that are usually utilised in a diversified portfolio.

Finally, the relationship between the S&P 500 and the CBOE Volatility Index is examined to assess implied market volatility and equity performance dynamics.

3.2. S&P 500 and Equity Indices

The correlation between the S&P 500 and the other two major US equity indices, the Dow Jones Industrial Average and NYSE Composite, stays very high most of the time, averaging 0.96 (Fig. 1) and 0.98 (Fig. 2), respectively. This suggests a strong market exposure connection between large-cap equities, regardless of the exact sectoral composition. Even though a 10-day rolling

correlation displayed some variability, a one-year correlation remained above 0.85 for all testing data.

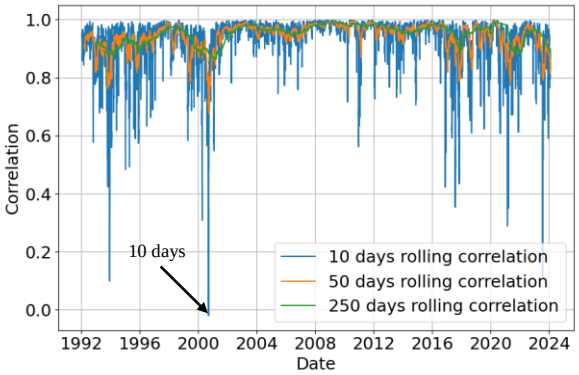

Fig. 1. Rolling correlation between S&P 500 and Dow Jones Industrial Average

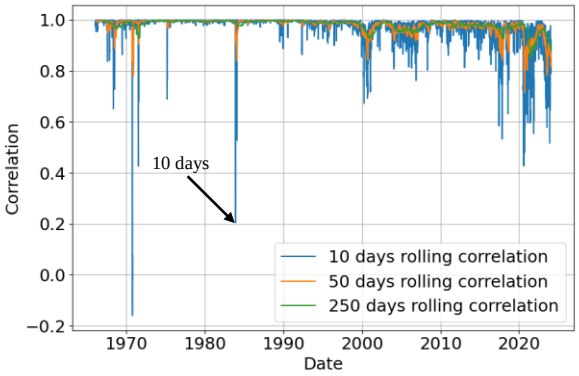

Fig. 2. Rolling correlation between S&P 500 and NYSE Composite

These results imply that the Dow Jones Industrial Average and NYSE Composite do not offer any meaningful diversification benefits to investors holding the S&P 500.

For the NASDAQ Composite, the average correlation measured was 0.86 (Fig. 3). We can see that the correlation between the S&P 500 and the NASDAQ Composite was lower in the 1980s and 1990s, with a one-year correlation of 0.8.

In contrast, after the year 2000, the one-year correlation remained above 0.9. This behaviour shift is likely caused by an increased sectoral exposure to tech in the S&P 500 index during the dot-com bubble and beyond.

The correlation between the S&P 500 and the Russell 2000 averaged 0.85 (Fig. 4), the lowest among these four indices. This is likely attributable to Russell 2000's composition of smaller capitalisation stocks, which may respond differently to the economic environment than their larger counterparts, as well as a higher number of stocks and smaller overlap with the S&P 500.

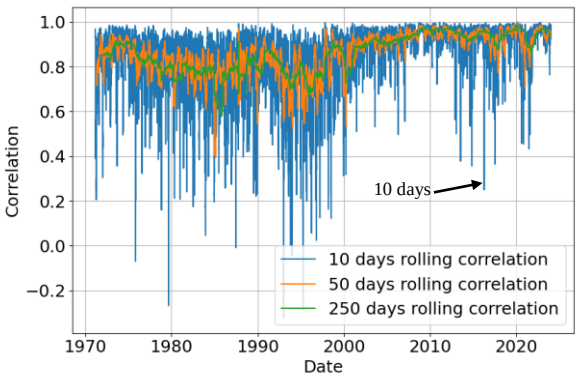

Fig. 3. Rolling correlation between S&P 500 and NASDAQ Composite

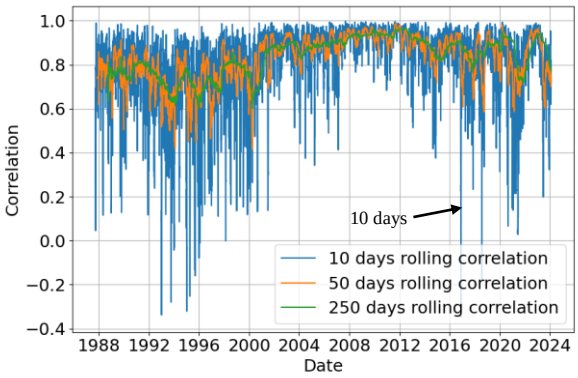

Fig. 4: Rolling correlation between S&P 500 and Russell 2000

3.3. S&P 500 and Non-Equity Asset Classes

The correlations between the S&P 500 and non-equity asset classes, such as gold and treasuries, displayed much more variability. Gold showed an average correlation of 0.05 with the S&P 500 (Fig. 5), indicating almost no consistent relationship. This low correlation highlights gold's historical reputation as a hedge against equity market downturns and inflation.

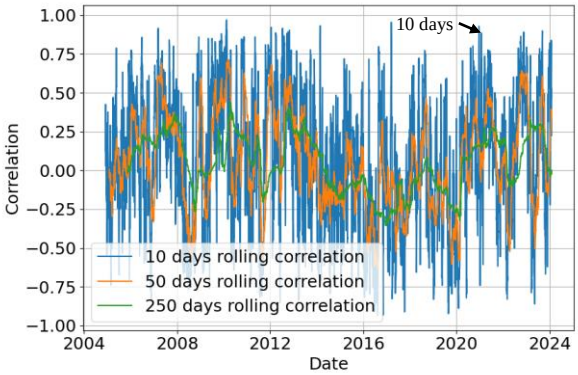

Fig. 5: Rolling correlation between S&P 500 and Gold (GLD)

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As for bonds, the long-term treasuries ETF had a negative average correlation of -0.34 with the S&P 500 (Fig. 6), and the Vanguard Total Bond Fund had an average correlation of -0.07 (Fig. 7). These results emphasise bonds' potential as a diversification tool and a hedge against equity risk.

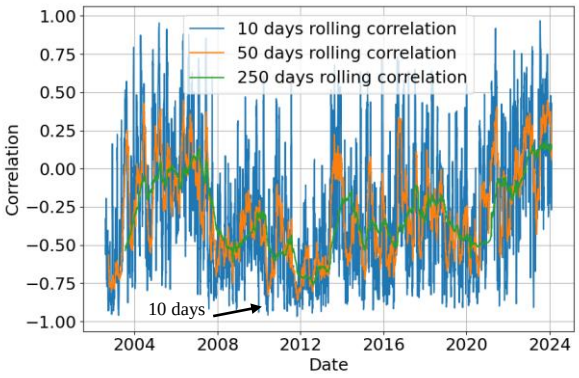

Fig. 6: Rolling correlation between S&P 500 and Long Term Treasuries ETF (TLT)

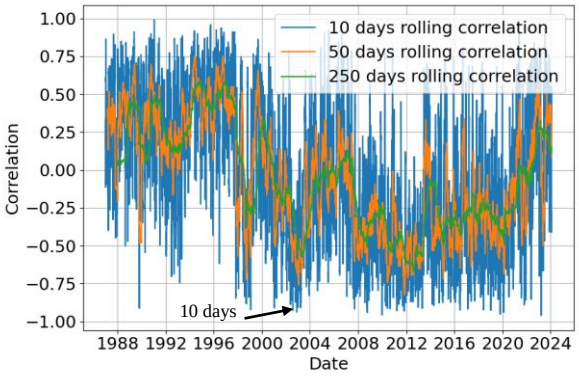

Fig. 7: Rolling correlation between S&P 500 and Vanguard Total Bond Fund

The difference in these two bond indices is mainly attributable to the different testing periods, as the TLT does not have data from the 1987-1997 years, when the bond-to-equity correlation was the highest, while the performance during the mutual period is almost identical.

However, long-term treasuries are likely more beneficial for portfolio diversification because they have higher volatility than shorter-term ones; therefore, lower exposure is needed to obtain the same diversification effect.

3.4. S&P 500 and Market Volatility (VIX)

A particularly insightful aspect of the analysis was the average correlation of -0.70 between the S&P 500 and the VIX (Fig. 8). As the VIX measures market expectation of near-term volatility represented by S&P 500 stock index option prices, this negative correlation is expected. In times of market turbulence, when the VIX rises, the S&P 500 often falls, and vice versa.

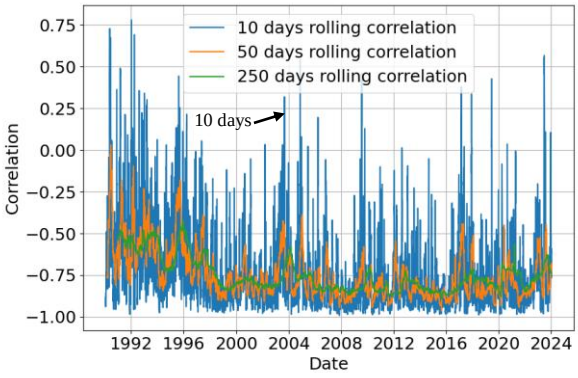

Fig. 8: Rolling correlation between S&P 500 and CBOE Volatility Index

However, the practicality of direct VIX hedging is questionable even though ways to obtain VIX exposure exist, such as holding VIX futures and ETFs holding them. The decay of the VIX futures due to contango likely outweighs any diversification and hedging benefits.

This experiment's findings show that while equity indices are highly correlated, non-equity assets and the VIX behave differently from the S&P 500. These results suggest that non-equity assets offer valuable hedging properties for a portfolio containing S&P 500 equities, especially in the context of varying economic conditions that affect market volatility and investor sentiment.

Analysing these correlations over time is essential for constructing a resilient investment portfolio. By understanding how different asset classes interact under various market conditions, investors can better manage risk and potentially enhance returns. This experiment's insights into the nuanced behaviour of asset correlations provide a foundational understanding that could be pivotal for strategic asset allocation and risk management.

4. Correlation Analysis Based on Economic Conditions

The hedging potential of various asset classes might depend significantly on the underlying economic conditions. The following experiment studies this relationship.

We will focus on the impact of inflation, the Federal Funds rate, and implied market volatility. As for the assets, we will use all assets that showed meaningful hedging and diversification benefits in the previous chapter: the NASDAQ Composite index, Russell 2000, Gold, Long-term treasuries ETF, Vanguard Total Bond Fund, and the VIX index.

In addition, to ensure the statistical robustness of the findings, we construct the 99% confidence intervals using Fisher's z-transformation.

4.1. Impact of CPI on Asset Correlation

Inflation, measured by the Consumer Price Index (CPI), significantly affects the absolute and relative performance of the stock market. The hedging performance of different asset classes also varies heavily based on the current economic conditions.

The NASDAQ Composite, heavily weighted towards technology and growth stocks, often exhibits a distinct behaviour in response to CPI changes compared with the S&P 500, which is a broader market representation. In periods of low inflation, technology companies benefit from the lower cost of capital and general market optimism, leading to a strong positive correlation between NASDAQ and the S&P 500.

However, the correlation diverges as the CPI increases, signalling rising inflation. Growth stocks are susceptible to inflation because their value depends more on future earnings, which could be discounted more heavily as inflation rises. This divergence in correlation can be seen in Fig. 9, where the NASDAQ starts to show an independent movement from the S&P 500. The technology sector's growth prospects may be revised downward as borrowing costs increase and consumers' purchasing power decreases, affecting tech companies' future cash flows and earnings potential.

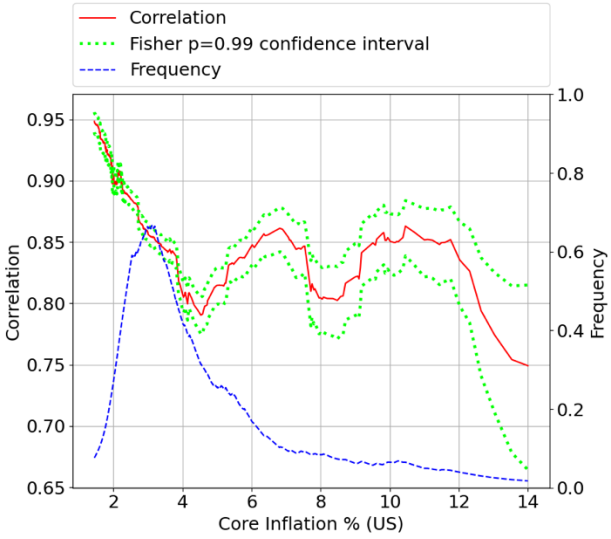

Fig. 9. Correlation between S&P 500 and NASDAQ Composite returns based on Core Inflation

The Russell 2000 index, which comprises small-cap companies, can be a barometer for domestic economic health and investor risk appetite. In an environment with stable or low CPI levels, small-cap stocks often move in tandem with the S&P 500, reflecting a uniform market outlook and investor confidence, as demonstrated in the early parts of Fig. 10.

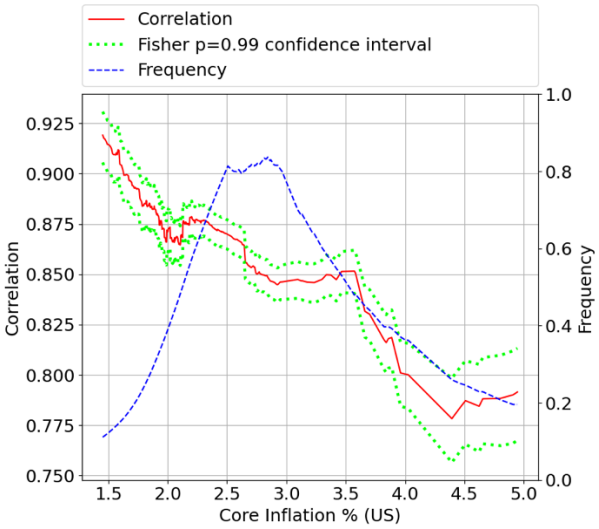

Fig. 10. Correlation between S&P 500 and Russell 2000 returns based on the Core Inflation

However, this correlation tends to weaken as the CPI rises. Small-cap companies are typically more vulnerable to inflation than their larger counterparts because of their often-higher operational leverage and lower pricing power. As inflation increases, the costs for these companies can rise more rapidly than their ability to pass on costs to customers, squeezing margins and potentially affecting earnings. This sensitivity is reflected in the correlations shown in Fig. 10, where the Russell 2000 exhibits a more varied correlation with the S&P 500 during higher CPI periods.

The implications of these correlation shifts are significant for portfolio construction and risk management. In a low-inflation environment, investors might favour a blend of S&P 500 and NASDAQ stocks for growth while including Russell 2000 stocks to capitalise on a bullish outlook for the domestic economy.

Conversely, as inflation rises, a more nuanced approach might be warranted, potentially reducing exposure to both NASDAQ and Russell 2000 equities in favour of assets with lower inflation sensitivity.

Bonds are susceptible to changes in inflation, as represented by the CPI. This sensitivity arises from the fact that fixed income generated by bonds can lose value in real terms when inflation increases. The CPI's movements can significantly influence bond prices and yields, making it crucial for investors to understand this dynamic.

Bonds are a good investment option when the Consumer Price Index indicates low inflation. This is because the fixed income generated by bonds retains its purchasing power, and the risks of yield increases due to changes in the fed funds rate and other factors are minimal.

ISSN 1814-4225 (print)
ISSN 2663-2012 (online)

The correlation between bond indices, such as the Vanguard Total Bond Fund (VBMFX) and Long-term treasuries ETF (TLT), and the S&P 500 during these times is the most negative (-0.4 and -0.5 respectively), as shown in Fig. 11 and Fig. 12.

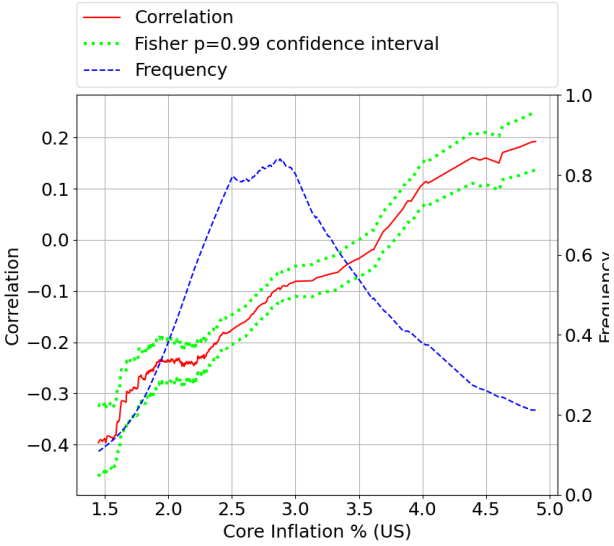

Fig. 11. Correlation between S&P 500 and Vanguard Total Bond Fund returns based on Core Inflation

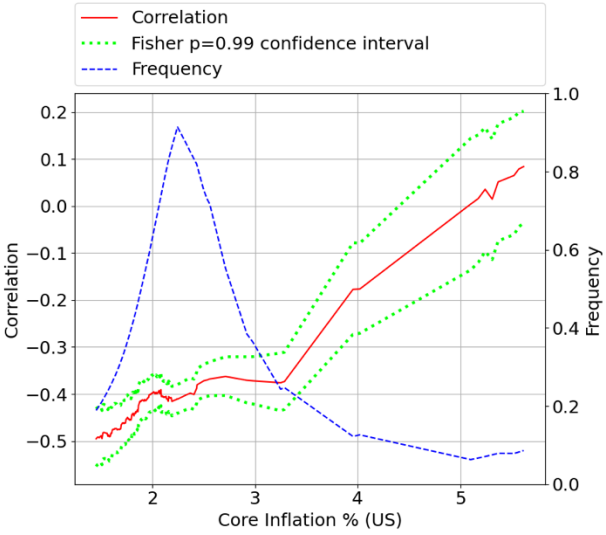

Fig. 12. Correlation between S&P 500 and Long-term treasuries returns based on the Core Inflation

Bonds become less attractive when the CPI rises, signalling increasing inflation. Higher inflation erodes the actual value of fixed income from bonds.

The correlation between bond prices and equities weakens as investors begin to reassess the value of holding bonds versus other assets (commodities such as gold, real estate investments, or alternative investments such as cryptocurrency that keep the value better in an inflationary environment).

Traditionally viewed as an inflation hedge, gold presents an intriguing correlation pattern with equities in response to CPI fluctuations. As shown in Fig. 13, there is an observable tendency for gold to decouple from equities as inflation rises although the relationship is not uniformly inverse. The correlation's variability suggests that gold's efficacy as a hedge may be influenced by factors beyond the CPI, such as actual interest rates and currency valuations.

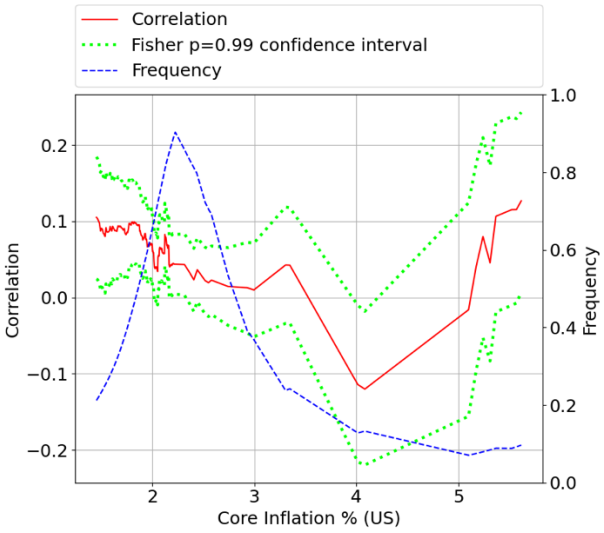

Fig. 13. Correlation between S&P 500 and GLD returns based on the Core Inflation

The VIX's correlation with equities in the context of CPI changes, as shown in Fig. 14, indicates that higher inflation is often accompanied by a weakened inverse relationship between the S&P 500 and VIX. When inflation is high, stocks might lose their value for prolonged periods without VIX spikes. In contrast, in low-inflation stable environments, stock market drops are more likely to be accompanied by a market fear spike due to unforeseen events.

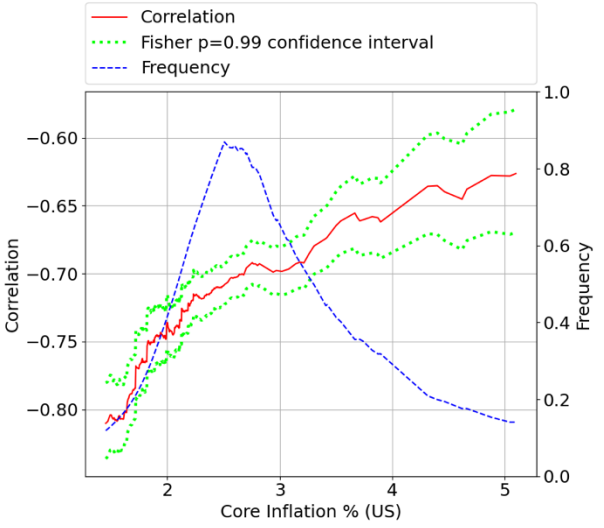

Fig. 14. Correlation between S&P 500 and CBOE Volatility Index (VIX) returns based on the Core Inflation

4.2. Influence of Federal Funds Rate on Asset Correlation

The Federal Funds Rate is a critical benchmark in financial markets that has a massive impact on all asset classes. The value of the Federal Funds Rate determines the market regimes and rarely changes, which allows the portfolio hedging strategy to be customised effectively based on it.

Equities are generally sensitive to changes in the Federal Funds Rate. Lower interest rates typically encourage spending and investment, buoying equity markets.

In contrast, higher rates can dampen economic activity, thereby impacting company profits and by extension, stock prices.

The positive correlation among equities may weaken when the Federal Reserve raises rates to curb inflation or cool an overheated economy (Fig. 15 and Fig. 16). Specific sectors more sensitive to interest rates, such as financials or real estate, might react differently than technology or consumer goods. This sectoral divergence offers opportunities for diversification within equity holdings, potentially mitigating risk in a rising rate environment.

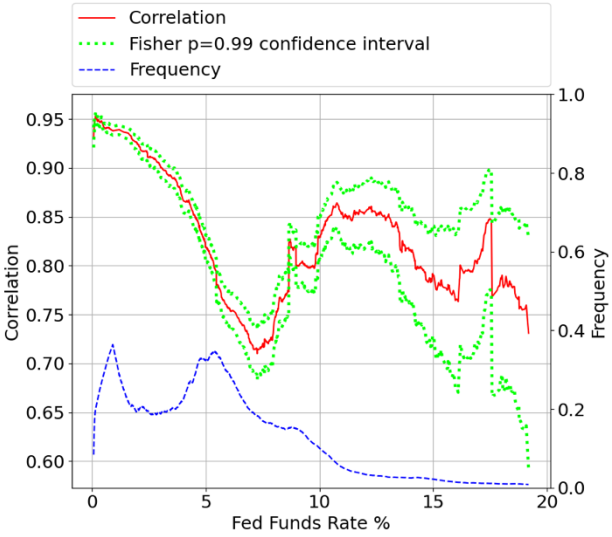

Fig. 15. Correlation between S&P 500 and NASDAQ Composite returns based on the Federal Funds Rate

Bonds, especially longer-duration bonds such as TLT, are directly impacted by interest rate changes. As rates climb, new bonds are issued at higher yields, making existing bonds with lower yields less attractive.

As shown in Fig. 17 and Fig. 18, the inverse relationship between bonds and equity returns weakens, likely for the same reasons as with the high CPI readings. This shows that the diversification effects of bonds diminish in a high Federal Funds Rate economic environment.

The behaviour of gold and similar assets in response to interest rate changes can be complex. Generally, as interest rates rise, non-yielding assets such as gold become less attractive. However, if rate hikes respond to high inflation, gold still holds appeal as an inflation hedge. This dual role of gold can be crucial in a portfolio, providing a hedge against both inflation and equity market downturns (Fig. 19).

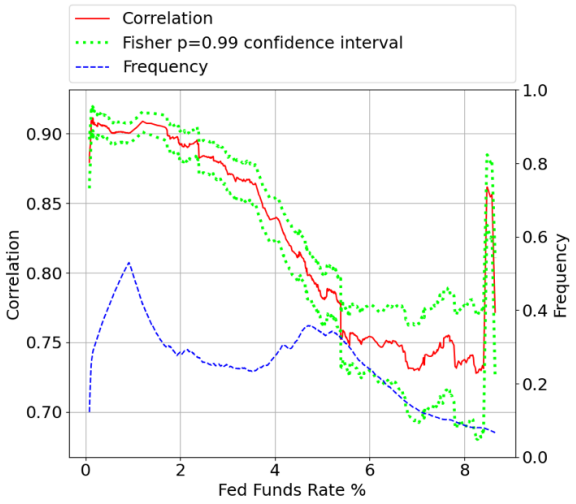

Fig. 16. Correlation between S&P 500 and Russel 2000 returns based based on the Federal Funds Rate

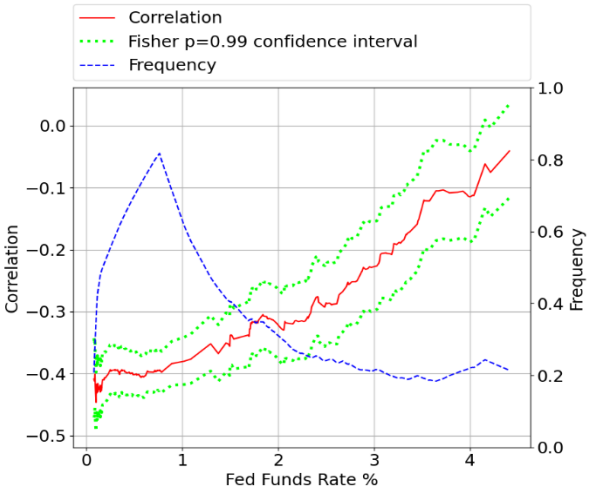

Fig. 17. Correlation between S&P 500 and TLT based on the Federal Funds Rate

Fig. 20 demonstrates the correlation dynamics between the VIX and equities during interest rate fluctuations. The data suggests that when interest rates rise, the inverse relationship between the S&P 500 and VIX weakens. This may result in extended periods of stock value decline without significant spikes in the VIX. Conversely, market downturns are more likely to be accompanied by a spike in market fear due to unforeseen events in low-rate environments.

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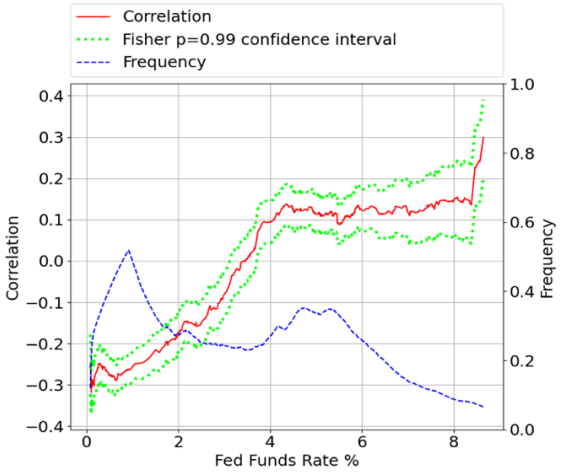

Fig. 18. Correlation between S&P 500 and Vanguard Total Bond Fund returns based on the Federal Funds Rate

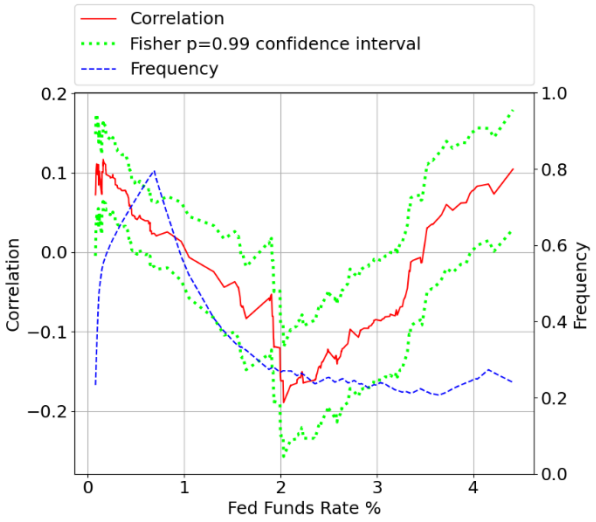

Fig. 19. Correlation between S&P 500 and Gold returns based on the Federal Funds Rate

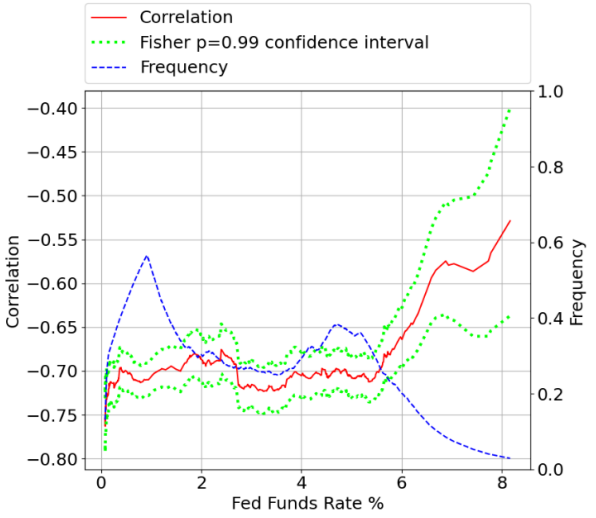

Fig. 20. Correlation between S&P 500 and VIX index returns based on Federal Funds Rate

4.3. Influence of VIX on Asset Class Correlations

The CBOE Volatility Index (VIX), often termed the "fear gauge," is a critical indicator in financial markets, reflecting the expected short-term volatility based on S&P 500 index options. Understanding the relationship between the Volatility Index (VIX) and various asset classes is crucial for hedging strategies in portfolio management.

The VIX, reflecting market volatility expectations, can significantly influence the behaviour of different assets. In portfolio construction, the goal often involves finding assets with low or negative correlations, particularly in volatile markets, to mitigate risk and enhance portfolio resilience.

As the VIX rises, indicating increasing market anxiety and expected volatility, a notable trend often emerges where equities move more closely together.

High VIX levels can lead to an environment where different stocks and sectors, which typically behave independently, exhibit high correlations (Fig. 21 and Fig. 22).

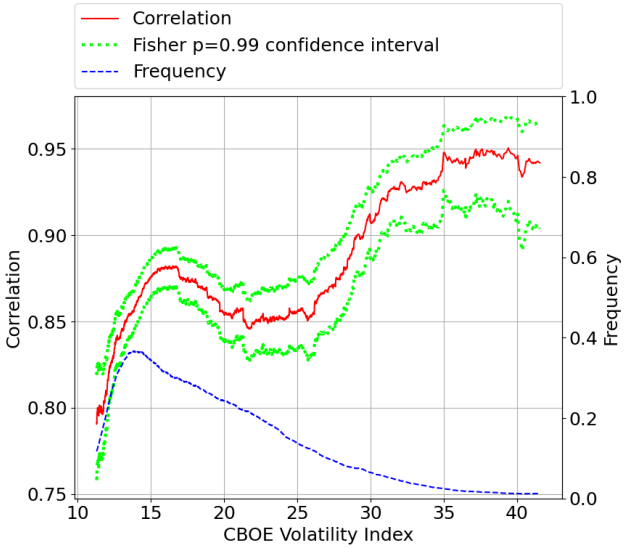

Fig. 21. Correlation between S&P 500 and NASDAQ Composite index returns based on the VIX index

The rising correlation among equities in times of high VIX is particularly problematic for diversification as a hedging strategy. Diversification relies on the principle that not all assets will simultaneously move in the same direction. However, during periods of high market stress, as indicated by a high VIX, this principle is undermined, and the protective power of diversification diminishes.

Equities and sectors may respond differently to economic news or company-specific events under normal market conditions, leading to a lower overall correlation. However, broader market forces overshadow these

individual differences during high-stress periods, leading to a synchronised market response. This synchronisation is driven by a collective risk-off sentiment where investors either flee the market or shift to perceived safe havens.

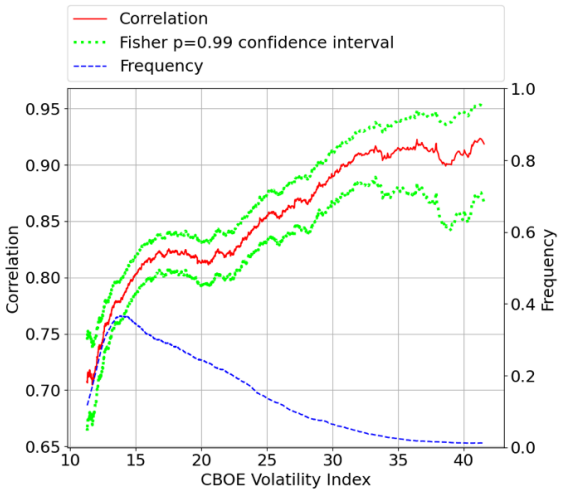

Fig. 22. Correlation between S&P 500 and Russell 2000 index returns based on the VIX index

The effectiveness of hedging through equity diversification is significantly reduced under high VIX conditions. Alternative hedging strategies may need to be employed, such as using options for downside protection, increasing cash holdings, or diversifying into non-correlated asset classes such as certain commodities or currencies.

Generally, bonds, especially government securities such as TLT, exhibit an inverse relationship with the equities market in high VIX scenarios (illustrated in Fig. 23 and 24). This inverse correlation is essential for hedging against equity risk. When equities underperform due to high volatility, bonds can provide stability, reducing the overall portfolio volatility.

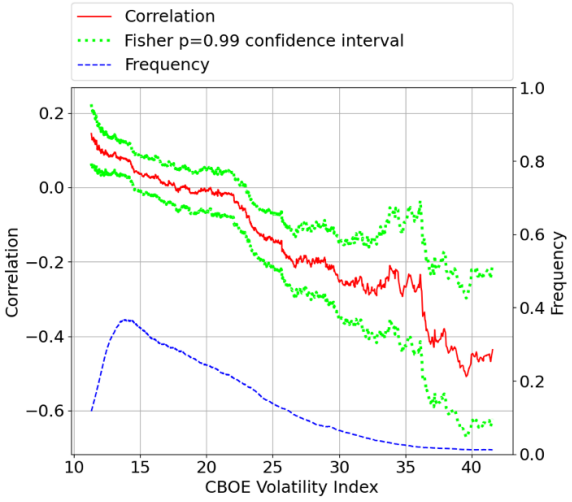

Fig. 23. Correlation between S&P 500 and Vanguard Total Bond Fund returns based on the VIX index

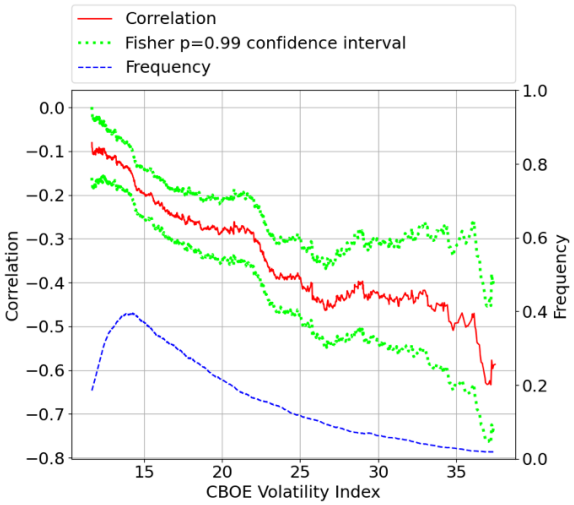

Fig. 24. Correlation between S&P 500 and TLT returns based on the VIX index

Adding bonds to a portfolio, particularly during periods of anticipated high volatility, can act as a buffer. This diversification is essential not only for stabilising returns but also for preserving capital during market downturns.

Gold's correlation with equities in the context of varying VIX levels can be an essential aspect of portfolio hedging. Often considered a safe-haven asset, gold might maintain or increase its value when the VIX is high. Equities are underperforming during this time; therefore, gold provides a hedge against market turmoil (Fig. 25).

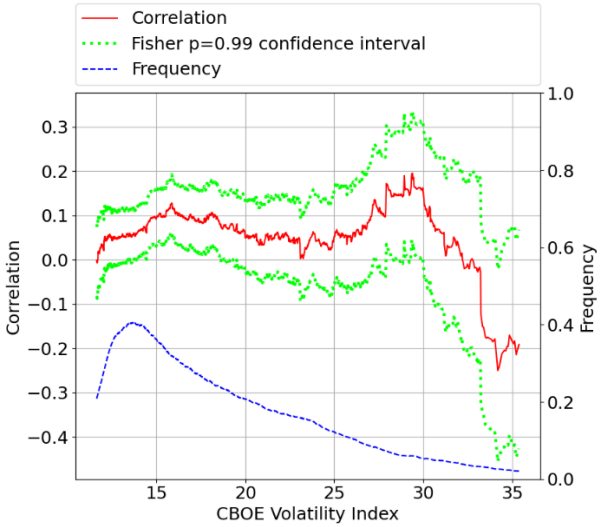

Fig. 25. Correlation between S&P 500 and gold returns based on the VIX index

5. Discussion

The experimental results underscore the complexity of asset relationships despite economic change. While equities often move together, their relationship with

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bonds, gold, and other asset classes can shift dramatically depending on the economic environment.

These shifts have profound implications for portfolio management, particularly in constructing diversified portfolios that mitigate risk. The varying correlations under different economic conditions suggest that a static asset allocation strategy might not be optimal. Instead, a dynamic approach that adjusts to the economic climate could offer better protection against market downturns.

This research illuminated the intricate and variable relationships between asset classes under specific economic conditions. It highlighted the importance of monitoring economic indicators such as inflation and volatility when making investment decisions.

Investors seeking to optimise their portfolios in anticipation of or in response to economic changes, aiming to maximise returns while controlling for risk, can leverage the results of this experiment. This study provides empirical evidence to guide strategic asset allocation and hedging practices in finance.

This study examined the constantly changing correlations among asset classes, such as stocks, bonds, and alternative assets, including gold. This study focussed on how these correlations are impacted by shifting economic indicators such as the Consumer Price Index (CPI), Federal Funds Rate, and the CBOE Volatility Index (VIX). Understanding these correlations is crucial for comprehending the behaviour of financial markets during stressful times and guiding strategic portfolio management during various economic conditions.

5.1. CPI Influence

The Consumer Price Index (CPI) is a primary measure of inflation, reflecting changes in the cost of goods and services. Its influence on various asset classes profoundly affects equities, bonds, and alternative investments such as gold. Understanding these relationships is crucial for investors seeking to navigate inflationary environments effectively.

Specifically, within equities, CPI uniquely affects different sectors. For instance, technology companies and small caps may struggle more with rising costs than sturdier large caps. The reason for this is that the technology industry heavily relies on future growth prospects, and small-cap companies usually operate on tighter margins, which makes them more susceptible to rising costs.

As inflation grows, investors often shift money from vulnerable areas into resilient ones such as consumer staples and energy. As a result, inflation changes the equity market behaviour, and the equity sectors tend to become less correlated, increasing the hedging opportunities.

Usually, bonds and CPI move opposite to each other. With fixed payments, bonds lose real value as inflation increases, dragging prices down. This relationship is important for investors using bonds to balance equity risk.

The impact of CPI on bonds varies with duration. Like those represented by TLT, long-term bonds may be more sensitive to inflation expectations because of their longer time horizons than shorter-term bonds. This sensitivity must be factored into portfolio decisions, especially when managing interest rate risk.

The correlation between bond indices and equities during high-inflation periods tends to increase, diminishing bond hedging benefits in a high-CPI environment.

Historically, gold has been viewed as an inflation hedge; however, the dynamics are complex. While gold may retain value amid high inflation, and the correlation with equities remains mostly constant near 0, the actual performance depends on actual interest rates and global economic factors. For investors considering gold to hedge inflation, grasping this multifaceted relationship is critical.

Overall, asset class reactions to inflationary pressures, as indicated by CPI changes, are nuanced. Recognising these subtle responses is critical to developing resilient investment approaches. By strategically allocating assets in response to CPI movements, investors can position portfolios to navigate the trials and opportunities of inflation.

5.2. Federal Funds Rate Impact

The Federal Funds Rate, as determined by the Fed, serves as a standard for short-term rates and indicates the price of borrowing money. Its fluctuations can significantly impact various asset types, shaping investors' choices as they navigate shifting economic situations.

Stocks, for example, respond to the Fed Funds Rate in ways that can significantly differ between industries. Tech companies and small-caps, often more dependent on debt for expansion and operations, can be especially sensitive to rate increases. Rates directly affect borrowing expenses and may hamper growth. In contrast, more giant corporations may be better positioned to handle higher rates because of their typically more substantial balance sheets and varied income streams.

As the Fed Funds Rate rises, tightening monetary policy, investors may shift towards sectors considered more secure or that benefit from the higher rates, such as financials, which can gain from increased interest margins. In times of lower rates, there may be a trend

towards industries that benefit from cheaper borrowing costs and economic stimulus, such as consumer discretion.

The bond market distinctly exhibits sensitivity to rate changes. Generally, bond prices move contrary to rates, with rising rates causing lower bond prices. This relationship is especially evident in long-duration bonds, such as those represented by TLT, since their longer maturity make them more vulnerable to shifts in rate expectations.

As a result, the inverse relationship between bonds and equity returns weakens, likely for the same reasons as with the high CPI readings. This shows that the diversification effects of bonds diminish in a high Federal Funds Rate economic environment.

Gold's relationship with the Federal Funds Rate is complex. Because gold does not pay interest, people usually see it as a safe place to put their money when things are rocky. However, bonds and other assets look more attractive when rates increase, so gold loses some appeal.

On the other hand, super-low rates combined with worries about inflation can boost gold as a way to preserve wealth.

5.3. Market Sentiment Impact

Chicago Board Options Exchange's Volatility Index (VIX) is a well-known way to measure market sentiment. Its changes have significant implications for various assets, impacting their performance and connection. For investors, understanding VIX's influence is key to managing portfolios when markets are shaky.

In the stock market, the VIX has different impacts on different sectors. Tech stocks and small caps can see higher volatility when the VIX spikes because they depend on future growth hopes and usually have tighter money margins. This can make these sectors more volatile when markets are stressed.

Investor behaviour tends to follow VIX's movements, often pulling back from high-beta sectors to safer places like consumer staples or utilities when the VIX goes up. However, this sector rotation is not sufficient to overcome the correlation increase due to the flight from equities to other asset classes, and as a result, the equity diversification power almost diminishes in a high-VIX environment.

Usually, as the VIX rises, bond prices can increase because of a flight to safety, so they move opposite to stocks. We have shown that the stock-bond correlation drops from near 0 to a strong inverse correlation of -0.4 to -0.6, which shows that bonds offer great hedging benefits in a high implied volatility market.

When thinking about gold and how it relates to the VIX, a complicated relationship occurs. Gold is usually seen as something stable when things get rocky. We can see that the correlation between gold and equities remains mostly stable with different VIX levels, and only with very high levels of VIX (>30) does the correlation become strongly negative, likely due to the extreme equities downturns.

The VIX shows market sentiment and affects different investments differently. Understanding these reactions helps investors construct portfolios that can handle volatility spikes and the market tanks. By modifying their portfolios based on the VIX, investors can smooth out the bumps and guard against downturns.

5.4. Strategic Insights for Portfolio Management

The findings emphasise diversification and dynamics as conditions for allocation. Traditional diversification strategies may work in stable economic conditions, periods of high inflation, rising interest rates, or increased market volatility, which call for a more nuanced approach, possibly involving a shift towards assets with lower correlations to equities.

The varying correlations in response to CPI, Federal Funds Rate, and VIX also shed light on effective hedging strategies. Inflation and interest rate hikes can erode the value of certain assets while bolstering others, such as gold or bonds.

Similarly, high volatility periods might necessitate alternative hedges beyond traditional asset classes.

Investors should be mindful of economic cycles and adjust their portfolios accordingly. For instance, reducing exposure to equities or shifting towards sectors less sensitive to rate changes can help mitigate risk in a rising interest rate environment.

Conclusions

The main contributions of this paper are as follows:

1. Historical evaluation of asset class dynamics and asset hedging performance. We have shown that asset correlations are not static over time and tend to change drastically with changes in historical market regimes. For instance, we have shown that after the dot-com bubble, the bond-to-equity inverse relationship became much stronger while the hedging potential of equity diversification across sectors decreased.

2. The breakdown of how specific economic conditions, such as inflation, Federal Funds Rate, and market sentiment, influence asset class correlations, offering an in-depth perspective on the relationship between economic forces and asset behaviour. We have

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shown that the high inflation environment presents major challenges to investors as standard hedging strategies become much less effective. For example, the equity-to-long-term bond correlation changes from -0.5 to 0 as inflation increases above 4%, which is exactly what happened during the 2022 market downturn.

3. Using correlation analysis, this study provides practical portfolio diversification and hedging strategies. It also offers multiple empirical insights that can be directly applied to portfolio management, thus bridging the gap between academic research and investment practice.

This study underscores the complexity of asset correlations despite economic and market volatility. Understanding how different asset classes interact under varying CPI, Federal Funds Rate, and VIX conditions is crucial for constructing resilient and strategically balanced portfolios. It highlights the need for investors to remain agile, adapting their strategies to the prevailing economic landscape to optimise returns and manage risk effectively.

This research illuminated the intricate and variable relationships between asset classes under specific economic conditions. It highlighted the importance of monitoring economic indicators such as inflation and volatility when making investment decisions. Investors seeking to optimise their portfolios in anticipation of or in response to economic changes, aiming to maximise returns while controlling for risk, can leverage the results of this experiment.

Given the demonstrated complexity of asset correlations under varying economic conditions, future research should aim to develop more sophisticated models that can accurately predict how different asset classes will interact under various economic scenarios, including extreme and unforeseen events.

One way to achieve this is to involve advanced statistical methods such as randomised Markov chain-based models [17].

Another prominent approach is the integration of machine learning to robustly and efficiently capture the relationship between assets using massive datasets aggregated for decades. Many recent advances in machine learning are likely to be helpful here, such as the use of semi-supervised learning [18], model ensembles [19], information-extreme machine learning techniques, and big data analytics [20]. These methods allow the capture of the highly complicated nuances of asset behaviours within the economic context.

A remarkable illustration of this is the paper "Man versus machine: on artificial intelligence and hedge funds performance", 2022, by Grobys et al. [21], where the authors compare hedge funds' returns based on the level of automation and technology use and conclude that there is a strong correlation between lower levels of human involvement and higher returns.

An important generalisation of the research is the study of broader asset classes, such as non-U.S. equities and bonds, cryptocurrencies and real estate, and the impact of different volatility and market stress factors.

For instance, a recent paper by Ghulam Sarwar (2023) [22] studied options-implied market risks during the 2008 financial crisis and its aftermath in the context of U.S.-European stock-return correlations. The author shows that the risks of U.S. and European stock and bond markets change during periods of extreme financial stress and that cross-market diversification can be extremely useful in such scenarios, even using the same asset classes.

Another major paper by Seema Wati Narayan, Mobeen Ur Rehman, Yi-Shuai Ren, and Chaoqun Ma (2023) [23] examines the long-term asset correlations and strategies based on them using data from Asia, Central and Eastern Europe, the Middle East, North Africa, and Latin America stock markets from 2000 to 2016. The authors develop multiple portfolios based on the average unconditional correlation between domestic and foreign assets to test the long-term diversification benefits and determine optimal portfolio allocation.

Finally, one more important direction of research is the market factors that affect asset performance, timelines, and correlations among themselves (e.g., the fed funds rate is very correlated with the inflation readings, so likely the amount of information in residuals is lower). In this way, we can extract the maximum amount of market information while minimising noise and data dimensions. Hossein Asgharian, Charlotte Christiansen, and Ai Jun Hou (2023) [24] studied the impact of risk aversion, fundamental factors, and economic policy on market volatility and asset class correlations. The authors find, for instance, that monthly data frequency provides better predictive ability than daily frequency and that risk aversion and fundamental factors are more important in predicting volatility than economic policy uncertainty.

Conflicts of interest

The authors declare that they have no conflicts of interest in relation to the current study, including financial, personal, authorship, or any other factors that could affect the study and the results reported in this paper.

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Data availability

All data links and sources are provided in the main text of the manuscript.

Use of Artificial Intelligence

The authors confirm that they did not use artificial intelligence technologies when creating the current work.

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ЕФЕКТИВНІСТЬ ХЕДЖУВАННЯ РІЗНИХ КЛАСІВ АКТИВІВ В ЗМІННИХ ЕКОНОМІЧНИХ УМОВАХ

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У сфері довгострокового інвестування стратегічний розподіл портфеля є важливим інструментом, особливо з точки зору управління ризиками та оптимізації дохідності. Існує багато способів досягти оптимального складу портфеля, і їх ефективність залежить від багатьох факторів, включаючи цілі інвестора, його схильність до ризику та інвестиційний горизонт. Одним з основних засобів оптимізації портфеля є диверсифікація. Основна ідея диверсифікації полягає у підтримці диверсифікованого портфеля зі слабо корельованими активами, що може значно зменшити вразливість портфеля до різних ринкових стресових факторів. Диверсифікація є фундаментальною стратегією в управлінні інвестиціями та портфелем, необхідною для зменшення ризику та збільшення потенційної прибутковості в довгостроковій перспективі. Розподіляючи інвестиції між різними класами активів, секторами, географічними регіонами та інвестиційними стилями, диверсифікація допомагає зменшити загальну волатильність портфеля. **Основним предметом дослідження в статті є** теоретичні основи диверсифікації портфеля та аналіз історичних даних для виведення оптимальних стратегій використання некорельованих активів для покращення показників портфеля. **Метою статті є** дослідження динаміки кореляції між різними класами активів, такими як акції, облігації та альтернативні інвестиції, та їх реакції на зміни інфляції, відсоткових ставок і волатильності ринку, а також тестування її на історичних даних для виведення оптимальних стратегій використання некорельованих активів для покращення ефективності портфеля. **Результати статті** доводять мінливий взаємозв'язок між класами активів за конкретних економічних умов. На основі історичних даних показано, як різні класи активів можуть бути оптимально використані або скориговані для зменшення ризиків і отримання вигоди від можливостей, що з'являються внаслідок зміни економічних показників. Вони показують, що переваги хеджування акціями, облігаціями та золотом значною мірою залежать від процентних ставок, волатильності ринку та інфляції. Стаття також досліджує рекомендації для інвесторів щодо оптимального розподілу портфеля та управління ризиками. **У висновку**, динамічне управління портфелем є важливим інструментом для зменшення загальної волатильності портфеля при одночасній максимізації дохідності. Ефективність диверсифікації різних класів фінансових активів залежить від основних економічних показників, таких як інфляція, процентні ставки та волатильність ринку. Ці результати можуть бути використані інвесторами, які прагнуть оптимізувати свої портфелі напередодні або у відповідь на економічні зміни, щоб максимізувати дохідність, контролюючи при цьому ризик.

Ключові слова: хеджування портфеля; диверсифікація; економічні умови; кореляція активів; інфляційний вплив; ринкова волатильність; стратегічний розподіл активів; управління ризиками.

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