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Effect of Land Characteristics on Poverty Levels among Tea Farming Households in Konoin Sub-County, Kenya

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Abstract
The purpose of this study was to investigate the effect of land characteristics on poverty levels among tea farming household in Konoin sub-county. The objectives of the study were to determine the effect of farm land size, diversified land use, increased land size under tea and diversified tea crop variety on poverty levels of tea farmers. To achieve the purpose of the study, the hypothesis tested was: farm land characteristics (farm land size, diversified land use, increased land size under tea and diversified tea crop variety) do not have significant effect on poverty levels among tea farmers. The sample that took part in the study was 380, selected from a target population of approximately 36,000 small-scale tea farming households. The sample was selected proportionately from 12 tea catchment areas. Generalized Linear Model (GLM) and censored Tobit regression models were used to analyze data. The farm land characteristics; farm size, land tenure, diversified land used, increased land size under tea and diversified tea crop variety were found to significantly influence the poverty levels among the tea farmers. These characteristics led to better incomes, more odds of the household being above the poverty line and where the household was poor, reduced likelihood of being deeply in poverty and less effort was required in lifting them out of vicious poverty. As a recommendation, interventions targeting on diversified land use, diversification of crop varieties, land consolidation and less subdivision, and adoption of fast maturing crops should inform policy formulation targeting poverty reduction in smallholder tea farming households.
Keywords: Small-scale Tea farming, Land characteristics, Poverty, smallholder

1.0 Introduction

According to World Poverty Report (2011), the most dominant characteristic of developing world is its rural peasant population. Close to 3.1 billion people or 55 percent of the population in developing countries live in rural areas depending on small scale farming as a key source of livelihood. A third of this population lives in extreme poverty with sub-Saharan Africa and East Asia as the leading sub continents hosting the majority of the poor (World Bank, 1990).In Kenya, agriculture is predominantly small-scale farming where the sector accounts for 75 per cent of total agricultural output and 70 per cent of marketed agricultural produce. The sector is a major source of the country's food security and stimulant to growth of farm employment, both of which are of primary concern to the government.

As postulated in a World Bank Report (2012), by 2015 it was estimated that about one billion people will be living on less than $ 1.25 (ksh.102) a day exposing them to deprivation to essential food, clothing, water and shelter needed for proper living. According to Harry (1975), poverty consists of having insufficient spendable resources to maintain a standard of living deemed by some standard to be adequate for civilized survival. According to World Bank (2000), poverty is not just being about income but is multi-dimensional, including access to social services, self-respect and autonomy.

In Kenya, agriculture contributes to 25 percent of GDP and employs 80 percent of labour force, contributing close to 60 percent of total earnings and 45 percent of government revenue and accounts for 80 percent of rural incomes (Republic of Kenya (ROK) (2004) in Tegemeo (2008). Tea, one of the cash crops found in Kenya highlands is among the leading foreign exchange earner recognized across the globe for its superior quality and taste raking in thousands of shilling annually in revenues to small scale household in rural Kenya. To the contrary, over 80 percent of Kenyan smallholder tea farmers live in poverty, with a key cause attributable to land subdivision making tea farms too small for one to make a decent living from tea alone (Trade-fair Foundation Report (2012).

In former Rift valley province alone, a region dominated by agriculture as a main source of income, more than 1 million people were added to the ranks of the poor in the same period meaning that almost half of the province's population of 8.7 million is currently living in poverty. According to Central Bureau of Statistics (CBS) (2003), more than half of tea farmers live below poverty line based solely on tea income. The report also showed that poor farmers' expenditures were found to be lower on household's routine expenses as well as investment in tea farming activities. It also indicated that the levels of financial investment in tea management were lower among the poor and non-poor farmers. In Konoin sub-County, majority of the farmers derive their income from the tea sector under the umbrella of Kenya Tea Development Agency (KTDA).

It was in the interest of this study therefore to extend the assessment of poverty measurement to include not only income but also position relative to the poverty line, level and depth and how they are influenced by farm land characteristics in Konoin sub-County.

1.1 Research Objectives

The main purpose of the study was to investigate the effect of land characteristics on poverty levels among smallholder tea farmers.

Specific Objectives

The specific objectives of the study were to determine the effect of; farm land size, land size under tea, other land uses/diversification of land use and increased land size under tea crop on poverty levels among the smallholder tea farmers.

1.2 Research Hypothesis

The hypothesis of the study was: farm land characteristics (farm land size, land size under tea, other land uses/diversified land uses and increased land size under tea crop) do not have significant effect on poverty levels among tea farmers**.**

2.0 Literature Review

2.1 Poverty

The dynamics of poverty as postulated by Harry (1975), can be attributed to two key sources: the size of the family relative with its income-earning opportunities, and the value of the services of its income-yielding assets in the market place. Accordingly, excessive number of people dependent on the earning capacity of the family unit for their sustenance and support puts the household into greater odds of being poor. In his second view, inadequate employment opportunities for household members of sufficient skill, inadequacy of factors of production and inadequate earnings from the individual's or the family's stock of capital productive assets raises household poverty exposure (Harry, 1975).

However, Brandshaw (2000) on a different view blames individuals in poverty for creating their own problems and argue that with harder work and better choices, the poor could have avoided their problems. According to Rank, Yoon and Hirschl (2003**),** economic, political and social systems with limited opportunities and resources required for generating income directly determines individual and household wellbeing. Poverty, according to this theory can occur among certain segments of the population due to discrimination and systems that make it very difficult for those segments to cope. On a different view, Grondone (2000), suggests that poverty is created by the transmission over generations of a set of beliefs, values, and skills that are generated but individually held and hence the poor create and maintain certain attitudes, beliefs and perspectives that keep them in poverty. However, Sondra (2001), a critique of the relevance of poverty theories, cautions that despite poverty theories having theoretical relevance, may not adequately explain the causes of poverty in less developed countries. Most of them have been developed in advanced countries' setting and there is a great difference in the characteristics that exist between the developed and developing countries.

Empirical evidence from sub-Saharan African countries largely finds agricultural income growth as a more effective strategy for reducing poverty than growth in other sectors. The incidence of poverty tends to be higher in agriculture and rural populations than elsewhere, and that most of the poor live in rural areas and a large share of them depend on agriculture for a living (World Bank, 2008) in Cervantes-Godoy and Dewbre, (2010)). In confirmation of this view, Bresciani and Veldes (2007) cited in Cervantes-Godoy and Dewbre (2010) concluded that when both direct and indirect effects of agricultural growth are taken into account growth is more poverty reducing than growth in non-agricultural sectors.

2.2 The Neoclassical Problem of the Household

According to Intriligator (1979), Varian (1992), and Jehle and Reny (1978), the neoclassical problem of the household is that of choosing a bundle of goods and services, given preference relation (utility function) and given the "budget constraint", which restricts the household to a subset of commodity space. The budget constraint states that total money expenditure on all goods and services cannot exceed money income.

2.3 Production Function

The production function portrays an input-output relationship. It describes the rate at which resources are transformed into products (Intriligator 1979; Varian 1992; and Jehle and Reny, 1978). Any given input-output relationship specifies the quantities and qualities of resources needed to produce a particular product. Much of the research in agriculture has attempted to find the relationships between, fertilizer applied, and so on, to a field and the resulting yield. Numerous other factors that affect crop yield, are weather, plant population, soil type and management practices among others (Doll and Orazem, 1984). Jehle and Reny (1998) and Varian (1992), refer

production as the process of transforming inputs into outputs. The state of technology determines and restricts what is possible in combining inputs to produce output. They described the firm's technology in terms of a production function.

2.4 The Theory of Agricultural Household

According to Intriligator (1979), the household is any group of individuals sharing income so as to purchase consumer goods and services, and is one of the basic institutions of economic theory. The economizing problem of the household is that of deciding how much of each of the available goods and services it should purchase, given the prices of all goods and services and its income. The economizing activities of the household are treated mathematically as the choice of a particular point in "commodity space".

2.5 The Household

Kenya Integrated Household Budget Survey (KIHBS) (2005/2006), notes that despite the overall poverty in Kenya declined from 52.2 percent in 1997 to about 46.0 percent in 2005/06, more than 2 million people were added to the ranks of the poor between 1999 and 2005/06 in Kenya.

Empirical evidence form sub-Saharan Africa, continues to focus on household demographics in uncovering the core causes of poverty. According to Ondari (2010), socio-economic factors centered on household size, structure, decision making, gender and occupation remains to be the key factors influencing household expenditure on both consumption and investment. Harvest Choice IFPRI (2013), notes that besides the socio-demographic traits of farmers such as education level, knowledge of farming practices, experience in farming, access to agricultural assets, age and gender structure of the household, farm characteristics can greatly affect farm performance and poverty levels of farming households. There is a persistent bias towards the influence of food producing peasant farming on poverty levels of households, leaving out households relaying on cash crops as a source of income. Income as an indicator of poverty dominates poverty and welfare analysis literature, a continued non recognition that poverty is a multi-dimensional concept.

2.6 Land Characteristics

Land use involves soil quality in terms of site selection and practices that promote soil management; size of plots that are large enough to provide economies of scale and economically sustainable livelihoods; and diversification of crops in order to diversify income and promote environmentally sound practices (Zepeda, 2001**).** Land in Africa is of significant importance. It is an economic property and the basis of agricultural and pastoral activities for most of the population. It has cultural, social, spiritual and political dimensions (Malan and Soumana, 2011). State/government is the principal land owner or majority shareholder in land ownership in many African countries. It can impose certain restrictions on utilization (Malan and Soumana, 2011). However, government has not been able to manage it well. Many researchers have studied the relationship between land size and production. Khaldi (1998), observed that in Tunisia, small farms make up two thirds of agricultural farms in the country. However, a small farm cannot only become viable again but also constitute a vector of social progress and economic growth, provided that the farm is well managed and sustained. It is framed to suit the local ecological and climatic conditions.

Bessaoud (2005) and FAO (2001) in Malam and Soumana, (2011) posit that appropriate land reforms with legislative framework that does not disrupt institutional credibility of the country but captures elements of the market like social dimensions and reduce political issues be introduced. This will help in the management of property rights and production. Mundlak *et al.;* (2002) in a study on determinants of agricultural growth in Indonesia, Philippines and Thailand, found that despite sharing geographical proximity, similar climate and other features, they get different results in terms of productivity and income. The reasons were related to new technology, fertilizer, land and capital usage.

Harvest Choice IFPRI (2013), stated that general and specific characteristics of the farm and their operators shape overall levels of production and productivity, generating differential returns to farming endeavors. Such characteristics as farm size, use of conservation practices, land tenure as well as household demographics and assets have been shown to exert some influence over enterprise and technology choice, input use and market participation.

In economic model, land is usually implemented as an input in the production of land-intensive commodities (IMPACT, 2002). Brovkin *et al.;* (1999) in Mendeljohn and Dinar (1999), states that land use is strongly determined by environmental conditions and that climate and soil quality affect land-use decisions. They strongly influence the suitability of land for specific crops, and thus affect agricultural and biomass production. Land-use model is a tool to compute the change of area allocated to at least one land use type.

Land remains the single most important asset for Africans. Majority of households largely depend on land-based activities especially agriculture for their livelihoods. The failure of agriculture to provide for some secure livelihoods is considered as a major factor contributing to rural poverty (Chileshe, 2005). Land access is usually a

key constraint in smallholder farming and with growth in population, landholdings are becoming smaller and increasingly fragmented. Most smallholder tea growers have fragmented landholdings reflected in the number of plots per household, (Chirwa and Kydd, 2003).

High population growth, land degradation, and lack of dynamism in technology are frequently mentioned factors that lead to low agricultural productivity in Sub-Saharan Africa. Since population has increased, farm sizes have been reduced to partitions as a result of the inheritance process and also due to land redistribution (Binyam, 2012). Boserup's (1965) in Binyam (2012), view was that increasing population density leads to more intensive land use systems and that population growth is a precondition for development since it eventually forces society to improve and intensify land usage. Further, population growth compels agricultural development in developing countries. Empirical evidence, cited of Machakos district indicates that despite a fivefold increase in population between 1930s and 1990s, per capita income had increased, erosion was much better controlled and trees were more prevalent in the landscape (Tiffen *et al*,; 1994), supports Boserup's view (Binyam, 2012). However, many studies have also found population growth to be associated with various aspects of resource degradation, deforestation, overgrazing, soil erosion, soil nutrient depletion, and other problems (Kates and Haarmann 1992, Panayotou 1994 and Fassil 1980 cited in Muluneh (2003) and in Binyam, (2012)).

How population growth and increasing land scarcity affect the well-being of agrarian societies has been a subject of considerable debate since Malthus time, today's proponents of Malthusian doctrine states that rapid population pressure will eventually reduce food surpluses, arrest agricultural development and lead to environmental degradation, starvation and other 'positive checks' (Hardin 1974; Grigg 1979 cited in Muluneh 2003; MacDonald 1989; Ehrlich and Ehrlich 1990; Kates *et al.;* 1993) in Binyam (2012). Many studies nonetheless, support the view that there is an inverse relationship between farm size and productivity – average crop yields fall when the size of farm increases (Carter, 1984 in Binyam, 2012). Recently, Lamb (2003) as reported in Binyam (2012), attributed the inverse relationship to a combination of heterogeneous land quality, market imperfections and measurement errors in the farm variable or unobserved factors.

Population pressure has led to competition for land resources, coupled with unfavorable poverty indicators, have impacted negatively on food access. Policies fronting commercialization of agriculture in Kenya assumed that realization of increased household income through cultivation of cash crop, would guarantee improved food security and subsequently reduce poverty, (Krishna, 1977) in Lagat *et al.;* 2011). A study on food security in Nyamira revealed that increasing household size puts a lot of pressure on household resources like land therefore affecting its' capacity to enhance production. Tea production also puts additional pressure on household land and affecting food availability. The effect can either be positive or negative on individual depending on socio-economic factors and intra-household allocation of income between food and non-food items (Ondari, 2010). The smallholder farmers own about 80 percent of land under tea but produce about 60 percent of made tea. The farmers realize lower yield per unit area as compared to their large scale counterparts which owns about 20 percent of land under tea and contribute about 40 percent of made tea. As population grows, the capacity of the land diminishes. It is necessary to apply new methods of farming and technology that are more effective (Gundu, (2006) in Chepkoeh, (2011)).

Land is the most important resource in Kenya as it is the base upon which agricultural activities are carried out (GOK, 2006). Resource endowment is one of the factors affecting farmer's decision to adopt a new agricultural technology (Khan *et al,;* 2008). Land size is often used as an indicator of wealth and proxy for social status and influence. Farmers with large farms are likely to be better informed (Nkonya *et al,;* 1997), richer and more keen in search for information on improved technologies, (Okwu and Iorkaa, 2011). Kenya National Bureau of Statistics (KNBS) (2008) and Kagira *et al.;* (2012), reported in their findings that the average land holdings in the smallholder sector is estimated to be 0.205 hectares while Kaivoi *et al.;* (2002), noted that the minimum economic tea unit for smallholder farmers is estimate at 0.1 hectares (0.25 acres). Limited farm size as stated by Harvest Choice IFPRI (2013), is seen as a major factor hampering the transition from household subsistence farm economics to commercially-oriented production systems. According to Tesfaye (2002), diminishing farm sizes and decline in return to labour in farming under population pressure may encourage rural households to diversify their employment and sources of income.

3.0 Methodology

Explanatory research design was used to explain the cause-effect relationship between variables. The target population was approximately 36,000 smallholder tea farmers in Konoin sub-county registered and contracted to supply green tea leaf to four KTDA managed factories, namely Mogogosiek, Kobel, Kapset and Rorok tea factories. The sub-County was purposively sampled as an analysis unit given it is predominantly a smallholder tea farming zone. Stratified random sampling was used to ensure representation of the 12 tea zones/catchment areas in the sub-County to sample 380 households determined based on a sampling formula fronted by Krejcie (1970). From the factory lists of the 36,000 registered households, simple random sampling was used in identifying participating households.

According to the standard microeconomic theory, individual welfare **W** depends on a bundle of goods, an array c, which also includes services and material and immaterial goods (Pradyot *et al*.; 2012).

$$W_i = W_i(C_i; x_i) \quad \text{.....(3.1)}$$

In equation (1), it is assumed that a socially-defined welfare function W exists which gives each individual i, a value of individual welfare W_i for every bundle of goods c_i, under consideration of additional factors x_i. Accordingly, following Strengmaun-Kuhn (2000) and Pradyot *et al.;* (2012)**,** equation (1) can be rewritten as:

$$W_i = W(C_i x^*(r_i); x_i) = W(r_i; x_i) \quad \text{.....(3.2)}$$

Where; the resources of individual i are called r_i. Welfare, then, is directly dependent on a bundle of goods c_i which is dependent on resources r_i. The bundle of goods c_i may not necessarily be identical with the observable bundle of goods ci, as preferences of the individual may differ from those preferences implied by the welfare function W defined by households/society. ci is the result of maximizing the socially-defined function Wi subject to the available resources ri. Relevant for poverty definitions is this value of Wi which depends on an optimization process theoretically restricted by available resources. This goes in line with the well-known resource definition of poverty by Sen (1981) and Strengmaun-Kuhn (2000) cited in Pradyot *et al.;* (2012)**.**

Following the model specification of Achia *et al*.; (2010), Pradyot *et al.;* (2012) and Glewwe (1991), the farm land characteristics shaping household poverty/welfare takes the linear form specified in equation (3), a framework on which Generalized Linear model (GLM) and Tobit regression analysis was modeled in recognition of different poverty indicators.

$$y_i = \beta x_i + \varepsilon_i \quad \text{.....(3.3)}$$

Where y_i is the household welfare measure, $\boldsymbol{x_i}$ is the household characteristics and other determinants of welfare, β is the vector of parameters to be estimated and ε_i is the random term.

Foster-Greer-Thorbecke (FGT) approach to multidimensional poverty provided the foundational measure for household welfare in line with the model adopted by Glewwe (1991) and Pradyot *et al.;* (2012). There are three widely used Foster–Greer–Thorbecke (FGT) poverty measures: Poverty count index, poverty depth index and poverty severity index derived from the following foundational formula of (Glewwe, 1991 and Pradyot, 2012);

$$P_\alpha = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z-y_i}{z}\right)^{\alpha} \quad \text{.....(3.4)}$$

Where:

$0 \leq \alpha \leq 2$

Taking Z as the poverty line, P_α is the poverty/welfare indicator, N as the total population, q as the number of "poor" households in the population and α as a poverty "aversion parameter" a measure of poverty aversion or the proportional shortfall of income from the poverty line for each poor. When α = 0, it is simply the head-count ratio, an indication of the proportion of the total population with income below the poverty line, following (Glewwe, 1991 and Pradyot, 2012).

$$P_0 = \frac{q}{N} \quad \text{.....(3.5)}$$

Where:

$0 < P_0 < 1$

When the degree of poverty aversion is increased to one (α = 1), the outcome is a measure of the "income-gap ratio" representing the average shortfall of income and hence the depth of poverty. This index measures the depth of poverty; it is also referred to as "income gap" or "poverty gap" measure.

$$P_1 = \frac{1}{N}\sum_{i=1}^{q}\left(\frac{Z-y_i}{Z}\right) \quad \text{.....(3.6)}$$

Where:

$0 < P_1 < 1$

As noted by Atkinson (1987), the measure has been widely interpreted as the minimum cost of eliminating poverty (relative to the poverty line), based on the reflection that it measures how much would have to be transferred to the poor to bring their income up to the poverty line. According to Foster et al.; (1984), increasing the poverty aversion parameter to two (α = 2) was necessary as a way of taking into account inequality among the poor. This is simply a weighted sum of poverty gaps indicative of how severe the household/unit is relative to the poverty line.

$$P_2 = \frac{1}{N}\sum_{i=1}^{q}\left(\frac{Z - y_i}{Z}\right)^2 \quad \text{.....(3.7)}$$

Where:
$0 < P_2 < 1$

Were variables for determining the effect that tea farm land characteristics have on the poverty depth and severity levels, following Pradyot *et al*.; (2012). While equations 3.6, 3.7 and 3.8 are used for determining poverty indicators for the entire population, the fundamental essence of the measure is the proportional shortfall of income of the poor from the poverty line component expressed by; identified with each unit on which poverty is measured. The proportional shortfall of income from the poverty line for each of the "poor" farm households was taken as the dependent variable for determining the impact of tea farming on poverty depth and severity following Pardyot *et al.;* (2012). The two dependent variables took the form indicated in equation (3.8) and (3.9).

$$P_1 = \left(\frac{Z - y_i}{Z}\right)^1 \quad \text{(Income gap ratio)}\text{.....} \quad (3.8)$$

$$P_2 = \left(\frac{Z - y_i}{Z}\right)^2 \quad \text{(Poverty severity)}\text{.....} \quad (3.9)$$

Based on this framework, and following the model adopted by Pradyot *et al.;* (2012), and the recommendations of Alkire *et al*.; (2015), fronting for Generalized Linear Models (GLM) as a means of overcoming the assumptions of linearity and equal variance in Ordinary Least Square (OLS) regression was adopted. GLMs are an extension of linear models that allows response variables from different distributions other than normal distributions. Generalized linear models were formulated by Nelder and Wedderburn (1972), as a way of unifying various other statistical models, including linear regression, logistic regression and poisson regression through the utilization of an iteratively reweighted least squares method for maximum likelihood estimation of the model parameters. The general modeling of GLM takes the form indicated in equation (10).

$$g(u) = \beta_0 + \beta_i X_i + \varepsilon \text{.....} \quad (3.10)$$

Following the recommendations of Alkire *et al.;* (2015) and Pradyot *et al*.; (2012), the different household parameters considered to affect the household poverty/welfare were modeled into equation (10) with; $g(I_i)$: Household income (Kshs per day), with an identity link function,
β: Coefficients estimated from the model,X_1: Other land uses (1= yes 0 = No),
X_2: Tea bush variety (1= Pure 0 = Mixed), X_3: Land size (acres) X_4: Mean tea bush age, (years), ε denoting the error term.

In gaining an in-depth into the poverty levels component, four measures were adopted: total income, position of the household relative to the poverty line, poverty gap and depth of poverty following the specification of Pradyot *et al*.; (2012) and Foster et al.; (1984). The first part of the analysis sought to analyze the level to which household characteristics affects income levels, taking the total income as an indicator of their welfare. The second and the third parts of the analysis sought to assess the level to which the household characteristics predicts the position of the farmer relative to the poverty line using the International Standard poverty line of 1.25 dollars per day set by World Bank (2001) as a reference. The dollar value was converted into Kenyan shilling using the purchasing power parity (PPP) exchange rate and then adjusted for monthly national inflation. A GLM with logistic link function was modeled as indicated in (3.11), following Ngunyi *et al.;* (2015).

$$\ln\left(\frac{Pu_i}{1 + Pu_i}\right) \quad \text{.....(3.11)}$$

Where: p_{ui} is the probability of household income being above the poverty line.

As envisaged by Foster *et al*.; (1984), the assessment of the household poverty gaps and poverty depth applicable to only poor households taking a form of variables that are left censored at zero, violating the assumptions underpinning the use of both GLM and OLS, a Tobit model for estimating the coefficients was instead used. The Tobit was developed by Tobin (1958) to describe the relationship between a non-negative dependent variable y_i and an independent variable x_i such that:

$$y_i = \begin{cases} y_i^* & \text{If } y_i^* > 0 \\ 0 & \text{If } y_i^* \le 0 \end{cases} \text{.....} \quad (3.12)$$

Where: y_i is a latent variable and

$$y_i^* = \beta x_i + \mu_1, \mu_i \sim N(0, \sigma^2) \quad \text{.....(3.13)}$$

Where: β is the regression coefficient and u_i is the random term.

4.0 Findings and Discussions

A number of land ownership and land use features obtained from the study were typical of similar households in most tea growing areas globally and across tea growing areas in Kenya. As seen in Table 1, the size of the land owned by the household was typically small with an average on 1.44 hectors with more than three quarters of the household with no other productive land use beyond the tea crop. An almost equal proportion of the households had one variety of the crop in their field with a mean age of 10 years compared to those that have adopted a mixed variety with a weighted tea bush age of 3.8years on an average land size of 1.33 acres. Daily income from green tea leaf sales averaged Kshs 385.44 with 43.4% of the household having daily income below the poverty line and an average poverty depth index of 0.2548, a result that closely matches the poverty levels reported by KNBS in its 2009 national survey.

Table 1: Descriptive statistics of the smallholder tea farming household income and firm characteristics in Konoin sub-county

Description	No of Households	Min	Mean	Max	SD
Land Area under tea (Acres)	371(100%)	0.1	1.44	11.0	1.36
Households with other Land uses	84(22.6%)	0.2	0.70	3	0.615
Single tea variety Land size (Acres)	268(72.2%)	0.10	0.938	4.00	0.766
Single Variety Weighted tea Age (Years)*	268(72.2%)	1	10.19	80	7.971
Mixed tea variety Land size (Acres)	103 (27.8%)	0.10	1.33	8.00	1.263
Mixed Variety Weighted tea Age (Years)*	103 (27.8%)	1	3.8	14.79	8.528
Daily Income (Khs/Day)	371(100%)	18	385.44	3,862	335.167
Poverty ratio**	161(43.4%)	-31	-2.21	1	4.460
Poverty depth**	161(43.4%)	0.00	0.2548	0.72	0.21047

* Weighted tea age = ∑ (Area under each variety x Age of each variety)/Total area under tea crop

** Based on World Bank's (2001 and2012) recommended poverty line of US$1.25 per day which was equivalent to Kshs 118 given inflation adjusted exchange rate.

Source: Author (2017)

The GLM and the Truncated Tobit regression model used for assessing the influence of household land characteristics and four measures of household welfare and poverty brought to fore a number of key findings.

Table 2: Generalized Linear Model Coefficients Estimates of the Factors on Household Income Level in Konoin Sub-county, Bomet County

Parameter	β	Wald chi- square	Robust Std. Error	Sig[a]
(Intercept)	46.071***	21.981	17.410	0.008
Has other land uses	-25.446***	31.004	4.592	0.000
Tea bush variety	-30.269***	40.822	4.7335	0.000
Land size on tea (Acres)	20.650***	70.185	2.4659	0.000
Mean Tea bush age(Weighted)[a]	0.668**	6.093	0.2705	0.013

[a] Based on Wald chi-square test

*** Significant at 0.01. ** Significant at 0.05.

Source: Author (2017)

Contrary to the principals of risk reduction through diversification, households with other land uses were found to earn on average, Kshs 25.00 per day less in mean income compared to households that have dedicated their land to tea farming holding all other factors constant. The most probable explanation for this was the benefits that arise with specialization given that households will dedicate all their efforts to tea farming when anticipating no other source of income. Those with mixed tea bush varieties are likely to make Kshs 30.26 less in their mean daily income than those with pure tea variety. Mixed tea varieties respond differently to different weather conditions and it is likely for a more consistent output to be achieved under this variety than under a pure variety. This was consistent with the finding and recommendations by Gamba and Mghenyi (2004), Kristjanson *et al.;* (2004) and Mango *et al.;* (2004), recognizing that crop variety diversification significantly reduces volatility in household incomes. In regards to land size under tea, an increase by one acre, increases mean household income by Kshs 20.63 per day holding other factors constant which can be closely attributed to exploitation of the economies of scale as noted by Mango *et al.;* (2004).

The position of the daily household income in relation to the World Bank's recommended poverty line of US$1.25 per day which was equivalent to Kshs 118 given inflation adjusted exchange rate of Kshs 94.5 to the

dollar for the year 2014 (Ranging from Kshs 86 –90) with average inflation rate for the year of 6.5% (CBK, 2014). This was used to separate the sampled households into those above and below the poverty line creating a binary outcome and distinguished whether an household is considered poor or not. Considering the poverty status is a binary variable with a binomial probability distribution, a logit link function was selected where the poor acted as a response variable while the non-poor set as the reference category. The GLM results are presented in table 3.

Table 3: Logit Regression Coefficient Estimates of Household Poverty Status/Levels in Konoin constituency Bomet County.

Parameter	β	Wald Chi square	Odds	Std. Error	Sig
(Intercept)	0.619	0.038			0.846
Has other land uses	0.885**	4.093	2.42	0.4374	0.043
Tea bush variety	1.037**	5.334	2.82	0.4488	0.021
Land size on tea (Acres)	-1.727***	16.987	5.62	0.4191	0.000
Tea bush age(Weighted)	-0.058	3.532	1.06	0.0310	0.060

[a] The Wald chi-square statistic are for the null hypothesis that the coefficient is zero. *** Significant at 0.01. ** Significant at 0.05. [++] Control Variable.

Source: Author (2017)

Those with other land uses were 2.42 times more likely to be above the poverty line as compared to those who only relied on income from tea farming, contrary to what was initially obtained in relation to income. This signifies that those below the poverty line tend to have limited sources of income as compared to those who have more income and hence more likely to invest and increase their sources of income. This is supported by the findings of Muyanga *et al.;* (2006), where highly diversified households were found to experience lower poverty level. In a similar way those planting mixed tea varieties had 3.052 more odds of being above the poverty line as compared to those who planted pure tea varieties, holding all other factors in the model constant. An analysis of covariates revealed that land size under tea, had a significant influence of the position of the household relative to the poverty line. An increase in land under tea by one acre was associated with a 1.73 decrease in the odds of the household's average daily income being above the poverty line holding all other factors constant. This agrees with the findings of Muyanga *et al.;* (2012) and Mwaura and Muku (2007), who found out that area under the tea crop was negatively related to the household poverty levels.

According to Pradyots *et al.;* (2012), poverty gap defines how far the poor household is from the poverty line as a ratio of the selected poverty line. The limit of considering only values greater than zero leads to a censored dependent variable and hence the choice of the Tobit regression model. The model left out 207 left-censored observations while retaining 164 uncensored observations for which the coefficients were derived. The findings are indicated in table 4.

Table 4: Censored (Tobit) Regression of the Smallholder Tea Farming Factors on Household Poverty Gap in Konoin Sub-county

Dependent Variable : Poverty Gap	β	SE	Z [a]	P-value
Intercept	1.064***	0.207	5.13	0.000
Has other land uses	-0.1238***	0.029	-4.22	0.000
Tea bush variety	-0.131***	0.035	-3.70	0.000
Land size on tea (Acres)	-0.228***	0.032	-7.01	0.000
Tea bush age (Weighted)	-0.005**	0.002	-2.49	0.013
Log likelihood = 5.806, Prob > chi2 = 0.0000, Pseudo R^2 = 0.907, N : 207 Left censored , 164 Uncensored				

[a] Based on z statistic , *** Significant at 0.01., ** Significant at 0.05.

Source: Author (2016)

Households with other land uses were found to have their poverty gap mean ratio reduced by 0.124 compared to households with no other land uses, holding all other factors constant. Households with a mixed variety of tea crop had a 0.131 reduction in their mean poverty gap ratio compared to households with pure tea crop variety corroborating the findings of Muyanga *et al.;* (2012). An increase in a household's land size by one acre was found to reduce the household mean poverty gap ratio by 0.228, while an increase in tea crop age by one year reduced the mean poverty gap ratio by 0.005.

The poverty depth is computed as the square of the poverty gap ratio and measures. By squaring each poverty gap data, the further a poor household's observed income per day falls below the poverty line, the more the weight is placed on the household in the measurement. This is simply a weighted sum of poverty gaps (as a proportion of the poverty line), where the weights are the proportionate poverty gaps themselves. By squaring the poverty gap index, the measure implicitly puts more weight on observations that fall well below the poverty line as compared to those closer to the poverty line. Considering that this measure is only for the poor households and being derived from the poverty gap ratio, it is censored at 0 for household on the poverty line. This hence warranted the use of

Tobit model, and the results are presented in table 5.

Table 5: Tobit Regression Coefficient Estimates of the of Tea Farmers Household Factors on Poverty Depth

Poverty Depth	β	SE	P-value
Intercept	.7671143	.1709972	0.000
Has other land uses	-.0782208***	.0242276	0.001
Tea bush variety	-.0899107***	.0296002	0.002
Land size on tea (Acres)	-.187228 ***	.0272907	0.000
Tea bush age(Weighted)	-.0031794	.001783	0.075
Log likelihood = 51.918, Prob > chi2 = 0.0000, Pseudo R^2 = 0.847, N : 207 Left censored , 164 Uncensored, [a]The z-statistics are for the null hypothesis that the coefficient is zero. ***Significant at 0.01. ** Significant at 0.05.			

Source: Author (2017)

Households with other land uses had were noted to experience poverty severity reduction by 0.078 compared to those with no other land uses, holding all other factors constant. In regards to the tea crop variety, those households with mixed variety of tea bushes had a 0.0899 reduction in their mean poverty severity compared to those with pure tea crop variety, while an increase in weighted tea age by one year reduced the mean poverty severity by 0.011 assuming all other factors remain constant. These findings were consistent with the results obtained by (Mwaura and Muku, 2007) noting that households with other income sources and diversified income were less likely to sink deeper into poverty.

5.0 Conclusion and Recommendations

The aim of this paper was to explore the influence that household land characteristics namely: land uses, tea crop variety, land size under tea crop and weighted age of the tea crop had in determining the tea farming household's welfare and poverty as measured by household income, status of the household relative to the poverty line, poverty gap and depth.

Despite households with other land earing less from their tea crop, they stood a better chance of being above the poverty line, and where they are poor, the stood a better chance of getting out of poverty that households who have dedicated all their farmland to tea farming. Planting different varieties of the tea crop was found to positively influence household welfare and likelihood of lifting them out of poverty. Mixed varieties led to better incomes, more adds of the household being above the poverty line and where the household was poor, their likelihood of being deeply in poverty was reduced and less effort was required in lifting them out of vicious poverty.

As the land size placed under the tea crop, the household will receive improved incomes, and more likelihood of being above the poverty line. More so, where the household is poor, they were less likely to be in poverty and less effort was required in lifting them out of extreme poverty. Despite the age of the tea crop not influencing the status of the household relative to the poverty line, it is a significant factor in influencing household income, their poverty depth and therefore efforts are required for lifting them out of extreme poverty.

Looking at the current findings, a number of policy implications become necessary. As much as diversification of land use may not have a direct impact on the incomes derived by the households, it remains to be a key element in bringing down the levels of poverty in the region as well as lifting many households out of poverty and must be considered in formulation of sustainable agricultural policies. Further, policies promoting diversification of tea crop varieties and minimizing further land subdivision but to the contrary consolidation should be encouraged in the tea growing areas.

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