Are farmers profit efficient? Evidence from groundnut farmers in Malawi

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Abstract

Groundnut growing is one of the major farming activities in Malawi, however, the extent of efficiency among the farming community has not been fully explored. This study analyzes the direct production efficiency by considering profit efficiency associated with groundnut production using stochastic profit frontier function and the inefficiency effect model specification. The results indicate that the profit efficiency in groundnut production ranges from 1% to 89% (mean of 45%). The relationship between efficiency and both farm and institutional characteristics was found to be significant. Efficiency appeared to be positively associated with farmer's access to extension services (t=2.10), household size (t=1.78) and soil fertility (t=3.56), but associated negatively with distance to market (t=6.30) and size of land allocated to groundnut production (t=5.33). The implication of the results is that there is scope for increasing the production of groundnuts by about 50% by improving the access to extension, market and improving farm management.

Key words: *Profit, efficiency, stochastic frontier, groundnuts, Malawi*

1 Introduction

Despite the crucial role that dryland legumes play for poverty reduction, inefficiencies and lack of technological change have often locked small producers into subsistence production and contributed to stagnation of the sector. In the face of increasing population and associated rise in food demand, which are further triggered by skyrocketing food prices, the need for increased agricultural productivity as an effective means to improve the livelihood of farm households cannot be over-emphasized.

There is scope to increase agricultural production through; (i) expanding area under crop cover; (ii) Investing in scientific research to generate improved varieties, and (iii) improving resource use and allocation efficiency to get higher output from limited resources and current level of technology. The first two approaches, however, faced several challenges. As the per-capita land is already at its minimal and merely possible to expand area under cultivation (Kidula et al. 2008; Asfaw et al. 2012); secondly; application of improved agricultural technology neither easily available nor accessible by smallholder farmers, and also requires high level of technical knowledge, that makes technology adoption as not ultimate alternative to increase productivity. Therefore, the promising solution to increase food production, mainly lies on improving resource use efficiency by smallholder farmers (Bravo-Ureta and Pinheiro 1993; Bravo-Ureta and Evenson 1994; Hallam and Machado 1996; Bravo-Ureta and Pinheiro 1997; Rahman 2003).

This is also consistent with Janvry et al (2001) who argue that production increase cannot sustainably come from area expansion since that has already become a minimal source of output growth at world scale and negative source in India and Latin America. Thus, growth in the production will have to come from growth in yields emanating from scientific advances offered by biotechnology and other plant breeding initiatives as well as through resources use efficiency. The foregoing argument underscores the need for increased efficiency as a sustainable way for increasing productivity.

In Malawi, although groundnut production has been on the rise, the productivity remains low with average yield in smallholder farms of 700kg/ha. Previous studies (Edriss and Simtowe, 2003) have attributed the low productivity, partly to the high levels of inefficiency by smallholder farmers in the production of groundnuts. However, the studies mainly focused on understanding aspect of technical efficiency. Production efficiency usually analyzed by its three components technical, allocative, and scale efficiency. The popular approach is that of measuring technical efficiency using the frontier production function. However, as expressed by Ali and Flinn (1989) the production function approach to measure efficiency, particularly, the technical efficiency component may not be appropriate when farmers face different prices and have different factor endowments. Hence, Ali and Flinn (1989) , Ali et al. 1994 recommend the application of a stochastic profit function model to estimate farm specific efficiency. The profit function approach combines these concepts of technical, allocative and scale inefficiency in the profit relationship and any errors in the production decision are assumed to be translated into lower profits or revenue for the producer (Ali et al., 1994, cited in Rahman 2003). Ali and Flinn, (1989) define Profit efficiency as the ability of a farm to achieve highest possible profit given the prices and levels of fixed factors of that farm, while they define profit inefficiency as loss of profit from not operating on the frontier.

Resource use and allocation inefficiency is a bottleneck in improving agricultural productivity in developing countries. Despite the intensity of inefficiency problem, little research was done dealing with inefficiency in groundnut production system, particularly in Africa. The present study will help fill this gap in Malawi where there is no such studies dealing with efficiency in groundnut production system. Most of the existing literature dealing with technical efficiency focuses on the major crops such as rice, wheat, and maize. Different level of efficiency in agriculture has been registered, for example, After reviewing 30 different studies from 14 developing countries on production efficiency (Bravo-Ureta and Pinheiro 1993), concluded that the average technical, allocative, and economic efficiency was, 72%, 68%, and 43%, respectively. Similarly, (Bravo-Ureta and Pinheiro 1997) estimated technical efficiency for smallholder farmers for the Dominican Republic was between 42 to 85%, with average of 70%.

An average 40.1%, and 52% economic efficiency was registered by (Bravo-Ureta and Evenson 1994), for cotton cassava, respectively in Paraguay. Profit efficiency analyses for Bangladesh rice producers found to between 6% to 83%, with mean of 77% (Rahman 2003). Profit efficiency analysis for basmati rice producer in Pakistani, by Ali and Flinn (1989) reported the mean 72% efficiency with ranges of 13% and 95%. (Wang 1996) reported mean estimated efficiency of 62% for china with the 6% and 93%, minimum, and maximum efficiency, respectively; (Bozoğlu and Ceyhan 2007) concluded that technical efficiency in vegetable farms in Samsun province of Turkey were 82% with the ranges of 56% to 95%.

Estimating profit inefficiency in groundnut production in southern Malawi was the main objective of this study. The study employs the profit frontier stochastic approach on data collected from smallholder groundnuts producers to determine the sources of Inefficiency as well as the level of profit efficiency. The empirical question that the study would like to address is "How efficient are groundnut farmers in Malawi in terms of profits? What circumstance leads to lower profit efficiency levels?

The rest of the paper is organized as follows. Section 2 presents an overview of groundnut production and significance, while the methodology and data are presented in section 3. In section 4 we present results and discussions on levels of profit efficiency in groundnut productions and its determinants. The conclusions and policy implications of the findings are presented in section 5.

2 Overview of groundnut Production and Significance

Groundnut production is one of the most important activities in the world; adaptability of the crops to dry condition and coherently with the lower input requirement, makes it to be the most suitable crops in tropics and subtropics regions. Although, it originated in South America, it is now widely planted in tropical, sub-tropical, and warm temperate areas in Asia, Africa, North and South America, and Oceania (Freeman et al. 1999) and it is the most widely cultivated legume in Malawi. The crop provides a number of benefits to smallholder farmers in developing countries. In Malawi and Senegal, for example, groundnuts account for 25 and 60 percent of household's agricultural income, respectively (Diop et al. 2003). Furthermore, as a legume, groundnut fixes atmospheric nitrogen in soils and thus improves soil fertility and saves fertilizer costs in subsequent crops. This is particularly important when considered in the context of the rising prices for chemical fertilizers, which makes it difficult for farmers to purchase them.

Globally, groundnut also forms an important component of both rural and urban diet through its provision of valuable protein, edible oil, fats, energy, minerals, and vitamins. Ground is one of the nutritionally rich crops, which can substitute high cost animal-based diets. For instance, groundnuts seed contains 48% of fat; 25% protein and 11% carbohydrate[1]; moreover, it is an

[1]http://agropedia.iitk.ac.in/content/nutritional-features-groundnut;

important source of vitamins, calcium, and fiber. In addition groundnut cake is safe, rich in protein and crude oil and used in livestock feed. This crop is consumed as such, roasted (more than 32% of supply), or processed into oil (about 52% of supply). In livestock-farming communities, groundnut can be used as a source of livestock feed and increases livestock productivity as the groundnut haulm and seedcake are rich in digestible crude protein content. The groundnut cake is used as protein supplement for livestock fattening.

In 2012, the world groundnut production was 45.65 million tons; China, India and USA, accounted for respectively, about 37%, 10%, 7% of the total production (FAOSTAT, 2014). Africa accounts for about 24% of world groundnuts production in 2012; the Malawi's contribution in Africa is about 2.48% with total production of 0.59 million tons; which makes the country to be the 13th largest groundnuts producer in the world (FAOSTAT, 2014). Moreover, studies indicated that over the past four decades, area under groundnut, yield and production grew by 3.4%, 3.6% and 5%, respectively (Simtowe et al. 2009). Malawi's groundnut productivity remains low largely due to the continued use of unimproved/local varieties by producers as well as due to technical inefficiency (Simtowe et al. 2009) .

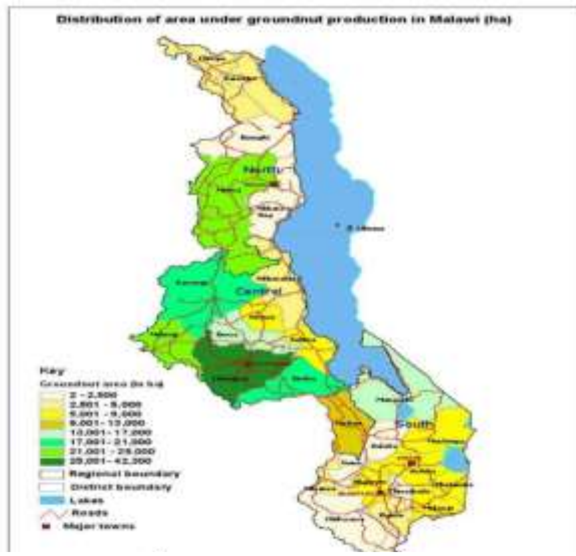

Figure 1: Distribution of Area under groundnut production in Malawi

Although produced in the entire country, the central and southern Agricultural Development Divisions (ADDs) of Kasungu, Lilongwe, Kasungu, Machinga, and Blantyre accounted for more than 75% of the total area planted to groundnuts in the period 2001-2006. A summary map indicating the major groundnut growing areas of the country is given in Fig.1. Concerning the production systems, groundnut is mainly a rain-fed crop cultivated either as a sole crop or in association with cereals such as maize and sorghum or millet or grain legumes such as groundnuts.

However, the groundnut sector in Malawi is constrained by poor productivity as well as low-marketed surplus from smallholder farmers. While attributed to poor crop management practices, the low yields are mainly due to low use of improved groundnut varieties and low technical efficiency. Even when improved varieties such as CG7 are adopted, they are highly susceptible to rosette attack hence their potential productivity gains are robbed by diseases attack. The adoption of improved groundnut varieties is said to be constrained by lack of awareness of the improved groundnut varieties and other constraints such as seed. Furthermore, the production of groundnuts has remained low in the last two decades due to the poor quality of groundnuts produced in Malawi, resulting from high aflatoxin levels. This further led to a reduction in the export volumes. Emphasis in current policies is focusing on supporting the production of high quality groundnuts with lower aflatoxin levels and on proper post-harvest handling techniques that reduce the buildup of aflatoxin.

3 Methodology and data

3.1 Data

Primary cross section data for this study is extracted from a survey conducted in four districts of Malawi in 2008. The data were collected by the International Crops Research Institute for semi-arid tropics (ICRISAT) in collaboration with Center for Agricultural Research and Development (CARD) of the University of Malawi and Malawian National Small Farmers Association (NASFAR). Data were collected from about 600 households of which 426 household reported growing groundnut. After cleaning the data and computing profit at household level, 388 households were found to eligible for application of stochastic profit frontier analysis for determinates of efficiency using household survey. Data were collected at both village and household level. The village level data acquires information on major crops grown, price for different crops, and access to infrastructure. While household information includes knowledge, farming experience on groundnut varieties, demographic characteristics, asset, area planted and area owned, production cost, yield, input use, consumption, marketing and participation in different institutions.

3.2 Theoretical framework for measuring efficiency/inefficiency using frontier profit function

In literature farmers production efficiency is mainly assessed by employing technical, allocative and scale efficiency. A farmer is said to be technically inefficient, for a given level of input use, if the output level is below the optimal (frontier output). Allocative inefficiency occurs if the farmer is not using input in proportion that is optimal, i.e. the ratio of marginal product of input equated with the input price ratio. In profit context a farmer can be scale inefficient, if the output level is at the level where product price is not equal to the marginal cost (Kumbhakar et al. 1989; Rahman 2003). In different studies, the observed differences in the efficiency among the farms measured by regressing the predict efficiency from the frontier production function on household characteristics (Wang 1996; Bozoğlu and Ceyhan 2007). The conventional production frontier function used to analyze the technical efficiency received a server criticism in its capability to yield reliable estimates, particularly when farmers face different prices and have heterogeneous resources endowment (Ali and Flinn 1989; Tzouvelekas et al. 2001). Moreover, single stage analysis of efficiency using production function assumes the independence between input and inefficiency (Kumbhakar 2001). This problems can be solved using a more general profit efficiency technique; which combines the three components of production efficiency into one system and enables simultaneous computation (Ali and Flinn 1989; Wang 1996; Rahman 2003) and both outputs and inputs are determined endogenously (Kumbhakar 2001).The profit efficiency assumes that any inefficiency in production system can be translated into lower revenue or profit. Profit efficiency thus measures the ability of farmer to attain the possible maximum profit from given level of input prices. Therefore, inefficiency defined in the context of profit efficiency as loss of profit (the difference between actual and frontier profit) (Ali and Flinn 1989). In this study we adopt the stochastic frontier profit function model proposed by Battese and Coelli (1995), this model measures the three components of efficiency gives more robust results with single estimation. This model allows estimating farm specific efficiency and factors explaining the efficiency differentials (Battese and Coelli 1995; Rahman 2003) simultaneously.

3.3 Specification of Empirical model

As in (Battese and Coelli 1995) and explained in (Rahman 2003); stochastic profit function is defined as

$$\pi_i = f(P_i, Z_i).\exp(\varphi_i) \qquad (1)$$

Where π_i is normalized profit (revenue less variable cost) of i^{th} groundnuts producing farmer divide by farm-specific (per kg groundnut price); P_i is the vector of input prices (labor, seed, fertilizer, manure) paid by farmer divided by the output price; Z_i is a vector of fixed inputs of i^{th} farm household; and φ_i is an error term for i=1, 2,…, n is the number of households in the sample. The error term φ_i has distribution consistent with the assumption of the frontier function, means that, φ_i is the difference in statistical (noise),v_i, term and inefficiency term, u_i.

$$\varphi_i = v_i - u_i \qquad (2)$$

Where v_i is independently and identically and normally, $NII(0, \delta_v^2)$ distributed two sided random errors, independent of u_is and the $u_i's$ are the non-negative random variables associated with inefficiency in production function; u_i are independent and zero truncated normal distribution with mean $\mu_i = \delta_0 + \sum_d \delta_d W_{di}$ and variance of $\delta_u^2(|N(\mu_i, \delta_u^2|)$, where W_{di} is the variable associated with in efficiency of i^{th} household; and δ_d and δ_0 are unknown parameters to be estimated .

The profit efficiency of i^{th} farm household in the context of stochastic frontier profit function is defined as

$$E(\varphi_i) = E(v_i - u_i) = E(\exp(-u_i|\varphi_i)) = E\left(\exp\left(-\left(\delta_0 + \sum\nolimits_d \delta_d W_{di}\right)\right)\middle|\varphi_i\right) \qquad (3)$$

Where E is the expectation operator; the result can be achieved by expressing the conditional expectation of u_i given φ_i. Maximum likelihood estimation can be used to estimate the unknown parameters, with stochastic frontier profit function and efficiency functions are estimated simultaneously. The likelihood estimates are presented as the variance parameters, $\delta^2 = \delta_v^2 + \delta_u^2$ and the $\gamma = {\delta_u^2}/{\delta^2}$ for details see (Battese and Coelli 1995).

The general form of the translog profit function after further computation can be presented as follows:

$$ln\pi' = \alpha_0 + \sum_{i=1}^{4} \alpha_i lnP_i' + \frac{1}{2}\sum_{i=1}^{4}\sum_{k=1}^{4} \omega_{ik} lnP_i' \, lnP_k' + \frac{1}{2}\sum_{i=1}^{4} \theta_i lnP_i' \, lnP_i' + v - u \text{ and}$$

$$u = \delta_0 + \sum_d \delta_d W_{di} + \rho \qquad (4)$$

Where $ln\pi'$ is the natural logarithm profit normalized by the output price , P_y, P_i' is the price i^{th} input (fertilizer, labor, seed, land) normalized by output price, P_y. $\alpha_i, \omega_{ik}, \theta_i, \delta_i$ are parameters to be estimated; v is two sided random error term and u is one-sided half-normal error term accounting for inefficiency.

4 Results

4.1 Characteristics of groundnut producers

Table 1 presents the summary of the variables used in the profit efficiency analysis. It is evident that per household profit was very small and the production volume was also small. On average, households produce 196 kg of groundnuts and generate a profit of 13270 K ($22.57). The average groundnut price is 52 MK. The average price of fertilizer and seed is about 17 and 50, MK, respectively. The total area cultivated by the household is included in the efficiency analysis served to test the null hypothesis of larger farmers are more efficient than the smaller once. The average land cultivated was 5.22 hectares with a standard deviation of 4.35, and about 5 people living in the house. The gender of the household head dummy is included in the model to explore relationship between profit efficiency and gender and to test the hypothesis of male headed households are more efficient in resource use. The majority (77%) of the respondents in the groundnut production system in Malawi were male-headed households. Access to market indicated to have an impact on the access to information and agricultural technology and thus influences the level of efficiency. On an average, the respondents have to travel about 1.24 km to the nearest local market. Participation in extension program dummy, which is 1 if the farmers received extension service and 0 otherwise, is included to see how the training on improved agricultural practices can influences farm level efficiency. Only, 5% of the groundnut producer received extension service. This indicates that the majority of sampled households were not getting extension services and operating in traditional way; which has a paramount implication for the importance of extension intervention to modernize agricultural production and enhance productivity by smallholder farmers. On average 15%, 64% and 21%, respectively, of the plots grown under groundnuts were have poor, medium, and good soil quality and about a hectare of land is allocated for groundnut production.

Table 1 Descriptive analysis of variables used in the model

Variable	Mean	Std. Dev.
Number of observation (n=388)		
Product (production in kg/HH)	195.52	222.64
Profit (MK/HH)	9971.67	11354.85
Price of groundnuts (MK/kg)	52.18	23.30
Seed price (MK/kg)	49.61	272.75
Area operated (hectare)	5.22	4.35
Distance to local market (km)	1.24	2.54
Participation in pvs training (1=yes, 0=no)	0.05	0.23
Household size (person)	5.19	2.20
Gender head (1=male, 0=female)	0.77	0.42
Poor soil quality(1=yes, 0=no)	0.15	0.60
Medium soil quality (1=yes, 0=no)	0.64	0.48
Good soil quality (1=yes, 0=no)	0.21	0.41
Plot size (hectare)	1.02	0.80

1 Malawian Kwacha equals (MK) 0.0023 USD

4.2 Determinants of profit efficiency

The maximum likelihood estimates for factors accounting to inefficiency and the estimated coefficients for the variance parameter were presented in the inefficiency section and variance parameter section of Table 2, respectively. The estimated variance parameter coefficients were statistically significant, indicating that technical efficiency were playing negative role in the groundnut production system in Malawi. In the inefficiency model, area allocated for groundnuts is included to expound the difference in technical efficiency if any, which may arise from difference in farming scale. As the increased area allocated for groundnut might have diminished the timeliness of input used, and spreads of activities over time, one may expect difficulties for larger farmers to operate at an optimal input use level (Amara et al. 1999). The positive sign of the coefficient on the plot size (groundnut area measured in hectare) implies that the larger the area allocated for groundnuts production the smaller the efficiency level. Moreover, the magnitude of the plot size coefficient is considerably higher, implying that, increasing the area allocated by one hectare leads to 80% decrease in efficiency. Similar results was reported regarding the relationship between farm size and efficiency in other studies (Bravo-Ureta and Pinheiro 1993; Hallam and Machado 1996; Amara et al. 1999; Tzouvelekas et al. 2001). The negative coefficient on the gender of the household head indicates that, though it is insignificant, male headed seems to be more efficient compared with their female counterparts.

As expected, distance to the local market has a statistically significant negative impact on the efficiency level. One more km from the local market is associated with a 25% loss in profit efficiency. This is mainly because the increased cost of transportation and less access to marketing and production technology for those who live in the remote areas. Another outcome of the efficiency model was the positive and significant effect of extension service on profit efficiency. It is indicated that farmers, those who have received extension service are about 90% more efficient than those who not do. This result is in line with the expectation as extension service provides technical support, including right input use, market information and training on improved farming techniques, similar results were registered (Kalirajan 1981; Bravo-Ureta and Evenson 1994). The coefficient of the household size variable in efficiency model indicates that households with larger family size are more efficient in resource use. Increasing the number of residents in the house will increase the profit efficiency by 8%. This is mainly, groundnut production is one of labor-intensive activities and family labor is an important input to increase production efficiency hence profit efficiency. Soil fertility plays a crucial role in profit efficiency; farmers growing groundnut on good soil quality are 110% efficient compared with those who grew on poor soil.

Table 2 Maximum likelihood estimates of profit frontier function for groundnut producers in Malawi

LnProfit	Coef.	z	P>z
Profit function			
LnLabor	6.33	1.36	0.175
LnSeed	-0.98	-1.42	0.156
LnLand	1.21	0.54	0.591
LnFert	-1.98	-0.73	0.466

LnLandLnFert	-0.72	-1.32	0.186
LnSeedLnFert	-0.90	-1.61	0.107
LnLabLnFert	1.91	1.47	0.142
LnLabLnSeed	0.33	1.05	0.292
LnManLnLand	-0.48	-0.43	0.669
LnSeedLnLand	-0.26	-1.78	0.074
LnLabor2	-3.70	-1.53	0.127
LnSeed2	0.24	2.34	0.019
LnLand2	0.20	1.16	0.245
LnFert2	-0.34	-1.75	0.080
Constant	0.51	0.11	0.913
Inefficiency			
Gender head (1=male, 0=female)	-0.18	-0.88	0.381
Distance to local market (km)	0.25	6.30	0.000
Participation in pvs training (1=yes, 0=no)	-0.91	-2.10	0.036
Household size (person)	-0.08	-1.78	0.075
Medium soil quality (1=yes, 0=no)[2]	-0.26	-1.08	0.279
Good soil quality (1=yes, 0=no)	-1.11	-3.56	0.000
Plot size (hectare)[3]	0.84	5.33	0.000
Constant	0.17	0.43	0.667
Variance parameters			
δ^2	0.29	6.54	
γ	0.19	10.83	
Log likelihood	-499.20		
x^2	90.32		

4.3 Efficiency ranges

The average profit efficiency among the groundnut producers in Malawi is 45%, wide range of profit efficiency is observed among the groundnut-producing farmers with minimum being 0.5%, and maximum value of 89%. This indicated groundnut production could be increased by about 55%, by improving technical, allocative or scale efficiency of farmers giving trainings on efficient agricultural input and right use. On the other why similar level of output can be achieved with 55% lesser input use. Such a deviation of efficiency is not uncommon as other studies show similar variation.

[2] Dummy for poor soil quality is used as base for soil fertility analysis.
[3] Is the size of a plot in hectare under groundnut production

The distribution of groundnut farmers over efficiency ranges reveals that 20% of the producers operate in efficiency range below, 0.2; and only 3% operates on 0.8 and above efficiency level. About half of the groundnut producer farmers have efficiency between 0.4 and 0.7.

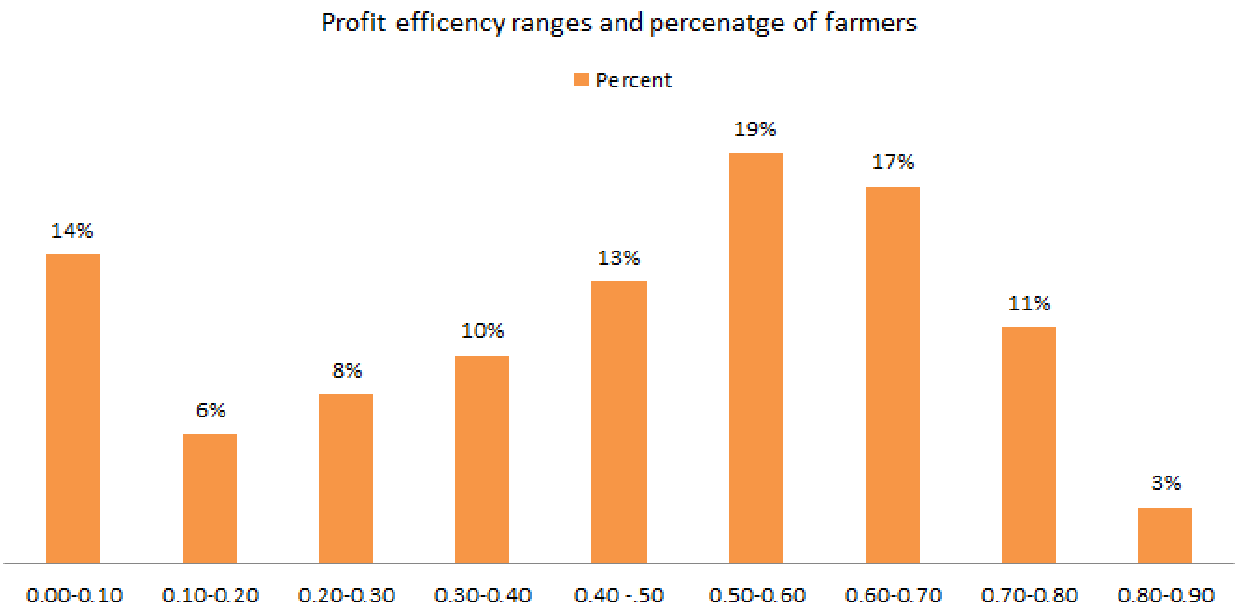

Figure 2 Percenatge distribution of profit efficiency score for groundnut producers in Malawi.

Analysis of profit efficiency for different farm and institutional variables was presented in Table 3. It is indicated that male headed households are found to generate 39% (29%) more actual profit and incur profit loss compared with female headed farmers and are 13% more efficient; this is mainly attributed to higher landholding and larger production so generates higher profit and at the same time higher profit loss by male than female do. The extension service plays an important role in improving knowledge about improved farming techniques and input use, coherently increases efficiency (Rahman 2003; Hasan et al. 2012). The result reveals that farmers receiving extension generate 34% higher actual profit, 14% profit loss and 20% more efficient than non-receiver does. Larger famers (farm size>3 hectare) able to generate 10,350 MK profit compared with 9182 of small farmers (farm size <=3 hectares), and higher profit loss of 4,482 MK against 3,858 MK, while operating slightly higher but insignificantly lower (0.46) efficiency level.

Table 3 Profit, profit loss and technical efficiency over key farm characteristics

Farm characteristics		Number	Actual profit	Estimated profit loss	Profit-efficiency
Gender of the household head					
	Female	92	6615	3264	0.40
	Male	296	10933	4571	0.46
	t-ratio (female vs. male)		**-4.47**	**-4.46**	**-2.48**
Received extinction serves					
	No	367	9684	4211	0.44
	Yes	21	14596	5148	0.57
	t-ratio (non-receiver vs. receivers)		**-1.60**	**-1.31**	**-2.74**
Farm size[4]					
	Small farm	137	9182	3858	0.46
	Large farm	251	10350	4482	0.44
	t-ratio (small vs. large farm)		**-1.03**	**-2.01**	**0.66**
Soil fertility					
	Non-fertile[5]	306	8929	4040	0.42
	Fertile	82	13813	5089	0.56
	t-ratio (non-fertile vs. fertile)		**-3.15**	**-2.35**	**-5.68**
The distance to local market					
	Distance greater than or 2 km	84	6106	3133	0.28
	Distance less than 2 km	304	11053	4573	0.49
	t-ratio (better access vs. weak access)		**-3.89**	**-3.43**	**-7.33**
All farms		**388**	**9950**	**4262**	**0.45**

[4] Households with landholding below 3 hectare are categorized as smaller farms and with larger than 3 hectares are larger farms.
[5]Non-fertile soil group is a combination poor and medium soil quality while fertile soil is a soil with good soil quality.

The mean actual profit for farmers living within 2km from the local market was MK1053 compared to MK6106 for those who live more than 2km away from the market. Similarly, the mean profit efficiency for farmers with market access was about 50% compared to about 30% of for those with limited access to market which is consistent with finding Ali and Flinn (1989). This can explain by the fact that market places in Africa are important sources of information, availability of extension service offices and other facilities located near to the market place where normally people gather.

5. Conclusion and policy recommendation

This study applies profit frontier function approaches, which combines the three components of efficiency namely technical, allocative and economic efficiency; in the analysis of the profit efficiency among groundnuts producers household in the southern African country of Malawi. To identify the level of efficiency and the factors that plays role in lower efficiency farm specific and institutional variables were identified from the survey conducted in southern Malawi

It is also found that both production characteristics and farm management factors significantly explain variation in profit efficiency among the producers. There exists a great variation on the level of profit, profit loss, and efficiency among the groundnut-producing farmers in Malawi depending on the gender, access to extension service, farm size, soil quality and access to market. Estimated profit efficiency using profit frontier function ranges from 0.5% to 89%, with average efficiency level of 45%. Similarly, the efficiency level of about 51% of the farm household is below 50%, and less than 5%, operates at efficiency level above 80%. The estimated results suggest the window of opportunity to increase production of groundnuts from the current level by improving the production efficiency by smallholder farmers. Number of factors found to significantly explain the profit inefficiency and indicates the target area for improvement to achieve increased efficiency. Institutional factors such as access to extension serve, access to market, managing the farm size are important factors to consider in order raise the profit efficiency in Malawi. Distance to market and larger plot size is significantly and negatively associated with the profit efficiency. The factors positively affecting profit efficiency are access to extension service and soil fertility.

The other interesting finding from this study is that, though gender of the household head is not significantly affecting the level efficiency in frontier profit model; the analysis of efficiency between male and female headed household reveals that male headed households were generating more profit and also incur higher profit loss compared with their female counterparts. The profit efficiency is 15% higher for male headed households than female counterparts and similar results were register by Amoah et al. 2014 . Similarly, farmers who received extension service are 30% more efficient than those who do not. Larger farmers are 5% less efficient than the smaller farmers (insignificant). Farmers residing near the market place are 29% more efficient than those residing far from the market.

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