RESEARCH ARTICLE

EVALUATING BEST GARCH MODEL FOR FORECASTING STOCK RETURNS OF EMERGING MARKETS IN AFRICA

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Abstract : The emerging market economies are fast improving in terms of real sector and financial sector growth. Due to the potentials in these economies, there have been influx of investors in these stock markets. The aim of this paper is to find best GARCH model for forecasting stock returns of emerging economies. This study adopted daily data (14/04/2010-08/06/2021) for ten emerging market economies. They are Tunisia, Botswana, Egypt, Kenya, Nigeria, Namibia, Mauritius, Sudan, Morocco and Malaysia. The GARCH type models were adopted. First, it was observed the best model for forecasting volatility in Tunisia bank, Malaysia breweries, Nigeria (MTN), Nigeria (breweries) stock market is exponential GARCH (eGARCH). Where sGARCH is applicable as in the case of Egypt, Kenya, and Sudan stock market, the market volatility in these markets does not react differently to market news. For Egypt, Kenya, and Sudan stock market, the standard GARCH (sGARCH) performs best. The emerging markets namely, Tunisia Bank, Nigeria Breweries, Nigeria MTN, Malaysia Building Society, Namibia Breweries where eGARCH and gjrGARCH are applicable implies their stock market returns react differently to market news relating to them. These findings have policy implications for investors in these respective economies. The asymmetric GARCH models highlighted should be used to forecast stock returns of Tunisia bank, Malaysia building society, Nigeria MTN and breweries as well as Namibia breweries.Amongst others, the study so recommend that investors in these market particularly those in the equity market where volatility decay slowly and the market where volatility responds asymmetrically to be watchful as these could pose significant threat to their market portfolio.

Keyword: GARCH, Stock markets, returns, investors, asymmetric GARCH models, emerging market economies ,eGARCH, sGARCH, gjrGARCH, Africa.

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INTRODUCTION

The importance and significance of a stock market can be better understood in a free market economy, where businesses in need of cash can obtain funds by issuing company shares on the stock market, which investors can purchase at a set price. This share trading not only offers funds to a company, but also gives the investor a stake in the company. This phenomena lasts for a long time, and a reputable company does not receive a huge sum of money. A well-managed, organized, and well-known stock market helps a nation's monetary as well as commercial sectors. It facilitates saving and investment in an economy by allowing both domestic and international investors to participate in purchase of assets. Increased productive activities result in profit for the company and dividends for shareholders as a result of such investment efforts. The equity market also facilitates the re-allocation of funds between firms and sectors (Tazeem&Yousaf 2016).

Every financial sector has been described as having two key pathways through which it might impact growth. These are achieved through the growth of the stock market and the banking sector (Levine & Beck 2004); Adusei 2013). Stock markets, unlike short-term bank loans, provide long-term capital in the primary markets, allowing for more efficient capital allocation to lucrative ventures, give stockholders a way to sell their stock on the secondary market, and Investor confidence in the performance of the local economy has increased as a result of their growth and development. (Tachiwou, 2010).

The present financial crisis, as well as the capital market's sensitivity to external shocks because of the worldwide finance meltdown, have had an impact on the economy's macroeconomic fundamentals. Despite the fact that the stock market's function in the growth process has been researchedwidely in the developed world, empirical study on the subject in SSA is yet to gain wide coverage and hence lack of adequate consensus regarding the influence stock market exerts on economic progress in Africa. Some studies have looked at the impact of stock markets and financial markets in general on economic growth in Sub-Saharan Africa. Tachiwou (2010); Enisan&Olufisayo are two notable examples (2009). However, these studies used unbalanced panel data and only found minor impact of stock market development. Can it be argued that there is any relationship between the key macroeconomic variables and the stock market index in Africa, given that along with the market stock price index, macroeconomic indicators have had varying values over time? This research paper examines pattern of stock market volatility and also impact of macroeconomic shocks on stock market.

Research Questions

The following research questions are before us in this study:

i. Which GARCH modeling performs best in forecasting the stock returns in emerging market economies
ii. Do stock returns in African stock markets respond symmetrically or asymmetrically to market news?

Objectives of the Study

The following are the objectives of the research

i. To examine the best GARCH model for forecasting stock returns of emerging markets in Africa.
ii. To show how stock returns responds to market news in the emerging market economies

Research Hypothesis

The following are the hypothesis of the research

i. Standard GARCH (sGARCH) models are best for forecasting stock returns of emerging markets in Africa.
ii. Do stock returns in African stock markets respond symmetrically or asymmetrically to market news?

LITERATURE REVIEW

According to economic theory, stock markets help investors allocate capital, offer a multiplicity of financial instruments at cheap costs, and reduce investor risk (Caporale, Guglielmo&Spagnolo, 2005; Dökmen, Ahmet&Bayramoğlu, 2015). Within the endogenous growth model, Caporale (2005) analyse the theoretical mechanisms via which stock markets influence long run economic growth. Wealth effects of households' return on portfolio savings in stock market, according to Ludvigson and Steindel (1998), influences long-term economic growth, whereas Kirchhoff (2016) claims that liquid stock markets have a greater positive influence on output growth than risky and costly stock markets. Financial market's strength, as Smith & Devereux (1994) feel that more financial market integration is necessary can reduce stock market volatility and boost return levels. Nonetheless, a closer integration of financial markets will necessitate the establishment of high-quality institutions to manage market human impulses (Acemoglu, 2007).

On the divergent views on stock prices behaviour, there are five school of expertise. Fundamentalist schools, random walk hypothesis schools, technical schools, behavioral finance schools, and macro-economic hypothesis schools are among them.

Fundamentalists think the stock value of a company is given by futuristic earnings estimates and the discount rate applied to the profits. To analyze company shares, fundamentalists utilize present value concepts.Calculating the price of stock using dividends, earnings, assets, and the interest rate. The technical school disagrees with the fundamentalists, claiming that stock price behavior can be predicted using financial data. They argue that stock prices tend to follow a predictable pattern that each price is influenced by previous prices, and subsequent prices are interdependent. Technical analysts, according to Smith (1990), are interested in examining variations in market prices, trading volume, and investor sentiment.

Researchersin favour of random-walk postulate, asserts stock price movements is a probability distribution with various possible outcomes. The random-walk postulate is based on the efficient market hypothesis, which states that investors modify security quickly to reflect the impact of new information. According to proponents of the efficient capital market theory, randomness in the movement of stock prices would not allow profit to be made from stock market speculation. The persistence of random shocks is an intriguing aspect of random walk. Scholars such as Moore (1962) and Fama (1962) have conducted empirical tests of the random walk hypothesis (1965). The statistical unpredictability of subsequent variations in stock prices was separately tested by these academics. Their findings were inconclusive and unsatisfactory, showing minor deviations from randomization. Under three conditions, according to the behavioural school of finance, markets may fail to represent economic realities. When all three of these conditions are met, the theory predicts that price distortions in financial markets will be severe and long-lasting. Irrational behavior is the initial behavioural state. It asserts that investors act irrationally when they fail to properly digest all available data while establishing their expectations for a company's future performance.

From 2002 to 2012, Nikoloski, Kacarski, &Lazarov (2016) evaluated the impact of stock market growth on the economy in the Macedonia Republic. The estimation methodologies employed were panel regression models, dynamic panel models, single country approach, and comparative analysis, and the data demonstrated that stock market development is positively and strongly connected with economic growth. The research also found that the stock market in Macedonian is undeveloped and faces a variety of problems according to the report, Integration of regional financial markets and harmonization of legal and institutional frameworks, such as bankruptcy processes, are examples, accounting and reporting standards, public sector regulatory agencies, corporate governance, and a liberalized trade system are just a few of the issues that need to be addressed.

Sucuahi, Sobrecarey, & Tamayo (2015) investigated the relationship between stock market success and development in the Philippines. The study adopted secondary data, and the estimate methodologies used were Granger Causality and the Augmented Dickey-Fuller test. The dependent variable in the study was gross domestic product (GDP), whereas the regressorsincluded market capitalization (MC) and total value of shares traded (VST). The findings suggest that none of the regressors had significantrelationship with output.Odia&Donwa (2010) use the Ordinary Least Squares method to look at the influence of the Nigerian capital market on socioeconomic improvement from 1981-2008. The influence of stock market indices on GDP is negligible, according to the findings. In order to prepare the market for future development, the report suggests that leadership take steps to boost investor trust and activity in the market, allowing it to make a substantial contribution to Nigeria's socio-economic improvement. The study of Briggs (2015) demonstrates that the capital market of Nigeria and economic growth are intertwined.

Gap in Study

The approach used in the existing research has been noted as a gap in the study. The methods used in earlier research, as well as the range of sample population, reveal the study's gap. In this seminar topic, ten African countries will be studied for a period of ten years, from 2002 to 2020. In order to analyze the data, the GARCH model will be used.

THEORETICAL FRAMEWORK

Financial intermediary theory ofShaw (1973), Mckinnon (1973) and Goldsmith (1969) are very prominent. Financial markets, they believe, play a critical role in economic development, integration, and expansion by transferring capital from the surplus to the deficit sector. According to Goldsmith (1969), there is a direct link between financial development and a country's level of growth. In his study, Mckinnon (1973) suggested that physical capital and money have a complementary relationship that is represented in money demand. The demand for money is intimately linked to the accumulation of physical capital through financial intermediation. Shaw (1973) proposed the financial intermediary theory, which claims that financial intermediation exists between savers of funds and investors. Financial intermediation, according to the hypothesis, leads to financial liberalization and development. It also enhances the incentive to save and promotes investment due to an increase in credit supply, which has an impact on the economy's growth and development.

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A. **Model Specification**

This workspecifies the conditional variance equation based on GARCH (2, 2) as given as:

$$\sigma_t^2 = M_0 + q_1 e_{t-1}^2 + q_2 e_{t-2}^2 + d_1 \sigma_{t-1}^2 + d_2 \sigma_{t-2}^2 \quad 1$$

Where σ_t^2 is the current volatility,M_0 is the intercept of the variance equation, (q_i $where$ $i = 1$ & 2) are the ARCH effectsand (d_i $where$ $i = 1$ & 2) are the GARCH effect both having coefficient greater than zero. The delaying rate of the volatility is calculatedas$1 - (q_1 + d_1)$, where $q_1 + d_1 \leq 1$. This assumption satisfies volatility persistency constraint.

Equation 1classifies all forms of shocks, both positive (good news) and negative (bad news) having symmetric effect on shocks as captured in terms of volatility but calculated as variance (Umoru, 2022). The exponential GARCH (eGARCH) model identified by Nelson (1991) comes conveniently as specified:

$$\log(\sigma_t^2) = M_0 + d_1 \log(\sigma_{t-1}^2) + w \frac{e_{t-1}}{\sqrt{\sigma_{t-1}^2}} + \propto \left| \frac{|e_{t-1}|}{\sqrt{\sigma_{t-1}^2}} - \sqrt{\frac{2}{\pi}} \right| \quad 2$$

Where w is the leverage effect and signifies fall in returns leads to higher volatility than its increase in returns of same magnitude.Other variants of asymmetric GARCH is the gjrGARCH model proposed by Glosten, et al. (1993).

$$\sigma_t^2 = M_0 + \mathrm{q}_{t-1}^2 + q_2 e_{t-2}^2 + d_1 \sigma_{t-1}^2 + d_2 \sigma_{t-2}^2 + w e_{t-2}^2 Q_{t-2} \quad 3$$

Where $Q_{t-2} = 1$ if $u_{t-2} < 0$ and 0 otherwise. The leverage parameter,w, has to be positive and statistically significant. For persistency, same assumption applied on standard GARCH holds for equation 2 to 3.To obtain the optimum p and q lags for conditional mean and variance equation, simulation was run on several lag orders on different distributional assumptions ranges from student t distribution and normal distribution. The best model specification is obtained using Bayesian Information Criterion (BIC) and presented in Table 4. The Generalized Autoregressive Conditional Heteroskedasticity estimator. The GARCH model has different variants and these include:

i. GARCH-M Model, Generalized Autoregressive Conditional Heteroskedasticity Mean Model
ii. E-GARCH model, Exponential-Generalized Autoregressive Conditional Heteroskedasticity Model
iii. T-GARCH (GJR–GARCH) model, Threshold-Generalized Autoregressive Conditional Heteroskedasticity Model

ARCH and GARCH models are mainly deployed to model non-stationary series, that is, varying mean of a series and heteroskedastic series that is, varying variance with high frequency.

Data Sample and Sources: Ten (10) merging markets have been chosen in this study on basis of available statistics. These are as enlisted in the table below:

Table 1: Data Set

Emerging market	N	Start	End
Tunisia	2639	14/04/2010	08/06/2021
Botswana	1051	14/04/2010	07/06/2021
Egypt	2470	14/03/2010	09/06/2020
Kenya	4743	14/05/2010	07/06/2021
Malaysia	2376	14/09/2010	08/06/2021
Nigeria MTN	261	14/05/2010	09/06/2020
Nigeria Breweries	2287	14/02/2010	08/06/2021
Namibia	1260	14/05/2010	01/06/2021
Mauritius	4504	14/05/2010	08/01/2021
Sudan	1403	14/12/2010	07/06/2021

B.

C. **PRESENTATION AND DISCUSSION OF RESULT**

Descriptive Statistics

Table 2 presents the various descriptive statistics for ten emerging markets. Among the emerging markets, The Kenya NSE has the highest mean value of 3597.24 followed by Namibia Breweries and Taqa Morocco SA with the value of 2040.72, 713.23 respectively. On the other hand, Namibia equity market has the highest standard deviation of 1578.46 compared to other equity market. This implied, Namibia equity market is highly volatility compared to other equity markets among the emerging markets. Al Salam bank of Sudan has the least standard deviation implying relative stability of the bank in the equity market. The mean value is the third least mean with the value of 1.69 whereas Egypt tourism and Malaysia building society has the highest mean of 1.42 and 1.49 respectively. These countries (Egypt and Malaysia) have relative stability among the emerging economies since their standard deviation is also 0.55 and 0.47 respectively.

Table 2: Equity Market Descriptive Statistics

Equity Market	Mean	SD	Min	Max	Sample Size	kurtosis
Tunisia Bank	4.74	1.23	2.64	8.91	2640	0.96
Botswana Telecom	23.26	42.84	0	135	1052	0.39
Egypt Tourism Resort	1.42	0.55	0	3.19	2471	-0.15
Kenya NSE	3597.24	1130.36	1004.7	6161.46	4744	-0.65
Malaysia Building Society	1.49	0.68	0.48	3.19	2377	-0.88
Nigeria Telecommunication	121.18	12.85	90	159.3	262	-0.32
Nigeria_Breweries	116.21	44.61	22	191.2	2288	-1.1
Namibia Breweries	2040.72	1578.46	140	4900	1261	-1.19
Mauritius Hotel ltd	35.28	24.39	4	104	4505	-0.44
Sudan Al Salam Bank	1.69	0.47	0.91	3.7	1404	2.22
TaqaMorrocco SA	713.23	191.55	345.5	1050	1537	-1.36

Emerging market	N	Start	End
Tunisia	2639	14/04/2010	08/06/2021
Botswana	1051	13/04/2016	07/06/2021
Egypt	2470	02/03/2010	09/06/2020
Kenya	4743	10/05/2002	07/06/2021
Malaysia	2376	23/09/2011	08/06/2021
Nigeria MTN	261	20/05/2019	09/06/2020
Nigeria Breweries	2287	09/02/2012	08/06/2021
Namibia	1260	17/05/2002	01/06/2021
Sudan	1403	05/12/2013	07/06/2021
Morocco	1536	26/12/2013	09/06/2020

Source:

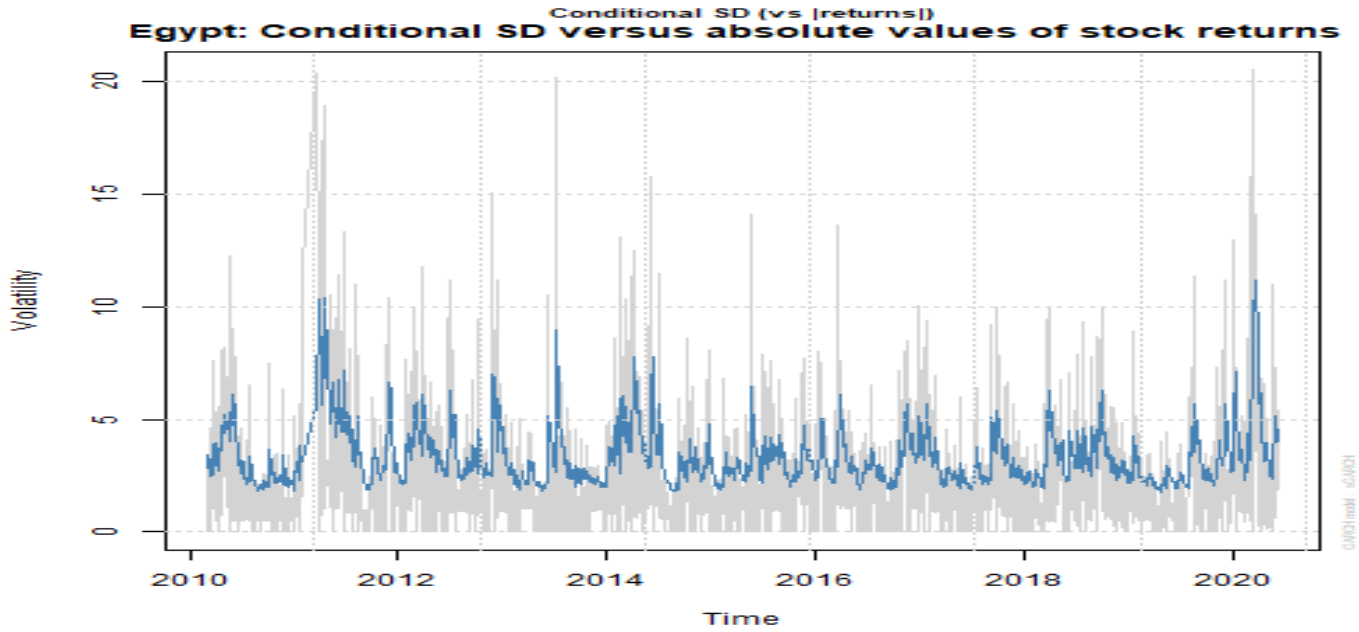


Figure 1: Pattern of Volatility in Egypt

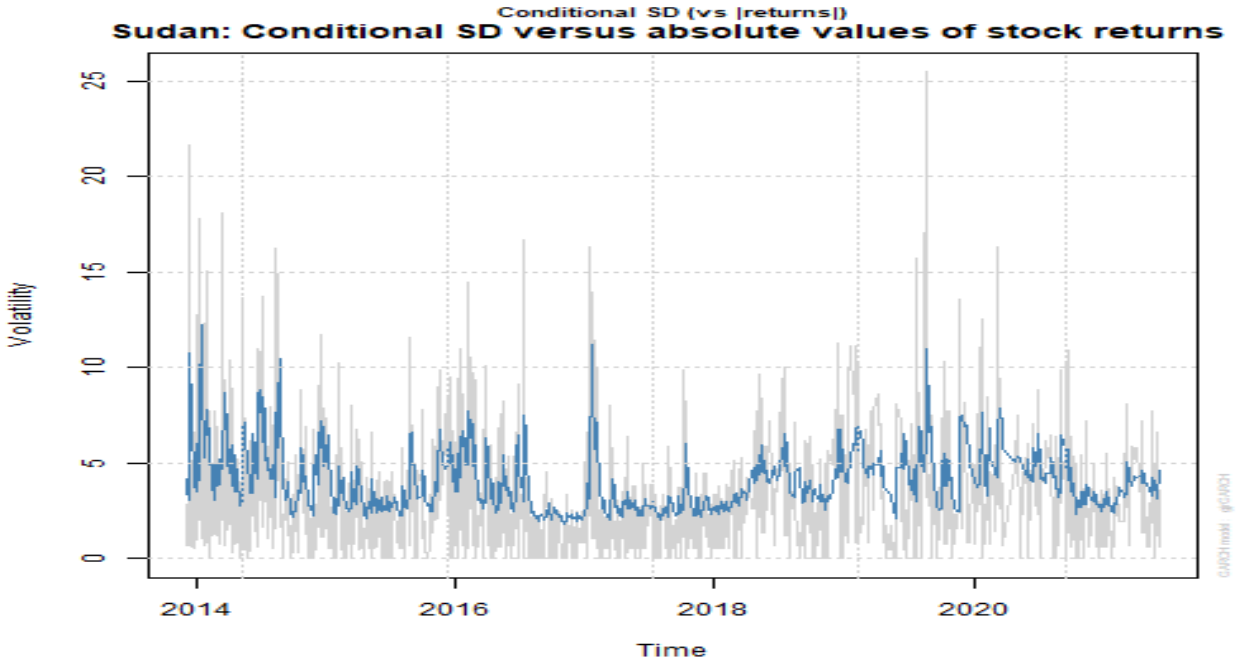


Figure 2: Pattern of Volatility in Sudan

Figure 3: Pattern of Volatility in Namibia

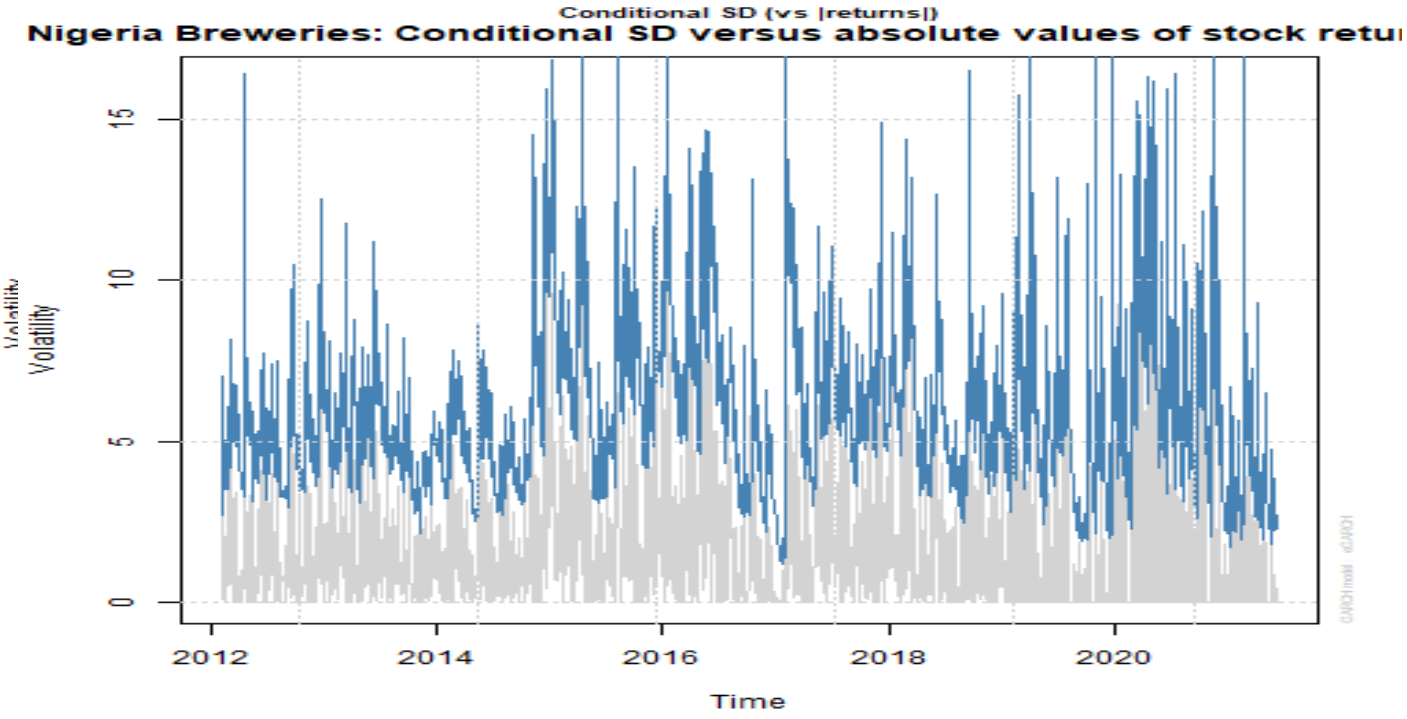


Figure 4: Pattern of Volatility in Nigeria

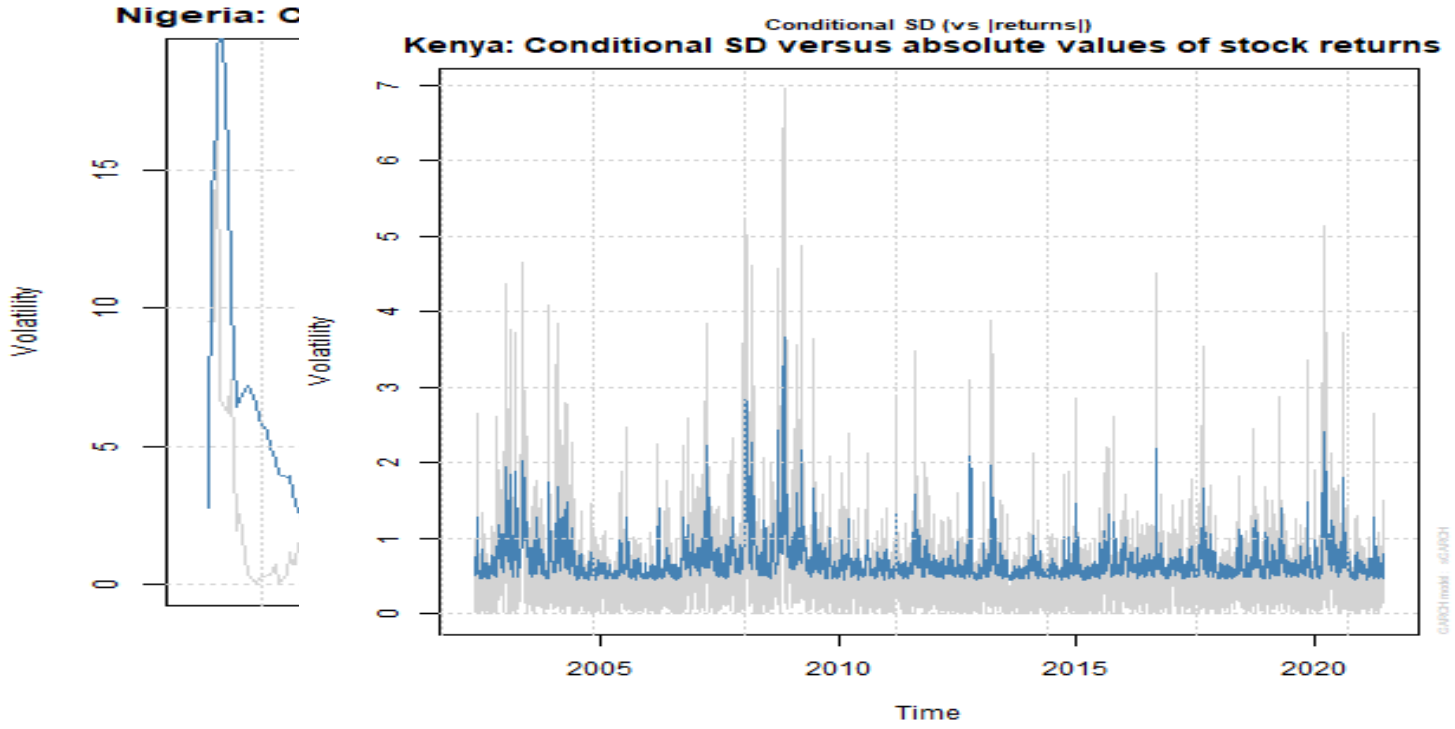
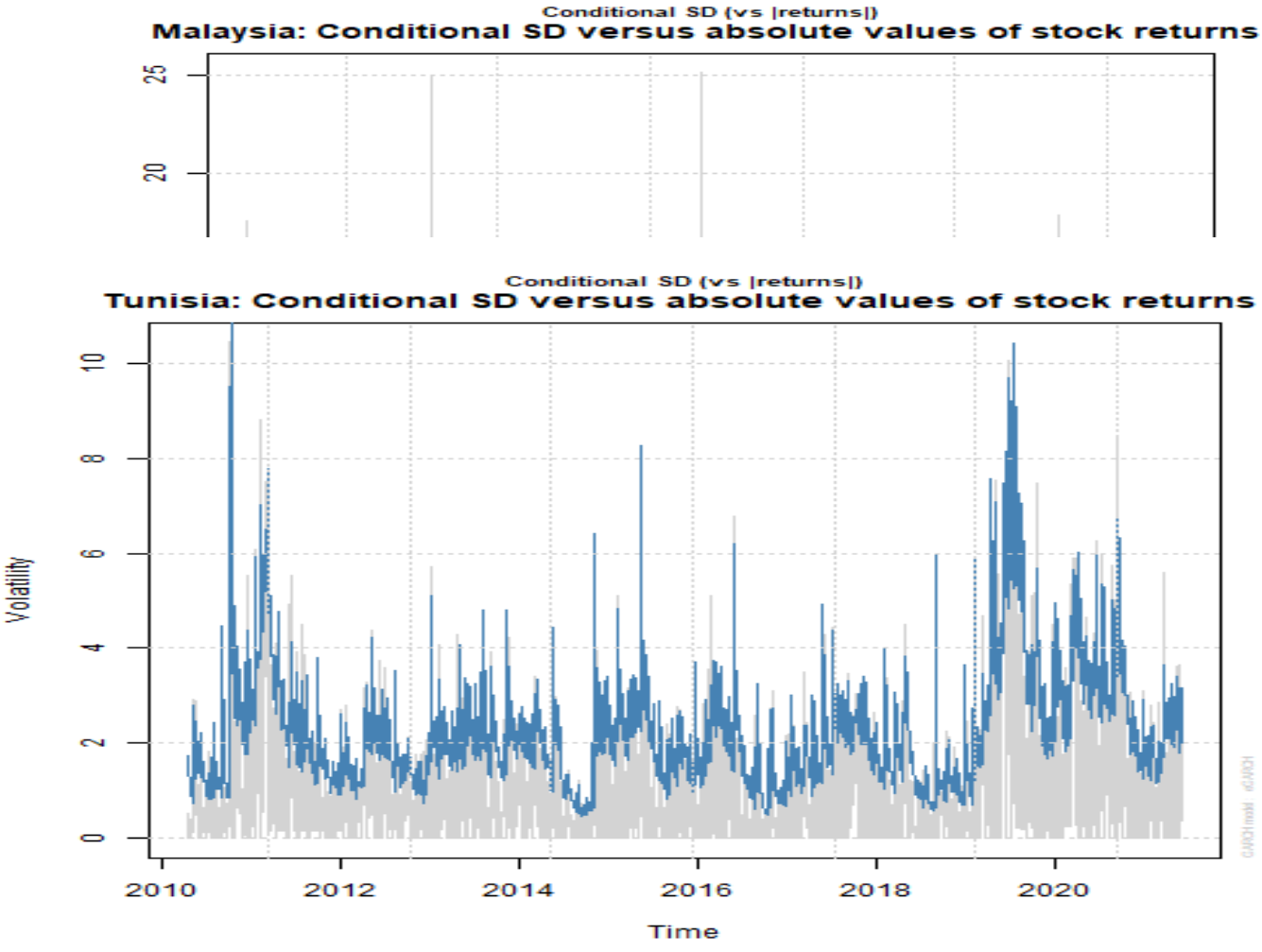


Figure 7: Pattern of Volatility in Tunisia



ARCH LM test for Heteroskedasticity

Table 1: ARCH LM test for Heteroscedasticity

Equity Market	lag1 [pvalue]	lag2 [pvalue]	lag3 [pvalue]	lag4 [pvalue]	lag5 [pvalue]
Tunisia Bank	405.47[0.00]	434.12[0.00]	448.88[0.00]	454.16[0.00]	463.07[0.00]
Botswana Telecom	0[0.975]	0[0.999]	0.00[1.00]	0.00[1.00]	0.01[1]
Egypt Tourism Resort	111.76[0.00]	159.7[0.00]	171.74[0.00]	208.89[0.00]	217.19[0.00]
Kenya NSE	1058.87[0.00]	1122.43[0.00]	1164.4[0]	1167.67[0.00]	1169[0.00]
Malaysia Building Society	1.14[0.286]	6.28[0.043]	8.3[0.04]	16.27[0.003]	17.82[0.003]
Nigeria Telecommunication	23.66[0.00]	44.48[0.00]	49.06[0.00]	48.87[0.00]	48.85[0.00]
Nigeria_Breweries	77.08[0.00]	97.18[0.00]	114.63[0.00]	114.5[0.00]	114.65[0.00]
Namibia Breweries	337.17[0.00]	369.06[0.00]	384.58[0.00]	384.88[0.00]	388.3[0.00]
Mauritius Hotel ltd	0[0.978]	0.00[1.00]	0.00[1.00]	0.00[1.00]	0.00[1.00]
Sudan Al Salam Bank	99.31[0.00]	99.82[0.00]	102.56[0.00]	103.43[0.00]	103.44[0.00]
TaqaMorrocco SA	0.84[0.36]	1.09[0.58]	1.83[0.608]	1.88[0.759]	1.88[0.866]

Sources: Authors

Any series that do not poses heteroscedasticity cannot be adopted in GARCH modelling. So as a rule of thumb, the ARCH Test for heteroscedasticity has to be adopted to check for the presence or absence of ARCH effects. The null hypothesis for this test is a series does not suffer from heteroscedasticity. Accepting this at 95 percent confidence level implies such series do not suffer from irregular movements in its residual. In other words, they do not pose any conditional volatility spikes. On the other hand, rejecting the null implies such series can be modelled and forecasted using either the ARCH model or any of the standard GARCH models. The results of the ARCH test are presented on Table 2. The calculated p-value at 95 percent confidence level is presented in presented in square bracket at several lag values. The results indicated an overwhelming evidence for accepting the null hypothesis for the equity market index for Botswana and Morocco. This implies the markets cannot be modelled or the series be forecasted using the GARCH modelling techniques. Partial evidence was presented for accepting the null hypothesis in the sense that at lag 1 we ought to accept the series for Malaysia building society cannot be modelled. But this claim is not robust by increasing the lags, hence, the null hypothesis is thus rejected and concluded the building society index for Malaysia can be modelled and forecasted using GARCH.

Unit Root Test

Table 2: Unit root test

	Philip Perron test		ADF test	
Equity Market	Const	Const and trend	const	const and trend
Tunisia Bank	-59.99**	-59.98**	-37.511**	-37.50**
Egypt Tourism Resort	-51.42**	-51.41**	-35.39**	-35.40**
Kenya NSE	-44.68**	-44.73**	-33.82**	-33.98**
Malaysia Building Society	-49.36**	-49.38**	-34.01**	-34.03**
Nigeria MTN	-14.03**	-14.04**	-8.99**	-9.00**
Nigeria_Breweries	-50.20**	-50.22**	-36.21**	-36.22**
Namibia Breweries	-43.07**	-43.16**	-28.66**	-28.72**
Sudan Al Salam Bank	-48.95**	-48.94**	-30.89**	-30.88**

*Note 1: * p<0.05 ** p<0.01 *** p<0.001. Source: Author computation*

It is essential to examining the using root test of time series data to avoid adopting series that are prone to introduce spurious relation in our modelling. On these basis, this seminar paper adopts the Augmented Dickey Fuller test (ADF) and Philips Peron

test (PP) on the time series of the emerging market worth examining using the GARCH models. The outcomes presented on Table 3 indicated, at 5 percent significant level, all the series are stationary.

Best GARCH Model Specified

Table 3: Best GARCH Model Specified

Equity Market	Best ARMA model	Best GARCH Model
Tunisia Bank	ARMA(1,1)	eGARCH(2,1) std
Egypt Tourism Resort	ARMA(1,0)	sGARCH(1,1) std
Kenya NSE	ARMA(1,1)	sGARCH(1,1) std
Malaysia Building Society	ARMA(0,1)	eGARCH(1,1) std
Nigeria MTN	ARMA(0,0)	eGARCH(1,1) std
Nigeria_Breweries	ARMA(0,1)	eGARCH(2,1) std
Namibia Breweries	ARMA(0,0)	eGARCH(2,1) std
Sudan Al Salam Bank	ARMA(0,1)	gjrGARCH(1,1) std

ARMA is autoregressive moving average, eGARCH is exponential GARCH, sGARCH is the standard GARCH, std is the standard normal distribution.
Source: Authors' computation

Havening established the stationarity properties of the series, and from the results presented in table 4, we find evidence for adopting GARCH models to examining the series at level. There are two stages in GARCH modelling. The first stage involves estimating the mean equation (presented as ARMA model) and the second stage involves estimation of the conditional mean equation (GARCH model). The appropriate p and q order for the ARMA model is essential to estimate the best ARMA model. Same goes for the GARCH model. In addition to the GARCH model, the best distribution has to be obtained for the model. Failure to obtain the most appropriate p and q order and type of distribution could lead to poor performance of the GARCH model particular in forecasting. This seminar paper adopts simulation technique to get the best p and q order for the ARMA and GARCH model. The best model was selected using information criteria. In addition, the simulation also leads to obtaining the best distribution (among others like normal distribution, student t distribution) for the series. The results as presented in table 4 indicated the best models for estimating the conditional volatility and forecasting. For Malaysia Building Society, Nigeria MTN and Nigeria Breweries, the best mean equation is ARMA (0,1), ARMA (0,0), ARMA (0,1) respectively. These countries best GARCH model for estimating and forecasting volatility is eGARCH. Same eGARCH model goes for Tunisia bank and Namibia. While for Sudab Al Salam bank, gjrGARCH happens to be the GARCH model. Egypt tourism, Kenya NSE corresponding best GARCH models is sGARCH.

Using the obtained ARMA and GARCH models presented in 4, this paper proceeds to estimating the conditional volatilities. The results are presented in Table 5(a). The values in the square brackets are the parameters' standard errors. Starting with Tunisia Bank, all the parameters in the ARMA and GARCH models (with exception to arch effect) are all statistically significant at 5 percent significant level. For GARCH equation, this implies, the GARCH effect (beta) is statistically significant and the ARCH effect (alpha) are present and statistically insignificant. The leverage effect (gamma) is statistically significant. This implies market news have asymmetric effect on Tunisia bank index. That is positive news on the market have different impact on market volatility compared to negative news. In addition, the model persistence is very close to but not equal to 1 which implies volatility of Tunisia bank is very long and thus decay slowly. Tunisia bank equity index can best be forecasted using the exponential GARCH model.

Similar to Tunisia Bank, the Malaysian building society can best be modelled using exponential GARCH model. All the parameters in the estimated ARMA and GARCH models are all significant statistically at 5 percent significant level with exception to alpha. This implies, the GARCH effect (beta) is present and statistically significant. The leverage effect (gamma) is statistically significant. This implies market news have asymmetric effect on Tunisia bank index. That is positive news on the market have different impact on market volatility compared to negative news. In addition, the model persistence is less than 1 which implies volatility of Malaysia Building society is persistence and decay slowly by 0.05 percent.

Table 4(a): GARCH Models for each equity market

	Tunisia	Egypt	Kenya	Malaysia	Nigeria MTN
mu	-0.06***[-0.01]	-0.08[-0.04]	0.01[-0.01]	-0.10***[-0.02]	-0.02[-0.02]
ar1	0.09*[-0.04]	-0.10***[-0.02]	0.64***[-0.03]		
ma1	-0.34***[-0.04]		-0.36***[-0.04]	-0.09***[-0.02]	
omega	0.02**[-0.01]	0.50***[-0.11]	0.06***[-0.01]	0.07*[-0.03]	0.29*[-0.13]
alpha1	0.01[-0.05]	0.16***[-0.02]	0.21***[-0.02]	-0.02[-0.02]	0.90*[-0.37]
alpha2	-0.02[-0.05]				
beta1	0.99***[0.00]	0.81***[-0.02]	0.68***[-0.04]	0.95***[-0.02]	0.87***[-0.03]
gamma1	0.80***[-0.07]			0.29***[-0.05]	0.02[-0.05]
gamma2	-0.51***[-0.05]				
shape	2.57***[-0.07]	4.47***[-0.41]	5.84***[-0.47]	2.90***[-0.19]	2.10***[-0.09]
Variance Model	eGARCH	sGARCH	sGARCH	eGARCH	eGARCH
Distribution	std	std	std	std	std
Model Persistence	0.99	0.98	0.89	0.95	0.87
Convergence	0	0	0	0	0
N	2639	2466	4743	2376	261
Log likelihood	-4529.92	-6149.18	-4578.27	-4493.17	-483.43
AIC	3.44	4.99	1.93	3.79	3.75
BIC	3.46	5.01	1.94	3.81	3.83

Note: Mu is the constant, ma is moving average, ar is autoregressive term, alpha is the arch effect, beta is the GARCH effect, gamma is the leverage effect, omega is N is the total observations. AIC and BIC are the information criterion. . p<0.05 ** p<0.01 *** p<0.001. Source: Author computation*

Similarly, Mobile telecommunication network (MTN) in Nigeria can best be modelled and best forecasted using exponential GARCH model. All the parameters in the estimated ARMA and GARCH models are all statistically significant at 5 percent significant level except the parameters of the ARMA model. From the GARCH model, the GARCH effect (beta) and the ARCH effect (alpha) are present and statistically significant. The leverage effect (gamma) is not statistically significant. Thus, this seminar paper finds no significant evidence to support market news have asymmetric effect on the shares of the telecommunication network (MTN) in Nigeria. Market participants do not react to news differently. In addition, the model persistence is less than 1 which implies volatility of MTN is persistence and decay slowly at 13 percent.

On Egypt Tourism Resort, best model is standard GARCH model and perform best in forecasting the series. Also, all the parameters in the ARMA and GARCH models are statistically significant at 5 percent significant level except mean equation constant (mu). In other words, the GARCH effect (beta) and the ARCH effect (alpha) are present and statistically significant. In addition, the model persistence is than 1 which implies volatility of Tunisia bank is very long and thus decay slowly. Similar to Egypt Tourism Resort, the Kenya NSE best model is standard GARCH model and perform best in forecasting the series. Also, all the parameters in the ARMA and GARCH models are statistically significant at 5 percent significant level except mean equation constant (mu). In other words, the GARCH effect (beta) and the ARCH effect (alpha) are present and statistically significant. In addition, the model persistence is less than 1 which implies volatility of Tunisia bank is very long and thus decay slowly.

Table 5(b): GARCH Models for each equity market

	Nigeria_Breweries	Namibia	Sudan
mu	0.02[-0.02]	0.01***[0.00]	-0.18***[-0.05]
ar1			

ma1	-0.10***[-0.02]		-0.37***[-0.03]
omega	0.12***[0]	-0.01***[0.00]	0.76**[-0.27]
alpha1	0.15[-0.09]	-0.12***[0.00]	0.16***[-0.04]
alpha2	-0.14[-0.09]	0.11***[0.00]	
beta1	0.97***[0.00]	1.00***[0.00]	0.75***[-0.04]
gamma1	1.25***[-0.12]	0.13***[0.00]	0.17**[-0.06]
gamma2	-0.57***[-0.12]	-0.12***[0.00]	
shape	2.10***[-0.01]	2.10***[-0.01]	5.45***[-0.72]
Variance Model	eGARCH	eGARCH	gjrGARCH
Distribution	Std	Std	std
Model Persistence	0.97	1	1
Convergence	0	0	0
N	2287	1260	1403
Log likelihood	-4950.4	-1091.76	-3796.73
AIC	4.34	1.75	5.42
BIC	4.36	1.78	5.45

Note: Mu is the constant, ma is moving average, ar is autoregressive term, alpha is the arch effect, beta is the GARCH effect, gamma is the leverage effect, omega is N is the total observations. AIC and BIC are the information criterion. . p<0.05 ** p<0.01 *** p<0.001. Source: Author computation*

The Nigeria breweries, an equity market can as well be modelled and forecasted using eGARCH model. All the parameters in the estimated ARMA and GARCH models are all statistically significant at 5 percent significant level except the parameters of the ARMA model. From the GARCH model, the ARCH effect (alpha) is statistically insignificant. This implies, previous shocks do not have significant effect on the current market volatility. For the GARCH effect, it has statistically significant impact. The model persistence is close to 1 and strongly indicate the market volatility does not die out.Similarly, best estimating model is found for Sudan Al salam bank is the gjrGARCH model and perform best in forecasting the series.

Also, all the parameters in the ARMA and GARCH models are statistically significant at 5 percent significant level. In other words, the GARCH effect (beta) and the ARCH effect (alpha) are present and statistically significant. In addition, the model persistence is 1 which implies volatility of Tunisia bank is very long does not decay as time passes.The Namibia Breweries can best be modelled using eGARCH model. All the parameters in the estimated ARMA and GARCH models are all statistically significant at 5 percent significant level. The GARCH effect (beta) and the ARCH effect (alpha) at lag 1 are present and statistically significant. The leverage effect (gamma) at lag 1 is statistically significant. This implies market news have asymmetric effect on Namibia breweries. That is positive news on the market have different impact on market volatility compared to negative news. In addition, the model persistence is 1.

D. **CONCLUSION**

In this study, an attempt was made to to find best GARCH model for forecasting stock returns of emerging economies of Africa. We utilized daily data series of ten stock markets in Africa. The contribution of the study to the literature derives from the empirical fact that the study established exponential GARCH (eGARCH) as the best models for forecasting volatility in Tunisia bank, Malaysia breweries, Nigeria (MTN), Nigeria (breweries) stock market, standard GARCH (sGARCH) as the best model for forecasting Egypt, Kenya, and Sudan stock market returns. The study also established that in emerging markets where eGARCH and gjrGARCH are applicable implies the stock market returns react differently to the market news relating to them while in markets where sGARCH is applicable as in the case of Egypt, and Kenya, the market volatility in these markets does not react differently to market news.The study examines the factors responsible for the volatility of stock market returns in African emerging stock markets. We conclude by stating our research findings as follows:

1. Botswana and Morocco stock returns does not possess ARCH effect whereas other emerging market poses ARCH effect.
2. The stock returns are stationary
3. For Egypt, Kenya NSE,and Sudan stock market the best GARCH model for estimating and forecasting volatility is sGARCH. This implies these market stock returns response symmetrical to both good and bad news concerning the stock returns in the market.

4. For Tunisia Bank, Nigeria Breweries, Nigeria MTN, Malaysia Building Society, Namibia Breweries the best GARCH models are eGARCH while gjrGARCH for Sudan.
5. In emerging market economies where eGARCH performs best, the volatility in these market does responds asymmetrically to good and bad news.
6. For Sudan stock market, the best GARCH model for estimating and forecasting volatility is gjrGARCH. This stock returns also responds differently to both good and bad news relating to the stock returns.

The study is original as it is a contribution to the empirical debated regarding the validity of models for measurement of volatility vis-à-vis attitude of investors towards expected returns and risk (uncertainty) in ten African emerging market economies which include, Tunisia, Botswana, Egypt, Kenya, Nigeria, Namibia, Mauritius, Sudan, Morocco and Malaysia based on the Generalized Autoregressive Conditional Heteroskedasticity estimator and its variants. The study also validate estimation of volatility with high frequency data with particular emphasis on daily series.This paper recommends the need for market participants, particularly the brokers and jobbers including the stock holders to uses the aforementioned models in forecasting each corresponding emerging market returns. Also, we so recommend that investors in these market particularly those in the equity market where volatility decay slowly and the market where volatility responds asymmetrically to be watchful as these could pose significant threat to their market portfolio.

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