FINANCIAL INTEGRATION RELATIONSHIPS AND LINKAGES IN EAST AFRICA COMMUNITY EQUITY MARKETS

By:

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Abstract

This paper investigates financial integration and linkage relationships amongst equity markets in East Africa Community over time by determining the speed and levels of integration using monthly market return data for the period 2007 to 2013. The study also examines the short run and long run relationships amongst the markets. The study was motivated by the ongoing plans of establishment of the East Africa Monetary Union (EAMU) which will be characterized by mobility of labor and capital as factors of production across the member states. Using beta and sigma convergence measures, the study notes that financial integration has not deepened in the EAC over the years though there are trends towards full integration. Correlation analysis suggests strong significant relationships amongst EAC equity market returns. Johansen Cointegration tests suggest existence of three stochastic trends in the equity markets. Vector auto regression analysis and impulse response analysis suggest linkages amongst the markets hinging on the NSE and mean reversion in all the equity markets. The study findings suggest that the EAC equity markets are weak form efficient and there are arbitraging opportunities across the equity markets. The responses to the shocks in any of the markets are found to be dependent on the relationships between the markets. From the study findings, it is inferred that the roadmap to EAMU should be fast tracked by facilitating efficiency in the EAC markets where rates of return are market determined. Policy initiatives should be put in place to eliminate arbitrage opportunities across the markets and to encourage capital mobility through the equity markets. To support integration, there should be academic studies on the existence of home bias in the EAC equity market segments.

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Introduction

Economic integration is described as elimination of economic frontiers between two or more economies by Pelkmans (2006) who define an economic frontier as any demarcation over which actual and potential mobility of goods, services, production factors and communication flows are relatively low.

Financial market integration is defined by De Brouwer (2005) as the process through which financial markets in an economy become more closely integrated with those in other economies or with those in the rest of the world. This implies an increase in capital flows and a tendency for prices and returns on traded financial assets in different countries to equalize.

The European Commission, in its financial integration monitor of 2005 defines financial integration as a process, driven by market forces, in which separate national financial markets gradually enter into competition with each other and eventually become one financial market, characterized by converging prices, product supply and converging efficiency or profitability.

Distinction between perfect, direct and indirect financial integration is provided by Oxelheim (1990). Perfect (or total) integration means that expected real interest rates are the same on the markets concerned. Under direct financial integration, the law of one price is held, that is, an investor can expect the same return on investments on different markets. Indirect financial integration, in turn, refers to a situation where the return on an investment in one country is indirectly linked to the return on investments in other countries through other markets like exchange market, or the goods market.

Traditionally, five stages of the integration process are distinguished; a free trade area (FTA), a customs union (CU), a common market (CM), an economic/ monetary union (EU/MU) and a complete integration. Mc Carthy (2004) explain that regional integration reaches its pinnacle when monetary and fiscal integration is added to free trade in goods and services creating a monetary union (MU) with a single currency. This is preceded by

a common market characterized by mobility of factors of production namely labor and capital.

In November 2013, the heads of states of the EAC countries signed a monetary union protocol for the introduction of a single currency in ten years time from the signing. The future East African Monetary Union (EAMU) is expected to replace the five individual country currencies with a common currency managed by the prospective East African Central Bank (EACB). The monetary union protocol is preceded by the treaty establishing the current EAC signed in 1999, the treaty establishing a customs union signed in 2004 and the treaty establishing a common market protocol signed in 2009.

Alongside these phases of economic integration, there has gown interest on integration in EAC financial markets amongst scholars and policy makers. Financial market integration has been studied from different perspectives. Goldberg and Delgado (2001) distinguish literature on integration in two sets. The first set of studies relate to regime breaks whose existence is verified through unit root tests or co-integration among different financial markets. The second set consists of studies that define integration as the convergence of asset returns where the more markets converge, the more the assets with related risk characteristics would yield similar returns.

In EAC, there are four equity markets namely; Nairobi securities exchange (NSE), Uganda stock exchange (USE), Dar es Salaam stock exchange (DSE) and Rwanda stock exchange (RSE). This study therefore seeks to investigate any existing integration relationships and linkages amongst the equity markets exhibited by convergences in market returns, responses to shocks in member country equity markets and significance of member country returns in explaining equity market returns.

Review of Related literature

A number of theories have been advanced in attempts to explain integration relationships in financial markets. The decision for geographic regions to economically integrate and adopt a single currency is based on the theory of optimum currency areas (OCA). OCA theory associated with Mundell (1961), McKinnon (1963), and Kenen (1969) define a common currency area in terms of the extent of trade and factor mobility between states.

The role of states in integration process is explained by Heather, Porter and Roberge (2004) in the hegemonic stability theory (HST) through an argument that integration is driven and shaped by powerful states rather than by forces endogenous to markets. The role of market forces in financial markets is anchored in the adaptive markets hypothesis (AMH) advanced by Lo (2004) where principles of evolution, competition, adaptation and natural selection explain financial interactions. Lately, financial markets are studied within the market microstructure theory explained by Krishnamurti (2009) as the study of the process and outcomes of exchanging assets under a specific set of rules. A basic premise of market microstructure theory is that asset prices need not reflect full information expectations value due to a variety of frictions.

Financial markets integration, measured through the identification of common mutual long run stochastic trends using cointegration techniques, has been the basis of studies by Mkenda (2001), Yang, *et al*. (2003), Adjasi and Biekpe (2006), Maneschiold (2006), Onay (2007), Yabara (2012) and Kaijage and Nzioka (2012). The Johansen and recursive co-integration techniques have been applied in these studies to measure stability of long run relationships in equity markets. Studies by Yang, *et al*. (2003) favor recursive co-integration over Johansen co-integration technique because it is able to reveal evolving patterns in long-run relationships.

In the EAC, long run relationships have been analyzed using Johansen co integration approach by Kaijage and Nzioka (2012) who use monthly secondary data on market indices for NSE, USE and DSE. The study finds absence of long run relationship amongst the equity markets indices. Yabara (2012) uses weekly and bi-weekly data and finds no co-integration vector in EAC stock prices thereby concluding on non existence of long run relationships among the EAC stock markets. The foregoing studies do not review the long run relationships between equity market returns which the current study addresses.

The law of one price that characterizes perfect financial markets integration has led to the adoption of beta (β) and sigma (δ) convergences as measures of financial integration by

Baele, Ferrando, Hordahl, Krylova and Monnet (2004), Vajanne (2006), Babetskii, Komarek and Komarkova (2007), Espinoza, Prasad and Williams (2010), Yabara (2012) and Kaijage and Nzioka (2012). In these studies, β-convergence indicates the speed at which markets are integrating and δ-convergence signify how far away a market is from being fully integrated into a regional integration arrangement (RIA). In the EAC equity markets, convergence analysis by Kaijage and Nzioka (2012) and Yabra (2012) concur on none deepening of markets integration with notable phases of divergence. Since divergence is not the intent for integration, the possible causes should be an area for further research.

Methodology

The study used secondary data of daily share indices from three equity markets (NSE, DSE and USE) for the period 2007 to 2013. The period was on the basis that DSE launched the share index in December 2006 though NSE and USE had share indices earlier. The RSE is excluded from the analysis since it had no share index for the study period as it started its operations in January 2008. The share indices were converted to a standard currency, using spot rates between the local currencies and the US dollar obtained from the respective countries central bank's databases.

The standardized end of month share indices were applied to compute the monthly equity market returns using the formulation:

$$Market\,\mathrm{Re}\,turn = \left(\frac{Index - Index_{-1}}{Index_{-1}} \right) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.. \text{Equation 1}$$

The relationships between the monthly equity market returns were tested in a Pearson's correlation analysis. The returns were then tested for unit root tests and a Johansen cointegration test was conducted to establish any existing long run relationships. A vector autoregressive (VAR) system was developed with the market returns with a lag of two periods to establish the statistically significant returns that explain each of the equity markets returns. From the VAR system, an impulse response analysis (IRA) was carried out to investigate how EAC member country equity market returns responds to shocks in one member country equity market returns. The speed (β) and levels (α) of equity

markets integration over the months and/or years were derived from equations tow and three respectively.

$$\Delta \mathbf{R}_{i, t} = \propto_1 + \beta \mathbf{R}_{i, t} + \sum_{l=1}^{L} \gamma_l \Delta \mathbf{R}_{i, t-1} + \varepsilon_{i, t}$$

……………………….. Equation 2

Where:

> *β – is Beta Convergence (the speed of integration)*
>
> *$R_{i,t}$ – is the spread of yields on a relevant portfolio investment between country I and a benchmark market at time t*
>
> *l - is the lag,*
>
> *Δ - is the difference operator*
>
> *$α_i$ - is the country specific constant*
>
> *$\varepsilon_{i,t}$ – is the error term that accounts for unexplained variations*
>
> *$γ_l$ - measures lagging effects from ΔRi, in previous periods.*

$$\delta = \left[\sqrt{\frac{1}{N-1} \sum_{i=1}^{N} \langle (y_{i, t}) - y *_t \rangle^2} \right]$$

…………………..………… Equation 3

Where:

> *δ – is sigma convergence (the level of integration),*
>
> *N – is number of countries,*
>
> *$Y_{i, t}$ - is the market return on investment in country i at time t,*
>
> *$Y*_t$ - is the cross-section mean return at time t (average market return in the region at time t)*
>
> *i – Index for separate countries.*

Results and Discussion

The movements of the monthly returns from the equity markets are presented in figure 5.2 below.

Figure 1 a: DSE Returns

Figure 1 b: NSE Returns
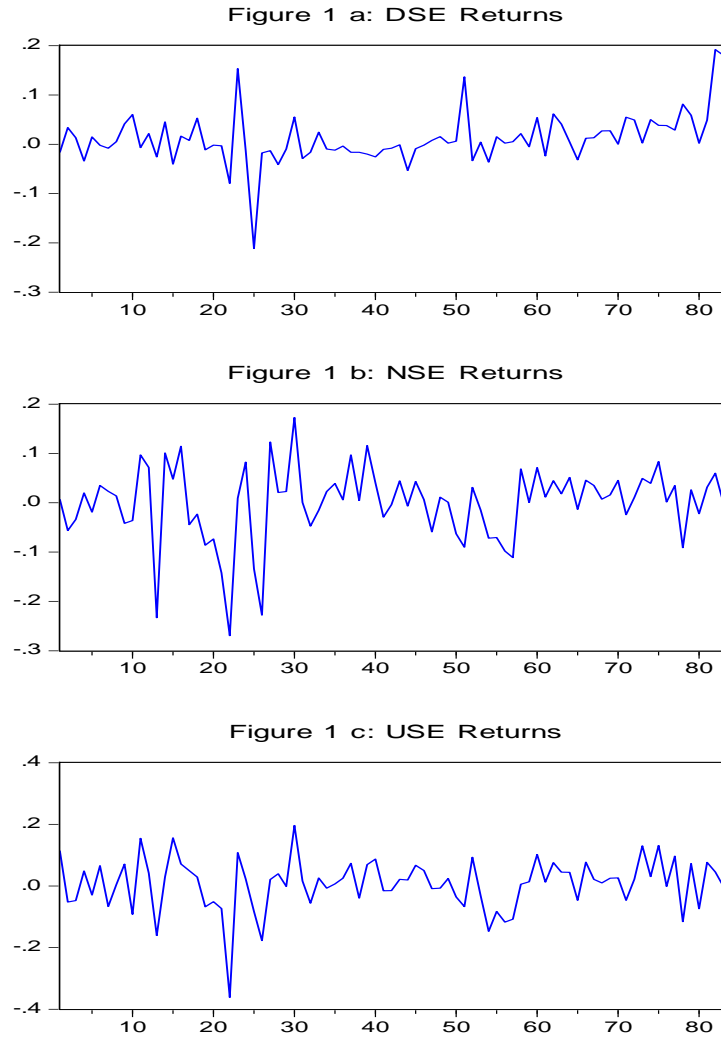

Figure 1 c: USE Returns

Figure One: EAC Equity Market Returns

Across all the three markets, the returns swing between the positive and the negative values over the months which indicate volatility of the market returns. It is inferred from figures 1 (a, b and c) that the market returns from DSE, NSE and USE respectively exhibit some forms of seasonality over the months/ years.

Correlation analysis on Equity Market Returns

The Pearson Correlation coefficients among the monthly equity market returns are summarized in table one below.

Table One: Correlation of returns of three EAC equity markets

		NSE	USE	DSE
NSE	Pearson Correlation	1		
	Sig. (2-tailed)			
	N	84		
USE	Pearson Correlation	.833**	1	
	Sig. (2-tailed)	.000		
	N	84	84	
DSE	Pearson Correlation	.221*	.223*	1
	Sig. (2-tailed)	.043	.041	
	N	84	84	84

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

As presented in table one, Positive correlation exists between the monthly returns in the EAC equity markets. At r = 0.221, P < 0.05 and r = 0.223, P < 0.05, it is inferred that returns between DSE and NSE on one hand and USE and DSE on another hand weakly move in the same direction. Movements in returns at USE and NSE exhibit a statistically significant strong relationship with a correlation of r = 0.833, P < 0.05. In the absence of perfect positive correlation between the equity markets attained by r = 1, the EAC equity markets are not fully integrated and thus there is a possibility for investors to earn arbitrage returns from portfolio diversification in the respective EAC equity markets.

Cointegration Tests in EAC Equity Markets

Cointegration analysis provides a framework for estimation, inference, and interpretation when the variables are not covariance stationary. As presented in tables two and three, EAC equity markets possibly have three cointegrating vectors (P <0.05) implying that there may be stochastic trends in the equity markets in EAC. This implication is further tested and confirmed through bivariate cointegration tests as presented in table four.

Table Two: Johansen Trace statistic test in Equity Markets

Unrestricted Co integration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.270352	54.36557	29.79707	0.0000
At most 1 *	0.219829	28.83490	15.49471	0.0003
At most 2 *	0.102142	8.727239	3.841466	0.0031

Trace test indicates 3 co integrating eqn (s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table Three: Johansen Eigen statistic test in Equity Markets

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.270352	25.53068	21.13162	0.0112
At most 1 *	0.219829	20.10766	14.26460	0.0053
At most 2 *	0.102142	8.727239	3.841466	0.0031

Max-eigen value test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table Four: Bivariate Engle Granger test in EAC Equity Markets

Automatic lags specification based on Schwarz criterion (maxlag=11)

Dependent	tau-statistic	Prob.*	z-statistic	Prob.*
DSE	-7.630329	0.0000	-68.65462	0.0000
NSE	-12.11437	0.0000	-105.1436	0.0000
USE	-14.09303	0.0000	-115.2873	0.0000

*MacKinnon (1996) p-values.
Intermediate Results:

	DSE	NSE	USE
Rho - 1	-0.827164	-1.266790	-1.389004
Rho S.E.	0.108405	0.104569	0.098560
Residual variance	0.002449	0.001550	0.001685
Long-run residual variance	0.002449	0.001550	0.001685
Number of stochastic trends**	3	3	3

**Number of stochastic trends in asymptotic distribution

The above results could be attributed to the possibility of some equity market return series being independent or some market returns with very weak relationships.

Vector Auto Regression (VAR)

VAR is a useful model that allows all variables to be endogenous. It is used to estimate equations and to examine how variables respond when another variable is shocked beyond its mean. The VAR system is generated to estimate how the EAC Equity market returns respond when another equity market rate is shocked beyond its mean as presented in table five below.

Table Five: Vector auto regression Estimates in Equity Markets

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.298719	0.117721	2.537505	0.0118
C(2)	-0.055844	0.122642	-0.455340	0.6493
C(3)	-0.178092	0.143773	-1.238703	0.2167
C(4)	0.306024	0.153797	1.989796	0.0478
C(5)	-0.015170	0.139137	-0.109027	0.9133
C(6)	-0.173073	0.133808	-1.293436	0.1972
C(7)	0.009670	0.005888	1.642298	0.1019
C(8)	0.340422	0.175494	1.939798	0.0537
C(9)	-0.303506	0.182830	-1.660048	0.0983
C(10)	0.263535	0.214331	1.229575	0.2201
C(11)	0.308244	0.229273	1.344440	0.1802
C(12)	-0.185585	0.207420	-0.894733	0.3719
C(13)	-0.280716	0.199475	-1.407272	0.1607
C(14)	0.001764	0.008778	0.200905	0.8410
C(15)	0.310454	0.189041	1.642257	0.1019
C(16)	-0.274837	0.196943	-1.395512	0.1642
C(17)	0.674996	0.230876	2.923635	0.0038
C(18)	0.246975	0.246972	1.000014	0.3184
C(19)	-0.545183	0.223431	-2.440044	0.0155
C(20)	-0.161346	0.214874	-0.750888	0.4535
C(21)	0.009632	0.009456	1.018627	0.3095

Equation: DSE = C(1)*DSE(-1) + C(2)*DSE(-2) + C(3)*NSE(-1) + C(4)*NSE(-2)+
C(5)*USE(-1) + C(6)*USE(-2) + C(7)
Equation: NSE = C(8)*DSE(-1) + C(9)*DSE(-2) + C(10)*NSE(-1) + C(11) *NSE(-2) +
C(12)*USE(-1) + C(13)*USE(-2) + C(14)
Equation: USE = C(15)*DSE(-1) + C(16)*DSE(-2) + C(17)*NSE(-1) + C(18) *NSE(-2) +
C(19)*USE(-1) + C(20)*USE(-2) + C(21)

As presented in table five above, the estimated coefficients for current DSE returns are one period lag returns for DSE itself (β=0.299, P <0.05) and two period lag returns for NSE (β=0.306, P <0.05). For USE returns, the significant coefficients are the one period lag returns for NSE (β=0.675, P <0.05) and USE (β= -0.545, P <0.05). These estimates suggest that the equity markets vary in the forms of their efficiency considering the reliability of using past equity market returns to predict the future market returns. The findings also suggest linkages between the EAC equity markets hinging on the NSE when the lagged NSE returns are statistically significant in explaining current USE and DSE returns.

Impulse Response Analysis (IRA)

Through impulse response functions, the study examines the speed of adjustment of monthly equity returns in re-establishing the long run equilibrium following a shock. By subjecting the market returns to an impulse response analysis, equity market returns response to the shocks are compared in terms of magnitude and speed of adjustment. Figure two below presents the findings on a 12 month period.
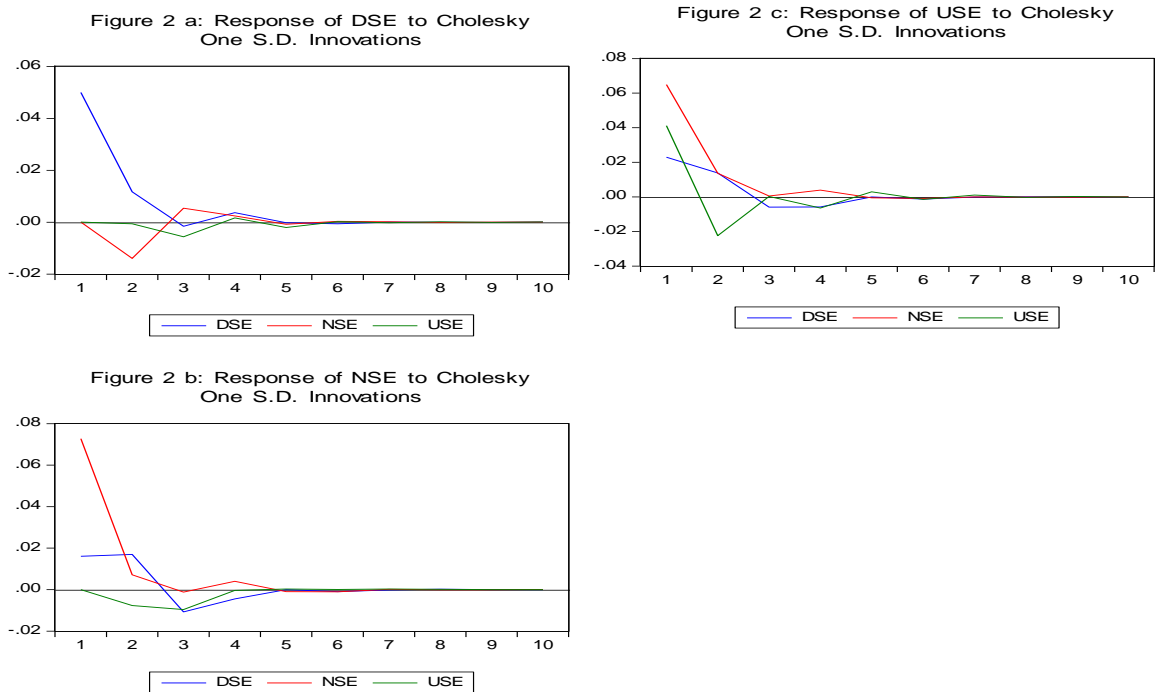

Figure 2 a: Response of DSE to Cholesky One S.D. Innovations

Figure 2 c: Response of USE to Cholesky One S.D. Innovations

Figure 2 b: Response of NSE to Cholesky One S.D. Innovations

Figure Two: Impulse Response in EAC Equity Markets

As observed in figure two (a) above, a prolonged shock in the DSE market returns has a short term lagged effect on the USE and NSE market returns. However, all the market returns in a short period revert to the mean market returns. Figure two (b) shows that a prolonged shock on the NSE has an immediate longer effect on the USE market returns and a lagged short term effect on the DSE returns as the overall market returns revert to the mean. As presented in figure three (c), a prolonged shock on the USE market returns also affects DSE and NSE market returns as the market returns revert to their mean after some reasonable time. In general, the figures show that the equity markets in EAC region respond to the shocks amongst themselves. The sensitivity of the impulse responses however vary between the markets as dependent on the linkages between them.

Monthly Sigma Convergence in EAC Equity Markets

Monthly cross sectional dispersion across the region and individual deviations by the East Africa community member countries equity markets is presented in figure three below.
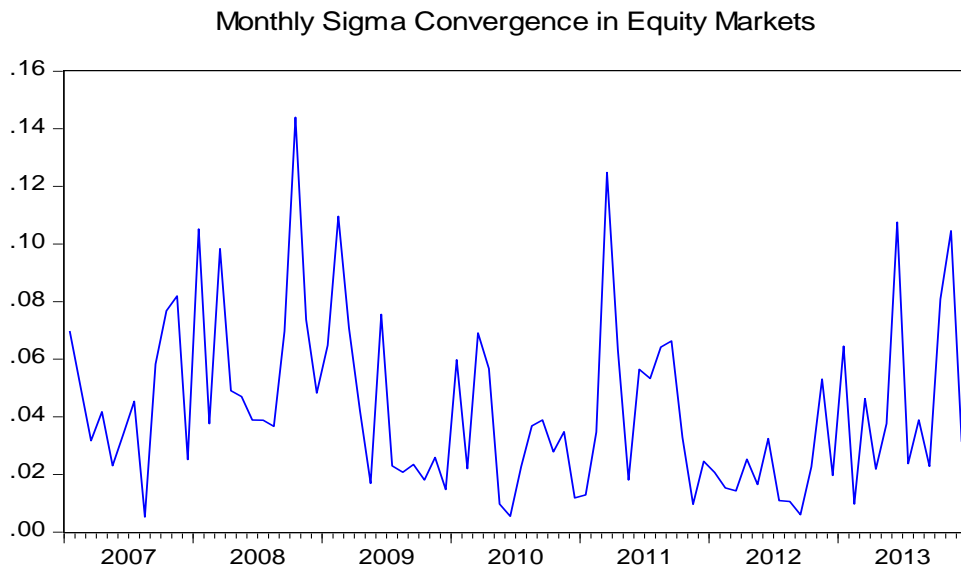

Monthly Sigma Convergence in Equity Markets

Figure Three: Monthly Sigma Convergence for the EAC Equity Markets

As presented in figure three above, the levels of sigma convergence in the EAC equity markets over the months and years has been swinging between a minimum of 0.005 attained in June 2010 and a maximum of 0.144 attained in October 2008. It is expected that the degree of financial integration increases when the cross sectional standard deviation of the market returns trends downwards. When the cross sectional distribution

collapses to a single point and the standard deviation converges to zero, full equity market integration is attained. With the swings evidenced, it is clear that there are seasonal trends towards convergence followed by trends towards divergence in EAC equity markets.

Annual Sigma Convergence in EAC Equity Markets

Annual cross sectional dispersion across the region and individual deviations by the East Africa community member countries equity markets is presented in figure four below.
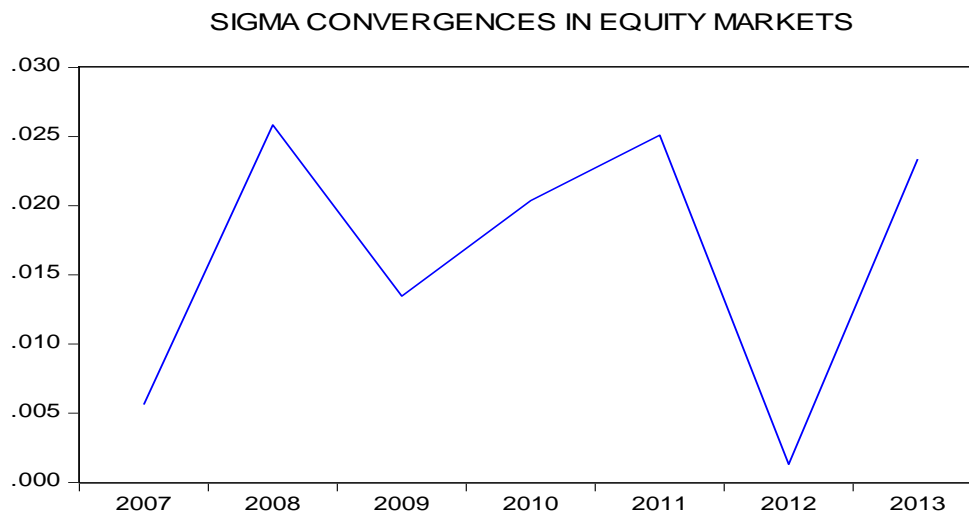
SIGMA CONVERGENCES IN EQUITY MARKETS

Figure Four: Annual Sigma Convergence for the EAC Equity Markets

As indicated in figure four above, the equity markets exhibit divergence and convergence over the years. It is notable that the Sigma convergences have not hit zero level implying no perfect integration in the markets. However, there is a trend for convergence as the levels of dispersion tends towards the zero level with the closest being in 2012.

Beta Convergence in EAC Equity Markets

Annual Beta (β) convergences are computed from the spread of equity market returns against lagged spreads of the other EAC equity markets and NSE as the benchmark market. The computed annual Beta Convergences in the Equity markets are presented in figure five below.
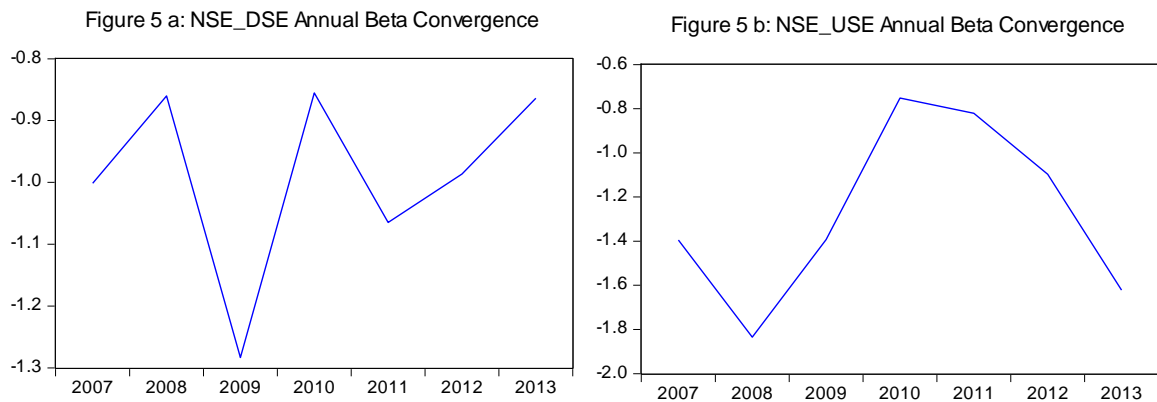
Figure 5 a: NSE_DSE Annual Beta Convergence

Figure 5 b: NSE_USE Annual Beta Convergence

Figure Five: EAC Equity Markets Beta Convergence

As presented in figure five above, mean reversion takes place across all the EAC equity markets from 2007 to 2013. If financial markets are perfectly integrated the spreads between the returns should be zero. Statistically significant ($p<0.05$) negative β coefficients as presented indicate mean reversion in the markets without attaining a desirable absolute speed of integration.

Conclusions and Recommendations

The existing relationship and linkage between EAC financial markets is of importance given the desire of the region to form a monetary union where there is mobility of labor and capital across the member countries. The positive correlations between the market returns suggest that the equity market returns in EAC move in the same direction.

Though there are three possible long run relationships amongst the equity markets as evidenced in cointegration tests, lack of perfect integration as evidenced in the beta and sigma convergence analyses imply that investors in EAC can still enjoy arbitrage returns by constructing portfolios across the member countries. Kaijage and Nzioka (2012) and Yabara (2012) did not establish the long run relationships between the equity markets, However, the findings of lack of a perfect integration from the convergence analyses is consistent with their earlier propositions.

Since the current market returns are explained by their past returns and the past NSE returns as evidenced from the VAR system estimates, the EAC equity markets are considered as weak form efficient which makes it possible for investors (chartists) to beat

the markets through accurate forecasting. Mean reversion in the EAC equity markets characterized by negative beta coefficients further confirms this proposition.

Since perfect financial markets integration would be a prerequisite for the success of the proposed EAMU, there is the need to put in place institutions and infrastructure that support convergence of returns in the EAC equity markets. The possible reasons for the divergences observed over time which may be country characteristics or market specific characteristics should be investigated in further research and possibly harmonized with the intent of the EAC. This should also include possible home bias for financial assets.

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