Agricultural Inputs and Efficiency in Tanzania Small Scale Agriculture: A Comparative Analysis of Tobacco And Selected Food Crops

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Abstract

This study compares the relative efficiency between tobacco and selected food crops (maize, groundnut and rice) among small scale farmers in Tanzania. A brief discussion on the contribution of tobacco to the Tanzanian economy, as well as the substantial health care costs emanating from tobacco related diseases, is highlighted. We hypothesize that the comparative efficiency of tobacco is not different when compared, even though preferential treatment is given to tobacco growers in the provision of inputs such as fertilizers better seed and the like. The method of analysis is the frontier production function. The study uses the data of householder farmers collected by the NBS in the 2007/08 agriculture census survey. The study is confined to the Tabora region of Tanzania—the major tobacco growing area of the country. It shows that a high preferential treatment is given to tobacco at the expense of maize and others crops. The frontier production results show that the efficiency indices for tobacco, maize, groundnut and rice as being 75.3%, 68.5%, 64.5% and 46.5% respectively. The 7.3% difference in efficiency between tobacco and maize is not substantial when modern inputs allotted to formers are taken into consideration. The most important explanatory variable that explains efficiency in tobacco is modern inputs. This is not so for other annual crops such as rice, groundnut and rice.

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Keywords: Efficiency input, tobacco, maize groundnut, rice, Tanzania

1. Introduction

This study aims at estimating the relative efficiency of tobacco production when compared with other three crops, namely maize, groundnut and rice. The motivation for the study emanates from the healthcare costs that arise as a result of tobacco production, and the need to search for alternates to tobacco farming. Many studies show that the revenue generated from one acre of tobacco farming by a typical small scale farmer in Tanzania as being more than those obtained from planting traditional crops such as maize, groundnuts, rice, and others. However, when per acre inputs such as labour, capital, as well as the number of cultivations per year are taken into consideration, the net revenue that small scale farmers get from planting tobacco is much lower than those obtained from

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traditional crops. Compared to traditional crops, preferential treatment appears to be given to tobacco growers in terms of the provision of vital inputs such as fertilizers, better seeds, chemicals, more access to credit facilities, access to markets, as well as extension services.
Comparing the efficiency between tobacco and the traditional annuals may not be complete if one does not take into consideration the working condition of tobacco growers and other farmers.

The gestation period for tobacco is almost eleven month, and the working environment is hazardous. Farmers have to search for wood in the forest for tobacco curing. This naturally leads to deforestation. Farmers are exposed to smoke inhaling in the process of curing, which may lead to increased frequency of cardiovascular and lung diseases. The latter may naturally lead to increased healthcare spending.

In general, a direct comparison in the efficiency between tobacco production and other cereal products may not yield the desired results unless one takes into account the negative health consequences of tobacco production and the resulting health costs. A direct or simple comparison may lead one to conclude that tobacco is by far more efficient when compared to other annuals. This may not be the case.

This study has four parts. Part 2 gives a brief summary on the history of tobacco farming in Africa, and summarizes the role of tobacco as a source of government revenue as well as a means of foreign exchange earnings for Tanzania. Part three compares the allocation of various agricultural inputs into tobacco and other crops. Part four highlights the objectives of the study, and the method of analysis, namely the frontier production function. Part five presents and discusses the results, while part six makes some concluding remarks.

2. Tobacco production and consumption in Africa

Within Africa, consumption of tobacco rose by 3.7% between 1995 and 2000 (Gates Foundation, 2011). Tobacco production and cigarette smoking became a means of generating economic benefits to many low income countries. This has contributed significantly to the low commitment by most governments to reduce production and consumption. In several African countries most tobacco leaf is for export. In Tanzania, tobacco production was introduced by the British colonial administration in the 20th century (Masudi et al, 2001). Table 1 provides acreage and yield for tobacco leaf for selected years. The average yield (production per area) is 1.1ton/ha. A significant increase is observed during 2010 and 2011.

Table 1: Tobacco Production in Tanzania

Year	Area('000' ha)	Production('000' tons)	Yield(ton/ha)

2005/2006	61.47	56.50	0.92
2006/2007	116.42	65.30	0.56
2007/2008	64.37	70.47	1.09
2008/2009	55.21	58.70	1.06
2009/2010	78.93	60.90	0.77
2010/2011	168.488	130.000	0.77
2011/2012	118.25	126.62	1.07

Source: Ministry of Agriculture

Tobacco crop has been contributing significantly to Tanzania's foreign exchange earnings as shown in Table 2. In 2001, for example, tobacco exports contributed about 15.6% of the total exports earnings. Since 2005 tobacco has ranked in the second position as it generated more than US$75m per year. Between 2007 and 2009 tobacco export earned by the country was US$323.20m, and constituted 26.74% of earning from all other major traditional crop. By 2012 and 2013 tobacco ranked first in export value of US$252.6m and US$335.5m, respectively.

Table 2: Export earnings from traditional crops in Tanzania

Crop	Export value in 2012	Export value in 2013	% export value in 2012	%export value in 2013
Tobacco	252.6	335.4	39.49	41.04
Coffee	137.7	189.5	21.53	23.19
Cashew nut	73.6	16.3	11.51	1.99
Cotton	65.3	174.5	10.21	21.35
Tea	49.9	55.8	7.80	6.83
Cloves	43.6	27.9	6.82	3.41
Sisal	16.9	17.9	2.64	2.19
Total	**639.6**	**817.3**	**100.00**	**100.00**

The processing of tobacco leaf into finished product (cigarette) appears to be increasing and thus yielding some economic benefits in terms of employment creation and revenue generation. Employment opportunities are generated in various processes that involve tobacco production and use. These include production, transportation, grading and marketing. These processes involve different players, including growers, grower associations, and transporters, buyers, grading companies, auction markets, technical support and regulatory institutions. In Tanzania, tobacco production has greater influence in the economy as it employs significant number of people in growing, processing, buying and selling. More than 500,000 Tanzanians depend—directly or indirectly —on tobacco for their livelihood.

2.3 Healthcare cost of tobacco production and consumption

While revenue and employment in tobacco industry appear to be significant, there are substantial health costs associated to the production and consumption of tobacco. These costs include health risks and environmental problems. Tobacco is a major cause of the death from non-communicable diseases (NDCs) such as heart ailments, cancer and respiratory diseases. In addition, communicable diseases such as TB can also be activated and exacerbated by the use of tobacco. According to the US Centers for Diseases Control and Prevention, smoking increases the risk of coronary heart diseases, stroke, lung cancer, infertility and other illnesses. Smoking also increases the risk of stillbirth and low birth weight in infants born to women who smoke during pregnancy. Second-hand smoke may also pose greater health risks; this is more so in African countries where household sizes are large, and where the number of rooms per household is less or equal to two. Globally, 40% of children and 30% of non-smoking adults are exposed to second-hand smoke (Eriksen et al., 2012). In 2004, about 600,000 individuals died as result of being exposed to second-hand smoke. Tchale's (2009) estimates indicate that second-hand smoke have put about 10.9 million people at risk; of these about 1.7 million are in Africa.

3. Input Allocation to Tobacco Leaf Production and Other Crops in Tanzania

We have already noted that African countries, including Tanzania, still hesitate to act decisively to reduce tobacco use: they are concerned that the 'economic benefits' derived from growing, processing, manufacturing, exporting and taxing tobacco may not be realized. The government appears to give due attention to increased tobacco production; the aim is to increase foreign exchange earnings. As a result there appears to be a disproportionate allocation of modern agricultural inputs to the production of tobacco at the expense of other annual crops such maize, groundnut and rice. Table 3 shows the case in point.

Table 3 Percent of modern input by Type of Crop

Variable	**Maize**	**Groundnut**	**Rice**	**Tobacco**
High variety seeds	13.36	2.51	3.17	83.77
Fertilizer	34.6	3.37	43.48	96.44
Irrigation	5.12	1.46	2.72	8.77
Credit	9.13	11.18	4.98	61.69
Extension advice	47.00	47.00	49.00	74.00
Market access	30.66	40.44	31.48	58.12
N	2365	1511	883	308

Source: Authors' calculation

Table 3 clearly shows that a high preferential treatment is accorded to tobacco farmers at the expense of other essential crops, especially maize -- the staple diet of Tanzanians. About 83.77% of tobacco growers are provided with high variety seeds; the corresponding value for maize is a mere 13.36%. Similar pattern is apparent for other modern inputs and for other annual crops. The disproportionate allocation of modern inputs to tobacco at the expense of maize appears to be inconsistent with the government's policy of poverty alleviation and food self-sufficiency.

4. Objectives of the study

The main objective of this study is to compare the relative efficiency of tobacco production when compared with other three crops, namely maize, groundnut and rice. We hypothesize that despite the preferential treatment given to tobacco farmers, and despite the higher proportion of labour allotted to tobacco production, the relative efficiency of the latter may not be different from that of maize, groundnut and rice. In other words, there is misallocation of resources to tobacco production at the expense of the other three crops; however this does not appear to enhance the efficiency of tobacco production.

5. Method of Analysis

The method of analysis for efficiency comparison, which is the frontier production function, is described hereunder.

Technical efficiency (TE) is defined as the ratio of a firm's or a farmer's actual production to the optimal output. TE reflects the ability of a producer to obtain maximum outputs from a given set of inputs. A producer is said to be technically efficient when the actual output is equal to the optimal output; and the same producer is said to be inefficient when the actual production is less than the optimal output or the frontier output (Farrell, 1957). For a given production processes, TE would be measured theoretically within the range $0 < \mathrm{TE} \leq 1$.

The literature proposes two alternative approaches for the estimation of TE. The first approach is the parametric Stochastic Frontier Analysis (SFA) (Ferrier & Lovell, 1990; Lovell, 1993; Berger *et al*., 1993; Kaparakis *et al*., 1994; Battese & Coelli, 1995; Tchale, 2009). The second approach is the non-parametric Data Envelopment Analysis (DEA) (Charnes *et al*., 1978; Herman & Gold, 1985; Seiford & Thrall, 1990; Chen & Yeh, 2000).

The SFA uses an econometric approach based on a functional form of the production process, and accounts for errors in the crop production process. With the SFA, the error term in crop production is assumed to come from two distinct sources. Source one is the random error that captures the inefficiency component and the effects of factors beyond the control of the farmer such as weather conditions and outbreak of diseases. Source two is the random error that captures inefficiency due to farm(er)-specific attributes such as soil fertility and the technical know-how of the farmer.

The non-parametric DEA approach is a statistical approach characterized as a central tendency approach, and it evaluates producers relative to the average producer. It measures inefficiency through the deviation of the observed values with the estimated frontier. With this approach, there is no functional form that is specified regarding the error term; and the DEA does not account for the effect of other factors that are normally not under the control of the producer. Consequently, these non-parametric approaches cannot be used to measure random factors such as climate and natural disasters, which may influence the shape and position of the estimated frontier (Jaime & Salazar, 2011). With this characterization, the applicability of the DEA is limited to cases where the error term in the data generation process plays an insignificant role.

In this study, TE is estimated with SFA. This method is chosen based on its ability to distinguish the error term between the two sources: the random error term that represents the inefficiency component and the effects of factors beyond the control of the farmer, and the random error term that represents inefficiency due to farm(er)-specific attributes (Bassete & Coelli, 1995; Coelli *et al.*, 1998; Tchale, 2009).

5.2 Model specification

We have noted that TE is determined on the basis of the stochastic frontier analysis (SFA). The specification of the model follows the procedure by Aigner et al., (1997), and incorporates two parts. In the first part the efficient production frontier is estimated as a function of control variables as indicated below:

$$Q_i = f(x_i;\beta)e^{\varepsilon_i} = f(x_i;\beta)e^{v_i-\mu_i} \qquad (1)$$

Where Q_i is production of the *i*-th observation (farm); x_i is a vector of explanatory variables related to production inputs and other control variables of the i^{th} observation; β is a parameter vector; and ε_i is the error term represented by the terms v_i and μ_i.

- The term v_i is for the standard random variations in production due to observation and data measurement errors, uncontrolled factors, etc. v_i is assumed to be identically and independently normally distributed: $v_i \sim N(0, \sigma_v^2)$.
- The second component, μ_i, is a random non-negative variable, which is associated with the measure of technical inefficiency relative to the stochastic frontier. μ_i is assumed to be truncated normally distributed.

In the second part, the stochastic frontier estimation involves the estimation of the function that relates the inefficiency measurement obtained in the first stage with a set of explanatory variables corresponding to farm and farmer-specific characteristics. The inefficiency function takes the form:

$$\mu_i = z_i\delta + w_i \qquad (2)$$

Where z_i is a vector of variables representing the technical inefficiency of the i^{th} observation; δ corresponds to a parameters vector; and w_i represents the error term.

Finally, we combine equation 1 and 2 and define TE as the ratio of the observed output, $f(x:\beta)\,e^{v_i-\mu_i}$, and the maximum feasible output, $f(x_i;\beta)e^{v_i}$. This ratio is representing the technical efficiency for the i^{th} observation:

$$TE_i = \frac{f(x_i;\beta)e^{\varepsilon i}}{f(x_i;\beta)e^{v_i}} = \frac{f(x:\beta)e^{v_i-\mu_i}}{f(x_i;\beta)e^{v_i}} = \exp(-\mu_i) = \exp(-z_i\delta - w_i) \qquad (3)$$

5.3 Empirical implementation

The empirical model to estimate the TE can take either the Cobb-Douglas production function (CDPF) (Cobb & Douglas, 1928), or the translog production function (TLPF) (Sharma & Leung, 2000). The TLPF formulation assumes the existence of a non-linear relationship between the output and the inputs. In addition, the production elasticities are not constant. Because of this flexibility, most TE studies have used this specification (Battese & Coelli, 1995; Coelli, 1996; Tchale, 2009). In the study area, the TLPF specification is adopted; and the specification of the model for the assessment of the TE of farmers is made based on three factor inputs, as specified in Equation 4 (Battese & Coelli, 1995).

$$\begin{aligned} ln(Q_i) = \beta_0 + \beta_1 ln(X_{i1}) + \beta_2 ln(X_{i2}) + \beta_3 ln(X_{i3}) + \beta_4 ln(X_{i1}{}^2) + \beta_5 ln(X_{i2}{}^2) + \\ \beta_6 ln(X_{i1})ln(X_{i2}) + \beta_7 ln(X_{i1})ln(X_{i3}) + \beta_8 \ln(X_{i2})\ln(X_{i3}) + v_i - \mu_i \quad (4) \end{aligned}$$

Where Q_i represents the value of harvest (kg); j represents the j^{th} input of the i^{th} farm household ($i = 1,2,\dots n$); X_{i1} is the total area planted (in acres) (FS); X_{i2} represents family labour (man-days) (FL); X_{i3} represents the fertilizer (FT); βs are coefficients to be estimated; v_i represents the random error; and μ_i is the error term that reflects the technical inefficiency.

The inefficiency model is estimated based on nine variables that reflect the technical inefficiency measures, as specified in Equation 5.

$$\mu_i = \delta_0 + \sum_{m=1}^{10} \delta_m z_{im} + w_i \qquad (5)$$

where z_{i1} represents the male gender of the head of the household; z_{i2} represents access to market; z_{i3} is the household size; z_{i4} represents the age of the head of the household; z_{i5} represents the education level of the head of the household; z_{i6} represents access to credit by the household; z_{i7} is the off-farm income; z_{i8} represents the wealth (number rooms); z_{i9} represents cattle ownership; δ are coefficients to be estimated; and w_i is the error term that follows the truncated normal distribution.

The parameters of the production frontier function defined by Equation (4) and the inefficiency model defined by Equation (5) are jointly estimated by the Maximum Likelihood (ML) method, using FRONTIER 4.1 (Coelli, 1996). The results are compared with results obtained in STATA by the two-stage progress. The ML estimation provides the consistent estimators for variance parameters given by:

$$\sigma^2 = \sigma_\mu{}^2 + \sigma_\upsilon{}^2 \qquad (6)$$

and

$$\gamma = \sigma_\mu{}^2 / (\sigma_\mu{}^2 + \sigma_\upsilon{}^2). \qquad (7)$$

Where the parameter γ refers to the proportion of total variance that is explained by the variance of the inefficiencies and whose values are between 0 and 1. $\sigma_\upsilon{}^2$ corresponds to the variance of the stochastic model, and $\sigma_\mu{}^2$ corresponds to the variance of the inefficiency model; and σ^2 is the total variance.

The performance of the model for estimating the parameters of technical efficiency is assessed through testing hypotheses (Equations 8 and 10) (Lovell, 1993; Battese & Coelli, 1995). These hypotheses are made to guide the assessment of the model performance by considering two issues: the first one is the adequateness of the functional form of the model. To test for the adequateness of the functional form of the model for the joint estimation (Equations 4 and 5), the procedure is to evaluate the significance of the coefficients of the parameters estimated. To achieve this we test the hypothesis (Equation 8).

$$H_0: \beta_1 = \beta_2 = \cdots \beta_8 = 0 \qquad (8)$$

The relevant test is the generalized likelihood-ratio (LR) test statistic. This statistic is obtained by estimating the above joint model in two ways; first we restrict the model to include only 3 inputs of production. From the restricted model we obtain the likelihood value (LH_0); and secondly, we estimate the unrestricted model and we obtain the likelihood function value (LH_1). We use these two values to define the test statistic in the Equation 9 (Battese & Coelli, 1995).

$$\lambda = -2\{\ln[LH_0] - \ln[LH_1]\} \qquad (9)$$

The test statistic has a χ^2 distribution or a mixed χ^2 distribution with degrees of freedom equal to the difference between the number of the estimated parameter in the restricted and the unrestricted model. The second issue is the significance of the inefficiency model specified, and the inefficiency variables. To evaluate the significance of the inefficiency model, the relevant hypothesis tested is one on whether the model is stochastic or not. The inefficiency model is valid when it is stochastic. This is evaluated by testing the hypothesis that the variance due to the inefficiency model (Equation 10) is not present, i.e.,

$$H_0: \gamma = 0 \text{ or } H_0: \delta_1 = \delta_2 = \cdots \delta_{10} = 0. \qquad (10)$$

The decision to reject or not is reached by the estimated value of γ in the joint model. The mixed chi-square test is used. The relevant decision is reached by assessing the significance of the λ statistics established by considering the likelihood function value of model with inefficiency (unrestricted) and without inefficiency variables (restricted). The hypothesis is rejected if the λ is greater than the standard value obtained from the mixed chi-square distribution table (Kodde & Palm, 1986). This also involves assessment of the significance of the individual coefficients from the estimated model and the *t*-ratio.

6. Data Sources

The study uses the data of householder farmers collected by the Tanzania National Bureau of Statistics (NBS) in 2007/08 agriculture census survey. According to the 2007/08 census, the survey targeted to interview the head or representative of households. The 2007/08 Agriculture Sample Census survey data was conducted for three months. The program was financially supported by the government of Tanzania (GoT), department for International Development

(DFID), Japan government (GJ), and the European Union (EU). The 2007/08 agriculture sample census survey was the fourth to be carried in Tanzania after the first, second and third in 1971/72, 1994/95, and 2002/03, respectively. The data collection method used during the census was the interview one only. No other physical measurements were taken. The census covered agriculture in detail, as well as many other aspects of rural development. The census was carried out using small scale farm questionnaire, community level questionnaire and large scale farm questionnaire. Thus the targeted universes in the census were small scale farmers, large scale farmers and the community level.

Geographically, the census covered Tanzania mainland and Zanzibar. Stratified two stage sampling was used in the census both in Mainland and Zanzibar. The number of enumeration areas (EAs) was selected for the first stage, with probability proportion to the number of villages in each district. In the second stage 15 household were selected from a list of farming in each EA using systematic sampling. The national agricultural census involved 48,000 households. This study uses a sub-sample of 2,365 households from Tabora region. These households are those that cultivate either one or mixture of maize, tobacco, groundnuts and rice. What follows is a discussion of the results.

7. Empirical results

7.1 Some descriptive statistics

Before presenting the econometric results, we present a summary of the descriptive statistics of the variables used to establish the technical efficiency in crop production. This is presented in Table 4.

Table 4: Descriptive statistics

Crop	Variable	Obs	Mean	Std. Dev.	Min	Max
	Area (are)	2365	2.548321	2.626793	0.05	40
	Harvest(Kg)	2357	1333.258	1729.518	12	23000
Maize	Labour (man-days)	2357	160.0926	93.10161	25	725
	Area (are)	883	2.042525	3.277233	0.05	45
	Harvest(Kg)	883	1111.362	1637.845	0	17100
Rice						
	Area (are)	308	2.296266	1.648366	0.5	20
	Harvest(Kg)	304	1038.609	744.7747	100	4856
Tobacco	Labour (man-days)	308	640.3704	372.4065	100	2900
	Area (are)	1511	1.320477	1.269905	0.02	20
Groundnut	Harvest(Kg)	1509	503.112	823.9304	0	20000

Labour (man-days)	1509	160.0926	93.10161	25	725

The average harvest per household for maize is 1,333kg, rice is 1,111kg, tobacco is 1,038 kg, and groundnut is 503kg. In terms of labour, tobacco accounts for more man-days than other crops.

Estimated Efficiency Model

Table 5 gives the Maximum Likelihood Estimates (MLE) of the stochastic frontier production function for each of the four crops

Table 5: Maximum Likelihood Estimates for the parameters of the stochastic frontier production function

Variable	Maize	Tobacco	Rice	Groundnut
Ln (labour)	0.002	1.672***	-0.901*	0.382
Ln (area)	1.903***	-0.002***	2.094***	3.319***
fertilizer	0.734**	0.064***	1.030	
$[\ln(\text{area})]^2$	-0.257***	-0.166***	-0.381***	-0.383***
$[\ln(\text{labour})]^2$	0.016	3.68E-09	0.090	-0.014
Ln(area) x ln (labour)	0.022	0.0184***	0.067	-0.192
Ln(labour) x fertilizer	-0.059	-0.0104***	-0.315	
Ln(area) x fertilizer	-0.111	0.0112***	0.980*	
_cons	4.773***	5.269***	7.483***	3.203***

Note: 1) *** p<0.01, ** p<0.05, * p<0.1

For tobacco, both linear and interaction components of the explanatory variables appear to be significant; for the other crops only the linear components appear to be significant.

7.2 Model performance

We evaluate the performance of the estimated TLPF by testing the hypotheses on the overall significance of the model, and the estimated parameters (Equations 8 and 10). The hypothesis expressed by Equation 8 was rejected at 5% level of significance (Table 4). This implies that the specified TLPF fits the data well. The hypothesis of Equation 10 was rejected (Table 5). This implies that the deviation of the actual output by the farmers in the study area was both due to data noise and to technical inefficiency. This is also supported by the estimated (significant) coefficients of the individual inefficiency variables (Equation 5), whose results are presented in Table 6.

Table 6: Test of hypotheses for the stochastic production frontier and inefficiency model

Hypothesis	Test statistic(λ)	Critical value	Decision
$H_0: \beta_1 = \beta_2 = \cdots \beta_8 = 0$	392	$\chi^2_{\alpha=0.05,6} = 12.6$	Rejected

$H_0: \delta_1 = \delta_2 = \cdots \delta_{10} = 0$	408	$\chi^2_{\alpha=0.05,10} = 17.7$	Rejected

7.3 The technical efficiency results

It should be noted that the objective of the modelling exercise is to generate efficiency indices for the four crops; as a result detailed discussion on the MLE-TLPF results in Table 6 are not discussed in detail.

Based on the estimated models we generate technical efficiency indicators for each observation and presented the frequency distribution in Table 7. The estimated mean technical efficiency of maize, groundnut, rice and tobacco is 67%, 65%, 47% and 75%, respectively; implying that rice growers are least efficient: it appears that rice growers should have produced the same output by utilizing 47% of the actual inputs. Technical efficiency for tobacco is 8% higher than maize growers. However, given the extensive preferential treatment given to tobacco growers in terms of modern inputs, the 8% differential may not be significant. With a lopsided preferential treatment tobacco efficiency measure should have been much higher than 75%.

Table 7: Distribution of efficiency

	Frequency Distribution (percentage)			
Category	**Maize**	**Groundnut**	**Rice**	**Tobacco**
0.00-0.20	0.93	2.2	13.9	0.66
0.21-0.40	5.77	5.86	30.13	12.83
0.41-0.60	14.47	18.77	21.67	13.82
0.61-0.80	59.95	63.32	24.68	19.41
0.81-1.00	18.88	9.85	9.62	53.29
Mean	0.685	0.645	0.465	0.753
Std Dev.	0.148	0.154	0.234	0.243
Sample size (n)	2357	1502	863	304

7.4 Factors influencing technical efficiency

The identified factors influencing the technical efficiency in the study are presented in Table 8. There are eight and six variables respectively (constant term not included) that significantly affect maize and groundnut efficiency. For rice, the number of significant variables are three; while for tobacco there is only one significant explanatory variable. In other words, the variables that affect efficiency in tobacco must be the modern inputs provided to tobacco farmers such as fertilizer, high variety seeds, fertilizer, credit availability, extension advice and marketing outlets. Table 5 showed that maize, groundnut and rice growers are not beneficiaries of modern inputs. In other words, the determinants of technical efficiency in tobacco are likely to be the modern inputs identified above. Without modern inputs efficiency in tobacco production would have been lower. The opposite would have been the case if modern inputs were provided to maize, groundnut and rice.

Table 8: Factors influencing technical efficiency in the study area

Variable	Maize	Tobacco	Rice	Ground nut
Male gender	0.01944293*	0.07489912	0.0402481	0.01300325
Education	0.00369095	0.02572637	-0.0246184	-0.00035275
Age	-0.0009148***	-0.00216898	-0.0007732	-0.00124657***
Ln(hhsize)	-.02459432***	0.03487474	-0.0363091*	-0.01983764*
usedraft	0.00530682	0.06960518	0.079556***	0.02803809*
credit	0.05013565***	0.05179019	0.01992145	0.03877928**
offarmincome	-0.01882176**	-0.03193166	-0.0345428*	-0.01686814*
cattleown	0.0206004*	-0.13602145*	0.01766649	-0.02134243
wealthroom	0.00647843*	0.01757511	0.00994858	.01085416***
totalarea	0.00059933**	-0.00073197	0.00044827	0.0005184
_cons	0.72345***	0.64176522***	0.48570935***	0.69160456***

8. Conclusion

The aim of this paper was to use evidence-based research findings to show that production of tobacco is not beneficial in Tanzania. The literature confirms that tobacco production and cigarette consumption has declined in developed countries. The opposite is true for African countries, including Tanzania. At face value the economic contribution of tobacco in terms of generating foreign exchange appear to be substantial. Chances are that the health costs emanating from tobacco-induced diseases are likely to be substantial (Kidane et al, 2014).

The empirical results presented here clearly show that there is a misallocation of resources in favour of tobacco at the expense of basic food items such as maize, groundnut and rice. In spite of this, tobacco production appears to be inefficient and a costly undertaking. Had there been more allocation of modern agricultural inputs (fertilizer, better seed, access to credit, etc.) to maize, groundnuts and rice, the efficiency of the latter would have been higher.

The government of Tanzania is committed to the alleviation of poverty in general, and maintaining food security in particular. The government is also committed to enhancing the health status of the entire population. Tobacco production is likely to worsen the already low health status of Tanzanians. By reallocating scarce resources (such as modern agricultural inputs) to the production of to maize, rice, groundnut and other basic cereals, the government will go a long way towards establishing food security, and controlling diseases that are related to under-nutrition and malnutrition, as well as diseases that emanate from tobacco production and cigarette consumption.

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