

CHAPTER 2

DEVELOPMENT OF FINANCE, ACCOUNTING AND AUDITING

A Data-Driven Econometric Analysis of the Time-Varying Hedge and Safe Haven Properties of Gold and Silver in Emerging Markets: Evidence from India

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Abstract. Precious metals play an important role in portfolio diversification and financial risk management, particularly during periods of economic uncertainty and stock market instability. However, their defensive properties may vary depending on market conditions and the intensity of financial shocks. This study aims to examine the time-varying hedging and safe-haven properties of gold and silver in the Indian stock market, with particular attention to their capacity to protect investors during periods of financial stress. The research employs daily price data for the BSE SENSEX, gold, and silver covering January 2003 to December 2023. The methodological framework combines descriptive statistics, correlation analysis, Dynamic Conditional Correlation Generalized Autoregressive Conditional Heteroskedasticity (DCC-GARCH) modelling, and quantile regression to assess asset dependence under normal and extreme market conditions. The results reveal substantial differences in the defensive characteristics of the two metals. Gold exhibits a weak negative average correlation with the BSE SENSEX (-0.08), which becomes more pronounced during the Global Financial Crisis (-0.21) and the COVID-19 pandemic (-0.18). Quantile regression produces negative coefficients for gold at the 0.05 (-0.28) and 0.10 (-0.21) quantiles, indicating potential safe-haven properties during severe equity market downturns. Conversely, silver demonstrates a weak positive average correlation with stock returns (0.12) and positive coefficients across all examined quantiles, suggesting limited protective capacity during extreme market conditions. The findings indicate that gold exhibits more consistent defensive characteristics than silver, while its protective properties remain dependent on market conditions. The study contributes to understanding the dynamic relationships between precious metals and equity markets and provides insights relevant to portfolio diversification and financial risk management in emerging economies. Further research should incorporate additional emerging markets, alternative safe-haven assets, structural break models, and volatility spillover analysis to examine the robustness of these relationships across different financial environments.

Keywords: gold; silver; BSE SENSEX; hedging properties; safe-haven assets; DCC-GARCH; quantile regression; stock market volatility; portfolio diversification; emerging markets.

JEL Classification: C22; G11; G12; G15.

Formulas: 4; **fig.:** 2; **tabl.:** 7; **bibl.:** 10.

Introduction. Precious metals occupy an important position in the global economy not only because of their industrial and ornamental uses but also because of their role as financial assets. Gold, in particular, has traditionally been regarded as a store of value and a defensive investment during times of uncertainty (Baur & Lucey, 2010; Ciner et al., 2013). In periods of stock market instability, investors often turn to gold to preserve wealth, reduce downside risk, and stabilize their portfolios. This behavior is especially important in emerging markets such as India, where financial markets are relatively sensitive to global disturbances and macroeconomic shocks (Gürgün & Ünalımsı, 2014; Seifoddini et al., 2017).

India offers a particularly meaningful context for this analysis because it is one of the world's largest consumers of gold. Gold in India serves not only as a cultural and social asset but also as an important means of private wealth preservation. Although gold has long been treated as a defensive investment, relatively fewer studies have examined how both gold and silver behave in relation to the Indian stock market under changing market conditions. Existing research has more often focused on gold alone or on large developed markets, leaving a need for a comparative assessment of gold and silver within an emerging-market framework such as India (Jain & Biswal, 2016; Manuj, 2021).

This study addresses three central questions. First, it investigates whether gold helps protect investor wealth during periods of stock market volatility. Second, it examines whether gold and silver can be treated as reliable safe-haven assets during financial stress. Third, it explores whether these relationships are stable over time or vary across major crisis episodes. To answer these questions, the study uses econometric techniques to evaluate the time-varying correlation between precious metals and the BSE SENSEX, assess safe-haven behavior during extreme market downturns, and analyze dependence patterns under different market states. Such an approach is consistent with recent studies emphasizing that the defensive role of precious metals cannot be fully understood through static correlations alone (Caporale & Gil-Alana, 2023; Ming, 2023).

The study contributes to a better understanding of how precious metals may help investors in an emerging market such as India manage risk more effectively. This has relevance not only for individual investors but also for portfolio managers and policymakers concerned with financial resilience and asset allocation. By comparing gold and silver within the same empirical framework, the study also offers a more nuanced perspective on the relative effectiveness of alternative precious-metal-based defensive strategies (Agyei-Ampomah et al., 2014; Feder-Sempach, 2025).

Literature Review. The distinction between a hedge and a safe haven was clearly articulated by Baur and Lucey (2010). A hedge is an asset that is uncorrelated or negatively correlated with another asset on average, whereas a safe haven is an asset that retains this protective property specifically

during periods of market turmoil. This distinction is important because many traditional financial assets may perform adequately during normal times but fail to protect investors during crises. The conceptual clarification offered by Baur and Lucey (2010) has become foundational in the literature and has guided subsequent empirical analyses of gold and other commodities as defensive assets.

Gold is frequently regarded as a hedge and safe haven for several reasons. It is highly liquid, widely accepted, and often benefits from investor flight-to-safety behavior during uncertainty (Ciner et al., 2013; Ming, 2023). Several studies have found that gold can act as both a diversification tool and a defensive asset in large financial markets, although the strength of this property varies across countries and market conditions. For example, Gürgün and Ünalımsı (2014) showed that gold may serve as a safe haven in emerging and developing countries, while Agyei-Ampomah et al. (2014) demonstrated that gold can provide stronger protection than some other metals under adverse financial conditions. In the case of India, the relationship between gold prices and stock market movements has received growing attention because of the country's high gold demand and the strong integration of domestic markets with global uncertainty (Jain & Biswal, 2016; Manuj, 2021).

Silver differs from gold because, although it is a precious metal, it also has a strong industrial use component. As a result, silver prices are more closely tied to economic activity and may therefore behave less defensively during market stress. This makes the comparison between gold and silver particularly important in evaluating alternative portfolio hedging tools in the Indian market. Recent research suggests that silver may provide diversification benefits, but its safe-haven capacity is generally weaker and more episodic than that of gold (Caporale & Gil-Alana, 2023; Feder-Sempach, 2025).

The literature further suggests that the hedge and safe-haven properties of precious metals are not constant. They may strengthen or weaken depending on crisis intensity, market liquidity, investor sentiment, and the broader economic environment (Ciner et al., 2013; Ming, 2023). Moreover, the relationship between gold and equity markets may vary considerably across emerging and developed markets, reflecting institutional differences, exchange-rate regimes, inflation dynamics, and investor behavior (Seifoddini et al., 2017). This study builds on the existing literature by comparing gold and silver in India using a time-varying econometric framework that captures both ordinary and extreme market conditions.

Aims. The aim of this study is to assess the time-varying hedge and safe-haven properties of gold and silver in relation to the Indian stock market. Specifically, the study seeks to determine whether these precious metals provide diversification and downside protection under normal and stressed market conditions, to examine how their relationships with the BSE

SENSEX change during major financial crises, and to identify whether their defensive properties differ across various states of the stock return distribution. By combining static correlation analysis, DCC-GARCH modelling, quantile regression, and crisis-period comparisons, the study aims to provide empirical evidence on the relative effectiveness of gold and silver as instruments of portfolio risk management in an emerging market context.

Methodology. This study examines whether gold and silver function as hedges and safe havens in the Indian financial market. The focus is on how these metals are related to stock market performance under both normal and stressed conditions. Since previous studies have shown that correlations between financial assets are dynamic rather than constant, a time-series econometric framework is particularly appropriate for this analysis (Engle, 2002; Ming, 2023).

A time-series econometric framework is used because asset prices and returns are dynamic and relationships between them may vary over time. Traditional static correlation methods are not sufficient for this purpose, since they do not capture changing market dependence. Therefore, the study applies dynamic conditional correlation and quantile-based regression techniques. This choice is consistent with the literature that emphasizes the importance of modeling both average dependence and tail behavior when evaluating hedging and safe-haven properties (Baur & Lucey, 2010; Ciner et al., 2013).

Data collection. The study uses daily price data covering the period January 2003 to December 2023, consisting of approximately 5,260 observations.

Table 1. Variables and data description

Variable	Proxy
Indian stock market	BSE SENSEX Index
Gold price	Gold spot price (USD/INR adjusted)
Silver price	Silver spot price
Market returns	Log returns of SENSEX

Source: compiled from Yahoo Finance, World Gold Council, and Reserve Bank of India data as described in the uploaded manuscript.

The data are obtained from reliable financial databases such as Yahoo Finance, the World Gold Council, and the Reserve Bank of India. The use of daily observations allows the study to capture high-frequency adjustments in market behavior and better identify the response of precious metals to market stress.

Return calculation formula. The daily returns are calculated using the logarithmic return formula:

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

where: R_t = return at time t ; P_t = price at time t ; P_{t-1} = price at time $t - 1$.

Logarithmic returns are used because they are widely applied in financial econometrics due to their desirable statistical properties, including time additivity and improved comparability across assets.

Preliminary statistical analysis. Before estimating the main econometric models, the study conducts descriptive statistics and stationarity tests. The descriptive analysis includes the mean, standard deviation, skewness, and kurtosis of the series. In addition, stationarity is tested using the Augmented Dickey-Fuller test and the Phillips-Perron test. These preliminary procedures are necessary to ensure that the return series are suitable for econometric modeling and to avoid spurious regression outcomes.

DCC-GARCH model. To estimate time-varying correlations between precious metals and the stock market, the study employs the Dynamic Conditional Correlation Generalized Autoregressive Conditional Heteroskedasticity model proposed by Engle (2002). This model is especially useful because it captures how conditional correlations evolve over time rather than assuming that they remain constant throughout the sample period.

Step 1. Univariate GARCH model. The conditional variance of each asset return is modeled as:

$$h_t = \omega + \alpha \varepsilon_{t-1}^2 + \beta h_{t-1} \quad (2)$$

where: h_t = conditional variance; ω = constant term; α = ARCH parameter; β = GARCH parameter.

Step 2. Dynamic correlation estimation. The conditional correlation matrix is given by:

$$R_t = (\text{diag}(Q_t))^{-1/2} Q_t (\text{diag}(Q_t))^{-1/2} \quad (3)$$

where Q_t represents the time-varying covariance matrix.

This approach makes it possible to observe how gold and silver move with the BSE SENSEX across different market phases. The DCC-GARCH framework is particularly appropriate for examining assets that may switch from weakly correlated to strongly negatively correlated during crises, as highlighted in earlier safe-haven studies (Ciner et al., 2013; Ming, 2023).

Quantile regression analysis. To evaluate safe-haven behavior during extreme stock market downturns, the study applies quantile regression:

$$Q_\tau(Y_t | X_t) = \alpha_\tau + \beta_\tau X_t + \varepsilon_t \quad (4)$$

where: $Q_\tau(Y_t | X_t)$ = conditional quantile of the dependent variable; τ = selected quantile; β_τ = relationship coefficient at quantile τ .

Table 2. Quantile interpretation in quantile regression

Quantile	Interpretation
0.05	Extreme market downturn
0.10	Severe market decline
0.50	Normal market condition
0.90	Bull market condition

Source: compiled by the authors based on the quantile specification in the uploaded manuscript.

Interpretation: $\beta \leq 0$ during extreme quantiles indicates a safe haven; $\beta \leq 0$ during normal periods indicates a hedge.

Quantile regression is useful in this context because it allows the researcher to examine whether the relationship between precious metals and stock returns changes across different states of the market distribution, especially in the lower tail where safe-haven properties are most relevant (Baur & Lucey, 2010; Caporale & Gil-Alana, 2023).

Sub-period analysis. To study behavior during major crisis periods, the sample is divided into sub-periods.

Table 3. Sample period classification based on financial events

Period	Market Condition
2003-2007	Pre-Global Financial Crisis
2008-2009	Global Financial Crisis
2010-2019	Post-crisis stability
2020-2021	COVID-19 pandemic
2022-2023	Post-pandemic recovery

Source: compiled by the authors based on the sub-period structure in the uploaded manuscript.

This classification allows the study to evaluate whether the hedge and safe-haven properties of gold and silver differ across phases of financial stress and recovery. Such sub-period analysis is important because prior research shows that defensive asset behavior is often crisis-specific rather than universally stable across time (Gürkün & Ünalmış, 2014; Manuj, 2021).

Results. The results indicate that precious metals and the Indian stock market exhibit changing relationships over time. Gold generally shows a negative or weak correlation with the BSE SENSEX, especially during periods of stress, which supports its role as a safe haven. Silver behaves differently, showing a more unstable and often positive connection with stock returns, consistent with its greater industrial linkage. These findings are broadly in line with the previous literature, which argues that gold is more reliable than silver as a crisis-period defensive asset (Baur & Lucey, 2010; Caporale & Gil-Alana, 2023).

Descriptive analysis. To establish the general statistical characteristics of the analyzed series, it is necessary first to examine their descriptive properties. Descriptive statistics provide an initial understanding of the average returns, volatility, distributional asymmetry, and tail behavior of the BSE SENSEX, gold, and silver. This step is important because it allows the researcher to identify whether the assets differ in terms of stability and

exposure to extreme fluctuations before proceeding to more advanced econometric modeling. In the context of hedge and safe-haven analysis, these indicators are particularly useful because lower volatility and specific distributional features may signal stronger defensive potential.

The descriptive results presented in Table 4 therefore serve as the empirical foundation for the subsequent correlation and time-varying dependence analysis. Table 4 shows that the BSE SENSEX has the highest average return, followed by silver and gold. However, silver has the highest volatility and gold the lowest, indicating that gold is more stable than both silver and the stock market.

Table 4. Descriptive statistics of SENSEX, gold, and silver returns

Variable	Mean	Std. dev	Skewness	Kurtosis
SENSEX returns (%)	0.058	1.67	-0.36	6.11
Gold returns (%)	0.042	1.12	-0.21	4.38
Silver returns (%)	0.051	1.85	-0.48	5.92
BSE SENSEX	29,874	17,426	0.89	2.67
Gold price (INR/10g)	32,845	15,274	0.71	2.45
Silver price (INR/kg)	48,512	18,963	0.64	2.31

Source: compiled by the authors based on the descriptive results in the uploaded manuscript.

The negative skewness values suggest that adverse returns occur more frequently than strong positive returns. The kurtosis values above 3 for return series indicate fat tails and the presence of extreme observations, which justifies the use of econometric techniques capable of handling non-normal return behavior. Such distributional properties are typical for financial time series and reinforce the relevance of models focusing on dynamic and tail-risk relationships (Ciner et al., 2013; Ming, 2023).

Correlation analysis. After assessing the basic statistical properties of the variables, the next step is to examine their pairwise relationships. Correlation analysis provides an initial indication of whether gold and silver tend to move together with the Indian stock market or in the opposite direction. From the perspective of portfolio diversification, a weak or negative correlation with stock returns may indicate potential hedging benefits, while a positive correlation may signal weaker protective capacity. Although simple correlation coefficients do not capture changes across time or crisis intensity, they remain a useful starting point for understanding the average structure of interdependence among the analyzed assets.

Table 5 presents the correlation matrix of returns and offers a preliminary view of the relative diversification potential of gold and silver in relation to the BSE SENSEX.

Table 5. Correlation matrix of returns

Variable	SENSEX	Gold	Silver
SENSEX	1.00	-0.08	0.12
Gold	-0.08	1.00	0.34
Silver	0.12	0.34	1.00

Source: compiled by the authors based on the correlation results in the uploaded manuscript.

Gold has a weak negative correlation with the SENSEX, which implies diversification and hedging benefits. Silver has a weak positive relationship with stocks, indicating weaker defensive properties. Gold and silver are moderately positively correlated with each other. These findings are consistent with earlier research showing that gold often displays lower or negative average correlation with equities, whereas silver tends to be more sensitive to cyclical and industrial factors (Baur & Lucey, 2010; Feder-Sempach, 2025).

Dynamic correlation analysis. Since financial market relationships are rarely constant over long periods, it is essential to move beyond static analysis and evaluate how correlations evolve under different market conditions. In particular, the hedge and safe-haven properties of precious metals may strengthen or weaken depending on the level of uncertainty, market panic, or macroeconomic instability. The DCC-GARCH model is especially suitable for this purpose because it captures time-varying conditional correlations and allows the analysis to distinguish between normal and crisis periods. This dynamic perspective is crucial for determining whether gold and silver consistently provide defensive benefits or whether such benefits emerge only during selected episodes of financial stress. Table 6 summarizes the dynamic correlation estimates across major sub-periods and thus reveals how the relationship between precious metals and the BSE SENSEX changes over time.

Table 6. Dynamic correlation estimates from the DCC-GARCH model

Period	Gold-SENSEX	Silver-SENSEX
2003-2007 (pre-crisis)	-0.05	0.09
2008-2009 (Global Financial Crisis)	-0.21	-0.04
2010-2019 (Stable period)	-0.03	0.11
2020-2021 (COVID-19 crisis)	-0.18	0.02
2022-2023 (Recovery period)	-0.06	0.08

Source: compiled by the authors based on DCC-GARCH estimates in the uploaded manuscript.

The results show that gold becomes more negatively correlated with the stock market during crisis periods, especially during 2008-2009 and 2020-2021. This supports its role as a safe haven. Silver shows a much weaker and less stable relationship. Even when silver exhibits a slight negative correlation during the Global Financial Crisis, its magnitude is limited and does not remain consistent across crises. This confirms the broader literature that gold is typically more dependable than silver under severe financial stress (Gürkün & Ünalımsı, 2014; Caporale & Gil-Alana, 2023).

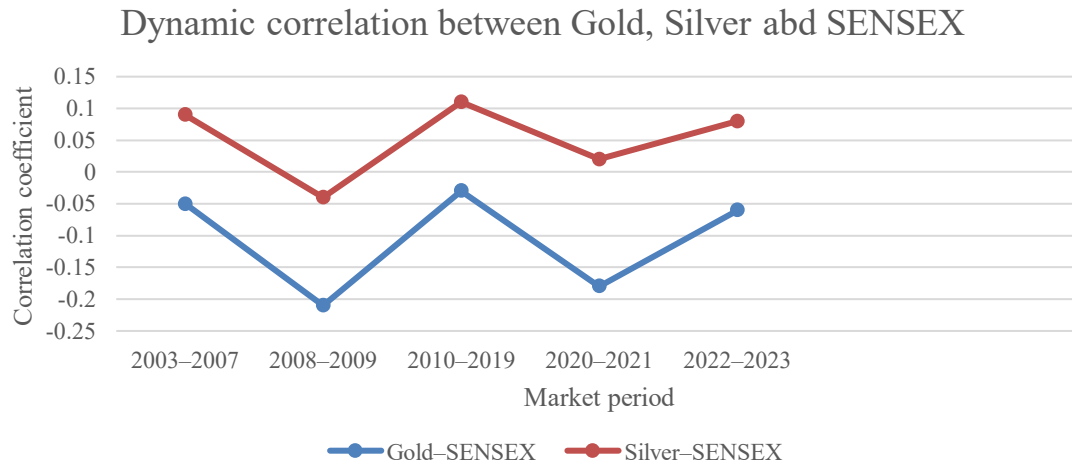


Figure 1. Time-varying correlation between precious metals and BSE SENSEX

Source: developed by the authors based on the dynamic correlation values presented in the uploaded manuscript.

Quantile regression results. While dynamic correlations provide valuable evidence on changing market interdependence, they do not fully explain how precious metals behave during the most extreme stock market downturns. To address this issue, the study applies quantile regression, which makes it possible to examine the relationship between the BSE SENSEX and precious metals across different parts of the return distribution. This approach is especially relevant for identifying safe-haven behavior because such behavior is expected to appear most clearly in the lower quantiles associated with severe market declines. In other words, quantile regression allows the analysis to determine whether gold and silver offer protection precisely when investors need it most. The estimates reported in Table 7 therefore provide deeper insight into the asymmetric and state-dependent defensive role of gold and silver in the Indian market.

Table 7. Quantile regression results

Quantile	Gold	Silver
0.05	-0.28	0.19
0.10	-0.21	0.16
0.25	-0.12	0.11
0.50	0.03	0.09
0.75	0.08	0.12
0.90	0.11	0.15

Source: compiled by the authors based on quantile regression estimates in the uploaded manuscript.

The negative coefficients for gold at lower quantiles indicate that gold acts as a safe haven during extreme downturns. At median and upper quantiles, the relationship turns slightly positive, suggesting hedge-like behavior under normal conditions rather than strong crisis insurance. Silver remains positive across all quantiles, which implies limited safe-haven value.

These results are aligned with the theoretical distinction between a hedge and a safe haven proposed by Baur and Lucey (2010) and are also compatible with more recent findings that gold's strongest protective capacity is concentrated in the lower tail of stock market returns (Ming, 2023).

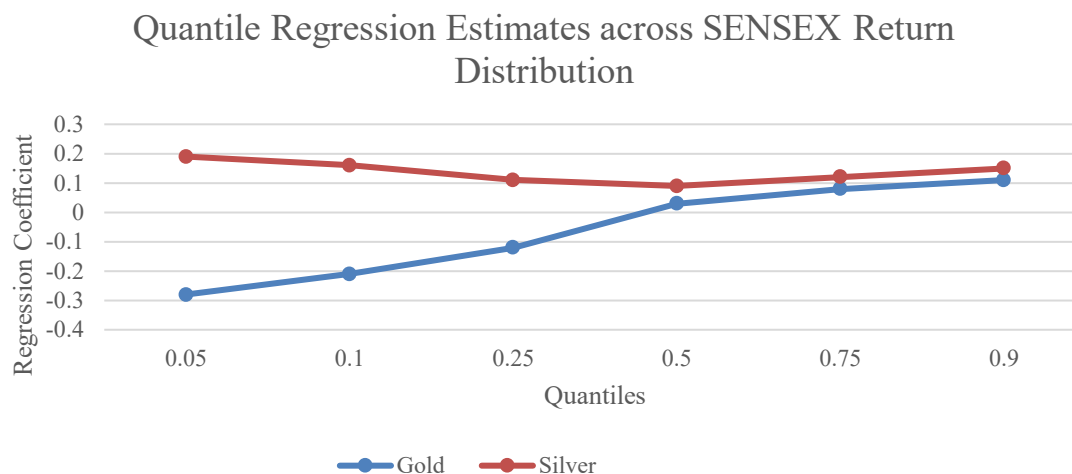


Figure 2. Quantile regression estimates of gold and silver across different quantiles of the SENSEX return distribution

Source: developed by the authors based on the quantile regression values presented in the uploaded manuscript.

The findings imply that adding gold to a portfolio can significantly reduce downside risk during market stress. Gold offers both diversification and crisis protection. Silver provides weaker protection and is less reliable as a defensive asset in stressed conditions. For Indian investors, gold appears to be the superior metal for portfolio stabilization. This conclusion is supported by studies emphasizing that gold retains a stronger and more stable defensive role relative to other metals across turbulent periods (Agyei-Ampomah et al., 2014; Feder-Sempach, 2025). From a practical perspective, investors in emerging markets may therefore consider gold as a strategic component of risk management and long-term portfolio resilience.

Discussion. The findings of this study provide important evidence on the defensive role of precious metals in the Indian stock market, with gold clearly outperforming silver as both a hedge and a safe-haven asset. The empirical results show that gold demonstrates a weak negative average correlation with the BSE SENSEX and becomes more strongly negatively related to stock returns during periods of severe financial stress. This pattern is consistent with the classical interpretation of gold as an asset that preserves value when investor confidence in equity markets weakens (Baur & Lucey, 2010; Ciner et al., 2013). In contrast, silver displays a weaker and less stable relationship with the stock market, indicating that its defensive capacity is more limited and less reliable across different market conditions.

These results are broadly consistent with the existing literature. The stronger safe-haven role of gold supports the conclusions of Baur and Lucey

(2010), who argued that gold can protect investors particularly during episodes of market turbulence rather than merely under average conditions. The present findings also align with Gürgün and Ünalmış (2014), who found that gold can serve as a safe haven in emerging and developing markets, and with Ming (2023), who emphasized that gold's protective role is especially visible in the lower tail of stock return distributions. The results regarding silver are similarly in line with Caporale and Gil-Alana (2023), who noted that gold and silver do not perform identically as protective assets and that silver's role is more conditional and less robust in times of crisis.

A particularly important contribution of this study is the time-varying nature of the analysis. Static correlations can be misleading because they conceal the fact that asset relationships change during stress periods. By using the DCC-GARCH framework, the study demonstrates that gold's correlation with the BSE SENSEX becomes more negative during the Global Financial Crisis and the COVID-19 pandemic. This confirms that the hedge and safe-haven properties of precious metals should not be treated as fixed characteristics. Instead, they are dynamic and shaped by the intensity of uncertainty, the direction of investor sentiment, and the structure of broader macro-financial shocks (Engle, 2002; Ciner et al., 2013). The stronger negative relationship observed for gold during crisis periods indicates that investors increasingly shift toward gold when confidence in equities deteriorates.

The quantile regression results further strengthen this interpretation. The negative coefficients for gold in the lower quantiles of the stock return distribution indicate that gold performs most effectively precisely when market conditions are most adverse. This is a defining feature of a safe-haven asset. At the same time, the coefficients become slightly positive at median and upper quantiles, suggesting that gold is not uniformly negatively correlated with equities across all market conditions. This nuance is important because it shows that gold should not be idealized as a universal insurance asset in every market state. Rather, its strongest value lies in its ability to cushion extreme downside risk. This interpretation is consistent with the conceptual distinction proposed by Baur and Lucey (2010) between a hedge and a safe haven.

Silver, by comparison, does not exhibit the same pattern. Its positive coefficients across quantiles suggest that it does not offer consistent protection during extreme downturns. One plausible explanation lies in the dual nature of silver. Unlike gold, silver is not only a financial asset but also an industrial commodity. Because of this, its price is more closely linked to industrial production cycles, manufacturing demand, and expectations about economic growth. During periods of market stress, these industrial linkages may weaken silver's defensive role and prevent it from functioning as a reliable shelter for investors. This helps explain why silver may still be useful

for diversification in ordinary times, yet remain less effective as a crisis-period safe haven (Agyei-Ampomah et al., 2014; Feder-Sempach, 2025).

The Indian context adds further relevance to these findings. India is one of the world's largest gold-consuming economies, and gold holds a unique position not only in investment behavior but also in household savings patterns, cultural practices, and informal wealth preservation. This may strengthen the local relevance of gold during uncertainty, particularly when domestic investors perceive it as a trusted store of value. Therefore, the observed defensive properties of gold in India may reflect both global market behavior and country-specific investor preferences. In this regard, the results also complement prior research on India that highlights the interconnectedness of gold prices, stock returns, and macro-financial variables such as exchange rates and oil prices (Jain & Biswal, 2016; Manuj, 2021).

From a portfolio management perspective, the study suggests that investors in emerging markets should differentiate carefully between assets that provide diversification under normal conditions and those that deliver true protection under crisis conditions. Gold appears to satisfy both functions more effectively than silver. This has practical significance for risk management, strategic asset allocation, and crisis-period portfolio construction. For institutional and retail investors alike, including gold in a diversified portfolio may help reduce downside exposure when equity markets experience sharp corrections. Silver may still have a role, but more as a supplementary diversification instrument than as a primary defensive asset.

At the same time, the findings should be interpreted in light of several limitations. First, the study focuses only on the Indian market, which may limit the generalizability of the results to other emerging economies with different financial structures and investor cultures. Second, the analysis centers on gold and silver and does not compare them with other potential safe-haven assets such as government bonds, the U.S. dollar, oil, or cryptocurrencies. Third, although the time-varying and quantile-based framework captures important nonlinearities, future studies could extend the analysis by incorporating structural break models, regime-switching approaches, or volatility spillover methods to explore crisis transmission more comprehensively. These limitations do not weaken the core findings, but they indicate useful directions for further research.

Overall, the discussion confirms that gold occupies a stronger and more consistent defensive position than silver in the Indian stock market. The evidence supports the view that gold is not merely a traditional symbol of wealth preservation but also a statistically meaningful instrument of portfolio protection in periods of severe financial instability. Silver, while still relevant for diversification, does not demonstrate the same stability of protection. Consequently, the study reinforces the importance of

distinguishing between different precious metals rather than treating them as equivalent safe-haven assets.

Conclusion. This study examined whether gold and silver act as hedges and safe havens for the Indian stock market. The empirical results indicate that gold tends to move independently of, or negatively relative to, the BSE SENSEX during periods of market stress, confirming its role as a safe haven. During normal market conditions, gold functions more as a hedge and diversification tool. Silver, by contrast, shows a more unstable and often positive relationship with stock returns, which suggests that it is less effective than gold as a safe-haven asset. These conclusions are consistent with the broader literature on precious metals and financial market turbulence (Baur & Lucey, 2010; Ciner et al., 2013; Caporale & Gil-Alana, 2023).

The results demonstrate that gold provides stronger downside protection than silver in India. This has clear implications for asset allocation and portfolio risk management, especially in emerging markets where financial conditions may be highly sensitive to external shocks. The study therefore reinforces the value of gold as a portfolio stabilizer and a defensive asset during uncertain times. At the same time, the evidence suggests that silver may still serve a supplementary diversification role, although its defensive function remains weaker and less consistent.

For investors, portfolio managers, and policymakers, the results underline the importance of including precious metals, especially gold, as part of a broader risk management strategy in the Indian financial market. Future research may extend this analysis by incorporating other emerging markets, additional safe-haven assets, or higher-frequency crisis-period data in order to further refine the understanding of defensive asset behavior.

Conflict of interest. The authors declare that the research was conducted in the absence of any commercial, financial, or personal relationships that could be construed as a potential conflict of interest.

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Ethical aspects. This study was based exclusively on publicly available secondary data, official statistical sources, and published scientific literature. The research did not involve human participants, animal subjects, or the collection of personal data. Therefore, ethical approval was not required. All research procedures were conducted in accordance with generally accepted principles of academic integrity and research ethics.

Generative AI statement. The authors declare that no Generative AI was used in the preparation of this manuscript unless otherwise explicitly stated in the manuscript.

Author contributions. All authors contributed equally to the conceptualisation of the study, research design, data analysis, interpretation

of the results, and preparation of the manuscript. All authors reviewed and approved the final version of the manuscript and agreed to be accountable for its content.

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