

**Firm size distribution and performance of maize and fertilizer traders after market
liberalisation: evidence from Kenya**

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1. Introduction

In the 1980s, it was realised that government intervention in markets was much less effective than previously expected. Government control in marketing had resulted in the suppression of producer prices and incentives, inefficiencies in agricultural marketing, stagnation in agricultural production, and an excessive budgetary burden that could no longer be sustained (Badiane, 2000). Consequently, agricultural markets world-wide entered a long process of liberalisation to reduce imposed market imperfections such as monopolistic public trade, entry barriers and subsidies (Kuyvenhoven *et al.* 2000). Market liberalisation started dismantling state control in favour of a more market oriented economy, resulting in entry of private traders. These private traders were expected to fill the void left by the withdrawing public sector by mobilising resources necessary to fund marketing activities including investments in buildings and storage facilities, vehicles and other equipments (Badiane, 2000). Entry of private traders was expected to increase competition to the benefit of the consumers. Given that resources were required to perform marketing activities and that the entrants did not have adequate business skills, it was expected that the size of most of the traders that could initially enter the market could be small.

In Kenya, trading in fertilizer and maize underwent reform with the advent of market liberalisation leading to increased entry of private traders. These traders perform multiple functions including dissemination of information on agricultural technologies to farmers (Mwaura and Woomer, 1999), provision of interest-free short-term credit to some clients (Mwaura and Woomer 1999, Omamo and Mose 2001) and as in Mali (Dembele and Staatz, 1999), spatial and temporal allocation of maize in the domestic market.

Earlier studies on participation of private sector in trade after market liberalisation reveal that there has been rapid entry (Beynon *et al.*, 1992; Badiane, 2000; Kherallah, *et al.*, 2000; Ade Freeman and Kaguongo, 2003). Most of these traders used own capital as start-up funds. The traders had limited investments in trading assets and equipment, factors likely to hold back firm expansion (Ade Freeman and Kaguongo, 2003). Badiane (2000), Omamo and Mose (2001) show that some of the new traders have invested mainly in storage and transport facilities but the type of investment varies across regions and commodities. These studies argue that market liberalization alone is not a sufficient condition to increase participation of private traders. Coulter and Golop (1992) observe that across many countries, limited access to credit, poor transport and communication infrastructure, inadequate wholesale market structures and low availability of market information constrain private sector activities.

These studies mainly focused on trader entry with minimal input on the structure of the resultant markets. This study focuses on the market structure of the traders, emphasizing firm size distribution and finally examines the performance of the various firm size categories of the traders. Analysis of the structure of the markets will provide insights on whether the expectations of achieving competitive markets after market liberalisation are realised.

The paper is organised as follows. In section 2, we present an overview of market reforms in maize and fertilizer in Kenya. Section 3 presents the analytical frameworks, results and discussion. In particular, we analyse firm size distribution, estimate extent of competition and performance by examining the levels of marketing margins and costs by firm size. Since prices have an effect on margins, next we illustrate the factors influencing the selling prices of fertilizer using fertilizer hedonic pricing technique. Finally, in section 4 we draw conclusions for the paper.

2. Overview of market reforms in fertilizer and maize

The slow down in Kenya's economic performance in the 1980s was partly attributed to prevailing poor policies and Kenya was encouraged to undergo structural adjustment programs (SAPs). Within the SAP framework, several policy measures such as privatization of state owned enterprises, promotion of the private sector and role of market forces were initiated. Privatization and the increasing role of markets were intended to increase efficiency through increased competition. Market liberalisation in Kenya followed a sectoral approach and within each sector, market liberalisation was gradual. Next is a brief on market liberalisation processes for fertilizer and maize.

Liberalization of the fertilizer marketing

All fertilizers used in Kenya are imported. The government controlled fertilizer imports and marketing prior to fertilizer market liberalisation in 1991. A few government-controlled merchants such as the Kenya Farmers' Association (KFA) imported and distributed fertilizers to appointed agents and stockists. Fertilizer prices and margins were fixed along the marketing chain. To import fertilizers, the merchants got permits (licenses) and often had problems accessing foreign exchange. Rent seeking was a common feature in this trade and partially contributed to late fertilizer deliveries to farmers resulting in low fertilizer use. This prompted fertilizer market liberalisation with the objective of achieving efficient and timely importation and distribution of fertilizers in addition to increasing its use. The private sector was expected to play a major role in importation, distribution and retailing. This policy shift also aimed at making fertilizers more easily available and cheaper to farmers.

Liberalization of maize grain marketing

Before maize market liberalisation, the government intervened in the marketing sector to (1) protect maize producers from unacceptably low or unstable prices, and provide reliable outlets for sale (2) protect consumers from unacceptably high or unstable consumer prices and (3)

promote food security through assurance of maize availability at all times within Kenya (Wangia *et al.* 2000). This was achieved through the National Cereals and Produce Board (NCPB), a government parastatal, which controlled maize prices, movement and storage. In early 1980s, NCPB expanded rapidly leading to coordination problems, incurred losses and became a drain to the exchequer. This resulted in delayed farmer payments for maize deliveries. The Cereals Sector Reform Program initiated in 1988/89 led to maize market liberalisation in 1994. With liberalisation, maize prices were decontrolled, movement restrictions were abolished and NCPB was designated a buyer of last resort. These changes ushered in increased participation of the private sector in maize trade.

The data used in this paper originate from trader surveys conducted between December 2003 and June 2004, from randomly-selected 169 maize and 122 fertilizer traders across 59 dispersed market centres in six districts of North Rift, Kenya.

3. Analytical Frameworks, results and discussion

Firm size distribution

Market liberalization ushered in many private traders. What size of traders entered the market? Information on size of traders could shed light on whether size of trader has effect on performance. Specifically, it will shed light on possibilities of vertical or horizontal integration among firms, which are necessary for achieving economies of scale or point to problems of firm expansion possibly due to existence of some entry barriers.

Firm (trader) size distribution is analysed by looking at the moments of firm size (Dinlersoz and MacDonald, 2005). Both the mean and skewness are used in this study. Skewness captures whether the firm size distribution is symmetric around its mean. Positive values of skewness indicate a pile-up of scores on the left of the distribution that is, assigning more of the probability to the left of the mean, that is, more toward smaller firms and the converse is true. In a normal distribution, the values of skewness should be zero (Field, 2004).

The Kolmogorov-Smirnov test is used to test for normality of the distribution. If the Kolmogorov-Smirnov test shows $p>0.05$, then it indicates that the firm sizes are normally distributed but if Kolmogorov-Smirnov test shows $p<0.05$, then it indicates that the firm sizes are not normally distributed

The logarithm of the value of fertilizer sales was used to establish the fertilizer firm size distribution in North Rift. Results show that the fertilizer firms are positively skewed with a value of 0.3 ± 0.2 around the mean implying a tendency of more, smaller firms than are larger firms. The Kolmogorov-Smirnov test ($p>0.05$) indicates that the firm sizes are log-normally distributed. Partly because of ease of entry into the fertilizer business, a large number of firms selling fertilizers have proliferated even in the remote areas (Table 1), where they sell smaller quantities compared to their counterparts in more accessible areas.

Insert Table 1

Table 2 shows that traders who entered the market after market liberalization are small. Even those who entered the market immediately after market liberalization have not grown big pointing to possible constraints in firm expansion.

Insert Table 2

The logarithm of maize purchases was used to determine firm size distribution in marketing maize. Results show that maize traders are positively skewed (0.3 ± 0.2) around the mean implying a tendency of more, smaller firms than are larger firms. The Kolmogorov-Smirnov test ($p>0.05$) indicates that the distribution of trader sizes are log-normally distributed. Ease of entry in maize trading partly explains the many smaller traders who sell

maize. Maize traders located in remote places (Table 3) sell relatively smaller quantities than those in accessible places pointing to possible constraints hindering the entry of larger firms. In accessible market centers, both small and large firms co-exist pointing to possibility of fair competition.

Insert Table 3

The distribution of maize traders by age in business shows that post-liberalization entrants are smaller in size than pre-liberalization entrants (Table 4). Like in fertilizer trade, there is high variability in size of traders even within the same group of entry. This could point to differences among traders resulting from factors such as source of start-up funds, location of business and socio-economic characteristics of the trader.

Insert Table 4

What do these firm size distributions portray in terms of competition? Market liberalization aimed at obtaining a competitive market characterized by the perfectly competitive market model. The Hirschman-Herfindahl (HH) index approach was used to measure the level of competition in each market. The HH index is given by the sum of the squared market shares of a firm, thus

$$HH = \sum S_i^2$$

where, S_i is the market share of the i^{th} firm. The value of HH equals one when there is only a single firm in the industry and tends towards one when there are a few firms and / or greater degree of inequality in market shares. This indicates minimal competition signifying exercise of market power. As the index tends to zero, it signifies increased competition, a situation envisaged with market liberalisation. The survey results indicate that the HH index of 0.11 for

fertilizer and 0.20 for maize traders are low and tend towards zero. Therefore, they signify that trading in the two commodities is fairly competitive.

There are vertically integrated traders among the maize and fertilizer traders. Survey data indicate that the ¹degree of vertical integration was 77.1% and 30.6% for maize and fertilizer traders, respectively. The high degree of vertical integration among maize traders points to the continued participation of NCPB and presence of several millers in maize trading. Vertically integrated firms should produce greater economies of scale and lower unit costs but these processes can also reduce competition with the effect of increasing price.

After assessing the size distribution of the firms, next we determine their performance in trade. We use two indicators of performance; marketing margins and marketing costs.

Market performance

Market performance was assessed by considering marketing margins (difference between selling and buying prices) and costs by firm size groups. High marketing margins indicate absence of adequate competition. Under such circumstances, more firms are attracted into that business. The marketing costs considered were; transport, labor, storage, packaging materials, market fees and losses. For purposes of comparing the marketing performance of different firm sizes, firms were arranged in increasing order of volume traded for each commodity. The firms were divided into four quartile firm size groups (named quartile 1, 2, 3 and 4) for each commodity. For each group, the mean marketing costs, buying and selling prices per given volume were determined. To determine differences in buying price, selling price and marketing costs, 3 analyses of variance (ANOVA) estimates were done. For significant ANOVA, orthogonal contrasts were made to determine difference among groups for marketing costs and margins.

¹ The degree of vertical integration is a measure of the share of the vertically integrated firms over the whole volume traded.

Performance of fertilizer traders

The mean (\pm s.e.) fertilizer sales (in 50kg bags) for the four firm size groups in ascending order were 77 (11), 439 (34), 1,993 (181), and 38,381 (11,375), respectively.

Insert Fig. 1a and Fig. 1b

Large firms buy and sell at lower prices than smaller firms (Fig 1a). However, there is an overlap between buying price of smaller firms and selling prices of larger firms indicating that some of the small firms buy from large firms probably suggesting that larger firms experience lower marketing costs and therefore sell at lower prices, implying they do not seem to exploit smaller traders or farmers. Both marketing margins and marketing costs decreased with increasing firm size (Fig. 1b).

Analysis of variance (ANOVA) results indicate that there was a significantly different effect of volume of sale (firm size) on marketing costs ($F(3,105) = 9.98, p < 0.01$). The very small traders (Quartile 1) incur significantly higher marketing costs ($t(105) = -4.36, p < 0.01$) than medium and large traders (Quartiles 2, 3 and 4). Similarly, the ANOVA results for marketing margins indicate that there were significant differences ($F(3,105) = 3.05, p < 0.05$) among quartile groups. The smallest traders (Quartile 1) obtain significantly higher marketing margins ($t(105) = -2.82, p < 0.01$) than medium and large traders (Quartiles 2, 3 and 4).

Mean marketing costs decreased with firm size, indicating that larger firms enjoy economies of scale especially in transportation and information. Marketing margins for fertilizer traders are similar except for the very small scale firms who obtain slightly higher margins. This indicates that larger firms tend to maximize on sales volume rather than per unit margins. This is a pointer to greater competition even with increased firm size.

Performance of maize traders

The mean (\pm s.e.) maize purchases (in 90kg bags) for the four firm size quartile groups formed in ascending order were 48 (5), 302 (23), 1124 (80), and 32,206 (12,260),

respectively. On average, the buying and selling price (Fig 2a) decrease with firm size but the trading margins are similar implying that the selling and buying price are positively correlated.

Insert Fig. 2a and Fig. 2b

Fig. 2a and 2b, show that marketing margins and marketing costs decrease with increasing firm size although not proportionately. Nevertheless, the first quartile traders receive the highest margin but also incur the highest cost while the third quartile has both the lowest cost and margin.

Overall, analysis of variance (ANOVA) results for the four firm size groups indicate that there was a significantly different effect of volume of maize purchases on marketing costs ($F(3,161) = 3.3, p < 0.05$). The very small traders (Quartile 1) incur significantly higher marketing costs ($t(161) = -2.6, p < 0.05$) than all other traders (Quartiles 2, 3 and 4). The ANOVA results indicate that marketing margins are statistically similar across all firm groups signifying existence of competition among traders of all sizes. The next section explains the factors influencing the observed differences in fertilizer sale price.

Factors affecting selling prices

The hedonic method was used to determine factors influencing commodity prices. This method uses regression to estimate the prices of the qualities or attributes of a good. While the attributes are not sold separately, the resulting regression coefficients yield the marginal contribution of each attribute to the sales price for the good (Maurer *et al.* 2004).

Spatial price variations and over traders observed in the commonly used fertilizers in maize production, Di-ammonium Phosphate (D.A.P.) and Calcium Ammonium Nitrate (CAN) were analyzed. The traders (wholesalers or stockists) often sell fertilizer in 10-kg or 50-kg packs. The following characteristics were considered as influencing fertilizer price: the

distance to the fertilizer market, type of trader-package size interactions and the purchase price of fertilizer per kg. The logarithm of the price of fertilizer sold was used as the dependent variable. This model was estimated for each of the two fertilizer types, thus;

$$P_{\text{fert}} = f(\text{trader-package size dummies, distance to fertilizer market, buying price}).$$

where, p_{fert} is the logarithm of the selling price of one kg of DAP or CAN; stockist or wholesaler-50kg dummy is a dummy specified as: 1= 50 kg; 0 = otherwise sold by stockist or wholesaler; stockist or wholesaler – 10kg dummy is a dummy specified as: 1= 10 kg; 0 = otherwise sold by stockist or wholesaler. For estimation, the stockist- 50kg dummy is not included.

As expected in a liberalized market where pan-territorial and pan-seasonal pricing system no longer exists, there were spatial price variations observed across the two fertilizers. Table 5 indicates that for both fertilizer types, the selling price of fertilizer decreased with pack size. The farther the distance from the major fertilizer distribution centres, the higher the selling price of fertilizer.

Insert Table 5

Overall, the results show that traders who demand small pack-size fertilizers incur higher per unit cost of fertilizers. It could be inferred that smallholder farmers who buy in small amounts of fertilizer in small pack sizes incur higher costs per unit of fertilizer bought from these traders.

4. Conclusions

This paper has attempted to determine the current structure of maize and fertilizer traders by looking at the firm size distributions. It has also attempted to assess the extent of competition among the existing firms and the ensuing performance of the firms by assessing marketing costs and marketing margins. Finally, factors influencing selling prices with an

illustration from fertilizer traders were analyzed. Available evidence indicates that the present maize and fertilizer traders though heterogeneous in size are log-normally distributed but with a tendency to more small size traders. Ease of entry but difficulties of obtaining external funds probably explain the observed pattern. Secondly, the HH index shows that these traders are fairly competitive. These results are further supported by the low and fairly uniform marketing margins observed among the various firm size categories. Though similar, marketing margins tend to decrease with increasing firm size. For both types of traders, marketing costs decrease with firm size probably pointing at economies of scale for the large traders. On factors explaining differences in observed selling fertilizer prices, pack size, place of purchase and distance from the market emerged as key factors. Overall, the emerging markets are fairly competitive as envisaged by the proponents of market liberalization.

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Tables

Table 1 Sale of fertilizers by location

Location	No. of traders	50-kg bags sold		
		Mean	minimum	maximum
Remote	45	862 (326)	18	14,400
Accessible	64	16,083 (5,121)	16	240,000
Total	109	9,799 (3,086)	16	240,000

Source: survey data, 2003-2004

Table 2 Fertilizer sales by age of traders

Year of entry	N	Mean (s.e.) fertilizer sales (50-kg bags)
Before 1992	19	38,676 (14,680)
1992-1995	14	3,485 (1,402)
1996-1999	28	8,035 (4,839)
2000-2003	48	1,239 (367)
Total	109	9,799 (3,086)

Source: survey data, 2003-2004

Table 3 Sale of maize by location

Location	No. of traders	90-kg bags sold		
		Mean	minimum	maximum
Remote	53	851 (181)	10	8,000
Accessible	112	12,204 (4,794)	5	300,000
Total	165	8,557 (3,276)	5	300,000

Source: survey data, 2003-2004

Table 4 Maize purchases by age of traders

Year of entry	N	Mean (s.e.) maize sales (90-kg bags)
Before 1995	40	22,838 (11,043)
1995-1997	26	1,382 (386)
1998-2000	58	7,408 (5,157)
2001-2003	40	819 (259)
Total	164	8,609 (3,295)

Source: survey data, 2003-2004

Table 5 Factors influencing selling price of D.A.P. and C.A.N.

Variable	Dependent variable is price per kg of			
	D.A.P.		C.A.N.	
	b	t	b	t
Distance to supplier (km)	0.01	1.7*	0.01	1.4
Stockist - 10kg dummy	3.6	13.6***	3.6	8.2***
Stockist - 25kg dummy	1.3	5.8***	1.8	4.0***
Wholesaler - 10kg dummy	2.6	5.7***	3.5	3.2***
Wholesaler - 25kg dummy	0.7	1.9*	-0.5	-0.7
Wholesaler - 50kg dummy	-0.003	-0.01	-0.4	-1.1
Transport cost /kg fertilizer bought	0.8	3.3***	0.6	1.9*
Purchase price / kg	0.6	13.1***	0.7	13.5***
Constant	10.2	9.6***	6.1	5.4***
R ²	0.83		0.87	
Adjusted R ²	0.82		0.86	
N	221		107	
F	F(8,213) = 128.8***		F(8,99) = 81.1***	

** = p<0.01, * = p<0.1

Source: authors' computations

Figures

Fig. 1a Mean buying and selling price

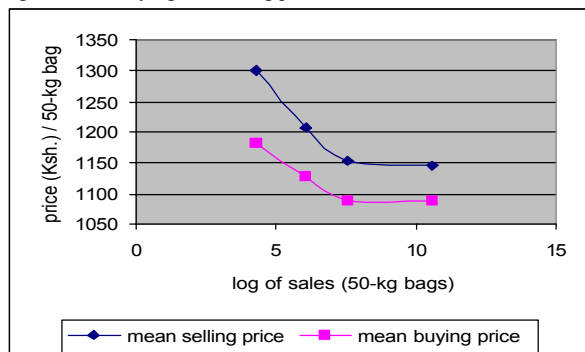


Fig. 1b Mean marketing margin and cost

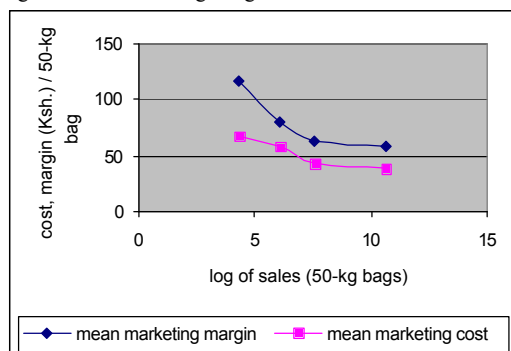


Fig. 2a Mean buying and selling price

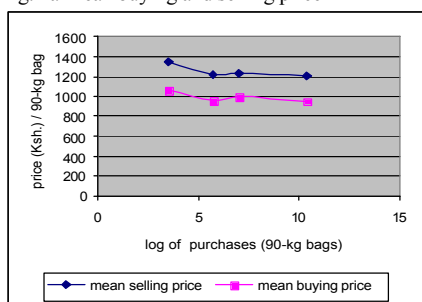


Fig. 2b Mean marketing margin and cost

