Effect of price and income changes on farmers' cassava marketed surplus in Edo state, Nigeria

Ojogho, O. and Alufohai, G. O.
Department of Agricultural Economics, University of Benin, Benin City, Edo State, Nigeria
E-mail: igomercy@yahoo.com

Abstract: The study investigated the effect of price and income changes to cassava farmers' marketed surplus in Oredo and Egor Local Government Areas of Edo State, Nigeria. To achieve this objective, the study examined the price elasticity of home consumption, the income elasticity of marketed surplus of cassava and the total price elasticity of cassava marketed surplus. The study used mainly primary data. Cross-sectional data were collected from 352 cassava farmers using the simple random sampling technique through well-structured questionnaire. The questionnaire contained questions that bothered on consumption, total production, and marketed surplus, price of cassava and income of farmers. The model used specified the consumption decision as a function of price of cassava and the farmer's income, and marketing was treated as residual using marketed surplus as a measure of marketing. Using the two Stage Least Square (2SLS) estimation method, the result suggested that the farmers were price and income responsive as consumers, and higher prices resulted in larger quantities being marketed with income elasticity of consumption of 0.59. This value implies that percentage change in consumption per unit percentage change in income is 0.59. For every percentage increase in income, there was a less than proportional increase in consumption. Thus a policy of attempting to stimulate output through higher prices which will reduce consumption by producers, as a result of increase in their income, will also be consistent with evoking a larger proportion of the output produced for non-farm consumers such as the urban industrialists.

Keywords*: production, consumption, output, marketed surplus, elasticity*

INTRODUCTION

Cassava is Africa's second most important food staple, after maize, in terms of calories consumed. Cassava is a major source of calories for roughly two out of every five Africans. According to Jones (1959); Fresco (1986); Dostie *et al* (1999); and Haggblade *et al* (2003), cassava is consumed daily and sometimes more than once a day. In the Democratic Republic of Congo, cassava contributes more than 1000 calories per person per day to the diet and many families eat cassava for breakfast, lunch, and dinner. Cassava is consumed with a sauce made with ingredients rich in protein, vitamins, and minerals. In the Congo, Madagascar, Sierra Leone, Tanzania and Zambia, cassava leaves are consumed as a vegetable (Jones, 1959; Fresco, 1986; Dostie *et al*, 1999; and Haggblade *et al*, 2003). Cassava leaves are rich in protein, vitamins, and minerals (Latham, 1979). Nevertheless, in Africa, cassava is a marginalised crop in food policy debates because it is burdened with the stigma of being an inferior, low-protein food that is uncompetitive with the glamour crops such as imported rice and wheat. Many food policy

analysts consider cassava an inferior food because it is assumed that its per *capita* consumption will decline with increasing per capita incomes. In some East and Southern African countries, such as Malawi, Tanzania, and Zambia, British colonial policies forced indigenous farmers to plant cassava as a famine-reserve measure and subsidised maize grown by settler farmers (Jones, 1959). Over the past 50 years, smallholders in Nigeria have increased the production of cassava as a cash crop, primarily for urban markets. In the 1990s, Africa produced half of the world cassava output, primarily because Nigeria increased her production fourfold. Thus, Nigeria has replaced Brazil as the world's leading cassava producer (Nweke, 2004). This shift to commercial production for urban consumers, livestock feed, and industrial uses can be described as the cassava transformation. During the cassava transformation, high-yielding cassava varieties increase yields while labor-saving and improved processing technologies reduce the cost of producing and processing cassava food products to the point where they are competitive with food grains such as wheat, rice, maize, and sorghum for urban consumers. Looking ahead, as the costs of cassava production, harvesting, processing, and marketing are reduced, one can expect cassava to play an expanded role as a source of livestock feed and industrial raw material in Africa as well as a source of foreign exchange earnings through the export of cassava pellets for livestock feed. The cassava transformation, as described in detail by Nweke *et al* (2002), encompasses four stages: Famine Reserve, Rural Food Staple, Urban Food Staple, and Industrial Uses and Livestock Feed. In a war situation, cassava has several advantages over yam production. For example, the establishment cost of cassava production for home consumption is generally low because stem cuttings and family labor are the main inputs. Cassava generates a high yield of carbohydrate per hectare and it requires labour only at planting weeding and harvesting with little or no fertiliser application. Since the roots can be stored in the ground for several months and even up to four years without deterioration, there is a possibility that a displaced population can find their cassava fields un-harvested upon their return home. At the average monthly exchange rate of 17 Naira to US$1.00 (1993 exchange rate) and the average of 11 persons per household in Collaborative Study of Cassava in Africa (COSCA), the mean cash income per person in the COSCA households was equivalent to US$177 which amounted to 120 percent of agricultural GDP per capita in the same year. That the cash income of the COSCA households is greater than the agricultural GDP per capita can be a paradox. But the chaos that exists in Nigeria's agricultural production statistics is exceptional (Berry, 1993).

The main objective of the study is to examine the effect of price and income changes to farmers' cassava marketed surplus in Oredo and Egor local government areas of Edo state in Nigeria. To achieve this objective, the study examined the price elasticity of home consumption, the income elasticity marketed surplus of cassava and the total price elasticity of cassava marketed surplus

LITERATURE REVIEW

Marketable Surplus refers to the quantity of produce which can be made available to the non-farm population, that is, the residual left with the

producer/farmer after meeting his requirements for family consumption, seeds, feed for cattle, payment to labour in kind, payment to artisans (carpenter, blacksmith, potter, mechanic), payment to landlord as rent and social and religious payments in kind is the quantity of produce which the producer/farmer actually sells in the market, irrespective of his other requirements. "Surplus" in the sense that buyers do not exhaust supply at any price acceptable to sellers is standard usage in economics. With food, the term denotes that a few countries have become net exporters of certain food-stuffs around which there is intense sales competition on the world market. While this is an important consideration for American agriculture, which produces many of those foodstuffs and competes on the world market, it says nothing about whether the world's growing human population can be adequately fed by any likely increases in food production. Used in connection with world population, world carrying capacity, or sustainable production, "food surplus" is misleading or worse. Unfortunately, the erroneous connection is widely made (Abelson, 1987). Only from the producers' point of view is there surplus. From many potential consumers' standpoint there is shortage. Some go hungry even in countries that are net exporters of food (Poleman, 1975). There is surplus largely because millions of malnourished persons do not have the financial wherewithal to create an economic demand sufficient to acquire a nutritionally adequate share (Wortman, 1980). The real costs associated with producing the marketed surplus suggest that far more than a distributional problem is involved. "New and better crop varieties" are cited as the most important factor in the increase in world food supplies (Abelson, 1987).

METHODOLOGY:

Study Area: the study was carried out in Uselu, Ugbiyiokho and Useh communities of Oredo and Egor Local Government Areas of Edo state, Nigeria.

Source of Data: The study used primary data only. Cross-sectional data were collected on 352 cassava farmer in Oredo and Egor Local Government Areas of Edo State.

Sampling Technique: The simple random sampling technique was used to collect data through the use of well-structured questionnaire. The questionnaire contained questions that bothered on consumption, total production, and marketed surplus, price of cassava and income of farmers.

Method of Data Analysis: The simple descriptive and inferential statistic was used in the study. The descriptive statistics used the frequency counts and percentages while the inferential statistics used the two Stage Least Square (2SLS) regression. The model used in this study is the same as that used by Bardhan (1970) and modified by Walter (1975). The total production (supply) of cassava (S) is allocated among consumption by cultivators (C), marketing (M), and other net disposals to non–cultivators (T) which consist of payments in kind for rent, wages and the like. The identity is given as:

$S \equiv C + M + T$ [1]

The farmer's short run decision is to allocate S –T = Q between consumption and sales.

$$C = f(P, Y) \quad \ldots\ldots [2]$$

and

$$M = Q - C(P, Y) = f(P, Y, Q) \quad \ldots..[3]$$

where Q = the net production

Y = net income of farmers which includes the income from cassava consumed and sold less all costs, i.e. sale (PQ) + other income (y^o)

P = price of the commodity in the market.

The linear functional form for estimating the consumption equation is given as:

$$C = \alpha_0 + \alpha_1 p + \alpha_2 Y + \mu_i \quad \ldots. \ [4]$$

Substituting [4] into [3] for marketing gives

$$M - Q = -C = -\alpha_0 + \alpha_1 P + \alpha_2 Y - \mu \quad \ldots \ [5]$$

The total price elasticity of marketed surplus is given as

$$\eta_p = \frac{dM}{dP}.\frac{P}{M} = \varepsilon_{mp} + r\varepsilon_{my} = -b\left(\varepsilon_{cp} + r\varepsilon_{cy}\right)$$

where $\varepsilon_{cp} = \frac{dC}{dP}.\frac{P}{C}$ represents farmer's price elasticity of demand for cassava, $\varepsilon_{cy}\frac{dC}{dY}.\frac{Y}{C}$, for income elasticity of farmer, $r = \frac{PQ}{Y}$ and $b = \frac{C}{M}$ is the ratio of consumption to marketed surplus.

The estimation method simply treated P and Y an endogenous and either of equation [4] or [5] was estimated by the method of two–stage least squares (2SLS).

RESULTS AND DISCUSSION

The summary statistics of production, consumption, net disposal and marketed surplus is presented in Table 1. The Table showed that the average total farm production of cassava is 38500 tonne with a standard deviation of 100 .8, which is highest among the small-scale farmers (56.27) and least among the medium-scale farmers (15.13). The large variability by the standard deviation implies that the farmers operated at different levels of farm sizes, as shown by the different size categories, which tend to affect their output level. The means consumption was 15600 with a standard deviation of 36.6. The variability in consumption measured by the standard deviation is due to the changes in consumption pattern under the production season. The mean total marketed surplus for marketing was 22772.75 with a standard variation of 27.17. This low variability implies that the farmers, on average, operated at different levels of net disposal to non-cultivator (a measure of the cost structure) which tend to affect their output level and marketed surplus. This low variability is also shared by the small-scale farmers (1.11). Among the different farm size groups, positive trend was noticed in respect of output, quantity consumed and marketable and marketed surplus of cassava. The proportion of marketed surplus to marketable surplus showed the declining trend with increasing farm size. The proportion of revenue to income is about the same for all categories of farm size, suggesting the non-dependence of revenue on farm size, and non-profitability of cassava in the study area, given the same market price. There is a greater variability in output among the farmers than there is in consumption, though with a higher variation in output among the small-scale farmers. This result is reflected in their income in which there is great variation in the entire sample with the small-scale farmers displaying higher variability. The reverse is the case with revenue in which variation is more noticed among the large-scale farmers.

Table1: Summary Statistics of Variable of Production, Consumption, Net Disposal and Marketed Surplus

Variable	Farm size			Entire Sample
	Small	Medium	Large	
Output	10582	26504	36106	38500
	(57.27)	(15.13)	(54.12)	(100.8)
	100.0%	100.0%	100.0%	100.0%
Consumption	8642.32	11171.44	11214.52	15600
	(0.19)	(12.17)	(2.11)	(36.6)
	81.67%	42.15%	31.06%	40.52%
Kind wages	267.72	924.99	1433.41	1378.3
	2.53%	3.49%	3.97%	3.58%
Farm need	130.16	564.54	621.02	1790.25
	1.23%	2.13%	1.72%	4.65%
	1541.80	13843.04	22837.05	19731.25
Marketable surplus	14.57%	52.23%	63.25%	61.25%
	2032.80	16363.57	24490.70	22772.75
Marketed surplus	(1.11)	(11.28)	(21.01)	(27.17)
Marketed surplus as % of output	19.21	61.74	67.83	59.15
% of marketed to marketable surplus	131.85	118.21	107.24	115.41
Income	9114.25	22793.44	31051.16	44700
	(121.17)	(79.10)	(101.15)	(432.10)
Price	21400	21400	21400	21400
Revenue (PQ)	3590.47	8992.81	12250.77	13061.92
	(0.03)	(9.07)	(17.11)	(132.09)

Figures in parentheses are standard errors
Source: Author's calculation from Field Survey, 2008.

The sign of estimates conform to *a priori* expectations and all parameters are significant at 5% level of significance as shown in Table 2. The result showed that the consumption of cassava will increase by 0.206 unit for every unit increases in the farmer's income while consumption will decrease by 1.23 for every unit increase in the price of cassava for the entire sample. This decrease in consumption as price increases implies that the farmers will have more for the market, *ceteris paribus*. The disproportionate increase in the consumption of cassava as income increases shows that cassava is an inferior commodity. These observations are also shared by all categories of farm size except that the decrease in consumption is highest among the large-scale farmer (-1.57) for unit increase in the price of cassava. Similarly, the proportionate increase in the consumption of cassava as income increases is highest among the large-scale farmers.

Table 2: the 2SLS Estimate of the Consumption Function.

Variable	Parameter	Estimate
Entire sample		
Constant	α_0	163.15
		(51.12)
Price	α_1	-1.23
		(0.56)
Income of farmer	α_2	0.206
		(0.0021)
Small farm size		
Constant	α_0	150.01
		(7.13)
Price	α_1	-1.02
		(0.97)
Income of farmer	α_2	0.209
		(0.039)
Medium farm size	α_0	
Constant		111.03
		(10.12)
Price	α_1	-1.41
		(0.76)
Income of farmer	α_2	0.317
		(0.064)
Large farm size		
Constant	α_0	57.19
		(21.19)
Price	α_1	-1.57
		(0.93)
Income of farmer	α_2	0.513
		(0.071)

Source: Author's calculation from Field Survey, 2008.

Table 3 shows the estimates of the elasticities of consumption and marketing. The Table showed that the income elasticity of consumption, 0.59, is inelastic since it is less than one. This value implies that percentage change in consumption per unit percentage change in income is 0.59. It implies that increase in income leads to a less than proportionate increase in consumption. The positive sign implies that income affects the consumption of cassava, but proportionate change in consumption is less than the proportionate change in income. This implies that farmers will retain a smaller percentage and make a larger percentage available for off-farm consumption (marketing). The 1.15 represent the direct price effect of marketing, while the -0.40 shows the indirect effect of income on marketing induced by a change in price. Estimate of total price elasticity of 1.03 indicates that as the price increases, the farmers will market more of cassava. The small-scale farmers tend to market more of their produce than any other category of farmers. This is contrary to the result of Bardhan (1970) who found the price elasticity of marketing to be negative. The result in this study, however, is in agreement with Walter (1975).

Table 3: Estimate of Price and Income Elasticities of Consumption and Marketing

Elasticity	Estimate			
	Farm size			Entire Sample
	Small	Medium	Large	
ε_{cp}	-2.53	-2.70	-3.00	-1.69
ε_{cy}	0.22	0.65	1.42	0.59
ε_{mp}	10.74	1.84	1.37	1.15
ε_{my}	-0.52	-0.44	-0.65	-0.40
η_p	10.54	1.67	1.11	1.03

Source: Author's calculation from Field Survey, 2008.

CONCLUSION

The study examines the price and income elasticities of home consumption and marketed surplus of cassava. A model concerning the decision to allocate the net production of cassava between consumption and marketing was used. The model specified the consumption decision as a function of price of cassava and the farmer's income, and marketing was treated as residual using marketed surplus as a measure of marketing. Using the 2SLS estimation method, the evidence suggests that the farmers are price and income responsive as consumers, and higher prices will result in larger quantities marketed. Thus a policy of attempting to stimulate output through higher

prices will also be consistent with evoking a larger proportion of the output produced for non-farm consumers such as the urban industrialists.

REFERENCES:

Abelson, P.H. (1987). World Food. Science, 236,9.

Bardhan, K. (1970). ' Price and Output Response of Marketed Surplus of Foodgrains. A Cross-sectional Study of Some North Indian Villages'. *American Journal of Agricultural Economics.* (52): 51-61.

Berry, S. S. (1999) *Socio-economic aspects of cassava cultivation and use in Africa: Implication for the development of appropriate technology.* COSCA Working Paper No. 8. Collaborative Study of Cassava in Africa. Ibadan, Nigeria: IITA.

Dostie, B., L. Rabenasola, and J. Randriamamonjy. (1999). La filière manioc: amortisseur oublié de vulnérables.. Anta anarivo: Institut National de la Statistique. In Haggblade, Steven and Zulu, Ballard. 2003. *Conservation Farming in Zambia*. EPTD Discussion Paper No. 108. Washington, D.C.: International Food Policy Research Institute.

Fresco, L. (1986). *Cassava in shifting cultivation: a systems approach to agricultural technology development in Africa.* Amsterdam, the Netherlands: Royal Tropical Institute.

Haggblade, Steven and Zulu, Ballard. (2003) *Conservation Farming in Zambia*. EPTD Discussion Paper No. 108. Washington, D.C.: International Food Policy Research Institute.

Jones, W. O. (1959). *Manioc in Africa*. Food Research Institute. Stanford, CA, USA: Stanford University Press.

Marter, A. (1978) *Cassava or maize: A comparative study of the economics of production and market potential of cassava and maize in Zambia.* Lusaka: University of Zambia.

Nweke, Felix I., Dunstan S. C. Spencer and John K. Lynam. (2002): *The cassava transformation: Africa's best kept secret*. Lansing, Mich., USA: Michigan State University Press.

Nweke, F. (2004) New Challenges in the Cassava Transformation in Nigeria and Ghana. www.iita.org.

Walter, H. (1975). "The Price and Income Elasticities of Home Consumption and Marketed Surplus of Food Grains". *American Journal of Agricultural Economics*, 57 (1):111-115.