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Kenyan Supermarkets and Horticultural Farm Sector Development

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1. Introduction

The rise of supermarkets in developing countries has received considerable attention in the development economics literature over the past few years (Reardon et al. 2003). That literature shows that (1) supermarkets are spreading quickly in urban areas; (2) supermarket chains are modernizing their product procurement systems, differentiating them from those used by traditional retailers and wholesalers. In Kenya for example, Neven and Reardon (2004) show that supermarkets are growing at an annual rate of 18% and have a 20% share of the urban food market overall (although only an extremely incipient 4% of the FFV (fresh fruit and vegetable) market).

Supermarket chains in Kenya have recently begun to modernize their procurement systems by centralizing procurement over the country into distribution centers (away from store-by-store sourcing), by selecting sets of preferred supplier-farmers and specialized wholesalers dedicated to sourcing from those farmers as well as the wholesale markets, and instituting incipient and basic private standards of quality. In 1997, when supermarkets first started selling FFV in a significant way, they procured from whatever source was available, hence sourcing only 30% direct, and the rest from traditional brokers. Over the past few years, the chains have begun shifting toward sourcing directly from farmers. In interviews with supermarket procurement officers, they told us that sourcing direct allows them to inspect the farm to judge potential reliability in volumes and quality by noting farm size, presence of irrigation, and the water source, allows them to cut out intermediaries' margins, and have more control of supply

through direct communication. By 2003, they sourced 50% directly, and told us that share would grow.

The new procurement systems puts more demands on the farmer than the traditional system – a spot market, fragmented, few if any standards, operating through many small brokers. The little research that has been done in developing countries on how supermarkets have changed market conditions and demands for farmers has nearly exclusively focused on the effects of European or US supermarket chains' effects on farmers in poor countries, such as Henson et al. (2005) for Zimbabwe, and Dolan and Humphrey (2000) and McCulloch and Ota (2002) for Kenya. However, despite the recent wave of research on domestic retail and wholesale sector transformation, there has been very little research on the effects of these changes on farmers.

This paper aims at that gap by focusing on the case of supermarkets and horticultural product producers in Kenya. We address three questions: (1) what are the determinants of the farmers' channel choice (supermarket vs. traditional)? (2) What are the production technology effects of participation in the supermarket channel? (3) What are the net income effects of participation in the supermarket channel?

2. Data

The "supermarket-channel farmers" universe is farmers who are listed as direct suppliers of FFV (fresh fruit and vegetables) to the two leading supermarket chains (these chains now market 90% of the FFV sold through supermarkets in Kenya). The "traditional-channel farmers" universe is farmers who sell to traditional wholesalers but not directly to supermarkets.

Two farmer surveys on samples from those universes were conducted. The first survey focused on the capacities of the farmers and the marketing methods they use and focused on a broad set of FFV items. 115 farmers (49 supermarket-channel & 66 traditional-channel farmers) were interviewed. The second survey focused on technology choices and net income effects and focused on kale growers only. 51 farmers (14 supermarket-channel & 37 traditional-channel farmers) were interviewed in this survey.

The supermarket-channel sample was chosen randomly from the preferred-supplier lists provided by the leading two supermarket chains. The traditional-channel sample consisted of kale, tomato, and banana growers selected in three stages. There were no lists or censuses or indeed any available information on the farmers in these areas. We thus selected a set of farmers considered to be a random representative and dispersed sample by the local government extension offices. We used that initial sample as geographic nodes from which to randomly geographically select around them five additional farmers.

3. Patterns in Differences between Supermarket-Channel Farmers and Traditional-Channel Farmers

Table 1 compares supermarket-channel and traditional-channel growers for kale, tomatoes, and bananas, the three products over which we sampled from each channel. These are the two most important vegetables and the most important fruit in both consumption and production in Kenya. Several salient differences between the farmers in the two channels emerge.

Table 1: Differences between Supermarket-Channel and Traditional-Channel Farmers

Crop	Tomato		Kale		Banana	
Farm characteristic	**Trad. Farm. (N=22)**	**Super. Farm. (N=5)**	**Trad. Farm. (N=22)**	**Super. Farm. (N=12)**	**Trad. Farm. (N=22)**	**Super. Farm. (N=5)**
farm size (ha)	2.5 *	9.3 *	1.5 *	18.5 *	2.3	13.8
land irrigated (% of farm size)	93 **	100 **	18 ***	75 ***	41	66
land farmed (% of farm size)	89	80	87 *	71 *	93	88
permanent employees(#/farm)	4	19	3 **	33 **	3	8
casual labor (#/farm)	10 **	17 **	4 *	19 *	4 ***	11 ***
Family labor (% of permanent)	47 ***	3 ***	79 ***	21 ***	74 ***	11 ***
labor-to-land ratio (farm level)	1.4	0.9	1.6	1.1	1.1	0.5
labor-to-land ratio (aggregate)	0.9	0.9	1.1	0.9	0.6	0.4
schooling farm head (yrs)	9 **	13 **	7 ***	13 ***	7 ***	15 ***
farms with phone (%)	29	100	31 ***	100 ***	24	100
farms with irrigation system (%)	100	100	27 ***	92 ***	55	100
farms with drip/overhead irrig. (%)	5	40	18 ***	92 ***	32	40
farms with transp. vehicles (%)	14	80	9 ***	100 ***	5	80
farms with a packing shed (%)	0	80	0 ***	75 ***	0	40
% of hh income from farming	87	82	81	60	87	60
# of different horticultural products grown (at a given time)	2 *	5 *	3 ***	7 ***	3	2
farms collaborating with other farms (%)	46	0	32	33	29	80
farms member of coop/assoc. (%)	18	0	73 ***	8 ***	77	0

Notes: *=significant at the 10% level, ** = significant at the 5% level, *** significant at the 1% level.
Transportation to buyer is for transportation beyond the main road. Most kale farmers will take produce to brokers near main road on a donkey cart.
Source: authors' farmer survey 2003.

Farm Size and Cropping Composition. The supermarket-channel farms are on average five times larger, in overall farm size, than traditional-channel farms (9-18 hectares versus 1.6-2.4 hectares per farm depending on the crop). Supermarket-channel farmers have less of their land under cultivation, but have a far larger percentage of it under irrigation. Both the size and the irrigation advantages make sense from the point of view of the supermarket procurement officer: they want to minimize transaction costs (hence work with the fewest number possible) and have product shipped to them year-round. The supermarket-channel farmers are also more diversified – producing twice the variety of crops compared to the traditional farmers, helping them to manage risk and reduce transaction costs for supermarkets to deal with them ("one stop shopping").

Farm Technology and Assets. Supermarket-channel farmers are more educated, on average with a secondary education versus only primary education for the traditional-channel horticulture farmers. All of the supermarket-channel farmers have a phone, 90% have their own means of transportation, and a large percentage have an advanced irrigation system and a packing shed. By contrast, significantly fewer of the traditional-channel farmers use these technologies, with (cellular) phones having reached the highest degree of diffusion amongst traditional-channel farmers (at 30% of the farmers). The higher capital/labor ratio among supermarket-channel growers again makes sense in terms of the more demanding requirements of this channel in terms of quality standards (in particular cosmetic appearance), volumes, and consistency.

Farmer Organization. There is no significant difference between the channels in degree of organization or farmer association, both of them having a relatively low degree of association. The subset of smaller farmers in the lower quartile of farm size among the supermarket channels are, however, organized, in order to reduce transaction costs for the supermarket client. In one case, an NGO organizes them to participate in the channel, in another, a government-owned company organizes the small farmer, another farmer-group is assisted by a private sector marketing facilitator, and in yet another case a lead farmer contracts small farmers.

Farmer Export or Domestic Market Orientation. It is often assumed that local supermarkets merely "cherry pick" their supplies from the export market suppliers. We found this not to be the case where it would have seemed most likely, in produce. Export markets are of minor importance to FFV supermarket-channel growers, as only 15% of the latter also sell to export markets. This of course differs by product: those involved in higher value, lower volume items such as French beans or avocado tend to also export, while the farmers selling lower value

and heavier products, the majority of the products, such as banana, tomato, and kale, are selling all to the domestic market.

What is then the "Composite Image" of these new Domestic Supermarket Suppliers? The supermarket suppliers appear to be an emerging "domestic elite" in horticulture production, between the small traditional farmers producing for local fragment spot markets, and the mainly larger export farmers producing for a very demanding foreign (supermarket) market. They are thus in an intermediate position. This is especially interesting because the development literature often points to farmer-leaders or innovators, somewhat better capitalized than the average but not extremely distant in capacity, that forge the way in product diversification, market development, and technology modernization. Time will tell whether they set in train such a dynamic; we are observing this at the very early stages.

Our qualitative interviews showed that these farms are for the most part newly-emerging, African-owned farms that, before the recent emergence of the supermarkets, used their land mostly for cattle or gains or left it idle. Supermarkets offered reliable, low-transaction cost contractual arrangements which allowed the land-owners to start managing their farm as regular business operations. For supermarkets, these business-savvy, well-capitalized farms had just the right size for their current needs and the capacity to grow along with the supermarkets as they expand their produce sections.

4. Determinants and Effects of Channel Participation, focus on Kale

For an exploration of the determinants and effects of channel participation, we focus on kale, with an adequate body of producers for supermarkets (and for traditional channels) to allow

statistically significant testing, it is the product for which supermarkets have gone furthest in shifting to direct sourcing from farmers, and kale is the most important horticultural food product and thus important in the agricultural diversification strategies of government – and farmers – alike.

Table 2, 3, and 4 show market channel choice, technology choice (controlling for channel choice in the first stage of the heckit estimation), and input use choice. The salient results are as follows.

First, we model channel choice as an adoption function of market channel. Assets are modeled using 1999 observations to avoid simultaneity bias. The probit estimation results shown in Table 2 concord with the descriptive results above, namely, the probability of a farm participating in the supermarket channel increases as the farm (1) is larger and (2) has drip or overhead irrigation. The marginal effect indicates that, for the average farm, having one more acre of land (i.e., a relatively large 10% increase relative to the average size of 10 acres) increased the probability that the farm will participate in the supermarket channel with nearly 12% while having a drip or overhead irrigation system increases this probability with 46%. Education, age, gender and land-ownership did ceteris paribus not have a statistically significant effect on the probability of a farm entering the supermarket channel.

Second, we model technology differences with production functions for the two sets of channel participants, controlling for the conditional probability of being in the channel. The results are shown in Table 3. We found that both models are significant and that the signs of the coefficients are as expected, namely output increases as, ceteris paribus, more land or more fertilizer are used. Labor was found not to have a statistically significant effect in the model for either channel.

Third, we then compared the marginal product values (MPV) in Table 4 for the significant coefficients (land, fertilizer). Several observations can be made. First, the MPV differs greatly between the two groups of farmers: in absolute terms the MPV is larger for the well-capitalized supermarket-channel farmers while as a relative measure (relative to gross revenue) it is larger for the traditional-channel farmers. Second, each of calculated marginal product values is larger than the corresponding factor cost, indicating that these factors are used below the optimal quantity for both groups of farmers. Third, the average land productivity and the average labor productivity are respectively 59% and 73% higher for supermarket-channel farmers than for traditional-channel farmers.

Fourth, a gross margin analysis for two types of farmers revealed that there are substantial differences between the two groups of farmers. (1) Supermarket-channel farmers use on average twice the amount of inputs per acre used by traditional-channel farmers. (2) Traditional-channel farmers use more labor per acre, mostly because there is an abundance of family labor relative to the small farm sizes. (3) Wages for hired labor are higher in the supermarket channel than in the traditional channel which is in line with the higher labor productivity. (4) There is almost no difference in the production cost per kg of kale between the two groups of farmers. (5) Different marketing practices lead to essential differences in profitability between the two farmer types. Whereas traditional-channel farmers incur only limited marketing costs, they sell to brokers at a low farm-gate price which allows them to break even at best. Supermarket-channel farmers on the other hand incur transportation costs, but receive a price which is more than three times the farm-gate price, resulting in a gross profit of about 40%.

Table 2: Determinants of Farmer Adoption of the Supermarket Channel (Probit Results)

Independent variables	P(Supplies kale to supermarkets) (s.e.)	Marginal effect
Size 99	0.30 (0.157)*	+11.8%
Education head	0.19 (0.164)	-
Percent owned 99	-0.01 (0.014)	-
Irrigation 99	1.35 (0.746)*	+46%
Gender of head	0.55 (1.078)	-
Age of head	0.02 (0.031)	-
Constant	-5.76 (3.930)	-
No. of observations	57	
(Pseudo) R-square	0.7621	

Notes: * = significant at the 10% level. Marginal effect measured at the mean levels of the determinant variables.
Source: authors' farmer survey 2004

Table 3: Heckit Two-Stage Estimates of the Cobb-Douglas Production Functions

Dependent variable: lnoutput Independent variables	Supermarket farmers Coefficient (s.e.)	Traditional market farmers Coefficient (s.e.)
Constant	6.8237 (1.1484)***	6.6034 (0.8699)***
Lnland	0.8681 (0.3133)***	0.5794 (0.2453)**
Lnlabor	-0.3254 (0.2527)	0.0446 (0.2388)
Lnfertil	0.2407 (0.1070)**	0.2030 (0.1553)
Mill's lambda	0.1952 (0.2471)	0.9889 (0.5379)**
Wald Chi^2	107.3	28.25
Significance	0.0000	0.0000

Notes: ** = significant at the 5% level, *** significant at the 1% level.
Source: authors' farmer survey 2004.

Table 4: Input Use and Farm Efficiency

	Supermarket farmers			Traditional farmers		
Input	**MPV**		**FC**	**MPV**		**FC**
Land (ha-months)	19,940Ksh	>	1,647Ksh	7,946Ksh	>	2,675Ksh
Fertilizer (kg)	56Ksh	>	28Ksh			
Productivity Measures						
Labor productivity (average output value per work day)	605Ksh			349Ksh		
Land productivity (average output value per ha-month)	25,352Ksh			15,899Ksh		

Notes: marginal product value (MPV) valued at farm-gate price of Ksh3.6/kg. Factor costs (FC) are sub-sample averages.
Source: authors' farmer survey 2004.

Finally, we use some qualitative results from our survey to support the channel choice results. Supermarkets pay the highest wholesale prices in the market (about 10-20% higher than traditional retailers), but other benefits of selling to supermarkets are even more important to farmers than the higher price. While 34% of the supermarket-channel farmers say that the higher price is the key reason for selling to supermarkets, 46% say that the ease of selling to supermarkets is the key attraction (i.e., lower transaction costs and market risks). The combination of higher net incomes, lower transaction costs and greater transaction stability in the supermarket channel has created a strong growth dynamic: the average farmed acreage of supermarket-channel farmers increased by 104% over 1999-2004, compared to by only 10% for traditional-channel farmers.

5. Summary and Conclusions

The rise of supermarkets in Kenya has given rise to a new group of medium-sized farms managed by well-educated farmers. Focusing on kale, the essay shows that nearly all supermarket-channel farmers have the capacity to supply larger volumes year round and have transportation vehicles, an irrigation system, a packing shed, a cellular phone, and so on, pointing to the existence of a threshold capital vector which farmers must have in order to access supermarkets. Especially farm size and irrigation were found to be significant determinants of participation in the supermarket channel. Kale suppliers to supermarkets use more capital intensive production technologies, leading to average labor and land productivities which are 60-70% higher than in the traditional channel. Eighty percent of labor consists of hired workers, indicating that these farmers could be important in alleviating poverty for rural households with

little or no land. While most traditional-channel kale farmers sell to brokers and get a price that lets them break-even at best, supermarket-channel farmers have a 40% gross profit margin. These margins and lower market risks in the supermarket channel have resulted in a strong growth dynamic of supermarket-channel farmers which have doubled the size of their operations over the last five years.

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