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A Study on Relationship Between Gold, Nifty50 and Cryptocurrencies

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Abstract

In order to comprehend their interdependencies and potential for portfolio diversification, this study looks at the link between gold, the Nifty50, and cryptocurrencies. The Indian equities market is represented by the Nifty50, gold has traditionally been seen as a safe-haven asset, and cryptocurrencies like Bitcoin and Ethereum have become well-known due to their extreme volatility and speculative character. The Granger Causality test, cointegration tests, and correlation analysis are used in this study to ascertain the interconnections between different asset classes using historical data from 2021 to 2024. The results show weak relationships between them, pointing to possible advantages of diversity. There are no meaningful long-term correlations between the three assets, but Bitcoin shows a predictive impact on the Nifty50. When creating diverse investment portfolios, investors and financial analysts can benefit greatly from these insights.

Keywords: Gold, Nifty50, Cryptocurrencies, Bitcoin, Ethereum, Portfolio Diversification, Financial Markets, Correlation Analysis, Cointegration, Granger Causality, Investment Strategy

A Study on relationship between Gold, Nifty50 and cryptocurrencies

Introduction

Over the last few years, the international financial markets have seen a substantial transformation due to the development of new asset categories such as cryptocurrencies, in addition to such traditional investment tools as gold and national stock indices like Nifty50. Gold has, for a long time, been a shelter in turmoil due to its status as a safe-haven asset, which granted it the property of the stable store of value especially when there were conditions of economic turbulence and market volatility. Nifty50, on the other hand, is an index of the top 50 companies that is listed on the National Stock Exchange of India and thus it is perceived to be the benchmark for the Indian equity market, and it reflects the diversified performance of various sectors of the Indian economy. The last decade has seen a significant mass adoption of cryptocurrencies, such as Bitcoin and Ethereum, which are known for their decentralized features and potential for investor high returns. Although they are also prone to volatility and speculation, they have been unfairly labeled the wild kids of the digital financial market.

The relationship between the trio — gold, Nifty50, and cryptocurrencies — indeed picks interest in financial analysts and investors. Elucidating how these assets are related allows one to better diversify their portfolio, manage risk, and speculate the market. This capstone project is a means to look at the connection between gold, Nifty50, and cryptocurrencies, the behavior of each asset in different market conditions, their interdependence, and the role that they play in the investment landscape. The research study, after evaluating the historical data, the amount of fluctuation, and the different correlation patterns of these assets, tries to reveal the connections they have among themselves in the market or operate as singular tools of investment. The outcomes of this study might be that the implications are provide practical for these investors who are looking to create a balance in their (risk and return) (diverse asset classes) of the portfolios.

Gold

Gold is the most ancient and commonly used means of money, and it is the richest form of wealth storage ever. Gold was the historic example of a safe-haven asset, which means that it is liable to keep or even appreciate its value during the times of financial instability, inflation, or market volatility. Investors often take advantages in gold as a hedge against inflation and currency depreciation situations which happen to be the most important at the time of a global financial crisis. Gold is also a non-correlated asset, this meaning that it mostly acts apart from stock and bond markets. In the investment world, the fact is that the performance of gold tends to follow a different direction from equity markets. As a result, investors use it as a diversification tool in their investment portfolios. In spite of its quite even long-term course, gold is still able to experience the short-term variations prompting such influences like interest rates, geopolitical tensions, or currency movements.

Nifty50

Nifty50 is a stock market index in India that shows how the top performing 50 companies listed on The National Stock Exchange of India (NSE) are doing. These companies represent a wide variety of sectors, including technology, banking, energy, and consumer goods, and thus, the Nifty50 is an important standard for the Indian stock market. The Nifty50 index is widely used by investors to gauge the overall health of the Indian economy and to assess the performance of Indian stocks vis-à-vis global markets. As far as investment is concerned, the Nifty50 index offers a wide-ranging exposure to the Indian market and allows the investor to take a diversified position without having to select the individual stocks. The index is the mirror of the economic and business growth of India which in turn makes it a leading indicator sensitive to macroeconomic factors such as GDP growth, inflation, and interest rates. The relationship between Nifty50 and gold, as well

as cryptocurrencies, can be analyzed in terms of market cycles: whether Nifty50 outperforms during bull markets and whether it faces volatility during economic slowdowns, thus contrasting with gold's more stable performance

Cryptocurrencies

Cryptocurrencies are virtual and digital assets that are secured using cryptography, making them counterfeit and fraud resistant. The most popular cryptocurrencies include Bitcoin, Ethereum, and Ripple. In contrast to fiat currencies which are traditional currencies that are issued by governments, cryptocurrencies are not backed by any central authority and are 100% decentralized using blockchain technology to ensure the authenticity and security of all transactions. Cryptocurrencies have become popular due to their high volatility, which results in large price swings within short time periods. Such is mainly because of the fluctuating mood of the market, uncertainty about the regulatory and technological advancements, and speculative activities. A few individuals look at cryptocurrencies as alternative investments offering higher yield, whereas the majority consider them as speculative assets with high risks. Throughout the previous decade, the rise of cryptocurrencies has sparked numerous discussions regarding their position in the financial system, particularly in comparison to other well-known assets such as gold and equities. Cryptocurrencies are among the instruments that some people suggest as a means for protecting future assets in case of inflation, similar to gold, the price of gold can go up over time. Nevertheless, their price growth does not always follow traditional markets, so they are an interesting subject that demands more research and analysis.

Literature Review

Unveiling the interlinkage between Ethereum and Nifty indices: impact of cryptocurrency on Indian equity markets post Covid-19

The literature review investigates the changing relationships among different asset classes, such as the effect of the outbreak of the COVID-19 pandemic on these relationships. It discusses the deepening relationship in finance between the asset classes with some scholars studying the correlation among the different asset classes. The paper presents findings of the literature with the study that identified stock markets to be positively related to cryptocurrencies, and thereby, underlines the examination that is unable to account for all the influencers and thus needs further research to make sense of this phenomenon, particularly during the trend of major market events and, the related issues on investors and policymakers.

A multicountry comparison of cryptocurrency vs gold: Portfolio optimization through generalized simulated annealing

Gold's low or negative correlation with paper assets like equities and bonds has historically made it a popular choice for capital preservation and inflation hedges. Gold's reputation as a safe haven—an asset that is uncorrelated or negatively correlated during extreme market conditions—is still up for debate. The relevance of gold as a safe haven is suggested by anecdotal evidence and investor mood, despite the absence of theoretical support. Meanwhile, cryptocurrencies are becoming more and more popular as alternative investment possibilities, which has led to an investigation of their volatility and portfolio optimization with gold.

On the Relationship of Cryptocurrency Price with US Stock and Gold Price Using Copula Models

The body of research on the connection between cryptocurrencies and conventional financial assets has grown considerably, especially when considering correlation and volatility dynamics. The foundation for comprehending Bitcoin's function as a digital asset has been established by studies like Nakamoto's groundbreaking work on the cryptocurrency. To compare the volatility of cryptocurrencies like Bitcoin to more conventional assets like gold and the S&P 500, recent studies have used a variety of econometric techniques, such as GARCH models.

These research draw attention to the distinctive features of cryptocurrencies, such as their increased risk and non-normal return distribution, which call for sophisticated modeling strategies such Gaussian copula-based approaches in order to accurately represent time-varying correlations. All things considered, the body of research highlights how crucial it is to use reliable statistical techniques in order to comprehend the intricate relationships that exist between cryptocurrencies and conventional financial markets, particularly when volatility is high.

Cryptocurrency, Gold, and Stock Exchange Market Performance Correlation: Empirical Evidence

The literature study identifies a number of important research topics pertaining to cryptocurrencies and their economic properties. Because of their limited cross-correlations with conventional assets, cryptocurrencies are known to offer advantages in diversification. Given the increasing amount of empirical data on cryptocurrencies, Angerer et al. (2021) emphasize the significance of combining knowledge, and a meta-analysis finds important characteristics impacting the intention to use cryptocurrencies. In order to investigate correlations in cryptocurrency environments, a two-phase technique that combines partial least squares structural equation modeling and artificial neural networks is suggested.
It is recommended that future studies concentrate on subjective risk perception, creative bitcoin adoption, and non-standardized financial hazards. Furthermore, a critique of fintech research offers a framework to help bitcoin studies better identify consumer demands. Lastly, the asymmetric GARCH methodology is used to evaluate Bitcoin's risk-hedging capabilities against gold and analyze the dynamic correlations between the prices of gold and silver, highlighting the efficacy of trade regulations.

Dynamic interconnectedness and portfolio implications among cryptocurrency, gold, energy, and stock markets: A TVP-VAR approach

With an emphasis on gold, oil, Bitcoin, renewable energy, and stock markets, the literature review explores how financial assets are interconnected, especially in times of crisis like the COVID-19 pandemic and the conflict between Russia and Ukraine. It draws attention to research showing that oil prices act as conduits for instability while safe-haven assets like gold and Bitcoin exhibit notable risk accumulation and volatility spillovers. The study highlights the need of comprehending both returns and volatility for building robust investment portfolios by employing sophisticated econometric techniques. All things considered, it offers insightful information to investors navigating a financial environment that is becoming more intertwined.

Diversification evidence of bitcoin and gold from wavelet analysis

Given that gold generally shows a negative correlation with stocks and bonds, the literature review emphasizes the proven function of gold as a dependable diversifier in investment portfolios, especially because of its capacity to lower risk and stabilize returns during economic crises. On the other hand, this study investigates how Bitcoin can offer comparable diversification advantages to investors worldwide, particularly in different market circumstances and during times of crisis. The study intends to provide important insights into the roles of Bitcoin and gold in investing strategies by enhancing knowledge of their interdependencies and volatility in respect to different market indices through the use of wavelet and multivariate GARCH approaches.

Dynamic Interrelationships among Bitcoin, Bonds, and Sectoral Indices in India: Evidence from Pre- and Post-COVID-19

With an emphasis on their potential as alternative assets for diversifying conventional investing risks, the body of research on cryptocurrencies has grown dramatically. According to recent studies, cryptocurrencies are becoming more and more popular and are becoming crucial parts of diverse portfolios. The worth of cryptocurrencies as investment vehicles and their risk-return comparisons to traditional assets are important subjects, but little is known about how Bitcoin interacts with larger market dynamics, especially in times of global health emergencies. By investigating Bitcoin's correlations with other asset classes, this study seeks to close this information gap and add to the body of knowledge already available on the interrelationships between financial markets.

The Impact of Gold Price and Us Dollar Index: The Volatile Case of Shanghai Stock Exchange and Bombay Stock Exchange During the Crisis of Covid-19

Component of the research paper that reviews the literature. Although it does not provide a comprehensive literature review, it makes reference to a number of research and articles about the effects of COVID-19 on financial markets, stock volatility, and the connection between gold prices and stock indexes. Please go directly to the full research report for the complete Literature Review.

Comparative Evaluation of Share Values Among Major Tech Companies, Bitcoin, and Gold Prices

The literature review examines several key areas of financial research, focusing on the share values of major technology companies, particularly the "Magnificent Five," and their influence on market dynamics and investor behavior. It also delves into Bitcoin (BTC), exploring its price determination, correlation with traditional assets like gold, and its emerging role as a modern investment amidst economic fluctuations. Additionally, the review discusses gold's historical significance as a safe haven and its performance during economic crises, highlighting its evolving role in contemporary investment portfolios. Overall, it identifies a gap in comparative studies of technology stocks, BTC, and gold, underscoring the need for further research to better understand their interrelationships and market behaviors.

Objectives:

1 To find the correlation among the selected financial assets.

2. To know the long-term relationship among....

3. To study the causal relationship among the selected

Research Methodology

1.Design of Research

This study uses a quantitative research design to investigate the connection between cryptocurrencies, gold, and the NIFTY 50. Historical price data from 2021 to 2024 is used in the secondary data analysis that forms the basis of the study. The study uses causality tests, long-term association tests, and correlation analysis to ascertain how interdependent these financial assets are.

2. Data Collection

- **Data Type**: Secondary data
- **Time Period**: 2021 to 2024 (4 years)
- **Data Sources**: Reputable financial data providers such as NSE (for NIFTY 50), World Gold Council (for gold prices), and cryptocurrency exchanges (CoinMarketCap, Binance, or other reliable sources).
- **Variables Considered**:
  - **Gold Prices** (daily/weekly/monthly closing prices)
  - **NIFTY 50 Index** (closing prices)
  - **Cryptocurrency Prices** (Bitcoin, Ethereum, and other major cryptocurrencies)

3. Methods of Data Analysis

EViews software will be used for the analysis, and the following methods will be used:

1. Analysis of Correlation
Goal: To investigate the degree of association and short-term link between cryptocurrencies, gold, and the NIFTY 50.

The linear link between asset returns is measured using the Pearson correlation coefficient.

2. Long-Run Relationship Analysis Goal: To ascertain whether the chosen financial assets have a long-term equilibrium relationship.

Approach: Johansen To determine whether a long-term link exists, use the cointegration test. If cointegration is discovered, use the Vector Error Correction Model (VECM) to examine long-term dynamics.

3 . The goal of causal relationship analysis: is to determine which way gold, the NIFTY 50, and cryptocurrencies are causally related.
To ascertain whether previous values of one asset may forecast future values of another, the Granger Causality Test is used.

Use the Impulse Response Function (IRF) to analyze the long-term effects of a shock to one asset on others.

4. EViews is the software used for statistical modelling, causality testing, correlation analysis, and cointegration testing.
Before importing data into EViews, using Excel or Python for data pretreatment and visualization is optional.

5. Anticipated Results determining the level of correlation between cryptocurrencies, gold, and the NIFTY 50. determining if there is a long-term equilibrium relationship between these assets.identifying any causal relationships that may exist between these financial assets.

RESULTS AND DISCUSSION

The Nifty 50 index's performance from 2020 to 2024 is depicted in the graph, which demonstrates a robust upward trend over time. The index, which began at about 14,000 in 2020, increased steadily to over 24,000 in 2024, indicating a notable expansion in the Indian stock market. But there have been ups and downs along the way. The market went through periods of volatility, especially in 2021 and 2022, when corrections and dips were noticeable. These were probably brought on by changes in policy, global market trends, or economic uncertainties. The index saw a significant upswing starting in 2023 and hit new highs, indicating robust corporate profits, heightened investor confidence, and advantageous economic conditions. A slight correction toward the beginning of 2024 is evident, suggesting possible profit booking or transient market fluctuations.

The gold price movement from early 2021 to late 2024 is depicted in the provided chart. At the beginning of 2021, gold prices seem to be mostly steady with only slight variations, staying within a small range. This suggests that the market was consolidated, that supply and demand were roughly equal, or that there was no noteworthy economic event that caused prices to rise or fall. But as 2022 draws near, gold briefly rises in value, perhaps as a result of increased investor interest in safe-haven assets, worries about inflation, or global uncertainties. Another phase of sideways movement and mild fluctuations, reflecting market adjustments, follows this rise.

By late 2022 and early 2023, gold prices start to show a consistent upward trend, suggesting increased demand as investors may have sought gold as a hedge against inflation, currency devaluation, or geopolitical uncertaintiesIn 2024, there is a notable breakout when gold prices sharply rise, indicating strong bullish momentum. A number of factors, including global conflicts, inflation, central bank policies, economic instability, and the depreciation of major currencies, could be responsible for this dramatic increase. Gold probably became a safe-haven asset for investors, which caused its price to soar to all-time highs. A slight correction or consolidation occurs toward the end of 2024, when prices somewhat level off following the steep increase, most likely as a result of profit booking or short-term market resistance.

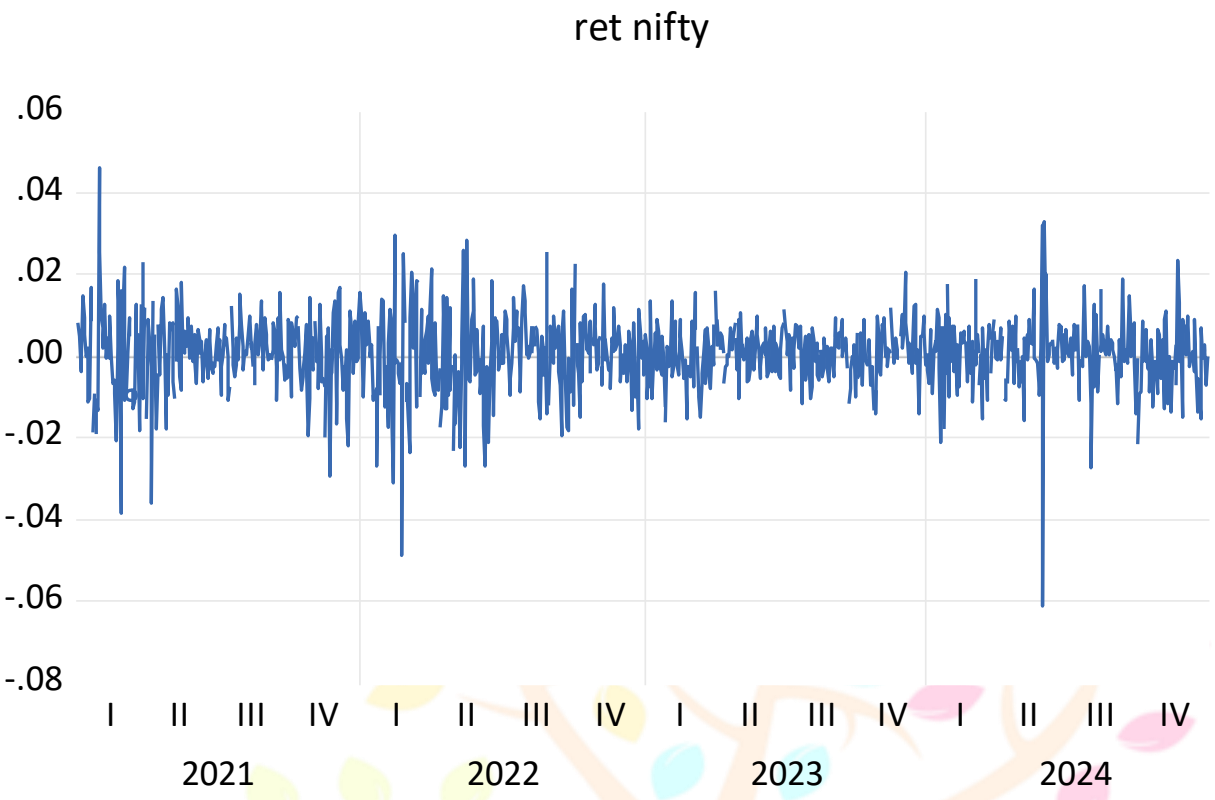
Due in significant part to the state of the economy and investor attitudes toward risk and safety, the gold market over this time has shown periods of consolidation, little declines, and robust bullish tendencies. Investors should take into account any corrections or outside variables that could affect future price fluctuations, even though the recent gain indicates high demand and market optimism for gold.

Interpretation

A very erratic market with notable swings is seen in the Bitcoin price chart for 2021–2024. Bitcoin saw a dramatic increase in early 2021, hitting all-time highs exceeding $60,000. This increase was fueled by institutional adoption, market fervor, and macroeconomic considerations. However, a number of corrections occurred in the second half of 2021 as a result of profit-taking, economic instability, and regulatory concerns. Amidst tighter monetary regulations, concerns about inflation, and significant collapses in the cryptocurrency industry, Bitcoin entered a protracted negative phase in 2022 and fell below $20,000. By 2023, a slow rebound had begun as market trust in cryptocurrencies grew, bolstered by heightened use and optimistic attitude.

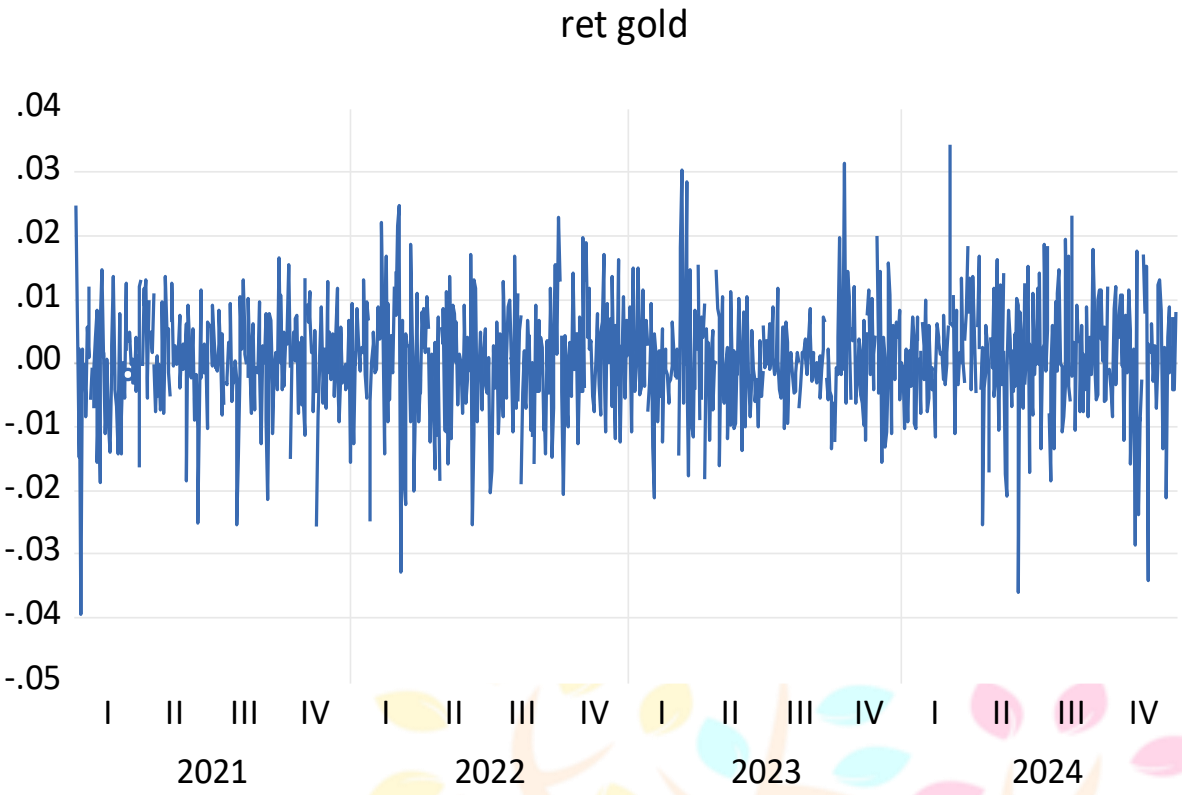
Bitcoin saw a significant increase in late 2023 and early 2024, breaking $60,000 once more. This increase was probably driven by a resurgence of institutional interest, hopes for the adoption of Bitcoin ETFs, and excitement for the next halving event. Although the graph indicates ongoing volatility, the general pattern points to a recovery in Bitcoin's value, propelled by sustained investor confidence and advantageous market circumstances.

Return Graph



Interpretation

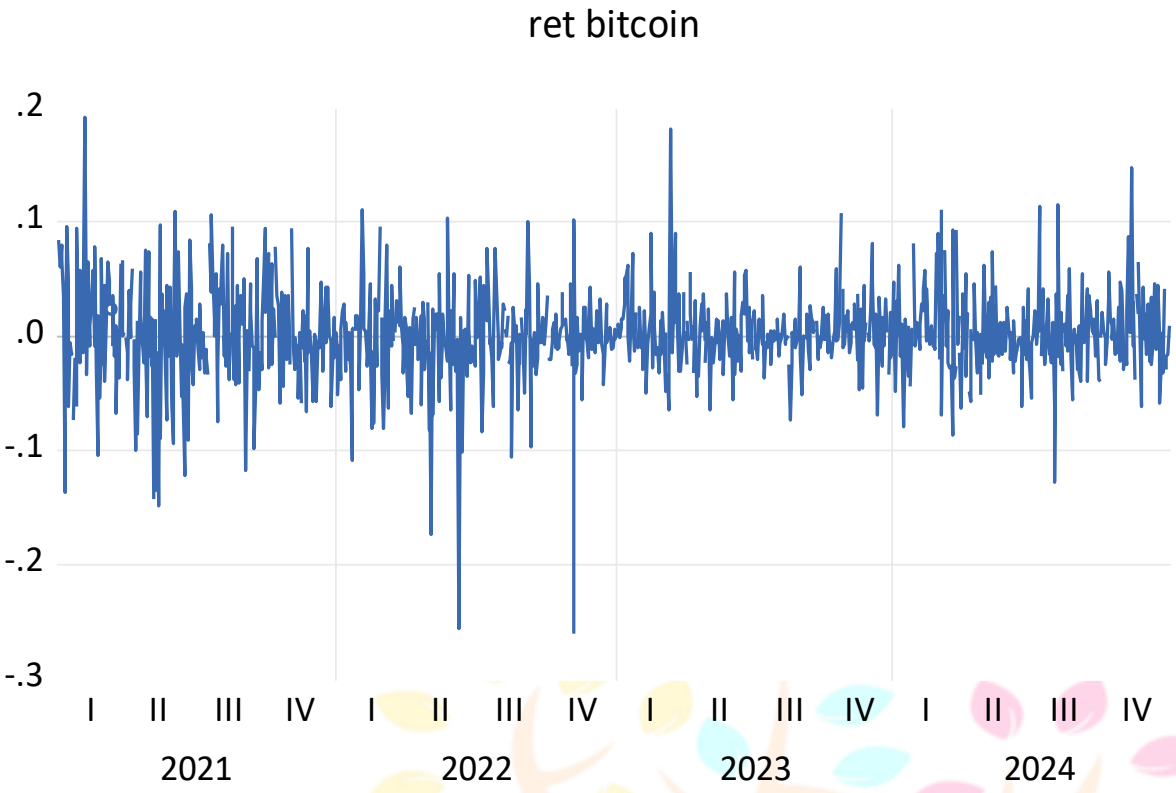
The NIFTY index's daily returns from 2021 to 2024 are displayed in the accompanying chart, which also illustrates the index's volatility over time. The returns range about zero, reflecting the market's normal ups and downs. The spikes and drops in the chart reflect periods of high volatility, with sharp increases and decreases in returns during specific events. Notable fluctuations appear in early 2021, late 2022, and early 2024, possibly linked to economic events, geopolitical factors, policy changes, or market corrections. The overall pattern suggests that while the NIFTY index generally moves in a stable range, occasional external shocks cause significant movements. This type of return chart helps investors analyze risk, as frequent high-magnitude fluctuations indicate periods of uncertainty or major economic developments.



Interpretation

The daily returns of gold from 2021 to 2024 are depicted in the provided chart, which also shows the volatility of the metal over time. The returns show regular but usually minor price swings as they oscillate around the zero level. Periodically occurring spikes and dips, however, point to abrupt rises or falls in the price of gold. Global economic conditions, inflation worries, geopolitical unpredictabilities, central bank policies, or shifts in investor sentiment toward safe-haven assets could all be responsible for these swings. The pattern demonstrates that although gold is more steady than more erratic assets like cryptocurrencies, it nevertheless goes through periods of elevated volatility, particularly during difficult economic times. Increases in 2022 and 2024 suggest that gold prices were impacted by significant financial events or possible market disruptions.

Investors can better grasp gold's risk profile and its function as a hedge against inflation and market volatility with the aid of this return analysis. Gold's enduring volatility emphasizes the necessity of doing a thorough risk assessment before utilizing it as an investment or portfolio diversifier.



Interpretation

In contrast to more conventional assets like gold or stock indexes, the chart, which displays the daily returns of Bitcoin from 2021 to 2024, exhibits a rather erratic pattern. With frequent and sharp spikes in both positive and negative directions, the returns exhibit considerable fluctuations around zero. This demonstrates that Bitcoin is a highly speculative asset that is subject to abrupt and significant price fluctuations. The significant positive and negative spikes that have been seen, especially in 2021 and 2022, are associated with times of market volatility that may be related to significant occurrences like institutional adoption, macroeconomic changes, regulatory crackdowns, or speculative trading cycles. A possible stabilizing of Bitcoin's market movements is suggested by the fluctuations' apparent minor decrease over time. Its reputation for unpredictability is further reinforced by the sporadic, severe swings that still occur.

Correlation

	ret nifty	*ret bitcoin*	*ret gold*
ret nifty	1		
ret bitcoin	0.105835	1	
ret gold	0.013135	0.050634	1

Interpretation of Correlation Results:

1. Nifty 50 & Bitcoin (0.106)

The Nifty 50 and Bitcoin returns appear to have little to no link, as seen by the weak positive correlation (0.106). Even though they occasionally go in the same direction, their relationship is not very important.

2. Nifty 50 & Gold (0.013)

The nearly insignificant correlation (0.013) suggests that the returns of the Nifty 50 and gold are mostly unrelated. In contrast to stocks, which react differently to market conditions, gold is typically seen as a safe-haven asset.

3. Bitcoin & Gold (0.051)

The very modest positive correlation (0.051) indicates that there is little to no association between the returns of gold and bitcoin. The idea that Bitcoin doesn't behave like a "digital gold" in terms of price fluctuations is supported by this.

Key Takeaways:

- These asset classes appear to move primarily independently based on the poor correlations, which may offer diversification advantages.
- There is a tiny positive link between Bitcoin and the Nifty 50, which could be the result of both being influenced by a larger risk sentiment.
- Gold's position as a hedge rather than a risk-driven asset is further supported by the fact that it is still mainly uncorrelated with both Bitcoin and the Nifty 50.

Cointegration Test

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.015307	19.40539	29.79707	0.4641
At most 1	0.004273	4.257935	15.49471	0.8816
At most 2	5.38E-05	0.052810	3.841465	0.8182

Trace test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.015307	15.14746	21.13162	0.2787
At most 1	0.004273	4.205125	14.26460	0.8371
At most 2	5.38E-05	0.052810	3.841465	0.8182

Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

BITCOIN	GOLD	NIFTY_50
1.43E-05	-0.002505	0.000821
4.41E-05	-0.001464	1.77E-05
-4.94E-05	-0.000964	0.000289

Interpretation of Cointegration Test Results:

Johansen Cointegration Test, which is used to ascertain whether a group of time series variables have a long-term equilibrium relationship, is the source of the results presented. The test consists of:

1. Rank Test for Unrestricted Cointegration (Trace)
2. Maximum Eigenvalue in the Unrestricted Cointegration Rank Test

1. **Interpretation of the Trace Test**
   A. According to the test's null hypothesis (H_0), there is no cointegration—that is, no long-term link between the variables.
   B. At the 5% significance level, the Trace Statistic is provided by the test findings and compared to the Critical Value.
   C. We reject the null hypothesis in favor of the alternative hypothesis (that there is at least one cointegrating equation) if the Trace Statistic is higher than the Critical Value.
   D. The Trace Statistics in this case are all below their corresponding critical levels (29.79707, 15.49471, and 3.841465) (19.40539, 4.257935, 0.052810).
   E. Since all of the p-values (0.4641, 0.8816, and 0.8182) are higher than 0.05, the null hypothesis cannot be ruled out.

In conclusion, the trace test indicates that Bitcoin, Gold, and the NIFTY 50 do not cointegrate.

2. **Interpretation of the Maximum Eigenvalue Test**

A. This test compares the alternative of r+1 with the null hypothesis that there are r cointegrating vectors.
B. The null hypothesis is rejected if the Max-Eigen Statistic exceeds the Critical Value.
C. In this case, the critical values (21.13162, 14.26460, 3.841465) are all greater than the Max-Eigen Statistics (15.14746, 4.205125, 0.052810).

Since none of the p-values (0.2787, 0.8371, and 0.8182) are less than 0.05, the null hypothesis cannot be ruled out.

Final Conclusion:

Given that there is no cointegration at the 5% significance level according to the Maximum Eigenvalue Test and the Trace Test, we deduce that:

- In the long run, there is no equilibrium link between Bitcoin, Gold, and the NIFTY 50.
- This implies that their prices do not fluctuate in tandem over time, indicating that they will probably remain independent in the long term.
- In terms of long-term price movements, these assets could not be highly connected for investment reasons, which could have an impact on diversification tactics.

Granger Causality Test Results

Null Hypothesis:	Obs	F-Statistic	Prob.
RET_GOLD does not Granger Cause RET_NIFTY	981	0.42453	0.6542
RET_NIFTY does not Granger Cause RET_GOLD		0.57109	0.5651
RET_BITCOIN does not Granger Cause RET_NIFTY	981	8.14090	0.0003
RET_NIFTY does not Granger Cause RET_BITCOIN		0.43409	0.6480
RET_BITCOIN does not Granger Cause RET_GOLD	981	0.09629	0.9082
RET_GOLD does not Granger Cause RET_BITCOIN		0.27736	0.7578

Interpretation

The Granger Causality test results for the correlations between Bitcoin (RET_BITCOIN), NIFTY 50 (RET_NIFTY), and Gold (RET_GOLD) are shown in this table. The test determines if one variable's historical values may be used to predict another.

1. **Gold & NIFTY 50**

❖ **Null Hypothesis 1:** RET_GOLD does not Granger Cause RET_NIFTY
- **F-Statistic:** 0.42453
- **p-value:** 0.6542 (greater than 0.05)
- **Conclusion:** Fail to reject the null hypothesis → Gold **does not Granger Cause** NIFTY 50.

❖ **Null Hypothesis 2:** RET_NIFTY does not Granger Cause RET_GOLD

- **F-Statistic:** 0.57109
- **p-value:** 0.5651 (greater than 0.05)
- **Conclusion:** Fail to reject the null hypothesis → NIFTY 50 **does not Granger Cause** Gold.

No causality between Gold and NIFTY 50. They do not predict each other.

2. **Bitcoin & NIFTY 50**

❖ **Null Hypothesis 1:** RET_BITCOIN does not Granger Cause RET_NIFTY
- **F-Statistic:** 8.14090
- **p-value: 0.0003 (less than 0.05)**
- **Conclusion:** Reject the null hypothesis → Bitcoin **Granger Causes** NIFTY 50.

❖ **Null Hypothesis 2:** RET_NIFTY does not Granger Cause RET_BITCOIN
- **F-Statistic:** 0.43409
- **p-value:** 0.6480 (greater than 0.05)
- **Conclusion:** Fail to reject the null hypothesis → NIFTY 50 **does not Granger Cause** Bitcoin.

Bitcoin returns can help predict NIFTY 50 returns, but NIFTY 50 does not predict Bitcoin returns.

3. **Bitcoin & Gold**

❖ **Null Hypothesis 1:** RET_BITCOIN does not Granger Cause RET_GOLD
- **F-Statistic:** 0.09629
- **p-value:** 0.9082 (greater than 0.05)
- **Conclusion:** Fail to reject the null hypothesis → Bitcoin **does not Granger Cause** Gold.

❖ **Null Hypothesis 2:** RET_GOLD does not Granger Cause RET_BITCOIN
- **F-Statistic:** 0.27736
- **p-value:** 0.7578 (greater than 0.05)
- **Conclusion:** Fail to reject the null hypothesis → Gold **does not Granger Cause** Bitcoin.

No causality between Bitcoin and Gold. They do not predict each other.

Final Summary

1. **Gold & NIFTY 50:** No predictive relationship.
2. **Bitcoin & NIFTY 50:** Bitcoin **Granger Causes** NIFTY 50, but not vice versa.
3. **Bitcoin & Gold:** No predictive relationship.

Investment Implications:

➢ The NIFTY 50 may be impacted by changes in the price of bitcoin, indicating some degree of market influence.
➢ Bitcoin and gold fluctuate separately, therefore they might not be accurate predictors or replacements for one another.

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