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Volatility & Relationship of Gold & Gold ETF in India

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Abstract- This research article was intended to estimate the volatility and connection between real Gold and Gold Exchange Traded Fund (ETF) in India by using various statistical models. The data for the study period for three years period 2015-2018 acquired from the National Stock Exchange of India's historical statistics and others. The outcome of this study was found that there are a strong positive short-run relationship and long-run equilibrium relation between gold and Gold ETFs. It is unidirectional, and few bidirectional causes and relationship existed in this study. This Study is fit to be analyzed GARCH model to estimate volatility in the Gold price returns; it shows there persist the volatility effect. This study will be helpful to investors in the selection of better investment options.

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I. Introduction

Gold is one of the treasurable and oldest metals among the inventions of the humankind. From ancient times, gold is accepted as the medium of exchange and as highly valuable wealth used in India. Times may change still gold stands as a traditional investment for everyone beyond the economic status. There are more than 16,000 tons of gold are available in India, and almost every family possess gold for its sentimental attachment. Gold has three purposes in general, namely - like ornaments, as household investments, and for industrial consumption.

In the 21st century, investors are more sensible enough to avoid high risk. In recent days, as the share prices are volatile, the investors are not anxious to invest their funds in the stock; they prefer investing in gold for its safety and liquidity. Volatility is the deviation of the return around its mean values either in the positive or negative direction. The Estimating of volatility becomes an essential task in the management of the portfolio. In the case of gold, its price always depicts an increasing trend to benefit the investors even during the recession period. However, the investment in gold needs a huge fund due to its excessive demand and less supply. Due to this, small investors find it hard to invest in bullion markets.

To enable the small-time investors to park their fund in the gold market, the Gold Exchange Traded Fund (Gold ETF) scheme introduced in the USA in the year 1993. In India, the ETF method is in vogue since 2007 onwards. The scheme Gold ETFs is just like other stock which is traded generally in the stock markets. It is a kind of mutual fund that is listed and operated in the stock market. They can be bought and traded through the online Demat account. As the system is more accessible and requires a less small amount of fund to invest, the schemes under GTFs are more lucrative for small investors, unlike conventional gold. This study aims to observe the casual relationship and volatility among the natural Gold and Gold ETF.

II. Review of Literature

A very few studies have conducted in the field of gold Exchange traded fund, which is referred to in this segment of review of the literature. (Pandey, 2010) felt that buying Gold ETF is safer, convenient, and adds some tax-oriented benefits when compared with physical gold. (Mishra, Das & Mishra, 2010) attempted the casual relationship between Indian natural gold price and stock market indices return found that there is a long-run equilibrium relationship exists, and the one-way causal relationship was noticed between Gold price and Stock market return. (Athma, Prashanta, & k, 2011) Stated that gold investment is less volatile while comparing with equity share investment. Gold ETF is one of the best methods for portfolio diversification.

(Kumar, Kumar, & Roy, 2012) analyzed the Gold ETFs performance by conducting risk and returns, and proved that Gold ETF had given good return compared with equity fund. (Nemavathi & Nedunchezhian, 2013) Attempted to estimate the volatility of gold and Gold ETF by using EGARCH model. They concluded the volatility of the fund is based on their yield performance. (Narend, 2014) Analyzed performance of Gold ETFs by Jensen Alpha Return. They estimated that ETFs are giving more returns and performing better than physical gold. (Tripath, Parashar & Singh, 2014) studied the causal relationship between the gold price and other macroeconomic factors, the result shows that there are Granger Causes that exists in the exchange rate and oil price in India.

(Mishra P. K., 2014) stated that gold is the best investment option for an investor in the alternative of other investments and there was a bidirectional connection between the gold price and stock market return in India. (Gencer & Musoglu, 2014) empirically analyzed gold price in Turkey by using the GARCH model and result expressed that market return has an

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impact on gold price volatility. (Anand, 2017) Found that Gold ETFs are influenced by gold price in India. In a long-run relationship, gold ETFs are giving more return, so it attracts the investors to invest in Gold ETF. (Jain & Mary, 2018) Found that gold ETF is a new concept in the investment portfolio for small investors. Gold ETFs is an easy and convenient way of trading. Investors need not worry about the security on holding storage and other physical damage like theft and due to natural scarcity of demand in gold.

However, the literature review reveals a certain aspect of the real truth of the research on the existence of Gold and Gold ETF. This study aims to estimate the short run and long run relationship between gold and Gold ETFs and its volatility.

III. Objective of the Study

- To investigate the volatility effect in Real Gold and Gold ETFs;
- To analyze the short run and long run association between Gold and Gold ETFs in India;
- To observe the impact of Real Gold price return in Gold ETFs return in India.

IV. Research Methodology

This study was aimed at estimating the volatility and relationship between Gold and Gold ETF in India. For this purpose, the top five gold ETFs which are listed in the National Stock Exchange was chosen based on the returns in the field of Gold ETFs in India. The Gold ETF selected for study are presented in Table 1.

Table 1: List of Gold Exchange Traded Fund in India

The issuer of the ETF	Name of the ETF	Symbol of the ETF	Return
Axis Mutual Fund	Axis Gold ETF	AXIS GOLD	9.45
HDFC Mutual Fund	HEDFC Gold Exchange Traded Fund	HDFCMFGETF	7.64
IDBI AMC	IDBI Gold Exchange Traded Fund	IDBI GOLD	9.03
Kotak Mutual Fund	Kotak Gold Exchange Traded Fund	KOTAK GOLD	7.73
Quantum Mutual Fund	Quantum Gold Fund (an ETF)	QGOLD HALF	6.63

Source: Bombay Stock Exchange

This study is empirical in nature, based on secondary data. The daily historical data from 1 November 2015 to 31 October 2018 (739 Daily Observations) were collected from National Stock Exchange (for GOLD ETF) and World Gold Council (for Physical Gold) for estimating volatility and relationship of gold and gold old ETF. The return on the gold price was calculated as the logged difference between time period t and t_{-1}.

$$R_t = \log (P_t) - \log (Pt_{-1})$$

Where R_t is the daily return of gold price at time t. P_t denotes the price of gold per gram at time periodt,and P_{t-1} indicates the price of gold per gram in the selected ETFs at time period t-1. For analyzing the data, various econometrics tools used such as the Augmented Dickey-Fullertest, Granger Causality, Johenson Cointegration test, and GARCH model and LM-ARCH test were applied by using "Eviews 10" statistical software package.

V. Empirical Results

Descriptive Statistics: The descriptive statistics of Gold and Gold Exchange Traded Funds are presented in Table 2.

Table 2: Summary Statistics of the Gold and Gold ETFs

	AXIS GOLD	HDFC MFGETF	IDBI GOLD	KOTAK GOLD	QGOLD HALF	REAL GOLD
Mean	2629.91	2720.27	2739.27	261.30	1322.21	83187.08
Median	2629.00	2723.75	2750.00	262.00	1325.00	83555.39
Max	2908.95	2939.70	3000.00	284.75	1426.00	91428.01
Min	2243.60	2341.90	2335.00	225.25	1148.60	69740.48
Std. Dev.	142.24	129.91	146.00	12.573	59.339	4538.491
Skewness	-0.6786	-0.9261	-0.7008	-0.8703	-0.9519	-0.9046
Kurtosis	3.6776	3.9573	3.1803	3.7967	3.9789	3.8795
Jarque-Bera (Prob)	71.066 (0.000)	134.229 (0.000)	61.663 (0.0000)	113.151 (0.0000)	141.502 (0.0000)	124.96 (0.0000)

Source: Author's calculation.

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Table 2 displays the summary of statistics of the gold and gold ETF data. As per the table, the mean values of gold ETFs are varied from each gold funds. Among these funds, IDBIGOLD had a more standard deviation that means that gold fund more volatile in the market and it has high risk; KOTAKGOLD was less volatile compared with other gold funds. Gold is very high because of various macroeconomic factors. The skewness for the gold funds and gold was almost negative (asymmetrical value), and Kurtosis concerned for Gold funds it was found to be nearly 3 (approximately). The Jarque Bara test for regularity was significance at the level of 5%, indicating the data used for this study were not normally distributed.

Analysis of Correlation Test: The correlation coefficient is used to measure the extent of the strength and direction of the connotation between the indices and stock returns in different countries. The analysis of Karl Pearson's Correlation is presented in Table 3.

Table 3: Karl Pearson's Correlation Test

	REAL GOLD	AXIS GOLD	HDFC MFGETF	IDBI GOLD	KOTAK GOLD	QGOLD HALF
REAL GOLD	1.0000	0.9273	0.9752	0.9584	0.9499	0.9621

Source: Author's calculation.

From table 3, Karl Pearson's Correlation among the Gold ETFs and Real Gold show that the entire gold fund's price is positively correlated with Real Gold price. That means all the Gold ETFs have a short run relationship. As per the table, all the values are above 95% (approximately), so each fund has a strong positive relationship with Indian gold price. Thus, to with stand the shocks, Multiple Regression Test has been conducted considering Gold as the dependent variable and other Gold ETFs as an independent variable.

Analysis of Regression Test: The Multiple Regression of Gold and Gold Exchange Traded Funds are presented in Table 4.

Table 4: Analysis of Regression Test

Dependent Variable	Real Gold	
Independent Variable	Coefficient	Prob
AXISGOLD	2.0577	0.0228
HDFCMFGETF	33.179	0.0000
IDBIGOLD	9.4062	0.0000
KOTAKGOLD	-81.755	0.0000
QGOLDHALF	-8.0132	0.0870
R-Squared		0.9600
Adj. R-Squared		0.9597
Durbin-Warson		0.6075

Source: Author's calculation.

Table 4 shows the result of Multiple Regression Analysis, which is conducted on non-stationary data. As per the table, the R-squared value is nearly 96% that means, the independent variable is having a high impact on the dependent variable. Almost all the independent variables are significant at 5% level other than QGOLDHALF, among those variables HDFC gold ETF has an extremely high coefficient value.

Augmented Dickey-Fuller Unit Root Test: Before examining the relationship between Gold and Gold ETF, it is crucial to check the univariate properties of the data sequence are non-stationary, or they comprise a unit root. For that, the ADF unit root test is employed, which was developed by Dickey-Fuller. A time series is said to be stationary; that means, the alteration of the series does not symmetrically fluctuate over time. Non-stationary data will lead to incorrect values. (Dickey & Fuller, 1979). Unit root was calculated as per the following equation:

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \sum_{i=1}^{m} \alpha i \, \Delta Y_{t-i} + \varepsilon_t$$

Where δY_{t-1} is the first difference operation, β_1, $\beta_2 t$ are coefficient to be estimated. $\delta = 0$, ε_t is white noise error term, if the estimated slope of coefficient not in this regression δ (hypothesis) is zero or not. if it is zero, then Y_t is nonstationary. The best lag length was taken with the Akaike Information Criterion (AIC) and maximum, lagwas put to 36. (Gujarati, 2009)The ADF null hypothesis is established as unit root in the time series, whereas, the alternative is - there is no unit root and it is stationary, which is observed and presented in table 5.

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Table 5: Augmented Dickey-Fuller Unit Root Test				
	At level		1st Difference	
	t-Statistic	Prob	t-Statistic	Prob
REAL GOLD	-2.1419	0.2284	-28.9504	0.0000
AXISGOLD	-2.0972	0.2460	-32.7590	0.0000
HDFCMFGETF	-2.0305	0.2737	-28.5065	0.0000
IDBIGOLD	-2.0482	0.2662	-19.9737	0.0000
KOTAKGOLD	-2.1085	0.2415	-29.1821	0.0000
QGOLDHALF	-1.8825	0.3407	-27.3636	0.0000

Source: Author's calculation.

Table 5 presented the t statistics and prob values of all the Gold ETFs at both level and first level. From the table, all the probability value of 'At level' is not significant that means the data series is not stationary; it has a unit root. In the first difference, all the index probability value is less than 5%, that means it rejects the null hypothesis to accept the alternative, so the data is stationary.

Analysis of Granger Causality test: The Granger causality test is directed to inspect the direction of causality amongst Real gold and Gold ETFs. This test is applied only to stationary time series data. Granger causality was calculated as per following formula (Gujarati, 2009)

$$\Delta Y_t = \sum_{i=1}^{m} \alpha_i Y_{t-i} + \sum_{j=1}^{m} \beta_j X_{t-j} + \lambda_1 t + \varepsilon_1 t$$

$$\Delta X_t = \sum_{i=1}^{m} \gamma_i X_{t-i} + \sum_{j=1}^{m} \delta_j Y_{t-j} + \lambda_2 t + \varepsilon_2 t$$

Where Δ is the difference operator, Y_{t-i} and X_{t-j} are represent as the lagged value of Y_t and X_t. ε_1 and $\varepsilon_2$are error terms assumed white noise. The lag length was picked by using Akaike Information Criteria (AIC) as the most favourable number. The Granger Causality Test results are presented in Table 6 -

Table 6: Granger Causality test		
Null Hypothesis	F-Statistic	Prob
AXISGOLD does not Granger Cause REAL GOLD	3.3851	0.0344
REAL GOLD does not Granger Cause AXISGOLD	33.805	9.E-15
HDFCMFGETF does not Granger Cause REAL GOLD	4.5756	0.0106
REAL GOLD does not Granger Cause HDFCMFGETF	59.300	1.E-24
IDBIGOLD does not Granger Cause REAL GOLD	2.4024	0.0912*
REAL GOLD does not Granger Cause IDBIGOLD	32.613	3.E-14
KOTAKGOLD does not Granger Cause REAL GOLD	1.1033	0.3323*
REAL GOLD does not Granger Cause KOTAKGOLD	44.931	4.E-19
QGOLDHALF does not Granger Cause REAL GOLD	2.7437	0.0650*
REAL GOLD does not Granger Cause QGOLDHALF	49.359	8.E-21

Source: Author's calculation.

The table 6, expresses that Granger Causality Test results in which the value of probability is less than 5% that means it rejects the null hypothesis, showing that the Axis Gold ETF and HDFC Gold ETF are bidirectionally caused with gold, other variables are causing unidirectionally. So, all the data are having cause and relationship with Real gold. Particularly the price of real gold has more effect on the rate of Gold ETFs.

Results of Co-integration Test: (Johansen, 1990) Co-integration test is the most commonly used method in investigative the long-run equilibrium association of the different time series or integration in the financial market. The data becomes stationary after the first difference in the ADF test. Following table 7, shows the cointegration relation between Real Gold and Gold ETFs.

Table 7: Johansen Cointegration Test					
	Hypothesized No. of CE(s)	Trace Statistic	prob	Max-Eigen Statistic	prob
AXISGOLD	None	21.241	0.0061	14.8393	0.0405
	At most 1	6.4020	0.0114	6.4020	0.0114
HDFCMFGETF	None	39.338	0.0000	30.736	0.0001
	At most 1	8.6020	0.0034	8.6020	0.0034
IDBIGOLD	None	53.773	0.0000	46.998	0.0000

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	At most 1	6.7741	0.0092	6.7741	0.0092
KOTAKGOLD	None	32.568	0.0001	24.643	0.0008
	At most 1	7.9250	0.0049	7.9250	0.0049
QGOLDHALF	None	31.048	0.0001	0.0261	0.0007
	At most 1	11.571	0.0007	11.571	0.0007

Source: Author's calculation.

The result of the cointegration test, Trace and Max-Eigen values are checked at 5% significant level. Here the null hypothesis is that 'these series are not integrated with the Real Gold Price'. As per the table 7, all the Gold ETFs are less than 5% level of significance. That means to reject the null hypothesis and accept the alternative one. All the Gold ETFs are having a long-run equilibrium relationship with Real Gold Price.

Estimation of Volatilit: GARCH model is useful in analyzing the financial time series such as market indices. A unique feature of these models is that the error variance may be correlated over time because of the phenomenon of volatility clustering. The AutoRegressive Conditional Hetroskedacity model was developed by (Engle, 1982) or Generalised AutoRegressive Conditional Hetroskedacity Effect (Bollerslev, 1986). GARCH model was initially proposed by Bollerslev the simplest model GARCH (1,1) can be inscribed as (Gujarati, 2009)

$$\sigma^2{}_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \varepsilon^2_{t-i} + \sum_{j=1}^{q} \beta_j \, \sigma^2_{t-j} + \lambda$$

Where σ2t is the variance for the time t. αi and βj are coefficients. εt-i is the lagged residual from the mean equation and, σ2t-j is the lagged variance from the period t-j. λ is the coefficient measuring the impact of real gold price on Gold ETFs. Estimated GARCH coefficient and prob value for returns are presented in Table 8.

Table 8: Volatility Estimation

	ARCH	GARCH	REAL GOLD
AXISGOLD	0.0938 (0.0000)	0.8363 (0.0000)	0.0002 (0.0295)
HDFCMFGETF	0.1368 (0.0072)	0.1911 (0.2987)	0.0004 (0.0032)
IDBIGOLD	0.0406 (0.0000)	0.9401 (0.0000)	0.0008 (0.0000)
KOTAKGOLD	0.1200 (0.0024)	0.2277 (0.3040)	0.0002 (0.1267)
QGOLDHALF	0.0961 (0.0455)	0.4087 (0.0241)	0.0004 (0.0000)

Source: Author's calculation.

From table 8, ARCH and GARCH coefficient were all significant at 5% level, other than KOTAKGOLD Which means there is an autoregressive effect in all the Gold ETFs. So, the future is influenced by the past movement of gold fund returns and GARCH implies there is strong volatility clustering effect was found in the data. The impact of Real gold in Gold ETFs was significance ag 5% level. However, the coefficient values are very less that means even though it has an impact,butit is not a strong impact over the ETFs.

ARCH-LM test: ARCH LM tests were conducted to find out whether any autocorrelation was found in the residuals of the GARCH equation, which is necessary to verify any arch effect that has remained in the data or not. The null hypothesis of this test is that the residuals from the Generalised AutoRegressive Conditional Hetroskedacity equation do not have the ARCH type of heteroskedasticity. Residuals are free from autoregressive heteroskedasticity, the estimated coeffect (Obs*R-Squared) of the ARCH-LM test and its P values are obtainable in Table 9.

Table 9: ARCH-LM Test

	Obs*R-squared	Prob
AXISGOLD	0.6909	0.4058
HDFCMFGETF	0.3394	0.5602
IDBIGOLD	1.1808	0.2778
KOTAKGOLD	0.2631	0.6080
QGOLDHALF	0.0065	0.9355

Source: Author's calculation.

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From table 9, the coefficient value is not signified in the all Gold ETFs at a 5% level of significance. So, the null hypothesis is rejected that means the data does not have any heteroskedasticity in the residual value after GARCH estimations. So, this model is fit for thevaluation of GARCH estimation in the Gold and Gold ETF returns.

VI. Findings

- ✓ There is a short-term association between real Gold price and Gold ETF price return by using a correlation test. It shows a Strong positive relationship.
- ✓ There are a cause and relationship between Gold price and Gold ETFs by measuring the Granger causality test; it reveals that it is unidirectional, and few bidirectional relationships also found in the data.
- ✓ There is a long-run equilibrium connection between Gold and Gold ETFs by analyzing Johenson cointegration test.
- ✓ By estimating Volatility and Volatility clustering effect, it was significant in all the Gold ETFs. So, it implies that all the data are performing like past performance.
- ✓ It is proved that there is a positive impact of real gold in Gold ETFs.
- ✓ This study is perfectly fit for analyzing GARCH model; this was proved by ARCH-LM test.

VII. Conclusion

This research article was planned to examine the relationship and volatility between real gold and gold ETFs in India. For the period of three years from 1 November 2015 to 31 October 2018, with selected Gold Exchanged traded funds by using various econometric analysis. The study was found that there is a strong positive relationship amongst the real gold and gold ETFs. By measuring the correlation test implies there exist short-run relationship and by using Johenson cointegration test, it shows that there is a long-run equilibrium relationship also. The data for the study was non-stationary while calculating ADF at first level it was significant at 5% level that means the data termed to be stationary. By using the Granger causality analysis, it shows that there are a cause and relationship between gold and Gold ETFs either in one way or both the ways. The volatility effect and clustering effect was found in the Gold ETFs; all the gold funds are performing almost the same as the past period performance. These results help to investors, market research's, companies and other financial institutions to make the best decision towards the Gold ETFs. It will also help to increase the Gold ETFs trade in the future.

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