Farmer Response to the Rise of Supermarkets in Kenya's Fresh Fruits and Vegetables Supply System

David Neven and Thomas Reardon

The rise of supermarkets in developing countries has received considerable attention in the development economics literature over the last few years (Reardon and Berdegué 2002; Weatherspoon and Reardon 2003; Hu et al. 2004). Those articles revealed that supermarkets are growing fast; becoming important, even dominant agents in the food-supply chain; and implementing very different procurement systems than those observed in the traditional food-marketing system. In Kenya, for example, Neven and Reardon (2004) showed that supermarkets are growing at an annual rate of 18%, had a 20% share of the urban food market, and are rapidly developing the various pillars of the new procurement system (i.e., centralization, private standards and grades, regionalization, preferred suppliers, specialized wholesalers). While indicating a likely differential impact of this more-demanding procurement system on farmer participation in the supermarket channel, the analyses in this first wave of research on supermarkets in developing countries was for the greater part limited in its scope to data from retailers and wholesalers. Based on farmer surveys in the fresh fruits and vegetables (FFV) sub-sector, this article aims to fill this gap in the literature by analyzing the rise of supermarkets in Kenya from the farmer perspective. The strategic objective of this essay is to assess the effect of the development of the supermarket sector in Kenya on FFV producers'

behavior and net incomes. Controlling for product, we have three research 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?

Conceptual Approach

The rise of supermarkets in Kenya is here modeled as a shock to a domestic FFV supply system. We take an essentially micro-economic approach, focusing on how this shock impacts the behavior of FFV producers as individual agents. First, we model the farmer's decision of whether or not to sell to supermarkets as a standard static-adoption decision, where adoption (in this case of the supermarket channel) is determined by the incentives for and capacities of farmers (Feder, Just, and Zilberman 1985). Second, we assess the differential effect of channel choice on production technology by comparing the production functions for farmers supplying supermarkets and farmers supplying traditional marketing-channel agents. The distribution of the farmers over these two groups is not random but rather the outcome of a self-selection process and this non-randomness may bias the estimated coefficients in the production function. In order to control for this selectivity bias, we use the Heckit two-stage method (Heckman 1979). Third, we assess the net income effect of channel choice using gross-margin analysis. We then place this net income effect in the broader context of value-chain theory (Kaplinsky and Morris 2001).

Definitions and Data

The target population (supermarket-channel farmers) is here defined as "the farmers listed as direct FFV

suppliers to the two leading supermarket chains." This population was selected because within the next five years 85–90% of the locally sourced FFV sold in supermarkets are expected to be supplied directly by farmers, and 90% of FFV sold through supermarkets are sold through the two leading chains. In order to assess to what extent these supermarket-channel farmers are different from farmers supplying through the traditional FFV system (traditional-channel farmers), a similar data set was also collected on farmers who supply directly to traditional marketing agents but not to supermarkets.

Two farmer surveys were conducted. The first survey focused on the capacities of the farmers and the marketing methods they used and on a broad set of FFV items. A total of 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 only. A total of 51 farmers (14 supermarket-channel & 37 traditional-channel farmers) were interviewed in this survey.

The Nature of Supermarket-Channel Farmers

Supermarket-Channel Farmers Compared to Traditional-Channel Farmers

Land-related differences: Supermarket-channel farms are on average much larger, in overall farm size, than traditional farms (23–46 acres vs. 4–6 acres). Other patterns, related to technology and land-use, are that supermarket-channel farmers have less of their land under cultivation but have a far larger percentage of it under irrigation.

Labor and human-capital differences: Supermarket-channel farmers have more permanent employees and more casual workers than do traditional-channel farmers, but the average labor-to-land ratio (number of permanent farm workers per acre of farmed land) is lower for supermarket-channel farmers than for traditional-channel farmers. There is also a clear pattern regarding the education of the farmers: traditional-channel farmers on average have a primary education while supermarket-channel farmers on average have a secondary education.

Physical-capital differences: There is a wide divide in physical technology use between the two farmer groups. 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 (30% of the farmers).

Differences in diversification and organizational capital: In terms of diversification, two observations can be made. First, we found no statistically significant difference in the percentage of overall income from farming. For both channels, farming is, on average, the main source of income. Second, farmers supplying supermarkets grow more than twice as many different horticultural crops and are therefore far less dependent on the production and market risks of any particular crop. While the degree of collaboration among farmers is not related to the channel they operate in, the nature of this collaboration is related: traditional-channel farmers collaborate on marketing, and supermarket-channel farmers collaborate on production issues.

The Relative Impact of Export Channel Farmers in the Supermarket Channel

Export-channel farmers are of limited importance as FFV suppliers to supermarkets, with only 15% of supermarket-channel farmers being involved in export markets as well. Exporters are critical in some produce lines (mostly the higher-value, lower-volume items such as French beans or avocados), and absent in most other produce lines (most domestic market fruits and vegetables, e.g. bananas, tomatoes, kale). This is primarily because there is little overlap in product types.

Supermarket-Channel Farmers Categorized

When we look at supermarket-channel farmers as a group, it becomes apparent that to a large extent they represent a newly emerging class of farmers in Kenya. We made the case above that supermarket-channel farmers are distinct from both typical traditional-channel farmers and export-channel farmers. Based on our random sample of 49 farmers from the leading supermarkets' FFV supplier lists, we can distinguish the following four types of supermarket-channel farmers: specialized farms, whose main focus is the production of FFV for domestic supermarkets; intensifying farms, whose main focus

is not FFV for the domestic market but who use part of their resources to also supply FFV to supermarkets; specialty-product farms, whose main focus is value-added FFV (e.g., vegetable packs) which they supply to supermarkets, among others; and market-diversifying farms, whose main focus is FFV for the domestic market but who do not have the domestic supermarkets as their main focus.

Smallholder Farmer Groups Supplying Supermarkets

The most promising pathway to facilitate greater participation by smallholder producers in the supermarket channel is group organization. Five cases representing five different formats/strategies of such group formation were encountered in this research: an NGO organizing smallholder farmers, a government-owned company organizing smallholder farmers, a farmer-group assisted by a private-sector marketing facilitator, an exporter with smallholder farmers contracted in an outgrowers scheme, and a lead farmer organizing smallholder farmers. These cases represent all the formats we could identify of smallholder involvement in the supermarket channel other than through traditional-channel brokers or through direct supplies. The types of suppliers in these cases represent in this early stage of supermarket development a very minor fraction of the supermarket's FFV supplies (<1%). Apart from the group formation, two additional key success factors emerged from the five cases: a focus on products with a clear market potential, and the catalyzing involvement of private or public organizations as marketing facilitators with a commercial basis (i.e., intended to be sustainable without subsidies).

The Impact of Supermarkets in the Kale Supply Channel

Kale Supply Channels in Kenya

The entry of supermarkets in the kale supply chain leads to supply-channel integration, with the farmer integrating the broker and part of the wholesale function and capturing a far greater part of the marketing margin. The traditional kale supply chain provides marketing solutions to smallholder farmers but is characterized by many intermediaries along the chain, a small percentage of the marketing margin captured by the farmer, high transaction costs (produce changes hands many times using spot markets), and brokers with high market power (they trade the largest volumes and are most knowledgeable about prices at the farm and in the wholesale markets). By stark contrast, the supermarket supply chain for kale is direct, allows the farmer to capture a large portion of the marketing margin, is more efficient from a transaction-cost point of view, and is controlled by the supermarket instead of the broker.

Determinants of Farmer Participation in the Supermarket Channel

We modeled this channel-adoption decision as a probit model. In their most general form, adoption functions contain the following five categories of explanatory variables: prices of inputs, prices of outputs, risk factors, quasi-fixed capital, and shift factors. Output prices, input prices, and risk factors, which are in part implicit to the channel choice and are further determined by farm characteristics such as its location and size, were not directly entered in the implementation model. Location (a shift factor usually included in adoption models) was left out the model because for our sub-sample there was too little variation over this variable; this implies that our channel choice model is mainly determined by quasi-fixed capital. For some of the quasi-fixed capital variables (size of the farm, land ownership, presence of an irrigation system) we used the 1999 situation. Using the current situation (e.g., the size of the farm in 2004) could potentially have introduced an endogeneity problem, as farm-size could well have been influenced by supermarket-channel participation.

The risk-factor and quasi-fixed-capital explanatory variables included here capture risk-sensitivity (land ownership), land capital (size of the farm), access to financial capital (size of land and ownership, education), human capital (age, education, gender) and physical capital (presence of an irrigation system). Each of these explanatory variables is hypothesized to *ceteris paribus* increase the probability of adoption of the supermarket channel. With regard to gender it is hypothesized that men are more likely to enter the supermarket channel because they are assumed to have better access to the required production factors and tend to get more involved when the transactions become more formal, sizeable, and rewarding (Dolan 2001).

The probit estimation results were as hypothesized, namely, that the probability of a farm participating in the supermarket channel increases as the farm is larger and 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 ten 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 by 46%. Education, age, gender, and land-ownership did not *ceteris paribus* have a statistically significant effect on the probability of a farm entering the supermarket channel.

Supermarket-Channel Participation and the Farmer's Production Technology

In the micro-economic theory of the firm, technology is represented by a production function which reflects the technological relationship that exists between any particular combination of inputs and the resulting levels of output (Sadoulet and de Janvry 1995). We selected the Cobb-Douglas production function which is the most-used functional form for the analysis of farm efficiency (Battese 1992). By selecting land, labor, and fertilizer as the inputs and taking the natural logs, we get the following production function:

(1) $\ln output_i = A_i + \alpha_i * \ln labor + \beta_i * \ln land + \gamma_i * \ln fertil + e_i$,

where lnoutput is defined as the natural log of output measured as kg of kale produced by the farmer from the current acreage over 1 cycle; lnlabor is the natural log of the number of full work-days used for land preparation, planting and weeding of kale; lnland is the natural log of the number of acre-months used for kale growing (we want to take into account a harvest-cycle length which over the sample varies from two to 12 months); and lnfertil is the natural log of the number of kg of fertilizer applied to the current acreage over one cycle. The distribution of the farmers over the two channels is not random, but rather the outcome of a self-selection process. In order to control for a potential selectivity bias, we used Heckman's two-stage method. We found that both models are significant and that the signs of the coefficients are as expected, namely, that, *ceteris paribus*, output increases as more land or

more fertilizer are used. Labor was found not to have a statistically significant effect in the model for either channel.

We then compared the marginal product values (MPV) 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.

Net Income Effect of Supplying Supermarkets

A gross-margin analysis for two types of farmers revealed that there are substantial differences between the two groups of farmers. Supermarket-channel farmers use on average twice the amount of inputs per acre used by traditional-channel farmers. Traditional-channel farmers use more labor per acre, mostly because there is an abundance of family labor relative to the small farm sizes. Wages for hired labor are higher in the supermarket channel than in the traditional channel, which is in line with the higher labor productivity. There is almost no difference in the production cost per kg of kale between the two groups of farmers. 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%.

Supermarkets and Farmer Growth Dynamics

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% from 1999 to 2004, compared to a 10% increase for traditional-channel farmers.

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, this article shows that nearly all supermarket-channel farmers have the capacity to supply larger volumes throughout the year and have transportation vehicles, an irrigation system, a packing shed, a cellular phone, etc., pointing to the existence of a threshold capital vector which farmers must have in order to access supermarkets. Farm size and irrigation especially 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 for supermarket-channel farmers which have doubled the size of their operations over the last five years.

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