KENYA CAPITAL MARKET INTERGRATION

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1. INTRODUCTION

Financial markets integration can be defined as the process by which segmented markets open up so that participants enjoy equal unimpeded access. This can occur through removal of domestic and international controls on a country-level (through relaxation of government imposed barriers or by fiscal policy reforms), sector wise reforms for commodity or services under consideration, and also as a result of technological advances which eliminate the problem of trading due to geographical factors. A consequence of these factors is the increase in capital flow and tendency of prices and returns of traded financial assets to equalize on common country basis.

The enduring popular representation of financial market integration is that the law of one price holds. This states that assets generating identical cash flows will command the same return, regardless of the place of issue or trade. The arbitrage argument to this follows by intuition: sellers will flood markets with highest prevailing prices and buyers will flood those with lowest prices. Then in an efficient market the convergence to one price follows.

Developments in international financial markets in the 1980's and 1990's, and consequent globalization, prompted the suggestion that international interest rates would converge accordingly. It is argued that this integration would reduce divergence between interest rates across countries and the yields would move together over time. Therefore, domestic central banks influence of national interest rates would be constrained by the international flow of capital.

The chain of events leading to opening up of the Kenyan financial market, through liberalization of the domestic financial systems and removal of restrictions in international capital flows, began in the late 1980's; with the final policy on abolishing foreign exchange control in place by the end 1993.

This paper investigates the extent to which Kenya's financial system has become integrated with the global financial system. In particular the paper focuses on two questions. First, as a result of the financial market liberation, particularly removal of capital controls and other barriers to international capital mobility, are interest rates in Kenya becoming increasingly linked to the world financial markets (the UK and USA)?
Secondly, to the extent that the interest rates are now influenced by world financial markets, is the control of USA (taken to represent the centre of world financial markets) greater than the UK (the traditional main foreign trade partner)?

In order to examine the level of integration, we examine the degree to which the real interest rate parity condition holds. The Johansen (1988) co-integration methodology is adopted for this analysis, which allows for multiple co-integrating vectors. The data employed is the weekly 90 day Treasury bill yields for Kenya, USA, and UK from January 1996 to December 2008 (restricted mainly due to data availability, but also chosen to cover period after reforms). The data is sourced from the *global financial data* database.

The paper is organised as follows: Section II provides a theoretical background to the empirical model. In section III the data is reviewed, tests for co-integration and interaction of the three interest rates are carried out. Finally, Section IV offers the interpretation, conclusion and implications of our results.

2. METHODOLOGY FRAMEWORK

Adam et al. (2002) classify indicators of financial integration into four broad categories:

A. indicators of credit and bond market integration;
B. indicators of stock market integration;
C. indicators of integration based on economic decisions of households and firms, and;
D. indicators of institutional differences that may cause financial market segmentation.

We assessed the suitability of the four categories to the study below, in particular with respect to available data from the Kenya market:

Indicators of integration based on economic decision of households and firms, and institutional differences (choice C and D) are considered not easily applicable due to lack of reliable data to construct these indicators, especially from Kenya.

The correlation of stock market returns is considered a plausible indicator for testing integration using the stock market. However, in Kenya, the only stock market - the Nairobi Stock Exchange (NSE) is rather young (open to public trading in 1991) and small with only 59 listed companies; with the majority of businesses remaining private entities, family run or nationalized institutions. The stock returns across various economic sectors for firms listed at the NSE exhibit synchronous movement indicative of strong influence of country-specific risk rather than firm-specific risk. Moreover, in 2008/9, series of claims and investigations into the stock market manipulation have arisen. For these reasons, the use of the stock market return would lead to bias in the assessing integration of Kenya's financial market.

We, therefore, employ the credit and bond market integration indicator, using interest rate differentials (in particular the government papers 90 day treasury bill yields) to assess the financial market integration due to availability of reliable data for all three countries.

The theory of interest rate parity postulates that in a perfect global market condition (with flawless capital mobility, frictionless markets and fixed exchange rates), interest rates will be equal across countries. In reality, there are constraints imposed from exchange rate regimes, taxations and transaction costs, to other subtle constraints like cultural and political limitations.

Interest rate parity as a measure of the degree of integration of financial markets takes the form of estimating the regression:

$$r_{j,t} = \alpha_0 + \alpha_1 r_{k,t} + \varepsilon_t \quad \text{..... (2.1)}$$

Where $r_{j,t}$ and $r_{k,t}$ are interest rate measures for country j and k respectively; the constant terms α_0 and α_1 are wedge parameters between interest rates possibly caused by a country specific or asset specific risk premium and ε_t denotes residual term.

Using the no-arbitrage consideration, the uncovered interest rate parity (UIP) condition states that the interest rate differential between two identical financial assets in different currency denominations has to equal the expected depreciation of the domestic currency.

The UIP condition assumes the financial assets valued in different currencies are perfect substitution with no risk premium. The only risk asset holder takes is the expected domestic currency depreciation compensated by higher domestic interest rates.

This can be written as follows:

$$r_{j,t} - r_{k,t} = E(\Delta e_t) \quad \text{..... (2.2)}$$

Where $r_{j,t}$ and $r_{k,t}$ are as previously defined, and Δe_t denotes the change in exchange rate ratio between the two countries from time t to $t+1$.

To obtain real interest rate parity, we apply the purchasing power parity theorem which states that the exchange rate between currencies is in equilibrium when the purchasing power is the same in each of the two countries. This can be written as:

$$E(\Delta e_t) = p_{j,t} - p_{k,t} \quad \text{..... (2.3)}$$

Where $p_{j,t}$ and $p_{k,t}$ denote the expected domestic inflation and the expected foreign rate inflation respectively.
Substituting (2.3) into (2.2) for $E(\Delta e_t)$ we obtain the real interest rate parity condition:

$$r_{j,t} - p_{j,t} = r_{k,t} - p_{k,t} \quad \text{..... (2.4)}$$

Equation (2.1) can therefore be viewed as a generalised form of equation (2.4) where constants:

$$\alpha_0 = p_{j,t} - p_{k,t} \text{ and } \alpha_0 = 1 \quad \text{..... (2.5)}$$

Cointegration examines stationarity of a linear combination of non-stationary time series. The econometric method underlying the test procedures for cointegration stem from the theory of simultaneous difference equation.
Two real interest rates are said to be cointegrated if each series is non-stationary in level, but stationary on first differencing, and the residuals of the linear combination of the two ε_t is stationary in level.
In the case of our study, this implies that if the interest rates in Kenya, UK and USA are cointegrated, then in the long-run, there exists an equilibrium relationship. Equilibrium here refers to situation where shocks will have a permanent effect on levels of each process, but the interest rates move to correct any disequilibrium existing at a point in time.
Cointegrated series can be viewed, therefore, as reduced number of common stochastic trends, plus stationary components.

Though the economic theory leads us to general form (2.1), there exists limitation in the theory on the dynamic specification of the relationships. In this case for Kenya, UK and USA, each of the series can be either exogenous or endogenous in a given regression.
To capture this dynamic relationship, dynamic impact of random disturbances and give a more general form of the system we apply the Vector Autoregressive (VAR) approach which treats every endogenous variable in a system as a function of the lagged values of all the endogenous variables in the given system.

The general Vector Autoregressive (VAR) model is of form:

$$Y_t = \alpha_0 + \sum_{i=1}^{k} \alpha_i Y_{t-i} + \varepsilon_t \quad \text{..... (2.6)}$$

Where Y_t is a vector of the relevant time series, α_0 the constant term and ε_t the residual term assumed to have zero mean and constant variance.

A principal feature of cointegrated variables is that their time paths are influenced by extent of any deviation from long-run equilibrium. Hence a deviation from one of our cointegrated variables would result in increase/ decrease in the given variable to close this gap, or an increase in the other terms with a smaller/larger increase/decrease in the deviating variable, or a similar movement from the other variables. The dynamic model implied in this situation is the error correction model.

The Johansen (1988, 1991) framework develops tests to determine a number of cointegrating vectors from a group of variables by rearranging equation (2.6) to a Vector Error Correction Model (VECM) of form:

$$\Delta Y_t = \alpha_0 + \sum_{i=1}^{k} \Gamma_i \Delta Y_{t-i} + \prod Y_{t-k}\, \varepsilon_t \quad \text{..... (2.7)}$$

The Johansen procedure can be viewed as a multivariate generalization of the Dickey – Fuller test applied in the univariate case for testing unit root and is based on the rank of the matrix Π via its eigenvalues, with two test statistics:

$$\lambda_{max}(r, r+1) = -T \ln(1 - \lambda_{r+1}^{\prime})$$

And

$$\lambda_{max}(r, r+1) = -T \sum_{i=r+1}^{n} \ln(1 - \lambda_{r+1}^{\prime}) \quad \text{..... (2.8)}$$

Where:

$\lambda_i's$ are the eigenvalues which are put in ascending order,
r the number of cointegrating vectors under the null hypothesis,
n the number of variables under consideration, and
$\widehat{\lambda_i}$ the estimated value of the ith ordered eigenvalue from the rank matrix Π.

The λ_{max} test has the null hypothesis that the number of cointegrating vectors is r against an alternative of $r+1$ whereas the λ_{trace} test has the null that the number of cointegrating vectors is less than or equal to r against an unspecified or general alternative that there are more than r. For both tests, we reject the null hypothesis if the test statistic is greater than the critical value from the Johansen's table.

There are three possibilities. First $r = 0$ in which case all the variables are non-stationary but there is no cointegration. Second, $r = N$, (where N is the number of variables) in which case all the variables are stationary. Third $0 < r < N$ in which case there are r linear combinations of the non-stationary variables that are stationary i.e. there exists r cointegrating vectors.

When cointegration is present, the long-run response matrix can be decomposed into $\pi = \alpha\beta'$ where α represents the speed of adjustment and β is the cointegrating vector.

The β coefficients are interpreted as the long-run or equilibrium coefficients. Strictly speaking β does not reflect elasticities or responses of the underlying economic system but rather indicates what happens to the system when one variable is increases with all other variables held constant. This represents a controlled system rather than what happens in the real world.
Rephrasing our first test objective question as "What happens to Kenya(UK/USA) with unit change in UK(USA/Kenya) " there is no constancy condition and hence answering our question would require the short-term dynamics and adjustments (captured in the α term) to be taken into consideration.

In summary, the above methodology can be implemented with the following steps:

a. Testing for stationarity property of the three time series using a unit root test.
b. Determining the appropriate order of VAR to use by using the Akaike's and Schwarz's Bayesian information criteria.
c. Testing for cointegration using the Johansen framework.
d. Interpreting the findings of tests run.

3. EMPIRICAL RESULTS

The main objective of the study is to examine the cointegration of the real interest rates in Kenya with the UK (representing the main trading partner) and the USA (representing global interest rates).

Data

The data consists of the weekly real interest rates for the 90 – day treasury bills for Kenya, UK and the USA from 1 January 1996 to 30 June 2008. The weekly 90-day treasury bill yields are obtained from *global financial data* database. The expected inflation rate is obtained by using the monthly CPI indices for the same period and taking an assumption that the inflation rate obtained are constant over a given month.

3.1. Descriptive Statistics

In figure 3.1(a) and table 3.1(b) we present the summary statistics for the three real interest rates under review. A discussion on the statistics and graph is presented thereafter.

Figure 3.1(a): Graph of real interest rates 1996 - 2008 for Kenya, UK and USA

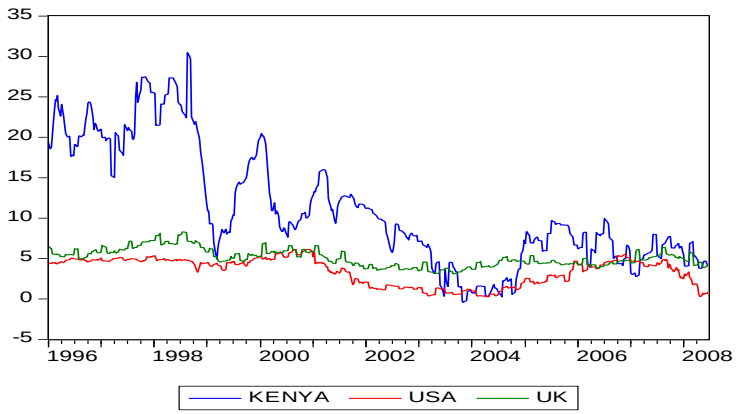

Table 3.1(b): Descriptive statistics for Kenya, UK and USA real interest rates

	KENYA	USA	UK
Mean	11.13763	3.438004	5.086045
Median	9.123574	4.163216	4.855834
Maximum	30.46901	6.142529	8.290545
Minimum	0.418361	0.275532	3.107219
Std. Dev.	7.400395	1.664753	1.097315
Skewness	0.654058	-0.475691	0.550630
Kurtosis	2.397927	1.794987	2.778213
Jarque-Bera	56.33439	64.03679	34.28335
Probability	0.000000	0.000000	0.000000
Sum	7261.734	2241.579	3316.101
Sum Sq. Dev.	35652.56	1804.184	783.8690
Observations	652	652	652

Discussion points on figure 3.1(a) and table 3.1(b):

Stock and Watson (1988) observed that cointegrated variables share common stochastic trends, providing a useful way to understand cointegrating relationships. A rough visual guide to this can be done by observing the graph of the 3 real interest rates. Whereas the UK and USA interest rates hold relatively stable and exhibit a common trend, the Kenya interest rates oscillates rather independent of the other two rates. Interestingly, we observe for a period around 2002 and 2007 the interest rates in Kenya lower than those in the UK and USA for the same period. These periods coincide with political election years in Kenya and the observations can be viewed as an indicator of political influence of financial markets. To this end we can infer country risk (in this case taken be equivalent to political risk) to be a strong influence on the prevailing interest rates in Kenya.

With respect to the descriptive statistics; in general interest rates in Kenya are 2-3 times higher than those in the UK and USA respectively; more so the rates in Kenya exhibit a high degree of variability as manifested in the standard deviation. This is within expectation with Kenya being a developing country and hence, as earlier inferred, having a high country risk. All three rates are positively skewed and platykurtic, as measured by their skewness and kurtosis.

Putting the statistics together with the graph, it would appear that the Kenyan rate is not (or is very weakly) cointegrated with the UK and USA, whereas the UK and USA rates would appear to hold a strong common stochastic trend. However, narrowing down to post 2002, the Kenyan interest rates exhibit smaller deviations, with behaviour of mean –reversion to a stable interest rate about 7%. This behaviour may lead to test results indicating some growth in the relationship of the three rates.

In the steps that follow, we will test these observations econometrically to arrive at a conclusion.

3.2 Testing for non-stationarity of the data

As a first step to testing for cointegration, we seek to satisfy the necessary condition that the 3 series are non-stationary on level, but stationary on first differencing.
The data analysis is carried out using Eviews. We imported the data into Eviews and tested the data for unit root. The summary of the results are in table below:

Table 3.2(unit root test) Null hypothesis (level - unit root)			**t-Statistic**	**Prob.***
Augmented Dickey-Fuller test statistic (UK)			-2.114873	0.2390
Augmented Dickey-Fuller test statistic (USA)			-1.310170	0.6265
Augmented Dickey-Fuller test statistic (Kenya)			-1.724843	0.4182
Test critical values:	1% level		-3.440228	
	5% level		-2.865790	
	10% level		-2.569091	

Table 3.2(unit root test) - continued Null hypothesis (first difference - unit root)			**t-Statistic**	**Prob.***
Augmented Dickey-Fuller test statistic (UK)			-16.40568	0.0000
Augmented Dickey-Fuller test statistic (USA)			-25.25405	0.0000
Augmented Dickey-Fuller test statistic (Kenya)			-14.09248	0.0000
Test critical values:	1% level		-3.440228	
	5% level		-2.865790	
	10% level		-2.569091	

Table 3.2: Unit root test for the three data series. The null hypothesis is that there is a unit root with the alternative of no unit root. We reject the null hypothesis if the test statistic is less than the critical values. Clearly from the above results all the three series have a unit root and on first differencing become stationary. The first step for conducting our tests is thus satisfied.

3.3 Determination of appropriate lag length for the VAR

Applying the Johansen (1988, 1991) methodology, the cointegrating vectors are estimating after setting an appropriate lag order. Using Eviews we estimate an unrestricted VAR for lags 1-10 with the three series declared as endogenous variables. A limited summary of the results is displayed in table below:

Lag	Akaike information criterion	Schwarz criterion
VAR(1)	*2.563593*	*2.646146*
VAR(2)	2.575786	2.720427
VAR(3)	2.593168	2.800045
VAR(4)	2.617589	2.886851
VAR(5)	2.555948	2.887745

Table 3.3: Estimating the lag length. As we seek to minimize the two information criteria, a VAR (1) is selected as the most suitable model.

3.4 Determination of cointegration equation and error correction model

To econometrically study whether the three series are cointegrated, we apply the Johansen test hypothesis for cointegration. We analyse the data in EViews and review the maximum Eigen value and trace statistics with their critical values.

As we have two objectives in our paper – first to test if there exists a cointegrating vector in the three real rates (a trivariate test in table 3.4a) and secondly to determine if Kenyan rates are influenced more by USA (table 3.4b) or UK (table 3.4c); three cointegration tests are run. See summary in tables in proceeding page:

Table 3.4(a) - Cointegration test Kenya – UK - USA							
		Unrestricted Cointegration Rank Test (Trace)			Unrestricted Cointegration Rank Test (Maximum Eigenvalue)		
Hypothesized No. of CE(s)	***Eigenvalue***	**Trace Statistic**	**0.05 Critical Value**	**Prob.****	**Max-Eigen Statistic**	**0.05 Critical Value**	**Prob.****
*None **	*0.053262*	45.35315	29.79707	0.0004	35.57631	21.13162	0.0003
At most 1	*0.013267*	9.776837	15.49471	0.2983	8.681219	14.26460	0.3136
At most 2	*0.001684*	1.095618	3.841466	0.2952	1.095618	3.841466	0.2952

Normalized cointegrating coefficients (standard error in parentheses)		
UK	USA	KENYA
1.000000	-0.291691	-0.072936
	(0.07942)	(0.01784)

Adjustment coefficients (standard error in parentheses)					
D(UK)	-0.097632	D(USA)	0.006637	D(KENYA)	0.079280
	(0.01652)		(0.01307)		(0.05749)

Table 3.4(a) Trivariate Johansen cointegration test results for the three rates: From the results above the null hypothesis of no cointegration is clearly rejected whereas the null hypothesis of there being at most one cointegrating vectors cannot be rejected. This suggests that there is one common stochastic trend driving the real interest rates in the UK, USA and Kenya; and by extension imply that in the long run the three real rates under study converge to an equilibrium. Normalized cointegrating coefficients, adjustment coefficients and their standard error are also reported in the table. The low standard errors indicate low degree of uncertainty in the estimated values of the coefficients.

Table 3.4(b) - Cointegration test Kenya – USA							
		Unrestricted Cointegration Rank Test (Trace)			Unrestricted Cointegration Rank Test (Maximum Eigenvalue)		
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.012933	9.608137	15.49471	0.3121	8.461174	14.26460	0.3337
At most 1	0.001763	1.146963	3.841466	0.2842	1.146963	3.841466	0.2842

Table 3.4(b) Bivariate Johansen cointegration test results for the Kenya and USA: From the results above the null hypothesis of no cointegration is accepted hence there is no cointegrating vector in the USA and Kenya series.

Table 3.4(c) - Cointegration test Kenya – UK							
		Unrestricted Cointegration Rank Test (Trace)			Unrestricted Cointegration Rank Test (Maximum Eigenvalue)		
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.041300	30.34155	15.49471	0.0002	27.41485	14.26460	0.0003
At most 1	0.004492	2.926698	3.841466	0.0871	2.926698	3.841466	0.0871

Normalized cointegrating coefficients (standard error in parentheses)			
UK	KENYA		
1.000000	-0.121899		
	(0.01884)		
Adjustment coefficients (standard error in parentheses)			
D(UK)	-0.068158	D(KENYA)	0.117517
	(0.01428)		(0.04905)

Table 3.4(c) Bivariate Johansen cointegration test results for the Kenya and UK: From the results above the null hypothesis of no cointegration is clearly rejected although the null hypothesis of there being at most one cointegrating vectors cannot be rejected. This suggests that there is one common stochastic trend driving the real interest rates in the UK and Kenya; and by extension imply that in the long run the two real rates under study converge to an equilibrium.
Normalized cointegrating coefficients, adjustment coefficients and their standard error are also reported in the table. The low standard errors indicate low degree of uncertainty in the estimated values of the coefficients.

From table 3.4(a) the Johansen cointegration test indicates that there exists one cointegrating vector that spans the three interest rates, where Kenya, UK and USA form a stationary linear combination. Normalised on the UK coefficient, the Kenya coefficient $\beta = -0.072936$ appears rather insignificant compared to the USA coefficient (4 times larger) of $\beta = -0.291691$.
Recalling the restriction on interpretation of the β coefficient as discussed in section 2, we further examine the α coefficient which represents weights with which the cointegrating vector enters in each equation. The UK, USA and Kenya coefficients are rather insignificant at -0.097632, 0.006637 and 0.079280 respectively. Interpreting these adjustment coefficients as percentages; when the UK real interest rates shift off the long run trend, UK rates depreciate by 9.7%, there is virtually no movement in the USA rates, while the Kenya rates appreciate by 7.9% . This would imply a rather very slow convergence to long-run equilibrium.

Based on the insignificant β coefficient and the relatively slow adjustment of the variables to equilibrium, we can infer that the UK, USA significantly do not adjust to Kenya and therefore conclude that Kenya is not integrated with the global financial markets in response to our first test objective.

From tables 3.4(b) and 3.4(c) our second test objective is answered. As there is no cointegrating vector with Kenya-USA and one cointegrating vector with Kenya-UK, we can therefore conclude that UK has greater influence on the Kenyan interest rates than the USA. Following the same argument as for interpreting table 3.4(a) above, the Kenya β coefficient of β = -0.121899 and the α coefficients for the UK and Kenya of -0.068158 and 0.117517 respectively are relatively significant indicating a tangible co-relationship of the two rates.

The test for cointegration implemented above following the Johansen procedure implies existence of causality, at least in one direction. It, however, does not indicate the direction of this relationship. To further investigate the causality, we perform causality tests in section 3.5 below.

3.5 Investigating causality and interaction of the Kenya, UK and USA real interest rates

Having identified the cointegrating vector, we proceed to examine how these variables drive each other. We implement this through the Granger – Causality test and the variance decomposition tests.
The granger causality test suggests which of the variables in the model have statistically significant impacts on future values of the other variables in the system. The results are presented in the table below:

Table3.5(a) Granger-Causality test

Null Hypothesis:	Obs	F-Statistic	Prob.
USA does not Granger Cause KENYA	651	4.06307	0.0442
KENYA does not Granger Cause USA		0.62895	0.4280
UK does not Granger Cause KENYA	651	4.13117	0.0425
KENYA does not Granger Cause UK		12.1814	0.0005
UK does not Granger Cause USA	651	0.75314	0.3858
USA does not Granger Cause UK		15.6987	8.E-05

Table 3.5(a) Granger-Causality test results: From the p-values presented, and drawing conclusion at 5% significance level, we can conclude that Kenya does not granger-cause USA; and UK does not granger cause USA.

On the other hand USA granger-causes both Kenya and UK; UK granger causes Kenya and surprisingly the data seems to imply that Kenya does granger cause the UK. The causality of Kenya→ UK and USA →UK are stronger and still hold at 1% significance level. Looking at the results above together with results from the cointegration test, the causality test supports the observation of linkage of common trend between the three rates. The causality between Kenya and USA is supported in one direction of USA →Kenya at 5% significance level whereas the Kenya and UK causality is bi-directional on Kenya→ UK and UK→ Kenya. This observation could further strengthen the conclusion of results of a common trend in Kenya-UK, no cointegration of Kenya-USA and a stronger relation of USA-UK.

Strictly speaking, the test does not imply that movements in Kenya and USA directly cause the UK movements or the movements in UK and USA directly cause Kenya; but simply implies a chronological ordering of movements of the series. The conclusions above are based strongly on the cointegration tests which econometrically evaluate the claims.

To further analyse the interaction of the variables in terms of impact of a shock on one variable in the system on movements in the variables, we examine the variance decomposition of the variables. The variance decomposition offers a cumulative response of movement in dependent variable due to its own shocks versus shocks on the other variables. The result of the test is tabulated in table 3.5(b) in the following page:

Table 3.5(b) Variance decomposition test (order UK - USA- KENYA)					
	Period	***Standard Error***	**UK**	**USA**	**KENYA**
Variance Decomposition of USA:	*1*	*0.264639*	0	100	0
	5	*0.494426*	0.033739	99.96103	0.005228
	10	*0.585443*	0.118724	99.85354	0.027738
	20	*0.655238*	0.307699	99.55851	0.133796
Variance Decomposition of UK:	*1*	*0.208531*	99.65319	0.346809	0
	5	*0.455678*	99.52545	0.183106	0.291449
	10	*0.627638*	97.65712	1.011499	1.331383
	20	*0.846724*	90.01954	5.36155	4.618909
Variance Decomposition of KENYA:	*1*	*0.920474*	0.158993	0.348917	99.49209
	5	*1.976344*	0.063835	0.206566	99.7296
	10	*2.67284*	0.25837	0.123972	99.61766
	20	*3.505261*	0.901609	0.475465	98.62293

Table 3.5(b) Variance decomposition test results: From results above we can see that generally all the variables have negligible explanatory power for the other series, with over 90% of shock explained by own series at period 20. For all the series, however, the effect of the shocks evolve gradually as the periods increase (i.e. does not wash away).

For the Kenya and USA decomposition, this effect is virtually negligible. However the influence in the UK is rather significant with 5.3% and 4.6% of influence in period 20 from USA and Kenya respectively. Extending to 50 periods this pattern is again repeated: Both USA and Kenya decompose generally independent of the other series; however the UK decomposition is still heavily influenced with 16% and 26% from Kenya and USA respectively explaining shocks at period 50. The long persistence of effects of innovations (with system still adjusting at period 50) as evidenced from the variance decomposition can be viewed analogous to the α coefficients which indicate very slow return to any long – run equilibrium.

The ordering of the variables is important in calculating the variance decomposition due to testing method. We re-run the test with the other possible 5 orderings of the variables and the results were generally identical and leading to the same conclusion.

From the two tests above, we can conclude that there is evidence of lead-lag relationship in the Kenya-UK and UK-USA markets. The USA and Kenya markets however evolve generally independently displaying very weak, if any, causality.

These results appear to support the conclusions arrived from the cointegration test in section 3.4 of a rather weak relationship between the three variables; but a notable relationship with Kenya-UK.

4. INTERPRETATION OF RESULTS AND CONCLUSION

In this paper we have reviewed the degree of the Kenya financial market integration, using recent data and the Johansen (1988) procedure. The issue of financial market integration is an important one in terms of interpretation as a measure of openness of the financial system to global markets and, by extension, resultant of more foreign capital inflow and investments into the Kenyan market.

Though the cointegration test indicates one cointegrating vector among the three real interest rates of Kenya UK and USA, the Kenya coefficient is considered rather insignificant and we therefore conclude the Kenya financial market is not integrated with global financial markets. The empirical tests also indicate that the UK has more influence on the Kenya financial markets than the USA. Bearing in mind, however, the limitations of the power of Johansen cointegration methodology and the real interest rate parity in terms of the validity of conclusions drawn from these results, the robustness of these inferences is subject to rigorous testing with various indicators and methodologies to arrive at a full conclusion on the integration of Kenya with the global markets.

In light of the East African Community (EAC) economic block that was revived in July 2000 which seeks to establish a common no-tariff barrier market and common currency within East African countries, a further study can be considered to investigate the integration of the individual economies; and further still the integration of this economic block to the global markets. Such an investigation is hindered at present due to lack of sufficient data and due to the fact that the EAC is still at formation stages with policies still being reviewed.

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