



Assessing Market Integration in the Presence of Transaction Costs: The Case of Pastoral Livestock Markets

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Market integration occurs when product flows between markets are on the same terms and conditions as within markets. A highly integrated commodity market is likely to increase market efficiency through efficient resource allocation and price transmission, which is likely to lower transaction costs and increase incomes to actors. Price data collected by the Livestock Information Network and Knowledge System (LINKS) project of the Global Livestock Collaborative Research Support Program led by Texas A & M University were used to assess the degree of livestock market integration by testing whether livestock prices in Nairobi and pastoral areas of Garissa and Isiolo are cointegrated or move together. Data from livestock traders' survey done in Nairobi and Garissa were also used to examine market characteristics. Key findings indicate that all the three livestock markets exhibit non-stationarity (statistical parameters are dependent on time) and integration of order one and that, whenever there is shock to the price in one market it will be manifested in the other market as well.

Background

Pastoral communities are dependent upon and bound to livestock. Livestock provides pastoral communities with food (meat, milk and blood), income (sale of livestock and livestock products), self-employment opportunities and in addition serves as an important store of wealth, insurance and prestige. The pastoral system is primarily geared towards meeting the subsistence needs of the pastoralists by providing the major ingredients of their diets and for enhancing social relationships. However livestock has acquired a niche in the national, regional and global livestock trading chains and livestock producers are part of the commercial webs of trade relationships with livestock providing the means for financing their basic needs expenditures (Barret and Luseno, 2001; Kariuki, 2001). Understanding the pastoral livestock markets is key to development of arid and semi-arid areas of Kenya which account for about 8% of the country's population and occupy roughly 63% of the total land area (Narman, 1990; Republic of Kenya, 1994) and developing the pastoral livestock markets is key to poverty alleviation.

Market integration occurs when product flows between markets are on the same terms and conditions as within markets. A highly integrated commodity market is likely to increase market efficiency through efficient resource allocation and price transmission, which is likely to lower transaction costs and increase incomes to actors. Moving towards market integration is done by removing barriers towards commercial exchange. The three kinds of barriers are natural, cultural (language, information, preference) and political. Barriers create a wedge between prices, tariffs are added to prices, quotas

create shortages that drive price up and transportation costs raise prices. Price convergence is one of the four measures of integration, the other measures are factor markets, trade volumes and product availability.

This study was set to find out if the pastoral livestock markets are cointegrated (move together and have a long run relationship). The markets under study were Nairobi, Isiolo and Garissa livestock markets. The study hypothesised that Isiolo, Garissa and Nairobi goat price series are non-stationary (the statistical parameters are dependent on time) and that pairs of categorised livestock markets (Isiolo and Garissa, Garissa and Nairobi, and Isiolo and Garissa) are not cointegrated.

Methodology

Primary data was collected through a livestock traders' survey by use of a structured questionnaire in Garissa and Nairobi markets. A purposive random sampling procedure was used to come up with the desired livestock traders to be interviewed. Secondary data used was time series price data collected by the Livestock Information Network and Knowledge System (LINKS) project of the Global Livestock Collaborative Research Support Program led by Texas A & M University. The traders' survey data was entered and analysed using the statistical package for social scientists (SPSS) software, while the time series livestock price data was entered in Ms-Excel and analysed in Econometric Views (EViews) software. The following steps were followed during analysis; the livestock price series for Nairobi, Garissa and Isiolo

were tested for stationarity using the Augmented Dickey-Fuller (ADF) unit root test. After confirmation of non-stationarity the price series were tested for cointegration using the Johansen method (1988).

Results

Descriptive analyses done on the traders survey data provide information on the market characteristics indicated that most pastoral livestock markets were under the control of local authorities in terms of the general management. Traders pay market cess to the local authority for maintenance of various facilities. Livestock trade is done by men in the most productive age bracket of 15 to 49 years old. The mean age of the livestock traders interviewed was 40 years. Maasai and Somali are the predominant tribes supplying livestock to Nairobi and Garissa markets respectively. All of the goats and sheep traders interviewed operating in Nairobi market also operate in other markets as well.

Cattle brought to Garissa market are sourced from Wajir district and a few from within Garissa while the small stock like sheep and goats are from within Garissa district, areas of Dadaab, Modogashe and Shantaabak. Trekking is the most preferred mode of transporting animals to the market. At Dagorreti market in Nairobi, most stocks are from Narok, while another smaller percentage come from Ewaso Nyiro and Kajiado. However, the small stock (goats and sheep) are sourced from Wajir, Marsabit, Garissa, Somali and Samburu. In the Nairobi market, most goats and sheep are brought by trucks.

Most of the traders interviewed preferred to use information from people known to them at a personal level in the business, 60% in Garissa and 80% in Nairobi. However, in the marketing chain, brokers are also used in selling and sourcing animals at an agreed fee. The brokers reduce

the search and negotiation times in buying and selling of animals. The brokerage fees for selling a goat or sheep is Ksh 20 while that for cattle is Ksh 100. In general, a livestock trader incurs the costs in the course of livestock trading: storage, transport costs for trekking and trucking animals, market cess, loading and offloading costs. Since most of the animals go straight to the next market after sourcing, only 25% of the traders spent money on storage which was on average between Ksh 250 and 750. Transportation to the terminal market was cited as a major cost to the trade. It costs from between Ksh 18,000 to Ksh 25,000 to hire a ten ton lorry load of cattle or sheep from Garissa or Isiolo to Nairobi irrespective of the number of animals on the truck.

The livestock price trend analysis showed that Nairobi cattle and goat prices were higher than Garissa and Isiolo prices during the period under study (February 2003 to December 2004). Nairobi cattle and goat prices were even higher during the months when Garissa and Isiolo markets were under quarantine. Econometric analysis (Eviews) shows that Nairobi, Garissa and Isiolo time series price data are non-stationary and are integrated of order one. The cointegration tests using Johansen procedure (Table 1) show that there is cointegration between Isiolo and Nairobi goat markets as well as Garissa and Nairobi goat markets and no cointegration between Isiolo and Garissa markets. The presence of cointegration indicates a long run price relationship in the markets, revealing that the prices will move together overtime and converge towards equilibrium in the long run. The results also show that a shock to the price in one market will manifest in the other market as well. The absence of cointegration between Isiolo and Garissa goat markets which are both source markets feeding Nairobi indicate that the two markets are independent of each other and have no long run price relationship. Consequently, a price shock in Isiolo does not mean a corresponding reaction in Garissa market.

Table 1. Johansen cointegration procedure of Nairobi, Garissa and Isiolo goat markets.

Goat market	Category	Eigenvalue	Likelihood Ratio (LR)	Hypothesized No. of Cointegrating Equations	Reject or Accept the Null Hypothesis
Nairobi and Isiolo	One	0.25	23.02	None	Reject
Nairobi and Isiolo	One	0.06	4.23	At most one	Accept
Garissa and Nairobi	Two	0.23	23.90	None	Reject
Garissa and Nairobi	Two	0.09	6.83	At most one	Accept
Isiolo and Garissa	Three	0.12	13.03	None	Accept
Isiolo and Garissa	Three	0.06	4.60	At most one	Reject
5% critical values			19.96		
5% critical values			9.24		

Source: Authors calculation 2004

The cointegration relationship and vector error correction model showed that Isiolo and Garissa market prices have a positive long run relationship with Nairobi goat market prices.

Granger Causality tests were done on the market prices. The test for Granger Causality involves examining whether lagged values of one series have significant in-sample explanatory power for another variable. Granger Causality showed that Isiolo goat prices granger cause Nairobi prices but not vice versa and that Garissa does not granger cause Nairobi prices. This provides a proof of the direction of price flow from the source market to the terminal market as it implies that whenever there is a positive change in Isiolo goat market, the Nairobi goat market reacts to that change positively. The goat volumes from Garissa market is not large enough to affect the Nairobi market prices.

Conclusions

The main conclusions from the study are that Isiolo and Nairobi, and Garissa and Nairobi goat markets are cointegrated and have a long run price relationship. However, the direction of the relation differs. Isiolo and Nairobi have a positive long run relationship while Garissa and Nairobi have a negative long run relationship. Consequently, whenever there is shock to the price in one market it will be manifested in the other market as well.

Practical Recommendations

- The goat and cattle price trend shows that whenever the government imposes quarantine in the source markets, then the terminal market prices go up. For example, Nairobi prices rose up when Isiolo and Garissa markets were on quarantine.
- Since the source markets (Garissa and Isiolo) have a long run relationship with the terminal markets (Nairobi), it is important for the government to focus on development of these source markets especially for supply to Nairobi.
- Results showed that there is positive cointegration between Isiolo and Nairobi goat market. This means that if Isiolo goat prices go up, then Nairobi goat prices will also increase.
- Survey results indicate that trekking is the most preferred mode of transport for cattle to the primary markets in Isiolo and Garissa markets hence the government and other development agencies should focus on developing the stock trekking routes to include watering points.

- Reducing lorry transport costs means increased incomes for the pastoral communities. The government should look into ways of reducing the cost of diesel as well as investing on having better road networks.

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The GL-CRSP Livestock Information Network and Knowledge System (LINKS) project developed from the GL-CRSP Livestock Early Warning System (LEWS) project which was established in 1997. The LEWS project developed and applied a suite of information communication technology to provide a regional decision-support framework for livestock early warning. The LINKS project is placing LEWS technology inside a broader livestock information and analysis system that is designed to improve livestock markets and trade, thereby enhancing the well-being of pastoralists in eastern Africa. The project was led by Dr. Jerry W. Stuth, Texas A&M University until his death in April 2006. The project is now led by Dr. Paul Dyke, Texas A&M University. Email contact: dyke@brc.tamus.edu.



The Global Livestock CRSP is comprised of multidisciplinary, collaborative projects focused on human nutrition, economic growth, environment and policy related to animal agriculture and linked by a global theme of risk in a changing environment. The program is active in East Africa, Central Asia and Latin America.

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