An Analysis of Factors Affecting Smallholder Rice Farmers' Level of Sales and Market Participation in Tanzania; Evidence from National Panel Survey Data 2010 -2011

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Abstract

This study analyzed the determinants of market participation for smallholder rice farmers in the five major rice producing regions in Tanzania. The study used Tanzania National Panel Survey (NPS) data compiled data by FAO. A sample of 842 households from high rice producing regions (Mbeya, Morogoro, Shinyanga, Mwanza and Tabora) was extracted from the dataset. Quantitative as well as quantitative analyses were performed; quantitative analysis involved estimation of Weighted Least Squares (WLS) and the Tobit regression models were used to analyze factors affecting volume of sales and determinants of market participation respectively. The household socio-demographic characteristics of smallholder rice farmers were analyzed and discussed in relation to their influence on production and market participation. The WLS results indicated that 10 variable out of 11 variables included in the model were significantly influence the quantity of sold. While age has a positive relationship with quantity sold but was insignificant implying that age of the household head does not directly affect the volume of sales. Results of the Tobit regression model indicated that household consumption, land cultivated, livestock owned and dummy for rural areas indicated a positive significant relationship while non-farm income, dummy region for Mbeya region and Tabora region indicates that, a negative and significant relationship with market participation. Further, low rice production, underdeveloped transport infrastructure and lack of reliable markets closer to higher rice producing regions and inadequate access and use of improved seeds and input were found to be the main of the problems associated with smallholder farmers in the study area. Hence, we discuss and recommend some policy implications based on the study findings.

Keywords: Agricultural Marketing, Market Participation, Smallholder rice Farmers, rice Production, Tanzania

1. Introduction

The Tanzanian economy depends heavily on agriculture, which accounts for more than 25% of GDP, provides 85% of exports, and employs 80% of the work force (Simbakalia, 2011; Sheila at el, 2010; Karl and Thurlow, 2010 and Daniel and Helieh, 2006). The Common food crops grown in Tanzania are maize, sorghum, millet, cassava, sweet potatoes, bananas, pulses, rice and wheat. However, the main staple food crops that account for household and national food security are maize, rice and cassava and on average the crop sub sector contributes about 34.8% percent of the Agricultural GDP (Mnenwa and Maliti, 2010; Sibuga, 2008 and Kadigi, 2003). Moreover, the bulk of the country's export crops being composed of coffee, cotton, cashew nut, tobacco, sisal, pyrethrum, tea, cloves, horticultural crops, oil seeds, spices and flowers (URT, 2008). Smallholder farmers in Tanzania, who are the dominant leaders in the sector as a whole, support average farm sizes of between 0.9 hectares and 3.0 hectares and cultivate 5.1 million hectares annually, of which 85 percent is food crops (Andrew and Diyamett, 2012; China-DAC, 2012; URT, 2012:2011 and Mashindano at el, 2011). While Tanzania has 95.5 million hectares (ha) of land, of which 44 million ha are classified as arable, but only 23 -27 per cent of the arable land is under cultivation. The area suitable for irrigation is estimated to be about 29.4 million ha, but only 0.34 million ha are under irrigation. One of the major setbacks to the agricultural sector is heavy reliance – about 70 per cent – on the hand hoe in a rainfed agricultural system dominated by small-scale subsistence farmers, who occupy and used over 80 per cent of the arable land while about 1.5 million ha are used for medium and large-scale farming (Joanne, 2014; Simbakalia, 2011 and ESRF, 2009). Only 15 percent of farmers use improved seed. Food production is mainly done in small scale and because of poor weather conditions, use of old technology

and other problems, land and labour productivity is low. The average food crop productivity is 1.7 tons per hectare against 3.5 - 4 tons per hectare that can be achieved with proper technology and skills (Simbakalia, 2011). According to MAFAP (2013), the economy of the United Republic of Tanzania (URT) is predominantly rural-based, with relatively low levels of manufacturing and value addition of the commodities produced. Hence, the livelihood of dwellers in the rural areas of Tanzania, like in other developing countries, rely on subsistence agricultural production (Deloitte and Touche, 2011: Mnenwa and Maliti 2010; Lokina et al., 2011 and URT, 2007. However, the weight of the agriculture sector in total gross domestic product (GDP) (Figure 1-2) has continued to decreased from 50 percent in 2000 to 28 percent in 2010, and is forecast to decline further to 18 percent by 2025. However, the sector's role in providing employment is expected to remain close to 50 percent until 2025. During the period 2001–2012, growth of the economy averaged 6.6 percent, with peaks of 7.8 percent in 2004/05 and 7.4 percent in 2008/09 (Figure 2). The services and industry sectors exhibited stronger growth rates compared with agriculture, whose growth averaged 4.2 percent per annum, with a high of 5.9 percent in 2003/04 and a low of 3.1 percent in 2002/03.
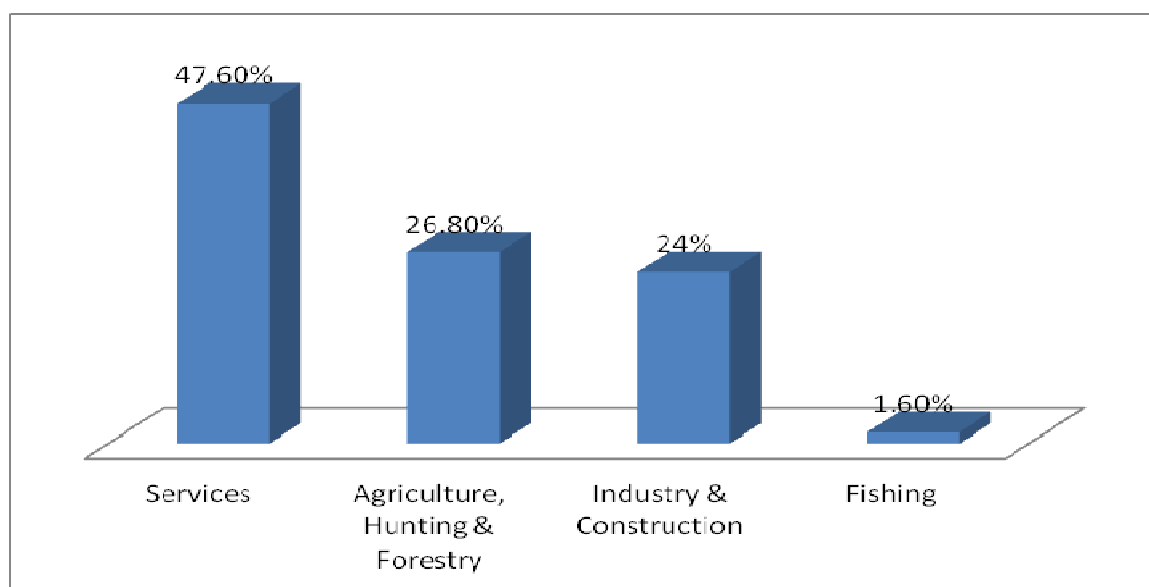

Figure 1-2: Tanzania's economic sectors Percentage Share of GDP at Current Prices, 2012

Source: NBS (2013)

The significance of the agricultural sector in terms of potential economic growth and poverty reduction in the country has been recognized by Government, which has also recognized the role that outside factors including infrastructure, rural financial services, land ownership and good governance have played and continue to play in the development of the sector (China-DAC, 2012). The Government has prioritized several tasks in a continued effort to strengthen the sector including the pursuit of macroeconomic policies in order to stimulate investment in agriculture by small holders and large–scale commercial farmers; the creation of an enabling environment and the provision of proactive support to private operators, farmers organizations, NGOs and CBOs who supply inputs and credit to small farmers thus ensuring a strong regulatory mechanism; the concentration of budgetary allocations in agriculture research and extension; the provision of special support to investments in agricultural processing, particularly in fruits and vegetables, while, at the same time, granting top priority to the implementation of new land Act (URT, 2012). Moreover, agriculture remains the dominant sector in Tanzania in terms of its size, contribution to GDP, generation of employment and export earnings. According to Mashindano et al.,(2011) for more than 12 years crops have dominated, with an average contribution to the sector of about 70 percent, followed by livestock and forestry (and hunting), with an average share of 16 and 8 percent, respectively. Fishing has an average share of 5 percent (Table 1-2).

Table 1-2: Decomposition of Tanzania's agricultural sector by percentage (1998 – 2009)

Subsectors	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Crops	71	70	69	70	71	721	71	70	70	70	70	
Livestock	14	15	16	16	16	15	15	17	18	17	18	15
Forest & hunting	9	9	9	8	8	7	8	7	8	8	8	8
Fishing	6	6	6	6	5	5	5	5	5	5	4	5

Source: Mashindano et al. (2011)

However, agribusiness in non-traditional export crops is still at very low stage. Higher food prices, driven by higher energy cost and rising demand in developing countries are good opportunities for Tanzania to develop its agro-industry to tap into regional markets and especially eight countries which it shares boarder with (Simbakalia, 2011). Agricultural sector is characterized by strong forward and backward linkages with other sectors and by high potential for a faster and sustainable growth and development. Its development is however constrained by insufficient   infrastructure (transport, water, energy and communication), finance and limited access to finance, insecure property rights, poor farming systems which lead to depletion of natural capital and release of greenhouse gases and other pollutants (Simbakalia, 2011).

2.   Factors Affecting Smallholder Farmers' Participation in Markets

According to Eskola (2005);URT (2008), Nyende (2011); Nyunza and Mwakaje (2012); Adenegan *et al.,* (2012) and Ohen *et al.,* (2013), there number of factors affecting smallholder farmers' participation in markets developing countries including Tanzania. These constraints can be grouped into five broad categories, namely; access to financial services, access to Input and Output Markets, poor marketing infrastructure, inadequate land tenure and management system, policy-related and institutional (Lundberg, 2005: Nyunza and Mwakaje, 2012 and Chiara *et al.,* 2012). Under institutional and market constraints the following specific constraints exist, there is a serious lack of sufficient and timely market information on the prices of agricultural products especially on their supply and demand (Dayo et al., 2008 and Mompati and Jacobs, 2009). As a result there no reliable market information at the time it is needed for decision-making leading to uninformed decisions making by smallholders when it comes to marketing their crops (Koskei et al., 2013). Tanzania is one of the five East African countries where Smallholder farmers have been facing numerous constraints. Some constrains are unique to each of the countries while most are of a similar nature. These constraints are not new rather long-standing and perhaps even chronic and can be summarized as;

2.1. Access to Financial services

According to Temu *et al.,* (2006), Salami *et al.,* (2010) and Nyende (2011), smallholder farmers in developing countries have limited access to financial loans and credits and so they depend on savings from their low incomes, which limits opportunities for increased production because they cannot afford to invest more in their farms. For example, a survey of a sample of 344 rural households in Tanzania between May and August 2001 showed that half of total rural household income came from farming, 47.6 per cent from nonfarm employment (wages and self-employment) and less than 4 percent from remittances. This can be associated with the lack of collateral and/or credit history; most farmers are bypassed not only by commercial and national development banks, but also by formal micro-credit institutions. Therefore, it is clear that there is inadequate funding for agricultural operations in Africa and the case study countries in particular, which negatively affects the farming operations of smallholder farmers (Fan and Rosegrant, 2008). Therefore, the provision of banking services to the poor including the smallholders needs to be highlighted as it can fuel the investments in agriculture production leading to higher yield and access to market.

2.2 Access to Input and Output Markets

According to FANRPAN (2001) and Salami et al., (2010) access to input and output markets are a key precondition for the transformation of the agricultural sector from subsistence to commercial production.

Smallholder farmers must be able to benefit more from efficient markets and local-level value- addition, and be more exposed to competition. Smallholder farmers in East African countries have limited access to markets of both agricultural inputs and outputs, with markets not adequately equipped to serve the needs of the poor farmers. For instance, most East African countries, more than half the population live five hours or more from a market centre (Salami et al., 2010). On the input use, Wiggins and Jonathan (2010) indicated that the average application rates of fertilizer for arable crops in East African countries are estimated to be bellow 30 kg/ha/year– far less than the world average of 100kg/ha/year. While the 2007 Tanzania's Poverty and Human Development Report revealed that 87 percent of Tanzanian farmers were not using chemical fertilizers; 77 percent were not using improved seeds; 72 percent were not using pesticides, herbicides or insecticides (agrochemicals), as a result of high costs of agricultural inputs and services (R&AWG, 2007 as quoted by Salami et al., 2010).

2.3 Poor Marketing Infrastructure

Andrew (2010) and Karugia (2011), argue that, for smallholder farmers to access market they need good and marketing infrastructures. In Tanzania like other developing countries, agricultural marketing infrastructure is still poor hence continues to impede agricultural activities in the country. The key challenges are inadequate and poor conditions of the market facilities and transportation systems, including road and rail. The road system, which is the most important for market development in terms of distribution of inputs and output to and from farms, is the most serious infrastructural bottleneck facing agricultural development in Tanzania (Temu *et al.,* 2006 and Salami *et al.,* 2010). FANRPAN (2001) urge that farming areas are generally poorly served by external transportation systems due to poor and in most cases, non-existent roads, long distances, mountain ranges and impassable rivers. As a result, the majority of the farmers have difficulties in procuring improved seed, fertilizers and other chemicals. For outputs to markets, transport services coming in the form of dilapidated old trucks. These often break down resulting in loss of quality and time and delays in marketing of produce. Poor communication systems and infrastructure contribute to lack of competition and transparency in agricultural output markets (FANRPAN, 2001). In general underdeveloped rural roads and other key physical infrastructure have led to high transport costs for agricultural products to the market as well as of farm inputs, reducing farmers' competitiveness in any one country (Temu *et al.,* 2006 and Salami *et al.,* 2010).

2. 4 Land Tenure, Access rights and Land Ownership

According to Salami *at el...*(2010), the constraints related to the land tenure system, such as insecurity of land tenure, unequal access to land, lack of a mechanism to transfer rights and consolidate plots, have resulted in under-developed agriculture, high landlessness, food insecurity, and degraded natural resource (Karugia, 2011). The available land in East Africa is overly subdivided into small and uneconomic units, resulting generally in fragmented production systems and low productivity. In fact, the farm sizes range from as low as about 1ha per household in Ethiopia and 2.0 ha in Tanzania and 2.5ha in Uganda and Kenya. Despite their small sizes, the landholdings in Ethiopia, Tanzania, Uganda and Kenya exceed the African average of 1.6 ha, but remain well below those of North America (121 ha), Latin America (67 ha) and Europe (27 ha). In addition to this very low absolute level of landholding, the distribution of available land is highly inequitable. Specifically, households in the highest per capita land quartile in East and Southern Africa control to 15 times more lands than households in the lowest quartile (Salami *at el...*(2010), the land ownership issues do not only mean small sizes of plots. For example, in Ethiopia, all land is state-owned, according to the country's 1994 constitution. In practice, traditional land tenure arrangements prevail as an outcome of subsistence agriculture, with peasant associations responsible for allocating land to residents (Kamara, *et al* 2004 as quoted by Salami *et al.,* 2010). Therefore, good land tenure systems will lead to improved land management and small farmers access to financial loans and credit as land can be used as collateral.

2.5 Policy-Related and Institutional

Since 1980s, many African countries have over time implemented a series of economic reforms and instituted agricultural policy as well as strategic frameworks. So far, however, hopes that policies would bring about positive and durable results remain unmet. The main policy challenges include those that pertain to land tenure and land distribution to different segments of the population, marketing of agricultural commodities and inputs, and price regulatory frameworks. Even though Tanzania has instituted several agricultural reforms and strategies including the agricultural development framework in the early 1970s and Agricultural Sector Development Strategy (ASDS), most of the policies had no significant impact on the majority smallholder farmers (Limbu, 1999: Temu *et al.,* 2006 and Andrew, 2010). According to FANRPAN (2001) and Mashindano and Patrick, 2013, the underperformance of agricultural sector have been associated with factors such as policy, market and

institutional failures, decay in institutions servicing the farmers due to corruption, exploitative economic policies, government mismanagement and underinvestment in technical capacities at universities, research and extension organizations. Even though the country undertook substantial market-oriented reforms during the 1990s, agricultural performance remained disappointing (Temu *et al.,* 2006). The experience of Tanzania illustrates that market reforms are necessary but not sufficient for raising agricultural productivity. Therefore, based on Tanzania's experiences reforms for institutional framework underpinning agriculture are importance of as well as the complementarities of policy reforms in the area of infrastructure, access to markets and to credit.

1.   Objectives of the Study

The overall objective of this study was to   analyze smallholder farmers' market participation in Tanzania. The specific objectives of this study were as follows: (1) To examine the characteristics and production levels of smallholder rice farmers in Tanzania (2) To analyze the factors influencing smallholder rice farmers' levels of sales (3) To analyze the determinants of smallholder rice farmers' market participation (4) To recommend government related policies that impact on smallholder staple crop farmers' market participation in Tanzania.

2.   Justifications for the Study

Smallholder farmers continue to face the challenge of integration and competition in this new globalized environment; at the same time they are constrained by a drastic reduction in the public provision of basic services as a result of recent policy reforms, market liberalization programs, and fiscal and governance problems. According to some scholars (Machethe, 2004; Gitau *at el*. 2009; Kaaria *at el.* 2009) agricultural sector growth and agriculture-related activities provide most of the employment in rural areas in the following three ways (i) Through the direct impacts of increased agricultural productivity and incomes; (ii) Through the benefits of cheaper food for both the urban and rural poor; (iii) Through agriculture's contribution to growth and the generation of economic opportunity in the non-farm sector. However, in Tanzania like in other Sub Saharan African countries, the marketing infrastructure is under developed; smallholder farmers have limited supportive organizations that represent them, mainly due to the collapse of agricultural cooperatives societies which had the role to link famers to markets. Furthermore, Mbaabu (2010) and Gani and Adeoti (2010) assault that increased incomes and reduced poverty can be attained by promoting access to efficient, well functioning markets that will create market linkages for millions of smallholder African farmers. Therefore, linking farmers to growth markets is therefore an important strategy for improving the adoption of agricultural technologies, raising rural incomes and reducing poverty (Sanginga *et al.,* 2004). Moreover, Barrett *et al.,* (2011) found that in many countries, the combination of increased commercial demand and supply has led to the emergence of modern marketing channels employing sophisticated management methods, such as costly grades and standards or vertical coordination or integration of activities that profitably add value to raw commodities through transport, storage and/or processing. Hence, smallholder farmers should be enabled to tap these emerging marketing channels (Barrett et al., 2011). In order to reduce the critical gap between agricultural research and development and farmers linkage to profitable markets for agricultural products, agricultural research and development have now recognized the need for a market driven, market-led or market orientated research. However, in Tanzania, most of the studies on smallholder grain farmers such as maize and rice value chain studies dealt with the value chain as the whole and have limited information on smallholder farmers' market participation. This study therefore becomes the first to use National Panel Survey (NPS) data to analyze the smallholder rice farmers' determinants/constraints for market participation and adds more knowledge on smallholder farmers and agricultural market systems in Tanzania.

3.   Research Methodology

5.1 Study Area and Producer Selection

The study area and producer selection has been done based on the findings by Kadigi (2003) and Match Maker Associates Limited (2010), that rice is the second most important crop in Tanzania after maize and mostly used as a cash crop. Tanzanian rice productivity is lower than most neighbouring East African countries and one of the lowest in the world. Tanzania's total rice production is 899,000 Mt, from which a small part is exported to neighbouring countries. Around 90% of the rice production is by (subsistence) smallholders and production concentrates in Mbeya, Morogoro, Shinyanga, Mwanza and Tabora regions. Moreover, Mbeya and Morogoro regions have good potential for rice production as they always receive good rain fall while Shinyanga, Mwanza and Tabora rely on rain fed rice production. The marketing of rice is highly fragmented with millers and brokers playing a central role in the trading process, this make the rice supply channels to be generally long as the produce changes many hands before reaching the final consumer.

5.2 Data sources and Collection

This study used data compiled by FAO from the Tanzania National Panel Survey (NPS) conducted between 2010 -2011. To make the data fit the study and comparable across rice producing regions in Tanzania, a sample of 842 households from high rice producing regions (Mbeya, Morogoro, Shinyanga, Mwanza and Tabora) in Tanzania was extracted and the definition and computation of variables relating to household socio-economic characteristics (head age, head gender, household size, head education, head marital, household dependence and household consumption), rice produced, maize sold, land cultivated, total livestock, nonfarm income, dummy rural and region dummies. Physical quantities were converted into standard units of measurement, and monetary variables were converted into local currency into Tanzania shillings (TZS).

5.3 Data analysis
5.3.1 Descriptive statistics

Descriptive analyses such as frequency distribution table, percentages, means and standard deviation, were used to describe distribution of respondents according to the socioeconomic characteristics, farm characteristics and productivity.

5.3.2 Econometric Model Specification

The study looked at factors influencing farmers' volume or amount of sales level and the determinants of farmer's participation in the rice market. In principal, several market participation studies have applied the OLS model when all households participate in the market. However, practically not all households participate; some households may not equally participate due to different factors that may influence the individual farmer's household. If the OLS regression is estimated excluding the non-participants from the analysis, a sample selectivity bias is introduced into a model. And when the dependent and independent variables included in model were tested for heteroskedasticity using IM-test it indicated a serious heteroskedasticity (Chi2=513.03 and P-value =0.000). Therefore, to deal with heteroskedasticity and overcome the problem of sample selectivity bias, two econometric models were used because of the need to infer causality and test factors that are significant. Weighted Lest Square (WLS) estimation was used to determine factors that influence productivity, measured in quantity of maize produced. WLS was used because the Ordinary Least Square (OLS) estimation was found to be heteroskedastic and thus re-estimation using WLS was used as a remedy. Tobit model was used to determine factors that influence market participation. Specification of these models is presented below.

5.3.2.1 Weighted Least Squares (WLS) Estimation procedure

This study used Weighted Least Squares (WLS) to account for heteroskedasticity which yields greater efficiency than OLS. Since OLS estimator remains unbiased in the face of heteroskedasticity and the variance of the parameters are no longer B.L.U.E, though robust standard errors can be used to ensure the inferences are not affected. Therefore, WLS has been used to correct for inequalities in how the sample represents the population since groups being compared run across several population strata and ensure the comparison is fair by similar corrections, so that the groups are compared on the basis of consistent samples, and take care of the large weights attached to poorly-responding strata. According to Wooldridge (2009), WLS is an action of assigning "different weights to different observations with an objective of giving less weight is given to observation with higher error variance and this study used region as a variable for weighting, unlike OLS which gives each observation the same weight because it assumes that the all partitions of a population error variance is identical, which is not the case in this study. There on order to recognize some observations as 'better' or 'stronger' than others, WLS which is the case in this study minimize the sum of squared residuals, where each squared residuals is weighted by 1/h (Wooldridge,2009) as outlined in the following equations;

$$y_i = \beta x_i + \varepsilon_i \qquad (1)$$

The OLS regression solution seeks to minimize the sum of the squared residuals, i.e.

$$\min Q = \sum_{i=1}^{n} (y_i - \beta x_i)^2 \equiv \sum_{i=1}^{n} (\varepsilon_i)^2 \qquad (2)$$

Implicit in the basic OLS solution is that the observations are treated as equally important, being given equal weights. Weighted Least Squares, however, attributes weights w_i to specific observations that determine how much each observation influences the final parameter estimates:

$$\min Q = \sum_{i=1}^{n} w_i \left(y_i - \beta x_i \right)^2 \qquad (3)$$

It follows that WLS estimators are functions of the weights w_i. Although WLS can be used in situations where observations are attributed different levels of 'importance', it is most often used for dealing with heteroskedasticity. Since the data used in this study have been drawn from the large survey collected from different regions, the data are weighted based on regions and in the context of this study, the weight w_i corresponds to the quantity of rice sold by the individual household, measured in terms of kilograms. Therefore, factors influencing farmers' volume or amount of sales were analyzed using Weighted Least Squares (WLS) model, where the volume of sales of the market participants made up the dependent variable as shown in equation below;

$$Y = \beta_0 + \beta_i X_i + \mu_i \qquad (4)$$

Y is the variable representing volume of rice sold; X_i is a vector of farmers' characteristics (independent variables) relevant in explaining the level or volume of sales are as specified bellow;

X_1 = Age of the farmer (in years)

X_2 = Sex of the Household Head

X_3 = Household Size (in numbers)

X_4 = Level of Education (in years)

X_5 = Marital Status (married =1, otherwise =0)

 (Male =1, Female =0)

X_6 = House hold dependence ratio

X_7 = House hold consumption

X_8 = Quantity of Maize produced (in kg)

X_9 = Ownership of livestock in (in numbers)

X_{10} = Total arable land cultivated (in ha)

X_{11}= Annual non - farm income (remittance and wage in TZS)

5.3.2.2 Tobit Model Estimation procedure

Is applicable when all households participate in the market but in reality not all households participate or at the same level in the markets, because some households may not prefer to participate in a particular market due to different factors facing the household at that particular time. Therefore, when the OLS regression is estimated excluding the nonparticipants from the analysis, a sample selectivity bias arises into the model and this problem can be overcome by following a two-stage procedure as suggested by Heckman (1979) and Tobin (1958) procedures as quoted by Adenegan *et al.,* 2012. These two-stage procedures have been widely discussed by and applied in many studies such as Makhura, 2001, John and Dawit, 2007, Sebatta C. *et al.,*2012, Shephard S. *et al* 2011 and Ehui S. *et al.,*2009, Adenegan *et al.,*2012 and Ohen *et al* 2014. Both Heckit and Tobit procedures are used to address this concern. Though, the Heckit procedure is a consistent but not an efficient way for controlling selectivity bias, while Tobit procedure is efficient and consistent. However, if a Heckit specification

is run using Maximum likelihood Estimation (MLE) procedure without lambda, it gives results that are identical to Tobit-MLE selection models with iterations constrained to one. The Tobit procedure results are the MLE or maximum likelihood estimates, as well as the marginal effects. The marginal effects indicate the amount of the sales resulting from a unit change in the explanatory variables and account for the probability of the level of market participation. The marginal effects have the same interpretation as the OLS coefficients, though the OLS coefficients are distorted. Data providing for market participation tend to be censored at the lower limit of zero. That is, the household may sell some of its produce, while another may not sell at all. If only probability of selling is to be analyzed, Probit or Logit models would be adequate techniques for addressing probability questions. But, at the same time it is important to know the factors that influence the level of sales too. Therefore, a hybrid model need arises that can accommodate the Logit or Probit and the OLS. The relevant hybrid economic model is the Tobit model that uses Maximum Likelihood Regression (MLE) estimation (Tobin, 1958, Wooldridge, 2009). A Tobit econometric model when applied in determining the factors affecting market participation under *ceteris paribus* can be as shown in equation 5 below:

$$Y^* = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \mu_i$$
(5)

$Y = 0$ if $y \leq 0$,

$y = Y^*$ if $y > 0$.

Y^* = Household rice sales Index

β_s = estimated parameter or coefficient

X_i = the explanatory variables

μ_i = error term and is normally distributed with zero mean and constant variance.

The dependent variable y equals 0 if the latent variable $y*$ is below a certain threshold, usually 0. If the values of the latent variable are positive, the dependent variable is equal to the latent variable.

$$Y^* = \beta_0 + x\beta_1 + \mu, \qquad \mu/x \sim N(0, \delta^2)$$
(6)

$$y \max(0, y)^* = y^*$$
(7)

The latent variable $y*$ in equation (6) satisfies the classical linear model assumptions; in particular, it has a normal, homoskedasticity distribution with a linear conditional mean while equation (3) indicates that the observed variable, y, equals $y*$ when $y* \geq 0$, but $y = 0$ when $y* < 0$.

Since $y*$ is normally distributed, y has a continuous distribution over strictly positive values. In particular, the density of y given x is the same as the density of $y*$ given x for positive values. Moreover,

$$P(y = 0/x) = P(y^* < 0/x) = P(\mu < -x\beta)$$
(8)

$$P(\mu/\delta < -x\beta/\delta) = \Phi(-x\beta/\delta) = 1 - \Phi(x\beta/\delta)$$
(9)

Since μ/σ has a standard normal distribution and is independent of x; the intercept is absorbed into x for notational simplicity (Wooldridge, 2009 and Cameron and Pravin,2005,). The maximum likelihood estimates for β and σ are obtained by maximizing the log-likelihood which is easily executed in STATA (Cameron and Pravin, 2005). Hence, the full Tobit model for this study is as specified in equation 10.

$$Y^* = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots\ldots\ldots\ldots + \beta_k X_k + \mu_i$$
(10)

Where Y^* is the latent variable (Proportion of rice sold), and x is a vector of independent factors, and μ is the error term. The dependent variable is the proportion of rice sold out of the total produced through sales to output formula while the explanatory variables are as specified bellow;

X_1 = Age of the farmer (in years)

X_2 = Sex of the Household Head

X_3 = Household Size (in numbers)

X_4 = Level of Education (in years)

X_5 = Marital Status (married =1, otherwise =0)

 (Male =1, Female =0)

X_6 = House hold dependence ratio

X_7 = House hold consumption

X_8 = Quantity of Maize produced (in kg)

X_9 = Ownership of livestock in (in numbers)

X_{10} = Total arable land cultivated (in ha)

X_{11}= Annual non - farm income (remittance and wage in TZS)

X_{12} = Area dummy Rural

X_{13} = Regional dummies (dummies for all the five regions)

6   Results and Discussion

6.1 Demographic and Socio-economic Characteristics of Household

This section provides an overview of the household socio-demographic characteristics namely; gender, age, educational background, marital status, number of people and dependence ratio of the sampled farmers' household were analyzed and discussed in relation to their influence on production and market participation. These aspects pose an important element because household heads and their decisions are more likely to be influenced by household socio-demographic characteristics since most of household activities are coordinated and led by household heads (Jari, 2005).

6.1.1   Gender of Household heads

Gender of the household head is an important factor that determines household capabilities in production and marketing. Results presented in Table 6-1 shows that 76.8 percent of the household heads were male while the remaining 25 percent were female. With this high percentage of male headed households it may result into female headed households being limited to information and market access since women are traditionally not mobile and tend to lose income control as farm product move from the farm to the market which agricultural markets are normally located in rural urban areas. This signifies a typical Tanzanian farming system especially in the rural areas where men are predominantly heads and more advantaged as they are comparatively more resource endowed. According to Sigei *et al,* 2013, women in Sub Saharan Africa are disadvantaged in marketing because of unequal distribution of resources as well as cultural barriers. Moreover, though women contribute significantly to all food production, processing, and marketing activities and are key participants in all staple value chains, forming about 75 percent of the agriculture labour force yet they have limited participation in decision making and benefit little from the downstream portion of value chain activities due to existing gender inequality in access to productive resources (particularly land, water resources and agricultural inputs such as improved seed and fertilizer) and to training and leadership opportunities. Hence, gender inequalities limit the growth potential of Tanzania (Feed the Future, 2011).

Table 6-1: Household Head Gender

Gender	Frequency	Percent
Male	638	76.8
Female	204	26.2
Total	**842**	**100.0**

Source; Analysis from NPS, 2010 -2011

6.1.2   Age of Household Heads

Results in Table 6-2 indicates that about 67.9 percent of the farmers are between 36 and above 55 years, with 26.4 percent been above 55 age group. Moreover, results in Table 6-3 indicates that, the farmers' ages range between 18 and 95 years while the mean age is 46 years with the standard deviation of 16, implying that the average age of the majority of household heads in the study regions shows that they were still young and in their productive age and this could positively influence productivity and consequently high volume of sales and hence, market participation *ceteris paribus*. This is due to the fact that, the age of a farmer has influence on farming experience and ownership of factors of production such as land and implements, these factors have influence on production and productivity of agricultural crops. Since larger land ownership will lead to larger area cultivated while ownership of implements such as machines aor oxen enhance labor productivity. Therefore, it leads to more crop harvest surplus and resulting to increases volume of sales and market participation. Moreover, based on report by Randela et al. (2008), older farmers view farming as a way of life rather than as a business and have a strong emotional or almost biological connection with farming, land and little or no contact with the outside world. Moreover, Chalwe (2011) as quoted by Sigei at el.,(2013), found that younger people participated more in the market because they are more receptive to new ideas and are less risk averse than the older people. Therefore, the head of the household age becomes an important factor in the behavior of the farmers towards production and market participation.

Table 6-2: Household head age groups

Age group	Frequency	Percent
18 - 25	57	6.8
26 - 35	213	26.3
36 - 45	193	22.9
46 - 55	157	18.7
Above 55	222	26.4
Total	**842**	**100.0**

Source: Analysis from NPS, 2010 -2011

6.1.3 Education Levels of Household Heads

In order to get the distribution of education level attained by a household head in his/ her life, the Education level of the household head was grouped and analyzed into five groups, namely; informal, primary, secondary, college and university level. As Table 6-4 indicates, about 66.2 percent of all the heads of households in the study area have attained primary education which is regarded to be a basic education in Tanzania. This farmer's level of literacy and the percentage of farmers having informal education among farmers in the study areas is an indication that agriculture has not attracted highly educated Tanzanians. The farmer's level of education is very

important in the agriculture productivity and market participation as it enhance farmers access to information and agricultural technology adoption, such as access to market information and proper use of inputs and fertilizer application leads to higher surplus of crop produced as a result more crops will be sold and hence increased household market participation.

Table 6-3: Variables descriptive results

Variable	Observation (N)	Mean	Std. Dev.	Min	Max
Head age	842	46.61639	16.92017	18	95
Head gender	842	0.24228	0.4287177	0	1
Household size	842	6.954869	6.114342	1	55
Head education	841	12.9025	8.35635	0	45
Head marital	835	2.91976	2.047875	1	7
Household dependence	842	0.502375	0.5479345	-1	1
Household consumption	821	2879921	2365276	124394	18700000
Rice sold	842	117.6615	589.8051	0	11500
Rice produced	842	252.1401	1011.106	0	14400
Rice yield	842	139.5	966.2231	40	4107
Maize sold	842	118.7399	516.2916	0	7200
Land cultivated	842	2.140143	6.997676	0	65
Total livestock	842	13.09026	26.34427	0	207
Nonfarm income	842	98339.12	271459.8	0	5160000

Source: Analysis from NPS, 2010 -2011

According to Nyunza and Mwakaje (2012), smallholder farmers with such a very low level of education could prevents them from getting opportunities other than farm such as formal employment, running business efficient and ability to bargain on the selling prices. However, higher education remains very important as this is likely to lead to better negotiation skills and better and appropriate use available information. Moreover, low education level can also lower farmers' effort towards forming groups to improve productivity and marketing structure and hence become vulnerable to bargaining power on crop prices and power to purchase inputs.

Table 6-4: Household head's education level

Education level	Frequency	Percent
Informal	216	26.68
Primary	540	66.21
secondary	72	8.56
College	9	1.07
University	4	0.48
Total	**841**	**100**

Source: Analysis from NPS, 2010 -2011

6.1.4 Household heads' Marital Status

The results in Table 6-5 shows that 48.0 percent of the household heads are married legally and 26.7 percent are cohabiting or live together as husband and wife without legal marriage. This implies that high percent of heads of households are married, whether legally or illegally. Marital status has being found to influence social organization and economic activities such as agriculture and resource management within a household (Nyunza and Mwakaje, 2012).

Table 6-5: Household head's marital status

Marital	Frequency	Percent
Married	401	48.0
Cohabitating	206	26.7
Separated	73	8.7
Divorced	11	1.3
Single	33	6.0
Widow	111	13.3
Total	**835**	**100.0**

Source: Analysis from NPS, 2010 -2011

6.1.5 Household Size

The results in Table 6-6 shows that 56.4 percent of the respondents have their household size ranging between 1-5 members with an average of 6.9 members and standard deviation of 6.1 as shown on Table 6-3. This is slightly higher than the national average of 6.8 persons as per Tanzania 2012 population and housing census (NBS and OCGS, 2013). This growing large household size could be responsible for the small and fragmented farm size and high consumption of produced food crops, as larger household with more dependants are likely to have a lower level of commercialization as confirmed by Awotide at el.,(2013) that propensity to participate in the market economy declines with number of household members.

Table 6-6: Household size

Size groups	Frequency	Percent
1 - 3	224	26.6
4 - 5	234	27.8
6 - 8	225	26.7
9 - 10	60	7.1
Above 11	99	11.8
Total	**842**	**100.0**

Source: Analysis from NPS, 2010 -2011

6.1.6 Household dependence ratio

Household dependence ratio refers to the ratio of the economically dependent part of the population to the productive part; arbitrarily defined as the ratio of the elderly (ages 65 and older) plus the young (under

age 15) to the population in the working ages (ages 16-64). Results in Table 6-7 shows that, 52.7% of households in the study regions have one (1) dependence ration followed by zero (0) dependency ratio which is 46.8%. Rios et al (2009) argued that, the demographic composition of the household or family matters in that labor of children and the elderly may be less productive than members in the 16-50 age range. This imply that more adults in the household offer more available family labor for farming activities and hence increased labor force for crop production. Moreover, a high dependence ratio in farming communities implies limited labour force for agricultural production.

Table 6-7: Household dependence ratio

Dependence ratio	Frequency	Percent
-1	21	2.5
0	377	46.8
1	444	52.7
Total	**842**	**100.0**

Source: Analysis from NPS, 2010 -2011

6.2 Factors Influencing Smallholder Rice Farmers' Volume of Sales

Factors influencing the quantity of rice sold were estimated using the Weighted Least-Squares (WLS) model; quantity of rice sold in kg by individual household was used as the dependent variable in the WLS model with farm and household specific factors were used as independent variables. The results of the WLS model are presented in Table 6-9. Results show that the WLS analysis indicated a significant overall fit and indicated that only one (1) variable was insignificantly different from zero out of the 11 independent variables. Though the coefficient for age of household head was positive, it wasn't significant even at $p < 0.05$, implying that age of the household head do not directly affect the volume of sales. Other variables indicated significant effect implying that an increase in any of these variables will lead to an increase or decrease in the volume of rice sold by a household in the study area. The positive coefficient on gender, given the category for gender dummy variable is female-headed households, suggests that female-headed households are more likely to sell more rice. In line with the prior expectation, education level of household head is has a positive influence on quantity of rice sold but not statistically significant too. Again in line with the prior expectation, household size statistically significant negatively affects quantity of rice sold. On contrary to the expectation household consumption and quantity of maize sold positively and statistically significant affects household rice sales. This can be explained by the fact that most of the households use maize as a main staple food so they may keep maize and sale more rice for addressing immediate household cash needs for other consumable such as clothes, drugs, shelter materials and the like. The head of household's marital status significantly exhibit a negative effect on sales as expected since married household heads always will focus on household food security so they may shy away from selling the food produced from subsistence farming. Moreover, the results suggests that the size of land cultivated by the household have a positive significant effect on rice sales, implying that any increase of the size of land cultivated leads to an increase of rice produced and hence positively affects the volume of rice sold in the study regions. The results also indicates that number of livestock owned and amount of non-farm income earned by a household are statistically significant and exhibit negative effect to the quantity of rice sales. This may imply smallholder rice farmers who own livestock and have access to non-farm income have diversified sources of income and hence may not depend on selling food crops such as rice and maize for immediate cash needs especially during harvest season when crop prices are low in the rural areas.

Table 6-9: VWLS results for factors influencing smallholder rice farmers' volume of sales

Dependent Variables	Coefficient	Std. Err.	P-Value	95% Conf. Interval	
Head age	0.03222	0.02473	0.193	-0.01626	0.08069
Head gender	20.98023	1.20015	0.000**	18.62798	23.33249
Household size	-1.32450	0.13193	0.000**	-1.58307	-1.06594
Head education	0.76900	0.05380	0.000**	0.66375	0.87463
Head marital	-7.05297	0.25200	0.000**	-7.54749	-6.55845
Household dependence					
	1.92000	0.68400	0.005**	0.57600	3.25502
Household consumption					
	0.00001	0.00000	0.000**	0.00001	0.00001
Maize sold	0.51713	0.00052	0.000**	0.51611	0.51815
Land cultivated	0.01126	0.00060	0.000**	0.01008	0.01243
Total livestock	-3.88440	0.11623	0.000**	-6.11220	-3.65660
Nonfarm income	-0.29359	0.01667	0.000**	-0.32627	-0.26092
Cons	0.00002	0.00000	0.106	-0.00000	0.00000
Number of Observations	814				
Goodness-of-fit	1.2e+06				
Prob > chi2	0.000				
Model chi2(11)	92871.33				
Prob > chi2	0.000				

Note: **Represents significance of coefficients at 5% and 1% levels**

6.3 Determinants of market participation for the smallholder farmer

Market participation was estimated using the Tobit model by analysing the determinants of household market participation. In the Tobit model, the proportion *of total rice sold* (total value of rice sold over total value of crop sold) by individual household was used as the dependent variable. Based on the results in Table 6–10, the log likelihood is -362.751 and 814 observations in the data set were used in the analysis while 28 observations have not been included as were treated as variables with missing values and with the model likelihood ratio chi-square is 6.76 with a p-value of 0.000, meaning that the overall model is significant and thus fits well the data. Furthermore, results of the Tobit model presented in Table 6-10 shows the marginal effects of each variable. Based on these results, household consumption indicated a positive significant relationship (p<0.10). This implies that a unit increase in household consumption will lead to an increase in smallholder market participation by a margin of 0.001 %. This can be explained by the fact that household consumption does not only include rice and rice is sometime used as a cash crop and maize be kept as a staple food. A total size of land cultivated has a positive significant influences (p<0.01) to house hold market participation, implying that an increase in the size of cultivated land increases household market participation in rice markets by a margin of 3.32%. This is line with Jagwe et al., (2010) who found that larger land sizes increase the probability of market participation for

sellers since land is a critical production asset having a direct bearing on production of a marketable surplus, *ceteris paribus*. This implies that households with access to large size of land are likely to increase crop production and hence more rice surplus that leads to high volume of rice sales by so doing the household market participation is increased.

The results also indicates that, a positive and significant relationship (p<0.05) exists between market participation and the number of livestock owned by the household which is in line with the prior hypothesized expectation of this study, implying that, a unit increase in number of livestock owned by the households will result into increased proportion of rice offered for sale by 0.544 % and hence increased market participation. This mean that livestock can be used as cultivating equipment such as oxen and that that household that owns cultivating equipment will produce more and are likely to offer more for the market than those without (Adenegan et al, 2012). The results also indicates that, there is a positive and significant relationship (p<0.01) between market participation and Dummy for rural areas contrary to the prior hypothesized expectation of this study. This relationship implies that, a unit increase in number of rural households will result into increased proportion of rice offered for sale by 101% and hence increased market participation. This is likely to be the result of agriculture being a most important rural occupation and an employer of many rural dwellers in many developing countries such as Tanzania as reported by several studies that agricultural sector employs over 80 per cent of the rural population in most rural agrarian economy (Joanne,2014 and Daniel and Helieh, 2006).

As an alternative source of income for the household, non farm income indicated a negative significant (p<0.10) weak relationship. This imply that, farmers with an additional source of income may not be willing to sale their rice for immediate cash need since they have other alternative especially when the crop prices are still low in the local markets. Moreover, the results indicate that a significant negative relationship exists between the market participation and dummy region for Mbeya region (p<0.10) and Tabora region (p<0.05) and this is in accordance with the prior *hypothesized sign*. That is, an increase in number of smallholder rice farmers from Mbeya and Tabora regions will reduce the proportion of rice offered for sale and hence reduce the possibility of household to participate in market by a margin of about 0.17% and 58.5% respectively. This may imply that smallholder rice farmers in Mbeya and Tabora regions face difficult in overcoming transaction costs due to the fact that though Mbeya region has access to good roads that connect to major cities but it is situated very far from these rice consuming cities while Tabora region's transport infrastructures are not well developed and Tabora is far from main cities (Mwanza, Arusha and Dar –es salaam) where rice (rice) is highly consumed.

The situation of poor road conditions and distance from markets leads to higher transportation costs to crop outputs market, thereby increase in transaction costs affecting market participation for Tabora rice producers because the higher the transportation cost, the more difficult and costly it would be to get the produce to the market thereby reducing the quantity taken to the market by the farmers as the results indicate. These results concur with Mukundi et al, (2013) and Martey et al, (2012) that increased distance to the market will lower the level of market participation as a result of increase in marketing costs, and output market is not only a function of the proximity to the terminal market but also the existing road infrastructure that link major production areas with the major consumption sites. Moreover, various studies argued that, higher transportation costs to market, increases transaction costs, thereby affecting market participation: that is, the higher the transportation cost, the more difficult and costly it would be to get the produce to the market thereby reducing the quantity taken to the market by the farmers (Adenegan et al, 2012). Therefore, the results suggest that interventions in improved rice production techniques and improved roads in rural areas that link production areas to the main roads especially in Tabora region could lead to enhanced smallholder rice producer's market participation.

Table 4 – 10: Tobit Analysis Results for Determinants of smallholder rice farmers' market participation

Dependent Variables	Coefficient	Std. Err.	P- Value	Marginal effects
Head age	0.00223	0.00550	0.685	0.00223
Head gender	-0.39797	0.27751	0.152	-0.39797*
Household size	-0.01050	0.02171	0.629	-0.01050
Head education	0.00332	0.01114	0.766	0.00332
Head marital	-0.01505	0.05313	0.777	-0.01505
Household dependence	0.13667	0.15180	0.368	0.13667
Household consumption	0.00001	0.00000	0.095***	0.00001
Maize sold	-0.00033	0.00022	0.151	-0.00032
Land cultivated	0.03317	0.01161	0.004*	0.03317
Total livestock	0.00544	0.00275	0.048**	0.00544
Nonfarm income	-0.00009	0.00005	0.075***	-0.00009
Dummy Rural	1.01045	0.28231	0.000*	1.01045*
Dummy Morogoro	0.26066	0.26647	0.328	0.26066*
Dummy Mbeya	-0.01674	0.26361	0.095***	-0.01674*
Dummy Tabora	-0.58519	0.27902	0.036**	-0.58519*
Dummy Shinyanga	0.26575	0.22711	0.242	0.26575*
Cons	-2.71209	0.47728	0.000	-
Sigma	1.39732	0.05456		

Number of observations =   814

 F(19,   798)   =   6.76

 Prob > F   =   0.000

Pseudo R2   =   0.081

Log pseudo likelihood   =   -362.751

*Note: *, ** and *** Represents significance of coefficients at 1%, 5% and 10 % levels respectively*

Marginal effects with (*) is for discrete change of dummy variable from 0 to 1

7   Conclusion and Recommendations

The study found that small holder rice farmers' level of sales and market participation are constrained by a number of factors; such as socio-economic, technological and institutional factors, these may include low level of education which may lead to inadequate access to extension services, low use of improved seed and application fertilizer which leads to small marketable surplus, poor infrastructure (rural roads, irrigation schemes and market). Therefore, the study findings suggest important policy implications on variables that are found to have significant effect on volume of sales and rice market participation need a close policy follow-up so that rice sales and market participation is enhanced. This can be achieved through institutional support and agricultural technological innovation support. The central government and local government should team up and enhance the ongoing investments in public facilities such as improved roads, irrigation schemes, telecommunications and input and output market places. However, emphasizes on construction of infrastructure alone such as construction of roads may not automatically result into improved smallholder farmers agricultural production and productivity. Hence it should go hand in hand with the enhancement of agricultural outputs, investing in improved and appropriate production techniques   such as small scale irrigation scheme and input uses (improved seeds and fertilizer application), this is likely to have a more consistent impact on both productivity *and* market participation. Moreover, interventions in improved rice production techniques and improved roads in rural areas that link production areas to the main roads especially in Tabora region could lead to enhanced smallholder rice producer's market participation, therefore, this region need to be given special consideration. By improving suggest smallholder rice farmers' participation in markets they capability to more from subsistence farming into commercial farming will be enhanced and hence their income from agriculture will be increased and rural poverty will alleviated. It is the believe of the researchers that, when the above recommendations are carefully considered and implemented, among other strategies, Tanzania's rice sector and other food crops production, productivity and marketing will be improved, hence, the livelihood of the rural poor who mostly depend on agriculture will improved.

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