Tobacco Contract Farming Participation and Income in Urambo; Heckma's Selection Model

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Abstract

This paper examines the factors influence smallholder farmers participation in tobacco production using in Urambo, Tanzania. A total of 150 farmers were surveyed using cluster sampling to obtained household head tobacco producers as respondents. Heckman's two stage model was used by incorporating probit model in first stage and regression analysis on income was analyzed using OLS in the second stage.

Results have shown that farming experience, farm group and age of the farmers have significant influence on farmers' participation in contract farming. Farmers' income was significantly influenced by the composite value of agricultural and non-agricultural assets and fertilizers despite timely delay on inputs distribution and assistance on technical application.

Based on the findings of the study, it is concluded that altering productivity by the farmer needs the policy adjustment on the timely distribution of inputs followed by training on the application of farming inputs. Primary cooperatives should be strengthened through SACCOS where they will finance farmers and thus improves income of the farmers. Contract Farming (CF) is not the only way to change the income, farmers should also think of other off-farm activities.

Key words: Heckman Model, Participation, Smallholder, Tobacco, Urambo

1.0 Introduction

Agricultural systems worldwide have been transformed by a tight align chain and networks of productions due to the changes in technology, demography, financial mobility, consumer demands, markets competitions, and liberalization of trade (Barret et al. 2012; Arthur, 2005). Taking these into consideration, one of the most prominent strategies to enhance agricultural production is the use of contract farming arrangements (Oya, 2012). Contract farming arrangements have become important in to date agricultural production system especially in cash crops, and applied also in developing countries as a means to address these changes (Eaton et al., 2008).Contract farming is a system for the production and supply of agricultural produce under forward contracts. The essence of such contracts is a commitment to provide an agricultural commodity of a type, at a time and a price, and in the quantity required by a known buyer (Singh, 2002). Tobacco industry contributes in the world for the economic growth and played the most significant role in provision of income, employment, government revenue, food expenses and adding foreign currency (FAO, 2003).

Tobacco industry contributes in the world for the economic growth and played the most significant role in provision of income, employment, government revenue, food expenses and adding foreign currency (FAO, 2003) The existing literature (Sunntar 2006, Oya 2005, Eaton and Shepherd, 2001) identifies several major areas where contract farming can provides benefits such as access to income, markets (inputs and outputs), credits, technology, and assets ownership to the farmers. Other benefits include improvements of risk reductions and price stability. Purchasers have control benefits on volume and quality consistency.

Most of the farmers, who were participants of the CF, have been experiencing changes on income earned as they access inputs packages from firms (Kumwende and Madola, 2005). In countries like Brazil and India, farmers were assured of the income from the payment received at the time of selling their tobacco. In comparing contract farmers and non contract farmers in Shandong province in China contract farmers were benefiting from high yields presumably due to the technical assistance and specialized inputs provided by firms. They were offered higher prices of their quality products by the firms (Miyata et al, 2007). While the tobacco companies set prices to avoid fluctuation under negotiation with the farmers during contracting, taking an example of China, the tobacco monopoly company has no difficulty in paying cash to farmers, thus limited to price risk (FAO, 2003).

Apart from tobacco crop some studies have also examined the impact of contract farming on income on other crops; and they have showed a positive impact using a comparative case study analysis (Minot, 1986, Glover and Kusterer, 1990). In developing countries, contract farming has improved the income of the farmers (Minot 1986). Nevertheless, some social problems that happened, Porter and Phillips-Howard, (1997) conclude that

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African farmers were generally better off as a result of their participation in contract farming. In their study on impact of contract farming on household income of smallholder farmers on honey production in South West Ethiopia, Meshesha, (2011) found that participation in contract farming significantly improved beekeepers annual income. In comparison with selling their product at the local market farmers can earn about 426.7 to 472.8 USD per year from contractual organic honey production. Similarly, Kumar (2008) on the effects of contract farming on income and employment generation has identified that both income and employment generation have been found higher, almost double, on contract than non-contract farms.

Contract also provide farmers with higher expected returns and improves production and marketing. From the average returns of contract and non-contract farmers, they concluded that the contract enables poor farmers to generate a comparable income (Meshesha, 2011 cited in Ramaswami et al., 2006). Similarly, the revenue effect on contract farmers' participation on organic cocoa production in Uganda has a positive effect from contract farming. Besides, contract farmers have exposure to improved farming techniques that can enhance their yields (Gibbons et al. 2009).

With regard to above significant influence of contract farming on income earning to farmers, a comparable difference on net returns exist between participants and non participants of contract farming. Also contracts returns vary according to types of crops, the model of contracting, and other endowments factors in a given location (Eaton and Sherpherd, 2001). Regarding to farmers income effect by contract farming, this paper employ farm income from the tobacco productivity, paid at the time of selling by the firms as a function of household and farm characteristics so as to avail the contribution of contract farming in tobacco production.

Sharma (2008), use a two stage Heckman model to describe how the household social economic factors influence the participation and whether the participation affects the income of the household. According to Sharma (ibid) factors that influence participation in contract farming were education, age, farm size, and membership to an organization.

While appreciating the role of contract farming especially favourable contract farming arrangement as put by Barret *et al* (2012), across some part of the world tobacco farmers have been facing major constraints in the crop production. The constraints include, inter alias, delays of payments after sale, credit access and difficulties in meeting quality standards of the produce (Kumar *et al,* 2008). Other constraints are unequal bargaining relationship and poor distribution of income, as result rural farmers find themselves poor and in debt (Miyata 2007, ASH 2009 and URT 2009). No matter these constraints tobacco farmers are still participating in contract farming (Sharma, 2008)

The rest of this paper is organized as follows. Section 2 explain data and sampling techniques. This is followed by econometric model and estimation methods in section 3. Section 4 provides a results of the findings. Finally, Section 5 concludes and discusses policy implications.

2.0 DATA AND SAMPLING
The paper uses crosss section data collected in Urambo, Tanzania by 2012. A total of 150 respondents were extracted after simple random cluser sampling applied as a sample selection criteria from four wards in Urambo, which are Urambo, Kaliua, Usoke and Ulyankulu.

3.0 ECONOMETRIC MODEL AND ESTIMATION METHODS
Due to the justification provided earlier, this study also employed a two-stage Heckma's (1979) approach. The first stage in our study was used to estimate the relationship between dependent variable, PARTICIPATION and set of independent variables which includes those capturing the income earning. PARTICIPATION takes values of 0 and 1, where by PARTICIPATION = 1, represents farmers who are participating in CF unless otherwise. Therefore probit model is chosen to determine factors influencing smallholder farmers participating in contract farming in this first stage. Probit model in this study was also selected purposely so as to provide the Inverse Mills Ratio (IMR)[1] which used to correct possible selection bias and provides unbiased and consistent estimates on the equation of interest[2]. Using a probit regression as follows:

$$\alpha* = \beta x_i + \varepsilon_i \ , i \sim N(0,1) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots[1]$$

$$If\ \alpha = \begin{cases} 1, & \alpha*_i > 0 \ \text{Participating in contract farming} \\ 0, & Otherwise \end{cases}$$

[1] IMR acts as a ratio between participants and non participants of contract farming and is inserted into the regression equation as an extra explanatory variable yielding the income equation

[2] Equation of interest is the income equation which is used to attain the third objective of this research

This equation consist of non-stochastic term βx_i and a stochastic term $\varepsilon_{i,}$ (error term), where $\alpha = 1$, if farmer PARTICIPATES in CF and $\alpha = 0$, otherwise. Factors influencing PARTICIPATION in CF are determined by regression analysis. Since the PARTICIPATION is binary variable, then the probability to PARTICIPATE in CF is given as follows (Giovanopoulou, 2011 adopted from Gujarat, 1995):

$Pi = \Pr(\propto= 1) = \Pr(\propto^* \geq 0) = \Pr(x_i â + \varepsilon_i \geq 0) = \Pr(\varepsilon_i \geq -x_i â = 1-\phi(-x_i â)$

$= 1 - \int_{-\infty}^{(-x_i \beta)} \frac{1}{\sqrt{2\pi}} e^{-\frac{t^2}{2}} dt$ ………......………………………….....…………..[2]

The ratio of the probability's partial derivation $\Pr(\propto= 1)$ towards x_i is estimated for the interpretation of β as follows:

$\frac{\partial \Pr\{\propto=1\}}{\partial x_{ik}} = \frac{\partial E[x_i \beta]}{\partial x_{ik}} = \beta_k \phi(x_i \beta)$……………….……..…….…………………..[3]

Taking into consideration on examine factors influencing income among respondents, there is a selectivity problem. Since the empirical studies reveal that participants of contract farming have been provided with inputs and other factors of production and thus upgrade their income, and if non participants have endowed with large factors of production and other asset ownership also resulted to high income, this indicates that there is a correlation between independent and dependent variables. The correlation leads to results having inconsistent and biased estimates of the coefficient of variables between participants and non participants of contract farming in the productivity (income) model. Heckman's self selection specification assumes that the error terms of the PARTICIPATION and the extent of INCOME from participations are correlated and that INCOME earned dominates the PARTICIPATION decisions.

The decision to PARTICIPATE is given by the following equation

$w = \beta x_i + \varepsilon_i$…………………………………………………………...…………………….[4]

if w> 0, then $\propto= 1$

if w≤ 0, then $\propto= 0$

The INCOME earned is given by $y = \gamma z_i + u_i$…………………………………………….……[5]

if $y = \gamma z_i + u_i$, then $\gamma z_i + u_i > 0$

if y=0,   then $\gamma z_i + u_i \leq 0$,

Due to correlation between the two error terms discussed above, this is similar to omitted variable bias. Thus, the inverse Mills ratio from the first stage enters as a regressor in the INCOME equation (result equation).

$E[w_i/y_i > 0] = E[w_i/\varepsilon_i > -\beta x_i = \gamma z_i + E[\frac{u_i}{\varepsilon_i} > \beta x_i = \gamma z_i + (\rho \sigma u)\lambda_i$………….….…..[6]

Where $\lambda_i = \frac{\phi(x_i \beta)}{\phi(x_i \beta)}$

First, equation (4) is estimated as a probit regression and then λ(IMR) is estimated, which enters equation (5) giving the following equation:

$y_i = \gamma z_i + \sigma \alpha + a\lambda + v_i$…………………………………………………….…………..[7]

This is estimated by OLS model. The $a\lambda$ term corrects the self selection bias, σ estimates the influence of participation and α represents PARTICIPATION in CF (Vella, 1998). Therefore this study employ the discussed model in the same procedure used by Giovanopoulou (2011), Kim (2010) and Sharma (2008). In the first stage of this model, probit estimation model used to determine the factors influencing PARTICIPATION in contract farming. The second stage OLS method was used for estimating the factors that influence INCOME of smallholder farmer's in the area.

The first stage model was specified as follows:

(Selection equation) $w_i = \propto_0 + \propto_1 Age + \propto_2 FARMSIZE + \propto_3 CREDIT + \propto_4 FARMGROUP +$

$\propto_5 EXTENSION + \propto_6 EXPERIENCES + \propto_7 FERTILIZERS +$

$+\propto_8 AGRIASSET$..……………………………………………………….……………[8]

Wi= 1 if farmers PARTICIPATES in contract farming, 0 otherwise. After estimating equation (8), an inverse of the mills ratio (IMR) is computed for each observation and included as an independent variable in the second stage model in equation (9)

(Result equation) $Y_i = \beta_0 + \beta_1 Age + \beta_2 FAMILYSIZE + \beta_3 FARMSIZE + \beta_4 CREDIT + \beta_5 FARMGROUP +$

$\beta_6 EXTENSION + \beta_7 EXPERIENCES + \beta_8 FERTILIZERS + \beta_9 CULTIVARS + \beta_{10} FAMILYLABOUR +$

$\beta_{11} AGRIASSET + \beta_{12} HIREDLABOUR + \beta_{13} LIVESTOCK + \beta_{14} BICYCLES + \beta_{15} TRACTORS +$

$\beta_{16} HOUSE + \beta_{17} IMR$ …………………………………………………………….………..[9]

INCOME of the farmers is Y_i is hypothesized to be affected by farmers participation in contract farming and β_is are estimation parameters. Based on relationship between variables from the theoretical framework and

empirical evidences of previous research, this model was estimated by using the OLS.

4. 0 RESULTS
4.1.1   Social and Economic Characteristics of the Households

Social and economic characteristics of the household have important implications on tobacco productions.
Almost 95% of the households were headed by male, and on average the majority of them have completed primary education level. The average size of each household was found to be 8 people which constitute dependants, adults and hired labour who stay as part of the family member for a given production season. The farmers participating in contract farming is almost 80%, and among them 70% are members of small groups under recognition of the Primary Cooperative society.

Tobacco as the main agricultural cash crop in the area, it was found to be produced on an average of 7 acres per household while food crops planted on other land area were maize and beans. While the total harvest of tobacco per household is worth an average of T. shillings 3,023,000 the production cost amount to shilings 1,150,000 giving an average of gross profits of T. shillings 1,840,000.

Family labour was seen to spend about a total of 31 days on farm preparation, planting, weeding and harvesting for the average farm size owned by the households. Hired labour cost an amount of T. sh 123,000 on average annually based on negotiation with the household head. Considering the cost of farm inputs, fertilizers mean averaging cost were about TShs 1.2 million per given average size of the farms owned by household. About 90% of the tobacco farmers do not purchase farm inputs on cash. Agricultural assets and non-agricultural assets which enable households on facilitation of agricultural production were valued at T. sh 353,500.

On credit basis, tobacco farmers have shown a low tendency of taking loans from the financial institutions or from individual people and out of 150 sampled farmers, only 44% of the household heads took loan. Details also indicate that 18.7% of sample selected used to buy seeds on cash and ignore the hybridized seed distributed freely from the firms as part of contract.

4.1.2   Reasons Perceived by Respondents on Participation in CF

The household heads were asked to list some of the reasons for them entering into contract farming. As the mean age of the household head is 41.51 years old, then out 150 farmers selected, 20.7% failed to indicates why they participates in CF, due to the fact that, for the majority of the household heads since childhood, tobacco production is their main economic activity. Primary cooperatives link them with the firms and that means cooperative farm-group makes them to be in contract farming automatically. On the other hand 24.7% explained that, poor economic condition is one of the reasons for them to participate in contract farming. Other reasons which attracted farmers is the provision of inputs by firms, ensured market access, credits and the provision of extension services. This group make about44.7% of the respondents.

4.2   Heckman Two Stage Analysis
4.2.1   Probit Selection of Factors Influencing Participation in Contract Farming
Probit analysis result shown in Table 4.1 indicates the probability of participation in contract farming and provides the IMR for the second stage analysis. The findings shows that age, farm size, experience, farm inputs, farming groups, agricultural assets, credits and extension services are likely to influence farmers' participation in contract farming. The negative coefficient of farm size was not significant and is silent in relation to participation in contract farming. This indicates that there are plenty of land areas which are owned by household heads but were not effective on influencing farmers to participate in CF. The positive significant coefficient of farming experience also indicate positive relation in contract farming. This means that, the more time spent in tobacco production, the more they become participants in CF. The upcoming farmers who are not yet registered with a primary cooperative society, at beginning tend to use the usernames of the registered farmers until when they are members of the primary cooperative society with full registration. With regard to extension services, the coefficient was not significant which implies that, the government and firms' extension systems were not effectives to enhance participation of farmers in CF. The negative significant coefficient of credit indicates that, credit institutions are negatively influencing the farmers to participate in contract farming as most of them end up to pay the loans for all what they have produced. Farming group has a positive significant coefficient indicating that, it is influencing their participation in CF. This is due to the reasons that farm group is accredited with collective agreements during contracting, bargaining power and attain crop insurance when production was not satisfactory.

The age coefficient has a significant positive coefficient with the participation in CF. This means the older the farmer the higher the probability of participation. Most of the farmers in Urambo district spent almost all their lifetime in tobacco production. On the other hand the coefficient of fertilizers was negative and not significant. This implies that, fertilizers have negative relation with tendency of farmers' participation in CF. The higher the cost of fertilizer, the lesser the probability of participation. The negative coefficient of agricultural assets on participation in CF implies that, the less the agricultural asset, the higher the probability to participate in CF. It means most of the tobacco farmers holding few agricultural assets are not likely to participates in CF.

Table 4.1: First Stage Probit Analysis

Dependent Variable			Participation
Independent Variables	**Coefficient**	**Standard error**	**P-value**
Farm Size	-1.714927	2.023377	0.397
Farming Experience	10.42236*	4.008656	0.009
Extension Services	.6323059	.8494976	0.457
Credit	-2.033683*	.8827404	0.021
Farmgroup	4.27031**	1.124094	0.000
Age	.8374094*	.3528182	0.018
Fertilizers	-.3267465	1.627675	0.841
Agri-asset	-7.418912*	3.326188	0.026
IMR	.1524734	.1841544	0.408
R^2	0.6639		

Probit equation for participation in contract farming, participant is 1, and 0 otherwise.
** Significant at 5%, * Significant at 1%

4.2.2 Regression Analysis on Factors Influencing Productivity

Table 4.2 shows the second stage results of the impact of factors on income. Income is taken as a dependant variable which is the total amount of money earned after selling the tobacco per given household for a given size of land cultivated. In this income model, the IMR was used also as a regressor to correct for possible selection bias[1] in the first stage (selection equation) and adjust the result equation to achieve consistent and unbiased estimates. IMR (lambda) is truncated in the second regression income equation. The Heckman second stage

truncated of income is significant because in the selection model the parameter 'rho' related to ρ which indicates the correlation coefficients in the error terms[2]. They are negatively correlated and correlation is not significant which implies that there is no selection bias.

Many of the coefficients in Table 4.2 are statistically significant, both positively and negatively. While the coefficient of fertilizers was not significant in the first stage with a negative sign, in the second truncated regression on income, it shows a positive significant impact on income. This implies that, the increase of fertilizers also leads to a rise in tobacco production and thus impacts the income earned by farmers. The coefficient of agri-asset also was positive and significant meaning that applied agricultural assets and non agricultural assets impacts the income of the farmers.

Lastly the coefficient of bicycles was significant but negative. Tobacco farmers in Urambo use bicycles as a major means of transport. The findings in Table 4.2 show that farmers have access to bicycles despite not contributing in the production process directly but indirectly it facilitates daily movement of the farmers. It should be noted that, some of the variables are not statistically significant, particularly with models having a large number of independent variables and this is partly attributed to relatively small sample. However the results of the interview questions from the farmers have shown the impact of these factors on income to be positive.

Table 4.2: Second Stage Truncated Regression of Income

Dependent variable			Productivity
Independent Variables	**Coefficient**	**Standard error**	**P-value**
Farm size	.2563904	.1935314	0.185
Farming experience	-.0149098	.1278206	0.907
Extension Services	.0099553	.0747031	0.894
Credit	.0896182	.0845202	0.289
Cash Inputs	-.06597	.0718261	0.358
Age	-.3147067	.3011099	0.296
Fertilizer	.4327416**	.1749921	0.013

[1] Selection bias associated with the fact that participants and non participants contract farmers may not be similar in unobservable characteristics(such as assets, knowledge and skills, or intelligence)

[2] Refer the Heckman assumptions stated

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Agri-asset	.2152344**	.0802899	0.007
Hired labour	-.0516275	.0844286	0.541
Family labour	-.0069195	.1260273	0.956
Type of House	-.0563992	.0730912	0.440
Tractor	-.0142006	.1814383	0.938
Livestock	.0500184	.1523199	0.743
Bicycle	-.455222**	.1919725	0.018

Productivity equation, for the factors influence productivity, ** Significant at 5%, * Significant at 1%
Concerning the factors that influence participation on CF using the Heckman's selectivity model, Sharma (2008) concludes that education, age, farm size, and membership to an organization influence participation in CF. While this study found that farming experience, credit, farm group, age, agricultural assets and non-agricultural assets were very important factors that influence probability to participates in CF in the district and also their coefficient were statistically significant. In additional to that, both credit and agri-asset were negatively related to participation in CF against the theory of contract on bound rationality, while farming experience, farm groups and age of the household were positively related to the participation in CF. This result is different from Olomola, (2010) and singh (2002) into which inputs motivates farmers in contractual arrangements.

Regarding the factors that influence tobacco income in the area by using Heckman's result equation, 98% of the response from the farmers shows that they applied organic fertilizers to enhance their productivity. In the selection equation, the variables such as fertilizers, agri-asset shows a positive relation with the increase of productivity, while the variable bicycle shows a negative relation with productivity. The coefficients of these variables were statistically significant at conventional level. This results were different as from Katozi (2009), and Chulaki (2001) into which the farm size, amount of access to credit, increase of farming experience, efficiency use of cultivars have significant influence on income but similarities were seen to Katozi, (2011) for the increase of fertilizer also lead to the increase of yields thus contribute to income rise. Most of the coefficients of the result equation in this study were not statistically significant. This was likely due to the size of the sample selected and large number of independent variables.

5. Summary, conclusion and policy recommendation
The distinction of this study is that rural farmers in Urambo whose backbone economy is tobacco production are inadequately accessible to capital with the highly dependency on a traditional hand hoes for farming. Moreover the income from tobacco production is high through CF which allows farmers to purchase farm inputs on credit, receive cash credit and hired labour of which all payment will be made later during selling of the crop. Other uses of income were for domestic uses, school fees, land purchase, business capital and purchase of firewood.

Recommended policy measures includes timely distribution of the fertilizers, pesticides, and hybridized seeds has future contribution of the increase in farm yields and income of the farmers including farmers payment to be done on time. Extension service should also be adhered from the seedbeds to the time of harvest and grading of the crops by the responsible personnel appointed by both firms and the Government.
CF is not the only solution for the smallholder farmers through access to credits, inputs, markets, extension services. There is a need for the establishment and maintenance of sound legal frameworks in rural areas where there are smallholder farmers. Primary cooperative societies (PCs) need to improve their operations as financial institution like SACCoS. This will create an opportunity for the farmers seeking the inputs credit from their own SACCo instead of depending from the firms or other financial institutions.

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