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AGRICULTURAL PRODUCTION INCENTIVES: FERTILIZER MARKETS AND

INSIGHTS FROM KENYA

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1. INTRODUCTION

Agriculture is the major economic sector in Kenya, employing over 70% of the population and contributing 24.6% to GDP (Economic Review, 1999). Therefore, economic development hinges on an improvement in agricultural productivity which, in turn, hinges on the use of productivity-enhancing inputs such as fertilizer.

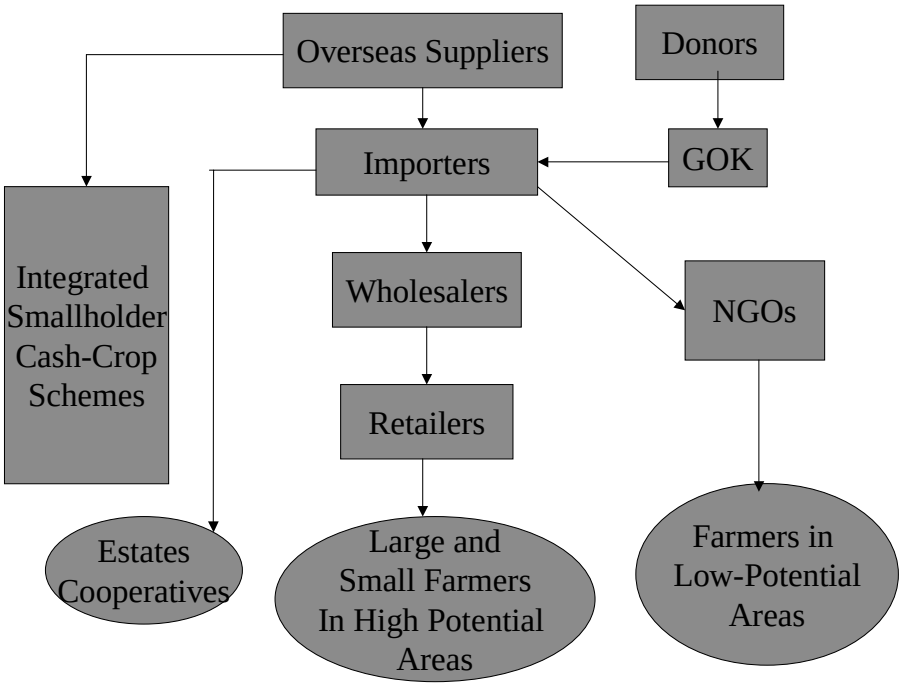
As was the case in many African countries, in the late 80's the Government of Kenya embarked upon a process to reform its agricultural sector, including the fertilizer subsector. However, unlike most other African countries, fertilizer market reform in Kenya has entailed not just the legalization of private trade, but also the virtual exit of government from continued involvement in distributing fertilizer. In other African countries, concerns with the ability of the private sector to meet the needs of smallholder farmers, especially with regard to credit and service provision to farmers in remote areas, has motivated governments to continue distributing fertilizer during the liberalization period, often at subsidized prices. Some studies have concluded that government distribution programs have often hampered commercial trading incentives and hence impeded the private sectors' response to liberalization (IFDC 2001; Govereh et al 2001; Stepanek et al 2001). By contrast, in 1993, the Government of Kenya withdrew completely from fertilizer distribution and since then, it has relied on the private sector and cooperatives to meet the fertilizer needs of farmers. By contrast, 95% of the fertilizer consumed in Kenya is imported and distributed by the private sector.[1] Because of this, the Kenyan experience provides an interesting test of how fertilizer markets have evolved (for a given level of institutional and infrastructural development) and whether they effectively serve the needs of smallholder farmers.

Figure 1 shows the current organization of the fertilizer market. There are two types of private sector groups involved in the market. The first group consists of importers, wholesalers and retailers who sell to farmers and to non-governmental organizations. The second group consists of smallholder cash-cropping firms involved in interlocked input-output market arrangements, and large estates, some of whom import their own fertilizer directly and some of whom purchase fertilizer directly from private importers. This paper focuses on the segment of the private sector that is comprised of importers, wholesalers and retailers. It is hereafter referred to as the private sector.

Government and donors anticipated that the fertilizer market reforms would initiate major investment by private firms in fertilizer distribution and marketing that would increase financial and physical access to fertilizers, particularly by smallholders who had been neglected under the

[1]The remaining 5% is donor-sourced by the Ministry of Agriculture-KRII program (MOA-KRII) which imports fertilizers that the private sector does not import, and sells it to private traders via an open tendering system. Instead of the government receiving aid monies, it receives the goods (fertilizers, pesticides, and agricultural and industrial machinery from Japanese companies) which it sells internally to the private sector and uses the proceeds to finance donor-approved development projects in any economic sector.

Figure 1. The Fertilizer Subsector in Kenya



Key:
GOK = Government of Kenya
NGO = Non-governmental organizations

controlled system, and thus catalyze farmer uptake and more efficient use of fertilizer (Arwings-Kodhek, 1996). Moreover, advocates of output market reforms, which were launched in the late 1980s, argued that the reforms would raise farm prices and production, which would in turn stimulate demand for purchased inputs like fertilizer (Nyoro et al., 1999).

However, the general view in Kenya is that the performance of the reformed fertilizer subsector has fallen short of expectations. On the one hand, liberalization has increased private sector participation in fertilizer marketing and distribution. The number of players in the fertilizer subsector has mushroomed; 78% of the retailers and 73% of the wholesalers surveyed in1999 entered the fertilizer trade after liberalization commenced in 1990. Allgood and Kilungu (1996) estimate that in 1996 there were already 10-12 importers, 500 wholesalers, and 5000 retailers of fertilizer countrywide. But despite the increase in the number of traders, the expected large increase in fertilizer use has not taken place.

1.1. Problem Statement and Objectives

Policy makers in Kenya regard agricultural productivity growth and rural food security as important objectives of policy. There is therefore much interest in assessing whether the current

system of fertilizer marketing helps to promote the achievement of these objectives, and if not, what changes might be identified to improve the performance of fertilizer marketing. The paper has several specific objectives. First, we identify how fertilizer marketing costs and the types of fertilizers used have changed over the course of the liberalization process in Kenya. A second objective is to examine the fertilizer subsector in Kenya with a view to identifying organizational and institutional changes that could improve its performance. To do this, we identify various types of fertilizer supply chains serving farmers in western Kenya, examine the cost structure of these supply chains, identify potential sources of cost reduction in these supply chains, and lastly, estimate the impact of illustrative scenarios for reducing fertilizer marketing costs on the profitability of maize production in western Kenya. We draw our findings from small/medium farm budgets in three districts: Bungoma, Lugari, and Trans Nzoia.

This study may have broader regional significance in that the Kenyan experience provides an opportunity to assess the private sectors' response to reforms and their ability to meet the needs of smallholder farmers in the an environment where the state has almost totally withdrawn from fertilizer marketing. The findings of this study may therefore be useful to the other African countries that are still undergoing the process of liberalizing their fertilizer subsector, and can benefit from the lessons to be learnt from Kenya's experience.

1.2. Data

The analysis is based on several types of data. Structured surveys of fertilizer traders were carried out during the long rains fertilizer trading season in 1999 which extends from January to August, inclusive. After identifying the universe of traders operating in the purposively targeted districts of Western Kenya, a sample of traders were identified in each district for interview. The following groups were interviewed: importers, wholesales, retailers, transporters, officials of various ministries in particular the Ministry of Agriculture, and other government and private sector bodies that are involved in the importation, marketing and distribution of fertilizer to smallholders in Rift Valley and Western Provinces in Western Kenya. The emphasis was on the marketing of DAP fertilizer in Western Kenya because: a) 69% of the maize produced in Kenya is in these two provinces; b) maize receives more fertilizer than any other crop in Kenya - 37% of the total fertilizer applied in Kenya in 1997/98; c) the majority of this is DAP, which accounted for the 40% of the fertilizer consumed in Kenya in 1998 (KAMPAP, 1997/8). The trader survey data was augmented by household-level survey data on fertilizer use patterns collected in 1997 under the Tegemeo/Egerton University/MSU Kenya Agricultural Monitoring and Policy Analysis Project.

2. TRENDS IN FERTILIZER USE AND PRICES

The main types of fertilizers consumed in Kenya are compound fertilizers that provide both nitrogen and phosphate. Planting fertilizers for grain (DAP, NPK) comprise the majority of the fertilizer consumed in Kenya, while straight nitrogenous fertilizers such as CAN and Urea are used for top-dressing. DAP is used on maize, MAP on wheat, NPK 25:5:5 is used on tea, NPK

17:17:17 and MOP (Muriate of Potash) on coffee, and speciality fertilizers are used on horticultural crops particularly in the flower industry. (Figure 2)

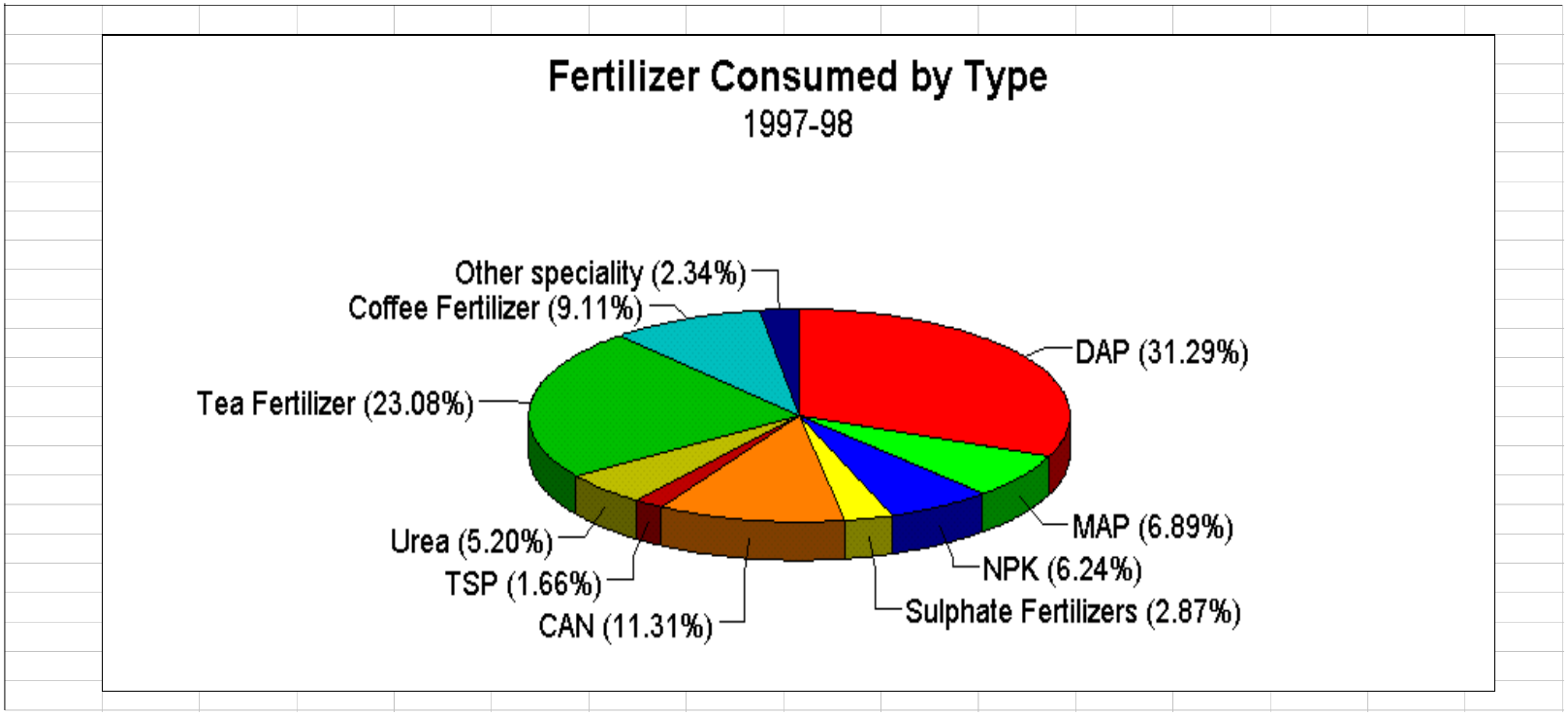
In general, fertilizer consumption has increased in the post-liberalization era. Annual fertilizer consumption increased by 19% from an average of 232,974 metric tonnes between 1984/85 and 1992/93 to 277,084 metric tonnes between 1993/94 and 1997/98. (Figure 3).

However, an decomposition of fertilizer use by crop shows important variations over time (Table 1). Analysis of this variation in consumption by crops reveals that consumption of maize fertilizer (DAP) declined from 70,182 tonnes between 1984/85 and 1992/93, to 67,636 tonnes between 1993/94 and 1997/98. Hence, the overall share of DAP in total fertilizer consumption declined from 30.1 % to 24.4 %. In contrast, the overall share of tea fertilizer increased from 18.4 % to 21.2 % during the same period; the share of wheat fertilizer (MAP) rose from 2.1% to 6.8%; and the share of speciality fertilizer rose from 2.1 % to 4.2 %. Therefore, the overall increase in fertilizer use in the post-liberalization era can be attributed to the increased use of fertilizer on tea, wheat, and horticultural crops, while the declining use of maize fertilizer (DAP) is dragging down national fertilizer consumption.

One possible explanation for the decline in DAP consumption is that fertilizer market reform has been associated with an increase in the price of fertilizer and dampened economic incentives to use this input. However, empirical data does not support this hypothesis. Analysis of secondary price data reveals that while nominal fertilizer prices have increased in the post-liberalization era, the price of most fertilizers has declined in real terms. The domestic price of fertilizer is a function of world prices, exchange rates and internal market conditions. Between 1990 and 1999, the f.o.b. price of DAP delivered at Mombasa in 1999 has increased by 200% from about 200 Ksh per 50kg bag to 600 Ksh per 50 kg bag and consequently, nominal retail price of DAP in Nakuru rose by 220% (MOA, 1999).[2] (Figure 4a) Two factors can account for this increase. Between 1992 and 1999, the Kenya shilling depreciated against the US dollar by 168%. The impact of the depreciation on domestic fertilizer prices was compounded by a steady upward trend in world fertilizer prices during this same period. However, after adjusting these prices for inflation, the data shows that both these prices have actually declined in real terms (Figure 4b).

[2]Why Nakuru? Nakuru is a city in Western Kenya, approximately 400 km from the capital Nairobi, and 1000km from the port of Mombasa. The MOA has found over the years that fertilizer prices in Nakuru are the most consistently representative of fertilizer prices prevailing in Kenya. It is also a central point that much of the imported fertilizer passes through on its way upcountry, and therefore it is not a thin market.

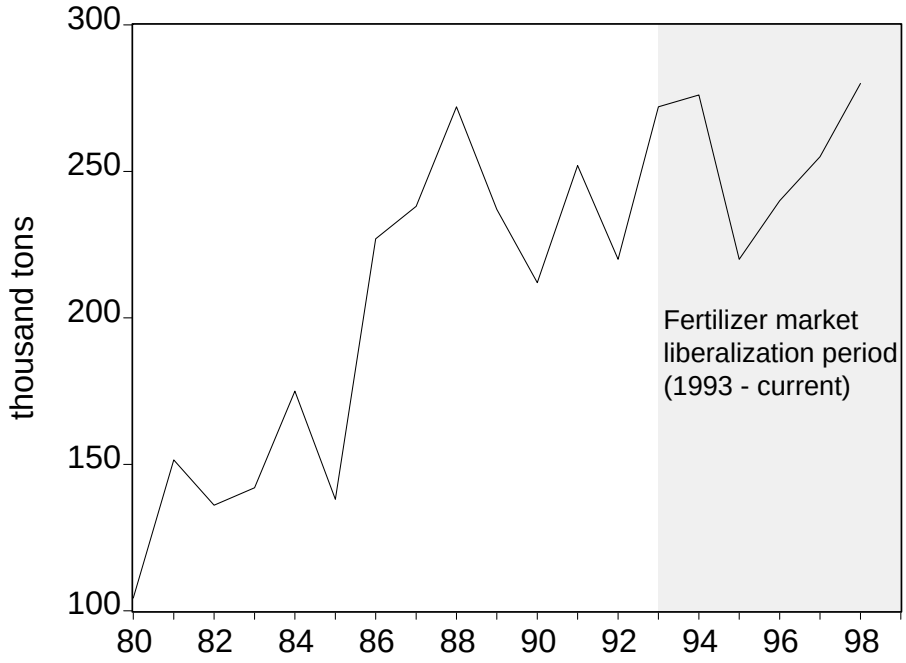
Figure 2. Fertilizer Consumed by Type (1997-1998)



Key

DAP = Diammonimum phosphate
MAP = Monoammonium phosphate
NPK = Nitrogen, Phosphorus, Potassium. Different types with numbers representing different percentages of the 3 nutrients: 23:23:23; 20:20:0 are the most common types of NPK used in Kenya
CAN = Calcium Ammonium Nitrate
TSP = Triple Super Phosphate
Other specialty fertilizers = mainly horticultural fertilizers

Figure 3. Trends in Fertilizer Consumption in Kenya, 1980 - 1998



Source: Ministry of Agriculture data files

Table 1. Annual Fertilizer Consumption by Selected Crops

	1984/85 to 1992/93		1993/94 to 1997/98	
Crop/Fertilizer type	Metric tonnes	% Share	Metric tonnes	% Share
Maize (DAP)	70,182	30.1	67,636	24.4
Tea (25:5:5s)	42,902	18.4	58,733	21.2
Coffee (17:17:17 & MOP)	23,605	10.1	23,220	8.4
Wheat (MAP)	4,947	2.1	18,788	6.8
Horticulture(Special fertilizer)	4,821	2.1	11,632	4.2
Others(TSP, Urea, CAN, etc)	86,515	37.1	97,073	35.0
Total	232,974	100	277,084	100

Source: Computed from MOA data files

Figure 4. Nominal and Constant (1999 = 100) f.o.b. Mombasa and Wholesale Nakuru Prices of DAP, 1990-1999

Figure 4a (nominal)

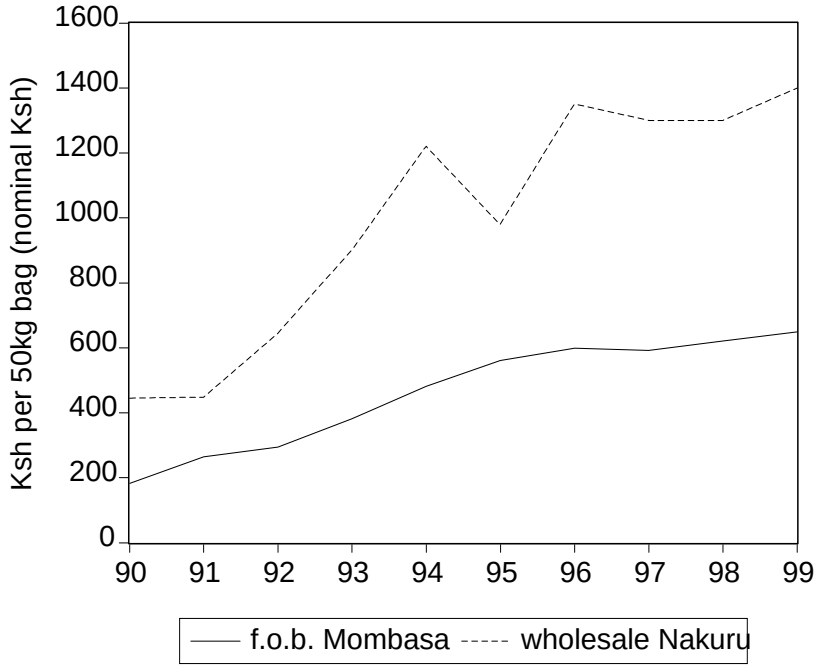
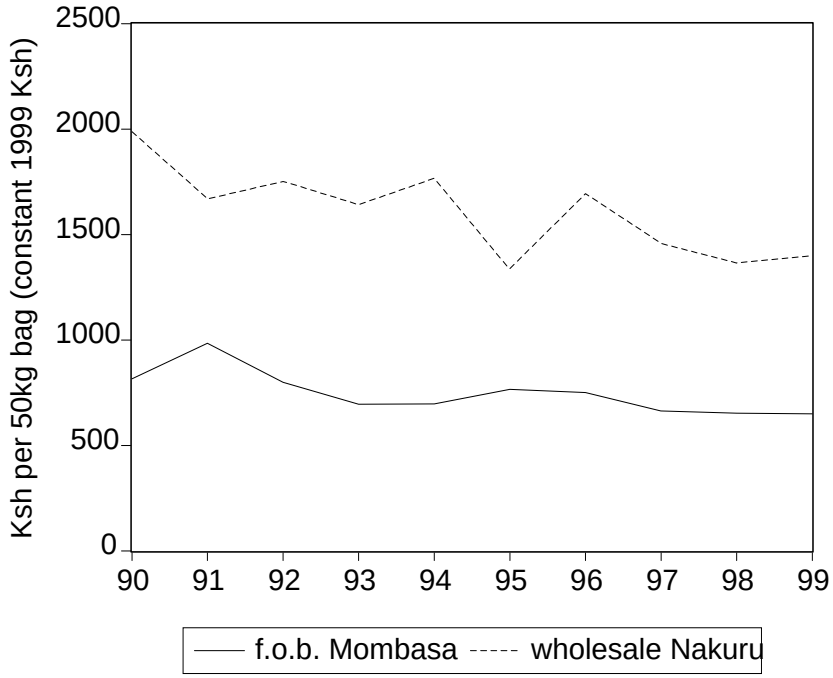


Figure 4b (Real)

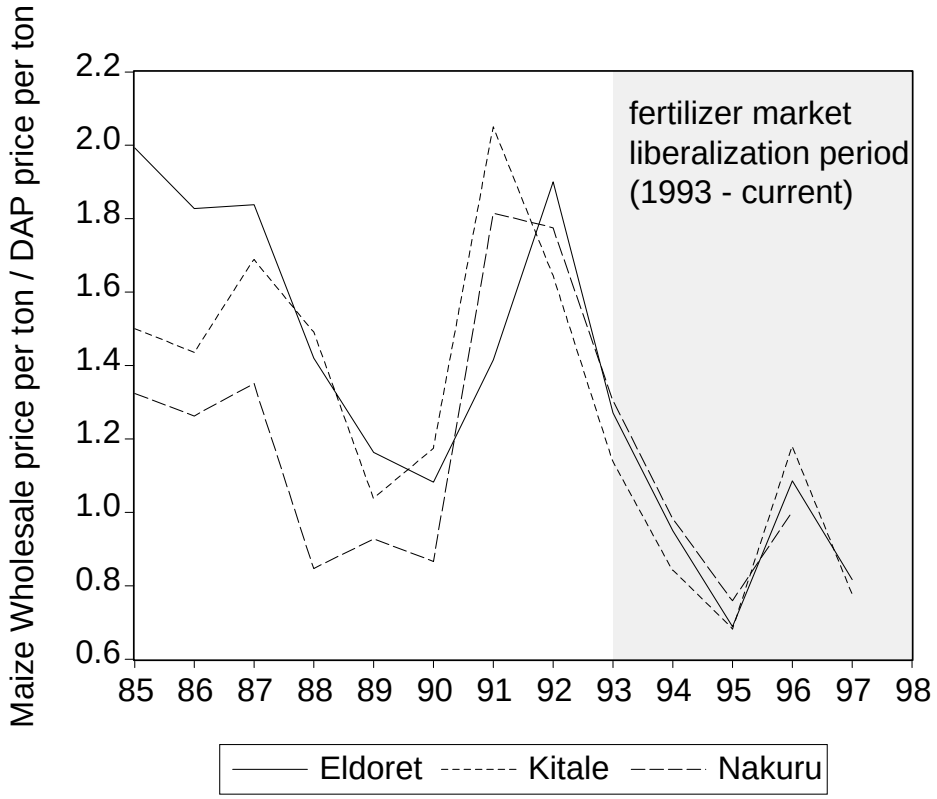


Source: Green Markets.

A second possible explanation for the decline in the use of DAP fertilizer for maize is the unfavorable terms of trade between maize and DAP fertilizer. That is, the decline in real fertilizer prices paid by farmers has not translated into increased incentives to use fertilizer on maize, because real maize prices have fallen even faster than fertilizer prices during the 1990-1999 period. The DAP-maize price ratio for these three major maize-producing districts is shown in Figure 5. As theory would suggest, exchange rate depreciation has increased the local currency price of traded commodities such as fertilizer compared to commodities such as maize that are mainly locally traded. Most of the marketed maize output in Kenya originates from local production. So, to some extent, the observed shift in fertilizer use from largely locally traded maize to export crops such as tea and horticultural crops could have been viewed as an unsurprising consequence of exchange rate depreciation.

However, this does not imply that fertilizer use on maize has become unprofitable in an absolute sense. The profitability of using fertilizer is a function of the physical yield response from applying fertilizer on the crop as well as input/output price ratios. Karanja et al. (1998), using econometric analysis of household survey data, showed that the response rate of fertilizer on maize yield was clearly profitable in most agricultural areas of Kenya, and especially in

Figure 5. Maize - DAP Fertilizer Price Ratios for Selected Markets, 1985-1998.



Source: Market Information Branch, MOA for maize price data.

conjunction with the use of hybrid seeds. They state "after considering mean fertilizer and maize prices prevailing during 1997, the year of the survey, the mean value-cost ratio for DAP fertilizer use is calculated at 5.86. This means that for every Ksh spent on DAP fertilizer, the farmer gets 5.86 Ksh back in value of maize output." There were regional differences in this value, but except for the drier agricultural zones, DAP use was clearly profitable given 1997 price ratios. Similarly, Nyambane (2001) has shown, using survey data from a number of maize-producing districts in Kenya, that the returns to land and labor are typically higher for maize when fertilizer is applied, yet this analysis was not able to net out the effect of hybrid seed use independently from fertilizer use.

Data from the 2000 season presented in Awuor (2001) also indicate that the gross margins for maize were reasonably high when fertilizer is applied. Table 2 shows farm budgets for medium-scale farmers in three major maize production districts in Western Kenya: Trans Nzoia, Kakamega/Lugari and Bungoma districts.

The results show that, with the fertilizer dose rate held constant, maize yields vary because of different levels of technology and farm husbandry techniques, and gross revenues from maize production using fertilizer (among other inputs) increase with the level of technology. Bungoma farmers use less-capital intensive technology and receive the lowest yields (14 bags/acre) and revenues (Ksh13,500/acre), while the most mechanized system in Trans Nzoia provides the highest yields at 25 bags per acre and the highest revenues (27,500/acre). Although the budgets assume the same quantity of fertilizer is used in all three districts, the total fertilizer cost in Kakamega/Lugari district is higher than in Bungoma and Trans Nzoia due to the significantly higher price of CAN in Kakamega/Lugari.

There are a number of important results from the budgets. First, fertilizer use on maize appears to be clearly profitable in these districts in Western Kenya. Fertilizer use on maize may be often unprofitable and very risk in the drier areas (Nyambane 2001). Secondly, fertilizer comprises a significant share of the costs of producing maize. It comprises the second highest share of the costs of production in Bungoma and Lugari districts (17% and 14% of the total production costs per acre respectively). The cost that comprises the largest share of cost of production in Bungoma is labor (20%) and in Lugari it is land preparation (22%). However, fertilizer is third in importance in Trans Nzoia district; it ranks after fixed costs (19%) and land preparation (14%) comprising 10% of the costs of producing one acre of maize. Clearly, in Trans Nzoia higher mechanization is substituting for labor as farmers move up to higher levels of technology. However, the costs of fertilizer remain a significant structural component.

In summary, the available evidence indicates that, despite a decline in the maize/DAP price ratio over the 1990s, and increased incentives to use fertilizer on export-oriented crops because of exchange-rate depreciation during the early 1990s, fertilizer use on maize remains profitable at least in the high- and medium-potential areas of Kenya. Yet, as we have shown, there has been a marked decline in the use of fertilizer on maize, perhaps the most politically strategic crop in Kenya. The dwindling use of fertilizer on maize has raised concerns in Kenya about national

Table 2. Farm Budgets for Selected Districts, 1999, in Ksh/acre

	Bungoma District	Lugari District	Trans Nzoia District
Revenue	**13500 (14 bags/acre @ Ksh1000)**	**17000 (17 bags/acre @ Ksh1000)**	**27500 (25 bags/acre @ Ksh1100)**
(a) Fixed Costs/acre	**1125**	**1250**	**3750**
(b) Labor Inputs	**2332**	**1662**	**1685**
Non-labor inputs:			
1st plough	**1500**	**1200**	**1200**
Furrowing	**250**	**1000**	**not applicable**
1st harrow	**not applicable**	**not applicable**	**800**
2nd harrow	**not applicable**	**not applicable**	**800**
Planter Hire	**not applicable**	**800**	**650**
Hybrid seed	**910**	**910**	**910**
DAP fertilizer*	**2025**	**1950**	**2025**
Top-dressing fertilizer*	**1425**	**1800**	**1425**
Chemical weeding	**not applicable**	**not applicable**	**1600**
Weed spraying	**not applicable**	**not applicable**	**500**
Sheller Hire	**not applicable**	**425**	**500**
Gunny bags	**135**	**85**	**250**
Transport to store	**405**	**484.5**	**375**
Transport to market	**not applicable**	**not applicable**	**1250**
Land rent per acre	**1500**	**2000**	**2000**
(c) Total non-labor inputs	**8150**	**10655**	**14435**
Total costs (a+b+c)	**11607**	**13567**	**19870**
Profit/acre	**1893**	**3434**	**7630**
Costs/bag	**829**	**798**	**789**
PROFIT/BAG	**135**	**202**	**305**

* Based on application rates of 75kg of DAP/acre and 100kg of CAN/acre
Source: Awuor 2001.

food security and whether the post-liberalization fertilizer subsector is competitive. This study seeks to provide a solid empirical understanding of the subsector in order to assess these claims and guide future policy. The structure of the market, however, depends on the structure of demand; hence it is first useful to examine where and how fertilizer is used in Kenya.

3. PATTERNS OF FERTILIZER USE IN KENYA

This section provides a foundation for the remainder of the paper by presenting basic information on fertilizer use patterns by crop and region. Analysis is based on a national rural household survey implemented under the Kenya Agricultural Monitoring and Policy Analysis Project (KAMPAP), a joint collaboration between Tegemeo Institute/Egerton University, Michigan State University, and Kenya Agricultural Research Institute. The survey was conducted in the 1996/7 season for 1540 households in 24 districts in Kenya, and repeated for a sub-sample of these households (n=612) in the 1997/98 season. The analysis here is based on the 612 households for which data was available over the two-year period. The 18 districts covered were aggregated into six agro-regional zones as shown in Table 1; these zonal definitions are used in subsequent descriptive analysis.

Table 3 shows that the six zones differ greatly in population density, rainfall, and cropping patterns. Total rainfall ranged from a high of 1,211 millimeters per season in Bungoma in the Western Transitional to a low of 266 millimeters in the Eastern and Western Lowlands. The Western Lowlands Zone is the most densely populated, while the Eastern Lowlands is the least populated. We defined "main cash crops" as crops that were sold by at least 40 percent of the households sampled in a zone during the 1996/97 season. According to this definition, maize and wheat were cash crops in the High Potential Maize zone, even though they were also important food crops. In general, the list of cash crops varied according to agro-ecological potential of the zone and population density, but there are notable exceptions.

3.1 Intensity of Fertilizer Nutrient Use

At this juncture it is important to make the distinction between fertilizer use (the amount of fertilizer material applied in kg per acre) and fertilizer nutrient use (the amount of fertilizer nutrients applied in kg/acre). Typically, a bag of fertilizer will contain both nutrients (nitrogen, phosphorus, potassium, sulphur) and fertilizer material which is just dry non-chemical matter which facilitates the packaging, handling and spreading of fertilizer by hand. The actual nutrient content of a bag of fertilizer is indicated on the label of the bag in percentages; hence the label of 50kg bag of DAP fertilizer will indicate that it is DAP 46:18:0. This means that the actual nutrient content of the bag is 46% nitrogen, 18% phosphorus, and 0% potassium. Therefore a 50kg bag of DAP actually holds 23 kg of nitrogen, 9kg of phosphorus, and the remaining 18kgs is dry fertilizer material. The data on fertilizer use patterns presented in the following sections is in terms of fertilizer nutrients per acre, not fertilizer use per acre.

Table 3. Sample Characteristics, Rainfall and Population Density by Agro-Regional Zones

Zone	District	Number of sampled households surveyed both in 1997 and 1998	Rainfall (mm)	Population Density (inhabitants per square mile)	Main Cash Crops[1]
Eastern Lowlands	Kitui	10	118	22	
	Machakos	10	266	100	
	Makueni	35	266	100	vegetables
	Mwingi	20	266	116	
Western Lowlands	Kisumu	50	659	732	
	Siaya	35	266	732	
Western Transitional	Bungoma	43	1211	221	Sugarcane
	Kakamega	65	733	411	Sugarcane
High Potential Maize Zone	Bungoma	43	733	221	
	Kakamega	65	1207	411	
	Bomet	20	1207	182	Tea
	Nakuru	50	1207	772	Maize
	Narok	11	611	480	Maize, Wheat
	Trans Nzoia	27	611	160	Maize
	Uasin Gishu	45	1092	25	Maize, Wheat
Western Highlands	Kisii	40	772	517	Coffee, maize, tea
	Vihiga	30	480	411	Vegetables
Central Highlands	Meru	40	1176	116	Vegetables, tea
	Muranga	33	969	340	Coffee
	Nyeri	48	677	186	Coffee, Tea
Total		612			

Source: Rainfall and population density are from Kenya Statistical Abstract (1997).
Note: 1) Main cash crops = more than 40 percent of households sold the crop during 1996/97. Data source: 1996/97 KAMPAP Household Survey.

The household data indicate that fertilizer use varies substantially across agro-regional zones, by crop, and by whether or not households use hybrid seeds. On average, more than 70 percent of the sampled households used mineral fertilizers in 1997 and 1998, and 57 percent of them used manure (manure data is only available for 1998). (Table 2.3) Manure use varies across zones, with the highest level of use found in the Eastern Lowlands and Central Highlands, where 84% and 91% of the households respectively, use manure. Dosage rates for manure were not available.

However, with the exception of the central highlands, zones where a higher percentage of households used manure had a lower percentage of households using fertilizer, and vice versa. In addition, usage of both manure and mineral fertilizer was very low among households in the Western Lowlands.

The highest levels of mineral fertilizer use were found in the High-Potential Maize Zone, the Western Highlands and the Central Highlands where, on average, 90% of the households used fertilizer in 1997 and 1998 (Table 4). Fertilizer use levels are also reasonably high in the Western Transitional and Eastern Lowlands (79% and 51% for 1998, respectively), but then they fall off dramatically for the Western Lowlands; in 1998 only 13% of these households used mineral fertilizer. Dose rates (i.e., the amount of fertilizer nutrient applied per acre among fertilizer users) also vary across zones. In 1998, only households in the Central Highlands and High-Potential maize zone applied more than 30 kg of mineral fertilizers nutrient per acre (47.9 and 33.5 kg per acre, respectively).

Table 4. Fertilizer Nutrient Use Per Acre in 1996/7 and 1997/8

Zone	Year	Percent of house-holds used manure	Percent of house-holds using fertilizer[1]	Fertilizer Nutrient applied[2]	Fertilizer nutrient application per acre				
					0 kg	0-10 kgs	10-30 kgs	30-50 kgs	50 + kgs
		----- Percent -----		-kg/acre-	-------- Percent of Households --------				
Eastern Lowlands	1996/7	n.a.	45	5.31	55	35	11	0	0
	1997/8	84	51	6.54	49	37	13	0	0
Western Lowlands	1996/7	n.a.	11	8.79	89	7	2	1	0
	1997/8	18	13	13.7	87	6	7	0	0
Western Transitional	1996/7	n.a.	69	15.1	31	29	32	5	3
	1997/8	48	79	16.6	21	31	32	16	0
High Potential Maize Zone	1996/7	n.a.	92	32.2	8	10	35	37	11
	1997/8	48	88	33.5	12	9	32	29	18
Western Highlands	1996/7	n.a.	91	19.5	9	27	50	10	4
	1997/8	51	86	19.4	14	27	46	10	3
Central Highlands	1996/7	n.a.	99	37.6	1	12	43	20	24
	1997/8	91	97	47.9	3	8	22	24	42
Total	1996/7	n.a.	74	27.3	26	17	31	17	9
	1997/8	57	73	30.4	27	17	26	17	14

Note: The total number of households is 612 for both year. 1) DAP is applied on 48 percent of the total 2216 plots on which fertilizer was applied; CAN 21 percent; NPK 16 percent; Urea 5%. 2) Among households who used fertilizer.

In the High-Potential Maize Zone, about 90 percent of households used fertilizer in 1997 and 1998. In Central Highlands, 99 percent of households used fertilizer in 1997, and 97 percent of households used fertilizer in 1998. Although the percentage of households that used fertilizer is high in the Western Highlands, the average dose rate is much lower than the Central Highlands and High-Potential maize zone. The difference comes from a lower number of high-end users. In the Western Highlands, only 14 percent of households used more than 30 kgs of fertilizer nutrient per acre in 1997, and in 1998 that figure was 13%, while more than 40 percent of households used more than 30 kgs of fertilizer nutrients in the Central Highlands and High-Potential maize zone.

4. ACTORS AND INSTITUTIONS IN THE FERTILIZER SUBSECTOR

4.1. Fertilizer Traders in the Private Sector

4.1.1. Importers

Importers are the principal commercial purchasers of fertilizer in a marketing channel. Importers determine the quantity of fertilizer to import for the coming season. Their import decisions take into account how much other importers will be importing, weather conditions, and maize prices. Importers place orders for fertilizer with overseas producers, establish credit arrangements with suppliers and local banks; solicit and process orders from customers; and extend credit to clients. The fertilizer import business is highly risky, primarily due to the uncertainty of local demand, exchange rate fluctuations, and changes in world market conditions..

Fertilizer imported into Kenya is sourced from the United States, Europe, the Middle East, and South Africa. In 1999 there were 46 importers registered with the Ministry of Agriculture (MOA). However, only 22 firms imported more than 1,000 tons of fertilizer per year, and of these, only 10 imported over 10,000 tons in 1999. Therefore, these latter 10 are regarded by MOA as the major players in the fertilizer import business. The rest tend to enter the market on a speculative basis to take advantage of projected high demand for a particular year.

Five of the 10 major importers were interviewed for this study. Four of them had their headquarters in Nairobi, and one in the upcountry city of Kitale. Three of the five importers were Kenyan-owned companies at the time of the interviews, and two were subsidiaries of international fertilizer manufacturers.[3] Only one of these five entered the subsector after the government withdrawal in 1993; the rest had been involved in fertilizer trading for at least 10 years. All the importers interviewed were diversified into other related distribution activities such as other agricultural inputs, grain trading, and hardware. The one exception is Norsk Hydro for whom fertilizer importing and distributing was its only activity in 1999.

[3]One of these importers is Norsk Hydro, the largest fertilizer manufacturer in the world. It has been selling fertilizer in Kenya under a USAID donor grant since the 1960's and its fertilizer, DAP, dominates the grain market in Kenya today.

Based on the interviews, traders were categorized on the basis of quantities purchased to facilitate analysis of marketing channels in the subsector. On this basis, two importers are categorized as large-scale (each purchasing an average of one million bags of fertilizer over the long-rains trading season). Three firms, purchasing an average of 300,000 bags over the same period were categorized as small-scale. One of these small-scale importers is vertically integrated. Therefore, importers are divided into 3 types for the purpose of this study: large-scale importers (LSI); small-scale non-vertically integrated importers (SSI); and small-scale vertically integrated importers (VI).

The large-scale importers typically purchased roughly 500,000 bags per consignment, while their small-scale counterparts typically purchased 100,000 to 150,000 bags per consignment. In general, all of the 10 serious importers in Kenya purchased a minimum of 100,000 bags (5,000 tons) of fertilizer at one time; any less would be uneconomical since the FOB price and freight rates increase with smaller tonnages.

4.1.2. Wholesalers

Wholesalers are classified by this study as traders who buy fertilizer from importers and transport the fertilizer to retailers or directly to large-scale farmers, cooperatives and estates throughout the country. In 1999, fertilizer wholesalers were located in the main cities in Western Kenya. Wholesalers' functions include: placing and processing orders with importers; establishing credit arrangements either with their suppliers, with a bank, or with a personal contact; soliciting and processing orders from customers; delivering fertilizer to customers; providing credit to retailers, and storing fertilizer.

The 14 fertilizer wholesalers interviewed for this study were located in six towns in three districts in the study area: six were in Kitale in Trans Nzoia district, four in Matunda in Lugari district; three in Eldoret in Uasin Gishu district; and one in Moi's Bridge in Bungoma district. This number and spatial distribution has not changed significantly in the past 5 years. Arwing-Kodhek's 1996 nationwide study on the evolution of fertilizer marketing in Kenya (which was carried out in 14 districts) found that in each major town visited in Western Kenya, between three and five firms were operating. This indicates that there has not been a major influx of wholesaler entrants.

As was the case for importers, wholesalers were categorized into large-scale and small-scale by the number of bags of fertilizer they purchased. However, the quantities purchased by wholesalers in 1999 were biased by two factors: the 1999 shortage of DAP fertilizer, and poor record-keeping practices by some traders. During the 1999 season, one of the major importers experienced delays in securing credit for DAP importation, resulting in shortages during the first two months of the main fertilizer distribution period. This was corroborated by large-scale wholesalers reports of lower levels of DAP purchases for 1999 compared to previous years. One wholesaler, for example, reported that 1999 DAP purchases were 5,000 tons, down from 7,000 tons he purchased in 1998. His purchases of the other types of fertilizer was the same for both years. Regarding poor record-keeping, some traders did not keep all their receipts. And for those who gave us total purchases over the season their memory and/or records may not have

been perfect. Therefore, some of the categorizations may be incorrect since traders who would normally purchase larger quantities of bags were unable to. Keeping these caveats in mind, eight of the 14 wholesalers were categorized as large-scale and six were small-scale.

Over the 1999 trading season, large-scale wholesalers (LSW) purchased on average 128,000 bags of fertilizer and small-scale wholesalers (SSW) purchased on average 4,000 bags of fertilizer during the same period. Quantities purchased by wholesalers during the 1999 fertilizer trading season vary from 248 bags to 186,000 bags (Table 5). Five of the eight large-scale wholesalers are Asians, whereas all six of the small-scale wholesalers are Africans.

Like importers, wholesalers in the sample are also involved in other businesses that are year round as opposed to seasonal like fertilizer trading. Wholesalers have diversified into agriculturally related activities such as grain trading, agricultural inputs, and hardware.

There was no noticeable difference in degree of specialization between large-scale and small-scale wholesalers. However, although wholesalers have diversified, they are still more specialized than retailers; wholesalers reported that fertilizer generates, on average, 80% of their sales revenue, whereas for retailers this figure was 50%. One reason wholesalers may choose to limit the type of items they diversify into is to avoid competing with supermarkets. That is, in contrast to retailers who, in addition to agricultural inputs and hardware also sell general retail items such as foodstuffs, stationary, and shoes, wholesalers have not branched out into these other items. By contrast, there are no supermarkets in the smaller towns to compete against and so retailers tend to serve as small convenience supermarkets, with fertilizer being one additional commodity for retailing.

Table 5. Distribution of Wholesalers by Number of Bags Purchased

Number of bags purchased	Number of traders (n = 10)[1]	% of fertilizer handled
0 - 1000	1	neg
1001 - 5000	3	2
5001 - 10,000	2	3
10,001 - 20,000	1	4
20,001 - 100,000	1	14
100,000 - 200,000	2	77
Total	10	100

[1]Ten of the 14 wholesalers interviewed gave us data on purchases; five were large-scale and 5 small-scale.
Source: 1999 Trader Survey data.

4.1.3. Retailers

Retailers are marketing agents who purchase fertilizer from wholesalers and sell it to farmers, the final consumers. They are located in major cities and upcountry towns, as well as in the smaller market centers or 'locations' in the hinterlands. Retailing functions include the buying and selling of fertilizer; rebagging into smaller quantities; provision of technical advice to farmers; delivering fertilizer to farmers; soliciting credit from their suppliers; and extending credit to farmers.

The main task of retailers is to provide an 'assortment' or wide variety of fertilizer at a single location, making it convenient for farmers to purchase all their fertilizer needs from one location. They are typically the most numerous of marketing intermediaries, and as noted earlier, the number of fertilizer traders at the retail stage of the subsector is large relative to those at the importer and wholesaler stages (Kohls and Uhl, 1998). Three types of retailers can be identified. First, 'speculative' retailers: These are general retailers who sell a wide variety of items throughout the year, and only enter the fertilizer trade during the main trading season when they feel they can make a quick return. For this reason, out of the 96 retailers counted in the initial sampling frame, only 46 were still selling fertilizer at the time the interviews commenced, which was just after the main trading season had ended. The rest had already exited the industry in search of more lucrative activities for their capital. Second, there are "permanent" retailers for whom fertilizer retailing is a major part of their trade and hence they continue to sell fertilizer even after the peak season ends in May/June. The third category of retailer are traders who sell miscellaneous items on market days. During the fertilizer trading season they will buy one or two 50kg bags of fertilizer on market days (which occur once a week), typically from other retailers, and sell it in 1 or 2 kg quantities, along with their other offering. The 47 retail outlets interviewed for this survey were purposively chosen to be "permanent" retailers, and as such, this sample overestimates the sales volumes of fertilizer retailers when the universe of retailers is viewed to include the seasonal traders and petty-volume traders.

For the 1999 trading season, quantities purchase by individual retailers varied from 198 bags to 24,000 bags. Table 6 presents the distribution of retailer purchases (number of bags purchased in 1999).

Twenty-five retailers are categorized as large-scale and 22 as small-scale. Twelve of the 25 large-scale and 18 of the 22 small-scale retailers gave us data on purchases and prices. Over the 1999 trading season, large-scale retailers (LSR) purchased a mean of 2000 bags of fertilizer and small-scale retailers (SSR) purchased 1200 bags on average. Ownership at the retail level is dominated by Kenyan Africans regardless of scale, and 37 of the 47 retailers started trading in fertilizer after 1993.

Table 6. Distribution of retailers by number of bags purchased

Number of bags purchased	Number of traders (n = 29)[1]	% of fertilizer handled
0 - 500	5	2
501 - 1000	11	9
1001 - 2000	6	7
2001 - 10,000	5	21
10,001 - 20,000	1	14
20,001 - 25000	2	47
Total	30	100

[1]30 of the 47 retailers interviewed were willing to give us data on quantities purchased
Source: 1999 Trader Survey data.

4.2. Agents and Marketing Facilitators

4.2.1. Agents

The only agents involved in fertilizer trading are clearing agents at the port of Mombasa. They receive fertilizer on behalf of importers and clear it through customs at the port. In general, fertilizer traders do not use purchasing agents or brokers (to sell) because it is perceived to be too risky.

4.2.2. Transporters

Road transportation dominates the distribution of fertilizer within Kenya. In 1999, road transporters distributed 72% of the grain fertilizer imported into Kenya, and 80% of the total amount of fertilizer imported into Kenya (Kenya Railways, 1999). Traders at every stage of the subsector provide delivery of fertilizer as part of their customer service; however, the majority of this transportation is hired, as very few traders own their own trucks.

There are two tiers of transporters catering to the fertilizer industry in Kenya. The first tier consists of the big transporters, operating trucks with a carrying capacity of between 28 and 32 tons. Transportation of fertilizer from the port of Mombasa to the various upcountry destinations of Nairobi, Nakuru, Eldoret and Kitale is dominated by these big transporters. They typically own a fleet of at least 20 trucks, mainly Scanias or Mercedes Benz, and charge on a per ton per km basis, and according to the tonnage of the vehicle. That is, if the vehicle a trader hires can carry 32 tons, but the trader only loads 25 tons, s/he will be charged for 32 tons, unless the transporter is able to find another client to hire the remaining tonnage. (See Appendix, 2 for a

detailed calculation of transport running costs and a breakdown of the components of transportation costs).

The second tier of transporters are small transporters. Whereas large transporters charge on a per ton per km basis, travel on average 500 km, carry large loads, and travel on better roads, small transporters charge per bag, carry smaller loads, and travel shorter distances (on average 20 km) on poorer roads. They operate vehicles with a capacity of up to 16 tons and are the main form of fertilizer transportation within districts in Western Kenya. Small transporters typically own 1 or 2 vehicles, which vary in type from 1-16 ton canters or small trucks, pick-ups, matatus and finally, bicycles or "boda-bodas". The canters and pick-ups are normally used to transport fertilizer from wholesalers to retailers, whereas the matatus are hired by farmers to transport the fertilizer from the retailer to drop-off points at varying distances from the farmgate. The remaining distances - ranging from a few hundred meters to several kilometers - are either covered on foot, or by boda-boda, i.e. bicycle traders that carry up to two 50kg bags at a time.[4]

Although two of the importers ship their landed fertilizer directly from Mombasa to their godowns and/or to customers upcountry, the majority of the wholesalers in cities and towns upcountry (such as Kitale, Eldoret, Webuye, Moi's Bridge, and Matunda) receive their fertilizer from importers' godowns in Nairobi.

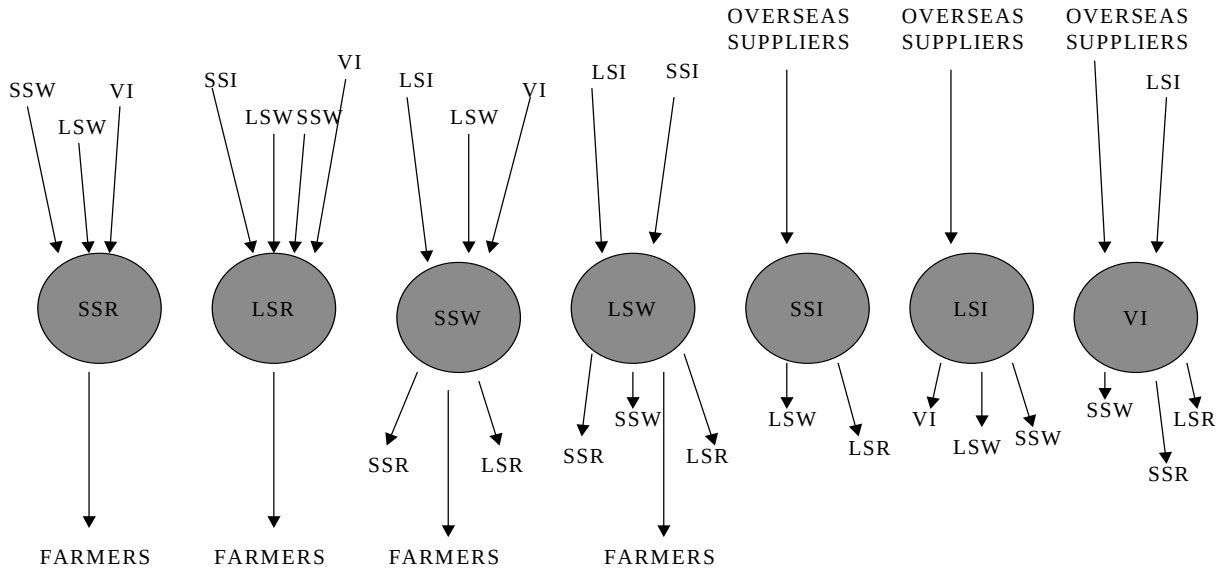
5. EMPIRICAL ANALYSIS OF THE COMPETITIVENESS OF MARKETING CHANNELS

A variety of marketing channels existed in the fertilizer subsector in 1999. A particular type of trader often purchased fertilizer from two or three different types of suppliers and sold it to two or three types of buyers. Figure 6 provides a graphical illustration of the different types of suppliers and buyers that existed for each type of trader in 1999. The channels differed in terms of their length (number of stages) and breadth (number of traders at the same stage of each channel) which has implications for the competitiveness of the channels.

Moreover, all the wholesalers sampled performed a dual function of retailing directly to farmers, in addition to selling to retailers. Therefore, retailers who purchased their fertilizer from wholesalers had to compete with these same wholesalers in the retail market. Presumably,

[4]The boda-bodas go where matatus will not go due to the bad condition of the road. Therefore, whether a road is serviced by a matatu and boda-boda, or by boda-boda only is a measure of the quality of the road.

Figure 6. Multiplicity of Marketing Channels in the Fertilizer Subsector



KEY:
SSW: small-scale wholesalers
LSW: large-scale wholesalers
VI: vertically-integrated importer-wholesaler
SSR: small-scale retailers
LSR: large-scale retailers
LSI: large-scale importers
SSI: small-scale importers

wholesalers performed this dual function to increase their sales. However, this behavior at the wholesale level may have eroded the net returns and/or profit margins at the retail level. Some retailers purchased their fertilizer directly from importers, by-passing wholesalers completely. These kinds of behavior suggest that retailers and wholesalers are, to some extent, competing for the same farmers (mostly farmers who have the ability to buy fertilizer in larger volumes and in towns), which most likely increases competition to the benefit of these farmers.

5.1. Specification of Marketing Channels

Each marketing channel has been identified by the transactions that took place between traders at each stage along the marketing channel as fertilizer traveled from the importer to the farmgate. For example, in the case of a small-scale importer who sold to a small-scale wholesaler or directly to a farmer, these two transactions comprise one marketing channel. To delineate the number of marketing channels by which fertilizer reached the farmgate, traders were asked to give us information for each transaction which included buying and selling price, who they purchased each consignment from, and the location of this supplier. By mapping out the trail of each transaction for each trader, and grouping together the transactions that followed the same route to the farmgate, all of the different channels that existed in the private sector in 1999 were delineated based on the penultimate stage before the farmgate. Two marketing channels were

Table 7. Marketing Channels for Performance Analysis

Channel:	Market Participants	Channel Route
Channel 1	Large imported to large wholesaler to large retailer	Nairobi - Eldoret
Channel 2	Large importer to large retailer	Nairobi - Eldoret
Channel 3	Vertically integrated importer/wholesaler to small wholesaler to small retailer	Nairobi - Kitale - Matunda
Channel 4	Large importer to large wholesaler to small wholesaler to small retailer	Nairobi - Eldoret - Matunda

identified that had large-scale wholesalers as the penultimate stage; 4 had small-scale wholesalers; 5 had large-scale retailers; and 3 channels had small-scale retailers as the penultimate stage. Although wholesalers also sell fertilizer to farmers, retailers are the main suppliers of fertilizer to farmers. Therefore, the performance analysis will focus on four marketing channels that have retailers as the penultimate stage before the farmgate. These channels, their marketing participants, and the channel route indicating the location of the traders are depicted in Table 7.

5.2. Cost Build-Ups

A cost build-up is an accounting technique which estimates and adds all costs and margins at the various stages of the downstream fertilizer supply channel, from the factory (or, in the case of Kenya, from the port of export) to the final consumer. The basic approach, normally conducted at an aggregate level, consists of adding the FOB price to costs such as shipping costs, import duties, levies, taxes, transport, labor, storage and handling costs, and margins. The purpose is, first, to assess the contribution of various stages in the supply chain to the farm-gate price of fertilizer paid by farmers. A second objective to identify whether there are some stages or practices in the supply chain that are unnecessarily inflating costs and ultimately borne by farmers. If such bottlenecks in the supply chain can be identified and addressed, it may be possible to raise the profitability and demand for fertilizer. After exploring the structure of costs in the supply chain through cost build-up analysis, we then examine the effects of potentially feasible cost-reductions on the profitability of using fertilizer in Section 6. This is done by conducting sensitivity analysis on the price of fertilizer used in the farm budgets presented in Section 2.

Cost build-ups were constructed for each of the four marketing channels presented earlier in Table 7. The cost build-up results are presented in Tables 8.1 to 8.4.

Table 8.1. PORT TO FARMGATE COST BUILD-UP FOR DAP FERTILIZER (APRIL, 1999): Channel 1			
CHANNEL ROUTE: NAIROBI - ELDORET (UASIN GISHU DISTRICT), CHANNEL 1: LSI - LSD - LSR			
CIF LINER IN (BULK). Exchange Rate: Ksh70 = US$1			
		Kenya Shillings per 50 kg bag	
	LARGE-SCALE IMPORTER (NAIROBI)[1]		
1	Importer buying price = US FOB price in November 1998[2]	707	
2	Freight rates (from port of Florida November 1998))	98	
3	Insurance (1% of landed cost of fertilizer)	8	
4	CIF price (lines 1+2+3)	813	
5	Port charges	84	
6	IDF (2.75% of CIF price)		22
7	KBS (.2% of CIF price)		2
8	KARI (1% of CIF price)		8
9	KPA Shore Handling[3]		16
10	Misc.KPA charges		1
11	Stevedoring		28
12	Agency Fees (0.8% of CIF price)		7
13			
15	Costs incurred at the port	75	
16	Bagging		26
17	Bags		12
18	Local transport (to Mombasa warehouse)		23
19	Local handling charges		14
20			
21	Importers Costs ex-Mombasa (line 4+5+21)	972	
22	Transport costs to Nairobi (Road)	125	
23	Transit losses	8	
24	Cost incurred in Nairobi	129	
25	Bank (LC) (3% of CIF price)		24
26	Handling Costs (cost of unloading (receiving) and loading (selling) fertilizer		6
27	Labor costs to repair torn bag		0
28	Transit losses		8
30	Storage Costs(rent, labor, security, electricity)		23
31	Cost of credit		1
32	Opportunity cost of capital		67
34	Total importers costs (line 21+22+23+24)	1234	
35	Importers selling price = wholesaler's buying price (from survey data)	1300	
36	Importers net margin (line 35-34)	66	
37	% mark-up of importer	5.08	
38			
39	**LARGE-SCALE WHOLESALER (ELDORET)[4]**		
40	Wholesaler's buying price (line 35)	1300	

Table 8.1. PORT TO FARMGATE COST BUILD-UP FOR DAP FERTILIZER (APRIL, 1999): Channel 1, con't.			
41	Operating Costs	138	
42	Wholesaler/distributor's transport costs Nairobi - Eldoret		60
43	Handling Costs (cost of unloading (receiving) and loading (selling) fertilizer		6
44	Labor costs to repair torn bag		0
45	Transit losses		8
47	Storage Costs(rent, labor, security, electricity)		10
48	Cost of credit		1
49	Opportunity cost of capital		53
51			
	Total Wholesalers Costs (lines 40+41)	1438	
52	Wholesalers' selling price (from survey data)	1450	
53	Wholesalers' net margin	12	
54	% mark-up of wholesaler	0.83	
55			
56	**LARGE-SCALE RETAILER (ELDORET)**		
57	Retailer buying price	1450	
58	Operating Costs	61	
59	Retailer transport costs (from wholesaler)		0
60	Handling Costs (cost of unloading (receiving) and loading (selling) fertilizer		4
61	Labor costs to repair torn bag		0
62	Transit losses		30
63	Rebagging		10
65	Storage Costs(rent, labor, security, electricity)		10
66	Cost of credit		4
67	Opportunity cost of capital		3
68			
69	Total Retailer Costs (line 57+58)	1511	
70	Retailer actual selling price (from survey data)	1550	
71	Retailer net margin (line 70-69)	39	
72	% mark-up of retailer (line 71/70)	2.52	
73	Transport to farmgate (assuming matatu and boda-boda used)	80	
74	**FARMGATE PRICE (line 70+73)**	1630	

Source: 1999 Fertilizer Trader Survey

[1] Average number of bags of all types of fertilizer purcahsed per fertilizer trading season = 1,000,000

[2] Source: Fertilizer Market Bulletin; Bureau of Labor Statistics

[3] Shorehandling includes: unloading from the ship; rebagging; and loading onto the trucks. These services are provided by KPA personnel.

[4] Average number of bags of all types of fertilizer purcahsed per fertilizer trading season = 128,000.

[5] Average number of bags of all types of fertilizer purcahsed per fertilizer trading season = 1200.

* Supplier delivers when trader purchases at least 100 bags

Table 8.2. PORT TO FARMGATE COST BUILD-UP FOR DAP FERTILIZER (APRIL, 1999): CHANNEL 2			
CHANNEL ROUTE: NAIROBI - ELDORET (UASIN GISHU DISTRICT)			
	LARGE-SCALE IMPORTER (NAIROBI)[1]	**Kenya Shillings per 50 kg bag**	
1	Importer buying price = US FOB price in November 1998[2]	707	
2	Freight rates (from port of Florida November 1998))	98	
3	Insurance (1% of landed cost of fertilizer)	8	
4	CIF price (lines 1 + 2 + 3)	813	
5	Port charges (lines 6 to 12)	84	
6	IDF (2.75% of CIF price)		22
7	KBS (.2% of CIF price)		2
8	KARI (1% of CIF price)		8
9	KPA Shore Handling[3]		16
10	Misc.KPA charges		1
11	Stevedoring		28
12	Agency Fees (0.8% of CIF price)		7
13			
15	Costs incurred at the port (lines 16 to 19)	75	
16	Bagging		26
17	Bags		12
18	Local transport (to Mombasa warehouse)		23
19	Local handling charges		14
20			
21	Importers Costs ex-Mombasa (lines 4 + 5 + 15)	972	
22	Transport costs to Nairobi (Road)	125	
23	Transit losses	8	
24	Cost incurred in Nairobi (lines 25 to 32)	129	
25	Bank (LC) (3% of CIF price)		24
26	Handling Costs (cost of unloading (receiving) and loading (selling) fertilizer		6
27	Labor costs to repair torn bag		0
28	Transit losses		8
30	Storage Costs(rent, labor, security, electricity)		23
31	Cost of credit		1
32	Opportunity cost of capital		67
33			
34	Total importers costs (lines 21 + 22 + 23 + 24)	1234	
35	Importers selling price = wholesaler's buying price (from survey data)	1300	
36	Importers net margin (line 35 - 34)	66	
37	% mark-up of importer (line 36/35)	5.08	
55			
56	**LARGE-SCALE RETAILER (ELDORET)**		
57	Retailer buying price (line 35)	1300	
58	Operating Costs	121	
59	Retailer transport costs (from wholesaler)		60

Table 8.2. PORT TO FARMGATE COST BUILD-UP FOR DAP FERTILIZER (APRIL, 1999): CHANNEL 2, con't.

60	Handling Costs (cost of unloading (receiving) and loading (selling) fertilizer		4
61	Labor costs to repair torn bag		0
62	Transit losses		30
63	Rebagging		10
65	Storage Costs(rent, labor, security, electricity)		10
66	Cost of credit		4
67	Opportunity cost of capital		3
68			
69	Total Retailer Costs (line 57+58)	1421	
70	Retailer actual selling price (from survey data)	1550	
71	Retailer net margin (line 70-69)	129	
72	% mark-up of retailer (line 71/58)	9.08	
73	Transport to farmgate (assuming matatu and boda-boda used)	80	
74	**FARMGATE PRICE (line 70+73)**	1630	

Source: 1999 Fertilizer Trader Survey

[1] Average number of bags of all types of fertilizer purcahsed per fertilizer trading season = 1,000,000

[2] Source: Fertilizer Market Bulletin; Bureau of Labor Statistics

[3] Shorehandling includes: unloading from the ship; rebagging; and loading onto the trucks. These services are provided by KPA personnel.

[4] Average number of bags of all types of fertilizer purcahsed per fertilizer trading season = 128,000.

[5] Average number of bags of all types of fertilizer purcahsed per fertilizer trading season = 1200.

* Supplier delivers when trader purchases at least 100 bags

TABLE 8.3 PORT TO FARMGATE COST BUILD-UP FOR DAP FERTILIZER (APRIL, 1999): CHANNEL

Channel Route: Nairobi - Eldoret - Matunda (Uasin Gishu District); Exchange Rate: Ksh70 = US$1

	VERTICALLY INTEGRATED IMPORTER	**Kenya Shillings per 50kg bag**	
	Operating Costs		
1	Importer buying price = US FOB price in November 1998[3]	1050	
2	Freight rates (from port of Florida November 1998))	112	
3	Insurance (1% of landed cost of fertilizer)	12	
4	CIF price (lines 1-3)	1174	
5	Total Port charges (lines 6-12)	101	
6	IDF (2.75% of CIF price)		32
7	KBS (.2% of CIF price)		3
8	KARI (1% of CIF price)		12
9	KPA Shore Handling[4]		16
10	Misc.KPA charges		1
11	Stevedoring		28
12	Agency Fees (0.8% of CIF price)		9
13			
15	Other costs incurred at the port (lines 16-19)	93	
16	Bagging		26
17	Bags		12
18	Local transport (to Mombasa warehouse)		23
19	Local handling charges		32
20			
21	Importers Costs ex-Mombasa (lines 4 + 5 + 15)	1368	
22	Other importer costs (lines 22 - 32)	309	
23	Transport costs to Kitale		175
24	Transit losses		24
25	Bank (LC) (3% of CIF price)		35
26	Handling Costs (cost of unloading (receiving) and loading (selling) fertilizer		10
27	Labor costs to repair torn bag		1
30	Storage Costs(rent, labor, security, electricity)		16
31	Cost of credit		0
32	Opportunity cost of capital		48
33			
34	Total importers costs (lines 21 + 22)	1677	
35	Importers actual selling price = wholesaler's buying price (from survey data)	1800	
36	Importers net margin (lines 35 - 34)	123	
37	% mark-up of importer (line 36/35)	6.83	
38			
39	**SMALL-SCALE WHOLESALER**		
40	Wholesaler's buying price (line 35)	1800	
41	Operating Costs	67	

TABLE 8.3 PORT TO FARMGATE COST BUILD-UP FOR DAP FERTILIZER (APRIL, 1999): CHANNEL 3, con't.			
42	Wholesaler/distributor's transport costs Kitale - Matunda		30
43	Handling Costs (cost of unloading (receiving) and loading (selling) fertilizer		0
44	Labor costs to repair torn bag		0
45	Transit losses		28
47	Storage Costs(rent, labor, security, electricity)		4
48	Cost of credit		1
49	Opportunity cost of capital		4
50			
51	Total Wholesaler Costs (lines 40 + 41)	1867	
52	Wholesalers' actual selling price (from survey data)	1887	
53	Wholesalers' net margin (lines 52 - 51)	20	
54	% mark-up of wholesaler (lines 53/53)	1.06	
55			
56	**SMALL-SCALE RETAILER**		
57	Retailer buying price	1887	
58	Operating Costs (lines 59 to 67)	66	
59	Retailer transport costs (from wholesaler)		0
60	Handling Costs (cost of unloading (receiving) and loading (selling) fertilizer		0
61	Labor costs to repair torn bag		0
62	Transit losses		47
63	Rebagging		10
65	Storage Costs(rent, labor, security, electricity)		8
66	Cost of credit		1
67	Opportunity cost of capital		0
68			
69	Total Retailer Costs (lines 57 + 58)	1953	
70	Retailer actual selling price (from survey data)	2000	
71	Retailer net margin (lines 70 - 69)	47	
72	% mark-up of retailer (lines 71 / 70)	2.35	
73	Transport to farmgate (assuming matatu and boda-boda used)	80	
74	**FARMGATE PRICE** (lines 70 + 73)	2080	

Source: 1999 Fertilizer Trader Survey

[1] Average number of bags of all types of fertilizer purcahsed per fertilizer trading season = 1,000,000

[2] Source: Fertilizer Market Bulletin; Bureau of Labor Statistics

[3] Shorehandling includes: unloading from the ship; rebagging; and loading onto the trucks. These services are provided by KPA personnel.

[4] Average number of bags of all types of fertilizer purcahsed per fertilizer trading season = 128,000.

[5] Average number of bags of all types of fertilizer purcahsed per fertilizer trading season = 1200.

* Supplier delivers when trader purchases at least 100 bags

TABLE 8.4 PORT TO FARMGATE COST BUILD-UP FOR DAP FERTILIZER (APRIL, 1999): CHANNEL 4			
CHANNEL ROUTE: NAIROBI - ELDORET - MATUNDA (TNZ AND UASIN GISHU DISTRICT)			
TYPE OF CHANNEL: LSI - LSW - SSW - SSR			
	LARGE-SCALE IMPORTER (NAIROBI)[1]	**Kenya Shillings per 50kg bag**	
1	Importer buying price = US FOB price in November 1998[2]	707	
2	Freight rates (from port of Florida November 1998))	98	
3	Insurance (1% of landed cost of fertilizer)	8	
4	CIF price (line 1+2+3)	813	
5	Port charges	84	
6	IDF (2.75% of CIF price)		22
7	KBS (.2% of CIF price)		2
8	KARI (1% of CIF price)		8
9	KPA Shore Handling[3]		16
10	Misc.KPA charges		1
11	Stevedoring		28
12	Agency Fees (0.8% of CIF price)		7
13			
15	Costs incurred at the port	75	
16	Bagging		26
17	Bags		12
18	Local transport (to Mombasa warehouse)		23
19	Local handling charges		14
20			
21	Importers Costs ex-Mombasa (line 4+5+15)	972	
22	Transport costs to Nairobi (Road)	125	
23	Transit losses	8	
24	Cost incurred in Nairobi	121	
25	Bank (LC) (3% of CIF price)		24
26	Handling Costs (cost of unloading (receiving) and loading (selling) fertilizer		6
27	Labor costs to repair torn bag		0
30	Storage Costs(rent, labor, security, electricity)		23
31	Cost of credit		1
32	Opportunity cost of capital		67
33			
34	Total importers costs (line 21+22+23+24)	1226	
35	Importers selling price = wholesaler's buying price (from survey data)	1300	
36	Importers net margin (line 35-34)	74	
37	% mark-up of importer (line 36/35)	5.69	
38			
39	**LARGE-SCALE WHOLESALER (KITALE)[4]**		

TABLE 8.4 PORT TO FARMGATE COST BUILD-UP FOR DAP FERTILIZER (APRIL, 1999): CHANNEL 4, con't.			
40	Wholesaler's buying price (line 35)	1300	
41	Operating Costs	148	
42	Wholesaler/distributor's transport costs Nairobi - Kitale		70
43	Handling Costs (cost of unloading (receiving) and loading (selling) fertilizer		6
44	Labor costs to repair torn bag		0
45	Transit losses		8
47	Storage Costs(rent, labor, security, electricity)		10
48	Cost of credit		1
49	Opportunity cost of capital		53
51			
	Total Wholesalers Costs	1448	
52	Wholesalers' selling price	1550	
53	Wholesalers' net margin	102	
54	% mark-up of large-scale wholesaler (line 53/52)	6.58	
	SMALL-SCALE WHOLESALER		
55	Wholesaler's buying price	1550	
56	Operating Costs	77	
57	Wholesaler/distributor's transport costs Kitale - Matunda		40
58	Handling Costs (cost of unloading (receiving) and loading (selling) fertilizer		0
59	Labor costs to repair torn bag		0
60	Transit losses		28
61	Storage Costs(rent, labor, security, electricity)		4
62	Cost of credit		1
63	Opportunity cost of capital		4
64	Total Wholesaler Costs (line 55+56)	1627	
65	Wholesalers' actual selling price (from survey data)	1650	
66	Wholesalers' net margin (line 65-64)	23	
67	% mark-up of large-scale wholesaler (line 66/65)	1.39	
	SMALL-SCALE RETAILER		
68	Retailer buying price	1650	
69	Operating Costs	66	
70	Retailer transport costs (from wholesaler)		0
71	Handling Costs (cost of unloading (receiving) and loading (selling) fertilizer		0
72	Labor costs to repair torn bag		0
73	Transit losses		47
74	Rebagging		10
75	Storage Costs(rent, labor, security, electricity)		8

TABLE 8.4 PORT TO FARMGATE COST BUILD-UP FOR DAP FERTILIZER (APRIL, 1999): CHANNEL 4, con't.			
76	Cost of credit		1
77	Opportunity cost of capital		0
78			
79	Total Retailer Costs (line 68+69)	1716	
80	Retailer actual selling price (from survey data)	1850	
81	Retailer net margin (line 80-79)	134	
82	% mark-up of retailer (line 81/80)	7.24	
83	Transport to farmgate (assuming matatu and boda-boda used)	80	
84	**FARMGATE PRICE (line 80+83)**	1930	

Source: 1999 Fertilizer Trader Survey

[1] Average number of bags of all types of fertilizer purcahsed per fertilizer trading season = 1,000,000

[2] Source: Fertilizer Market Bulletin; Bureau of Labor Statistics

[3] Shorehandling includes: unloading from the ship; rebagging; and loading onto the trucks. These services are provided by KPA personnel.

[4] Average number of bags of all types of fertilizer purcahsed per fertilizer trading season = 128,000.

[5] Average number of bags of all types of fertilizer purcahsed per fertilizer trading season = 1200.

* Supplier delivers when trader purchases at least 100 bags

The cost build-ups show several interesting findings. First, there are large differences in the prices paid by farmers through the four marketing channels. Farm-gate prices for DAP were as high as 2,080 Ksh per 50kg bag through Channel 3 (the vertically-integrated channel of importer/wholesaler to small wholesaler to small retailer in Matunda, a small town outside Kitale). This price was equivalent to $595 per tonne during the survey period (April 1999, 70 Ksh=1 $US). However, Channel 4, which also services farmers in Matunda, was able to make DAP available at 1,930 Ksh per bag, equivalent to $533 per bag. In the other two Channels (1 and 2), which retail DAP from the town center of Kitale and therefore face lower transport costs than the channels serving Matunda, farm-gate prices were both around 1,630 Ksh per bag ($430 to $480 per tonne).

A second important finding is that profit margins for fertilizer traders were all relatively low in this survey year. Importers' mark-up margins (the difference between their selling price and buying price divided by their buying price) were in the range of 5% to 6% in all four marketing channels. Wholesalers' mark-up margins ranged from less than one percent in the case of Channel 1 to 7% in Channel 4. Retailers' margins ranged from 2% in the cases of retailers in Channels 1 and 3, up to 9% in Channel 2. Channel 2 is unique in that only two traders were involved in the domestic supply chain, and mark-up margins were relatively high for both agents in this channel. Apparently they could by-pass the wholesaler stage and afford to take a higher cut as a result and still offer a relatively competitive price to farmers.

Third, the generally low mark-up margins of traders indicates that the relatively high price of DAP fertilizer in western Kenya (when compared to other countries in the region) is due to high costs incurred in domestic distribution and not excessive profits of fertilizer traders. The relatively low mark-up margins at each stage is consistent with the observation that there appears to be strong competition in the survey areas at each stage, especially wholesaling and retailing.

Fourth, there is also great price risk incurred by these traders. An example of how price risk may affect the margins of fertilizer traders occurred during the survey recall period in 1999. Two major importers were unable to import fertilizer because their local bank was having problems and as a result the international bank refused to guarantee their letters of credit. This created a shortage in the market which another major importer attempted to fill by ordering another consignment of fertilizer which began to arrive and be distributed in March/April. However, in the interim, there was a severe shortage of fertilizer in Kenya, and as a result, wholesalers and retailer supplies were constrained and prices reached unprecedented levels of up to Ksh2000 in April 1999.

Fifth, the c.i.f. price of DAP in Mombasa during the survey period was roughly 45% to 55% of the farm-gate price of DAP in western Kenya. Thus, a major portion of the farm-gate price is taken up in distributing DAP internally. The internal costs include transportation and handling, storage and interest charges for financing the fertilizer purchases, and charges for transit losses, and bagging. Most, if not all of these costs are beyond the control of fertilizer traders themselves. They hire out for these services and must simply absorb them as costs that are then passed on to the next buyer. Ultimately, farmers pay for these costs. There may be some scope to reduce these costs through procedures to improve efficiency. For example, traders reported

that losses of fertilizer in transit add costs ranging from 38 Ksh per bag in the relatively short supply chain of Channel 2, to about 95 Ksh per bag in Channels 3 and 4. Transit losses were especially large toward the end of the marketing channel as fertilizer was transported to the smaller towns in rural areas. Retailers transit losses were on average about 3 times greater per unit shipped than for importers and large wholesalers. These transit loss costs are passed on to farmers in the form of higher prices. They amount to 3% of the farm-gate price in Channel 2 to almost 5% of the farm-gate price in Channels 3 and 4.

However, the greatest scope for fertilizer cost reduction appears to rest with government, in terms of investments to reduce transport costs through infrastructure improvement and through reducing the taxes and charges incurred at the port of Mombasa. The cost build-ups show that port fees and taxes amount to about 64 Ksh/bag, which contributes about 3% to the retail farm-gate price. Domestic transport costs (not including handling costs) in each of the supply chains contribute Ksh 222 and 302 per bag in Channels 1 and 2, and Ksh 285 and 315 per bag for Channels 3 and 4, which involve an extra transportation step in bringing the fertilizer from Kitale to Matunda. Transport costs per km traveled increase greatly toward the end of the supply chain as fertilizer is transported in smaller units along generally poorer-quality roads.

Also, all of the surveyed traders indicated that they could not transport their fertilizer directly up-country from the port of Mombasa but rather needed to transport the goods to a local warehouse near the port before securing road transport for subsequent movement up-country. This extra stage involves a 55 ksh per bag addition to transport and handling costs. The Kenya Port Authority (KPA) also has a stipulation that stevedoring and loading onto vehicles at the port can only be carried out by KPA employees or 'gangs' as they are commonly referred to. Moreover, only certain transporters are licensed to be on hand at the port to load and transport the fertilizer outside the port. This extra stage involves a 37 ksh per bag addition to transport and handling costs. Also, transit losses are incurred with each additional handling and transport stage. The net effect of these problems is to cause relatively high domestic transport rates per ton/kilometre. Under the assumption that transport costs and port charges could be reduced, in Section 6 we simulate the effects of a 20% transport cost reduction and a waiving of port taxes on the farm-gate price of DAP and their implications for the profitability of using DAP on maize by farmers.

6. FARM-BUDGET SIMULATIONS

An important question for agricultural policy is whether there are feasible changes in policies and/or investment strategies that can reduce the farm-gate price of fertilizer. From the farm budgets for Western Kenya presented in Table 2, Section 1, it can be seen that farmers in the Trans Nzoia and Kakamega/Lugari undertake a number of additional activities in the cultivation of maize and operate with higher production costs per acre than farmers in Bungoma. Therefore, given similar levels of fertilizer application, fertilizer comprises a higher share of total costs of producing one acre of maize in Bungoma. Top dressing and basal fertilizer comprises 29.7% of the costs of production in Bungoma, compared to 27.6% in Kakamega/Lugari and 17.4% in Trans Nzoia. Therefore, in medium potential zones like Bungoma, profitability of fertilizer use may be more sensitive to the price of fertilizer, because it comprises a higher percentage of total production costs.

To test these hypotheses, this section reports results of sensitivity analysis on the price of DAP, reflecting several scenarios that are envisioned to reduce farm-gate prices. These scenarios are (1) elimination of government taxes and fees charged at the port of Mombasa; (2) better coordination between port off-loading and up-country transport so that the extra step of transferring fertilizer from the port to local warehouses in Mombasa is avoided; (3) a 20% reduction in transport costs assumed to result from improvements in road infrastructure; and (4) the combined effects of all three of these sources of cost reduction. For exposition purposes, we selected the cost structure of Channel 3 as the base case.

The exposition as to how the cost build-ups for Channel 3 are affected by these scenarios is shown in Appendix 1. Scenario 1 -- the elimination of government taxes and fees at the port -- is assumed to reduce the farm-gate price of fertilizer by 64 Ksh per bag. Scenario 2 – the elimination of the need for storage in Mombasa – is assumed to reduce farm-gate prices by 55 Ksh per bag. In Scenario 3, a 20% decline in transport costs is assumed to reduce farm-gate prices by 57 Ksh per bag. The combined total cost reduction if all three of these scenarios were introduced simultaneously (Scenario 4) would be roughly 176 Ksh per bag. These cost reductions would apply to all fertilizer transported through these supply chains, which include not only DAP but also top dressing fertilizers such as CAN and urea. We then examine the effects of each of these scenarios on total production costs per acre and profit per bag of maize produced.

The simulation results are presented in Table 9. Costs per acre and profit per bag are copied from Table 2, which are based on the use of 75 kgs of DAP (basal) and 100 kgs of CAN (top dressing) per acre. Under Scenario 1, which reflects the abolition of Mombasa port fees, the profit per bag of maize increases 11.9% in Bungoma, 6.4% in Lugari, and 3.0% in Trans Nzoia. As mentioned earlier, maize profitability is more sensitive to the price of fertilizer in Bungoma because under recommended application rates, they form a higher proportion of total production costs compared to the other districts. While the removal of port taxes would not appreciably affect maize profitability per bag in areas with high production costs and high agronomic response rates to fertilizer application, such as Trans Nzoia, they appear to have a significant effect on the profitability of maize production in medium-potential areas such as eastern Bungoma, other factors constant. The impact on profitability of Scenarios 2 and 3 are comparable to those of Scenario 1.

Over the long run, in which in may be more possible to capture the combined benefits of several of these scenarios, the implications of reducing marketing cost in the fertilizer supply chains are very important. As shown in the last row of Table 9, the combined effects of each of the three individual scenarios are dramatic. Using recommended rates of DAP and CAN in Bungoma, the profit per bag of maize produced increases by 32%, while in Lugari and Trans Nzoia, profits per bag increase by 17.8% and 10.5%, respectively.

Table 9. Simulated Changes in Maize Profitability From Illustrative Reductions in Fertilizer Marketing Costs, Bungoma, Lugari, and Trans Nzoia Districts, 1999.

Scenario	Profit Measure	Bungoma	Lugari	Trans Nzoia
Base Case (as shown in Table 2):	Fertilizer Costs as % of total production costs per acre:	29.7	27.6	17.4
	Cost per acre (Ksh):	11,607	13,567	19,870
	Profit per 90kg bag maize (Ksh):	135	202	305
Scenario 1: Remove Mombasa Port fees[1]	Cost per acre (Ksh):	11,383	13,343	19,646
	Profit per 90kg bag maize (Ksh):	151	215	314
	% increase profit/bag maize (relative to Base Case):	+11.9	+ 6.4	+ 3.0
Scenario 2: Port-to-up-country transport coordination, obviating need for transport to warehouse and port storage[2]	Cost per acre (Ksh):	11,415	13,374	19,678
	Profit per 90kg bag maize (Ksh):	148	213	313
	% increase profit/bag maize (relative to Base Case):	+10.4	+ 5.4	+ 2.6
Scenario 3: 20% transportation cost reduction[3]	Cost per acre (Ksh):	11,408	13,367	19,671
	Profit per 90 kg bag maize (Ksh):	149	214	313
	% increase profit/bag maize (relative to Base Case):	+10.5	+5.4	+2.6
Scenario 4: combined effects of scenarios 1, 2, and 3[4]	Cost per acre (Ksh):	10,991	12,951	19,080
	Profit per 90 kg bag maize (Ksh):	179	238	337
	% increase profit/bag maize (relative to Base Case):	+32.6	+17.8	+10.5

[1] This will result in a reduction of Ksh 64 per 50kg bag of DAP

[2] This will result in a cost reduction of Ksh55 per 50kg bag of DAP

[3] This will result in a cost reduction of Ksh57 per 50kg bag of DAP

[4] This will result in an accumulated cost reduction of Ksh176 per 50kg bag of DAP

These simulation results are likely to underestimate the actual increase in the profitability of using fertilizer on maize in western Kenya. This is because the simulations are based simply on benefits from lower fertilizer prices, holding application rates constant. In reality, farmers are likely to respond to lower fertilizer prices by increasing the quantity applied to maize, other factors constant. In theory, farmers would increase their use of an input until the marginal cost of applying an additional kg would equal the marginal value of output produced. While risk aversion issues are also important to consider, it is likely that the simulation results show a

conservative estimate of changes in maize production profitability resulting from the illustrative reductions in fertilizer marketing costs.

7. CONCLUSION AND POLICY RECOMMENDATIONS

This paper set out to describe and analyze how the private sector has organized itself to supply fertilizer to farmers in Kenya, subsequent to government withdrawal from fertilizer distribution in 1993. The analysis indicates that DAP fertilizer marketing costs have declined in real terms over the 1990s. However, the maize/DAP price ratio has also declined over the 1990s. The decline in the maize/DAP price ratio has been associated with a gradual depreciation of the Kenyan shilling, which tends to increase the prices of internationally-traded commodities such as fertilizer relative to commodities such as maize that are primarily locally-traded.

The study also found that overall, fertilizer use has increased by roughly 20% in the 1993-1998 period compared to the 1985-1992 period. There has also been a shift in the composition of fertilizers used in Kenya, with those used on tea, wheat, and horticulture having increased, while DAP, which is primarily used on maize, has stagnated.

The study also found that numerous types of private sector supply chains have evolved in the liberalization era. There appears to be strong competition at all stages of the supply chain, with relatively small mark-up margins being earned at importer and wholesaler levels. In the four supply chains analyzed, importer profit margins for DAP were about 5% to 7% of their selling price; wholesalers' mark-up margins were between zero and 6%, and retailers' mark-ups were from 2% to 9%. An examination of the cost structure of the marketing channels, using cost build-up accounting methods, revealed that port charges, transport costs, and transit losses were major cost components experienced by traders. There is room to reduce these costs by removing restrictions at the port that stipulate that only Kenya Port Authority-approved 'gang's can unload fertilizer form ships and load them onto trucks for transportation, and that only certain KPA approved transporters can be on hand to transport the fertilizer out of the port. If the fertilizer could be loaded directly onto trucks that transported the fertilizer directly upcountry to Nairobi or Eldoret/Kisumu, this would make unnecessary certain storage and transportation charges incurred at the port. The elimination of such costs would have non-marginal effects on farm-level profitability of fertilizer use on maize in some areas in western Kenya, but not others. For example, the elimination of these extra transport, handling and storage costs at the port would reduce the per hectare costs of maize production by 10.4% in Bungoma, 5.4% in Lugari, and less than 3% in Trans Nzoia for farmers using recommended rates of DAP and CAN application per acre. If the government eliminated the various port fees and levies charged to importers, this alone would reduce maize production costs by almost 12% in Bungoma and by over 6% in Lugari.

In the long run, it may be more possible to achieve cost reductions in several stages of the supply chain, and the cumulative effects of this on the profitability of maize production would be quite dramatic. The combination of removing port restrictions, eliminating port fees on fertilizer, and reducing transit losses are estimated to increase the profits per bag of maize produced by over

30% in Bungoma, 17% in Lugari, and close to 10% in Trans Nzoia. This would in turn alleviate the budget pressures faced by the Government of Kenya in supporting maize prices by the National Cereals Produce Board, and would also make Kenyan maize more competitive vis a vis the international market and neighboring countries. Currently, the government implements an import tax on maize and buys maize from farmers at a high price relative to market conditions in order to provide farmers with adequate production incentives. The Government of Kenya may wish to consider how a reduction in port fees on fertilizer might affect costs of domestic maize production and the required support price level needed to maintain the same expected profit margin per bag of maize produced. The strategy of reducing maize production costs rather than supporting output prices would also be anticipated to improve the food security position of poor urban consumers and rural households in maize-purchasing regions.

APPENDIX A

APPENDIX A. COST-REDUCTION SCENARIOS, FARMGATE COST BUILD-UPS FOR DAP FERTILIZER (APRIL, 1999)

SIMULATION BASED ON CHANNEL 3 BASE CASE

		---------- All figures are in Kenya Shillings per 50kg Bag ----------									
				Scenario 1:		**Sceario 2:**		**Scenario 3:**		**Scenario 4:**	
	VERTICALLY INTEGRATED IMPORTER	**Base Case**		**Eliminate Port Fees**		**Eliminate Need for Port Storage**		**20% Reduction in Transport Cost**		**Combined Effects of Scenarios 1, 2, and 3**	
	Operating Costs										
1	Importer buying price = US FOB price in November 1998[3]	1050		1050		1050		1050		1050	
2	Freight rates (from port of Florida November 1998))	112		112		112		112		112	
3	Insurance (1% of landed cost of fertilizer)	12		12		12		12		12	
4	CIF price (lines 1-3)	1174		1174		1174		1174		1174	
5	Total Port charges (lines 6-12)	101		37		101		101		37	
6	IDF (2.75% of CIF price)		32		0		32		32		0
7	KBS (.2% of CIF price)		3		0		3		3		0
8	KARI (1% of CIF price)		12		0		12		12		0
9	KPA Shore Handling[4]		16		0		16		16		0
10	Misc.KPA charges		1		0		1		1		0
11	Stevedoring		28		28		28		28		28
12	Agency Fees (0.8% of CIF price)		9		9		9		9		9
13											
15	Other costs incurred at the port (lines 16-19)	93		93		38		93		38	
16	Bagging		26		26		26		26		26
17	Bags		12		12		12		12		12
18	Local transport (to Mombasa warehouse)		23		23		0		18.4		0
19	Local handling charges		32		32		0		32		0
20											
21	Importers Costs ex-Mombasa (lines 4 + 5 + 15)	1368		1304		1313		138		1249	

APPENDIX A. COST-REDUCTION SCENARIOS, FARMGATE COST BUILD-UPS FOR DAP FERTILIZER (APRIL, 1999), con't.											
22	Other importer costs (lines 22 - 32)	309		309		309		274		274	
23	Transport costs to Kitale		175		175		175		140		140
24	Transit losses		24		24		24		24		24
25	Bank (LC) (3% of CIF price)		35		35		35		35		35
26	Handling Costs (unloading, loading)		10		10		10		10		10
27	Labor costs to repair torn bag		1		1		1		1		1
30	Storage Costs(rent, labor, security, electricity)		16		16		16		16		16
31	Cost of credit		0		0		0		0		0
32	Opportunity cost of capital		48		48		48		48		48
33											
34	Total importers costs (lines 21 + 22)	1677		1613		1622		1642		1523	
35	Importers actual selling price = wholesaler's buying price	1800		1736		1745		1765		1646	
36	Importers net margin (lines 35 - 34)	123		123		123		123		123	
37	% mark-up of importer (line 36/35)	6.83		7.09		7.05		6.97		7.47	
38											
39	**SMALL-SCALE WHOLESALER**										
40	Wholesaler's buying price (line 35)	1800		1736		1745		1765		1646	
41	Operating Costs	67		67		67		61		61	
42	Wholesaler/distributor's transport costs Kitale - Matunda		30		30		30		24		24
43	Handling Costs (unloading, loading)		0		0		0		0		0
44	Labor costs to repair torn bag		0		0		0		0		0
45	Transit losses		28		28		28		28		28
47	Storage Costs(rent, labor, security, electricity)		4		4		4		4		4
48	Cost of credit		1		1		1		1		1
49	Opportunity cost of capital		4		4		4		4		4
50											
51	Total Wholesaler Costs (lines 40 + 41)	1867		1803		1812		1826		1707	
52	Wholesalers' actual selling price (from survey data)	1887		1823		1832		1846		1727	
53	Wholesalers' net margin (lines 52 - 51)	20		20		20		20		20	
54	% mark-up of wholesaler (lines 53/53)	1.06		1.10		1.09		1.08		1.16	

APPENDIX A. COST-REDUCTION SCENARIOS, FARMGATE COST BUILD-UPS FOR DAP FERTILIZER (APRIL, 1999), con't.											
55											
56	**SMALL-SCALE RETAILER**										
57	Retailer buying price	1887		1823		1832		1846		1727	
58	Operating Costs (lines 59 to 67)	66		66		66		66		66	
59	Retailer transport costs (from wholesaler)		0		0		0		0		0
60	Handling Costs (unloading, loading)		0		0		0		0		0
61	Labor costs to repair torn bag		0		0		0		0		0
62	Transit losses		47		47		47		47		47
63	Rebagging		10		10		10		10		10
65	Storage Costs(rent, labor, security, electricity)		8		8		8		8		8
66	Cost of credit		1		1		1		1		1
67	Opportunity cost of capital		0		0		0		0		0
68											
69	Total Retailer Costs (lines 57 + 58)	1953		1889		1898		1912		1793	
70	Retailer actual selling price (from survey data)	2000		1936		1945		1959		1840	
71	Retailer net margin (lines 70 - 69)	47		47		47		47		47	
72	% mark-up of retailer (lines 71 / 70)	2.35		2.43		2.42		2.40		2.55	
73	Transport to farmgate (assuming matatu and boda-boda used)	80		80		80		64		64	
74	**FARMGATE PRICE** (lines 70 + 73)	2080		2016		2025		2023		1904	

Source: 1999 Fertilizer Trader Survey

[1] Average number of bags of all types of fertilizer purcahsed per fertilizer trading season = 1,000,000

[2] Average number of bags of all types of fertilizer purcahsed per fertilizer trading season = 300,000

[3] Source: Fertilizer Market Bulletin; Bureau of Labor Statistics

[4] Shorehandling includes: unloading from the ship; rebagging; and loading onto the trucks. These services are provided by KPA personnel.

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