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The impact of South African supermarkets on agricultural development in the SADC: a case study in Zambia, Namibia and Botswana

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Abstract

Supermarkets have expanded rapidly in SADC during the last decade, leading to fears that small-scale farmers and food processors could be excluded from access to urban markets. To assess the impact of supermarket chains on various participants in the supply chain, a survey was carried out in Botswana, Namibia and Zambia in 2004, 2005 and 2007. To determine the factors that influence the choice between the supermarket or traditional market channel and the impact of participation in the supermarket supply chain, a two-step treatment model was used. The results showed that over 80% of all processed food products in Botswana, Namibia and Zambia were imported from South Africa, and that supermarkets used a mixture of procurement systems for fresh fruit and vegetables and processed food products. Participation in the supermarkets channel had a positive impact on small-scale farmers' incomes. Farmers who supplied fresh fruit and vegetables to supermarkets had a significantly higher income than those who supplied to traditional markets in Zambia. The expansion of South African supermarkets into the SADC countries may be beneficial to small-scale farmers and therefore efforts should be made to incorporate them into the supermarkets' fresh fruit and vegetable supply chain.

Keywords: Supermarkets; fresh produce and processed food; procurement practices; SADC; regional impact

1. Introduction

The growth and expansion of supermarkets in Africa is spearheaded mainly by South African supermarkets. Supermarkets are not a new phenomenon in South Africa, having been present in this country in various forms for more than 60 years. However, growth and expansion outside South Africa is a recent occurrence that has been facilitated by trade liberalisation, increased economic growth, positive political changes, regional integration, increased urbanisation, an increase in per capita income, an enlargement of the middle

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class, and the liberalisation of foreign direct investment. On a continent where the majority of people depend on agriculture for their food, changes occurring in the agri-food systems could have large implications for the rural poor. Increased investment by South African supermarkets in other African countries is therefore of concern to those involved in development because supermarkets are important markets for farmers and processors, but the potential threat of exclusion of small-scale farmers and processors from the supply chain of supermarkets exists. Due to the fact that African countries depend on agriculture as the mainstay of their economies, and because small-scale farmers comprise the majority of agricultural producers, excluding these farmers would pose a real threat to livelihoods, poverty alleviation, and rural development in general. The major issues of concern are the strategies used by supermarkets to source and procure products.

There is a growing body of literature on supermarket growth in developing countries, but there are very few empirical studies in Southern Africa that have gone beyond the initial work of Weatherspoon and Reardon (2003) in effectively documenting the extent and size of the investment mainly of South African supermarket chains in the rest of Southern Africa and the impact this has had on the agricultural and food sectors of the host nations.

This research uses a case-study approach in three countries – Namibia, Botswana and Zambia. Anecdotal evidence provided by Mattoo and Payton (2007) suggests, for example, that the cash income of Zambian farmers has increased since Shoprite started sourcing from them, and at the same time access to local health care and educational services has also improved. The objective of this paper is to provide some quantification and some measurable results of these reported impacts.

In order to measure the agricultural development impacts of the investment by South African retailers, this study used both qualitative and quantitative methods in collecting data. In the survey, 12 chain supermarkets; 42 local shops; 18 food processors; 30 farmers supplying fresh fruit and vegetables (FFV) to the chain supermarkets; and 61 farmers who supplied FFV to the traditional markets in Zambia, Namibia, and Botswana in 2004, 2005 and 2007 were sampled and interviewed using questionnaires and checklists. This data was augmented with secondary data. By applying a conceptual framework, the impacts of supermarkets on small-scale farmers, agriculture and the food processing industry were elucidated.

In order to test whether there were any differences in income among small-scale farmers who supplied to supermarkets and those who supplied to

traditional markets, a one-way analysis of variance was performed to test for equality of means between these two groups.

The article is organised as follows: Section 2 details the growth and expansion of South African supermarkets in Africa and the SADC region. Section 3 describes the issues of concern that emerge as supermarkets expand in the rest of Africa. In section 4 the theoretical constructs of the potential impact of supermarkets' trading activities on agricultural development in Africa are described. Empirical evidence of the sourcing and procurement practices for food products is given in section 5, and in section 6 the question of whether the sourcing and procurement practices of supermarkets in host countries have excluded farmers is addressed. In section 7 measurement of the impact of supermarkets on small-scale farmers in the case study countries is provided. Finally, section 8 concludes.

2. Growth and expansion of South African supermarkets in SADC countries

The growth and expansion of South African supermarkets in SADC countries increased dramatically in the mid-1990s (Weatherspoon & Reardon, 2003). The major South African supermarkets have expanded their market share in the region through buying other supermarkets, franchising, and forming partnerships with other supermarket chains in host countries. The major South African supermarkets have invested in one or all SADC countries (Table 1).

Shoprite is the most expansive retailer, having entered four new countries over the past three years, with operations now spanning a total of 16 African countries. By comparison, Pick 'n Pay operates stores in six other African countries. Due to the relative youth of the network, sales from foreign operations are still small, accounting for 8% of Shoprite sales and slightly less than 8% of those of Pick 'n Pay.

Table 1: Number of outlets of South African supermarkets in SADC (2007)

Country	Shoprite	Pick 'n Pay	Spar (multinational)	Woolworths (RSA)	Total number of stores	% of stores
South Africa	718	552	675	320	2265	85.4
Angola	8	0	0	0	8	0.3
Botswana	10	19	26	11	66	2.5
DRC	0	0	0	0	0	0
Lesotho	7	0	0	2	9	0.3
Mauritius	1	0	11	1	13	0.5
Malawi	5	0	0	0	5	0.2
Mozambique	5	0	0	0	5	0.2
Namibia	65	15	19	4	103	3.9
Seychelles	0	0	0	0	0	0
Swaziland	7	6	7	3	23	0.9
Tanzania	5	0	0	1	6	0.2
Zambia	18	0	2	1	21	0.8
Zimbabwe	1	56	70	2	129	4.9
Total	850	648	810	345	2653	100

Source: Adapted from various supermarkets' annual reports (2007).

2.1 Supermarkets in Botswana

South African supermarkets, such as Shoprite (with most of its brands – Shoprite, Checkers, OK Foods and Super Save), Spar, Pick 'n Pay, MetCash and Woolworths, dominate the retail market in Botswana. Local supermarket chains, such as Payless and Choppies; smaller independent stores, such as Cash and Carry; and convenience stores located at filling stations are also important in the retail market in Botswana (Table 2). As is the case in South Africa, the modern retail sector handles about 50 to 60% of food retailing in major towns such as Gaborone, Francistown, Kasane and Maun, and in urban villages such as Mochudi, Lobatse, Molopolole and Kanye (Exploratory survey results, 2004)³. In the rural areas and rural villages, the general dealerships are more important in food retailing.

In contrast with South Africa and Zambia, there are no wholesale markets for fresh fruit and vegetables operating in Botswana. Limited horticultural production in Botswana is perhaps the main reason for this situation.

³ Strictly speaking, this share refers to the 'food from home' retail market, i.e. it excludes the 'food away from home' market, which includes institutional food supply (schools, hospitals, prisons), takeaways, etc. The same caveat applies to the shares in the other countries.

Table 2: Supermarkets in Botswana

Supermarket name	Number of stores	Urban (Gaborone)	Other and/ rural towns	Origin
Shoprite	3	1	2	South Africa
Checkers	2	1	1 (Francistown)	
OK Foods	3	3	-	
Payless	4	4	0	Botswana
Spar	26	8	18	Franchise/ supervised by Spar South Africa
Choppies	27			Botswana
Woolworths foods	3	3	0	South Africa
Fairways	7	1	6	Botswana
Pick 'n Pay (family stores)	2	2	0	Franchise
Score supermarkets	16	4	12	Pick 'n Pay owns over 50% shares
Other independent supermarkets	many	many	many	Botswana

Source: Survey results (2005)

Based on information obtained from participants in the retail industry in Botswana, it is evident that food prices have declined over the years, as more supermarkets invested in the food retail market, resulting in increased competition. These observations concur with studies carried out in countries in the European Union (Cooper, 2002; Dobson *et al.*, 2003), which established that consumers benefit from supermarkets' trading activities, while some producers and suppliers may be negatively affected by some of the practices of supermarkets.

Spar is the largest food retailer in Botswana, with a total of 26 stores and retail sales of about €32 million in 2003. About five years ago Spar was the main retailer of food products in Botswana, but in the last two years Shoprite and Pick 'n Pay have invested in Botswana, leading to stiffer competition among retailers. The entrance of many of these chain supermarkets has led to the closure of some of the smaller stores.

2.2 Supermarkets in Namibia

The same South African supermarket chains that operate in Botswana also operate in Namibia. Locally owned supermarket chain stores, such as Woermann Brock and smaller independent supermarkets (See Table 3), are also active in the food retail markets.

Like Botswana, Namibia has limited horticultural production, resulting in the supermarket chains importing fresh produce from South Africa. Wheat-flour products, maize-flour products and most pasta products are sourced from local manufacturers.

Table 3: Supermarkets in Namibia

Supermarket Name	Number of stores	Urban (Windhoek)	Other urban and/ Rural towns	Origin
Spar	23	5	18	South Africa
Shoprite	48	15	33	South Africa
Pick 'n Pay	9	4	5	South Africa
Woolworths	5	1	4	South Africa
Woermann Brock	15	11	4	Namibia
Fruit and Veg City	3	2	1	South Africa
Other independent supermarkets	many	many	many	Namibia

Source: Survey results, 2005

Shoprite dominates the supermarket scene in Namibia with 65 stores and total sales valued at € 83 million. The number of Shoprite outlets increased from 41 in 2002 to 65 in 2007, while retail sales grew from €60 million to an estimated €95 million in the same period (Shoprite Holdings Ltd., 2007). Spar is the second largest supermarket chain in Namibia, with 23 stores and estimated total sales of €23 million (Spar Ltd., 2007). Spar supermarkets in Namibia are run by independent retailers under franchise arrangements with Spar Group Limited, South Africa.

2.3 Supermarkets in Zambia

Shoprite is the largest supermarket retailer in Zambia (Table 4). The first Shoprite store was opened in Lusaka in 1995. Shoprite now operates 18 stores across all provinces of Zambia, each with a floor space of about 2 000m² and total retail sales of about US\$ 30 million (Shoprite, 2007). Shoprite Zambia is a subsidiary of Shoprite South Africa, and the stores are based on a similar concept to those in South Africa. The stores are large supermarkets with fresh food counters and in-store bakeries. The bakeries operated by Shoprite supermarkets seem to be very popular, since one finds long queues of people waiting to buy bread. It was evident that small traders also buy their bread stocks there, for resale in the *Ntembas* (kiosks) in estates around Lusaka. This is because the price of bread at the Shoprite supermarkets is much lower than at other shops in the same area.

Table 4: Supermarket chains in Zambia

Supermarket name	Number of stores	Urban (Lusaka)	Rural towns	Origin
Shoprite	18	4	14	South Africa
Melissa	3	3	0	Zambia
Spar	2	2	0	South Africa

Source: survey results, 2007

Even though food retailing accounts for between 60 to 90% of the sales in supermarket stores such as Shoprite, in Zambia supermarkets are not yet very important in the marketing of fresh agricultural products, compared with other local markets. Key informants estimated that with crops such as tomatoes and potatoes over 75% are still sold through the traditional market channels (farm gate, street vendors, and traditional wholesale markets).

3. Issues relating to the expansion of South African supermarkets in the SADC

The expansion of South African supermarket chains in the SADC and in other African countries is seen as offering an opportunity to suppliers (farmers and food processors) in the host countries to increase their output and income, as supermarkets offer a ready market for domestically produced produce. However, several issues of concern have been raised.

One of the major issues has been the sourcing strategies of the South African supermarkets, which may exclude local producers, especially small-scale farmers and processors. These issues relate to high transaction costs, which make it difficult for supermarkets to do business with small-scale farmers and small-scale food processors. The supermarkets therefore prefer to procure from large suppliers who can supply all of their outlets with a consistent product in terms of quality and quantity. Since many farmers and food processors in the SADC countries other than South Africa are not able to comply with these requirements, the supermarket chains prefer to source from large suppliers in South Africa. In addition, the rapidly changing procurement systems of the supermarkets may contribute to the further marginalisation of producers. As supermarkets move from decentralised to centralised procurement systems, farmers and food processors may need to implement increased technological, managerial, organisational, and financial changes to enable their participation or to remain in the supermarkets' supply chain.

4. Theoretical constructs of the impact of supermarkets on potential agricultural development in host countries

A conceptual representation of the impact of the supermarkets on agricultural and industrial development resulting from their sourcing decisions is presented below. The impacts on the host nation's agriculture, food manufacturing and processing sectors resulting from the supermarkets' activities are complex, in that some are direct and observable, while others are indirect and may affect the whole economy. These impacts may occur as a result of the decisions made by supermarkets to source and procure from local suppliers in the host nations or to import from South Africa or other countries in the world. Assuming that these impacts depend solely on the procurement decisions made by the supermarkets, the impacts will be felt at producer, consumer and industry levels (Figure 1).

Supermarkets may develop food supply chains that consist of imports from South Africa or elsewhere in the world, which may result in positive impacts accruing to consumers, who may be able to access goods and services that have been efficiently procured and sold by supermarkets. Consumers may benefit from supermarket trade through convenient one-stop shopping, lower food prices, and in some cases availability of exotic products (not produced in the host countries) imported from other countries. Therefore, supermarkets increase the choice of products available to consumers. Consumers may also benefit by accessing high quality imported goods from South Africa and the rest of the world. It has been documented that the impact of supermarkets on consumers may be positive (Cooper, 2002; Dolan & Humphrey, 2000; D'Hease & Van Huylenbroeck, 2005).

Notwithstanding the gain by consumers, supermarkets' importation of food and other industrial products may depress production in host countries as locally produced goods have to compete with high-quality, low-cost goods produced in South Africa and the rest of the world. Increased production will be stimulated in exporting countries whereas output in host nations may decline. Owing to competition from imports, some domestic firms that are not able to compete may go out of production, leading to the stifling of various industries such as agriculture, food processing and manufacturing.

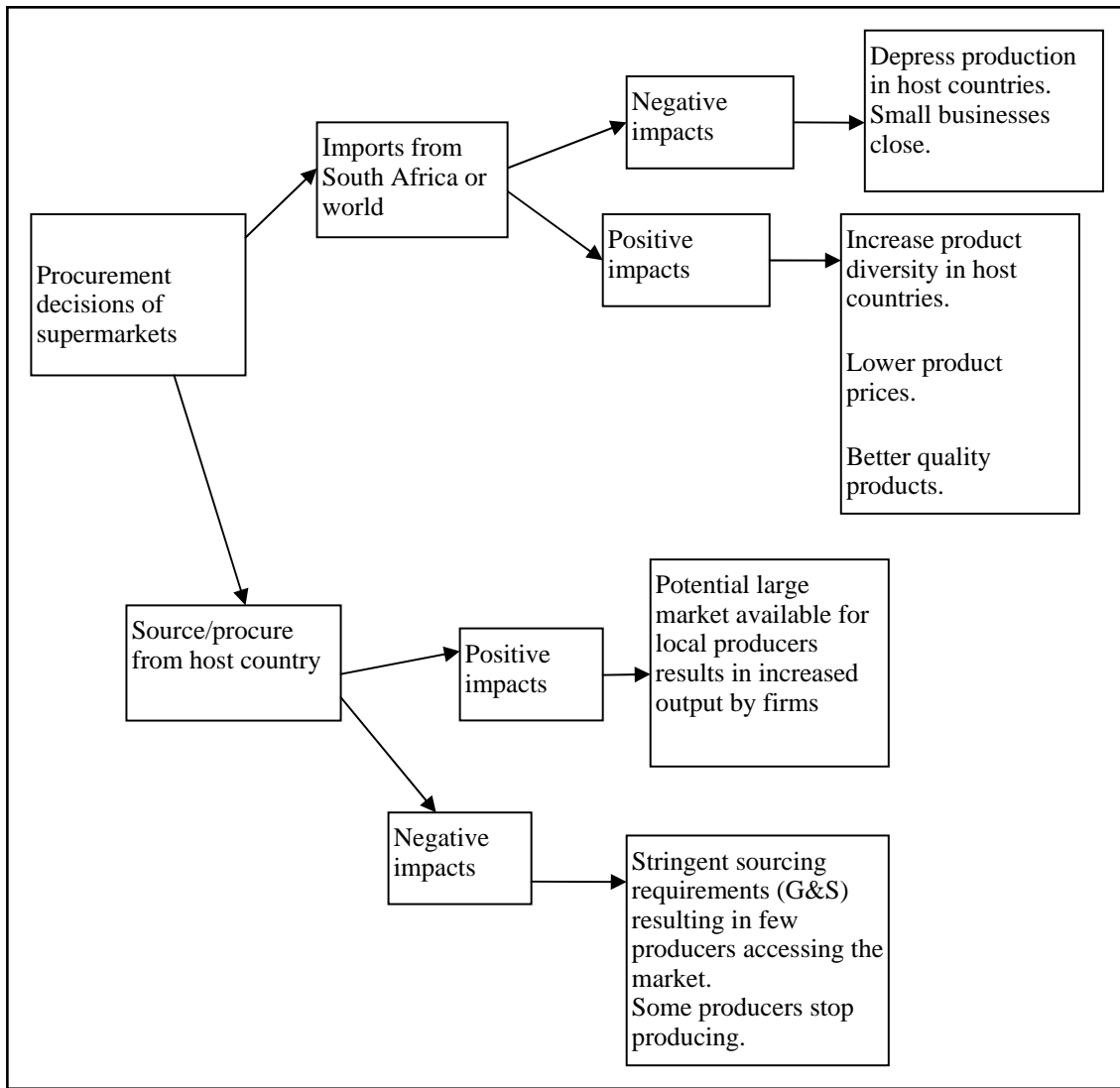


Figure 1: Theoretical construct for considering the possible impact of South African supermarkets in the SADC countries

On the other hand, supermarkets may develop supply chains based on locally procured goods because of prevailing government policy. Local companies may also develop greater capacity by observing and imitating the quality of imported goods in supermarkets or by working together with supermarkets that provide them with the required standards and quality. This means that local companies may in due course be able to produce goods that meet the quality requirements of supermarkets. Supermarkets may also develop supply chains based on local goods, especially if the goods required are bulky and expensive to transport, for example FFV such as cabbages. Local producers may benefit when they access locally based supply chains that supermarkets have developed for the various products that can competitively be produced domestically.

5. Empirical evidence of supermarket procurement practices relating to food items

All the supermarkets surveyed in the case study countries stocked both fresh and processed foods. Several forms of sourcing and procurement practices for FFV were observed among supermarkets in Botswana, Namibia and Zambia. These practices included (i) the use of specialised sourcing and procurement companies; (ii) farmers delivering FFV directly to individual supermarket outlets; (iii) the use of specialised FFV wholesalers; (iv) delivery to distribution centres; and (v) outsourcing.

The most important criteria used by supermarkets in making sourcing and procurement decisions were price, volume and consistency of supply, quality, and trust, respectively. These sourcing and procurement decisions and practices follow similar global trends.

5.1 Products sold in supermarkets and local shops in Namibia, Botswana and Zambia

A survey of food products sold in supermarkets and local shops was undertaken in the three case study countries. Using the survey results and information obtained from key informants, estimated percentages of the sources of the various products were determined. The results showed that fresh vegetables, such as cabbages, and fresh milk, were mainly sourced from local farmers and processors in Zambia. In Namibia and Botswana most of the fresh produce was imported from South Africa, due to limited local production (Table 5). In all case study countries, canned fruits and vegetables, jam and other processed foods, such as 100% fruit juices, were imported from South Africa. All supermarkets (local and South African), including small shops, stocked similar products, especially in the processed food categories. There was also evidence of global sourcing, albeit on a very small scale.

Table 5: Sources of product categories found on supermarket shelves/local shops

	Botswana		Namibia		Zambia	
	Source of products	% of brands on supermarket shelves**	Source of products	% of brands on supermarket shelves	Source of products	% of brands on supermarket shelves
Processed food products						
Frozen vegetables (mixed vegetables, peas, potato chips)	South Africa Zimbabwe	90 ^z 10	South Africa	100	South Africa	100
Tomato sauces	South Africa Zimbabwe ROW	85 10 5	South Africa ROW	90 10	South Africa Zambia	90 10
Fruit juices (100%)	South Africa	100	South Africa	100	South Africa	100
Milled products (wheat flour, maize flour)	Botswana South Africa	80 20	Namibia	100	Zambia	100
Pasta products	Botswana South Africa ROW (Italy)	25 70 5	Namibia	100	South Africa ROW (Italy)	90 10
Canned vegetables	South Africa	100	South Africa	100	South Africa	100
Canned fruit	South Africa	100	South Africa	100	South Africa	100
Processed milk (UHT)	South Africa Zimbabwe	90 10	South Africa	100	Zambia	100
Pasteurised fresh milk	Botswana*	100	Namibia	100	Zambia	100
Fresh vegetables						
Tomatoes	South Africa Botswana	70 30	South Africa Namibia	90 10	Zambia South Africa	80 20
Potatoes	South Africa	100	South Africa	100	Zambia	100
Cabbages	South Africa Botswana	30 70	South Africa	100	Zambia	100
Leafy vegetables (spinach/kale)	South Africa Botswana	30 70	South Africa Namibia	90 10	Zambia	100
Onions	South Africa Botswana	80 20	South Africa	100	Zambia South Africa	50 50
Carrots	South Africa Botswana	80 20	South Africa Namibia	90 10	South Africa Zambia	60 40
Fresh fruit						
Apples	South Africa	100	South Africa	100	South Africa	100
Oranges	Botswana South Africa	50 50	South Africa	100	South Africa	100
Bananas	South Africa	100	South Africa	100	South Africa	100
Mangoes	Botswana South Africa	50 50	South Africa	100	South Africa Zambia	80 20

Source: Survey results (2004-2005) and author's own estimations. * Fresh milk imported by local dairy processing firms. These firms process and supply to supermarkets and shops; ROW: other countries outside of Africa; ** Products were similar across supermarkets (local and foreign) and local shops, especially in processed products. ^zThe percentages were calculated by taking into account the number of brands available across the sampled supermarkets and local shops, augmented by information from key informants.

5.2 Sourcing of fresh fruit and vegetables in the case study countries

In all the case study countries, supermarkets sourced fresh fruit and vegetables from local as well as international sources. Locally, fresh fruit and

vegetables were sourced directly from both large and small-scale farmers, who supplied to supermarkets under verbal contract. Due to their requirements such as large volumes throughout the year, high quality, and specific grades and standards, supermarkets sourced mainly from medium to large-scale farms and small-scale farms using intensive methods of production, which met the supermarkets' requirements. Some supermarkets used specialised wholesalers and preferred suppliers for procuring fresh fruit and vegetables. This practice was observed among supermarkets in Botswana and Namibia. The larger supermarkets, such as Shoprite and Pick 'n Pay, used specialised sourcing companies such as Freshmark, to purchase fresh produce from farmers. This practice was also found in Zambia and Namibia. In the case of Botswana, due to its proximity to South Africa, products were sourced by South African sourcing companies and then distributed to the Botswana market. Some supermarkets used distribution centres. This practice was observed in all three of the case study countries.

5.3 Sourcing of processed products

Between 80% and 100% of staple food products such as milled cereals and processed fresh milk were sourced from local processing companies in the case study countries (Table 5). Medium- and small-scale processors supplied milled cereals and processed fresh milk to small independent supermarkets and local shops and hence were excluded from the supply chains of the South African supermarkets for these products. These processing companies were protected, thus most of the products produced locally in these categories were more expensive in comparison with those imported from South Africa.

Products not produced locally due to lack of capacity, such as canned fruit and vegetables, powder milk, UHT milk, and breakfast cereals were predominantly imported from South Africa. Whether the importation of these products curtails the processing industry's development in host countries needs further analysis.

6. Have supermarket procurement practices resulted in the exclusion of farmers?

Survey results show that supermarkets source fresh fruit and vegetables from South Africa and from both large and small-scale farmers in the host countries. There is no evidence of a deliberate effort by chain supermarkets to exclude small-scale FFV producers from their supply chains. Whether supermarkets source from small-scale or large-scale farms is largely influenced by factors such as the price, and quality of the produce, volume and consistency of supply, and trust relationships. Based on these factors, large-scale farmers are

often better placed to sell to supermarkets as they can fulfil the volume and quality requirements of supermarkets more easily than small-scale farmers. There are, however, also environmental factors that dictate whether certain products can be produced in the host country, in which case the supermarket chains' only option is to import from South Africa. Small-scale farmers who meet the requirements of the supermarkets stated above were able to supply to them in certain of the case study countries – notably Zambia and Botswana. Small-scale farmers able to produce on an individual basis and farmers organised in groups, such as cooperatives, were able to access the supermarkets' FFV supply chains. The large- and small-scale farmers supplying supermarkets were those who were able to meet their volume and quality requirements and hence could negotiate contracts with them.

7. Measuring the impact of supermarket procurement activities on farmers' income in the case-study countries

The survey results reveal that small-scale farmers supplying supermarkets are, in general, those better endowed with resources compared to those who supply traditional markets. A one-way analysis of variance was carried out to compare the resources of small-scale farmers who supplied supermarkets and those who supplied traditional markets. The results showed that, on average, small-scale farmers who participated in the supermarkets' FFV supply chains had more resources and were more commercially-oriented (Table 6), in that they used more hired labour and chemical inputs, which were reflected in their high input costs.

Table 6: Mean comparison of sampled farmers supplying FFV to supermarkets vs. the traditional market channels in Zambia

Variable	Least-squares means	t Value	p Value
Farm size (ha)			
Supply to supermarkets	4.7306	2.50	0.0221**
Supply to traditional markets	2.6658		
Age of household			
Supply to supermarkets	47.198	1.65	0.1172
Supply to traditional markets	42.0545		
Household size (number)			
Supply to supermarkets	7.78277	0.64	0.5296
Supply to traditional markets	7.3091		
Number of labourers			
Supply to supermarkets	7.58277	3.98	0.0009***
Supply to traditional markets	4.1090		
Input use (costs) in Kwacha			
Supply to supermarkets	672 780.885	3.89	0.0011***
Supply to traditional markets	291 422.727		
Value of sales (Million Kwacha)			
Supply to supermarkets	K million 2.0701	2.44	0.0252**
Supply to traditional markets	K million 1.1642		

Supply to supermarkets, N=19; Supply to traditional markets, N=55

* 10 % significance level ** 5% significance level; *** 1% significance level

To measure the impact of supermarkets' sourcing and procurement on small-scale farmers, a two-step treatment effects model was used. The model also determined the factors that influence small-scale farmers' decisions to supply to the supermarket channel and whether farmer participation in the FFV supply chain is beneficial.

7.1 Two-step impact estimation model

The model, accounting for farmers' participation or non-participation in supermarket FFV supply chains is given as the following:

$$Y_i = \beta X_i + \delta R_i + \varepsilon_i \quad (1)$$

δ is the treatment effect (impact) to be estimated; R_i is a dummy variable, indicating whether the farmer participates in the supermarket channel or not. The sample selection rule is that Y_i is observed when $R_i^* > 0$

The model for supermarket participation (whether the farmer chooses to sell to a supermarket channel or not) is given as the following:

$R_i^* = w_i Z_i + u_i$ defines households that participate in the supermarket channel as (2)

$R_i = 1$ if $R_i^* > 0$, 0 otherwise

$R_i = 0$ if $R_i^* \leq 0$

Step one

The first step of the procedure involves establishing the probability of a farmer participating in the supermarket channel, by using a probit model (Greene, 2000; Heckman, 1979).

Y_i is observed when $R_i^* > 0$

u_i and ε_i are distributed such that u_i / ε_i is jointly distributed

$(u_i \mid X_i) \sim N(0, \sigma^2, \rho)$

Given that $u_i \sim N(0, \sigma^2=1)$

$\Pr(Y_i \text{ observed} \mid X_i, Z_i) = 1 - F(-w_i Z_i)$

$E(Y_i \mid Y_i \text{ observed}, X_i, Z_i) = \beta X_i + \sigma \lambda_i$

Where $\lambda_i = E(u_i \mid u_i > -w_i Z_i) = f(-w_i Z_i) / 1 - F(-w_i Z_i)$ - indicator or inverse Mills ratio, which is not observable but can be obtained by estimating a probit choice model - and where $f(\cdot)$ represents the density and $F(\cdot)$ the cumulative distribution function of a standard normal variable. Then λ_i can be estimated from the probit model coefficients, obtained by the maximum likelihood estimation method. The equation for estimating the impact of supermarkets on small-scale farmers is:

$Y_i = \beta X_i + \delta R_i + \sigma \lambda_i + v_i^*$

Where $E(v_i^* \mid X_i) = 0$

Step two

To obtain the average treatment effect, δ was estimated by regressing Y_i on X_i , R_i and estimated λ_i by ordinary least squares method. This model was intended to answer the research question *Do small-scale farmers gain by participating in the chain supermarkets FFV supply chain in the case study countries?*

7.2 Estimating the model

The number of small-scale farmers involved in the supply of FFV to the market was small in Botswana and almost non-existent in Namibia. Therefore, the analysis was done solely for Zambia, where a reasonable data set was available. To estimate equations 1 and 2, data was collected from 78 farmers (20 small-scale farmers who supply FFV to Shoprite in Lusaka, and 58 who supply to traditional markets in Zambia) for the year 2005. The dependent variable consisted of two variables: (1) the probability that a farmer participates in the supermarket supply chain for FFV by selling FFV to Freshmark or directly to Shoprite, and (2) the value of sales of vegetables (proxy for income) to the supermarket. The first variable assumes a value of 1 for those who participate in the supermarket supply chain and a value of 0 for those who do not (Table 7). The products used in the analysis included all the fresh vegetables grown by any farmer in the area that could be sold directly to a supermarket or designated buying company.

Table 7: Dependent and independent variables used in the model

Dependent variables	Model description
Fresh fruit and vegetable market	<ul style="list-style-type: none"> • Probability of selling FFV (STSMKT) • Value of products sold (VFFVSALT)
Independent variables	
Household resource endowments (assets)	<ul style="list-style-type: none"> • Farm size (ha) • Ownership of tractor or vehicle (yes=1, 0 otherwise)
Household structure	<ul style="list-style-type: none"> • Labour = number of household members working on the farm + hired labour (numbers) • Age of household head (years) • Gender of household head (household head is female = 1, 0 otherwise)
Information-accessing variables	<ul style="list-style-type: none"> • Distance from farm to market or urban centre (km) • Membership in a farmers' organisation (yes = 1, 0 otherwise)

Independent variables

The independent (explanatory) variables were divided into three constructs: household resource endowments (assets), household structure, and access to information.

Household endowments

Variables included in household endowments are farm size and ownership of a tractor or vehicle (transport facilities). Land is a necessary requirement in the

production of FFV, if there is to be a marketable output. The variable *land* (FARMSIZE) was documented in hectares (ha). Households accessed land through ownership or rental. Households with more arable land have greater potential to produce more FFV and stand a better chance of participating in the FFV market. Ownership of land alone, without other inputs, may not necessarily increase the probability of a farmer accessing the supermarket supply chain for FFV.

Ownership of a tractor or vehicle (OWNVEH) could help reduce transaction costs, especially transport costs, enabling the household to participate in the FFV market more easily. Ownership of a tractor or vehicle may help farmers to seek and access distant markets, thus increases their likelihood of being able to supply the supermarket channel. This was also a dummy variable, assuming the value of 1 if the household owned a vehicle or tractor and 0 if not.

Household structure

This construct consists of three variables: labour available to the household and the gender and age of the head of the household.

The *total number of people working on the farm* (LABOUR), which includes the number of household members who work full-time on the farm plus hired workers, may influence the ability of the household to produce for the market. Households with a higher labour supply may be able to devote more labour to the production of FFV, which is a labour-intensive enterprise. These households may be able to produce more, making participation in the FFV chain easier. This variable is expected to have a positive impact on participation and income.

The second variable in this group is the *gender of the household head* (GHHD). Generally, male heads of households tend to have more resources and greater access to information for production. This variable is presented as a dummy variable, assuming the value of 1 if the head of the household is female and 0 if male. Its impact on accessing the supermarket supply chain is unknown.

The final variable in this group is the *age of the household head* (HHAGE). This variable is taken as a proxy for the farmer's experience in the production of FFV. It is measured in number of years. Older household heads may have more experience in the production of FFV and may have more social capital and wider networks. On the other hand, older household heads may be more risk averse, and may therefore opt not to supply to this market. Therefore, this variable is expected to have either a positive or a negative impact on

participation and on income accruing from participation in the FFV supply chain.

Access to information variables

The third group of explanatory variables is related to the ability of households to access information about markets and production. Variables in this group could assist households in reducing the cost of sourcing information and hence facilitate the household's participation in the marketing channel. This construct consists of two variables, namely the *distance of a farm from the nearest urban centre* (DIURBC) and *membership of a farmers' organisation* (MOFAGRP).

The variable *distance of the farm from the nearest urban centre* (DIURBC) was measured in kilometres. Households nearer urban centres are nearer the markets and sources of information about market conditions. These households are more likely to participate in FFV markets as these farmers face lower transaction costs, especially those relating to transport. This variable is expected to have a negative impact on participation as well as on income.

Another variable that may improve the ability of farmers to access the FFV markets is the capability of producing a continuous supply of FFV throughout the year. For most small-scale producers, achieving this requirement may necessitate joining a cooperative or other farmers' group (MOFAGRP). This was a dummy variable assuming the value of 1 if a farmer belonged to a farmers' group and 0 if not. The fact that a farmer joins a farmers' group may not necessarily increase the probability of supplying to supermarkets. The impact of this variable, in so far as it influences participation in the supermarket channel and impacts on household income, is unknown in the context of the SADC countries. The expected sign of the coefficient is unknown.

7.3 Factors that influence a farmer's decision to supply FFV to supermarkets vs. traditional markets

In this section, the empirical two-step treatment model was used to estimate the factors that influence farmers' decisions to supply to supermarket channels and to show the results of the impact of participation by small-scale farmers in the supermarket FFV supply chains.

The model for farmers' decisions to supply to supermarkets is determined by the probit model, which is specified as:

Pr (STSMKT) = f (FARMSIZE, OWNVEH, HHAGE, GENHD, LABOUR, DIURBC, MOFAGRP)

Table 8 presents the results of the probit estimates of factors influencing farmers' participation in the supermarket FFV supply chain. These results show that the model is highly significant and correctly predicts 90% of the observed outcomes. The model chi-square of 61.22 is highly significant at a 1% significance level. Four of the seven factors are significantly different from 0. Two of these (ownership of a tractor or vehicle and labour) are positively related to participation in the supermarkets' FFV supply chain, whereas two (distance of farm from urban centre and membership of a farmers' organisation) are negatively associated with farmers' participation in the FFV markets. This implies that a unit increase in distance from the urban centre will reduce the probability of the farmer participating in the FFV market. The remaining three variables (farm size, gender, and age of the household head) do not differ significantly from zero.

Table 8: Factors that influence farmers' participation in the supermarkets' FFV supply chain, probit results

Variable	Coefficient	Std. error	Z-Stat.	P value
Constant	5.343919	3.751057	1.42	0.154
Household endowments				
Farm size (ha)	0.160136	0.150677	1.06	0.288
Owns tractor or vehicle	4.328424	1.810059	2.39	0.017**
Household structure				
Household head age	-0.069235	0.527433	-1.31	0.189
Household head is female	-1.637593	1.058993	-1.55	0.122
Labour	0.490036	0.227575	2.15	0.031**
Information access				
Distance from farm to nearest urban centre	-0.269457	-0.137126	-1.97	0.049**
Membership of a farmers' organisation	-2.429095	1.237532	-1.96	0.050**
% Correctly predicted LR (model) χ^2 N= 74	90 61.22***			
N selling to supermarket = 19				

* 10 % significance level; ** 5% significance level; *** 1% significance level

Membership in a farmers' organisation is negatively related to participation in the FFV supply chain. This is contrary to expectation, but was also found by

Hernandez *et al.*, (2007) in Guatemala Farmer organisations in Zambia are cooperatives or informal farmers' groups. The cooperatives are generally recently established and, even though farmers belonged to a cooperative, they sold products as individuals (Emongor *et al.*, 2004). Cooperatives assist farmers to access inputs and information but not to market their produce. This implies that, given the current level of farmer group formation in the case-study countries, membership of a farmers' group does not increase the probability of the farmer supplying the supermarket or traditional channel. Furthermore, the result suggests that supermarkets prefer dealing with farmers on a one-to-one basis, and do not like the countervailing power inherent in a cooperative structure.

7.4 The impact of farmers' participation in the supermarket FFV supply chain on their household income

In stage two of the Heckman procedure, an ordinary least-squares regression was estimated to account for selection bias and to estimate the treatment effect (impact) of farmer participation in the supermarkets' FFV supply chains on farmers' incomes. The OLS model was specified as the following:

$$\text{VFFVSAL} = f(\text{FARMSIZE OWNVEH HHAGE GENHD LABOUR DIURBC MOFAGRP STSMKT Mills})$$

This means that the value of sales of FFV to supermarkets is determined by the above factors in the model. In order to estimate treatment effects (impact), the OLS model includes the dummy for supermarket participation and the variable inverse Mills ratio (Mills). Table 9 presents the results of the regression model, showing the impact of farmers' participation in the supermarket FFV supply chain on farmers' household incomes.

Table 9: Impact of farmers' participation in supermarket FFV supply chains regression results

Variable	Coefficient	Std. error	t-Stat.	p value
Constant	0.767818	1.214656	0.63	0.530
Household endowments				
Farm size (ha)	0.0108219	0.0581635	0.19	0.853
Owens tractor or vehicle	1.226134	0.62706	1.96	0.055
Household structure				
Household head age	-0.0278303	0.126074	-2.21	0.031**
Household head is female	0.0236544	0.2885752	0.08	0.935
Labour	0.1451915	0.540874	2.68	0.009***
Information access				
Distance from farm to nearest urban centre	-0.0571444	0.025957	-2.20	0.031**
Membership of a farmers' organisation	-483265.6	402691.2	-1.20	0.235
Mills	3.391477	1.848337	1.83	0.071*
STSMKT	1.060624	0.474308.7	2.24	0.029* *
F (9, 64) 4.12	4.12 ***			
Probability value	0.0003			
R ²	0.367			
Adjusted R ²	0.278			
N selling to supermarket	19			
Total N	74			

* 10 % significance level ** 5% significance level; *** 1% significance level

The model is highly significant at a 1% significance level, with an F-statistic of 4.12. Five variables have coefficients significantly different from 0. These are household age, labour, distance of farm from urban centre, the supermarket participation dummy variable and the 'Mills'. Participation in the supermarket channel has a positive impact on the farmers' incomes. By participating in the supermarket FFV supply chain, farmers increase their value of sales by 1.060624 million kwacha (approximately R 1 494) per month.

Among the household structure variables, a unit change in household age has a negative impact on the value of sales of FFV. Increasing household age by a unit results in the value of sales of FFV declining by 0.0278303 million kwacha (R39.2) per month. On the other hand, if a farmer increases labour by one person, it will increase the value of sales by 0.1451915 million kwacha (R 204) per month.

Among the access-to-information variables, distance of the farm from an urban centre has a negative impact on the value of sales. If the distance is increased by 1 unit, it results in a decline in the value of sales by 0.057144

million kwacha (R80) per month. Farm size and ownership of a tractor or vehicle do not contribute significantly to the value of sales. The inverse Mills ratio is significant at a 10% significance level in this model. Membership of a farmers' organisation has no impact on household income.

In order to test the null hypothesis that there was no difference in income among farmers who supplied supermarkets and those who supplied the traditional markets, mean quality tests were carried out on the value of sales (proxy for income) for these two groups of farmers in Botswana and Zambia. The model allows for a comparison in the value of sales for farmers who supplied to supermarkets and those who did not. The results of these mean income comparisons are shown in Table 10.

Farmers who supplied to supermarkets had a significantly higher mean value of sales (income), compared to those who supplied to traditional markets in Botswana and Zambia (Table 6). The difference in mean income of those supplying to supermarkets and those supplying to traditional markets was not significant in Botswana.

These results imply that supermarkets may be beneficial to small-scale farmers if they can access them. The results from the model are corroborated by those from focus group discussions, in which farmers who supplied to supermarkets reported having increased their income. For example, a widowed farmer in Lusaka made the following remark, about supplying FFV to Freshmark: "I have been able to earn a good income and send my children to school (2 in secondary school), buy food, build a good house and dress myself and my children well. Even though I have not yet been able to purchase a vehicle, all in all my family have been catered for; we have not lacked."

A farmer in the village of Luangeni, Chipata had this to say: "We were trained to produce better quality vegetables by the Shoprite project. Even though I no longer supply to Shoprite, the conditions in our village have changed drastically. Most people in the village now produce more vegetables and sell at the local market; earning more money than before we were trained. We can now afford to take our children to school, to hospital, and some people in the village have purchased iron sheets to build better houses. Generally, the lives of the villagers have been changing for the better." This shows that there is a correlation between supermarkets and the wealth of the farmer. Due to difficulties in apportioning causation due to lack of lagged variables, this association between the ability of the farmer to supply to supermarkets and wealth creation is difficult to prove.

7.5 Caveat

While questions to capture data on lagged assets were included in the questionnaire the information collected was not sufficient to allow tests of causality. Due to insufficient responses to those questions on lagged assets, the study did not carry out causality analysis but the analysis carried out in the study used current values of assets, therefore it is not possible to conclude whether supermarkets select asset-endowed small-holder farmers or whether small-holder farmers accrued assets as a result of trading with supermarkets.

It is worth noting that currently, the number of small-scale farmers who access the supermarket channel is still small. For example in Zambia Freshmark sources about 10% of its vegetables from small-scale farmers whose number was about 22 compared to large scale farms who supply 90% of the produce. The reader should also bear in mind that these 22 farmers are drawn out of a large number of small-scale farmers who make up the bulk of farmers in Zambia

8. Conclusions

There has been rapid growth and expansion of South African supermarket chains in the SADC countries since 1991. This has been facilitated by trade liberalisation, increased economic growth, positive political changes, regional integration arrangements, increased urbanisation, an increase in income, enlargement of the middle class population groups, and the liberalisation of foreign direct investment. South African supermarket chains have increased their market share in the case-study countries through buying other supermarkets, franchising and forming partnerships with other supermarkets in these countries.

The study concludes from the results of the models and focus group discussions that the expansion of South African supermarkets in other SADC countries has not excluded local farmers and food processors. Small-scale farmers who participate in the FFV supply chains of the chain supermarkets are more commercially-oriented and generally better-endowed with resources than those supplying traditional FFV markets.

Eighty percent of small-scale farmers in Botswana, Namibia and Zambia were subsistence-oriented. This category of small-scale farmer was excluded from the supermarkets' FFV supply chains due to erratic production and their inability to meet the chain supermarkets' quality and quantity requirements. This category of farmer depends on traditional markets for marketing surplus products.

Membership in a farmers' organisation does not increase the chances of farmers accessing and supplying to supermarkets. The study concludes that membership in a farmers' organisation does not necessarily increase the opportunities for small-scale farmers' to participate in the FFV supply chains of chain supermarkets in case study countries. There is need to re-evaluate the farmer organizations that are being formed to ensure that they assist farmers in accessing the supermarkets FFV supply chains and marketing of produce in general.

The results of the study show that both large-scale and some small-scale farmers have managed to participate in the supermarkets' FFV supply chains in Botswana and Zambia. Participation in the FFV supply chains of chain supermarkets has a positive impact on small-scale farmer's incomes. Small-scale farmers who supply supermarkets have higher incomes than those who supply traditional markets. Therefore, supermarkets have the potential to contribute to the agricultural and food processing and manufacturing industries in host nations.

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