Volatility Analysis of Exchange Rate of Emerging Economies: A Case of East African Countries (1990-2010)

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Abstract

The aim of this study is to analyze the volatility of exchange rates of the currencies of the five East African Community (EAC) countries. Time series modeling is applied to the data of these countries. Various models were fitted and compared using Maximum Likelihood approach in order to select the best fitting model for each of these countries. The paper also aims at establishing whether NEWS affects the smooth movements of the exchange rates. Static and dynamic forecasts were obtained for periods of unrests to ascertain the contribution of the NEWS to abrupt shifts in the exchange rates movements. The results show that all the economies yield significant volatility models implying that the exchange rate volatility does exist in these countries. Furthermore, forecasts show that the exchange rate volatility in these countries reduce after the date of each one's joining the EAC. This implies that openness of these economies should be encouraged to reduce the exchange rate volatilities of their currencies. The existence of high rates of exchange volatility could be explained by the fact that these currencies are not pegged to any major international currency. The countries are thus advised to peg their currency to avoid future fluctuations.

Keywords: Exchange rate volatility, East Africa, EGARCH, GARCH, Burundi, Kenya, Rwanda, Tanzania, Uganda

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1. Introduction.

1.1 History of EAC and definition of emerging economies

Kenya, Tanzania and Uganda have enjoyed a long history of co-operation under successive regional integration arrangements. These have included the Customs Union between Kenya and Uganda in 1917 and with Tanganyika joining in 1927; the East African High Commission (1948-1961); the East African Common Services Organization (1961-1967); the East African Community (1967-1977) and the East African Co-operation (1993-2000). The former East African Community was dissolved in 1977 and the Co-operation was restarted on November 30, 1993 which saw its full operations on March 14, 1996 when the Secretariat of the Permanent Tripartite Commission was launched at the Headquarters of the EAC in Arusha, Tanzania. The three initial countries later came up with a treaty for the establishment of the East African Community which was signed in Arusha on 30 November 1999 and came into force on **7 July 2000** following the conclusion of the process of its ratification and deposition of the Instruments of Ratification with the Secretary General by all the three Partner States. Upon the entry with force of the Treaty force, the East African Community came into being. Following the success and the benefits that the three countries where enjoying, the Republic of Rwanda and Burundi acceded to EAC Treaty in 18 June 2007 and become full members of the community on 1st July 2007. The table 1 shows the countries and corresponding dates of their joining of the EAC.

Table 1: Date of Accession to EAC and Per capita GDP

Country	Date of Accession to EAC	Per capita GDP in Million US Dollars
Uganda	7 July 2000	503
Kenya	7 July 2000	769
Tanzania	7 July 2000	527
Rwanda	1 July 2007	548
Burundi	1 July 2007	189

Robert *et al*, (2000) define emerging economies as low-income, rapid growth countries that use economic liberalization as their primary engine of growth. They further state that emerging economies fall into two groups: developing countries in Asia, Latin America, Africa, the middle East and transition economies in the former Soviet Union and China. The annual report of 2009 by the Boao forum for Asia on the development of emerging economies define an emerging economy as that which has a per capita GNP of less than US$11906 by 2008. The above two authors make it clear that EAC member countries are emerging economies. This is because the figures of the per capita GDP highlighted by the press release from the South Sudan National Bureau of statistics on 11th August 2011 were far below the bench mark data figures indicated by the Boao report. The 2010 per capita GDP figures of the East African countries indicated by the South Sudan Bureau of Statistics report are shown in table above.

1.2 Background of the study

Exchange rate volatility is defined as the risk associated with unexpected movements in the exchange rate. Economic fundamentals such as the inflation rate, interest rate and the balance of

payments, which have been more volatile in the 1980s and early 1990s, by themselves, are sources of exchange rate volatility (Ozturk, 2006). The NEWS impacts suggested by Tibesigwa and Kaberuka (2014) could also be added onto the list of the factors that bring about volatilities or abrupt shifts in the exchange rates of any economy. The volatilities in the macroeconomic variables have attracted most researchers to not only study the phenomenon but also suggest some remedies to this problem. Volatility is considered a problem since it possess serious risk to most organizations' returns in their businesses.

Researchers in the last two decades have brought on board various models, modelling techniques and modelling software in modelling exchange rate volatility. Since the early 1980s to date researchers like Engle (1982), Bollerslev (1986) have advanced various time series models and edited the ARCH model to come up with a more generalized ARCH model. Tibesigwa and Kaberuka (2014) however, state that though these models have been used in developed countries, their applicability is still minimal in the analysis of developing countries like Uganda. Their paper tried to check the applicability of the GARCH model to exchange rate of Rwanda and found that volatility periods existed in the exchange rate data of Rwanda implying the GARCH models were applicable. Further analysis and forecasts done using the models obtained showed that joining the East African community reduced the volatility of rates of Rwanda (Tibesigwa and Kaberuka, 2014). This implies that the market relationship of the East African economies plays a role in harmonization of the variable. It therefore, suggests that the model could also apply in the rest of the economies of East Africa. Furthermore the GARCH model has also been applied in research done by Danson *et al*. (2012) that analyzed the impact of real exchange rate volatility on economic growth in Kenya. Results show that RER was very volatile for the entire period under study .These results imply the presence of the volatility periods in the most macro-economic variables of the East African countries and therefore gives confidence in the applicability of the GARCH model in capturing the volatility of these variables in the regional economies. The idea of the exhibition of the volatility periods in economic variables is also stressed by Ozturk (2006) who in his paper confirms the existence of the volatility in trade brought about by shifts in the volatility of exchange rates. He further suggests some demerits of volatility like the inhibition of the growth of foreign trade.

The main objectives of this paper are therefore to:

(i) Examine whether there exists volatility periods in the exchange rate data of these economies.
(ii) Establish whether joining the East African common market group has reduced volatility of exchange rates of currencies of the five East African countries.
(iii) Establish whether NEWS affects the exchange rates of the currencies of the countries in question.
(iv) Test which of the five currencies is more vulnerable to NEWS.

The remainder of this paper is organized as follows. The next section (i.e., section 2) shows the methodology of the study. Section 3 estimates the model and presents the results. The last section gives conclusions, policy implications and recommendations for further research.

2. Methodology

2.1 Data

The monthly time series data of exchange rate of the five countries' currencies (Uganda, Kenya, Tanzania, Rwanda, Tanzania and Burundi) that form the East African community has been used. Data on exchange rates was obtained from the IMF data bank for a period of 20 years from 1990 m1 to 2010 m12. The currencies of the respective countries are; The Ugandan shilling, The Kenyan shilling, The Tanzanian Shilling, The Rwandan Franc and The Burundian Franc). Eviews package has been used in the analysis as this package does not require programming and is one of the recommended and suited software for analysis of time series economic data.

2.2 Stationarity of data

The study of time series requires that the data be stationary. This means the absence of seasonality and trend from the data, if they exist. Gujarati (2000) asserts that though time series data are used heavily in econometrics studies, they present special problems to econometricians and hence most empirical work based on time series data assumes that the underlying time series be stationary. A time series is stationary if its mean and variance do not vary systematically over time. The stationary data has the advantage of being used in forecasting unlike non-stationary data that can only be analyzed for the time periods under consideration and thus analyzed for a particular episode and results cannot be generalized to other periods. A stationary time series is always mean reverting (tend to its mean) and fluctuations around its mean (measurement of variance) will have a broadly constant amplitude.

We therefore say that a series is non stationary if it follows a purely random process. A stochastic process is called purely random if it has a zero mean, constant variance σ^2, and serially uncorrelated. A series is non stationary if it follows a random walk model (RWM) (Gujarati, 2000). A random walk model either has a drift or does not have a drift. A random walk without a drift has no constant or intercepts term while that with a drift has a constant or intercept term

Random walk without a drift

A random walk without a drift is of the form $Y_t = Y_{t-1} + u_t$ where the value today is equal to yesterday's plus a disturbance (error) given by u_t. Most economic variables follow this type of random walk and this explains why we should think of the exchange rate of the five east African countries as non-stationary

Showing that a random walk process is non stationary

$$Y_t = Y_{t-1} + u_t \qquad (1)$$

Substituting for t=1,2,3 …., in equation 1, we obtain the following

$$Y_1 = Y_0 + u_1$$

$$Y_2 = Y_1 + u_2$$

equation $Y_2 = Y_0 + u_1 + u_3$

$$Y_3 = Y_2 + u_3$$

$$Y_3 = Y_0 + u_1 + u_2 + u_3$$

Therefore

$$Y_t = Y_0 + \sum u_t \qquad (2)$$

We recall that u_t =deviations .The mean and variance of this process is shown as:

Mean of Y_t

$$E(Y_t) = E(Y_0 + \sum u_t)$$

$$E(Y_t) = E(Y_0) + \sum E(u_t)$$

$$E(Y_t) = Y_0 + 0$$

$$E(Y) = Y_0$$

The variance of Y_t

$$E(Y_t - Y_0)^2$$

$$E(Y_t^2 - 2Y_tY_0 + Y_0^2)$$

$$E(Y_t^2) - Y_0^2$$

$$tVar\ (Y_t\ )$$

The variance of the random walk process is therefore given by

$$Var(Y_t) = t\sigma^2 \quad (3)$$

The variance is not constant since it depends on t. In fact it increases as the time (t) increases hence showing that the random walk process is not stationary. Therefore working with such data would requires making it stationary before empirical analysis.

2.3 The persistence in the shocks of the random walk model

Suppose that at any one time t we obtain the disturbance $u_t = k$ then all the proceeding series values from the point of the disturbance will be k units higher than the preceding series values. This therefore shows that the errors in the random walk type model will never die out, a reason as to why random walk processes are said to have an infinite memory (Peterson, 2000). The shock will always be remembered from the time it occurs onwards.

Gujarati (2000) suggests that non-stationarity of a purely random walk process can be removed by trend differencing. Although the original series of the data may be non-stationary, the first difference of such data is always stationary i.e $Y_t - Y_{t-1} = \nabla Y_t = u_t$ is stationary. If $Y_t = \alpha Y_{t-1} + u_t$, $-1 \le \alpha \le 1$ it is enough to test whether α is statistically equal to 1 and if this is the case then the series at hand is non stationary otherwise stationary.

This paper employs the successive detrending of the original series using trend differences and testing the resulting series for stationarity by use of the Augmented Dickey Fuller test. ADF test is the test for the existence of the unit root in the data series. The null hypothesis for the test is H_o: Data is not trend stationary. We reject the null when the probability for the test is less than 0.05

2.4 Lag determination

The analysis done in this paper involves the modelling of an ARIMA (P,d,Q) as a mean and GARCH(P,Q) as the Variance model for the data of the currencies of the five East African countries. This requires us to know how far back we have to take the data. The values of P and Q will be the lags with the most significant spikes on the Partial Autocorrelation and Autocorrelation function plots respectively. Gujarati (2000) states that to get the best estimates of P and Q, we should analyze the lags at least equal to $\frac{1}{4}$ of the number of the observations. Since we have 240 months for our data, the analysis has at least 60 lags of the months. After obtaining the significant lags, the mean model and the variance model are respectively be written as;

$$Z_t = \mu + \sum_{i=1}^{p} \varphi_i Z_{t-i} - \sum_{j=1}^{q} \phi_j \varepsilon_{t-j} + u_t \quad u_{t\sim}(0, \sigma_t^2) \quad (4)$$

,

$$\text{and } \sigma_t^2 = \alpha_0 + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}^2 + \sum_{j=1}^{p} \beta_j \sigma_{t-j}^2 \quad (5)$$

Where μ and α_0 are the intercepts, P and Q being equal monthly lags of the exchange rates, $Ø_i$, $Ø_j$, α_i and β_j are the coefficients to be determined , $\alpha_i \geq 0$, $\beta_j \geq 0$ and $\sum (\alpha_i + \beta_j) < 1$. For the matter of parsimony of the mean and variance models, we require that the lags P and Q are as small as possible which is in agreement with Chen and Lian (2005) who found that GARCH (1, 1) had the capability to capture all the volatility aspects of any data. Each of the countries data series used in this study is modelled for the mean and variance and the optimal model chosen by the use of AIC (Akaike Information Criterion) since it ensures that the model is parsimonious.

2.5 Parsimonious nature of GARCH

Advances in research shows that GARCH removes the effects of long memory and its related effects. This is popularly referred to as parsimonious nature of GARCH. Brooks (2002) gives the interpretation of this parsimonious nature of GARCH which has guided this study in detailed. Firstly we begin with the understanding of the shortest GARCH model as GARCH (1, 1).

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2 \quad (6)$$

For

$\alpha_0 > 0$, $\alpha_1 \geq 0$ and $\beta_1 \geq 0$, $\alpha_1 + \beta_1 < 1$

Subtracting 1 from the subscripts of the equation (6) gives us

$$\sigma_{t-1}^2 = \alpha_0 + \alpha_1 \varepsilon_{t-2}^2 + \beta_1 \sigma_{t-2}^2 \quad (7)$$

Substituting (7) into (6) will yield the equation below

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 (\alpha_0 + \alpha_1 \varepsilon_{t-2}^2 + \beta_1 \sigma_{t-2}^2)$$

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \alpha_0 + \beta_1 \alpha_1 \varepsilon_{t-2}^2 + (\beta_1)^2 \sigma_{t-2}^2 \quad (8)$$

Also subtracting 1 from the subscripts of equation (7) gives us

$\sigma_{t-2}^2 = \alpha_0 + \alpha_1\varepsilon_{t-3}^2 + \beta_1\sigma_{t-3}^2$ and when this is substituted into equation (8) we obtain

$$\sigma_t^2 = \alpha_0 + \alpha_1\varepsilon_{t-1}^2 + \beta_1\alpha_0 + \beta_1\alpha_1\varepsilon_{t-2}^2 + (\beta_1)^2(\alpha_0 + \alpha_1\varepsilon_{t-3}^2 + \beta_1\sigma_{t-3}^2)$$

$$\sigma_t^2 = \alpha_0 + \alpha_1\varepsilon_{t-1}^2 + \beta_1\alpha_0 + \beta_1\alpha_1\varepsilon_{t-2}^2 + (\beta_1)^2\alpha_0 + (\beta_1)^2\alpha_1\varepsilon_{t-3}^2 + (\beta_1)^3\sigma_{t-3}^2$$

Successive substitutions of $\sigma_{t-3}^2, \sigma_{t-4}^2, \sigma_{t-5}^2, \ldots$ would yield the equation

$$\sigma_t^2 = \alpha_0[1+\beta_1+(\beta_1)^2+\ldots] + \alpha_1\varepsilon_{t-1}^2[1+\beta_1 L+(\beta_1)^2L^2+\ldots] + (\beta_1)^\infty\sigma_0^2 \quad (9)$$

From equation (9), $(\beta_1)^\infty \to 0$ since $\beta_1 < 1$. Hence the term $(\beta_1)^\infty\sigma_0^2$ will be zero. Therefore the GARCH (1, 1) can be written as

$$\sigma_t^2 = \lambda_0 + \alpha_1\varepsilon_{t-1}^2[1+\beta_1 L+(\beta_1)^2L^2+\ldots]$$

$$\sigma_t^2 = \lambda_0 + \alpha_1\varepsilon_{t-1}^2 + \beta_1\alpha_1 L\,\varepsilon_{t-1}^2 + \alpha_1(\beta_1)^2L^2\varepsilon_{t-1}^2 + \ldots$$

$$\sigma_t^2 = \lambda_0 + \lambda_1\varepsilon_{t-1}^2 + \lambda_2\varepsilon_{t-2}^2 + \lambda_3\varepsilon_{t-3}^2 + \quad (10)$$

Looking at equation (10), we see that it resembles the infinite order ARCH. This implies that the GARCH (1, 1) is parsimonious. In fact GARCH (1, 1) containing three parameters is very parsimonious than the ARCH model hence it is more applicable than the ARCH model. It is also important to note that equation (5) can be written as

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^{q}\alpha_i\varepsilon_{t-i}^2$$

For B_j all equal to zero and this reduces to an ARCH model of lag (q). Once stationarity of the data has been achieved, we proceed with model fitting. This is followed by the post modeling tests that establish the optimal models.

Post modelling tests (Diagnostic Tests)

The post modelling tests employed in this paper are the tests on the residuals of the optimal models. For a model to be considered optimal, its residuals should possess the following characteristics;

(i) Should be normally distributed. i.e. the residuals are identically and independently distributed.($\varepsilon_t \sim N(0, \sigma^2)$)

(ii) Should not exhibit serial autocorrelation
(iii) Should be random (white noise)
(iv) Should have a constant variance or spread (Homoscedastic).

The details of these tests and their corresponding Null hypotheses are discussed by Tibesigwa and Kaberuka (2014). This paper also carries out the Chow-break point test (stability test) to test for the existence of break points in the data series under consideration. The break points are the same points where there is random/erratic fluctuations in the series.

3. Model estimation and Presentation of the results

This is done country by country. The plots of the exchange rates of all the countries are shown in fig. 1. This plot shows the periods when the countries' data are suspected to have been affected by NEWS. These are the period when there are abrupt increases and decreases in the data values of these countries. From the plot, the data for all these countries are seen to have clear upward trends implying that they follow a random walk which is not stationary and therefore they would need to be differenced in order to remove this trend.

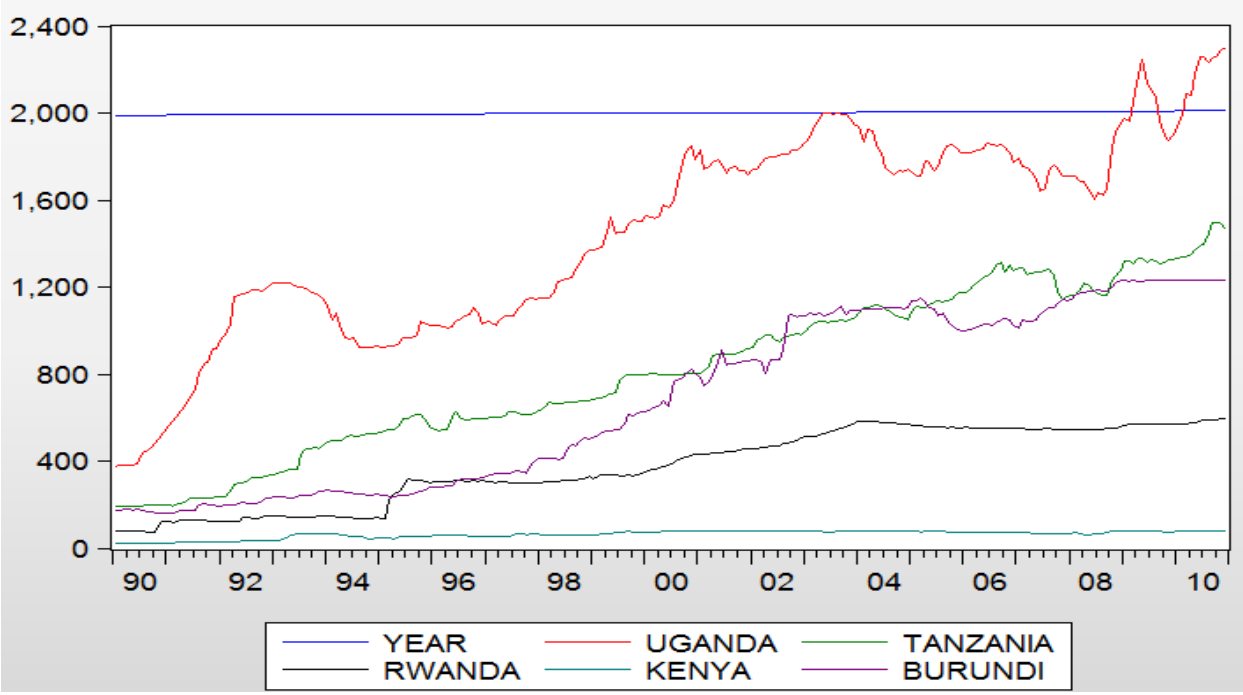

Figure 1: Plots of Exchange Rates of the East African Countries (1990-2010)

From Figure 1, it is evident that the exchange rate data of all the five countries exhibit an upward trend. This therefore would require detrending in order to attain stationarity which is a requirement for time series data modelling. Furthermore, Fig. 1 shows that the Kenyan shilling has the least variations and therefore it can be considered to be the most stable currency among all the East African currencies while Ugandan shilling is evidently the most volatile currency. The Rwandan Franc is the most susceptible currency to NEWS as evidenced by the abrupt increase in the volatility in the period of 1994 when the country faced genocide.

The ADF tests for existence of a unit root in the original data and the first differenced data of all the countries' data are shown in table 2. From the table, the data are stationary after the first difference since the P= 0.0000 at 0.05 level of significance. This therefore implies that the value of d in all the ARIMA (P, d, Q) models is 1.

Table 2: ADF test results on the data of the five countries

Prob of the ADF test on the data of the five countries		
Country	Non- differenced data	First differenced data(P value)
Uganda	0.4800	0.0000
Kenya	0.1777	0.0000
Tanzania	0.9019	0.0000
Rwanda	0.6426	0.0000
Burundi	0.9327	0.0000

The correlograms (Partial autocorrelation and Autocorrelation functions) of all the countries' exchange rate data yielded the ARIMA models shown in the table 3. The table below shows the countries and their respective volatility as fitted in Eviews 7. These optimal model are obtained from a group of competing models by use of the AIC.

Table 3: The Long Run Average of Volatility

Country	Volatility Model	Long run average of volatility
Uganda	ARIMA(1,1,0):GARCH(1,1)	151.35
Kenya	ARIMA(1,1,0):GARCH(1,1)	0.25
Tanzania	ARIMA(1,1,0):GARCH(1,1)	4.92
Rwanda	ARIMA(3,1,4):GARCH(1,1)	-0.05
Burundi	ARIMA(1,1,1):GARCH(1,1)	22.42

3.1 Forecasting using the models obtained.

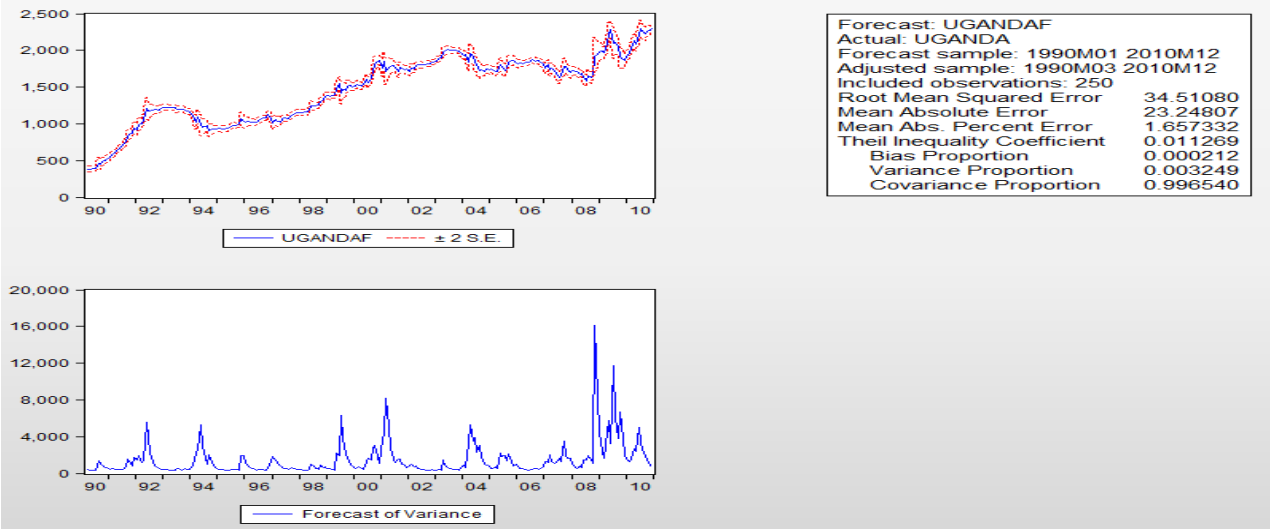

Figure 2: The static forecasts of Uganda's exchange rate.

From the static forecast in Figure 2, the model fits the data well since the confidence limits are very close to the mean forecasted that is indicated by the blue line. Further to that, the MAPE (Mean Absolute Percentage Error) of 1.66% shows that the model is good enough. A look at the static forecast of variance tells us that the volatility of the exchange rates of Uganda has been violently increasing since the period of 2008. It is also evident that this volatility reduced from the last quarter of 1993 to the last quarter of 1998. This is possible since Uganda had started enjoying the benefits of the East African Corporation which saw the volatility of her exchange rate reduce. Furthermore, the reduction is seen in the period between 2000 and last quarter of 2003. This is the period when the country was fully integrated into the East African Community. In fact this effect extends to 2008.

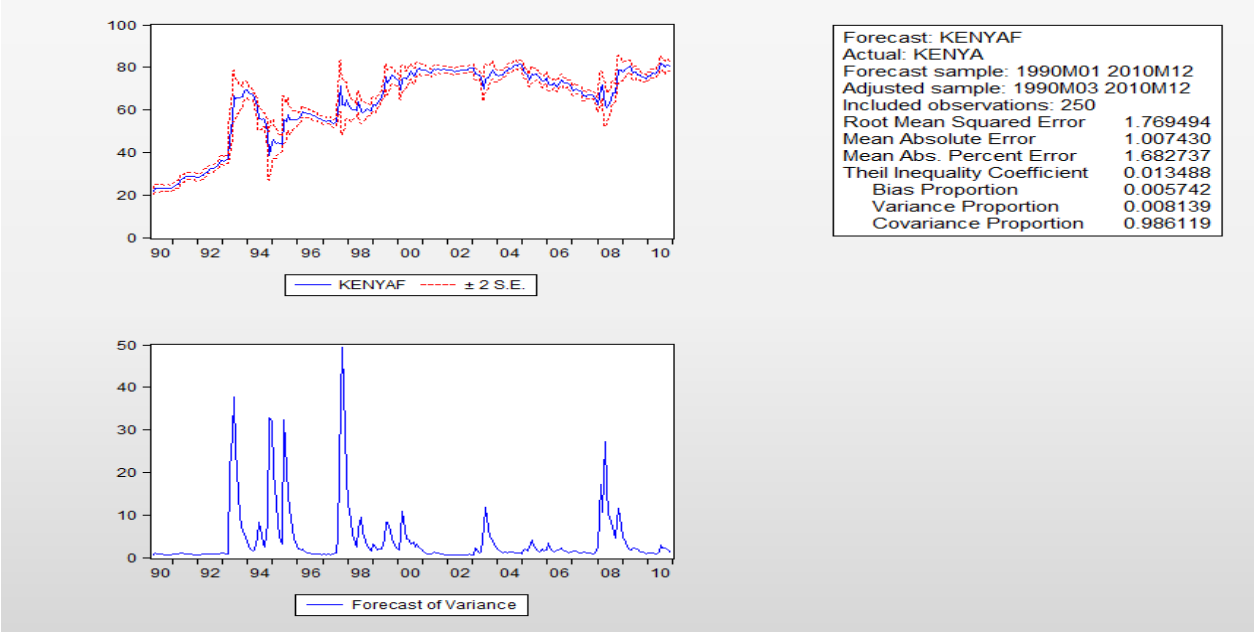

Figure 3: The static forecasts of Kenya's exchange rate.

The model fits the Kenyan exchange rates data well since the mean absolute percentage error is 1.68%. It is evident that joining the East African Community has done the economy good because the volatility reduced tremendously from 2000 when the country joined the East African Community. This therefore shows that joining the common market group was a piece of good news to this economy. A sharp peaked increase in the volatility exhibited in 1998 could be due the unrest caused by the bombing of the US embassy in Kenya during that period. It makes sense to think of this since the dollar could have become scarce due to that event. However this may not suffice since there are various other factors that affect the volatility of the exchange rate of any country as suggested in the recommendations for further research.

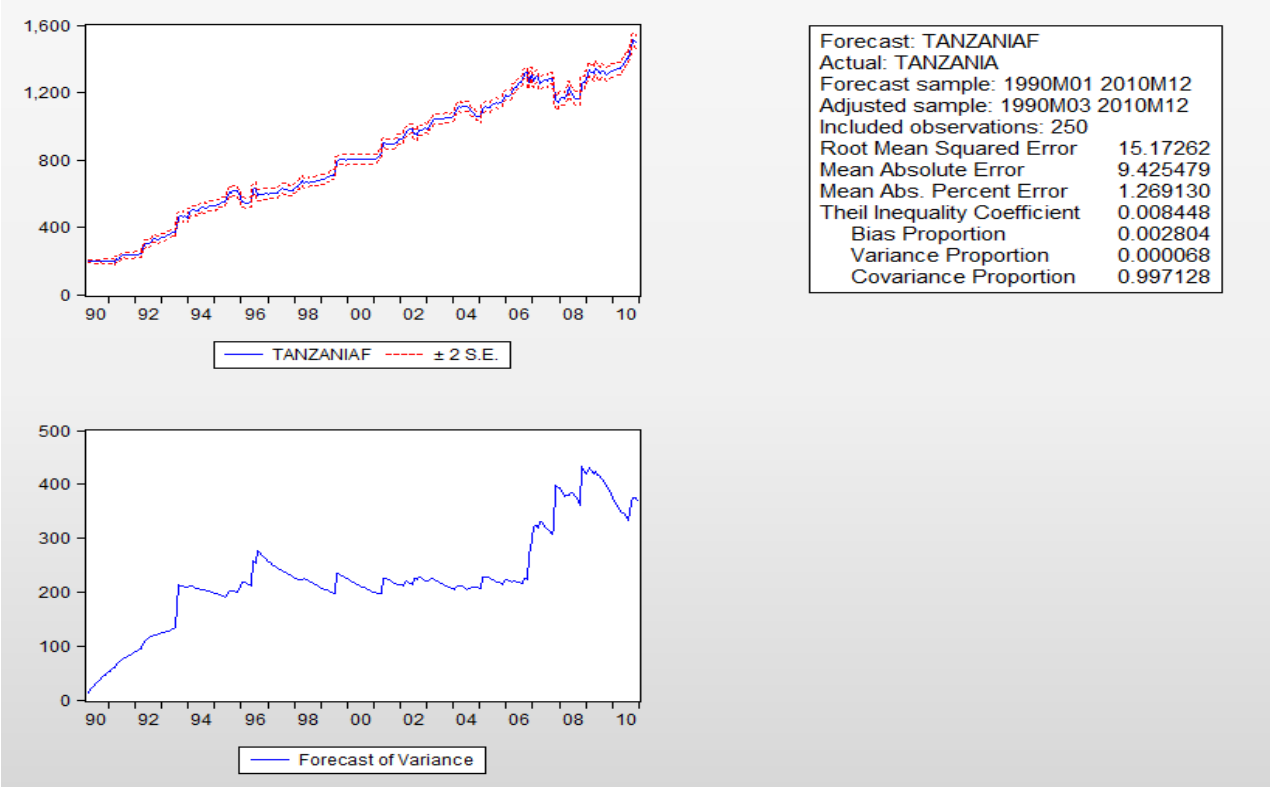

Figure 4: The static forecasts of Tanzania's exchange rate.

The look at the forecast of the mean in figure 4 shows an almost smooth variation in the exchange rates of this country. This may imply little NEWS effects in the country. The model fits the data well since the error made is 1.26%. The variance graph however shows very little variations in the volatility values from the period 2000 to 2007. Again this is the period when the country had joined the East African Community.

Unlike other East African countries, Rwanda has had a lot of political instabilities characterized by events that could be responsible for the variations in the exchange rates data of this economy. Some of these events include the genocide of 1994 and the country's joining of the EAC in July 2007. Analysis of the forecasts shows that the model obtained for Rwanda's data is good since the error is 1.26%. A one year forecast of the volatility of exchange rate of this country after the period of 1994 and 2007 in figure 5 and 6 shows that the genocide increased the volatility while joining the EAC reduced the volatility of exchange rate. Therefore it is worth noting that joining a common market group is also a piece of good news to the economy

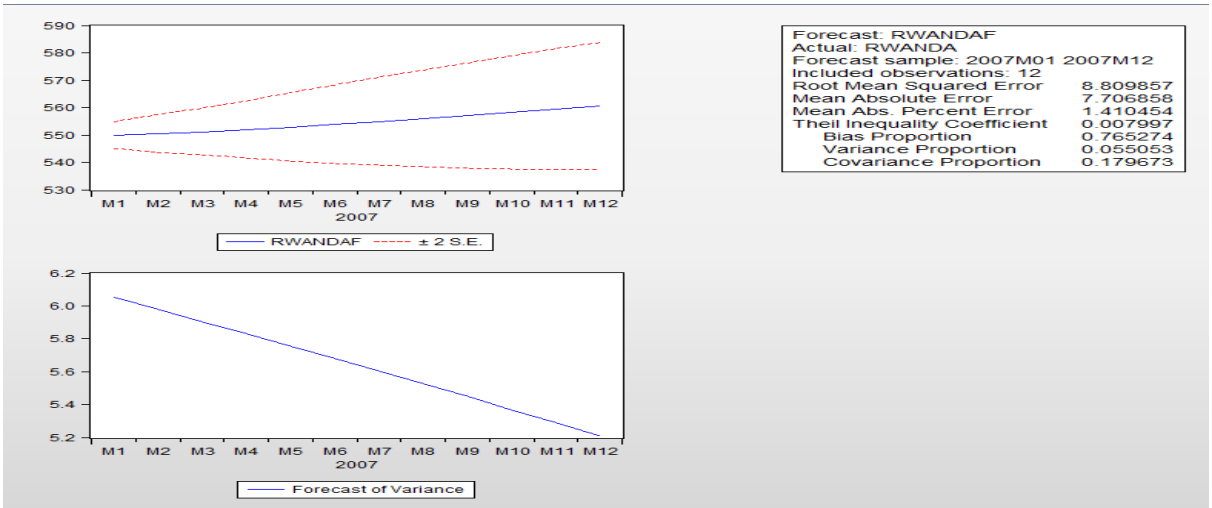

Figure 5: The forecasts of Rwanda's exchange rate after joining EAC.

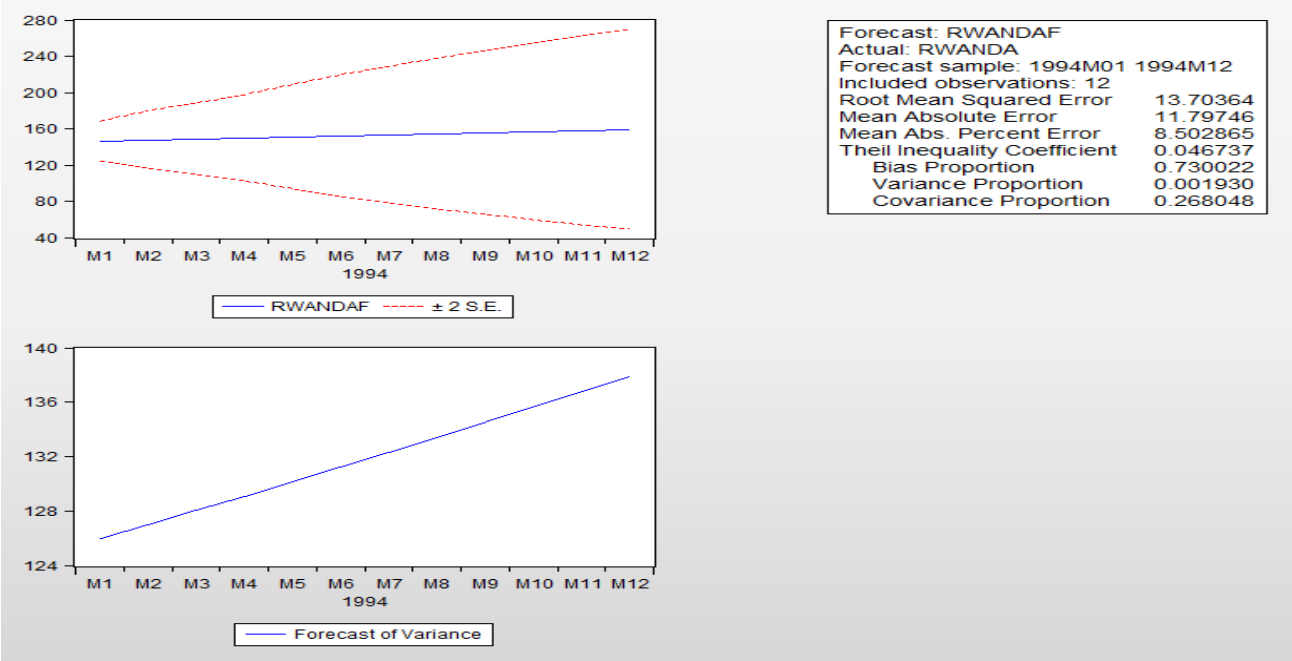

Figure 6: The forecast of Rwanda's exchange rate after Genocide.

Just like Rwanda, the exchange rate volatility of Burundi is not violent. The country had violent shifts in its exchange rate volatility from 2000 to 2003 as shown in the figure 7 below. It should be noted that Burundi's exchange rate tremendously reduced after its joining date (July 2007) as shown on the forecast of variance in figure 7. This therefore shows that the market group was responsible for harmonization of Burundi's exchange rate volatility.

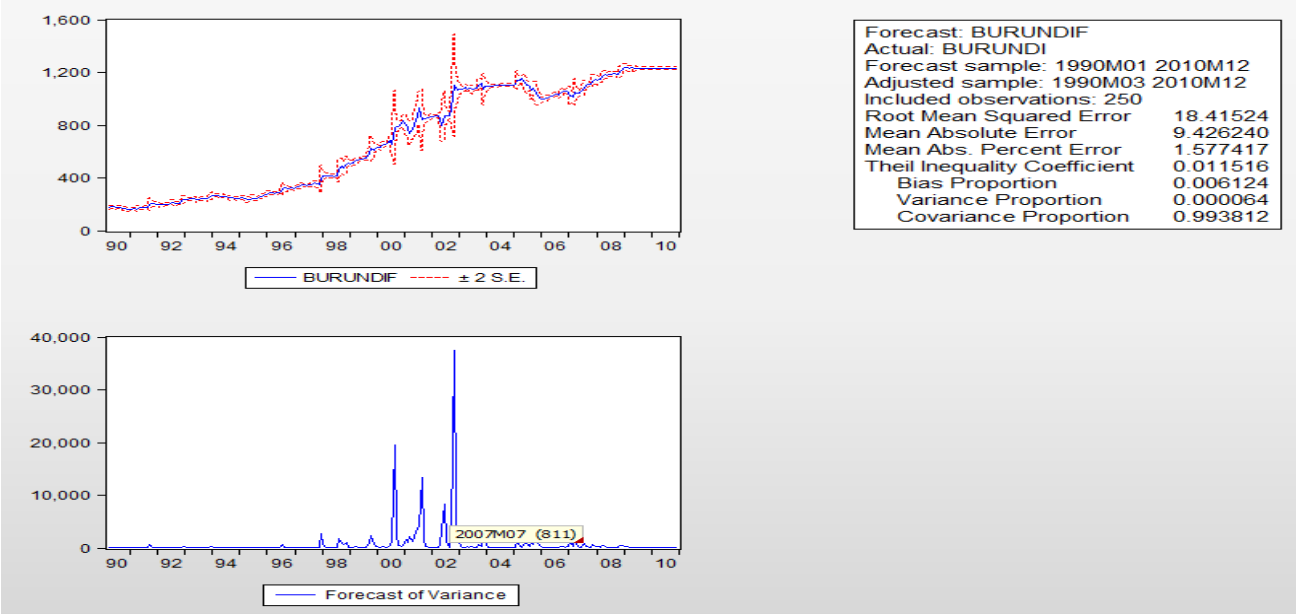

Figure 7: The static forecasts of Burundi's exchange rate.

Structural Stability Tests

In this test we are interested to know if there are significant structural breaks in the time series of exchange rates of the five countries. The null hypothesis for the test is H_0: there are structural breaks in the data. We then carry out the test for each of the country's data following the dates in table 4 where we suspect that there were NEWS effects (Chow 1960 and Quandt 1960).

Table 4: Dates suspected to be affected by NEWS

Country	Suspected Dates	Reason
Uganda	March 1993	East African corporation started
	July 2000	EAC started
Kenya	March 1993	East African corporation started
	July 2000	EAC started
	Dates for the bombs	
Tanzania	March 1993	East African corporation started
	July 2000	EAC started
Rwanda	April 1994	Genocide period
	July 2007	Joined EAC
Burundi	April 1994	Genocide period
	July 2007	Joined EAC

The results of the tests are shown in table 5. From these results, it is evident that there were structural breaks in the exchange rates of the five East African countries. This therefore, implies that the events in these periods were responsible for the structural changes in the data of these economies.

Table.5: The structural stability tests

Country	Suspected Dates affected	Null hypotheses	Prob. for the test	Decision
Uganda	March 1993 July 2000	H_o: Data **has no** structural breaks at the stated points	0.1703	Reject the Null
Kenya	March 1993 July 2000 Date for the bombs	H_o: Data **has no** structural breaks at the stated points	0.5215	Reject the Null
Tanzania	March 1993 July 2000	H_o: Data **has no** structural breaks at the stated points	0.9923	Reject the Null
Rwanda	April 1994 July 2007	H_o: Data **has no** structural breaks at the stated points	0.3653	Reject the Null
Burundi	April 1994 July 2007	H_o: Data **has no** structural breaks at the stated points	0.6018	Reject the Null

4. Conclusions and policy implications

The results of the analysis show that there exists volatility periods in the exchange rate of the East African countries given the significant volatility models obtained of the GARCH family by fitting and selecting the optimal models the AIC. The most parsimonious GARCH model is GARCH (1, 1) of which Chen and Lian (2005) state that it has the capacity to capture all the volatility aspects of the data. All the volatility models that were obtained for all the countries' data had the values of P and Q of less or equal to 2 which shows that the models were parsimonious. Results show that joining the East African Community has led to a reduction in the exchange rate of the countries in question. Joining a common market harmonizes the volatility of an economy and sometimes increases the volatility due to cross boarder contagion. The effect depends on the level of development of the economy and whether or not the economy is joining an existing market group. Usually the new comer economies have their volatility reduced and the reverse is true for old members of the group. This therefore implies that economies should be encouraged to join market groups in order to reduce their exchange rate volatility and especially those that are in their immediate neighborhood.

Furthermore, the analysis showed that NEWS are responsible for most of the abrupt shifts in these data. Good news were found to reduce the volatility while bad news were found to increase the volatility of the exchange rate of the countries. This is also evidenced by the structural

stability test which shows that there were significant structural breaks in all the data of the countries. The periods with breaks are thought to be those when the NEWs effects are taking place. The countries are therefore advised to maintain good or harmonious political climate to ensure that adverse effects to stability like the bombings, genocides etc. do not occur as these cause instability in the exchange rates.

According to the long run average values of the volatilities of the exchange rates of the five East African countries in table 3, the Ugandan shilling is the most volatile with an absolute average volatility of 151.35 and the most stable currency being that of Rwanda with an absolute average volatility of 0.05 in spite of the political turmoil at the beginning of the 1990s and the subsequent genocide of 1994.

4.1 Recommendations for further research

Similar research should be done by use of the macro economic factors that affect the exchange rate of the currencies of these countries to find out if it is only the events in this paper that affected the volatility of the exchange rates of these economies during the periods analyzed. In such research the model to be used will be a regression model with the exchange rates data of these countries as the dependent and the suggested macroeconomic factor as the independent variable. The d**ummies** may also be used to represent the dates when the NEWS are suspected to have an effect. These dummies can then also be incorporated in the model during the analysis and their respective effects determined. Alternatively, given the availability of data on the exchange rates and the macroeconomic variables, the analysis may be done by use of a panel data model.

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