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The Determinants of Smallholder Maize Supply to Private Traders and Profitability: Evidence from Lilongwe District in Central Malawi

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ABSTRACT

This study was devoted to estimate profitability and various determinants of quantities of maize sold to private traders by smallholder farmers in Lilongwe district. Multiple Regression analysis was employed to test various determinants of quantities of maize sold to private traders. Gross margin analysis was used to estimate economic returns realized by the smallholder maize farmers supplying their produce to exporting traders. The findings of the study revealed that income level of the household, household size, access to extension service, education level of household head, size of land under maize production and price of maize were important determinants of quantities of maize that a given household sold to private traders. The gross margin per Malawi Kwacha invested was MK2.98.

Keywords: Determinants, gross margin, selling maize, smallholder farmers, private traders

INTRODUCTION

Malawi's agriculture is characterized by a dual structure consisting of the smallholder and estate sub – sector. These sub – sectors are distinguished according to legal and institutional rules regulating crop production, land tenure, and marketing and pricing arrangement for agricultural commodities. Agricultural production occurring on the traditional tenure or customary land is defined as that of smallholders, where estate production occurs on leasehold or freehold land (Edriss, 2002). The smallholder agriculture is dominated by maize production and is already operating at its land frontier with very little or no scope to increase the supply of land to meet the growing demand for food (Smale and Jayne, 2003). A further expansion of the crop area which was the major source of maize output growth till the 1980s, is no longer possible due to population pressure. Thus, the only plausible solutions to increase food production lie in raising the productivity of land by improving the technical efficiency and/or through technological improvements. Efficiency gains will have a positive impact on raising farm incomes of these largely resource poor farmers (Kydd, 1989 ; Smale and Jayne, 2003 ; Chirwa, 2003).

The combined effects of small farm holdings, use of low yielding varieties, low levels of inputs, high losses in storage and processing, and poor crop management

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practices contribute to low productivity (Edriss, 2002). Low levels inputs might be attributed to the low incomes received in the product markets which are not enough to offset the rising prices of inputs. The smallholder sector has also been characterized by low levels of agricultural production and low land usage due to overdependence on hand hoe technology, limited availability of land due to rapid population growth and transfer of land from smallholder to estate sub-sector (National Economic Council, 1998). Many times production is regulated by fluctuating and low product prices which in turn affect farmer's capacity to purchase farm inputs.

In Malawi, maize being a staple food is a very important crop, a kind of call for all smallholder farmers to have enough maize in their reserves for a year out consumption. On the contrary, most farmers, though producing enough of it, they face planning problems as they fail to properly ration how much to sell and how much to store. These farmers sell maize produce after harvesting and they are stricken by food insecurity and starvation in the long run prior to the next harvest. Selling maize in itself may not be a problem if the realized income is rationed throughout the year to meet next harvest. In addition, the monopolistic nature of the private traders has exploitative effects on the smallholder farmers. These effects can be captured in the level of profits being realized by the farmers. Hence, there is a need for empirical evidence as to whether these smallholder farmers capture positive economic returns from the sales.

Studies have been done on technical efficiency of maize production (Tchale and Sauer, 2007), labour productivity in maize production (Kankwamba, 2010). However, information gap still exists on the profitability of maize marketing by smallholder farmers to private traders. In addition, policy options in Malawi have dwelled much on input markets than output markets. Present study has been devoted to estimate profitability and various determinants of quantities of maize sold to private traders by smallholder farmers in Lilongwe district.

METHOD

The Study Area

The study was conducted in Lilongwe Central District, one of the major maize growing districts in Malawi. Of the approximately 1,537,651 ha of land under Irish potato cultivation in Kenya. 344,006 ha (22.37%) are located in Lilongwe District (MOA, 2005). The district falls within the central Malawian plain with an altitude of about 600m above sea level. Mean maximum temperatures vary from 12.5°C to 33°C in winter and 15-35°C in summer (Mzima, 1985; UNICEF and Ministry of Finance, 1993).

The district generally receives reliable rainfall. The average annual rainfall is 600 to 1,000 mm with a uni-modal distribution, falling from November to March. Soils are predominantly humic andosols with high to moderate fertility. The population is 65% rural-based consisting 261879 households with a mean household size of 4.7 persons (GoM., 2009). According to the 2008 population census, population of Lilongwe District had 1,905,282 persons consisting of 960,066 males and 945,216 females. Land ownership is predominantly freehold in the study area and small-scale farms are predominate.

The Data

A survey of the production practices and household characteristics of smallholder Irish potato producers was conducted in September 2008. Data were obtained from 60 smallholder maize sellers. A two - stage sampling technique was used. First, two sub-locations were selected from each of the locations on a random basis. Secondly, a random sample of 60 households from 15 sub - locations was selected for the survey. Data were collected using a structured questionnaire. The questionnaire was designed and pre-tested in the field for its validity and content and to make overall improvement of the same and in line with the objectives of the study. Data were collected on output levels, this include: input use, socio-economic and institutional variables. Maize output comprising of quantities sold and that retained for consumption and as seeds, measured in kgs, the cost of fertilizer used, was measured in Malawi Kwacha; Finally, land area devoted to maize production, measured in hectares

The model

Multiple Regression analysis was used to analyze the data. Regression analysis is one of the commonly used tools in econometric work and it is concerned with describing and evaluating the relationship between a given explained or dependent variable and one or more other explanatory or independent variables (Maddala, 2001). The general form of the multiple regression model was specified as follow;

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \mu_i \quad (1)$$

In which case;

- Y = Amount of maize sold to traders (Kg)
- X₁ = Income level of the household (MK/Month)
- X₂ = Household size (number of persons)
- X₃ = Access to extension service (1 = access to extension and 0 = otherwise)
- X₄ = Education level of household head (number of years of schooling)
- X₅ = Size of land under maize production (ha)
- X₆ = Price of maize (MK)
- β_i = Responsiveness of a quantity sold for a unit change in a given determinant
- μ_i = Stochastic disturbance

Estimation of economic returns

Gross margin analysis was used to estimate economic returns realized by the smallholder maize farmers supplying their producer to exporting traders. It assumes the form as shown below: Gross margin was presented by the total amount of income earned by selling the farm products less variable costs. Variable costs are those costs in production, which are specific to the enterprise and vary in proportion to the size of the enterprise.

$$\Pi = PQ - TVC \quad (2)$$

Where:

- Π = Gross Margin (MK/ha)
- PQ = Revenue(MK/ha)

TVC = Total Variable Costs (MK/ha).

RESEARCH FINDINGS

The results show that the land area allocated to Maize was small at an average of 0.43 hectares. The average age of the sample farmers was 41.7 years with a minimum of 22 and maximum of 75 years. Mean household head's farming experience was 10 years and 4 years of formal education. The farm size in the sample was between 0.52 - 2.35 ha with a mean of 0.75 ha and a standard deviation of 0.56 ha. On average, the sampled farms reported a mean yield of 1475kg/ha while the yields vary between a low of 375kgs/ha and a high 4447kgs/ha, suggesting considerable room for improving Maize yields. The results reported that there are 20% households headed by females. This ratio is much deviated from the literature by GoM (2002) who estimated that the majority of households (about 70%) in the country are headed by males. The lowest income level was found to be MK200 and the highest was MK8 000 with mean of MK1996.98 and standard deviation of MK1 784.47.

The coefficient estimates, standard errors, t-values and significant test for the multiple regression model fitted into the data are presented in the table 1. The coefficient estimates for education level, access extension service and household size are statistically significant at 1% level of confidence thereby determining the quantities marketed by smallholder maize producers in the study area.

Table 1: Estimates of Quantities of Maize Sold to Private Traders

Variable	Coefficient estimate	t-ratio	P-Value for Park's Test for Heteroskedasticity
Constant	192.005(12.344)	15.555	
Education Level	0.461 (0.091)	5.065***	0.64
Field Size	0.136 (0.055)	2.473**	0.63
Off-farm Income	-0.579 (0.247)	-2.348**	0.56
Extension	0.098 (0.031)	3.116***	0.68
Price	0.136 (0.063)	2.159**	0.89
Household size	-0.742 (0.059)	-12.52***	0.25
Adjusted R-square =83%, DW=2.08, VIF=5.882, F-value=43.13, n = 60			

Values in parenthesis are standard errors.

****indicates variables that are significant at 1% level. **indicates variables that are significant at 5% level. *indicates variables that are significant at 10% level*

The adjusted R-squared value indicated that the model was explaining 83% of the variation in the quantities marketed by maize producers. However, this had shown a sensible as well as a high degree of goodness of fit in adequately explaining the determinants of quantities marketed by maize producers. The model had an F-value of 43.13 significant at 1% level against the tabulated F-value of 2.15 implying that the independent variables significantly explained the variation in the dependent variable at 1%, 5% and 10% levels. The validity of the F-value is also supported by the acceptable standard which postulates that calculated F-value has to be at least four times the

computed value. All the independent variables in the model were also tested for multicollinearity and there was no serious level of multicollinearity as supported by Variance Inflation Factor (VIF)² of less than 10 (Table 1). The Durbin-Watson (DW) test had a value of 2.084 which is within the tolerable range of autocorrelation problem (Gujarat, 1995).

The elasticity estimates are presented in Table 2. The elasticities are functions of the variables and the parameter estimates of the multiple linear regression model. The elasticities were computed at mean values of the variables.

Table 2: Computed Elasticities of Marketed Maize Supply

Variable	Elasticity of Maize Supply
Field Size	0.001
Off-farm Income	-6.362
Own Price	0.034
Education	0.022

Source: Author's own computation from household survey 2008/2009.

Price of maize positively affected quantities of maize marketed. This implied that as favourable prices are offered on the market the producers would increase the quantities marketed. Prices are supposed to send signals to producers in form of incentive (Tomek, 1991). A price increase by 1% would skyrocket maize quantities marketed by 3%. This is also consistent with consumer preference in microeconomic theory (Binger and Hoffman, 1988). Farmers derive more utility from maize revenue at high prices than at low prices. Thus, when prices go up, the utility of holding a unit of maize is exceeded by that realized from the revenue when that unit of maize is traded off.

Field size was significant at 5% level. Land size allocated to maize production positively affected the quantities of maize marketed. An increase in maize field size would result in increased production. This increases production would in turn induce increased output and hence, surplus from consumption reservoirs. With increase in surplus the quantities marketed also increase. The land size elasticity of supply show that a percentage increase in maize field size would result in 0.1% increase in sales of maize. However, the allocation of more land to maize production more than subsistence requirement depends on a number of factors including relative profitability of other cash crops.

Off-farm household income portrayed an inverse relationship with quantities of maize marketed. An increase in income by 1% would reduce sales by a very explosive percentage. This would mean that farmers are in constant search for income through sale of maize and hence, implies that if farmers have enough income, they would not participate in selling maize. These results are consistent with what Tembo (2007) who found a negative relationship between off-farm income and quantities of cassava and maize marketed.

² VIF checks for tolerance level of multicollinearity. The rule of thumb is, if VIF is greater than 10, which correspond to R-squared of greater than 90%, be concerned for multicollinearity (Edriss, 2003).

Household size had a negative relationship with quantities of maize sold just as expected. The bigger the household size, the more maize flow into consumption. As a result, less of it will go into the market. On the other hand, the small household size will have relatively less consumption, sending the surplus into the market. A percentage increase in household size will reduce quantities of maize sold by 74%.

Extension service is directly related to quantities of maize sold. An increase in extension service by 1% will increase quantities on the market by 9%. The technical expertise of extension officers need to be revised because they are resulting in increase of maize sales at expense of food security in the area. Extension service was significant at 10% level.

Education is positively related to quantities of maize sold to private traders. An educated individual is assumed to be more productive and basic education, whether acquired through formal or informal programs, is foundational to increased productivity (GoM, 2002). This increased production translates into surpluses of maize which is then allocated for the market. If education level of maize producers was to be increased by 1% then quantities of maize sold would rise by 46% because it would increase maize surpluses at household level.

Table 2: Profitability Analysis

Variable	Gross Margin Analysis
Average Yield of Maize/ha	1262.5Kg/ha
Average Price of Maize	MK40.68/Kg
Total Revenue	MK51367.92/ha
Variables Costs	
Seed Cost	MK 3754.35/ha
Fertilizer	MK4335.516/ha
Cost of Chemicals	MK692.60/ha
Cost of hired labour	MK2537.42/ha
Transportation Cost	MK1628.37/ha
Total Variable Cost	MK12948.25
Gross Margin /ha	MK38626.47
Gross Margin / MK	MK2.98
Break Even Point of Production	318.28Kg
Production Cost (MK/kg)	MK10.26

Source: author's computation

Gross Margin Analysis results as denoted in the summary table 5.1, show positive orientation. This does not exclude the fact that the some units of analysis had no negative gross margins. From the original data set, it was computed that 4.55% of the household interviewed had negative gross margins. About twenty percent (20.45%) had gross margins less MK11 000 but greater than MK1. Eleven percent had their gross margin between MK11 000 to less than MK20000. Eighteen percent had their gross margins ranging from MK20 000 to less than MK30000. Six percent of the respondents

had their gross margins ranging from MK30 000 to less than MK40 000. Forty thousand Malawi Kwacha to less than MK50 000 was comprised in 13.63% of the respondents.

The gross margin per kwacha invested was 2.98. This means that the farmer returns MK2.98 for every kwacha invested. The Break Even Point (BEP) of production shows, at this level of cost of production, that farmers' minimum production is 318.28Kg for the farmer to break even. The farmer incurs MK10.26 per Kg of maize produced. This means that the minimum price of maize, for the farmer just to recover the costs of production is MK10.26 per Kg of maize.

CONCLUSION AND IMPLICATION

Education level of household head, off-farm income level and household size were significant at 1% level. Field size was significant at 5% level, price and extension service were found to significant at 10% level. We therefore, reject the narrow hypothesis and conclude that income level of the household, household size, access to extension service, education level of household head, and size of land under maize production and price of maize do affect the quantities of maize smallholder farmers sell to private traders.

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