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Dynamic Causal Linkage from Selected Equity Market in Sub-Saharan African Market-Vector Autoregressive (VAR) Approach

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ABSTRACT
Market interactions among stock market of the world have necessitated the relationship among different financial markets driven by market liberalization and international pressure to lower trade barriers, which have enhanced international linkages between capital markets. This study examines the dynamic causal linkage among the selected equity market in Africa using the generalized Vector autoregressive (VAR) framework that produces forecast error variance decompositions and also accounts for correlated shocks using historically observed distribution of the errors. The time series data from investing.com over 01/02/2004-01/07/2016 are employ for the study. The findings on dynamic return linkages is that there is no strong significant returns linkages among the African selected markets. Controlling for the influence of advance market (UK and US). The results show that the South African market has more link with international markets than the Nigerian market. A crucial finding is the lowest spillover index recorded through variance decomposition and impulse response among the African markets. This is an indication of possible gain in African market and in line the portfolio theory. The finding of this study have important implications for policymakers.

Introduction

Market interactions among stock market of the world have encouraged investors and scholars to study the relationship among different financial markets. Globalization, driven by improved communications technology and international pressure to lower trade barriers, is likely to enhance international linkages between financial markets. While dynamic linkage in financial markets provides advantages, potential pitfalls also a result. Events such as the stock market crash in 1987, Asian financial crisis, technological meltdown of 2000 and sub prime crisis 2007 also make this an important issue for financial policy makers since market dynamic linkage among stock can result in contagion as investors incorporate into their trading decisions price changes in other markets in an attempt to form a complete information set, so that errors in one market may be transmitted elsewhere (Fernandez-Serrano and Sosvilla-Rivero, 2001, Ogbonna, Iheanacho and Okere 2016).

Linkages among developed stock markets have been studied since the 1970s. Many researchers have investigated the short-term and long-term relationships among worldwide financial markets. The primary focus of the empirical research has been on relationships among the advanced financial markets. Swanson (1987) suggests that world stock markets are becoming more integrated. For developed countries this might be true. However, only a few studies have examined the relationship between the emerging financial markets in the Sub-Saharan Africa (Ogbonna et al 2016)

Another point of interest to researchers has been that of arbitraging and international diversification. According to Efficient Market Hypothesis, if stock markets are efficient, their stock prices should not be cointegrated, because then, arbitrage profits can be obtained (Granger, 1986; Baillie and Bollerslev, 1986). Cointegration in the stock markets is also an important factor with regards to international diversification of investment. Recent empirical developments in the field of global stock price spillovers and dynamic linkages have led to renewed interest in intra-regional and inter-/intra-market spillovers (Weber,2013; Karunanayake and Valadkhani,2011). Although several attempts have been made to analyse the transmission of stock market spillovers across markets with emphasis on Asian tigers and European market, very little has been done in terms of Sub-Saharan African markets despite the continent's increasing global financial integration and economic liberation. Although the study by Ruch (2013) tried to establish the impact of spillovers on the South African economy, the author focused on industrial production and not equity markets while the scope was only limited to South Africa, Euro area, US, Japan and China. International stock market shave experienced increasing interactions with one another in the past decade primarily as a result of 3 factors: speedy information transmission, stock market capital movements due to asset diversification, and cross- border multi-listing and geographical proximity of markets (YehandLee,2000). These developments over the past decade further motivate an assessment of how spillovers and shocks are transmitted from mature equity markets to emerging markets during periods of calm and turbulence (Beirne et al.,2013,).

Therefore, understating the interaction between international stock market could have a significant impact on the formulation and implementation of major market policies targeting stock malpractices in Nigeria. It could also guide investors in the possible gain from the international portfolio diversification, given the dynamics of stock market integration, dynamic linkage and volatility in Africa.

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Controlling for the possible influence of NYSE-US prices and FTSE-UK on the selected African stock market, this study seek to uncover .(i) The dynamic linkage of stock market in Sub-Saharan Africa (ii) the contribution of each selected market to the Nigeria stock market. (iii) To contribute to the body of literature on spillovers and interdependence across equity markets by conducting an empirical investigation of return.

The rest of this article will be organized as follows; section 2, presents survey of the literature. Section 3, will discuss the methodology employed in the study, while section 4, analyses the empirical results.Finally, section 5, contains conclusions and recommendations

2. Empirical Review

Studies on stock market have typically focused on the merits of portfolio diversification, volatility, the lead relationship and comovement of equity prices among market indices. On the other side, many studies have focused on the movement of world exchange indices during a worldwide stock market crash.(see Engsted and Lund (1997), Ahlgren and Antell (2002), of Fraser and Oyefeso (2005), Pascual (2003), Rangvid (2001), Ogbonna et al (2016), Dickson (2000), Chan et al (1997).These scholars have all focused on the relationship among worldwide financial markets. The centre of their debate have been the relationships among the financial markets of industrialized countries. Most advanced economies deregulated their capital markets, removed barriers to international investment, and improved accessibility to information. However, some notable studies that focused on dynamic causal link among stock market are in the likes of Masih and Masih (2004),(Richards 1995).Masih and Masih (2004) assess the dynamic linkages of the stock prices of France, Germany, Netherlands, Italy and the UK for 14years the from 1979 to 1994 in terms of what effect the October 1987 crash had on its transmission. They employed the use of unit root tests and Johansen cointegration test on three sample periods; January 1978- September 1987, November 1987-June 1994 and January 1979 – June 1994. They found the presence of unit roots in the samples and both the max-eigen value and the Trace statistic indicate the existence of at most a single cointegrating vector in each of the models over the pre and post crash samples, this signify four common stochastic trends among the set of stock price indexes. The evidence of cointegration among these markets implies that each national stock price series contains information on the common stochastic trends which binds all the markets together; the predictability of one country's stock prices can be enhanced significantly by utilising information on the other country's stock prices. They concluded that the evidence of cointegration in their findings is consistent with a violation of the market efficiency hypothesis, this should however be evaluated with due caution since predictability implies nothing about market inefficiency (Richards 1995); a market is inefficient only by using the predictability one could earn risk-adjusted excess returns. Yang et al (2003) investigated the impact of the Economic and Monetary Union (EMU) on stock market linkages, allowing for inference on international market integration from three different perspectives; contemporaneous, the short run and long run. They employed the Johansen and Julius 1990 and Johansen 1991- Trace test on daily closing prices of ten European Monetary Union countries including the UK and US from 1996 to 2001, their findings shows that European stock markets as a whole are more integrated in the long run after the EMU was implemented.

Dickson 2000 examined the macroeconomic variables driving the common stochastic trends of the US, UK, German and French stock markets, using cointegration analysis on monthly stock prices and macroeconomic variables (industrial production, interest rate and exchange rates) from 1980 to 1995, there does not appear to be a major increase in the degree of integration in Europe despite the potential for much real integration as monetary union proceeds. His results shows an equilibrium relationship between German stock index and the UK real interest rate, the US stock index also has a long run effect on the German real interest rate. He concluded that interest rate is an important source of stock market variability

Using an error correction vector autoregressive model on the daily stock index closing prices in the six markets from 1997 to 2003, Syriopoulos (2004) examined the presence of short and long run linkages among major emerging central European stock markets as well as developed markets; Poland, Czech Republic, Hungary, Slovakia, Germany and the USA. Their empirical findings support the presence of one cointegration vector, indicating a stationary long run relationship. Based on their findings, both domestic and external factors affect stock market behaviour leading to long run equilibrium but the individual central European markets tend to display stronger linkages with their mature counterparts rather than neighbours.The same findings was observed by Dickson (2000) and Yang et al (2003). They also argued that the cointegrating relationship among the major European stock markets especially after the 1987 stock crash may be driven partly by the long run relationships of macroeconomic fundamentals among these countries.

On the side of Africa countries, one common finding has been that the African equity markets are generally segregated from each other and from the world equity markets, which is an indication that they are mostly influenced by domestic factors. Lamba and Otchere (2001), Ogbonna et el (2016) report that South Africa and Namibia, are linked to each other and also influenced by the US and UK equity markets. This study analysed the linkages among African stock markets and with the global market using VAR and impulse response. Furthermore, the authors documented that Ghanaian, Namibian and SA markets were linked to the resource-based stock markets like Australia and Canada influences.

3. Data and Methodology

3.1 Data

This study uses monthly time series covering 01/02/2014 to 01/07/2016. Highly capitalized equity market from Nigeria Allshare index, South African index 40, Morocco (MAS), Tunisia (TUN) are employed. All these variables are sourced from investing.com and have been employed in related studies (see Allen and McDonald, 1995; Lamba and Otchere 2001; Ogum 2002; Collin and Biekpe 2003). Another reason why these studies utilise such a proxy is that it is normally level non-stationary, unlike return series which are level stationary. As mentioned earlier, level non-stationarity of series is one of the preconditions for the series to be applicable for cointegration analysis. On the other hand, studies that seek to establish whether return linkages exist between stock markets use stock market returns as their proxies. Since return series are not readily available, they are computed from market indices series as follows:

$$\boldsymbol{y_t = (lnP_t - lnP_{t-1}) \times 100}$$

Where $\boldsymbol{y_t}$ is current continuous compounded returns, $\boldsymbol{P_t}$ is the current month stock price index and $\boldsymbol{P_{t-1}}$ is the previous month stock market index.

3.2 Unit root Test

In time series analysis, before running the cointegration test the variables must be tested for stationarity. For this purpose, we use the conventional ADF tests, the Phillips–Perron test following Phillips and Perron (1988) .Therefore, before applying this test, we determine the order of integration of all variables using unit root tests by testing for null hypothesis $H_o: \beta = 0$ (i.e β has a unit root), and the alternative hypothesis is $H_1: \beta < 0$. All the variables should be integrated at first order difference I(1) so as to avoid spurious result.

3.3 Examining Dynamic Returns Linkages

In order to understand the returns it important analyse the market dynamics, transmission and propagation mechanism driving these markets. A model that clearly shows how returns are transmitted from one market to another in a recognised fashion, as well as ensuring that multilateral interactions are simultaneously analysed, is necessary. The Vector Autoregressive (VAR) model would be among one of the most appropriate models. Developed by Sims (1980), the VAR model can estimate a dynamic simultaneous equation system without putting any prior restrictions on the structure of the relationships. Because it does not have any structural restrictions, the VAR system can enable the estimation of reduced form of correctly specified equations whose actual economic structure may be unknown. This is an important feature in empirical analysis of data since structural models are normally misspecified.(see Ogbonna, Iheanacho and Okere 2016)

This study adopts a dynamic vector autoregressive regression (VAR) which explores the dynamic causal linkage among selected market. The essence is to capture the causal dynamics between stock market returns, and at the same time to observe the short run dynamics. Therefore, we start with the Johansen co-integration equation which starts with the vector auto regression (VAR) of order p is given by:

$$y_t = \mu + A_1 y_{t-1} + \ldots\ldots\ldots + A_p y_{t-P} + \varepsilon_t \quad \ldots. (1)$$

Where y_t is a $(n \times 1)$ vector of stock market prices in log form that are integrated at order one- commonly denoted 1(1), n=6, A_P are the parameters to be estimated, ε_t are the random errors.

Our study will express the VAR model as follows:

$$y_t = \alpha + \sum_{s=1}^{m} A_s\, y_{t-s} + \varepsilon_t \quad (2)$$

Where y_t is a (6×1) vector of equity market prices return in log form α is the deterministic component comprised of a constant, A_s are the parameters to be estimated, ε_t are the 6×1 random errors is uncorrelated with all the y_s..

The VAR analysis is a useful tool to test for and examine spillovers and linkages between stock markets. However, the fact that there are so many coefficients raises problems regarding interpretation. Of particular concern here is that the signs coefficients of some of the lagged variables may change across lags. Together with the interconnectivity of the equations, this could make it difficult to see how a given change in a variable would impact on the future values of the variables in the VAR system (Brooks, 2002). Furthermore, the VAR estimates do not allow us to determine very much about the transmission of shocks across the system or the period of time that it takes these shocks to work through the system.(see Ogbonna et al 2016) Thus, the VAR model is normally extended with block exogeneity, impulse responses and variance decompositions functions in order to alleviate these problems. In that case, variance decomposition permits inferences to be drawn regarding the proportion of the movement in a particular time series due to its own earlier "shocks" vis-à-vis "shocks" arising from other variables in the VAR model while the impulse response function traces the time path of the effects of "shocks" of other variables contained in the VAR on a particular variable.

4. Empirical Results

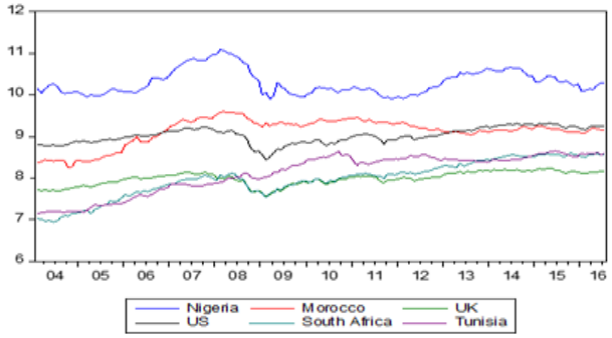


Figure 1. Evolution of selected stock market index based on local currency

Source: from eview9

4.1 Descriptive Statistic

Table 1 above provides the summary statistics, namely, sample means, maximums, minimums, medians, standard deviations, skewness, kurtosis and the Jarque-Bera tests with their p-values for the return series. Four proxies of sub-Saharan African market (NIG Allshare, Tunindex, Morr.Allshare-MASI, South Africa 40), and two control variables (Ftse 100-UK, NYSE-US) over the period of 02/01/2004-07/01/016. Whilst it is clear that all the statistics show the characteristics common with most financial data, for instance non normality in the form of fat tails, there are a number of noticeable differences, especially between control variables (developed market) and African market. Firstly, returns in African stock markets are larger than those of their developed counterparts. More specifically, the South African stock markets (SA40) has the largest unconditional average monthly stock market return of around 1.02%. The returns for SA40 fluctuate between the minimum of –16.14% and a maximum of 12.09%. The Nigerian All-share index recorded the least returns of around 0.1021%, the minimum and maximum are -36.58% and 32.4% respectively. Among the African markets, Tunindex has the second highest average returns and MASI the third with unconditional average returns of 0.964% and 0.5272% respectively.

Of the developed stock markets (UK) FTSE100 has the higher unconditional average returns of around 0.309% than the (US) NYSE, which is the world's largest stock market, has unconditional mean returns of about 0.0303% and its returns fluctuate between -14.4% to 9.09% and -21.7% to 10.7% respectively. A common observation is that the African markets have more extreme values (i.e. the difference between the maximum and the minimum) for the monthly returns compared to the developed stock markets. This could be an indication that volatility is much higher in African stock markets than in developed stock markets, which is well in line with most theoretical and empirical underpinnings.

Interestingly, contrary to the common findings that the unconditional standard deviation for African markets tends to be higher than in developed markets,

Table 1. Summary statistics of monthly returns for six selected market.

	Mean	Median	Maximum	Minimum	Std.dev.	Skewness	Kurtosis	J-B	Prob.
FTSEUK	0.003091	0.009367	0.090936	-0.144118	0.038205	-0.80768	4.548484	31.08633	0
MASI	0.003091	0.009367	0.183381	-0.169717	0.046147	0.159545	5.433184	37.38783	0
NIG	0.001021	0.090936	0.324064	-0.365883	0.076107	-0.50636	7.949172	158.436	0
NYSEUS	0.003033	0.144118	0.107842	-0.217377	0.044654	-1.084541	6.642281	111.5798	0
SA40	0. 010283	0.038205	0.120966	-0.161438	0.047179	-0.345107	3.936512	8.402681	0
TUN	0.009647	4.548484	0.095492	-0.142611	0.037259	-0.414253	4.887909	26.38927	0

Table 2. Correlation matrix for returns

	LNIG	LMASI	LFTSEUK	LNYSE.US	LSA40	LTUN
LNIG	1					
LMASI	0.411003	1				
LETSEUK	0.470812	0.368275	1			
LNYSEUS	0.564687	0.247635	0.960703	1		
LSA40	0.348181	0.638622	0.835132	0.75049	1	
LTUN	0.049527	0.707946	0.548803	0.397465	0.880982	1

Source: calculated from eview9

indicating the existence of more risk in the former markets (see Tastan, 2005), the picture seems to be mixed in our case. As evident from the Table 1 Nigeria, has the highest unconditional standard deviation of around 7.5%, whilst Tunisia has the lowest of about 0.37% compared to the advanced market. This could be due to the fact that there has been a lot of political issues and investors are risk averse. Returns of most of the stock markets under consideration are negatively skewed except for the Moroccan stock markets. All the stock markets under consideration have distributions with positive excess kurtosis and show evidence of fat tails. A distribution with a kurtosis value of more than 3 is described as leptokurtic relative to normal (Bala and Premaratne, 2003 and Hosking, 2006). This implies that the distribution of stock returns in all the stock markets tends to contain extreme values.

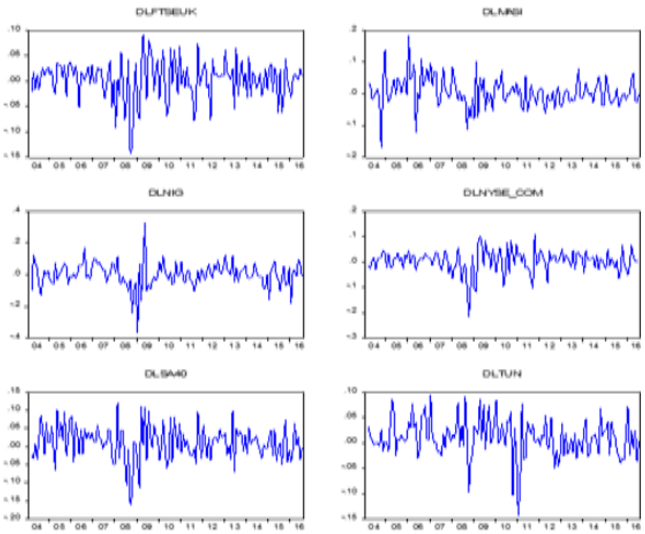
Lastly, the Jarque-Bera (JB) statistic tests whether the series are normally distributed. As can be seen from the Table 1, the JB indicates that the hypothesis of normality is rejected for all return series. This non-normality is also evident from the fatter tails of the kurtosis and negative and positive skewness. This is contrast to the market efficiency hypothesis.

4.2 Correlation matrix for returns

Table 2 shows the pairwise correlation matrix and there is evidence of contemporaneous correlation among the markets. Correlation between all the markets is positive, and correlation among African markets seem to low confirming some of the existing literature. However, this is a good signal for international diversification since one condition for international diversification is that correlation between returns should be negative high and to ensure that some markets will go up if some go down (see Narayan and Smyth, 2005). Evident from Table 2, shows weak correlation between most of the stock markets returns (except for the case of the UK with the US stock markets, the UK with the SA40 stock markets and the US and SA40 markets). None of the market has a strong influence in the Nigeria market because the market are less than 50% except for US. However, the correlation matrix cannot provide any empirical answer since correlation does not imply causality (Gujarati, 2005). Furthermore, correlation merely provides insight into short run market linkages, but fails to account for long term arbitrage activities in stock markets (Narayan and Smyth, 2005). Therefore we need to infer this from other empirical tests.

4.3 Unit root test

All that data are transformed into the natural log form. To determine the order of integration of the variables, the ADF (augmented Dickey-Fuller) test complemented with the PP (Philips-Perron) test in which the null hypothesis is $\boldsymbol{H_0 = \beta = 0}$ (i.e $\boldsymbol{\beta}$ has a unit root), and the alternative hypothesis is $\boldsymbol{H_1: \beta < 0}$ are implemented. The results for both the level and differenced variables are presented in Table 3.



Source: author's computation

Figure 2. Graphical plots of monthly returns series from February 1, 2004 to July 1, 2016

The stationarity tests were performed first in levels and then in first difference to establish the presence of unit roots and the order of integration in all the variables. The results of the ADF and PP stationarity tests for each variable show that both tests fail to reject the presence of unit root for NIG, MASI, FTSE100, NYSE, SA40, and TUN data series in level, indicating that these variables are non-stationary in levels.

The first difference results show that these variables are stationary at 1% significance level (integrated of order one 1(1)). As mentioned in the preceding sections, a linear combination of I (1) series could be I (0) if the series are cointegrated. We thus proceed to test for cointegration of the index series.

Table 3. Unit root test.

Variable	1(0)		1(1)		
	ADF	PP	ADF	PP	Order of integration
Inftse	-2.2664	-1.9054	-4.5931*	-11.7079*	1(1)
In magi	-2.4006	-2.3228	-7.79181*	-11.0678*	1(1)
Ln NIG	-1.6034	-10.6529	-10.6529*	-10.7107*	1(1)
In NYSE	-2.2776	-1.7452	-4.9507*	-10.1978*	1(1)
In S40	-1.7853	-1.7581	-12.0802*	-13.0859*	1(1)
In TUN	-2.2334	-2.0972	-10.7397*	-10.9241*	1(1)

Note: all variable are in the natural log form
*level of significant at 1%
Source: calculated using eview9

Table 4. block Exogeneity.

Excluded	NIG Chi-sq	NYSE Chi-sq	SA40 Chi-sq	NIG df	NYSE df	SA40 df	NIG Prob	NYSE Prob	SA40 Prob
FTSE UK	1.1066			1			0.2928		
MASI	1.0409	2.853	3.9508	1	1	1	0.3076	0.091	0.046
NYSE	0.4125			1			0.5207		
SA40	0.8437			1			0.3583		
TUN	0.9116			1			0.3397		
AII	10.4612			5			0.0632		

Source: partial extract from eview9 calculation

4.4 Result of dynamic returns linkages

In analysing returns linkages using a VAR, it is important to distinguish between the influences of own-returns and those of returns from other markets. Since we are concerned with determining which of the stock markets has the greatest impact on Nigerian returns, our discussion is mostly concerned with the influence of the other stock market returns on Nigerian returns, rather than how all the markets influence each other. Thus, we employ the extended VAR model with block exogeneity, impulse responses and variance decompositions.

4.5 Block Exogeneity

The block exogeneity test results are reported in Table 4. None of the markets individually influence the Nigerian market returns. But collectively all the have influence at the Nigeria at 10% level at 10.4612 chi-sq. None of the stock markets influence its returns except Moroccan market influence SA40 and NYSE at 5% and 10% respectively. This result is in line with, amongst others Hassan and Naka (1996) and Masih and Masih (2001).

4.6 Variance Decomposition

Lutkepohl (2007) explained that variance decomposition indicates the amount of information each variable contributes to the other variables in the auto regression. It seeks to address the question with regard to the proportion/percentage of the movements in the stock market returns that are due to its 'own' innovations, against those that are due to shocks to other stock markets. Therefore the variance decomposition for Nigerian stock market return is shown Table 5. The table shows a 10 period forecast of the contribution of the variables to the Nigeria stock market return. There are certain common features that seem to be evident.

Firstly, the Ftse100 is the most exogenous in that its innovations tend to explain the variations in returns of all markets better than other innovations explain its returns. Secondly, in the first period Nigeria All share index account for 94.27% of its change. In the second period, ftse100 accounts for about 9.6%, MASI accounts for 1.86% while NYSE and SA40 were the least contribution by 0.065% and 0.56% respectively. From the third period it is surprising that all the equity market maintained a consistent influence on the Nigerian market up until the last period. Generally, the contribution of all equity returns are relatively low to the Nigeria equity market.

Table 5 shows the variance decomposition of DLMASI. Most of the deviation in the equity market is attributable to its own shocks in the first period and maintained that position all the way to the final period except the UK market that account for 2.134% in the first period and remained 3.07% from third period to the last period. The standard error for the forecast remain stable and unchanged for the whole period. This is an indication of poor transmission mechanism and poor dynamic linkages from other equity market.

Variance decomposition for SA40 indicates that the deviation in the equity market is partly attributable to less than 50% of its own shock in the first period and maintained that position all the way to the final period except the UK market that account for 53.07% in the first period and remained above 50% from second period to the last period. The standard error for the forecast remain stable and unchanged for the whole period. This is an indication of poor transmission mechanism and poor dynamic linkages from other equity market. Indeed, UK is the most influential market and purely exogenous variable. This evidence is in line the existing literature.

Table 5 shows the variance decomposition of DLTUN. Most of the deviation in the equity market is attributable to its own shocks in the first period with 94.84% and maintained that position all the way to the final period except the Nigeria market that account for 2.35% in the first period and remained 2.35% from second period to the last period. The standard error for the forecast remainstable and unchanged for the whole period. This is an indication of poor transmission mechanism and poor dynamic linkages from other equity market.

4.7 Impulse Reponse

The impulse response function was estimated using the Cholesky approach and the results are reported in Figure 3. The orthogonalisation followed is in line with the approach used for variance decomposition. Generally the response of Nigeria returns to both own and to foreign markets innovations is positive.

Table 5. Variance Decomposition for the Selected Equity market.

Varience Decom Position of DLFTSE UK:							
Period	**S.E.**	**DLFTSE UK**	**DLMASI**	**DLNIG**	**DLN YSEUS**	**DLSA40**	**DLTUN**
1	0.038432	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.039019	97.17476	0.847447	0.164366	1.639177	0.077952	0.096293
3	0.039083	96.95180	0.901787	0.254272	1.682438	0.113166	0.096535
4	0.039085	96. 93934	0.904196	0.254243	1.689262	0.116132	0.096831
5	0.039086	96. 93802	0.904413	0.254450	1.689489	0.116700	0.096965
6	0.039086	96. 93789	0.904461	0.254450	1.689489	0.116740	0.096965
7	0.039086	96. 93788	0.904462	0.254451	1.689489	0.116749	0.096966
8	0.039086	96. 93788	0.904463	0.254451	1.689489	0.116750	0.096966
9	0.039086	96. 93788	0.904463	0.254451	1.689489	0.116750	0.096966
10	0.039086	96. 93788	0.904463	0.254451	1.689489	0.116750	0.096966
Varience Decom Position of DLMASI:							
Period	**S.E.**	**DLFTSE UK**	**DLMASI**	**DLNIG**	**D LN YSEUS**	**DLSA40**	**DLTUN**
1	0.045973	2.134320	97.86568	0.000000	0.000000	0.000000	0.000000
2	0.047080	2.963387	94.00828	0.559485	0.263631	1.611973	0.593239
3	0.047214	3.075519	93.69274	0.637782	0.292027	1.700869	0.601059
4	0.047226	3.092287	93.64698	0.637788	0.305430	1.711083	0.606435
5	0.047228	3.093390	93.64424	0.638586	0.306157	1.711223	0.606409
6	0.047228	3.093434	93.64393	0.638587	0.306350	1.711264	0.606440
7	0.047228	3.093450	93.64389	0.638587	0.306363	1.711263	0.606440
8	0.047228	3.093450	93.64389	0.638587	0.306365	1.711263	0.606440
9	0.047228	3.093450	93.64388	0.638587	0.306365	1.711263	0.606440
10	0.047228	3.093450	93.64388	0.638587	0.306365	1.711263	0.606440
Varience Decom Position of DLNIG:							
Period	**S.E.**	**DLFTSE UK**	**DLMASI**	**DLNIG**	**DLN YSEUS**	**DLSA40**	**DLTUN**
1	0.074137	4.556335	1.172724	94.27094	0.000000	0.000000	0.000000
2	0.077224	9.691820	1.862020	87.25142	0.065155	0.569673	0.559914
3	0.077495	10.00031	2.014616	86.64105	0.119920	0.637274	0.586830
4	0.077513	10.00921	2.040208	86.60665	0.119929	0.636987	0.587014
5	0.077514	10.01037	2.040991	86.60381	0.120323	0.637187	0.587318
6	0.077515	10.01051	2.041149	86.60350	0.120328	0.637185	0.587329
7	0.077515	10.01052	2.041156	86.60348	0.120334	0.637186	0.587331
8	0.077515	10.01052	2.041157	86.60347	0.120334	0.637186	0.587331
9	0.077515	10.01052	2.041157	86.60347	0.120334	0.637186	0.587331
10	0.077515	10.01052	2.041157	86.60347	0.120334	0.637186	0.587331
Varience Decom Position of D LN YSEUS:							
Period	**S.E.**	**DLFTSE UK**	**DLMASI**	**DLNIG**	**D LN YSEUS**	**DLSA40**	**DLTUN**
1	0.044287	80.25146	0.001033	0.737089	19.01042	0.000000	0.000000
2	0.045651	78.82122	2.187771	0.939603	17.89506	0.149901	0.006440
3	0.045715	78.67676	2.293114	0.953102	17.90607	0.158873	0.012082
4	0.045724	78.66413	2.304468	0.959066	17.89968	0.159154	0.013503
5	0.045725	78.66307	2.305216	0.959060	17.89984	0.159150	0.013661
6	0.045725	78.66297	2.305309	0.959092	17.89978	0.159166	0.013675
7	0.045725	78.66296	2.305316	0.959092	17.89978	0.159167	0.013676
8	0.045725	78.66296	2.305316	0.959093	17.89978	0.159167	0.013676
9	0.045725	78.66296	2.305316	0.959093	17.89978	0.159167	0.013676
10	0.045725	78.66296	2.305316	0.959093	17.89978	0.159167	0.013676
Varience Decom Position of DLSA40:							
Period	**S.E.**	**DLFTSE UK**	**DLMASI**	**DLNIG**	**DLN YSEUS**	**DLSA40**	**DLTUN**
1	0.047018	53.07835	1.010533	0.095247	2.698755	43.11711	0.000000
2	0.048112	50.69337	3.034221	0.560913	2.579628	42.89873	0.233130
3	0.048239	50.61739	3.018335	0.561414	2.602195	42.92275	0.277917
4	0.048250	50.59599	3.035394	0.565414	2.604264	42.92092	0.278025
5	0.048251	50.59448	3.035250	0.565465	2.605474	42.92089	0.278436
6	0.048251	50.59425	3.035414	0.565541	2.605588	42.92077	0.278437
7	0.048251	50.59423	3.035413	0.565544	2.605612	42.92076	0.278441
8	0.048251	50.59423	3.035414	0.565545	2.605614	42.92076	0.278441
9	0.048251	50.59423	3.035414	0.565545	2.605615	42.92076	0.278441
10	0.048251	50.59423	3.035414	0.565545	2.605615	42.92076	0.278441
Varience Decom Position of DLTUN:							
Period	**S.E.**	**DLFTSE UK**	**DLMASI**	**DLNIG**	**DLN YSEUS**	**DLSA40**	**DLTUN**
1	0.037293	0.446051	1.393416	2.358890	0.486404	0.473227	94.84201
2	0.038087	1.490418	2.768505	2.321014	1.111204	0.558698	91.75016
3	0.038121	1.489014	2.786422	2.336757	1.195299	0.588362	91.60415
4	0.038125	1.492583	2.791778	2.341471	1.203757	0.588273	91.58214
5	0.038125	1.492566	2.791756	2.341535	1.204844	0.588266	91.58103
6	0.038126	1.492548	2.791783	2.341564	1.204924	0.588270	91.58081
7	0.038126	1.492548	2.791783	2.341565	1.204935	0.588271	91.58080
8	0.038126	1.492549	2.791783	2.341565	1.204935	0.588271	91.58080
9	0.038126	1.492549	2.791783	2.341565	1.204935	0.588271	91.58080
10	0.038126	1.492549	2.791783	2.341565	1.204935	0.588271	91.58080
Cholesky Ordering : DLFTSE UK DLMASI DLNIG DLN YSEUS DLSA40 DLTUN							

Source: extract from eview9

As would be expected, the response of Nigeria returns to own innovations is the low. It quickly declines to zero within the third period after which it becomes insignificantly negative and finally dies off within the tenth period.

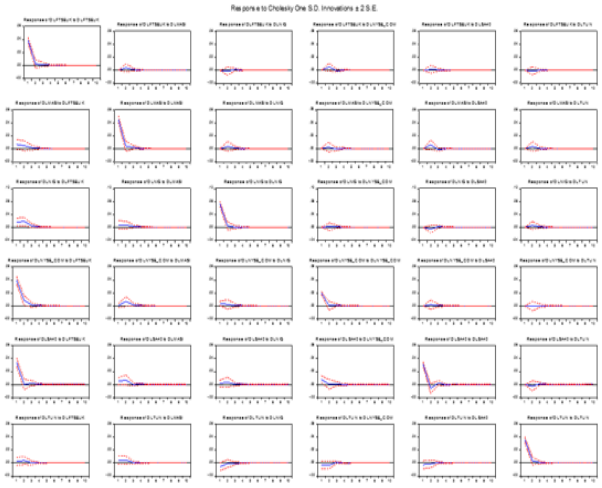


Figure 3

Source: extract from eview9

With regard to response from cross innovation, the Nigeria returns seem to respond slowly and very insignificant. Response from the US innovations starts at zero in the first day, picks sharply and then sharply declines by the thereafter. Response of other stock markets to Nigeria innovations is insignificant .Overall, consistent to informational efficiency, the response of all stock market returns to both own is quick but slow on cross innovations i.e. it takes more than a month.

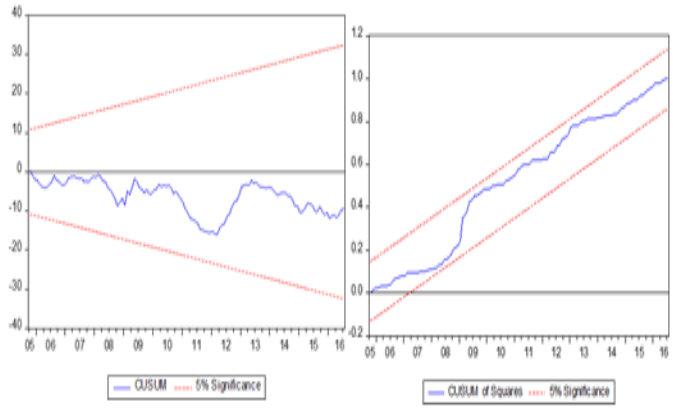


Figure 4. CUSUM and CUSUMQ for the coefficient stability of ECM for the selected market returns

Source: eview7 calculation

The cumulative sum of recursive residuals (CUSUM) and the CUSUM of square (CUSUMSQ) tests are applied to assess parameter stability (Pesaran and Pesaran, 1997). Fig 4 plot the results for CUSUM and CUSUMSQ tests. The results indicate the absence of any instability of the coefficients because the plot of the CUSUM and CUSUMSQ statistic fall inside the critical bands of the 5% confidence interval of parameter stability.

4.8 Discussion of findings

Market interactions among stock market of the world have necessitated the relationship among different financial markets driven by market liberalization and international pressure to lower trade barriers, which have enhanced international linkages between capital markets. The time series data from investing.com over 01/02/2004-01/07/2016 are employ to study the dynamic causal linkage among the selected equity market in Africa using the generalized Vector autoregressive (VAR) framework that produces forecast error variance decompositions and also accounts for correlated shocks using historically observed distribution of the errors. Six selected equity markets are used to form Six endogenous VAR in line with econometric system. The findings on dynamic return linkages is that there is no strong significant returns linkages among the African selected markets, with the exception. Controlling for the influence of advance market (UK and US). The results show that the South African market has more link with international markets than the Nigerian market. A crucial finding is that the lowest spillover index recorded was among the African markets. This is an indication of possible gain in African market and in line the portfolio theory.

We therefore establish three possible implications to the aforementioned. There no strong causal link among the selected African equity market. The second implication flows from the first and as regards the possibility of gaining from international diversification. The weak causality between the Nigerian and the considered stock markets implies that these markets offer potential for pairwise portfolio diversification for a Nigerian portfolio manager. The third implication is in the spirit of efficient market hypothesis (EMH) for international equity markets.

However, weak causality and poor relationships between the Nigeria and the African equity markets considered in this study implies that none of the markets help predict the direction of the Nigerian equity market price index. However, a note of caution should be sounded when interpreting the implication of causal linkage.

5. Conclusion and Policy Implications

Controlling for the possible influence of advance stock market (UK and US) and, in the spirit of finance proposition that portfolio diversification is fruitful if more markets are added into the portfolio, this paper examines the dynamic linkage in selected stock from February 1, 2004 to July 1, 2016 dynamic causal linkage among the selected equity market in Africa using the generalized Vector autoregressive (VAR) framework that produces forecast error variance decompositions and also accounts for correlated shocks using historically observed distribution of the errors. Six VAR from the perspective of Nigerian investors were formed and tested in a multivariate VAR. VAR framework, along with the block exogeneity, impulse response and variance decomposition functions, were estimated. Results from the VAR framework established that there are no significant linkages of returns coming from the individual equity market. But collectively all the have influence at the Nigeria. Furthermore, the response of Nigeria to innovations from other markets was examined and responses to innovations from the UK was the fastest. It was also established that the UK has the dominant influence on Nigeria returns followed by Morocco and the other markets are not very important. However, own innovations were found to be more important than cross innovations.

The findings of this study have important implications for policymakers and investment strategies. Firstly, the fact that the Nigeria equity market is weakly integrated into the world stock markets considered implies that long term portfolio diversification may be worthwhile for Nigeria portfolio managers. Thus, investors can exploit this to construct potentially risk-averting or profit maximising portfolios. Moreso, the fact that the Nigerian equity market is not well integrated into the world equity market should be of concern for policy makers. This is because more integration of world equity markets will ensure reduction of cost of capital (see

Kearney and Lucey, 2004). Therefore, we advocate that more openness and more relaxation of any form of foreign currency control could be of importance to achieve this end and indeed encourage foreign direct investment. Secondly, the fact that volatility from other stock markets is quickly transmitted into the Nigeria stock market should be of concern for policy makers. This is because volatility affects financial stability. Volatility transmission from the world stock markets to the Nigeria market could be harmful during times of crises.

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