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Investor's Perspectives on Gold and Silver Investment in India

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Abstract

Gold and silver are considered precious metals not only because of their beautiful presentation but also because they would serve a role as investments. Thus, understanding how well they form part of investment portfolios and their capacity for hedging is critical. This study seeks to evaluate the investment prospects of gold and silver with respect to their functionality as hedging instruments against inflation and market volatility in the Indian market. We analysed the time-varying correlation between the Nifty index, inflation, gold, and silver using the GARCH-DCC framework, considering market volatility during the 2008 financial crisis and the COVID-19 pandemic. This study addresses the gap in the existing literature by analysing the role of gold and silver as hedging instruments in the Indian financial market over a comprehensive period from 2003 to 2023. Findings reveal that there is indeed a statistically significant positive correlation between silver and inflation, making silver an excellent hedge against inflation- albeit likely better than gold. During the financial crisis, gold's correlation was a significant negative to the Nifty index- in other words, gold served as a strong hedge against declines in the stock market. The research focuses on the importance of gold as an asset in the financial market downturn, which was evidenced by its performance during the crisis of 2008. These findings will have practical implications in terms of hedging strategies and portfolio management within the ambit of the Indian financial market.

Keywords: COVID, Financial Crisis, Gold, Hedge, Inflation, Silver

1. Introduction

Gold, one of the earliest precious metals to be discovered by mankind, has long been used as a store of value, a fashionable ornament, and a form of money. It served as a means of trade and a repository for riches back then. It still serves as a significant store of value, particularly in difficult times. Gold's tangibility distinguishes it from paper asset classes like stocks and bonds (Sumner *et al.*, 2010). Investors seek out gold for a variety of reasons, such as diversification, inflation safeguards, store of value, as a hedge against any currency, political, or economic crises, they purchase gold (Wang *et al.*, 2011). Gold could provide diversification advantages due to the likelihood of its price changes being distinct from those of ordinary stocks (Jaffe, 1989). When kept in a portfolio, precious metals offer substantial diversification advantages in volatile markets (Hillier *et al.*, 2006). Silver is a priceless metal, it has served a variety of functions, including jewellery, coinage, and industrial applications. Silver is a different precious metal that has drawn interest from investors as a potential investment.

It is important to consider the Indian economy's rapid growth when evaluating gold and silver's potential to protect against inflation and volatile stock markets. India's economy has grown enormously, and this trend is seen in the country's demand for gold. The World Gold Council found a close correlation between India's demand for gold and income growth;

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a one percent rise in income frequently results in a one percent rise in demand for gold (World Gold Council, 2021). Gold is considered by investors as a safe-haven asset that is in great demand during volatile markets or uncertain economic times. Investors use gold as a commodity to diversify their assets and hedge against inflationary pressures. Even while silver might not have the same qualities as gold, it is nevertheless valued as a precious metal and can offer similar protection against downward economic trends. This article uses data on gold futures from the Multi Commodity Exchange India (MCX) to examine these trends and dynamics. Through gold futures contracts, investors can make predictions about the price of gold in the future, giving them insight into the expectations and sentiment of the market.

Research exclusively focused on the behaviour of investments in gold and silver as part of the Indian financial sector is elusive. Given the uniqueness of India's economy and its status as an emerging market, it would be imperative to analyse the roles gold and silver might play in that regard as safe haven assets and inflation hedge. Although several studies have attempted to understand the impact of economic crises on gold and silver, a lot more needs to be addressed concerning the real behaviour of these assets in the Indian context during the COVID-19 and 2008 Financial Crisis events. This study addresses the gap in the existing literature by analysing the role of gold and silver as hedging instruments in the Indian financial market over a comprehensive period from 2003 to 2023.

2. Literature Review

The dynamics and underlying causes that determine the correlation between inflation and gold prices have been the subject of significant studies. The ability of gold prices to hold their value in the face of inflation becomes crucial from the standpoint of an investor. Investors have traditionally considered gold and gold equities to be effective inflation hedges (Chua *et al.*, 1990). The method through which inflation affects gold prices is described by Fortune. Fortune (1987) claims that future inflation and interest rates determine how much the price of gold will rise. The actual value of liquid assets will decline when expected future price increases happen. As a result, people will be motivated to transfer their liquid assets into gold. As a result, the value of gold in that currency increases, protecting its users from the effects of inflation. While there is no long-term equilibrium between gold prices and inflation in China, India, and France, gold serves as a short-term inflation hedge in the US, UK, and India (Hoang *et al.*, 2016). The studies by Artigas (2010) and Ghosh *et al.* (2004) support gold's ability to hedge against inflation. Gold is a good hedge tool for ASEAN countries, and it helps maintain purchasing power during inflation periods. Besides, the effectiveness varies with economic conditions (Arshad *et al.*, 2023). Bình (2024) remarks that gold has superior potential for inflation hedging, especially during periods of high inflation, giving long-term stability against currency depreciation. In this context, Valadkhani *et al.* (2022) observed that gold represents the best hedge against inflation during an economic downturn and when fiat currencies lose most of their value.

However, gold's performances have varied in relation to different markets. Ghannadian *et al.* (2023) observed that gold generally has been only weakly or inconsistently positively correlated with price inflation. They further claim that recent geopolitical events such as the Russia-Ukraine conflict have disrupted the otherwise role of gold as a safe haven into negative abnormal returns. Ergül & Karakaş (2024) have similarly found that inflation is not effective in having an overall statistically significant impact on gold prices, except for under certain given periods. The contexts also determine the hedging roles of gold. Do *et al.* (2023) observe a non-linear relationship between gold prices and inflation in Vietnam and add that gold plays a role as a short-term hedge based on a number of local and international market factors. This is similarly supported by Wolski (2022), who finds no significant relationship between gold prices and inflation levels in different market conditions in Poland. Finally, there are regional patterns making assessments of the hedging effectiveness of gold more complicated. Prominent examples include Turkey and Malaysia, which use gold as a hedge against inflation, whereas Indonesia

uses it for hedge purposes vis a vis exchange rate risk (Lubis & Chalid, 2022). Smales (2023) reinforces the view of gold as a proven, reliable hedge against inflation in contrast to cryptocurrencies that seem to perform similarly under limited confines. While some studies affirm gold's status as an inflation hedge, others challenge this perspective, suggesting that its effectiveness varies across time horizons, regions, and economic conditions.

Silver has long been studied as an inflation hedge, but the studies offer various contradictory findings. McCown and Zimmerman (2007) observed that silver is tied strongly to future inflation expectations, particularly during the 1970s. Again, it was found to have a perfect hedge against inflation as demonstrated by Adrangi *et al.* (2003), which agree with the Fisher hypothesis. Different from these studies, others indicate deficits in the strength of silver as an inflation hedge. Taylor (1998) indicated that it had been a partial hedge before the war but has currently failed those post-war analyses because of non-stationary residuals. Bilgin *et al.* (2018) showed that there was evidence for the effectiveness of silver as a hedge in particular countries, such as Canada and South Africa, but were negated post-1998, after which palladium became a better alternative for hedging. Bampinas and Panagiotidis (2015) made an extensive historical view of the fact that silver did not always work as an inflation hedge for the past two centuries and that varying market conditions and economic conditions affected it. However, Dempster and Artigas (2010) concluded that silver yielded no better returns than gold in light of their definition of the asset as an inflating hedge. For a lead in risk-adjusted returns and an opportunity to diversify a portfolio in it, one turns to gold. This argument also sounds by Ghosh *et al.* (2004), who highlighted that gold is superior to silver as an inflation hedge. Silver shows indeed all the signs of being an inflation hedge but does not perform well under all market environments, states a healthy economy, and passage of time.

Mixed results have been seen in the hedging effectiveness of silver and gold during economic crises in various markets and environments. Gold has shown consistent hedging properties, whereas silver is said to depend upon the situation. Chiang (2022) found that silver showed a great negative correlation with stock returns but weak hedging capacity during the COVID-19 pandemic in the Chinese market. According to Kyriazis *et al.* (2023), both gold and silver were effective hedges in the early storms of crises, with blue-chip stocks coming ahead during their mature phases. Burdekin *et al.* (2020) showed that gold during the 2008-2009 financial crisis and the 2020 pandemic provided huge hedging, while its benefits were proved less during the pandemic because the market quickly bounced back from the shock. Ghazali *et al.* (2020) examined the hedging function of gold in five countries, showing its loss protection against stock markets, leaving silver out of it. Talbi *et al.* (2018) analyses explored the hedging features of precious metals for the G-7 countries. Findings show that gold is at all times observed as a strong hedge, while it is noted that silver is a better diversifier. Similarly, Uyar *et al.* (2021) also noted that gold showed superior hedging properties than silver at very extreme market conditions like the Global Financial Crisis and COVID-19. Dias and Carvalho (2020) claimed that gold and silver did not act as safe havens in any stock markets of Latin America because integration among markets was high. Mensi *et al.* (2013) looked into the dynamic correlation between stock indexes and commodity future returns. They found that because gold and silver have a negative correlation with Saudi Arabian stock returns, they can be used to manage risk. Bhatia *et al.* (2020) studied the dynamic relationship between the stock markets and precious metals in developed and emerging nations. They noticed that the precious metals return series and the stock market changed over time. They also found that compared to other precious metals, silver provides stronger long- and short-term hedging potential. Alqaralleh and Canepa (2022) examined how the initial COVID-19 epidemic affected the stock market and the price of precious metals. They found that precious metals offer potential benefits for market diversification. With regard to short-, medium, and long-term investment perspectives, all metals, including silver, serve as safe-haven assets.

3. Data and Methodology

Our data set includes monthly time series for futures gold prices, futures silver, Nifty index and the

Wholesale price index. Instead of using the Consumer Price Index to calculate inflation, we used the Wholesale Price Index. The Consumer Price Index (CPI) is computed differently in India for several groups, including the Consumer Price Index for Industrial Workers (CPI-IW), Consumer Price Index for Agricultural Labourers (CPI-AL), and Consumer Price Index for Rural Labourers (CPI-RL). The more complete measure, known as the CPI Combined accounts for the prices of the goods and services that households in both urban and rural regions use. The CPI Combined Index was introduced in India in January 2011. Prior to this, the CPIs for urban and rural regions were calculated separately. As our study period covers 2003 to 2023, we used the wholesale price index to calculate inflation. The monthly frequency is used because only monthly data is available for the Wholesale Price Index (WPI). Gold futures prices and silver futures prices are collected from the website of the Multi Commodity Exchange (MCX). Nifty data was collected from the website of the National Stock Exchange (NSE). WPI is collected from the website of the Office of Economic Advisor. Our research spans the years December 2003 through March 2023. As a result, it covers both the 2008 financial crisis and the recent COVID-19 pandemic period. Thus, we can evaluate gold's performance during these periods.

To calculate the return series, we used the following formula.

$$r_t = \ln \frac{X_t}{X_{t-1}} \quad (1)$$

where, Xt is the closing price of future gold, futures silver price, and stock market index.

4. Unit Root Test

The stationarity of the series is very important in the time series analysis, otherwise, it will produce spurious results. Data is said to be stationary when the value of a time series data reverts to its long-run average value and the qualities of the data are not influenced by changes in time alone.

We used the most popular methods of unit root test, Augmented Dickey Fuller test (1979) and Phillips Perron test (1988).

5. Augmented Dickey-Fuller (ADF) Test

In the ADF test, the alternative hypothesis of stationarity is compared with the null hypothesis that a unit root exists in a time series. The regression equation using the ADF test:

$$\Delta y_t = \theta + \lambda t + \phi y_{t-1} + \psi_1 \Delta y_{t-1} + \psi_2 \Delta y_{t-2} + \cdots + \psi_q \Delta y_{t-q} + \varepsilon_t \quad (2)$$

In the given Equation (2), Δy_t represents the first-differenced time series at time t. The term θ denotes the intercept, while λt accounts for any linear trend in the data, ϕy_{t-1} represents the influence of the lagged level of the dependent variable. Additionally, $\psi_i \Delta y_{t-i}$ correspond to the coefficients of the lagged differenced series, and represents the error term.

6. Phillips-Perron (PP) Test

The PP test is similar to the ADF test but accounts for both serial correlation and heteroskedasticity. The PP test regression equation is:

$$\Delta u_t = \theta + \lambda t + \phi u_{t-1} + \psi_1 \Delta u_{t-1} + \psi_2 \Delta u_{t-2} + \cdots + \psi_q \Delta u_{t-q} + \varepsilon_t \quad (3)$$

In the given equation, Δu_t represents the differenced residuals from the regression. All other variables retain their interpretations from the Augmented Dickey-Fuller (ADF) test.

7. DCC-GARCH

Engle (2000) developed a DCC-GARCH model that extracts time-varying correlations between distinct variables using dynamic correlation coefficients. It involves a two-step process that begins with the GARCH(1,1) model introduced by Bollerslev (1986). This first step reduces the number of parameters to be estimated through nonlinear constraints, which increases the efficiency and parsimony of the estimate. The following is the mean and variance equation for GARCH(1,1):

$$Y_t = \phi + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

$$v_{ii,t} = \omega + \alpha \varepsilon_{i,t-1}^2 + \beta v_{ii,t-1} \quad \ldots\ldots\ldots\ldots\ldots (5)$$

where, Y_t represents the dependent variable, ε_t is the error term, $v_{ii,t-1}$ is the conditional variance, and α and

β are parameters that govern volatility persistence. The mean equation consists of a constant and error terms, while the variance equation accounts for: A constant component ω, a squared lagged residual term $\varepsilon_{i,t-1}^2$ to incorporate prior period volatility, a lagged variance component $v_{ii,t-1}$ to capture volatility persistence. The second step is to construct a DCC model on the study variables. The conditional variance covariance matrix can be expressed as

$$\varepsilon_{i,t} / I_{t-1} \sim N\left(0, V_t\right)$$
$$V_t = \begin{bmatrix} v_{ii,t} & v_{ij,t} \\ v_{ji,t} & v_{jj,t} \end{bmatrix}$$

where, the diagonal elements represent conditional variances and the off-diagonal elements represent conditional covariances.

Let us take INF and FG as an example.

$$V_t = \begin{bmatrix} v_t^{INFINF} & v_t^{INFFG} \\ v_t^{FGINF} & v_t^{FGFG} \end{bmatrix}$$

The residuals, denoted as $\varepsilon_{i,t}$ form a 2×1 vector derived from the Vector Autoregression (VAR) model. The information set available up to time t−1 is represented by I_{t-1} .

The variance–covariance matrix of residuals in a two-variable context is given as

$$H_t = D_t R_t D_t \tag{6}$$

where, D_t is a diagonal matrix of size 2 by 2 of the time-varying standard deviations produced by univariate GARCH (1,1) and H_t is the conditional variance-covariance matrix of size 2 by 2 at time t; R_t is the time-varying correlation matrix of size 2 by 2 at time t.

$$h_t = \phi + \alpha \varepsilon_{t-1}^2 + \beta h_{t-1} \tag{7}$$

The conditional covariance terms are then assumed to follow the DCC (1, 1) specification.

$$h_{ij,t} = \rho_{ij,t} \sqrt{h_{ii,t}} \sqrt{h_{ij,t}}$$
$$\rho_{ij,t} = \frac{q_{ij,t}}{\sqrt{q_{ii,t}} \sqrt{q_{jj,t}}} \text{ and} \tag{8}$$
$$q_{ij,t} = \rho_{ij}\left(1-a-b\right) + a q_{ij,t-1} + b \eta_{i,t-1} \eta_{j,t-1}$$

here, is the conditional covariance between standardised residuals $\left(\eta_{i,t-1} = \varepsilon_{i,t} / \sqrt{h_{ii,t}}\right)$ from Equation (4). $\rho_{ij,t}$ is the unconditional correlation between model residuals $\left(\varepsilon_{it}\right)$. The average variance of qij,t will be 1, and the average variance of will be $\overline{\rho}_{ij}$. When a + b <1, the qij,t expression will mean-revert. The specification lowers down on the number of parameters that must be calculated.

A two-stage method to maximise the log-likelihood function can be used to estimate the DCC model.

$$\left[-\frac{1}{2}\sum_{t=1}^{T}\left(n\log\left(2\pi\right) + \log\left|D_t\right|^2 + \varepsilon_t^{'} D^{-2} \varepsilon_t\right)\right] +$$
$$\left[-\frac{1}{2}\sum_{t=1}^{T}\left(\log\left(2\pi\right) + \log\left|R_t\right| + \mu_t^{'} R_t^{-1} \mu_t - \mu_t^{'} \mu_t\right)\right]$$

In the first stage, the log-likelihood function can be maximised over the parameter in Dt. Utilising the calculated parameters from the first step, the correlation component of the likelihood function may be maximised in the second stage to estimate correlation coefficients.

8. Result and Discussion

The following section presents the results of the analysis on the effectiveness of gold and silver as investment instruments or as potential inflation hedges. The plots, in turn, will offer valuable insights into trends, interrelationships, and implications of the variables involved for investors and other market players. Therefore, we hope to shed further light on these important financial indicators under different market circumstances.

Figure 1 shows how the price of gold and silver varies over time, increasing and decreasing at various points. The price is affected by a number of factors, including the status of the global economy, geopolitical events, and supply and demand dynamics. As a result, the price of gold is prone to sharp fluctuations and might be quite volatile. The COVID-19 epidemic and the 2008 global financial crisis were only a couple of the trends and occurrences that happened throughout the research period and had an effect on the price of gold. 2013 saw a huge drop in the price of gold, for



Figure 1. Plots of futures gold price, futures silver and stock price.

Source: Authors' calculation

which the strengthening US economy may be partly responsible. In contrast, a variety of factors resulted in a significant increase in the price of gold in 2019. One of the primary reasons for this growth was the Federal Reserve's accommodative monetary policy, which lowered interest rates and raised the attractiveness of gold as an investment. Concerns over trade between the world's two major economies, the US and China, have led investors to turn to gold as a safe haven asset. The price of the precious metal was also driven higher by central banks' desire for it, especially those in China and India. Indian investors had to pay more for gold as a result of the rupee's declining value against the US dollar, which also raised demand for the precious metal. Investors quickly turned to safe-haven assets like gold as a result of the coronavirus pandemic's widespread fear and market volatility in 2020. Due to the low-interest rate environment that central banks created to support their economies throughout the pandemic, gold became more attractive as an investment. These resulted in the rise in the price of gold.

From 2003 to 2006, the price of silver barely rose compared to earlier years. In 2013, the price of silver fell by the most. Compared to gold, silver is more volatile. Silver's price fell as a result of a sluggish worldwide trend and little demand. 2015 saw the lowest silver price ever. The cost of silver skyrocketed in 2019. The recovery of the manufacturing sector and considerable investment inflows were the primary causes of this high price. Silver's price increased in 2020, along with the price of gold. Uncertainty around the coronavirus epidemic and the weakening of the dollar. Because of the weakening dollar and the uncertainty surrounding the coronavirus pandemic, the price of gold and silver increased. In terms of stock values, they rose steadily before dropping during the financial crisis of 2008. It also declined in the early stages of the COVID-19 epidemic before continuing to rise in March 2020. Between November 2003 and December 2022, the Nifty index experienced volatility but mostly in an upward direction.

Efficient portfolio diversification requires a thorough examination of the movements of the Nifty index. Investment plans are greatly impacted by the stock market, which also acts as an indicator of the condition of the economy. Between January 2005 and December 2007, there was an impressive rise in the Nifty index, which climbed from about 2000 points to about 6000 points. It is driven by strong economic growth, huge inflows of foreign institutional investment, and positive market sentiment. During this period, a number of significant events and circumstances contributed to the upswing, such as the introduction of value-added tax, the decrease of corporate tax rates, and the major expansion of the telecom and IT industries.

The worldwide financial crisis that started in the US subprime mortgage market and expanded to the rest of

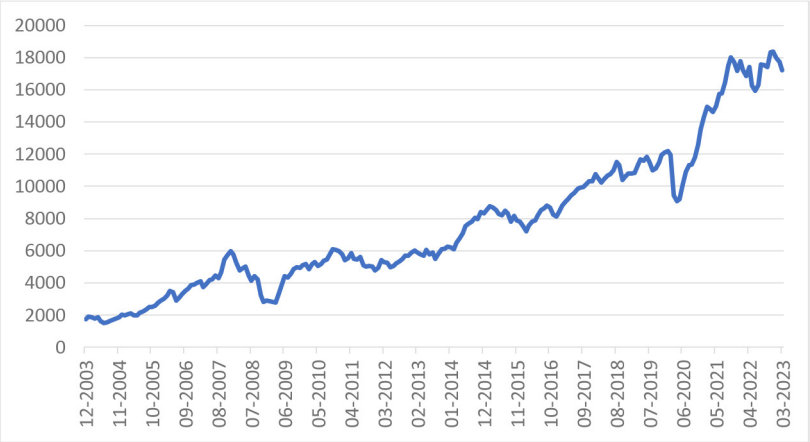


Figure 2. Plots of Nifty index.

Source: Authors' calculation

the world caused the Nifty index to crash, from about 6000 points in January 2008 to about 2500 points in March 2009. Massive sell-offs, a lack of liquidity, a contraction in credit, a depreciating currency, and fears of a recession all hurt the index. Between March 2010 and November 2010, there was a strong recovery in the Nifty index, which was attributed to a combination of factors that promoted economic revitalization. A synchronized global economic recovery, wherein international markets regained momentum and provided a good backdrop for Indian shares, was a major factor supporting the rebound. The global downturn, the market turbulence driven by China, the Fed's rate hike, the disappointment of domestic earnings, the hardship in rural areas, and the stress on the banking sector all contributed to the decline in the Nifty index between March 2015 and February 2016. January 2017 saw a resurgence of the Nifty index. It was caused by a number of variables, including the improvement of corporate earnings, the resurgence of domestic demand, and the global economic recovery. The index was drastically lowered by the COVID-19 pandemic in 2020, reflecting the pandemic's effects on the Indian economy and global markets. January 2021 saw a sharp rise in the Nifty index. The COVID-19 pandemic's domestic and international recovery, the immunization campaign, and the monetary and fiscal stimulus all contributed to its growth. The descriptive statistics for all return series are reported in Table 1.

Except for gold, every asset class exhibited mean returns that were generally higher during the pre-crisis period than they were during other periods. This suggests that average returns on investments were higher during this period. Nifty, with a mean return of 0.0271, showed the highest average return among the assets examined. Silver was the second-best performing asset in terms of average returns, behind Nifty, with a mean return of 0.0171. Silver, which is often regarded as a precious metal that is comparable to gold, had considerable volatility during the examined time but still showed potential as an investment. It was found that the highest standard deviation (0.068) of Silver was suggestive of very high volatility. Of the averaged returns, Gold emerged third in rank, with a mean return of 0.0115. While this may be comparatively less than Nifty and Silver, it does not reduce the assets' attraction as diversification tools within a portfolio. The entire duration had negative skewness for the left-skewed distributions of Nifty, Gold, and Silver.

All return series exhibited lower mean returns during the financial crisis period than they did during other periods. Interestingly, Nifty had a negative mean return of -0.050, pointing to a stock market decline in which investors suffered losses. The extent of the market fail during the crisis is highlighted by this negative mean return. In contrast, Gold showed a very strong performance throughout this period of uncertainty, yielding a significantly higher mean return of 0.026. Gold's strength during market turmoil was probably aided by its status as a safe-haven asset. Investors usually choose gold as a store of value and a haven

Table 1. The descriptive statistics for all return series

A: Pre-financial crisis period (12/2003 to 12/2007)				
	Inflation	Gold	Silver	Nifty
Mean	0.4342	0.0115	0.0171	0.0271
Median	0.3902	0.0119	0.0258	0.0430
Maximum	1.9868	0.1072	0.2495	0.1578
Minimum	-0.7361	-0.1056	-0.2088	-0.1649
Std. Dev.	0.5483	0.0393	0.0683	0.0582
Skewness	0.5696	-0.1571	-0.1302	-1.2114
Kurtosis	0.7172	1.1802	3.8242	2.2465
B: Financial crisis period (01/2008 to 03/2009)				
Mean	0.3854	0.0262	0.0103	-0.0503
Median	0.2333	0.0354	0.0270	-0.0354
Maximum	2.5786	0.0978	0.1463	0.0685
Minimum	-1.8913	-0.0970	-0.1744	-0.2703
Std. Dev.	1.2377	0.0542	0.0889	0.0842
Skewness	-0.0607	-1.1351	-0.5651	-1.1633
Kurtosis	-0.2565	0.8040	-0.4127	2.1388
C: Post-financial crisis period (04/2009 to 03/2023)				
Mean	0.3882	0.0079	0.0066	0.0108
Median	0.3771	0.0096	0.0048	0.0162
Maximum	2.4776	0.1362	0.2083	0.1815
Minimum	-1.7528	-0.0691	-0.1375	-0.2359
Std. Dev.	0.7875	0.0322	0.0580	0.0449
Skewness	-0.2112	0.5993	0.5388	-0.5756
Kurtosis	0.3630	1.8443	0.9015	6.1625
D: Whole period (12/2003 to 03/2023)				
Mean	0.39770	0.00985	0.00906	0.01030
Median	0.37715	0.01186	0.00738	0.01815
Maximum	2.57857	0.13617	0.24954	0.18146
Minimum	-1.89125	-0.10558	-0.20879	-0.27033
Std. Dev.	0.77720	0.03565	0.06243	0.05377
Skewness	-0.15129	0.20388	0.22065	-1.13781
Kurtosis	0.65419	1.23568	1.47709	5.12458

Source: Author's calculation

from turmoil in the markets. The higher mean return for Gold suggests that it did rather well and produced some positive returns despite the broader market decline. In comparison to the crisis period, the financial landscape showed a different picture throughout the post-crisis period. The Nifty index showed positive mean returns, indicating a broader economic recovery and a revival of investor confidence after the crisis. However, even considered to be safe haven assets, Gold and Silver had lower mean yields during this period. Gold recorded a mean yield of 0.0079, while Silver reported a mean yield of 0.0066. As the market conditions recovered and investors, once again, began accepting risk, there may have been a shift in demand from safe-haven assets to riskier assets. The standard deviations are significantly lower when comparing pre-financial crisis periods to those after the financial crisis. Among the three assets, Silver (0.0580) has the highest standard deviation, followed by Nifty (0.0449) and Gold (0.0322).

The mean returns for the whole period were generally lower than they were during the pre-crisis period. At 0.0107, Nifty had the greatest mean return of all the series during the whole period. This indicates that, on average, the stock market performed fairly well for the whole time. Moving on to standard deviations, we observe that Silver has the highest value (0.0624), indicating more volatility across the whole period compared to the other series. Nifty ranks in second with a standard deviation of 0.0537, illustrating the market's inherent volatility. In contrast, Silver and Nifty showed higher volatility than Gold, which had the lowest standard deviation (0.356). When the skewness statistics are reviewed, Nifty displays negative skewness for the whole time. This shows that the distribution of returns for Nifty, which was skewed to the left, had more occurrences of lower returns. The positive skewness of Gold and Silver, on the other hand, indicates a distribution with a longer right tail and more instances of higher returns. Understanding correlation gives investors the power to make smart choices, combining assets in a way that maximizes diversification benefits and minimises risk. The correlation coefficients between various asset returns are seen in Table 2.

All correlation coefficients are theoretically valid. There is a negative correlation between gold and the Nifty. Given the negative correlation, investors may use gold as a hedge or safe-haven investment during times of stock market declines. While a bull market encourages investors to allocate more of their portfolios toward equities, the result would be a decrease in gold prices. The correlation between gold and inflation is positively related. The price of gold, on the whole, rises during inflationary bouts due to the positive

correlation between gold and inflation. As a result, during times of inflation, investors may turn to gold as a store of value and protection against the decline of purchasing power. Silver exhibits a positive correlation with Nifty. The fact that silver serves as both a precious metal and an industrial commodity may be the reason for this positive correlation. These correlations assume that there is a consistent and stable correlation between two variables. It is important to realize that, despite providing valuable insights into the relationships between different assets, correlations are not static and may vary over time. A wide range of factors, such as market dynamics, economic conditions, geopolitical events, and others, can cause asset correlations to vary

Table 2. Correlation matrix

	Gold	Nifty	Silver	Inflation
Gold	1.000000	-0.093208	0.711530	0.051024
Nifty	-0.093208	1.000000	0.233899	0.050569
Silver	0.711530	0.233899	1.000000	0.176441
Inflation	0.051024	0.050569	0.176441	1.000000

Source: Author's calculation

Table 3. Unit root test result

	Gold	Silver	Nifty	Inflation
ADF	-13.5843 (0.0000)	-11.1825 (0.0000)	-14.19547 (0.0000)	-8.5508 (0.0000)
PP	-13.5683 (0.0000)	-12.0123 (0.0000)	-11.212 (0.0000)	-8.4630 (0.0000)

Source: Author's calculation

Table 4. Empirical results of GARCH and DCC GARCH models

	Inflation	Nifty	Silver	Gold
Mean	0.420984 4.908	0.009970 3.183	0.005110 1.541	0.009048 3.443
Variance	0.091497 3.037	1.235311 2.000	2.806908 3.566	1.191343 4.249
	0.050252 1.521	0.038639 2.48	0.023085 1.231	0.011279 1.028
	1.517157 8.053	1.654659 13.87	1.763432 14.57	1.842405 19.19
Model Fitness				
Ljung Box Q(5)	5.92535 [0.3135510]	11.2793 [0.0461158]	17.1256 [0.0042677]	4.90132 [0.4280412]
Ljung Box Q(10)	10.4545 [0.4015651]	12.0952 [0.2787376]	19.1456 [0.0384515]	11.7484 [0.3022505]
Ljung Box Q(20)	33.6315 [0.0287286]	22.1301 [0.3334934]	27.1694 [0.1305659]	17.6181 [0.6125468]
Ljung Box Q^2 (5)	1.71381 [0.8871552]	1.00359 [0.9622756]	4.12088 [0.5321462]	3.49782 [0.6237177]
Ljung Box Q^2 (10)	6.81594 [0.7426998]	1.66704 [0.9983139]	8.93264 [0.5385078]	7.57447 [0.6703238]
Ljung Box Q^2 (20)	16.7805 [0.6671804]	6.75182 [0.9974231]	14.8147 [0.7869125]	9.81587 [0.9713891]
DCC with correlation targeting				
	0.193422** (2.275) [0.0239]			
	0.109200* (1.940). [0.0549]			
	0.224944*** (2.842) [0.0049]			
	-0.078599 (-0.9273) [0.3548]			
	0.711290*** (19.32) [0.0000]			

Source: Author's calculation.
The t-values(), the values in [] provided in the section are P values, and the symbols ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

and fluctuate. Through the examination of correlations across various periods of time, investors can get a better understanding of the ways in which assets interact in various kinds of market conditions and modify their investment approaches accordingly. To understand asset relationships in more depth under diverse market conditions, we use time-varying correlations.

The Philips Perron unit root test and the Augmented Dickey Fuller (ADF) test are used to examine a stationary process of the return series. Table 3 displays the outcomes of these tests.

It indicates that, at the 1% level of significance, we can rule out the existence of a unit root, proving that the return series is a stationary process. To comprehend the time-varying correlation, we used the DCC-GARCH (1,1) model. The parameters and results of the diagnostic test are shown in Table 4. The time-varying correlation coefficients are depicted in Figure 2. The averages of the time-varying correlations for the three distinct time periods—the pre-crisis, crisis, and post-crisis periods—are shown in Table 5. The dynamic relationship between the variables during these several temporal phases is thoroughly outlined in this table.

According to the DCC rho coefficient, showed in the Table 4. there is a statistically significant positive correlation between inflation and silver as well as Nifty and Silver.

Silver manifests a higher positive correlation with inflation before the crisis (0.146), during the crisis (0.198), and post-crisis (0.186). It appears from these findings that silver has a very strong capability to hedge against inflation as compared to gold. Unlike gold, silver shows a stronger positive correlation with inflation, and therefore, silver could serve as a better hedge against inflation than gold, particularly during high-inflation periods. This is consistent with the findings of Adrangi *et al.* (2003), but it may diverge from studies such as Dempster and Artigas (2010), which suggested that silver might lack long-term effectiveness in inflation hedging. There is a positive correlation between Nifty and silver. This correlation may have an impact on investors since the diversification of a portfolio that already incorporates Nifty stocks may not be significantly increased by the inclusion of silver. Investors may need to look at alternative assets or industries that have a weaker relationship with the Nifty in order to diversify their portfolios. Traditionally, it is believed that gold protects against inflation, but there are various conditions such as macroeconomic factors, investor psychology, and financial market conditions under which it works. Compared to silver, which has a high correlation, gold returns and inflation have a weaker relationship. Moreover, it is statistically marginally significant at a level of 10%. The low positive correlations suggest that gold may have certain features that help it hedge against inflation, but it may not provide the greatest protection. From the plot of correlation between inflation and gold, it is evident that for some of the period, it shows a negative correlation. The correlation is slightly higher during the crisis period than it is throughout the other periods, as per Table 5. However, the correlations show very little variation, which points to a persistent overall pattern throughout the various time periods. His aligns with Hoang *et al.* (2016), reinforcing the view that gold's role as an inflation hedge is more pronounced during economic distress.

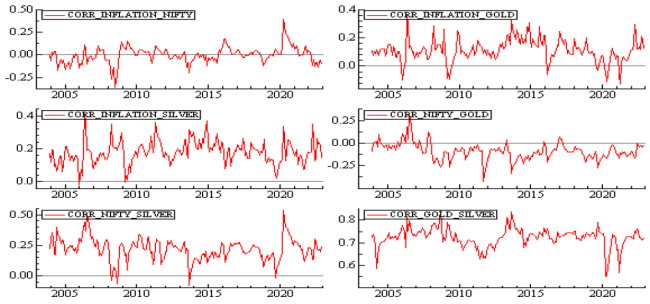


Figure 2. Visualization of time-varying correlation coefficients.

Table 5. Average of time varying correlation

	Gold-Inflation	Silver-Inflation	Gold-Nifty	SILVER-NIFTY	Nifty-Inflation	Gold-Silver
Pre crisis-period	0.100	0.146	0.009	0.279	-0.039	0.729
Crisis period	0.115	0.198	-0.165	0.110	-0.08844	0.766
Post-crisis period	0.114	0.186	-0.113	0.206	0.013787	0.718

Source: Author's calculation

Gold and the Nifty's returns are negatively correlated. It lacks statistical significance, though. The non-significant connection suggests that there is no meaningful or persistent relationship between gold and the Nifty index. The variations in gold prices and the Nifty index could not have always correlated during the time period under consideration. However, combining the two assets in a diversified investment portfolio could provide some advantages for diversification. The likelihood that the Nifty index and gold prices would fluctuate independently reduces the portfolio's exposure to the risks related to each asset. The correlation values fluctuate over time. The range of the correlation, from -0.4207 to 0.3243, illustrates how the relationship between gold and the Nifty has changed over time. There are several situations where the correlation is negative, as well as situations where it is positive, it is depicted in the plot if the correlation between gold and nifty. This exemplifies how the relationship between gold and the Nifty is dynamic and influenced by a number of factors, including monetary policy, sentiment among investors, and other global events. As per Table 5, it was highly negative during the period of the financial crisis of 2008. Thus, gold can be used as a hedge against market falls. The study reconfirms the position of gold as a hedge against a downturn in the market, especially at the time of financial crisis as the global financial crisis of 2008. The negative relationship established between gold and stock indices demonstrates that investors can, therefore, use gold as a safe haven during the decline of equity markets, which indeed supports previous studies by Creti *et al.* (2013) and Bhatia *et al.* (2020).

The calculated correlation coefficient between the returns on silver and gold is 0.711290. These two assets are associated in a highly statistically significant manner (p-value = 0.000). This means that macroeconomic factors and investor sentiment that impact one metal may also affect the other metal. The high positive correlation between silver and gold suggests that a portfolio of diversified investments that contains both silver and gold may not benefit as much from diversification. However, pair trading can be considered. The spread between the two series may be monitored by traders, and trades can be made when it deviates from its historical trend. When the gap widens by more beyond a certain level, a trader may simultaneously buy silver and sell gold. The spread is expected to gradually narrow, which might lead to benefits when the prices converge. We found an insignificant positive rho value between Inflation and Nifty. Depending on how strong various channels are at work, the relationship between inflation and stock market prices may be either positive or negative. During both the crisis and pre-crisis periods, it shows a negative correlation, whereas it is positive during the post-crisis period. Normally, the relation between Inflation and the stock market is positive. There are two explanations for why inflation has a positive impact on stocks: The dividends would increase firstly if the economy were stimulated along with inflation. Small inflation is considered beneficial for the economy. Second, it lowers bond returns, which would increase the demand for stocks. In our result, most of the time, it shows a positive relation. However, it is negative when there is a financial crisis.

10. Conclusion

In this article, we looked at the portfolio and hedging capabilities of gold and silver in the Indian financial market. We extracted the time-varying interdependencies between the Nifty, inflation, gold, and silver in order to analyse this. The correlation between gold, silver, and stock indices is not static but varies across different economic conditions. The fluctuating relationship suggests that macroeconomic factors, monetary policy, and investor sentiment play a crucial role in determining the effectiveness of these metals as hedging tools. Our findings show that silver has a significant positive correlation with inflation and is, therefore, a more effective inflation hedge than gold. Silver has a high positive correlation with the Nifty index limits the diversification benefit it might offer to equity portfolios. In contrast, gold has a lower, albeit still significant, correlation with inflation, granting it some inflation-hedging properties. This insight is particularly relevant for institutional investors, pension funds, and mutual funds that seek to preserve purchasing power in inflationary environments. Gold's relationship with

the Nifty index is weakly negative, yet statistically insignificant, which means that gold does not maintain a consistent long-term hedge against equity market movements. Nevertheless, its safe-haven status has been reaffirmed by its strong performance during times of economic distress, such as the 2008 financial crisis. The fluctuating nature of correlations suggests that the timing of when gold and silver effectively hedge depends on the changes in macroeconomic parameters and the sentiments of investors.

These findings bring significant implications for investors and portfolio managers. Though silver may be a more robust hedge against inflation, its correlation with equities, at least, could serve to limit its usefulness for diversification in risk. Monetary policies, like interest rate adjustments and liquidity measures, can directly affect investments in silver since silver is positively responsive to inflation. While designing inflation-targeting policies, the authorities may need to take such dynamics into account to ensure that capital markets are stable and efficient. Gold, whose safe-haven characteristics hold firm particularly during times of financial crises, would, therefore, remain an essential asset for risk-averse investors. This study emphasizes that investors must continuously review economic conditions and adapt their hedging strategies strongly. While previous studies generally assert gold's role in inflation hedging, this research emphasizes time-varying correlation and conditionality about the hedging capability of both gold and silver in India. The study is limited in addressing only historical price relationships without taking into account possible structural breaks in monetary policy or investor behaviour. Future research could explore the impact of central bank interventions, geopolitical risks, and alternative safe-haven assets to provide a more comprehensive understanding of inflation-hedging strategies in dynamic market environments.

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12. References

Adrangi, B., Chatrath, A., & Raffiee, K. (2003). Hedging: The case of gold and silver investments. *The Journal of Wealth Management, 6*(2), 60-77. https://doi.org/10.3905/jwm.2003.320482

Alqaralleh, H., & Canepa, A. (2022). The role of precious metals in portfolio diversification during the COVID-19 pandemic: A wavelet-based quantile approach. *Resources Policy*, *75*, 102532. https://doi.org/10.1016/j.resourpol.2021.102532 PMid:34980935 PMCid:PMC8716323

Arshad, S., Vu, T. H. N., Too, S. W., & Loke, M. Y. (2023). The hedging ability of gold, silver, and Bitcoin against inflation in ASEAN countries. *Asian Academy of Management Journal of Accounting and Finance*, *19*(1). https://doi.org/10.21315/aamjaf2023.19.1.5

Artigas, J. C. (2010). *Research links global money supply and future inflation expectations to gold price*. World Gold Council.

Bampinas, G., & Panagiotidis, T. (2015). Are gold and silver a hedge against inflation? A two-century perspective. *International Review of Financial Analysis*, *41*, 267-276. https://doi.org/10.1016/j.irfa.2015.02.007

Bhatia, V., Das, D., & Kumar, S. B. (2020). Hedging effectiveness of precious metals across frequencies: Evidence from Wavelet based Dynamic Conditional Correlation analysis. *Physica A: Statistical Mechanics and its Applications*, *541*, Article 123631. https://doi.org/10.1016/j.physa.2019.123631

Bollerslev, T. (1986). Generalized autoregressive conditional heteroskedasticity. *Journal of Econometrics, 31*(3), 307-327. https://doi.org/10.1016/0304-4076(86)90063-1

Bilgin, M. H., Gogolin, F., & Lau, M. C. K. (2018). Time-variation in the relationship between white precious metals and inflation: A cross-country analysis. *Journal of International Financial Markets, Institutions and Money*, *56*, 55-70. https://doi.org/10.1016/j.intfin.2018.03.001

Bình, N. T. T. (2024). Comparative analysis of gold, art, and wheat as inflation hedges. *Journal of Risk and Financial Management, 17*, Article 270. https://doi.org/10.3390/jrfm17070270

Burdekin, R. C. K., & Tao, R. (2020). The golden hedge: From global financial crisis to global pandemic. *Economic Modelling, Forthcoming Claremont McKenna College Robert Day School of Economics and Finance Research Paper No. 3747401*. https://doi.org/10.2139/ssrn.3747401

Chiang, T. C. (2022). Can gold or silver be used as a hedge against policy uncertainty and COVID-19 in the Chinese

market? *China Finance Review International*, *12*(4). https://doi.org/10.1108/CFRI-12-2021-0232

Chua, J. H., Sick, G., & Woodward, R. S. (1990). Diversifying with gold stocks. *Financial Analysts Journal*, *46*(4), 76-79. https://doi.org/10.2469/faj.v46.n4.76

Creti, A., Joëts, M., & Mignon, V. (2013). On the links between stock and commodity markets' volatility. *Energy Economics*, *37*, 16-28. https://doi.org/10.1016/j.eneco.2013.01.005

Dempster, N., & Artigas, J. C. (2010). Gold: Inflation hedge and long-term strategic asset. *The Journal of Wealth Management*, *13*(2), 69-75. https://doi.org/10.3905/jwm.2010.13.2.069

Dias, R., & Carvalho, L. (2020). Hedges and safe havens: An examination of stocks, gold, and silver in Latin America's stock market. *China Finance Review International*, *13*(5), 1114-1132. https://doi.org/10.5902/1983465961307

Dickey, D. A., & Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American Statistical Association*, *74*(366), 427-431. https://doi.org/10.2307/2286348

Do, M. D., Tran, T. D., & Nguyen, H. N. (2023). Is gold an inflation hedge in Vietnam? A non-linear approach. *Cogent Economics & Finance*, *11*(2). https://doi.org/10.1080/23322039.2023.2244857

Engle, R. F. (2000). *Dynamic conditional correlation: A simple class of multivariate GARCH models*. UCSD Economics Discussion Paper No. 2000-09. https://doi.org/10.2139/ssrn.236998

Ergül, Ö., & Karakaş, T. (2024). Analysis of the relationship of gold prices with inflation and Bitcoin in the post-tapering period. *Borsa Istanbul Review*, *24*(4), 797-805. https://doi.org/10.1016/j.bir.2024.04.009

Fortune, J. N. (1987). The inflation rate of the price of gold, expected prices, and interest rates. *Journal of Macroeconomics*, *9*(1), 71-82. https://doi.org/10.1016/S0164-0704(87)80007-1

Ghannadian, F., & Vahlberg, M. A. L. D. (2023). Gold as a hedge for inflation: An event-study of abnormal inflationary periods in the past five decades. *The Journal of Applied Business and Economics*, *25*(6). https://doi.org/10.33423/jabe.v25i6.6581

Ghazali, M. F., Lean, H. H., & Bahari, Z. (2020). Does gold investment offer protection against stock market losses? Evidence from five countries. *The Singapore Economic Review*, *65*(2), 275-301. https://doi.org/10.1142/S021759081950036X

Ghosh, D., & Levin, E. J. (2004). Gold as an inflation hedge. *Studies in Economics and Finance*, *22*(1). https://doi.org/10.1108/eb043380

Ghosh, D., Levin, E. J., Macmillan, P., & Wright, R. E. (2004). Gold as an inflation hedge? *Studies in Economics and Finance*, *22*(1), 1-25. https://doi.org/10.1108/eb043380

Hillier, D., Draper, P., & Faff, R. (2006). Do precious metals shine? An investment perspective. *Financial Analysts Journal*, *62*(2), 98-106. https://doi.org/10.2469/faj.v62.n2.4085

Hoang, T. H. V., Lahiani, A., & Heller, D. (2016). Is gold a hedge against inflation? New evidence from a nonlinear ARDL approach. *Journal of Economic Modelling*, *54*, 54-66. https://doi.org/10.1016/j.econmod.2015.12.013 PMid:32287826 PMCid:PMC7115710

Jaffe, J. F. (1989). Gold and gold stocks as investments for institutional portfolios. *Financial Analysts Journal*, *45*(2), 53-59. https://doi.org/10.2469/faj.v45.n2.53

Kyriazis, N. A., Papadamou, S., & Tzeremes, P. (2023). Are benchmark stock indices, precious metals, or cryptocurrencies efficient hedges against crises? *Economic Modelling*, *128*, 106502. https://doi.org/10.1016/j.econmod.2023.106502

Lubis, K. A., & Chalid, D. A. (2022). Is gold a hedge against inflation and exchange rate risks: Evidence from Muslim majority countries. *Islam, Media and Education in the Digital Era* (1st ed., p. 7). Routledge. https://doi.org/10.4324/9781003219149

McCown, J. R., & Zimmerman, J. R. (2007). Analysis of the investment potential and inflation-hedging ability of precious metals. *Social Science Research Network*. https://doi.org/10.2139/ssrn.1002966

Mensi, W., Beljid, M., Boubaker, A., & Managi, S. (2013). Correlations and volatility spillovers across commodity and stock markets: Linking energies, food, and gold. *Economic Modelling*, *32*, 15-22. https://doi.org/10.1016/j.econmod.2013.01.023

Phillips, P. C. B., & Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika*, *75*(2), 335-346. https://doi.org/10.1093/biomet/75.2.335

Smales, L. A. (2023). Cryptocurrency as an alternative inflation hedge? *Accounting and Finance*, *64*(2), 1589-1611. https://doi.org/10.1111/acfi.13193

Sumner, S. W., Johnson, R. R., & Soenen, L. (2010). Spillover effects among gold, stocks, and bonds. *Journal of Centrum Cathedra*, *3*(2), 106-114. https://doi.org/10.7835/JCC-BERJ-2010-0041

Talbi, M., Bedoui, R., Belkacem, L., & de Peretti, C. (2018). Do precious metals act as hedges and safe havens against G-7 stock markets? A vine copula approach. *Social Science Research Network*.

Taylor, N. (1998). Precious metals and inflation. *Applied Financial Economics*, *8*(2), 201-210. https://doi.org/10.1080/096031098333186

Uyar, S. G. K., Uyar, U., & Balkan, E. (2021). The role of precious metals in extreme market conditions: Evidence from stock markets. *Studies in Economics and Finance*.

Valadkhani, A., Nguyen, J., & Chiah, M. (2022). When is gold an effective hedge against inflation? *Resources Policy*, *79*, 103009. https://doi.org/10.1016/j.resourpol.2022.103009

Wang, K. M., Lee, Y. M., & Nguyen Thi, T. B. (2011). Time and place where gold acts as an inflation hedge: An application of long-run and short-run threshold model. *Economic Modelling*, *28*(3), 806-819. https://doi.org/10.1016/j.econmod.2010.10.008

Wolski, R. (2022). Investments in bonds, stocks, gold, and real estate as a hedge against inflation. *Acta Universitatis Lodziensis. Folia Oeconomica*, *3*(360), 1-17. https://doi.org/10.18778/0208-6018.360.01

World Gold Council. (2021, October 19). The drivers of Indian gold demand: India gold market series. *World Gold Council*. https://www.gold.org/goldhub/research/drivers-indian-gold-demand-india-gold-market-series