

**IS GOLD HEDGE, OR SAFE HAVEN ASSET? EVIDENCE FROM INTERNATIONAL STOCK MARKETS****DASAUKI M.C.****DEPARTMENT OF ECONOMICS, VERONICA ADELEKE SCHOOL OF SOCIAL SCIENCES (VASSS)****BABCOCK UNIVERSITY, ILISHAN-REMO, OGUN STATE, NIGERIA****OBIAKOR R. T.****DEPARTMENT OF ECONOMICS, VERONICA ADELEKE SCHOOL OF SOCIAL SCIENCES (VASSS)****BABCOCK UNIVERSITY, ILISHAN-REMO, OGUN STATE, NIGERIA****EDY-EWOH U.****DEPARTMENT OF ECONOMICS, VERONICA ADELEKE SCHOOL OF SOCIAL SCIENCES (VASSS)****BABCOCK UNIVERSITY, ILISHAN-REMO, OGUN STATE, NIGERIA****OKEDINA I. M.****DEPARTMENT OF ECONOMICS, VERONICA ADELEKE SCHOOL OF SOCIAL SCIENCES (VASSS)****BABCOCK UNIVERSITY, ILISHAN-REMO, OGUN STATE, NIGERIA****&****NNAJI N.K.****DEPARTMENT OF ECONOMICS, VERONICA ADELEKE SCHOOL OF SOCIAL SCIENCES (VASSS)****BABCOCK UNIVERSITY, ILISHAN-REMO, OGUN STATE, NIGERIA****Abstract**

The study applied Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model, and Threshold Asymmetric GARCH (T-GARCH) model of Glosten, Jagannathan, and Runkle (1993) to examine if Gold is a safe haven or hedging asset in relation to international stock markets indices of the 5 largest gold consuming counties in the World. Monthly data from 2000-2018 is applied. The result indicates that gold is negatively correlated and not statistically significant with the stock market index of Turkey and Germany. Indicating that the stock market index of Turkey and Germany do not impact the returns on gold, thus Gold can act as a hedging asset. India, China and USA have positive correlation with the returns on gold. Nonetheless, they are not statistically significant at 5% level of significance. There is presence of significant leverage effect. The T-GARCH indicate presence of Asymmetry as positive shock leads to higher volatility compared to negative shocks of the same magnitude.

Keywords: Hedge; Safe Haven Stock Market; GARCH; T-GARCH

Word Count: 115

**Introduction**

A Safe haven is a place of safety for people during stormy times. Similarly, a safe haven asset must have the ability to shield the investor from adverse loss during harsh economic times and offer preserves investor's wealth during unfavorable market

conditions. Markets and economics have become more and more integrated with the rise of globalization and thus paved the way for the transmission of political and macroeconomic shocks from one market, region, or economy to another. When shocks and asymmetries exist, returns of assets

become more volatile which increases the risk to the investors (Baur, 2011).

Investors around the world, both informed and uninformed investors, desire to minimize exposure to risk to maximize returns by diversification their investment into a portfolio with less risk or safe assets. However, safe investment in one market could be a disastrous investment in another down market, and so the analysis of safe-haven investments varies and investors must perform adequate assiduousness? To capture the safe-haven asset feature of an investment instrument, we need to analyze the co-movement between that instrument and other assets in the portfolio at extreme market falls. It is against this context that this study seeks to investigate and analyze the dynamic relationship between gold price volatility and stock market returns as well as the relationship between gold returns and consumer price index of the top 5 gold consuming countries in the world.

Investors consider a rise in the gold prices to indicate that an asset is a safe haven and a signal of higher risk and uncertainty in macroeconomic and financial conditions leading which gives rise to higher volatility in the gold market. On the other hand, a fall in the price of gold indicates lower volatility and market uncertainty. However, the ability of gold to act as a safe haven asset is compromised in the presence of rising volatility while lower volatility improves the ability of gold to act as a safe haven asset (Baur, 2011). According to Choudhry, Hassan, & Shabi, (2015), Local investors can regard Gold as a hedge and or a safe haven asset to a local investor.

Although historically gold has been treated as a safe haven and hedging asset, few studies have tested this hypothesis. It is important to note that “bad news” implies negative shocks in the equity market while

“good news” implies positive shocks however the reverse is the gold case. A positive shock in the gold market is an indication of a “Bad News” in the financial and macroeconomic conditions while negative shocks imply good news in the gold market.

Over the years, investors have chosen to buy gold when bonds and stocks face extreme negative returns and this action eventually raises the price of gold. Gold tends to lose its ability to resist adverse economic turmoil (safe haven) when there is an increase in the volatility of gold. If higher gold volatility is observed in periods of financial or economic turmoil the effectiveness of gold to act as a safe haven asset is compromised (Baur, 2011). On the contrary, the effectiveness of gold as a safe haven asset is enhanced when gold volatility decreases during financial turmoil (Baur, 2011). It is thus essential to analyze the volatility of gold and its reaction to a positive and negative shock. This study examines if gold is a safe haven asset, hedging, or diversifying asset in 5 top gold consumer countries.

### Literature

There is an absence of a research study on the correlation of gold price and macroeconomic variables of very recent data. There is also little research on this objective with Nigeria as a case study. Also, most studies focus on the volatility of gold but do not emphasize on the asymmetric volatility of gold. Another distinguishing factor is the inclusion of an index of 5 largest gold consuming countries as the independent variables.

The value of gold in one currency compared to gold in other currencies is an important factor in this study. It will show that the safe haven and hedge properties of gold in one

currency might not be favorable in certain of another currency.  
financial and economic conditions in terms

**Table 1: Summary of Literature**

AUTHOR (S)	SCOPE	METHODOLOGY	VARIABLES	FINDINGS
Rabia Najaf and Khakan Najaf (2016)	2003-2011	i)correlation matrix ii)Co integration tests iii)Granger causality test iv)Variance decomposition analysis	i)stockmarket returns ii) gold price iii) oil price	There is no long run relationship between stock market of India and oil and gold markets.
Korhan K. Gokmenoglu, NegarFazlollahi	2008-2014	i)unit root test ii)co-integration test iii)error correction mechanism	i)Gold price ii)oil price iii)stock price	Gold price has the highest impact on the stock price in long-run and short-run which has important implications for investors.
Jalal Seifoddini, FraydoonRahnamayRoodposhti, ElaheKamali	2013-2016	i)rule of thumb ii)regime switching models iii)threshold regression	i)stock market returns	Relationship between stock market and gold in developed market differs from that of an emerging market
Dirk G. Baur, Brian M. Lucey	1995-2005	i)regression model	i)gold returns ii)stock returns iii)bond prices iv)positive & negative shocks	Gold is a safe haven for stocks, however, generally not a safe haven for bonds in any market
DrNalinipravaTripathy	1990-2016	i)unit root test ii)ADF test iii)Dickey-Fuller test with GLS De Trending iv)Phillips-Perron(PP) test v)KPSS Test vi)Ng and Perron test vii)Causality test viii)CUSUM Test	i)gold return ii)stock market return	Stock market and Gold price are stationary at their level.
Muhammad MansoorBaig, Muhammad Shahbaz, Muhammad Imran, MehwishJabbar, Qurat UI Ain	2000-2010	i)co-integration ii)unit root test ii)granger casuality	li)KSE100 return ii)gold prices iii)oil prices	KSE100 has the highest return. Gold and oil market have low growth
Maryam Al-Ameer, WalaaHammad,	2007-2016	i)descriptive statistics ii)ADF iii)Pearson's correlation	i)gold ii)HDAX index	The financial crisis did not affect the correlation between the two variables

AreejIsmail,Alla mHamdan		iv)Hansen's co-integration v)pairwise granger causality test		but they maintained their co-integration or long-run relationship through the market shock, the financial crisis
SomnathMukhuti	2008-2018	i)regression ii)correlation iii)unit root test iv)co-integration test v)Granger causality test	i)gold price ii)Indian stock prices	Positive association with Indian stock indexes while gold price expected inverse relationship with stock prices changed over time.
Mohamed El HediArouri, Amine Lahiani, DucKhuong Nguyen	2004-2011	i)descriptive statistics ii)bivariate VAR-GARCH	i)returns o stock market ii)gold price index	Gold assets can be considered a dynamic and valuable asset class that helps to improve the risk-adjusted performance of a well-diversified portfolio of stocks.
Ming Qi, Wenyao Wang	2002-2011	i)unit root test	rate of gold returns	High demand before public holidays pushed up the gold spot prices.
KgotsoMorema and LumengoBonga-Bonga	2006-2015	i)asymmetric dynamic conditional correlation model ii)optimal portfolio weights iii)optimal hedge ratios	oil prices gold prices stock returns	Returns in different sectors of the stock exchange are affected differently by both oil and gold price shocks.
Jan J. Szczgielski, Zack Enslin, Eida du Toit	2006-2013	i)Regression analysis ii)multifactor model	gold mining returns rand-dollar exchange rate gold price	There are other factors that are important for gold mining industry returns.
MongiArfaouri	1995-2015	i)simultaneous equations approach	oil price gold rate US dollar exchange rate stock market prices	Oil price is significantly affected by stock market, gold and USD.
LeventBulut and Islam Rizvanoghlu	2000-2018	i)modeling tail dependence ii)weak and strong safe-haven property	i)returns on stock holdings ii)returns on gold holding	Gold serves as a hedge instrument for all countries in the sample.
NedaBashiri	2005-2010	i)ADF unit root test ii)co-integration test iii)granger cause test	i)gold prices ii)stock market index iii)stock market capitalization	There exists long run equilibrium relation between gold prices and stock market returns
Abdul Basit	2005-2011	i)regression model	i)domestic gold price ii)oil prices and iii)stock market returns	There could be the set of other macro variables that also affect the oil and gold prices
Muhammad SHAIQUE, Abdul	1993-2014	i)ADF test ii)co-integration	i)gold price ii)KSE100 index	Investors should make their decisions on

Aziz, Gobind M. Herani		iii)VECM iv)VAR		subjective knowledge by aligning them with empirical evidence
Vishal Geete	2011-2014	i)multi regression analysis	i)dollar price ii)gold prices iii)Sensex	Positive correlation between gold and Nifty, and negative correlation between dollar price and Nifty.
CuneytAkar	1990-2010	i)ADF test ii)DDC-GARCH	i)gold prices ii)dollar prices	The dollar-gold relationship is positive throughout the sampling period except 2000
SomnathMukhuti and AmalenduBhuni a	1991-2012	i)ADF unit root method ii)bivariate and multivariate co-integration methods iii)pairwise granger casual method	i)gold price index ii)stock market index	Gold price in India was increased during the study period because of stock market reaction in India along with other macro-economic factors.
Ke Chen and Meng Wang	2002-2017	i)DCC-GARCH model	i)gold price index ii)stock price index	For nonbear markets, gold did not act as a safe haven.
Syed JawadHussainShahzad	1989-2015	i)VAR model ii)pseudo quantile impulse response function	i)stock returns ii)bonds returns ii)gold returns	Gold does not act as a safe haven for the stock and bond markets of G-7 countries
NiyatiBhanja, ArifBillah Dar	1999-2013	i)wavelet approach ii)DWT iii)MODWT	i)stock returns ii)gold returns	Gold could be used as a weak hedge as well as a weak safe haven by the stock market investors
NiyatiBhanja	1999-2013	i)wavelet	i)stock market index ii)gold price index	Gold is a weak safe haven asset during market crises for investors, irrespective of their dealing or investment horizon
Claire G., Ginette M. McManus, Rajneesh Shama, Ahmet Tezel	1996-2007	I)co-integration I)unit root test	Stock market index Gold prices Gold mining company stock prices	Both gold and large-cap stock prices adjust to disturbances to restore the long term relationship between the variables
Garry Twite	1985-1998	Descriptive statistics	i)return on gold ii)exchange rate index iii)gold stock market returns	No relationship exists between the gold premium and other identified opinion characteristics
Lauren Bodington	1998-2013	i)regression model	i)returns on gold ii)ALSI prices iii)ALBI prices	For a South African investor, gold does not act as a contemporaneous hedge for international stocks.
MatiurRahman,	1986-2016	i)co-integration	i)stock market	US stock market ( proxied

Muhammad Mustafa		technique ii)multivariate VAR model	returns ii)gold price iii)oil price	by S&P 500) return, gold price and oil price in log-levels are nonstationary
Hamed Sadri, EhsanTayebiSani	2001-2011	i)ARCH technique ii)GARCH technique iii)ADF iv)Lagrange Multiplier	i)crude oil prices ii)gold prices iii)stock market returns	Crude oil has significant positive effect on stock index of studied countries
MrAmees Gupta	1986-2017	S&P BSE SENSEX index	i)international crude oil prices ii)gold price	International crude oil and gold prices have a significant impact on India's economy and stock markets.
Semei Coronado, Rebeca Jimenez-Rodriguez and Omar Rojz	1986-2017	ADF test RALF test	i)crude oil prices ii)gold price returns iii)stock market returns	The direction of influence between markets do not exhibit material differences between subsamples
Ahmad IbnIbrahimi, Azwadi Ali, Sajid Ali	1996-2014	i)Wavelet ii)Panel cointegration test iii)Johansen cointegration	i)gold price returns ii)stock market returns	Gold exhibits low correlation with stock market

## Methodology

The study applied monthly data covering 18 years (2000-2018) making a total of 219 observations. Data will be obtained from World Bank Development Indicator (WDI), World Gold Council, and GMFS. The variables for the study include a stock market index for 5 largest gold consuming counties with their respective stock exchange indices Nifty 500 (India); Shanghai composite (China), XU030 (Turkey), GDAX1 (Germany); and S&P500 (USA), as proxies for international stock markets. This research will focus on the analysis of the

relationship between the gold price and stock market returns in four international stock market indexes. The Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model and Threshold Asymmetric GARCH model of Glosten, Jagannathan, and Runkle (1993) will be applied to estimate the parameters in equation 1-4

## Model Specification

This study will implement the following symmetric GARCH (1,1), and Asymmetric GARCH models specified below as respectively.

$$rGOLD_t = \beta_0 + \beta_1 \ln GOLD_{t-1} + \beta_3 S\&P500_{t-1} + \beta_4 NIFTY500_{t-1} + \beta_5 XU030_{t-1} + \beta_6 GDAX1_{t-1} + \beta_7 SHANC_{t-1} + \varepsilon_t \quad (1)$$

$$\sigma_t^2 = \exp(\mu_0 + \mu_1 S\&P500_{t-1} + \mu_2 NIFTY500_{t-1} + \mu_3 XU030_{t-1} + \mu_4 GDAX1_{t-1} + \mu_5 SHANC_{t-1} + \alpha \varepsilon_{t-1}^2 + \beta \sigma_{t-1}^2) \quad (2)$$

The asymmetric GARCH model is given as:

$$rGOLD_{t-1} = \beta_0 + \beta_1 GOLD_{t-1} + \beta_2 S\&P500_{t-1} + \beta_3 NIFTY500_{t-1} + \beta_4 XU030_{t-1} + \beta_5 GDAX1_{t-1} + \beta_6 SHANC_{t-1} + \varepsilon_t \quad (3)$$

$$\ln(\sigma_t^2) = \mu_0 + \mu_1 GOLD_{t-1} + \mu_2 S\&P500_{t-1} + \mu_3 NIFTY500_{t-1} + \mu_4 XU030_{t-1} + \mu_5 GDAX1_{t-1} + \mu_6 SHANC_{t-1} + \gamma_1 (e_{t-1})^2 + \gamma_2 (e_{t-1})^2 I(e_{t-1} < 0) + \delta \sigma_{t-1}^2 \quad (4)$$

Equations (1) and (3) represent the mean equation and equations (2) and (4) represent the variance equations. Where  $\beta_0, \beta_1, \beta_2, \beta_3$  and  $\beta_4$  are the parameters to be estimated in the equation, while  $\varepsilon_t$  is the random stochastic error term. If  $\beta_1$  is statistically significant, this suggests autocorrelation among the variables. When there is a serial correlation, it suggests that trading of gold is done by uninformed traders.  $(e_{t-1})^2$  Represents the ARCH the constant volatility is estimated by  $\mu_0$ . The effect of lagged return shocks of gold on its volatility (ARCH) is estimated by  $\gamma_1$  and a differential effect, if the return shock is negative, is captured by  $\gamma_2$ . If there is asymmetric effect of lagged shocks on the volatility of gold  $\gamma_2$  is zero.

## Result

### Descriptive Statistics

Figure 1 illustrates the time series of gold returns, and the stock market index of the top 5 gold consuming countries in the world (India, China, USA, Turkey and Germany). From the graph, it is observed that there was a steady increase in the price of gold. From 2000 – 2010, there was a steady increase where it reached a peak in 2010 and started to decline slightly. Gold return is observed that there is a more volatile change in prices. The graph for NIFTY 500 shows a steady increase in stock market returns over the span of 18 years with some fluctuations occurring. From 2006- 2008 there was significant decrease in stock market returns. The S&P500 index shows an initial decrease in stock market returns from 2000-2002 following an increase from 2002-2007 then a significant decrease between 2007-2008. The Shanghai Stock exchange

index shows increase in stock market returns at a decreasing pace between 2000-2006 and then a persistent increase between 2006-2007. The XU030 of Turkey shows a n be seen that there was persistent increase in stock market returns with some period of decrease over 18 years. German GDAX displays an initial decrease in stock market returns then a persistent increase over the period of 18 years.

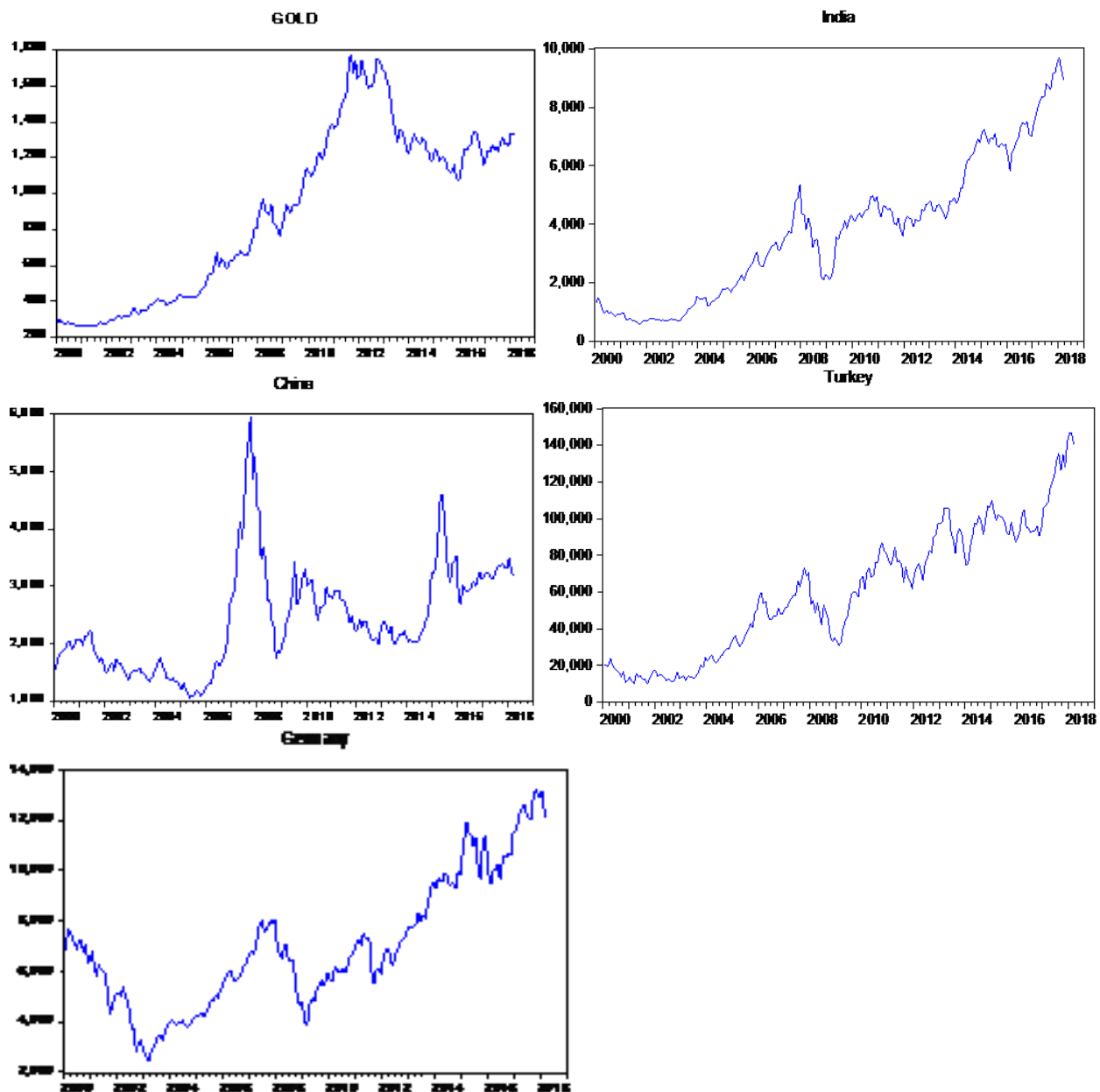
The preliminary statistics are presented in Table 2. The average value of gold is 896.6111. The large difference between the maximum (1772.140) and minimum (260.4800) values suggest that there is a substantial variance in the patterns of the consideration time variable show. The frequency dependence of the series also indicated that it is positively distorted, based on the result. The values for returns on gold is 1.65 and is platykurtic because this value is less than 3 which shows it does not have a higher than normal distribution. It is an indicator that the series is low peaked, which is slightly below the normal peak of distribution, which means that there are few gold returns above the average value. The normality of the series was checked by skewness / kurtosis normality test; this test's null hypothesis which states that the data set is normally distributed but the test's p-value is 0.000217%. This is less than the 5% significance level and it indicates that returns is not normally distributed. The effect of the skewness of 0.075 is greater than the threshold of 0, indicating that gold is positively skewed; the sequence is not normally distributed roughly.

The overall average of India's stock market returns over the span of 18 years is 3764.882. The maximum value is 9697.900

while the minimum value is 583.5500. The skewness of the result is 0.472435 which is greater than the threshold of 0 therefore indicating a positive skewness. The values for India 's return on the stock market are 2.368612 and are platykurtic, suggesting that the series is low peaked, slightly below the usual peak of distribution, and that few of its values are above the average. The normality of the series was evaluated by the skewness

kurtosis normality test; this test's null hypothesis states that the series is normally distributed but the test's p-value indicates 0.002761 which is less than the 5 percent indicating level indicated that the returns are not normally distributed.

Figure 1: Time series Plots of Gold and international stock returns (India, China, Turkey, Germany, USA)





**Table 2: Descriptive Statistics**

Statistics	Gold	India	USA	China	Turkey	Germany
Mean	896.6111	3764.882	1455.522	2409.493	60292.92	7012.824
Median	928.6450	3840.250	1320.640	2220.500	59053.14	6596.920
Maximum	1772.140	9697.900	2823.810	5954.770	146553.9	13229.57
Minimum	260.4800	583.5500	735.0900	1060.740	9812.420	2423.870
Std. Dev.	468.3079	2372.682	456.4039	911.0603	35295.34	2615.121
Skewness	0.075170	0.472435	0.971487	0.986306	0.247484	0.566052
Kurtosis	1.648524	2.368612	3.149858	4.262924	2.111705	2.534393

**Source:** Authors computation using E-Views 9.0

The mean value of USA's stock market index is 1455.522, it has a minimum value of 735.0900 and a maximum value of 2823.810. The skewness of the result is 0.971487 which is greater than the threshold of 0 therefore indicating that it is positively skewed and is not normally distributed. The values USA's stock market index is 3.149858 and is leptokurtic because this value is greater than 3 which shows it has a higher than normal distribution. It is an indicator that the series is extremely peaked, which is slightly above the usual peak of distribution, which means that all of the stock market returns in the USA are above the mean value. The skewness / kurtosis normality test tested the normality of the sequence; the null hypothesis of this test states that the series is normally distributed but that the p-value of the test indicates 0.00000000. This is less than the 5% significance level which indicates that the returns is not normally distributed.

The average value of China's stock market index is 2409.493 with a minimum and maximum value of 1060.740 and 5954.770 respectively. The skewness of the result is 0.986306 which is greater than the threshold of 0 therefore indicating that it is positively skewed and is not normally distributed. The value of China's stock

market index is 4.262924 and is leptokurtic because this value is greater than 3 which shows it has a higher than normal distribution. This is an indicator that the series has a high peak, which is slightly higher than normal distribution peak, which means that many of China's stock market returns are greater than the average value. The skewness / kurtosis normality test tested the normality of the sequence; the null hypothesis of this test states that the series is normally distributed but that the p-value of the test indicates 0.00000000. Thus, it is less than the 5% significance level which means that returns is not normally distributed.

The overall average value of Turkey's stock market index is 60292.92. It has a minimum value of 9812.420 and maximum value of 146553.9. The broad difference between the maximum and minimum values indicates that the indicator patterns vary greatly. The skewness of the result is 0.247484 which is greater than the threshold of 0 therefore indicating that it is positively skewed and is not normally distributed. The values for Turkey's stock market returns is 2.111705 and is platykurtic because this value is less than 3 which shows it does not have a higher than normal distribution. It is an indicator that the series is low peaked,

which is slightly below the usual peak of distribution, meaning few of its values are above the mean value. The normality of the series was evaluated by a skewness / kurtosis normality test; this test's null hypothesis states that the series is normally distributed but the test's p-value shows 0.008934. That is less than the standard of significance of 5%2 indicated that returns are not normally distributed.

The mean value of Germany's stock market index is 7012.824 with a maximum value of 13229.57 and minimum value of 2423.870. The skewness of the result is 0.566052 which is greater than the threshold of 0 therefore indicating that it is positively skewed and is not normally distributed. The values for Turkey's stock market returns is 2.534393 and is platykurtic because this value is less than 3 which shows it does not have a higher than normal distribution. It is an indicator that the series is low peaked,

which is slightly below the usual peak of distribution, meaning few of its values are above the mean value. The normality of the series was evaluated by a skewness / kurtosis normality test; this test's null hypothesis states that the series is normally distributed but the test's p-value indicates 0.001074 which is less than the 5% significance level revealed that returns is not normally distributed.

### Unit Root Test

The Augmented Dickey Fuller test was implemented to examine the statistical properties of the variables. Presence of non stationarity in series cause spurious regression results. This test is based on the null hypothesis which states that the variable is not stationary. The null hypothesis is rejected at least, at 5% significance level and if otherwise, the null cannot be rejected.

**Table 2:** Augmented Dickey Fuller (ADF) Test

Series	Level	First Difference	Order of integration
rGold	-13.3***	-12.5***	I(0)
CHINA	-3.0	-8.3***	I(1)
INDIA	-2.5	-14.0***	I(1)
USA	-1.22	-14.23***	I(1)
TURKEY	-3.26	-15.33***	I(1)
GERMANY	-2.34	-13.62***	I(1)

**Source:** Authors computation using E-Views 9.0

From the table above, we can see the results it is observed that stock market index of China, USA, Germany and India are non-stationary at level because their respective absolute test statistic is less than their 5% critical values indicating there is presence of unit root. However, return on gold are stationary at level because their respective absolute test statistic is greater than their

5% critical values indicating there is no presence of unit root. All variables are stationary at first difference; hence, it is statistically significant and the null hypothesis would be rejected. However, the unit root properties of the variables are not relevant within GARCH framework.

The presence of ARCH effect is essential in the use of the GARCH Model. If

there is no ARCH effect, the GARCH model cannot be used be applied. The rejection of the null hypothesis shows that there is presence of ARCH effect. At 5% significance level , probability level is 0.0113 which is less than 0.05. It is essential, therefore, so the null hypothesis is rejected. This implies that

for the residuals, the variance is not standardized, which is the existence of heteroskedasticity. This justifies the use of the GARCH Model as this is the model that can accommodate the analysis if data with ARCH effect. There is significant serial correlation.

Table 3: Estimates from Garch(1,1) Model

<b>Panel A: Mean Equation</b>			
Variables	Coefficients	Standard Error	Prob
C	1.91	1.49	0.20
INDIA	0.0008	0.0006	0.17
CHINA	0.0007**	0.0004	0.07
USA	0.001	0.002	0.61
TURKEY	-2.58E-05	2.97E-05	0.39
GERMANY	-0.0009**	0.005	0.06
<b>Panel B: Variance Equation</b>			
C	2.65	2.24	0.24
RESID(-1)^2	0.14	0.08	0.10
GARCH(-1)	0.66**	0.23	0.004
R <sup>2</sup>	0.06		
Adj R sq	0.03		

Where \*\* represents 5% significance level

From the mean equation of the Generalized Autoregressive Conditional Heteroskedasticity Model, C represents the intercept which indicates a positive relationship. India, China and USA are positively correlated with returns on gold. However, turkey and Germany have a negative correlation with returns on gold. Using 5% level of significance, the probability levels of are all greater than 0.05, therefore,

it is not significant. From the variance equation, C, there is a positive correlation with the intercept intercept but however not significant at 5% level of significance. The ARCH term is positively correlated but is also not significant at 5% level of significance. At 5% level of significance, the GARCH term is significant and its correlation with the dependent variable is positive.

Table 4: TGARCH Asymmetric Model

<b>Panel A: Mean Equation</b>			
Variables	Coefficients	Standard Error	Prob
C	2.19	1.47	0.14
INDIA	0.0008	0.0005	0.14

CHINA	0.0006	0.0004	0.13
USA	0.001	0.002	0.7
TURKEY	-2.75E-05	2.72E-05	0.31
GERMANY	-0.0008	0.004	0.07

#### Panel B: Variance Equation

C	2.46	2.38	0.30
RESID(-1)^2	0.20	0.13	0.12
RESID(-1)^2*(RESID(-1)<0)	-0.12	0.12	0.28
GARCH(-1)	0.68***	0.25	0.007

R <sup>2</sup>	0.06
Adj R sq	0.03

#### Panel C: Post Estimation

Serial Correlation	0.33
Heteroskedasticity	0.76
Normality Test	0.76

Where: \*\*\* represents 1% statistical significance

From the mean equation, the intercept, C, has a positive correlation with the dependent variable, R. However, at 5% level of significance, the dependent variable R is not statistically significant as the probability level is greater than 0.05. India, China and USA have positive correlation with the returns on gold. Nonetheless, at 5% level of significance, these variables are not significantly significant. Turkey and Germany are negatively correlated with the dependent variable, R and are not statistically significant. From the variance equation, the ARCH term is positively correlated with returns on gold but is not significant.

The GARCH term has a positive correlation with the dependent variable and is statistically significant as the probability level 0.0068 is less than 0.05. The GARCH term tries to explain if past volatility has any effect on current volatility. The positive coefficient of the GARCH term indicates that

volatility has increased, if negative, indicates that volatility has reduced. This result being positive shows that volatility has increased. Any shock that increases volatility reduces the ability of gold to be a safe haven. The asymmetric term has a negative coefficient. This represents the asymmetric effect. The negative coefficient indicates that lagged negative shocks reduce the instability of gold. In other words, positive shocks of gold increase instability than negative shocks of the same magnitude. Positive shocks are more important and they cause more volatility than negative shocks. If the instability of gold reacts differently to shocks than equity or stock returns, the low correlation of gold with other assets could be affected under some circumstances. That is, the ability of gold to act as a hedge or safe might not be effective.

Before the estimation of the GARCH models, we estimated the data using a simple Ordinary least square approach and

the diagnostics indicates the presences of significant ARCH effect which is the pre-requisite for implementation of GARCH(1,1) model. Also there is presence of significant serial correlation. However, after implementation of the GARCH (1,1) and T-GARCH models Heteroskedasticity is not present. This further confirms that GARCH model is the best and consistent when dealing with high frequency data with significant ARCH and GARCH effect compared to other standard time series models. The estimated result is also free from serial correlation.

In this study,  $R^2$  will be used to evaluate and determine the explanatory power of the model. To help figure out how well the sample linear regression matches the results, it is considered. It calculates the ratio or percentage of the total variance in 'Y' explained by the regression model, from the regression result,  $R^2$  is 0.056 and this indicates that approximately 6% of variations in gold returns is jointed accounted explained by international stock market returns of the top 5 gold consuming countries.

### **Conclusion**

This investigated volatility of gold price and stock market returns index using daily time series data from 2000-2018. The standard GARCH (1,1) model and Threshold Asymmetric GARCH Model is applied to analyse the data. From the analysis, it was discovered that India, China and USA have positive correlation with the returns on gold. Nonetheless at 5% level of significance, the variables are not statistically significant. Turkey and Germany are negatively correlated with gold price, the dependent variable and are not statistically significant. This indicates that changes in the stock market index of Turkey and Germany do not

impact the returns on gold. This indicates the hedge properties of gold. That is, you can invest in gold if stock market returns are high and vice versa.

Evidence from the TGARCH model showed that the ARCH term is positively correlated with returns on gold but is not significant. The GARCH term is statistically significant and has a positive correlation with the Gold returns. This implies that instability in the previous period can predict instability in the present period. The negative coefficient of the asymmetric term indicates that lagged unfavourable. Shocks decrease the instability of gold. That is, favorable shocks of gold increase its instability by more than unfavourable shocks. Positive shocks cause uncertainty greater than negative shocks. If the gold volatility responds differently to shocks than equity or stock returns, under some circumstances the low gold relationship with other assets can be undermined. That is, it might not be productive for gold to be able to serve as a hedge or a security. The positive shocks were greater than the negative shocks which reduces the safe haven and hedge properties gold. Positive shocks which can be considered good news cause less instability than negative shocks which can be considered bad news. This implies that the leverage effect is present. Based on the findings of the study, some conclusions could be drawn. The positive coefficient of the GARCH term indicates that volatility has increased, if negative, indicates that volatility has reduced. This result being positive shows that volatility has increased. Anything that increases volatility reduces the ability of gold to be a place of safety during stormy times. Thus, the ability of gold to perform as a safe haven is compromised by high volatility.

The negative correlation of stock market indices and returns on gold would be advantageous to the general public and investors as there can be diversification of risk. That is, when one market is not favourable for investment, the other can be. However, the volatility of gold should also be considered before investments are made because the safe haven property of gold tends to be compromised in cases of high volatility. It is proposed that investors should purchase gold on days with significant negative returns and sell it when volatility is reduced or lower and confidence has been gained by market participants. In periods of financial or macroeconomic instability, if the price of gold rises, investors purchase gold and transfer on the volatile market conditions to the gold market. At the same time, the gold price and volatility are rising. If the gold price declines in the investor's quiet period selling gold thus indicating that there is low macroeconomic and financial instability. The positive correlation of stock market indices and returns on gold indicates that gold can be used as a diversifier.

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