

Analysis of Market Integration: A Case of Sugar in Selected Markets in Kenya

Odipo O. Timothy, Bett K. Hillary, Lagat K. Job, Sigei K. Geoffrey
Department of Agricultural Economics and Agribusiness Management, Egerton University,
P.O Box 536-20115, Egerton, Kenya
E-mail of corresponding author: odipotimothy1@gmail.com

Abstract
Market integration is one of the most important aspects that can be used to assess the impacts of market development and liberalization policies. In the study areas, there was thin knowledge whether the sugar markets were integrated or segmented. Therefore, this paper seeks to determine the existence of integration among the selected sugar markets. Secondary data was obtained for average monthly prices of sugar from January 2008 to December 2012. Data was analyzed using Co-integration model. The result revealed that road networks, communication networks, consumers' purchasing power and the distance between the markets greatly influenced market integration. Based on the findings the policy implication was drawn to enhance sugar market integration in the study areas.
Key words: Co-integration model, market integration, selected markets

1. Introduction

Integrated markets can be defined as the markets that are connected through a process of arbitrage. There is undisputable importance of well integrated markets to a country. Linkages to marketing centres have been found to contribute significantly to rural households' escape out of poverty (Krishna, 2004; Krishna *et al*., 2004). Sugar is a vital product that nearly all households in Kenya hardly miss among their daily meals. Kenya's sugar consumption continues to grow and outpace production in line with the increasing population. Domestic production supplies about 70 percent of total consumption and the shortfall must be met through imports. Kenya Sugar Board forecasts consumption to grow at an annual rate of 4 percent (KSB, 2011), and this is nearly the same rate of growth in population. The other factor driving consumption increase is the expansion in industrial use. The use of sugar in industrial activities such as manufacturing soft drinks, biscuits, other beverages and confectionary products is rising steadily (KSB, 2011). It is this fact that necessitates a well-informed study to heighten development of sugar marketing in Kenya. Past literature shows that very few studies have been done concerning market integration in Africa. Indeed, the most innovative studies on market integration are on markets in developed economies (Spiller and Huang, 1986; Ardeni, 1989; Sexton *et al*., 1991; Goodwin and Schroeder, 1991; Goodwin and Piggott, 2001). Since it is through marketing that the surplus commodities in a production region can be adequately distributed to areas of scarcity, studies that focus on market integration are thus important. Distribution of the processed sugar in Kenya is done by company agents or wholesalers. These distributers use their own transportation vessels save some retailers. The country does not have any competitive advantage in the world and regional market. However, according to Mumias Sugar bulletin (2011), regional cross border trade remains a common occurrence with Mumias Sugar Company exporting ten percent of its produce to the neighbouring Uganda, Sudan, Rwanda and Ethiopia. To increase sales and product identification, local sugar mills have not only segmented the consumer market but also branded their products. They have packaged both white and brown sugar in different sizes (2kg, 1kg, 1/2kg, 1/4kg, 100g and 5g) to cater for different markets and different pockets (KSB, 2011). Producer companies have adopted different strategies to market their sugar. According to Kenya Sugar Board Report (2011), Kenyan millers sourced 80 percent of their brown sugar from Egypt in marketing year 2010, while South Africa and Saudi Arabia supplied 47 and 42 percent of refined sugar, respectively. However, the occasional sugar shortage in the country sometimes lead to sugar rationing where an individual is not allowed to purchase more than 2 kilograms of sugar in leading supermarkets. Such shortage often aggravates the increase in sugar prices which the traders pass to consumers. Market integration can be vertical, spatial or inter-temporal. Spatial market integration refers to a situation in which prices of a commodity in spatially separated markets move together and price signals and information are transmitted smoothly across the markets (Ghosh, 2000). An integrated market is synonymous with pricing efficiency, that is, prices as defined by Fama and Eugene (1970), should always reflect all information. For instance, prices move from time to time and their margins are subject to various shocks that may drive them apart or not. If in the long run the prices exhibit a linear constant relation then it is said that they are co-integrated.

2. Methodology

2.1 Study areas and Sampling techniques

The study was conducted in four different selected markets in Kenya these include: Kisumu, Garissa, Nairobi and Machakos. Kisumu is located in 0°6′0″S and 34°45′0″E. Kisumu is the major market located in close proximity to main sugar producing areas such as Awendo and Mumias. It acts as a surplus region for the sugar industry. Nairobi is located in 1°16′59.88″S and 36°49′ 0.12″E. It is the capital city of Kenya. It is deficit region and the major consumption point of sugar produced in Kenya. Garissa is located in 0°27′ 25″S and 39°39′30″E. The area is located in the furthest part of the country and it is exhibited by poor road networks and poor communication networks. Machakos is located in 1°31′S 37°16′E and 1.517°S 37.267°E. The area has the major rural centre, and also a satellite town due to its proximity to Nairobi. A monthly average price of sugar was obtained for the period of five years beginning January 2008 to December 2012 and time series data was used. Kisumu acted as the source market for sugar whereas Garissa, Machakos and Nairobi acted as deficit regions which depended on the integration with Kisumu. Secondary data was used in this study. Retail price data were obtained from the Kenya Sugar Board (KSB) for the four cities.

2.2 Data analysis

To analyse the direction of market integration in the four different markets in Kenya, Co-integration analysis was used. However, the method of estimation depended on the stationarity properties of the independent time series. Augmented Dickey-Fuller (ADF) test was applied to establish for the stationarity in price series. Co-integration analysis was then used to test for price connection among the regional markets; based on the model as developed by Engle and Granger (1987) and as used by Goodwin and Schroeder (1991). Co-integration analysis was used to determine the relationship between prices in different locations. When a long-run linear relation exists among different price series, these series are said to be co-integrated. If geographically separated markets are integrated, then there exists an equilibrium relationship amongst them [Goodwin and Schroeder (1991), Sexton *et al.*, (1991)]. The long run equilibrium relationship for analyzing market integration as used in Goodwin and Schroeder (1991) was specified as:

$$Y_t = \alpha + \beta X_t + U_t \quad (1)$$

Where; Y_t and X_t is commodity prices of a homogenous good (sugar), in two different markets at time t, and α and β are parameters to be estimated. If two markets are perfectly spatially integrated, then β =1. If this holds, then price changes in one market are fully reflected in alternative market. When $\beta \neq 1$ (i.e. $\beta < 1$ or $\beta > 1$), then the degree of integration may be evaluated by investigating how far the deviation of $\alpha_1$is from unity. Since price time series are usually non-stationary whereas standard statistical models do not allow explicit determination of α and β, a 2- step model (Engle and Granger, 1987). The first step was to determine the "order of integration" of each price series by checking for stationarity. A time series (say Y_t) is stationary if the joint distribution of $Y_t$and Y_t+ t is independent of time (t). This was guaranteed by ensuring that the time series is integrated of order zero [I (0)]. Since most price series have trends in them if only because of inflation, they are I (1) and thus they need differencing once to obtain I (0) process. Augmented Dickey-Fuller test was used to determine the order of integration. This was achieved by regressing ΔY_ton Y_t-1 and several lags of ΔY_t (enough to eliminate auto correlated disturbances). The model is specified as:

$$\Delta Y_t = \alpha_0 + \alpha_1 Y_t - 1 + \varepsilon_t \quad (2)$$

Where: ΔY_t is the first difference of prices in market Y, Y_t-1 is the lagged price of sugar in market Y, α_0 and α_1 are parameters to be estimated, ε t is the error term. The t-statistic on the estimated coefficient of $Y_t - 1$ will then be used to test the hypothesis that: *Ho:* Y_t *~ I(1) Vs H1:* Y_t *~ I(0).* If we fail to reject the null (Ho) above then Y_t is not stationary and can be integrated of order one or even higher. To find out the order of integration the test will be repeated with ΔY_tin place of $Y_t$thus regressing $\Delta\Delta Y_t$on a constant ΔY_t-1 and several lags of $\Delta\Delta Y_t$. ADF test will be used to test the hypothesis that: *Ho:* ΔY_t *~ I(1) Vs; H1:* ΔY_t *~ I(0).* That is, *Ho:* Y_t *~ I(2) VS; H1:* Y_t *~ I(1).* This process continued until the order of integration was established. The second step then involved testing for co-integration based on the idea that if two time series ($Y_t$and X_t) are each *~ I (1),* then their residual (U_t) will be integrated of order zero (stationary). Where:

$$U_t = (Y_t - \alpha - \beta X_t \quad (3)$$

The residual (U_t) was then tested for stationarity. The ADF tests applied to these residuals were expected to yield statistics which are large and negative so as to reject the null hypothesis of I (1) in favour of stationarity. If the first step shows that each time series is integrated of order one, and if the second step results to a stationary residual, then the two time series are said to be co-integrated. This implies that long run (or equilibrium) relationship exists between the two sets of prices. In addition, to make a clear distinction between short-run and long-run integration an Error Correction Model (ECM) was applied. This allowed for derivation of the speed of price transmission from one location/market to another. Within the context of market integration, it is important to consider the speed of adjustment as one dimension of integration. The error term in the cointegration regression was treated as the equilibrium error. To tie the short-run behaviour of Y_t to its long run value, the Error Correction Model (ECM) was specified as:

$$\Delta Y_t = \alpha_0 + \alpha_1 \Delta X_t + \alpha_2 U_{t-1} + \varepsilon_t \quad (4)$$

Where; Δ = first difference operator, ε_t = random error term and $U_{t-1} = (Y_{t-1} - \alpha - \beta X_{t-1})$

ECM states that ΔY_t depends on ΔX_t and on equilibrium error term, while absolute values of α_2 decide how quickly equilibrium will be restored (speed of adjustment).

Table 1: Variables used in co-integration model

Variable	Description	Measurement	Expected sign.
KsmPr	Price of sugar in Kisumu	Kenya shillings	+
NrbPr	Price of sugar in Nairobi	Kenya shillings	+
MkcPr	Price of sugar in Machakos	Kenya shillings	+
GrsPr	Price of sugar in Garissa	Kenya shillings	+

3. Results and Discussions

3.1 Establishment of the existence or non- existence of integration between the selected sugar markets

To establish the existence or non-existence of integration between the selected sugar markets, several stages were involved where the average monthly sugar prices in each market was subjected to stationarity test. The test is used to show whether prices are stable or unstable. To proceed, unit root test was carried out for all the sugar prices in various markets and the results are presented in Table 2.

Table 2: Unit root test for the price of sugar in Kisumu, Garissa, Machakos and Nairobi

Model		β	Std. Error	Beta	T	Sig.	Lower 95%	Upper 95%
Kisumu	(Constant)	5.821	3.818		1.250	0.300	-1.824	13.466
	Laggedk	-0.061	0.045	-0.178	1.320	0.900	-0.151	0.029
Garissa	(Constant)	6.535	4.407		1.483	0.144	-2.290	15.360
	Laggedg	-0.054	0.041	-0.172	-1.318	0.193	-0.137	0.028
Machakos	(Constant)	6.670	4.264		1.564	0.123	-1.870	15.209
	Laggedm	0.065	0.046	-0.186	-1.431	0.158	-0.157	0.026
Nairobi	(Constant)	9.391	5.064		1.854	0.069*	-0.570	19.532
	Laggedn	0.096	0.054	0.228	1.767	0.083*	-0.205	0.013

* Significant at 10%, ** significant at 5%, ***significant at 1%

The p-value for the coefficient of the price of sugar in four markets: Kisumu, Garissa, Machakos and Nairobi were insignificant at the 5% significance level. The null hypothesis $Ho: \beta = \gamma = 0$ was therefore accepted. The price of sugar in four markets therefore had a unit root. This is interpreted to mean that the prices of sugar in four markets were not stationary and that the price of the previous period influenced the current prices of sugar. Stationarity test for all the four markets were all negative. Similar to results obtained by Korir *et al.* (2003), all the test statistics of the price series data were insignificant at 95% confidence level. This implied that the price series were not stationary (had unit roots). However, the Augmented Dickey Fuller (ADF) test statistics for the first differences of the price series data for all markets were significant at 95% confidence level. This showed that differencing the price series data once made it stationary, hence were said to be integrated of order one process, denoted as I(1). Having established that the series were I(1), the second stage in the co-integration test according to Engle and Granger (1987) was applied to determine the co-integration between different markets. From Table 2, the average prices of sugar in all markets were autoregressive integrated of order one process. First difference of the prices was then obtained to establish the order of integration. The stability test for the first difference of the average monthly prices of sugar in all markets under the study is as presented in Table 3.

Table 3: Stationarity test for the first difference of the price of sugar in Kisumu.

		β	Std. Error	Beta	T	Sig.	Lower Bound	Upper Bound
Kisumu	(Constant)	0.448	0.966		0.464	0.644	-1.486	2.383
	claggedk	-0.543	0.119	-0.521	-4.569	0.040**	-0.781	-0.305
Garissa	(Constant)	0.443	1.094		0.405	0.687	-1.749	2.635
	claggedg	0.408	0.108	-0.452	-3.794	0.030**	0.624	-0.193
Machakos	(Constant)	0.354	1.180		0.300	0.765	2.010	2.719
	claggedm	0.406	0.107	-0.451	3.776	0.036**	0.621	-0.191
Nairobi	(Constant)	0.421	1.164		0.362	0.719	-1.911	2.754
	claggedn	-0.682	0.127	0.584	5.388	0.046**	-0.936	-0.429

*Significant at 10%, ** significant at 5%, ***significant at 1%

From Table 3, the coefficients of the first difference of the average price of sugar in four markets (Nairobi, Kisumu, Machakos and Kisumu) were significant at 5% significance level. Therefore, the null hypothesis that $\beta = \gamma = 0$ was rejected since the difference was significantly different from zero. The first difference of the average prices of sugar in four markets was stable. The stability of the average prices of sugar in the four markets at first differentials mean that the price series was autoregressive integrated of order one process. The first difference of the prices of sugar in the four markets was therefore used to conduct consequent co-integration analysis since they were stable.

Stationarity test for the first difference of the price of sugar in all the four markets indicated that the first difference of the prices were stationary. The results were consistent with those obtained by Korir et al. (2003) where the first difference of the price of bean in Nairobi, Taveta, Arusha, and Moshi were found to be stationary at 5% significance level. It means that the sugar prices in all markets were integrated of order one process. This showed that to attain the stability of the average prices of sugar in the four markets under the study, only first differencing was required.

3.2 Co-integration test for different markets

Having determined the order of integration, the price data was then subjected to the second stage test of Co-integration. The markets were then paired to establish whether co-integration existed or not.

Table 4: Co-integration test between Kisumu and Nairobi

Model	Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for β	
	β	Std. Error	Beta	T	Sig.	Lower Bound	Upper Bound
(Constant)	0.140	0.817		0.171	0.865	-1.496	1.776
laggedreskn	-0.175	0.076	-0.291	-2.299	0.025**	-0.327	-0.023

*Significant at 10%, ** significant at 5%, ***significant at 1%

Table 4 shows that the coefficient of the lagged residual of Kisumu with respect to Nairobi was significant at 5% significance level. Since the coefficient of the lagged residuals (laggedreskn) was significant at the 5% significance level, the null hypothesis of a unit root was rejected. It therefore meant that $\beta - \gamma \neq 0$. According to Engle and Granger (1987), the presence of co-integration between the two series is indicative of non-segmentation between the two series. Since the first step yielded non stationarity of the prices of sugar in both Kisumu and Nairobi and the second step resulted in the absence of the unit root in the residuals of regression between the prices of sugar in Kisumu and Nairobi, it was concluded that the two markets were co-integrated.

The constant for the Kisumu-Nairobi model was insignificant at 5% significance level. This indicated that the price of sugar did not reach the zero level. In economics, it is not very easy for the price of any commodity on sale to hit the zero level otherwise there will be no justification for the profit motive by the sellers. Wei and Xiu (2006) observed that if two same order stationary time series are co-integrated, then the causality of the two vectors should also be determined. If one of the two vectors changed then it is important to examine how long they take to return to long-term equilibrium in short-run. In order to appropriately model the full dynamic behavior of two co integrated vectors, there was need to incorporate short-run adjustment factors along with the co-integration equilibrium relationship. This was best done using the error-correction model (ECM) technique. The co-integration relationship represented the foundation of a complete dynamic error correction model. Based on the results obtained in Table 4, an Error Correction Model (ECM) was necessary to explain the relationship between the prices of sugar in Nairobi and Kisumu. It is vital to note at the onset that throughout the study, ECM was only generated for the pair of markets that were co-integrated. Table 5 presents the Error Correction Model between Kisumu and Nairobi.

Table 5: Error Correction Model (ECM) of Kisumu and Nairobi.

Model	Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for β	
	β	Std. Error	Beta	T	Sig	Lower Bound	Upper Bound
(Constant)	0.375	0.711		0.528	0.600	-1.049	1.800
changeinn	0.610	0.078	0.693	7.816	0.002**	0.454	0.767
laggedreskn	-0.189	0.066	-0.254	2.863	0.006**	-0.322	-0.057

*Significant at 10%, ** significant at 5%, ***significant at 1%

From Table 5, the Error Correction Model of Kisumu and Nairobi can be written as;

$$\Delta\widehat{K}_t = 0.375 + 0.610\Delta N_t - 0.189e_{t-1} \qquad (5)$$

Where: $\Delta\widehat{K}_t$ is the first difference of the price of sugar in Kisumu at time t, ΔN_t is the first difference of the price of sugar in Nairobi at time t and e_{t-1} is the residuals lagged by one period. In the error correction model, the coefficient of the first difference of the price of sugar in Nairobi as well as the coefficient of lagged residuals of Kisumu with respect to Nairobi were both significant at 5% significance level. The price of sugar in Nairobi and the residuals of Kisumu were, therefore, applicable for price determination in the two markets. The error term was included as an extra variable in the analysis because of its significance. From equation 5, a percentage change in the price of sugar in Nairobi would yield a unit rise in the price of sugar in Kisumu.

Table 6: Co-integration test between Kisumu and Garissa sugar markets.

Model	Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for β	
	β	Std. Error	Beta	T	Sig	Lower Bound	Upper Bound
(Constant)	0.070	0.680		0.104	0.918	-1.291	1.432
laggedreskg	-0.515	0.117	-0.504	-4.401	0.080*	-0.749	-0.281

*Significant at 10%, ** significant at 5%, ***significant at 1%

Table 6 shows the results for co-integration test between Kisumu and Garissa. The coefficient of lagged residuals (laggedreskg) was insignificant at 5% level. The t-value is also large and negative. The null of a unit root of the residuals was therefore accepted meaning the residuals were not stationary. Therefore, it was concluded that Kisumu and Garissa markets were segmented. The constant was insignificant at 5% level indicating that neither the price nor the demand reached the zero level in the two markets. Similar observations were made by Jayasuriya *et al.* (2007) that a number of grain markets in India were highly segmented due to various distortions including infrastructural development as well as the government policies.

Table 7: Co-integration test between Kisumu and Machakos

Model	Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for β	
	β	Std. Error	Beta	T	Sig	Lower Bound	Upper Bound
(Constant)	0.122	0.549		0.223	0.825	-0.977	1.221
laggedreskm	-0.309	-0.097	-0.388	-3.176	0.002**	-0.505	-0.114

*Significant at 10%, ** significant at 5%, ***significant at 1%

Table 7 shows that the coefficient of the residuals of the price of sugar in Kisumu was significant hence; the null of a unit root was rejected. Kisumu and Machakos sugar markets were therefore co-integrated. Since Kisumu and Machakos markets were co-integrated, it was necessary to generate the model that could precisely explain the relationship in the two markets without distortions. An Error Correction Model was therefore generated and presented in Table 8. In the Error Correction model, the residuals of Kisumu with respect to Machakos were included in the analysis as it was necessary in determining the prices in Kisumu - Machakos model.

Table 8: Error Correction Model (ECM) for Kisumu and Machakos

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.312	0.468	0.665	0.508	-0.626	1.249
changeinm	0.498	0.048	10.307	0.005**	0.401	0.595
laggedreskm	0.514	0.093	-5.517	0.009**	0.701	0.327

* Significant at 10%, ** significant at 5%, ***significant at 1%

From Table 8, the price of sugar in Machakos was found crucial in determining the prices of sugar in Kisumu. As shown, the coefficient of the first difference of the price of sugar in Machakos was significant at 5% significance level. Consequently, the residual was also significant at 5% significance level. The residual was therefore included as an extra explanatory variable in the model due to its significance. The constant was insignificant at 5% significance level indicating that the prices as well as the demand of sugar in the two markets (Kisumu and Machakos) did not in any occasion throughout the study hit the zero level. No zero average monthly price of sugar was recorded. The ECM for Kisumu and Machakos was then specified as follows;

$$\Delta K_t = 0.312 + 0.498 M_t + 0.514 e_{t-1} \quad (6)$$

Where ΔK_t and ΔM_t are the first difference of the price of sugar in Kisumu and Machakos respectively, whereas e_{t-1} is the lagged residuals. From equation 6, a unit rise of the price of sugar in Kisumu was explained by 0.498 percent rise in the price of sugar in Machakos.

Table 9: Cointegration test between Garissa and Nairobi

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.083	0.846	0.098	0.922	-1.611	1.776
Laggedresng	-0.256	0.088	-2.907	0.005**	-0.433	-0.079

* Significant at 10%, ** significant at 5%, ***significant at 1%

Table 9 shows that, the null of a unit root was rejected for the residuals of the price of sugar in Garissa and Nairobi. That was because $\beta - \gamma$ was significantly different from zero. Due to stationarity of the residuals in the second stage of co-integration test, it was concluded that Nairobi and Garissa markets were co-integrated. The co-integration of Nairobi and Garissa was exceptional in the study. Garissa market was only found to be integrated to Nairobi. Since the co-integration was unidirectional, the integration can possibly be explained to have accrued from the transport of sugar from Nairobi to Garissa. Error Correction Model was therefore generated to fit the Nairobi-Garissa model. The specification of the ECM is as shown in equation 7.

$$\Delta N_t = 0.85 + 0.57 \Delta G_t + 0.25 e_{t-1} \quad (7)$$

Where, ΔN_t , is the first difference of the price of sugar in Nairobi, ΔG_t is the first difference of the price of sugar in Garissa and e_{t-1} is the lagged error term. The correct model for the price of sugar in Nairobi and Garissa was an error correction model due to co-integration of the two markets.

Table 10: Co-integration test between Nairobi and Machakos

Model	Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for β	
	β	Std. Error	Beta	T	Sig.	Lower Bound	Upper Bound
(Constant)	0.103	0.702		0.147	0.884	-1.303	1.508
laggedresnm	-0.201	0.079	-0.32	2.548	0.014**	-0.359	-0.043

* Significant at 10%, ** significant at 5%, ***significant at 1%

Table 10 shows that the coefficient of the lagged residuals of Nairobi with respect to Machakos was significant at 5% level. The null hypothesis for the unit root was rejected hence the error term was stationary. Similar to the observation made by Engle and Granger (1987) that when the first stage in co-integration yielded autoregressive autocorrelation of order one process, and the second stage resulted in stationary residuals then the two markets are co-integrated. Therefore, Nairobi and Machakos sugar markets were co-integrated.

Table 11: Error Correction Model between Nairobi and Machakos

	Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for β	
Model	β	Std. Error	Beta	T	Sig.	Lower Bound	Upper Bound
(Constant)	0.098	0.711		0.137	0.891	-1.326	1.521
changeinm	0.643	0.066	0.767	9.784	0.001**	0.511	0.774
laggedresnm	-0.200	0.080	-0.196	-2.499	0.015**	-0.361	-0.040

* Significant at 10%, ** significant at 5%, ***significant at 1%
ECM between Nairobi and Machakos is therefore specified as:

$$\Delta N_t = 0.098 + 0.643\Delta M_t - 0.2e_{t-1} \quad (8)$$

Where; ΔN_t is the first difference of the price of sugar in Nairobi, ΔM_t is the first difference of the price of sugar in Machakos and e_t is the error term. The coefficient of the first difference of the price of sugar in Machakos was significant at 5% significance level. It was therefore paramount in determining the price of sugar in Nairobi. The significance of the one period lagged residuals of the price of sugar in Nairobi with respect to Machakos was also significant at 5% significance level. This led to the inclusion of the error term as an extra explanatory variable in the model. The constant for the ECM was insignificant indicating that zero price levels or demand levels were not realized in the two markets (Nairobi and Machakos). In the ECM presented in equation 8, it can be explained that a 0.643 percentage increase in the prices of sugar in Machakos triggered a percentage increase in the prices of sugar in Nairobi.

Table 12: Co-integration test between Garissa and Machakos

	Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for β	
Model	β	Std. Error	Beta	T	Sig.	Lower Bound	Upper Bound
(Constant)	5.755	3.849		1.495	0.140	-1.953	13.462
laggedrsegm	-0.054	0.041	-0.172	-1.318	0.193	-0.137	0.028

* Significant at 10%, ** significant at 5%, ***significant at 1%
The coefficient of the lagged residuals of Garissa with respect to Machakos was insignificant at 5% level. The null of a unit root was therefore accepted for the residuals. Garissa and Machakos were therefore segmented as indicated in Table 12. ECM was not generated because the two markets were segmented.

4. Conclusions and Recommendation

Based on research on market integration of four different sugar markets, the study concluded that market integration in the sugar sector is majorly influenced by infrastructural facilities such as road networks and communication channels. Other factors that yielded higher influence on market integration were purchasing power of the consumers in the different markets and geographical distance between the markets.
The study recommends that for proper market integration, infrastructure like transport and communication services should be enhanced. Therefore, the government of Kenya in conjunction with international development partners should magnanimously underscore the due importance of infrastructural development.

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