

Volatility ARCH And GARCH Effect on Returns to Gold Electronically Traded Funds

Dr. Kiran Kumar C. R.

Associate Professor, Department of Economics, Government First Grade College for Women, K.R. Nagar, Mysuru, Karnataka

Abstract—The very nature of financial time series is random and subject to volatility. Hence, prediction of its return is not only difficult it is not reliable. In this background the present paper has examined the presence of ARCH and GARCH effects on returns to ETF using time series data. For the present study the standard ARCH and GARCH procedures are used. It is found that the time series data used for the present analysis is non-stationary at level and found stationary at first difference. The mean regression estimated for returns to ETF and the residuals for returns to ETF are generated and found from the diagnostic tests that there are sufficient evidences for presence of heteroscedasticity in returns to ETF. It is found from the ARCH estimations that the previous shocks are having significant impact on the current volatility clustering of returns to ETF. It is also found from the GARCH estimations that the previous conditional variances for returns to ETF are having significant impact on current conditional variance. Therefore, there are significant ARCH and GARCH effects and hence, returns on ETF are not reliable. Accordingly, there is need of careful examination of ETF price fluctuations and volatility before investing in ETF shares.

I. INTRODUCTION

A Gold Exchange Traded Fund (Gold ETF) is a market-linked investment product that provides investors with exposure to the price of gold without requiring them to purchase, store, or insure physical gold (Jesse, Sarah, & Thierry, October 2018). Gold ETFs are generally structured as open-ended mutual fund schemes and are traded on stock exchanges, allowing investors to buy and sell ETF units during market hours in a manner similar to shares (Sahi, Kamboj, & Mittal, 2013). In India, Gold ETFs operate within the regulatory framework of the Securities and Exchange Board of India (SEBI). SEBI's framework provides for Gold ETFs to invest primarily in gold and

permitted gold-related instruments (Bolomope, Amidu, Filippova, & Levy, 2020).

Trading in SEBI platform for gold ETF is subject to market risk due to unpredicted price fluctuations and volatilities (Muazila & Fibria, 2022). Accordingly, investing in gold ETF is always subject to risk (Vijayalakshmi & Sathishkumar, 2019). Hence, there is need to understand the risk and uncertainties involved in the trading of gold ETF. In this background in the present paper an attempt has been made to examine the volatility clustering in the returns to gold ETF.

II. REVIEW OF LITERATURE:

The applicability of behavioural finance in the modern society with relation to the investment decisions are made by the investors (Banerjee, 2011). Many factors have been influenced the investment behaviour like gender and demographic factors (Siraji, Nazar, & Ishar Ali, 2021), (Priya & Seema). The financial variables like returns to ETF are random and difficult to estimate and predict the returns (Vijayalakshmi & Sathishkumar, 2019).

It is also found from the previous literature that investors of middle-income level agree that regular income and liquidity of the investment plays a vital role in investment decisions (Devrshi, 2021). Many studies have tried to estimate the risk in financial market using traditional approaches (Pooja Chaturvedi, 2024). Use of ARCH and GARCH methods for assessing the risk and volatility are very rare with standard time series procedures. Accordingly, in the present paper an attempt has been made to examine the presence of volatility in the returns to gold ETF.

III. METHODOLOGY

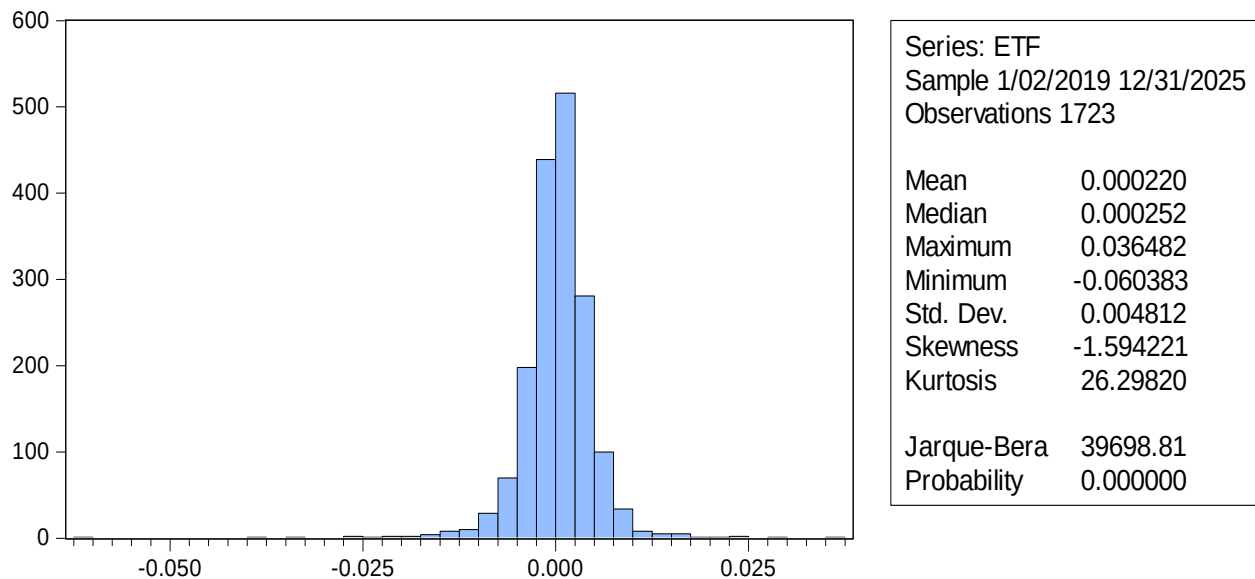
The present paper used time series procedures to examine the risk and volatility in returns to gold ETF. The present study used time series daily data from January 2019 to December 2025. The returns to gold ETF are calculated using $\log(P_1/P_0)$. The descriptive statistics are used to explain the status of gold ETF. The Augmented Dickey-Fuller procedure used to verify the stationarity of data. The mean regression is computed to generate the residuals. The diagnostic heteroscedasticity test was conducted to confirm the presence of Auto Regressive Conditional Heteroscedasticity (ARCH) in the residuals. ARCH

(1) and Generalized Auto Regressive Conditional Heteroscedasticity (GARCH) (1) methods are used to estimate the influence of previous shocks on present volatility and influence of previous conditional variance on the present conditional variance. The results are accepted at one percent level of significance.

IV. RESULTS AND DISCUSSION

The results of the present study are present bellow with discussion and the time series econometric procedures are followed while analyzing the results.

Table 1: Status of Returns to ETF



Source: NSE of India Website

The above table presents the status of returns to ETF during 2019-2025. It is found the mean of returns to ETF is positive and it is log of 0.000220, the minimum is negative and maximum is positive. The value of kurtosis is very high (26.298) and the distribution is not normally distributed (39698.81) as normal distribution. Therefore, the returns to ETF are expected to have volatility and ARCH and GARCH effects. Accordingly, in the following section an attempt has been made to examine the impact of ARCH and GARCH on returns to ETF.

The first procedure of volatility analysis is to verify the stationarity of data. it is found from the Augmented Dickey-Fuller (ADF) test that the time series data is found non-stationary and found stationary (tau: -

19.037, p: 0.000) at first difference. Accordingly, the ARCH and GARCH applications are appropriate for the ETF time series data on returns to ETF.

Table 2: The Mean Regression Heteroscedasticity for Returns to Gold ETF

Dependent Variable: ETF				
Method: Least Squares				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000220	0.000116	1.896982	0.0580
Heteroscedasticity Test: ARCH				
F-statistic	65.08342	Prob. F (1,1720)		0.0000
Obs*R-squared	62.78343	Prob. Chi-Square (1)		0.0000

Source: NSE of India Website

The simple regression with least square method estimated with a single constant and returns to ETF as dependent variable. The primary objective the mean regression is to generate the residual and verify the presence of heteroscedasticity in the time series ETF data. Accordingly, using the mean regression the residuals are generated and verified for the heteroscedasticity. It is found from the diagnostic test

that the F-statistic (65.083) for the residuals of returns to ETF is very high and significant and Chi-square is also significant. Accordingly, there is proof for presence of ARCH in the time series on returns to ETF.

The following graph shows the fluctuations and volatility in the residuals of time series regression for returns to ETF.

Graph 1: Residuals of Mean Regression for Returns to Gold ETF

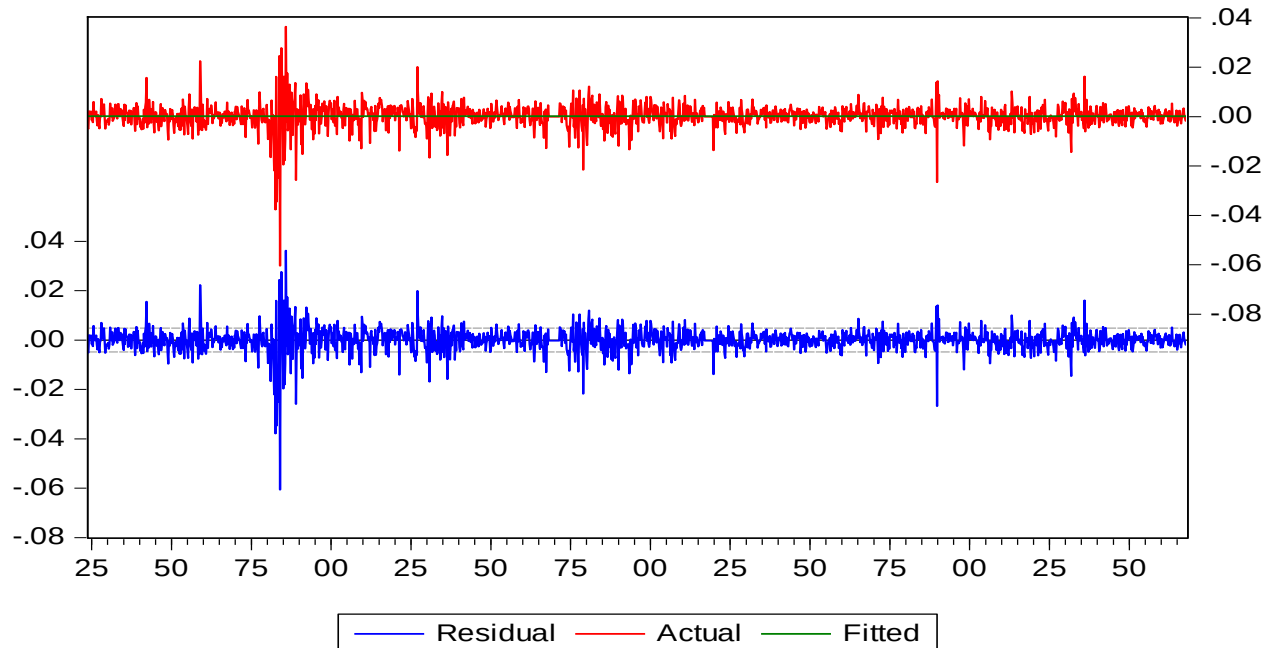


Table 3: Impact of ARCH and GARCH on Returns to Gold ETF

Dependent Variable: Returns on ETF				
Method: ML - ARCH (Marquardt) - Normal distribution				
GARCH = C (2) + C (3) *RESID (-1) ^2 + C (4) *GARCH (-1)				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.000308	8.03E-05	3.835677	0.0001
Variance Equation				
C	8.00E-07	1.04E-07	7.670720	0.0000
RESID (-1) ^2	0.119562	0.009564	12.50140	0.0000
GARCH (-1)	0.837762	0.013786	60.76685	0.0000

Source: NSE of India Website.

Both mean and variance models are estimated and presented above. It is found from the variance model

that the coefficient of C (3) *RESID (-1) ^2 is (0.119) in statistically (0.000) significant. Accordingly, the previous shocks are having significant impact on the current volatility clustering. The coefficient of C (4) *GARCH (-1) is (0.838) is also statistically (0.000) significant. Accordingly, the previous conditional variances are having significant impact on current conditional variance. Therefore, there is significant ARCH and GARCH effect and hence, returns on ETF are highly not reliable.

V. CONCLUSION

The present paper has examined the presence of ARCH and GARCH effects on returns to ETF using time series data. The time series data used for the present analysis is non-stationary at level and found stationary at first difference. The mean regression estimated for returns to ETF and the residuals for

returns to ETF are generated and found from the diagnostic tests that there are sufficient evidences for presence of heteroscedasticity in returns to ETF. It is found from the ARCH estimations that the previous shocks are having significant impact on the current volatility clustering of returns to ETF. It is also found from the GARCH estimations that the previous conditional variances for returns to ETF are having significant impact on current conditional variance. Therefore, there are significant ARCH and GARCH effects and hence, returns on ETF are not reliable. Accordingly, there is need of careful examination of ETF price fluctuations and volatility before investing in ETF shares.

REFERENCE

- [1] Banerjee, "Application of behavioural finance in investment decisions: An overview," *The Management Accountant*, vol. 46, no. 10, 2011. [Online]. Available: <https://ssrn.com/abstract=3259747>
- [2] M. Bolomope, A.-R. Amidu, O. Filippova, and D. Levy, "Property investment decision-making behaviour amidst market disruptions: An institutional perspective," *Property Management*, vol. 39, no. 1, pp. 1–21, 2020.
- [3] U. Devrshi, "An analytical study on investor behavior and perception towards mutual funds as investment avenue in Ahmedabad," *Journal of the Maharaja Sayajirao University of Baroda*, vol. 55, no. 1(II), pp. 101–106, 2021.
- [4] C. Jesse, B. Sarah, and B. Thierry, *Agricultural Investments under International Investment Law*. ISSD, Oct. 2018.
- [5] N. Muazila and I. Fibria, "Application of Theory of Planned Behavior (TPB) in cryptocurrency investment prediction: A literature review," *The Asian Institute of Research*, vol. 5, no. 2, pp. 181–188, 2022.
- [6] S. Pooja Chaturvedi, "Influence of behavioural biases on market investment behaviour— Mediating role of brand trust," *Interdisciplinary Journal of Management Studies (IJMS)*, vol. 17, no. 1, pp. 1–19, 2024.
- [7] K. Priya and S. Seema, "Investment behaviour of Indian investors: Gender biasness," *JEL Classification*, pp. 1–12, n.d.
- [8] S. Sahi, S. Kamboj, and S. Mittal, "An empirical analysis of the behavioural factors affecting individual investment decisions," *Journal of Commerce and Business Studies*, Delhi School of Economics, University of Delhi, Jul. 2013. [Online]. Available: <https://ssrn.com/abstract=2996358>
- [9] M. Siraji, M. Nazar, and M. Ishar Ali, "Irrational behaviour and stock investment decision: Does gender matter? Evidence from Sri Lanka," *Revista Geintec*, vol. 11, no. 2, pp. 2185–2204, 2021.