Testing Market Integration for Fresh Pineapples in Kenya

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1. Introduction

1.1. Agricultural Markets in Sub-Saharan Africa

Despite depending on agriculture for food security, majority of agricultural markets in African countries are inefficient and poorly integrated. Christensen and Erickson (1989) maintains that the vagaries of weather, poor infrastructure and information asymmetry cause existing agricultural markets in Africa to be less competitive.

The approach to use market integration to measure marketing efficiency is based on the concept by Bressler and King (1970) that an efficient commodity market will establish prices that are interrelated spatially by transaction and transfer costs and inter-temporally by storage costs. If a market is integrated, there will be a low spatial and inter-temporal variation in prices implying that commodity market prices will be functionally related. Among the factors that determine market efficiency is the prevailing market structure with market efficiency likely to be high in a competitive market than in those that are less competitive. The ideal market structure for optimal market efficiency is pure competition, *ceteris paribus*. The supply of pineapple to consumer markets is seasonal because of their growth and climatic requirement. The problem of assemblage and perishability of the fruit has resulted in relatively few market actors at the wholesale levels, as opposed to existence of a large number of pineapple buyers at the retail levels. Thus, increasing the number of market actors is likely to elicit competition.

One of the greatest benefits of increased competition in agricultural markets is efficient price formation. Timmer, Falcon and Pearson (1983) maintained that prices are formed efficiently when large number of buyers and sellers, all with similar access to market information, interact to agree on the basis of exchange, a price. This price sends signals to consumers about the resource costs of supplying the commodity to them and to producers about the willingness of consumers to pay the resource costs of the production. This implies that efficient price formation is essential for efficient allocation of resources in a market economy. While non-competitive agricultural markets may operate in the conventional sense, their failure to transmit accurate signals about real opportunity cost can cause enormous misallocation of resources in production and consumption, and serious disruptions to the smooth temporal flow of agricultural goods and services to consumers.

Factors constraining the existence of efficient agricultural markets in Africa include price fluctuations that are not consistent with demand and supply conditions causing price risks in residual market (Hull, Tomek, Ruther and Kyerene, 1981), poor market conditions (Djisktra and Magori, 1995), inadequate transportation infrastructure and poorly developed market information system (Ayieko, 1995; Eicher and Baker, 1982; Wanmali and Idachaba, 1987) and low consumer purchasing power. Others include inappropriate government policies meant to achieve socio-political objectives that do not acknowledge the economic role of competitive markets in allocation of resources and costs among producers,

consumers and middlemen by giving erroneous information about market and market actors (Christensen and Erickson, 1989). In addition, resource limitation and weather that influence what is to be produced and sold in markets and lack of viable and cheap post-harvest technologies to boost marketing are also constraining variables (Maritim, 1995).

1.2. Agricultural Sector and Agricultural Markets in Kenya

Kenya depends greatly on the agricultural sector that contributes about 75 percent of employment, 25 percent of gross domestic product and almost 80 percent of food requirement (Republic of Kenya, 2001). Smallholders constitute about 80% of agricultural producers, own less than 2 hectares and contribute 75% of total production and over 50% of marketable output (Republic of Kenya, 2001).

The horticultural industry in Kenya is characterized by intensive farming, and is the third foreign exchange earner and contributes more than 10% of agricultural GDP (Republic of Kenya, 2001). Despite of this, the market for fresh horticultural crops such as pineapples is largely informally organized (Dijkstra and Magori, 1995), and poorly integrated thus leading to high risks through spoilage (Jafee, 1992). Studies on agricultural markets in Kenya (George and Mwangangi, 1994; Dijsktra and Magori, 1995; Mwakubo, 1994; Ayieko, 1995) show post-harvest problems between farmgate and consumption points as leading to heavy losses, through high transaction costs. This paper presents the current pineapple marketing structure and derives indices of marketing efficiency for pineapple

from producing markets in Nyamira district and consumption markets in Kisumu, Nakuru, and Nairobi.

2. Methodology

2.1. Sampling and Data

Primary data on marketing activities and prices for fresh pineapples was collected weekly for 39 weeks during the period October 2002 to July 2003. This period coincides with the variability in supply in the pineapple market. Using personally administered questionnaire, interviews were conducted with thirty-one pineapple traders in producing markets located in Ikonge, Mawawa, Chabera, Ekerenyo and Kebirigo, and consumption market in Kisumu, Nakuru and Nairobi. Two-stage stratified random sampling was used with the first stratum being the markets and the second being the middlemen (wholesalers, retailers, farmer-traders).

The selection of the research sites was based on the fact that areas surrounding Nyamira District are the major pineapple producing areas, whereas, Kisumu, Nakuru, and Nairobi are the major consuming points. Interviews were with local brokers, urban wholesalers and village assemblers/collectors. Informal interviews with truck owners/drivers from Nakuru, Kisumu and Nairobi were also made.

2.2. Measuring Market Efficiency

Marketing efficiency usually has two components, operational efficiency and price efficiency. We adopt the second approach and use market integration measures to infer on market efficiency. Cummings (1967), Thodey (1969), Berg (1977), Ejiga (1977) and

others have used correlation coefficient to measure market integration and conclude on market efficiency. Heyten, (1986), Ravallion, (1986), Dahlgran and Blank, (1992) and Dittoh, (1994) have used variance and covariance measures. The more integrated a commodity market is, the greater the market efficiency since the variation in price across space and time will be lower. We use a model by Ravallion (1986) and its extension by Heyten (1986) and Dahlgran and Blank (1992).

The basic model is stated as follows:

$P_i = f_i\ (P_j, X_i, T);\ and\ \ P_j = f_j\ (P_i, X_j, T)$ $for\ i, j = 1...m\ \ and\ \ i^1 j$ (1)

where; P_i, P_j are the prices of pineapple in local market i and reference markets j respectively. X_i, X_j are the non-price exogenous seasonal variables influencing the demand for and the supply of commodity in the *local* market, T is the trend, whereas, m is the number of market locations being studied, eight in this case. The model tries to determine whether a change in the price of a commodity in a *local* (producing) market is influenced by the change in price in a *reference* (consuming) market. It assumes an autoregressive distributed lag relationship between commodity prices in the *local* market and those in the *reference* market.

The extension by Heyten (1986) makes it possible to directly test hypotheses regarding integration, while that by Dahlgran and Blank (1992) recognizes the Ravallion model by not making any assumption about *local* and *reference* markets. The two view both producers and consumers as dispersed through all

markets to the extent that no specialization exists in either production or consumption. Two dummies were used to reflect the seasonality changes in demand and supply conditions and any other special features in the markets during the periods. The pineapple season was divided into three: June-September to reflect medium supply, October-February for peak supply and March-May for low supply. The models were expanded to obtain distributed lag equations as follows:

$$P_{it} = \sum_{k=1}^{n} \alpha_{ik} \, P_{it-k} + \sum_{k=0}^{n} d_{ik} \, P_{jt-k} + \eta_i \, X_{it} + \lambda_i \, T + U_{it} \qquad (2)$$

$$P_{jt} = \sum_{k=1}^{n} \beta_{jk} \, P_{jt-k} + \sum_{k=0}^{n} d_{jk} \, P_{it-k} + \gamma_j \, X_{jt} + \lambda_j \, T + U_{jt} \qquad (3) \text{ for } i, j = 1...m: \text{ for } i \neq j$$

where, $a_{ik,}$ β_{jk}, $d_{ik,}$ d_{jk} and $\eta_{i,}$ γ_j are the regression coefficients and n is the number of lags. Two lags of one week each were assumed due to the perishable nature of the fruit. There is or there is no market integration depending on the statistical significance of $d_{ik,}$ $d_{jk.}$ In the models, every market location is regarded as *local* as well as *reference* with respect to every other market thus, no assumption is made as to the price interrelationships as would be in causality study (Mayer and Hart, 1993). Although prices in consuming markets usually determine those in producing markets, the opposite can also be true, especially for highly perishable crops like pineapple, with prices in *local* markets reflecting supply conditions in *reference* markets.

The above equations were estimated as single equations as opposed to a system of equations since the indirect effects are expected to be minimal and insignificant, given the nature of pineapple markets, and if any would result in a negligible

simultaneous equation bias. The types and levels of market integration are determined by the significance of the regression coefficients of P_{it-k} *and* P_{jt-k} and the index of market concentration *(imc)*. Tests of market integration were used to determine the degree to which two or more markets for pineapple were jointly influenced by parameter affecting supply and demand, and were analyzed as follows. Where; $\delta_{ik} = 0$ and $\delta_{jk} = 0$ for $k = 1$ and 2, $k = 0$ is not considered relevant since the transportation of the fruit and transmission of the price information by market actors cannot be instantaneous, this would indicate complete market segmentation thus no market integration. Also, if $\delta_{ik} = 0$ but δ_{jk} ¹ 0, or δ_{ik} ¹ 0 but $\delta_{jk} = 0$ for $k = 1$ and 2, there exists a one-way market integration. Finally, if δ_{ik} ¹ 0 and δ_{jk}¹ 0 for $k = 1$ and 2, there exists a two-way market integration.

3. Results and Discussion

3.1. Market Structure and Marketing Chains

The pineapple marketing chains shows that pineapple marketing structure is characterized by interlink-ages among farmers, village collectors, retailers and wholesalers. A terminal wholesaler establishes a link with about 3-5 local brokers or village collectors. Likewise, village collectors keep a permanent relationship with about 10 farmers. As a result of such relationships, some farmers are at times willing to give pineapple to brokers or collectors on credit, which is paid back immediately the commodity is sold (Figure 1).
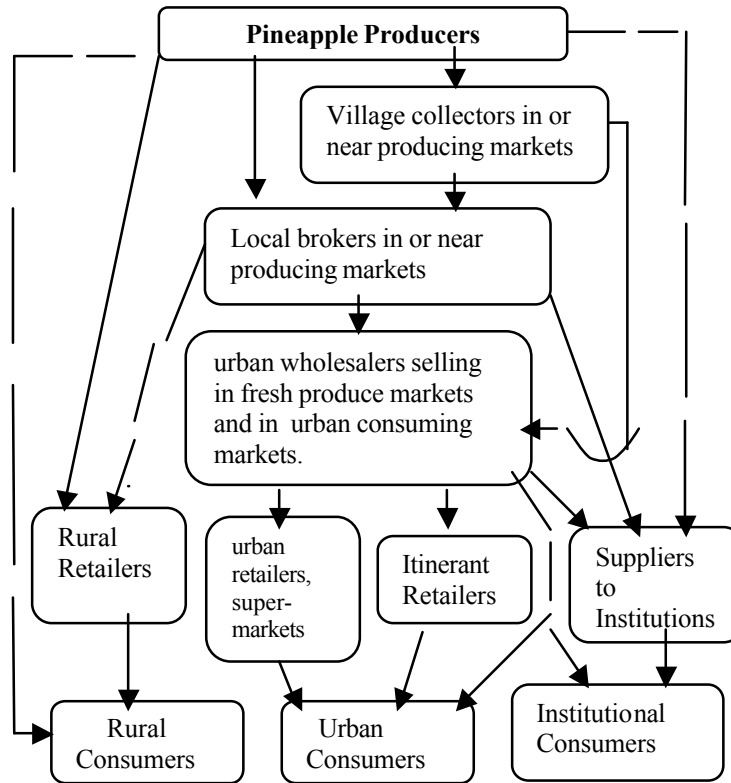
Legend: —→ alternative channels; ——→ major channels
Source: Market Survey
Figure 1: Marketing Channels for Fresh P ineapple in Kenya.

The local fresh pineapples are sold to consumers in rural areas and urban centers. In rural producing areas here, there are two levels; one level is where the farmer sells to local retailers or consumers, the second level is where the farmer sells to wholesalers. Wholesalers sell mostly to urban markets. Retailing to consumers is also done by some farmer-traders selling pineapple on trucks along busy highway junctions for reasons of making higher margins and as an alternative way of disposing of excess supply.

3.2. Pineapple Market Integration in Kenya

Table 1 presents pineapple market integration results and only contains those relationships that indicate some level of integration, all other market pairs in the study did not show any integration. Parameters P_{2t-1} and P_{2t-2} represent P_{jt-1} and P_{jt-2} or P_{it-1} and P_{it-2} depending on the market being regarded as *local* or *reference*. The statistical significance of the coefficient of lagged exogenous variables P_{jt-1} and P_{jt-2} for equation (2) and P_{it-1} and P_{it-2} for equation (3) indicates whether or not there is market integration between two markets. The values of the indices of market concentration (*imc*) also called Timer Index of market integration (Ditto, 1994) indicate whether the integration is low or high. An *imc* of < 1 or > 1 indicates a high or low market integration of pairs of markets, respectively. In most cases, the coefficients of P_{2t-1} and P_{2t-2} are negative but significant. Coefficient for the distance between markets, and those for prices between the most producing markets are non significant.

Table 1: Pineapple Market Integration Regression Results

Market 1	Market 2	P_{1t-1}	P_{1t-2}	P_{2t}	P_{2t-1}	P_{2t-2}	R^2	*imc*
Nairobi	Kebirigo	0.7414* (0.2513)	-0.0089 (0.4296)	0.1472 (0.1753)	-0.1773 (0.2699)	-0.3199** (0.1429)	0.9787	0.8401
Nairobi	Mawawa	0.9677* (0.1971)	-0.4802 (0.4286)	0.1972 (0.8753)	-1.9813 (0.3985)	-0.9199 (0.1429)	0.7985	1.3431
Nairobi	Ikonge	0.8788* (0.1426)	-0.5419 (0.2436)	0.2341 (0.1267)	0.1785 (0.1368)	-0.4236* (0.1240)	0.9826	1.6597
Nairobi	Nakuru	0.9897* (0.2430)	-0.4659* (0.2787)	0.3165 (0.1120)	-0.4479** (0.2432)	0.2147** (0.1126)	0.8573	0.0259
Nairobi	Chabera	0.8784* (0.1427)	0.1504* (0.0779)	0.5052 (0.1428)	-0.5147** (0.2192)	-0.4273 (0.1532)	0.8906	1.1592
Nakuru	Ekerenyo	0.7895* (0.2231)	-0.1765 (0.2164)	-0.2837* (0.0722)	0.3927* (0.0992)	0.0517 (0.3196)	0.9803	1.8501
Nakuru	Ikonge	0.8792* (0.1924)	-0.4438* (0.1601)	0.7653 (0.4128)	-1.6139* (0.5845)	0.2047* (0.8569)	0.9742	0.9386
Nakuru	Mawawa	1.1633* (0.2398)	-.03769 (0.3446)	0.3769* (0.0873)	-0.3184** (0.1327)	0.2136* (0.0957)	0.9476	1.9278
Nairobi	kisumu	1.1356* (0.1935)	-0.2814 (0.3716)	0.2537 (0.2448)	-0.2894 (0.1857)	0.3063** (0.1435)	0.9772	0.0534
Kisumu	Mawawa	0.5874* (0.1936)	-0.8209 (0.1926)	0.3759* (0.0951)	-0.3183** (0.1329)	-0.2048 (0.0956)	0.9582	1.9494
Kisumu	Ekerenyo	0.7317* (0.1740)	-0.1959 (0.1516)	0.5291 (0.8451)	0.0047 (0.0601)	-0.6650 (0.2741)	0.9371	2.6266
Kisumu	Nakuru	0.3520** (0.1731)	-0.0674 (0.1378)	0.6870 (0.1297)	-0.7531* (0.2557)	0.4269* (0.1534)	0.9788	0.8143
Ikonge	Mawawa	0.7628* (0.1869)	-0.2565 (0.3101)	-0.2652 (0.4657)	-0.1390 (0.3794)	0.9687** (0.3464)	0.9789	1.0831[+]
Ikonge	Ekerenyo	0.8219* (0.1689)	-0.4437* (0.1512)	1.0845* (0.2736)	-2.1123* (0.4371)	0.8428 (0.5163)	0.9371	1.4286
Ikonge	Chabera	0.9597* (0.1873)	-0.4010 (0.1788)	0.7204 (0.4963)	-1.8609* (0.3771)	0.4921 (0.4832)	0.9537	1.9656
Ekerenyo	Kebirigo	0.5463** (0.2116)	-0.5419 (0.1436)	0.5052 (0.1428)	-0.4992** (0.1838)	-0.4236 (0.1249)	0.9982	2.0793
Mawawa	Ikonge	0.6847* (0.2064)	0.0513 (0.2131)	-0.0788 (0.2163)	0.3075** (0.1140)	-0.0023 (0.1040)	0.9755	1.1683[+]

Legend:[a] * $p < 0.01$, **$p<0.05$. Standard errors in parenthesis; [b] Type of market integration. All were one-way short-run integration except for integration between Mawawa and Ikonge that showed a two-way short-run integration.

The negative but significant parameters for the P_{2t-1} and P_{2t-2} suggest that high lagged prices in *reference* markets have the effect of lowering prices in *local* markets since, factors other than price movements in consuming markets influence market actors' behavior and expectations, and for a given demand or supply situation, it is their expectations and behavior that greatly influence prices in the *local* markets. Out of fifty-six pairs of pineapple markets analyzed, seventeen indicate some integration with only six market pairs indicating high integration while the rest did not show any market integration and are excluded fro table 1. With the exception of Ikonge, there is very little integration between producing markets. Ikonge serves as a transit point for pineapple from Mawawa, Ekerenyo, Chabera and Keberigo markets destined for the urban markets, so prices in Ikonge may influence or be influenced by prices in these producing markets.

Market pairs that show some integration are just pairs of producing and consuming markets, or those among consuming markets. Ikonge and Chabera being very important pineapple growing areas are integrated with pineapple markets in Nakuru, Kisumu and Nairobi. This is due to the information flow from consuming to producing markets through urban wholesalers. However, due to remoteness of major parts of Kebirigo, Ekerenyo, and Mawawa markets from the tarmac roads linking producing markets with the major consuming markets, these markets are not highly integrated with the major consuming markets. This

indicates the importance of good access roads for market integration and hence market competitiveness, as more traders would be able to reach the markets.

An element of cartel exists that limits pineapple farmers bargaining power especially in determining the farmgate price. At retail level, however, market competition is more apparent since many buyers have to bargain with many small-scale retailers. The chain linkages among market actors described above also strengthened the oligopsonistic nature of pineapple markets.

4. Conclusions and Recommendations

Market integration for fresh pineapple market varies from high integration among the consumption markets, low integration between producing and consuming markets to weak or no integration between the rural producing markets. The major determinant of pineapple market integration is information flow between producing and consuming locations. Since distance was found not to influence integration, the greatest influence on fresh pineapple prices may be the condition of rural roads rather than the distance between markets.

In order to increase more competition among traders, policy intervention to enable potential entrants should be encouraged as a means of promoting increased private sector participation in the markets, with information to boost their bargaining power. Farmer associations should also be encouraged to enable strong linkages and in reducing market information asymmetry.

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