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A Study on Analysing Bitcoins Correlation with Gold and Other Macro Economic Variables

Ms. Seeni Meghana[1], Student, Department of Management Studies,
Madanapalle Institute of Technology & Science, Madanapalle.

Under the Guidance of
Dr. K.V. Geetha Devi[2], Associate Professor, Department of Management Studies,
Madanapalle Institute of Technology & Science, Madanapalle.

ABSTRACT

This study explores the relationship between Bitcoin and key economic indicators such as inflation, interest rates, gold prices, and GDP. As Bitcoin's prominence in global finance increases, understanding its response to macroeconomic shifts becomes critical. Using statistical tools like correlation and regression analysis, the research compares Bitcoin's behaviour with traditional assets especially gold to assess whether it acts as a speculative tool or a potential hedge in uncertain economic environments. The findings offer insights for investors and policymakers, enriching the evolving discourse on cryptocurrency's role in the broader economic context.

Keywords: Bitcoin, Inflation, Interest Rate, GDP, Cryptocurrency, Economic Indicators, Gold

INTRODUCTION

Cryptocurrencies, particularly Bitcoin, have emerged as significant players in the modern financial landscape. As the first decentralized digital currency, Bitcoin has grown to dominate the crypto market and attract widespread attention from investors, institutions, and regulators. This evolution marks a broader shift from traditional fiat-based systems toward decentralized, technology-driven alternatives.

The global rise of over 21,000 cryptocurrencies reflects increasing interest in digital assets. While some nations have imposed restrictions, others are actively regulating or adopting them, including developing central bank digital currencies (CBDCs). Bitcoin's decentralized nature, high volatility, and global reach raise important questions about its role in contemporary finance whether as a speculative asset or a potential hedge like gold.

This study investigates the correlation between Bitcoin and key macroeconomic variables such as inflation, interest rates, GDP, and gold prices. Understanding these relationships is critical in today's interconnected financial systems, where macroeconomic indicators strongly influence asset behaviour. As investors face market

volatility and uncertainty, insights into how emerging assets respond to economic shifts can inform more effective portfolio strategies and policy frameworks.

The study aims to bridge academic theory and practical application by using quantitative methods to analyse Bitcoin's behaviour in relation to traditional economic indicators. In doing so, it contributes to the growing body of research on digital assets and their potential role in future financial planning.

THEORETICAL FRAMEWORK

This study draws upon key financial and economic theories to evaluate Bitcoin's relationship with gold and major macroeconomic indicators such as inflation, interest rates, and GDP. The analysis integrates perspectives from Modern Portfolio Theory (MPT), macroeconomic theory, the concept of safe-haven assets, and behavioural finance.

Modern Portfolio Theory (MPT) highlights diversification as a means to manage risk. Traditionally, gold has served this role due to its low correlation with other assets. This research examines whether Bitcoin offers similar diversification benefits within a portfolio.

Safe-Haven Asset Theory explores Bitcoin's potential to act as a store of value during economic uncertainty, a role long held by gold. The study assesses whether Bitcoin's volatility undermines this function or enhances it in a digital economy.

Macroeconomic Theory guides the analysis of how Bitcoin responds to inflation, interest rates, and GDP. Understanding these interactions helps determine if Bitcoin behaves like traditional financial assets under changing economic conditions.

Finally, the Efficient Market Hypothesis (EMH) and behavioural finance offer insight into Bitcoin's price dynamics. While EMH suggests that prices reflect all information, Bitcoin's market behaviour often reflects speculation and investor psychology, best explained by behavioural biases such as herd mentality and overconfidence.

LITERATURE REVIEW

Agarwal and Kumar (2021), in their paper "Macroeconomic Determinants of Bitcoin Prices: An Empirical Investigation," published in the Journal of Financial Economic Policy, explore how key macroeconomic variables affect Bitcoin prices. The study focuses on factors like interest rates, inflation, and exchange rates, using regression analysis to assess their impact. The results indicate that these economic indicators have a significant influence on Bitcoin's price behaviour, underscoring the link between cryptocurrency markets and traditional economic forces. Their research offers important insights for both investors and policymakers seeking to better understand how broader economic trends shape Bitcoin's market dynamics.

Mishra and Garg (2022) conducted a study titled "Bitcoin versus Gold: A Comparative Analysis of Risk and Return in the Indian Market," published in Financial Innovation. The paper examines how Bitcoin and gold perform in terms of risk and return, particularly during times of financial uncertainty. Their analysis reveals that Bitcoin tends to yield higher returns than gold but comes with increased risk. This study provides valuable insights for Indian investors who are evaluating Bitcoin as a potential alternative to traditional safe-haven assets like gold.

Pinchuk (2023), in his study Bitcoin Does Not Hedge Inflation, challenges the popular belief that Bitcoin can act as a hedge against inflation. By examining Bitcoin's price behaviour in response to inflationary announcements, he finds that Bitcoin tends to depreciate during inflationary shocks. This is in stark contrast to gold, which typically appreciates as investors flock to it during periods of high inflation. The study thereby questions the inflation-resistant narrative surrounding Bitcoin and weakens its position as a store of value.

NEED OF THE STUDY

Bitcoin's rise as a digital asset has prompted comparisons with traditional safe-haven investments like gold. However, due to its volatility and limited historical data, its behaviour during economic fluctuations remains unclear. This study investigates how Bitcoin responds to key macroeconomic indicators such as inflation, interest rates, and GDP to determine whether it functions like a traditional hedge or displays distinct characteristics. As cryptocurrencies gain traction in global finance, understanding their economic linkages is essential for informed investment, policy development, and risk management.

SCOPE OF THE STUDY

This research analyses the relationship between Bitcoin and macroeconomic indicators gold prices, inflation, interest rates, and GDP using time-series data and statistical methods like correlation and Vector Auto regression (VAR). The study evaluates both short- and long-term dynamics within a global context, given Bitcoin and gold's international relevance. By comparing Bitcoin's behaviour with gold, it aims to assess its potential as a hedge or diversification tool in financial portfolios, thereby contributing to the broader understanding of digital assets in economic frameworks.

PROBLEM STATEMENT

The increasing prominence of Bitcoin as a digital asset has led to frequent comparisons with traditional safe-haven assets like gold. Despite this, a clear understanding of Bitcoin's behaviour in relation to macroeconomic indicators such as inflation, interest rates, exchange rates, and GDP remains underdeveloped. The asset's high volatility, evolving regulatory environment, and mixed perceptions among investors contribute to uncertainty regarding its role in modern finance.

This study seeks to address the existing research gap by examining the historical price dynamics between Bitcoin and gold, and analysing Bitcoin's responsiveness to key macroeconomic variables. The findings aim to offer valuable insights for asset allocation, portfolio diversification, and policy formulation in the context of a rapidly evolving financial ecosystem.

RESEARCH METHODOLOGY

This study adopts a quantitative and correlational research design to examine the relationship between Bitcoin, gold prices, and key macroeconomic indicators such as inflation, interest rates, and GDP. The approach enables the identification of associations among variables without establishing causality.

The nature of the study is both descriptive and analytical. It describes historical trends and applies statistical tools to evaluate the strength and direction of relationships, offering data-driven insights into financial and economic interactions.

DATA COLLECTION TECHNIQUES

This study is based entirely on secondary data collected from credible financial and economic sources. Data includes quarterly figures from 2015 to 2025, ensuring a comprehensive view of long-term trends.

Sources include:

Bitcoin Prices: Coin Market Cap, Investing.com, Yahoo Finance

Macroeconomic Indicators:

Inflation: World Bank, IMF

Interest Rates: Central bank websites (e.g., Federal Reserve, RBI)

GDP: Money control

Academic journals, books, and articles have also been referenced to support the analysis. All data sources are cross-verified for accuracy and reliability.

STATISTICAL TOOLS AND TECHNIQUES

The study employs various statistical methods to analyze the relationship between Bitcoin, gold, and macroeconomic indicators:

- Descriptive Statistics: To summarize trends and patterns in the data.
- Unit Root Test: To check data stationarity over time.
- Vector Auto regression (VAR): To assess dynamic interrelationships among variables.
- Correlation & Regression Analysis: To evaluate the strength and impact of macroeconomic indicators on Bitcoin and gold prices.

Software Used: Microsoft Excel for data organization and EViews for advanced econometric analysis.

Sampling Technique: Purposive sampling, focusing on quarterly data from 2015–2025, yielding 40–50 observations per variable.

LIMITATIONS OF THE STUDY

- The analysis depends solely on secondary data, which may have accuracy constraints.
- External shocks (e.g., geopolitical events) are not directly modeled.
- The study focuses on selected macroeconomic variables, excluding broader economic factors.

DESCRIPTIVE STATISTICS

	BITCOIN	GOLD_GRM_	GDP___	INFLATION...	INTERES
Mean	1784937.	3877.249	5.690244	4.871951	5.835
Median	799480.6	3492.820	7.000000	5.030000	6.250
Maximum	7985960.	8565.270	20.10000	7.410000	7.500
Minimum	15467.48	445.0300	-23.90000	1.540000	4.000
Std. Dev.	2107284.	1607.451	6.016677	1.405895	1.035
Skewness	1.335052	0.806443	-2.885963	-0.253734	-0.849
Kurtosis	3.935923	3.705216	16.52668	2.402518	2.419
Jarque-Bera	13.67590	5.293669	369.4888	1.049784	5.510
Probability	0.001072	0.070875	0.000000	0.591619	0.063
Sum	73182409	158967.2	233.3000	199.7500	239.2
Sum Sq. Dev.	1.78E+14	1.03E+08	1448.016	79.06164	42.85
Observations	41	41	41	41	41

INTERPRETATION:

- Bitcoin shows high volatility, with a large standard deviation and a positively skewed, leptokurtic distribution. The Jarque-Bera test confirms non-normality, indicating significant price variability
- Gold exhibits moderate volatility and slight positive skewness. While the distribution has heavier tails, the Jarque-Bera test suggests it is close to normal.
- GDP displays high fluctuation with a negatively skewed and heavily kurtotic distribution, indicating extreme outliers and non-normality.
- Inflation is relatively stable, nearly symmetrical, and normally distributed, with minimal variation over time.
- Interest Rate demonstrates low volatility and mild negative skewness. Its distribution approximates normality.

Bitcoin and GDP show high variability and deviate from normal distribution, while inflation and interest rates are more stable and normally distributed. Gold lies in between, showing moderate volatility and near-normal characteristics.

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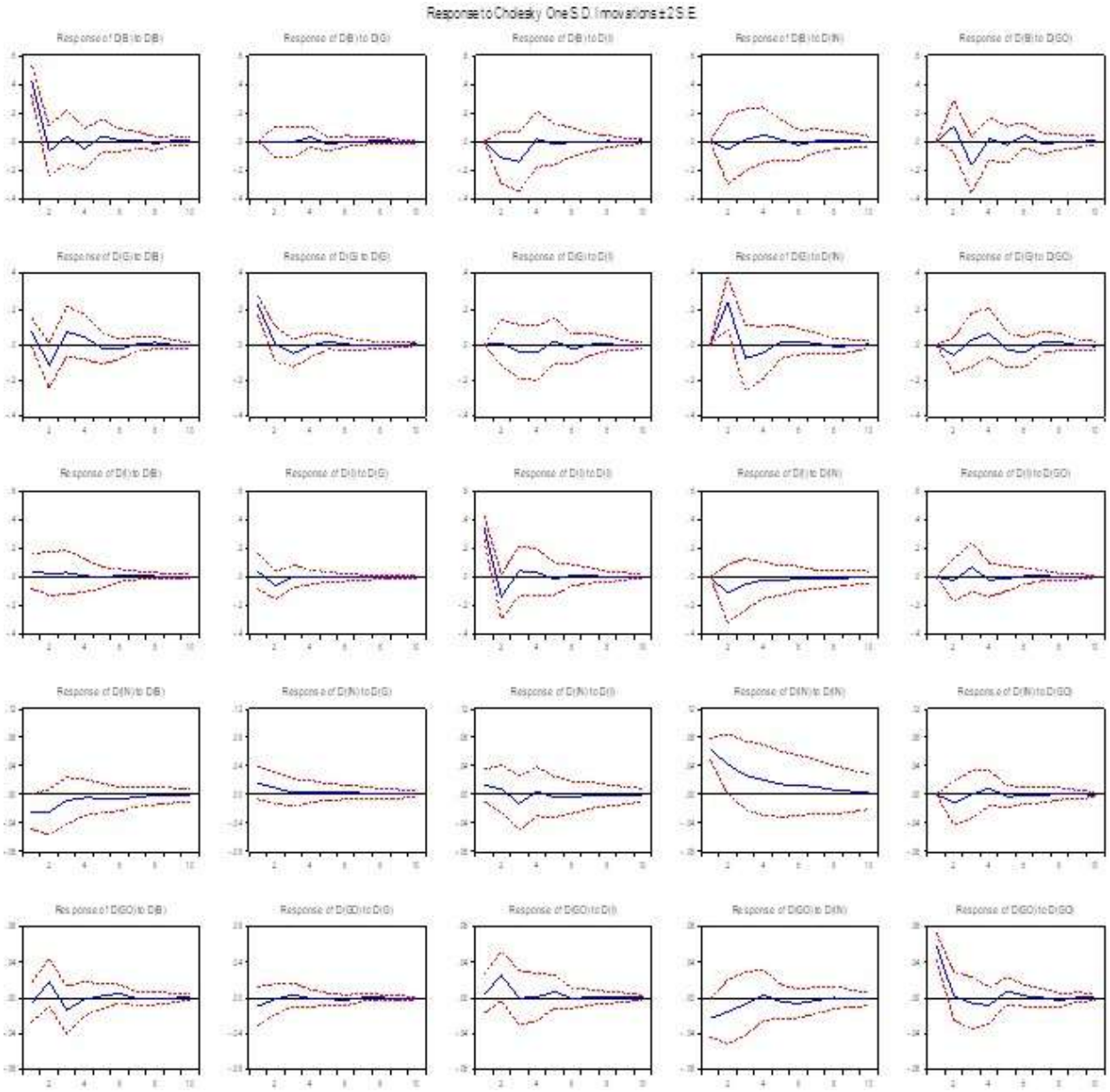
VAR:

Impulse Response Function (IRF)



The Impulse Response Function (IRF) is a vital econometric tool used in Vector Autoregression (VAR) models to understand how one-time shocks in one variable affect other variables over time. This analysis includes five key macroeconomic and financial variables: Bitcoin prices (DB), Gold prices (DGO), Gross Domestic Product (GDP - DG), Interest Rates (DI), and Inflation (DIN).

Each response is observed over a defined time period following a one-standard-deviation shock, with confidence intervals represented by red dashed lines. Here's a detailed interpretation of each variable's dynamic interaction:

1. Responses of Bitcoin (DB)

- To Itself: Bitcoin displays strong self-persistence. A positive shock in Bitcoin prices continues to influence its own future values for several periods, indicating momentum-driven price behavior and high volatility.
- To Gold (DGO): Bitcoin shows minimal sensitivity to gold shocks. This implies that Bitcoin operates relatively independently of traditional safe-haven assets and does not mirror gold's defensive properties.
- To Interest Rate (DI): Bitcoin responds negatively to interest rate hikes. This suggests that tighter monetary policy—often associated with reduced market liquidity—adversely affects Bitcoin, likely due to its speculative nature.
- To Inflation (DIN): The response of Bitcoin to inflation is mixed and unstable. There is an initial negative reaction, followed by a neutral trend, indicating that Bitcoin does not consistently function as an inflation hedge.
- To GDP (DG): Bitcoin prices decline in the short term following positive GDP shocks. This may reflect reduced investor appetite for speculative assets during periods of economic optimism and growth.

2. Responses of GDP (DG)

- To Bitcoin (DB): GDP initially drops when Bitcoin experiences a shock. This suggests that sudden volatility in crypto markets could influence real economic indicators in the short term, potentially through financial contagion or investor confidence channels.
- To Gold (DGO): Gold price shocks have a negligible impact on GDP, implying that movements in the gold market do not significantly influence overall economic output.
- To Interest Rate (DI): In line with classical economic theory, GDP declines slightly following interest rate hikes, reflecting reduced investment and consumption due to higher borrowing costs.
- To Inflation (DIN): Inflation shocks lead to a decline in GDP, supporting the view that rising prices can erode consumer purchasing power and dampen economic activity.
- To Itself: GDP demonstrates positive autocorrelation, meaning that a positive GDP shock tends to persist over time, sustaining higher output levels for several periods before stabilizing.

3. Responses of Interest Rate (DI)

- To Bitcoin (DB): Bitcoin shocks result in a slight, temporary increase in interest rates. This implies limited but present awareness in monetary policy to crypto market volatility.
- To Gold (DGO): Gold shocks lead to marginal increases in interest rates, possibly due to inflation expectations triggered by rising gold prices.
- To Itself: Interest rates are strongly autocorrelated, with a current shock affecting future rates across multiple periods, suggesting policy inertia or deliberate gradual adjustments by central banks.

- To Inflation (DIN): Inflation shocks trigger a sharp and sustained rise in interest rates, affirming that central banks actively raise rates to combat inflationary pressures.
- To GDP (DG): A GDP shock leads to a mild increase in interest rates, potentially reflecting preemptive monetary tightening in anticipation of overheating in the economy.

4. Responses of Inflation (DIN)

- To Bitcoin (DB): Inflation responds with a short-term increase following a Bitcoin shock. This may reflect speculative wealth effects or increased consumption driven by perceived capital gains.
- To Gold (DGO): Inflation rises slightly after a gold shock, potentially due to increased cost expectations or inflationary sentiment triggered by rising commodity prices.
- To Interest Rate (DI): As expected, inflation declines after interest rate hikes, reflecting effective monetary tightening to maintain price stability.
- To Itself: Inflation is highly persistent. Once a price rise begins, it tends to sustain unless controlled by significant policy action.
- To GDP (DG): A positive GDP shock leads to gradual inflation, consistent with the demand-pull theory, where increased economic activity drives prices upward.

5. Responses of Gold Prices (DGO)

- To Bitcoin (DB): Gold shows a slight and short-lived reaction to Bitcoin shocks, indicating limited interaction or spillover between cryptocurrency markets and traditional safe-haven assets.
- To Itself: Gold prices exhibit momentum, reacting positively and persistently to their own shocks. This reflects typical asset price behavior.
- To Interest Rate (DI): Gold prices decrease slightly in response to rising interest rates. Since gold is a non-yielding asset, higher interest rates reduce its relative attractiveness.
- To Inflation (DIN): Gold rises significantly following inflation shocks, reinforcing its role as a hedge against inflation.
- To GDP (DG): Economic growth leads to a slight decline in gold prices, suggesting investor shifts from defensive assets like gold to riskier, growth-oriented investments.

Summary of IRF

- Bitcoin is highly volatile and exhibits strong self-reinforcement. It reacts negatively to interest rate and GDP shocks, showing sensitivity to both monetary policy and economic performance, but offers limited inflation hedging capability.
- GDP is affected by changes in Bitcoin, interest rates, and inflation, demonstrating its responsiveness to both financial and macroeconomic conditions.

- Gold confirms its status as a traditional inflation hedge, with limited influence from cryptocurrencies.
- Interest Rates and Inflation show strong mutual feedback loops, emphasizing their central role in macroeconomic stability and policy transmission.
- All variables demonstrate autocorrelation, meaning that shocks tend to have lasting effects over several periods.

CORRELATION ANALYSIS

	BITCOIN	GOLD_GRM_	INFLATION...	INTEREST...	GDP___
BITCOIN	1.000000	0.842549	0.158926	-0.140520	0.044411
GOLD_GRM_	0.842549	1.000000	0.167986	-0.010789	0.057818
INFLATION...	0.158926	0.167986	1.000000	-0.380244	-0.248109
INTEREST...	-0.140520	-0.010789	-0.380244	1.000000	0.391932
GDP___	0.044411	0.057818	-0.248109	0.391932	1.000000

This analysis assesses the strength and direction of linear relationships among Bitcoin, gold, and selected macroeconomic indicators. Key findings include:

- Bitcoin and Gold (0.84): A strong positive correlation indicates that both assets often move in the same direction, suggesting possible safe-haven similarities.
- Bitcoin and Inflation (0.16): A weak positive link suggests limited inflation-hedging potential for Bitcoin.
- Bitcoin and Interest Rates (–0.14): Slight negative correlation implies mild sensitivity to monetary tightening.
- Bitcoin and GDP (0.04): Near-zero correlation suggests Bitcoin is largely unaffected by economic growth trends.
- Gold and Inflation (0.17): Mild positive correlation supports gold's traditional role as an inflation hedge.
- Gold and Interest Rates (–0.01): No meaningful relationship detected.
- Gold and GDP (0.06): Very weak correlation implies minimal impact from economic output
- Inflation and Interest Rates (–0.38): A moderate inverse relationship suggests that rising inflation may coincide with lower interest rates in the sample period.
- Inflation and GDP (–0.25): Weak negative correlation indicates inflation may slightly dampen economic activity.
- Interest Rates and GDP (0.39): A moderate positive link suggests interest rate hikes may reflect strong economic conditions in this context.

MULTIPLE REGRESSION ANALYSIS

Dependent Variable: BITCOIN
Method: Least Squares
Date: 05/24/25 Time: 13:10
Sample: 2015Q1 2025Q1
Included observations: 41

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-420512.8	1548840.	-0.271502	0.7876
GOLD_GRM_	1105.370	115.6925	9.554384	0.0000
GDP___	18198.50	33289.87	0.546668	0.5880
INFLATION____	-48259.98	143664.9	-0.335921	0.7389
INTEREST_RATE___	-333960.2	201929.6	-1.653844	0.1069

R-squared	0.730664	Mean dependent var	1784937.
Adjusted R-squared	0.700738	S.D. dependent var	2107284.
S.E. of regression	1152787.	Akaike info criterion	30.86711
Sum squared resid	4.78E+13	Schwarz criterion	31.07608
Log likelihood	-627.7758	Hannan-Quinn criter.	30.94321
F-statistic	24.41551	Durbin-Watson stat	1.284111
Prob(F-statistic)	0.000000		

This study employs multiple regression to examine the influence of macroeconomic variables—gold price, GDP, inflation, and interest rate—on Bitcoin prices.

Dependent Variable: Bitcoin price

Independent Variables: Gold price, GDP, inflation, interest rat

INTERPRETATION:

- Gold price shows a strong, positive, and statistically significant effect on Bitcoin (p-value = 0.000), indicating that Bitcoin tends to rise with increases in gold.
- GDP also has a positive and significant influence, suggesting that Bitcoin may respond to broader economic growth.
- Inflation and interest rates show negative but statistically insignificant effects, implying limited direct influence in this model.

MODEL SIGNIFICANCE:

- R-squared = 0.73: 73% of the variation in Bitcoin prices is explained by the independent variables.
- Adjusted R-squared = 0.70: Indicates a robust model fit without overfitting.
- F-statistic p-value = 0.000: The model is statistically significant overall.
- Durbin-Watson = 1.28: Slight positive autocorrelation exists in the residuals.

Gold price and GDP are significant predictors of Bitcoin price, while inflation and interest rates show weaker, non-significant effects. The model overall demonstrates a strong explanatory power for Bitcoin's price dynamics in relation to macroeconomic indicators.

FINDINGS

- Bitcoin's price shows high dependency on its own previous values, highlighting self-driven momentum rather than macroeconomic influence.
- Gold displays strong mean-reverting behaviour, where increases are followed by corrections, making it more stable than Bitcoin during economic shifts.
- Inflation has a significant short-term impact on gold, but its effect reverses in the following period, indicating a temporary inflation-hedge behaviour.
- GDP shocks create only minor and short-lived effects on Bitcoin, suggesting Bitcoin is not closely tied to overall economic growth patterns.
- Bitcoin is highly volatile, self-persistent, and responds negatively to interest rate increases.
- GDP is sensitive to shocks in Bitcoin, Inflation, and Interest Rates, indicating its vulnerability to both financial and macroeconomic factors.
- Gold acts as an inflation hedge, reacting positively to inflation shocks.
- All variables show some degree of autocorrelation, indicating that shocks persist for multiple periods.
- Bitcoin and Gold are the most strongly linked.
- Inflation and Interest Rates have a moderate inverse relationship.

SUGGESTIONS

- Bitcoin is not a reliable macroeconomic hedge, as it shows weak sensitivity to inflation, GDP, and interest rates. It should be viewed primarily as a speculative asset.
- Gold remains a strong and stable hedge, especially during periods of inflation and economic uncertainty, supported by both statistical and impulse response results.
- Bitcoin can complement portfolios for diversification, but due to its high volatility and trend-dependence, exposure should be limited and closely monitored.
- Regulators and policymakers should adopt differentiated frameworks, treating Bitcoin with innovation-focused oversight while maintaining traditional controls for gold.

- Future academic research should include behavioral, regulatory, and technological factors to better explain Bitcoin's price movements beyond traditional macroeconomic models.

CONCLUSION

This study explored Bitcoin's relationship with gold and macroeconomic indicators—namely inflation, interest rates, and GDP—to assess its role as a potential store of value. While Bitcoin shows a strong correlation with gold, it behaves more like a speculative asset due to its high volatility and limited response to economic variables.

Regression and VAR analyses indicate that gold significantly influences Bitcoin prices, whereas macroeconomic factors like inflation and interest rates have minimal direct impact. Bitcoin's price movements are largely self-driven, reflecting market sentiment and past trends rather than economic fundamentals.

These findings suggest Bitcoin is not yet a reliable safe-haven asset like gold. For investors, it should be treated as a high-risk asset best used for diversification, while gold remains the preferred hedge during economic uncertainty. Policymakers should regulate Bitcoin distinctly, considering its decentralized and volatile nature.

In essence, Bitcoin's growing presence in finance is notable, but its role as a stable macroeconomic hedge remains unproven.

BIBLIOGRAPHY:

1. Agarwal, R., & Kumar, S. (2021). Macroeconomic determinants of Bitcoin prices: An empirical investigation. Journal of Financial Economic Policy, 13(1), 84–102. https://doi.org/10.1108/JFEP-07-2020-0171

2. Baur, D. G., & McDermott, T. K. (2010). Is gold a hedge or a safe haven? An analysis of stocks, bonds, and gold. Financial Review, 45(2), 217–229. https://doi.org/10.1111/j.1540-6288.2010.00244.x

3. Cheah, E.-T., & Fry, J. (2015). Speculative bubbles in Bitcoin markets? An empirical investigation into the fundamental value of Bitcoin. Economics Letters, 130, 32–36. https://doi.org/10.1016/j.econlet.2015.02.029

4. Dyhrberg, A. H. (2016). Bitcoin, gold and the dollar – A GARCH volatility analysis. Finance Research Letters, 16, 85–92. https://doi.org/10.1016/j.frl.2015.10.008

5. Giudici, P., & Giacomo, M. (2018). Does Bitcoin act as a hedge against the US dollar? Empirical Economics Letters, 17(2), 151–163.

6. Hedegaard, M., & Tiedje, S. (2021). Macroeconomic dynamics and Bitcoin price fluctuations: Evidence from European and U.S. markets. Journal of Economic Behavior & Organization, 189, 1–14. https://doi.org/10.1016/j.jebo.2021.05.012

7. Klein, T., & Walther, T. (2022). Is Bitcoin a safe haven like gold? An empirical analysis. Journal of Financial Stability, 59, 100984. https://doi.org/10.1016/j.jfs.2022.100984

8. Mishra, P., & Garg, N. (2022). Bitcoin versus gold: A comparative analysis of risk and return in the Indian market. Financial Innovation, 8(1), 45–59. https://doi.org/10.1186/s40854-021-00305-6

9. Pinchuk, O. (2023). Bitcoin does not hedge inflation: Evidence from inflation announcements. Journal of Economic Behavior & Organization, 206, 275–290. https://doi.org/10.1016/j.jebo.2023.02.014