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THE PURSUIT FOR ENHANCING THE NET INCOME AND SUSTAINABLE LIVELIHOOD FOR SMALLHOLDER FARMERS: THE CASE OF CONTRACT FARMING IN OROMIA REGIONAL STATE, ETHIOPIA

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ABSTRACT

This study aims to investigate impacts of contract farming (CF) on net-income of smallholder farmers' (SHFs). Data was gathered through household survey, focus group discussions, key informant interviews, field observations and case studies from a sample of 383 SHFs selected through proportionate random sampling. It relied on propensity score matching and average treatment effect techniques:- Nearest Neighbour Matching (NNM), Radius Matching (RM), Kernel Matching (KM) and Stratification Matching (STM) to quantify the impacts of CF on net-income. Results revealed that despite households' participation in CF, they experienced a decrease in income by 24.3%, 29.6%, 30.2% and 28.3% as measured by NNM, RM, KM and STM, respectively. Treatment effects exhibited that participation in CF resulted in reduction of net-income by 28.1%. Therefore, increasing net-income, CF policy measures should focus on better CF design, management; formulate policy and legal frameworks that have the capacity to ensure sustainable net-income and livelihood of SHFs.

Keywords: Contract Farming, Net income, Propensity score matching, Smallholder farmers, Sustainable agriculture, Ethiopia

INTRODUCTION

Contract farming[1] (CF) or outgrower schemes as an integrated and vertically coordinated business arrangement refers to an agreement between SHFs and the agribusiness firms that involved in agricultural production. This engagement is of course for the benefits of all under certain predetermined agreement on price, market facilitation, production system, input supply, provisions of technical advice, trainings and even incentives arrangements (Ayelech, 2010; Eaton & Shepherd, 2001). The successful arrangement of such a business model should take into account the quality of the agricultural products, up to standards and the required quantities of commodities as per the agreement within a specific time interval (Priscilla et al., 2012), which paves a way for sustainable agricultural commercialization and sustainable livelihood. Sometimes, the direct business arrangements in such business hampered through various production risks that emanated from the agribusiness firms, either the smallholder farmers[2] (SHFs) or the nature of natural risks that may have the capacity in affecting the business arrangement, which could have impacts on sustainable commercial agriculture. For example:- defaulting, side selling, problems of transparency, unclear or imprecise languages, labour exploitation, indirect land appropriation (Daniel, 2015) that may be termed as "land grabbing"[3]. In fact, the balanced business arrangements take into account the benefits or as Singh (2015) termed it "equal share" of benefits for farmers, agribusiness firms', basic cooperatives, cooperative unions, and other development partners working on CF schemes.

Sustainable agricultural commercialization as a means of improving agricultural production, income and plays a crucial role in shaping livelihood of SHFs through better access to inputs, access to credits, technical assistance and market facilitation (Wendimu et al., 2017). Now a days, agricultural productivity in sub-Saharan Africa has received an increasing attention from international donors, Non-government Organizations (NGOs), and governments (GOs) because it is much lower than in most other regions of the world. Its enhancement has seen as an essential precondition for sustainable economic development (Collier and Dercon, 2014). Except few farmers that are privileged to use irrigation, the rest of the majority of the farmers rely on rain-fed agriculture of which the distribution of rainfall is often erratic. Despite the fact that severe drought and famine caused by recurrent climatic irregularities affected these two study areas, the production methods used by farmers are also very traditional characterized by subsistence mode of production. Agriculture is a dominant form of SHFs' livelihood; it comprised more than 40% of the Gross Domestic Product (GDP) and more than 80% of the employment in Ethiopia (Climate Resilient Green Economy (CRGE), 2011). SHFs by their very natures faces several interrelated socioeconomic challenges

[1]Contract Farming designated as CF refers to the Malt Barley and Sugarcane contract farming or outgrower schemes at Kofele and Adama districts, respectively. CF and Outgrower schemes are here convey the same meaning where a business arrangement made between the agribusiness firms and farmers through Cooperative Unions and agreed up on pre-determined price of agricultural products, supply of agricultural inputs, technical assistance and agronomic practices followed in the process of production. The sampled smallholder farmers in these two districts are engaged in CF schemes.

[2] Smallholder farmers in this context refers to those farmers engaged in Contract Farming arrangement in the study areas

3 "Land grabbing" is a land appropriation methods where investors systematically control the farmland of SHFs and even control it for a long period. Moreover, they again systematically rely on the household labour for agricultural production both in pre-harvest and post-harvest periods.

including insufficient financial resources, less access to markets, poor infrastructure and technology; high marketing and transport costs; and limited resources (land and human capital) (World Bank, 2008 and Hazell et al., 2007).

In this study, we employed an impact evaluation method to explore the impacts of CF on net-income SHFs earn from CF and their livelihood situations. i.e., Propensity Score Matching (PSM). The impact evaluation studies are not a simple task in any projects that aimed to improve the livelihood of SHFs through enhancing the income earned from the scheme on continuous basis.

First, as evidenced in Nijhoff and Trienekens (2012), there are no or few researches conducted on CF practices in Ethiopia. Although CF as a systematic agricultural practice, no researches done on impacts of CF as a practice in enhancing of livelihood of SHFs on sustainable basis, which researchers, policymakers and development practitioners overlooked.

Second, even though there are many studies conducted in the field of CF practices in different corners of the world, there are little evidences documented in Ethiopia. For example, Nijhoff and Trienekens (2012) carried out their study on "Critical factors for contract farming arrangements: the case of Ethiopia". Ayelech (2010 & 2012) has also undertaken exploratory studies on "Contract farming in Ethiopia: An overview with focus on sesame value chain, and "Contract Farming: Business Models that Maximizes the Inclusion of and Benefits for Smallholder Farmers in the Value Chain", respectively. She only confined to explore Sesame value chain in which it's marketing run under the guidance of Ethiopian Commodity Exchange (ECX). USAID (2012) also conducted an assessment on "Contract Farming and policy options in Ethiopia". This study focused on policy briefing aspect and failed to examine impacts of CF schemes or arrangements on the livelihood of farmers. For these reasons, all these studies did not explicitly discussed about Malt Barley and Sugarcane CF arrangements. All of these studies were concerned in the analysis of value chains of limited crops such as Sesame, Oil and pulses and Wheat. They did not discussed about Malt Barley and Sugarcane CF arrangements.

Third, there were no researches conducted in Ethiopia that tried to look into the importance of CF as an agricultural arrangement to explore the effect of CF on net-income. For example, an empirical study by Minot (2011) only dealt with the overall aspects of challenges and opportunities of CF in Africa, but they did not relate it with impacts on net-income. Moreover, Barret et al. (2012) conducted a study on "SHFs participation in CF Schemes". However, they did not mention how CF contributed in enhancing SHFs' net-income that in turn improves the livelihood of SHFs on sustainable basis. Consequently, none of these studies considered Malt Barley and Sugarcane CF schemes as an integrated business model enhances income, improve livelihood sustainability of SHFs in the context of Ethiopia in general, and study areas in particular.

Fourth, farmers can get access to farm inputs such as credit, fertilizers, agro-chemicals, technical expertise (Bijman, 2008 and Minot, 2011) and other services that broaden income bases through SHFs participation in CF schemes. SHFs can also very easily rely on these resources to enhance their productivity and increase their income (Prowse, 2012). Moreover, CF creates an opportunity for agro-processing firms to acquire land and labor without displacing SHFs from their farmland (Bijman, 2007). Finally, in Ethiopia there are also few studies conducted on CF schemes itself as pinpointed in Nijhoff and Trienekens (2012) and Ayelech (2012 & 2010). All the aforementioned studies discussed above lacked comprehensive understanding of the problem under investigation.

Consequently, the current study aims at analyzing the impacts of CF arrangement on the net-income of SHFs in the context of Malt Barley and Sugarcane CF practiced in Kofele and Adama districts of Oromia Regional State. Furthermore, this study tried to examine the differences in net-income among the participants and non-participant SHFs and the determinant factors that affect the impact of such CF on the net income of SHFs. To explore this study, the primary data collected through field survey complimented with FGDs, KIIs, field observations and case studies was organized through SPSS version 20 and Stata version 14. It employed an econometric model: Propensity Score Matching (PSM) to evaluate the impact of CF schemes on the net-income and its ultimate effects on the livelihood of SHFs. Thus, it analyzed the impacts of CF on the net-income based on the findings obtained from this study.

A CONCEPTUAL OVERVIEW

This study focuses on the investigation of enhancing net income and livelihood improvements of SHFs before and after their engagement in CF practices (i.e. impacts of contract farming on their net income and livelihood) in Kofale and Adama Districts of Ethiopia. SHFs are those farm households engaged in subsistence agriculture in rural areas of Ethiopia. Subsistence farming dominates the livelihoods of SHFs in Ethiopia in general and Oromia region in particular, which is not enough in generating sufficient income and supporting the livelihoods of SHFs in sustainable way (Yami and Snyder, 2012). This subsistence farming is oriented towards consumption and not able to produce surpluses for market. Now days, agriculture is in the process of transformation from subsistence oriented traditional farming to commercial and modern agriculture in the form of CF with the aim of enhancing agricultural productivity and production that ultimately increase the income of SHFs and improve and ensure sustainable livelihoods (Agarwal, 2008; Eakin, 2005 & 2003) .

In this paper therefore, understanding how CF business arrangement influenced the SHFs' livelihood sustainability, how SHFs' mobilized resources to earn income from CF and it is very crucial to understand livelihood situations of SHFs in the context of livelihood transformation and sustainable agricultural commercialization (Agarwal, 2008; Eakin, 2003 & 2005). Consequently, this study conceptualized the SHFs net-income earnings, income sustainability and livelihood improvement. It thoroughly examined the net income SHFs' earned in the context of before their participation in CF and during CF. Moreover, it is paramount important to see the socioeconomic situations, policy environments and the inter linkages between institutional structures and processes, the resultant outcomes that contributes for the better agricultural development in general and commercial agricultural in particular (Ayelech, 2010).

The definition of sustainable livelihood here goes to livelihood assets i.e. this refers to the means of production for a certain individuals or groups that can be sufficient to generate income for SHFs and hence improve the livelihoods of SHFs in a sphere of shifting agricultural production from subsistence farming to commercial agriculture (Gichane, 2015; Eaton and Shepherd, 2001). The more the varied asset base means, the more sustained and secured livelihood (FAO, 2013 & FAO, 2012).

As evidenced in (Prowse, 2012; USAID, 2012; Minot, 2011; Bijman, 2008; Eaton & Shepherded 2001) CF arrangement requires access to factors of production such as land, capital, labour technical assistance, technologies and time, which are the cornerstones and serve as inputs for the agribusiness firms and the overall livelihoods improvements of SHFs.

The livelihood assets in terms of income earned from CF generally shape and strengthen the livelihood capabilities of SHFs for better agricultural performances, which in turn contribute towards achieving food security and sustainable development. It helps the SHFs in improving their agricultural practices through increasing access to agricultural inputs and creates conducive working ground for better agronomic practices, which in turn increases the production and productivity of smallholder farmers engaged in agriculture (i.e. CF). Moreover, the introduction of CF reduces transaction costs that are required in the value chain of the agricultural product under contract (Ayelech, 2012). Da Silva (2003) clearly explained that transaction costs are costs incurred before and after the transactions, which are allocated for the appropriate supply with the right quality, quantity at the required time; contracting costs: cost for negotiation and agreement, monitoring and enforcement; costs incurred to make sure that contract agreement is enforced as agreed of production and transportation.

In this conceptual framework, the transforming structures and processes can enhance, facilitate, improves or worsen the livelihood situations of SHFs in general and/or contribute for the CF practices in particular. Thus, this conceptual framework scrutinizes SHFs livelihood in the view of sustainable livelihood framework. The organizations that sets and implement the policies and legislations, delivers goods and services, perform many other functions for the support and improvement of CF practices in this context affects livelihood strategies and livelihood outcomes of SHFs (Getachew, 2012). The organizations determine the way structures and individuals operate and interact through setting policies, legislations and rules that regulate access to assets, market and power relations between the agribusiness firms and the SHFs engaged in CF arrangements. In the context of SHFs livelihood, the livelihood strategies consists of a wider array of activities and choices that SHFs make in order to achieve their ultimate goals. Here, the SHFs choose to participate in CF to gain better institutional support and gain experiences in agricultural activities by developing their asset base through better endowment in asset (i.e. better access to agricultural inputs, better technical assistance, technologies, market networks, trustworthiness, etc). In addition, as evidenced in Kirsten and Sartorius (2002), CF is considered as the most successful income-generating scheme for SHFs as well as important in earning foreign exchange despite its strong criticism in limited equity and socio-economic differentiation. To this end, the institutions at local and national level (both GOs and NGOs) include the agribusiness firms and the participant SHFs operating with the intention to improve the overall CF practices or agricultural commercialization processes plays significant role in supporting the income of SHFs and the goals of agribusiness firms.

However, in agricultural commercialization process, there are challenges related to institutional capacities, resource mobilization, limited asset base in the side of SHFs, climate change, transaction risks and self-centered agribusiness firms that seriously affect the sustainability of agricultural commercialization. Accordingly, it is very essential to address the "external drivers" as (Blaikie et al., 1994) stated and "influences acting on place" pointed in (Folke et al., 2003) that reflects human and biophysical conditions; and processes operating at broader scales, which elsewhere called "root causes". Climate change in the face of SHFs induce the incidence of crop failure and harm sustainable livelihood and aggravates the existing non-climatic stress factors for SHFs such as marginal land use and limited access to technical knowledge, insurance and financial services (Fan et al., 2013).

In general, the concerns of the agribusiness firms, their commitments in realization of the CF arrangement, the SHFs active participation in the scheme and development partners' engagement in the process of contract arrangement. It also it requires their strong conviction plays a pivotal role in increasing the income earned from such business arrangements, sustaining the

livelihood of SHFs and the continuity of the contract itself. Thus, these circumstances determine the existence of the contract arrangement and the whole processes pertaining to the overall agricultural commercialization process. Moreover, as depicted in figure 1 below, the question of sustainable agricultural commercialization is the result of the interplay between various factors: perceptions, knowledge and use of agricultural technologies, market and pricing situations, policy environments, institutional and the way SHFs participate in every development endeavors that concerns them.

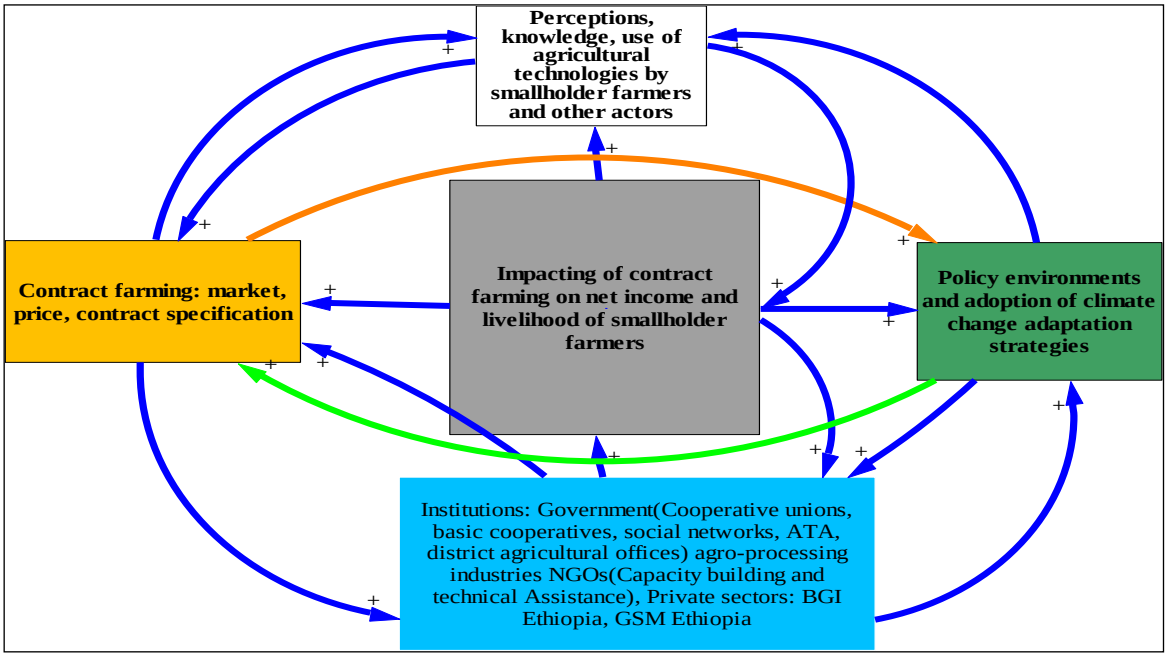

Figure 1: An analytical model on impact of contract farming on net income and livelihood of farmers

(Source: Own construction, 2018)

MATERIALS AND METHODS

Description of the study areas

This study was conducted in Kofale and Adama districts of West Arsi and Eastern Shewa of Oromia Regional State in Ethiopia in 2018. The study areas are located in West Arsi Zone and Eastern Shewa Zone of Oromia Regional State of Ethiopia. In West Arsi, Kofale district extends from $06^{0}50'$ to 07^{0} 09' North latitudes and $38^{0}38'$ to $39^{0}04'$ East longitudes. It consists of a total area of 720Km2, which is equivalent to 72,000 hectares and located 25Kms away from the Zonal Capital,

Shashamene. It has a total population of 179,508: out of these, 90,000 were males and 89,508 were females (Kofale District Finance and Economic Development Office, 2007). Agriculture is the main stay of the District's economy. Around 95% of the population was engaged in various agricultural activities to generate income for their families. It is only 5% of the people engaged in other forms of livelihood such as petty-trade and other non-farm activities.

Wonji Shewa sugar factory is another study location found in Adama district. It is situated in Rift Valley in Eastern Shewa district of Oromia regional State of Ethiopia. It extends from $8^0$20'0" to $8^0$28'0" North latitude to $39^0$12'0" to $39^0$16'0" East longitude. The topography of the factory is within 1500-2300 Meter above Sea Level (m.a.s.l) and dominated by the surging plains that involve extensive ridges all along the western boundaries (Tadesse et al., 2013). Most of the portion of the factory is situated in sub-tropical agro-climatic zone. Very flat and regular land characterizes Wonji-Shewa having a general slope varying between 0.02-0.05 percent (Dinka et al., 2013). It is one of the densely populated districts in East Shewa zone (CSA, 2007). The total Population of Adama district was estimated about 155,321. Among these, 16.9% of the population lives in urban areas, while 83.1% are rural population (CSA, 2007). The district has more than 43 PAs (Adama District Finance and Economic Development Office, 2007). Wonji-Shewa is the only Sugarcane out grower schemes found within upper Awash River Basin, Central Rift Valley of Ethiopia.

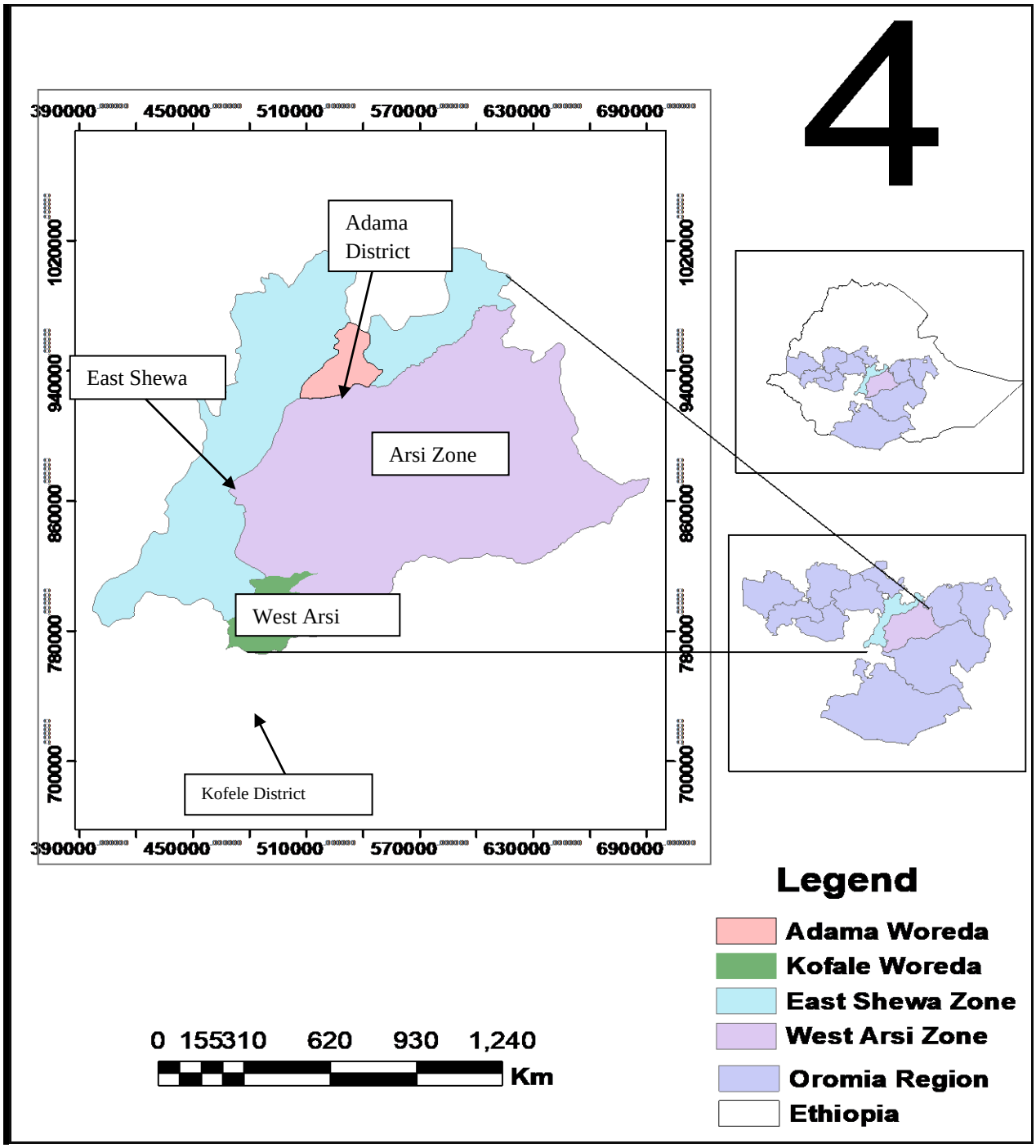

Figure 2: Map of the study areas

(Source: Own Construction, 2018)

Research Methods: Sampling procedures and data collection

Primary data were collected from the selected farmers using quantitative was administered through household survey. In the qualitative study, Six Focus group discussion that consisted of ten participants each, twenty key informant interview were conducted, three field observation and case histories were undertaken in the study PAs.

Table 1: Proportion of sample smallholder farmers by sex and peasant associations

Sample Population	Germama Peasant Association (PA)		Kuriftu Hida PA		Adulala Hake PA	
	P	NP	P	NP	P	NP
Male	51	48	48	50	34	35
Female	17	20	18	15	9	23
Total	**n=68**	**n=68**	**n=66**	**n=65**	**n=43**	**n=58**

Source: Kofale and Adama District Agricultural Office, 2010

A multistage random sampling technique was employed to select a sample of 383[4] SHFs from the districts. Three PAs were purposively selected from the districts in these two Zones (i.e. one PAs from West Arsi Zone, Kofale district). The proportionate sampling techniques were employed and randomly selected the participant and non-participant SHFs from the lists obtained from PAs. From Germama PA, 136 sample SHFs engaged in Malt Barley production, two PAs from Eastern Shewa Adama district namely: Kuriftu Hida and Adulala Hake Haroreti) with 131 and 116 respondent SHFs, respectively, were selected randomly from the lists taken from the PAs. Accordingly, the PAs were selected based on their crop production history, where households at Germama started Malt Barley Contract Farming at Kofale district in 2006 E.C, Kuriftu Hida and Adulala Hake Haroreti villages started Sugar cane contract farming in 1975 G.C and 2008 G.C, respectively. Consequently, the heads of households engaged in contract farming was the unit of analysis in the study.

We analyzed the quantitative data obtained by household survey through a Statistical Packages for Social Science (SPSS Version 20) and Stata version 14. The quantitative data gathered through household survey from the participant and non-participant SHFs and substantiated it with the qualitative data: - transcribed, narrated and used in the analysis.

Participation situations

This study tried to explore impacts of CF on the livelihood of farmers in the light of income they obtained from their participation (i.e. Income difference between before their participation and during their participation in CF schemes). The impact analysis includes the difference between the net income (i.e. denoted as income diff) the participants get before and during their participation in CF. To evaluate the impacts of participation of farmers in CF and its impact on net income it is very essential to consider the participant and non-participant SHFs. Thus, we came up with the new data set by assigning

[4] The plan was to collect household survey data from 383 sample smallholder farmers who are participants and non-participant in contract farming practices in the study areas. However, in the actual field survey the data were collected from 368 smallholder farmers who were available during the field survey as per their appointment with the data enumerators.

variable equal to 1 if the households participate in CF and 0 if the households did not participate in CF scheme. Thus in this study, the participants are considered as the treatment group and the non-participants as the control group. Based on this categorization, the study revealed that 47.8% of the households engaged in CF are falling in participant groups and 52.2% of them are non-participants sampled households.

Theoretical framework

In development projects, impact assessment is an approach that helps to assess impacts of an intervention (African Impact Evaluation Initiative, 2010). This approach attempts to see the "before and after" or the "with and without" an intervention of contract farming. Similarly, this study adopted a methodology developed by (Priscilla et al., 2012) to assess the impacts of CF "before and after" on livelihood of SHFs taking net income difference as a dependent or outcome variable. In this approach, the statistical methods were employed to evaluate whether there is a significant change in some variables observed or not. The major variables in the study would be compared the comparison groups or control group as a proxy for what would have happened on the livelihood considering net income difference of farmers because of their participation in CF. Moreover, the treatment variable employed in this study is the situation of the participations of smallholder farmers in CF (i.e. participant and non-participant denoted as PNP in the model).

This impact evaluation relies on econometric and statistical models. As stated in (Priscilla et al., 2012), there are three types of impact evaluation designs. These are experimental, quasi-experimental or non-experimental, respectively, associated with the comparison groups, control groups (participants in CF) and non-participant. In this regard, Baker (2000) approached such impact evaluation through econometric methodologies, which include differences, reflexive comparison, instrumental variables methods and matching methods.

Consequently, as indicated in Ali and Abdulai (2010), most recently the matching techniques are gaining to much acceptance in impact evaluation studies. The most widely used type of matching is Propensity Score Matching (PSM), in which the comparison groups is matched to the treatment group based on a set of observed characteristics in the form of a "propensity score". The propensity score is the predicted probability of participation in CF given the observable characteristics of the farmers. Under this approach, the closer the propensity scores for the treatment and the better the match for the control (Priscilla et al., 2012).

Now days, PSM in many academic literatures have become the popular methods in research related to impact evaluations. In many agricultural project impact evaluations, this type of methods has become common (Ali and Abdulai, 2010; Becceril & Abdulai, 2010). It has been widely employed in evaluating impacts of labour policies and other diverse fields of study (see Dehejia & Wahba, 1999 & Heckman et al., 1998). This was applied in studies that have treated individuals and untreated individuals. Some authors, therefore, argue that this method is the best method for selecting a matched or re-weighted comparison groups in specially evaluating the impacts of CF on net income of farmers in order to understand the livelihoods of farmers (Ali & Abdulai, 2010; Barbara, 2009; Becerril & Abdulai, 2010). To this end as Heckman (1979) underscored that, impact of an intervention is an estimation of treatment effect in policy analysis. Nevertheless, the change in the outcome of the treatment is a function of multiple endogenous and exogenous factors (Priscilla et al., 2012). However, Priscilla further

noted that the problem might emanate from the change in the outcome variable (i.e. net income)[5] due to treatment of the population under study (Priscilla et al., 2012). Therefore, it is very crucial to see the counterfactual impacts and the decisions made by the farmers to participate and not to participate in the treatment, which may be associated with the net benefits obtained from the participation (i.e. the issue of self-selection). In this study, we employed the PSM technique in order to evaluate the impact of contract farming on the net income they obtained before and during contract farming. The first step in estimating the treatment effect is to estimate the propensity score. To obtain this score, any standard probability model could be used (for example:- logit, probit or multinomial logit) in this study (Rajeevet et al., 2007).

Empirical methods: Econometric model specifications

In this study, the dependent variable is estimated to assess the factors of participating in CF is binary; assigning the value of 1 if a SHF participated and 0 for non-participant farmers. At the end of the day, a probit regression model was used. As explained in Priscilla et al. (2012), different authors relied on probit regression model to estimate binary dependent variable regression models. Both the probit and logit models estimate parameters using maximum likelihood ratio and come up with similar results. The probit model take in to account normally distributed error term, while the logit model assumes a logistic distribution of the error term. As a result, the probit model was selected and assumed the error term in equation has a normal distribution (Ravallion, 2001& Baker, 2000).

To assess the impact of CF participation on livelihood in terms of net income of farmers, PSM is used with aim of balancing the observed distribution of covariates across the groups of participants and non-participant farmers (Priscilla et al., 2012; Wendimu et al., 2016;). First, we estimated the propensity score separately through discrete choice model. To estimate the participation probability, the default probit model with maximum likelihood method is employed to estimates the parameters associated with the assumption that the error term in equation has a normal distribution (Ravallion, 2001; Baker, 2000). Moreover, as underscored by Caliendo and Kopeinig (2005) because of high-density mass in the probit model the mass in bounds could be employed to estimate the propensity score *p(X)*. Second, matching algorithm is selected based on the data at hand after conducting matching quality test.

We employed PSM to evaluate the impact of contract farming on the livelihood (in terms of net-income) of farmers engaged in Malt Barley and Sugarcane CF (i.e. their net-income before and with their participation in CF) as the treatment. Therefore, based on the Heckman (1979) model, the impacts of participation in CF on farmers (*Y*) can be expressed as a function of explanatory variables (X_i) and a participation dummy variable (*R*) specified as:

$$Y = \beta Xi + ARi + \mu i \qquad (1)$$

Where R_i =1 for contracted farmers and 0 for non-contracted farmers or 1 for before and 0 otherwise, μ_i is the error term, β and *A* are coefficients.

[5] Net income here refers to the overall income earned before contract farming and during contract farming and it is the aggregate income from on-farm, off-farm and non-farm activities that contributed in the livelihood of smallholder farmers.

Whether farmers participate in contract farming or not is dependent on the characteristics of SHFs and farms, hence the decision of a farmer to participate in CF was based on each farmer's self-selection instead of random assignment. Assuming a risk-neutral farmer, the index function to estimate participation in contract farming is therefore, written as:

$$Ri* = \Upsilon Xi + ei \text{ .... } (2)$$

Where R_i = is a latent or hidden variable denoting the difference between utility from participating in CF (U_{iA}) and the utility from not participating in CF (U_{iN}). The SHFs' may participate in CF, if $Ri* = UiA - UiN > 0$. The term ΥX_i provides an estimate of the difference in utility from participating in CF ($UiA - UiN$), using the household and farm-level characteristics such as farm size, household size, input application, access to credits etc, as explanatory variables, while e_i is an error term. In estimating equations (1) and (2), it is clear that the relationship between participating in CF and the outcome (net income) could be interdependent. Thus, participating in CF can increase output and as such, the farmers endowed with broader livelihood asset base may be better willing toward participating in CF. Thus, treatment assignment is not random, with the group of farmers being systematically different. Specifically, selection bias occurs if unobservable factors influence both the error terms of the income equation, and that of the participation choice equation, thus resulting in correlation of the error terms of the outcome and participation choice specifications (Greene, 2003). In this case, estimating equation (1) with ordinary least square will lead to biased estimates and it would not be employed in the calculations.

To address the above selection bias, the researcher employed several strategies. Since, the PSM is a non-parametric method; it does not require assumption about the functional form in specifying the relationship between outcome and the predictors of outcomes. As proposed by Rosenbaum and Rubin (1983), PSM was used as treatment effect correction model to reduce self-selection bias in the model.

Methods of data analysis: Impact estimation strategies

Hence, to evaluate the impact of participation of Malt Barley and Sugarcane CF on net income difference, all observable characteristics have to be the same between contract farmers (i.e. the treatment group) and the non-contract farmers (i.e. the control group). The Average Treatment Effect (ATT) here is therefore, the difference between the actual incomes before and during CF if the farmers did not participate in CF. Thus, this is shown as:

$$ATT = E(Y1i - Y0i/Pi = 1) \text{ .... } (3)$$

Where Y_{1i} denotes income when the i-th farmer participates in contract, Y_{0i} is the income of i^{th} farmer when he does not participate in contract, and Pi denotes the contract participation, 1 = participate, 0 = otherwise. ATT is called conditional mean impact, which is the mean difference between observable and control is, thus written as:

$$D = E(Y1/Pi) = 1) - E(Y0/Pi = 0) = ATT + \varepsilon) \text{ .... } (4)$$

Where $\mathcal{E}$ is the bias, and written as:

$$\varepsilon = E(Y0i/Pi = 1) - E(Y0/Pi = 0) \quad \text{..... (5)}$$

From equation (4) and (5), it is possible to come up with the true parameter of ATT, which is only identified as the outcome of the treatment and control under the absence of contract are the same. This is given as:

$$E(Y0/Pi = 1) = E(Y0/Pi = 0) \quad \text{..... (6)}$$

Here, it is very crucial to check for the validity of the outputs of PSM methods based on the satisfaction of two basic assumptions. The first is the Conditional Independent Assumption (CIA) and the Common Support Condition (CSC) (Sascha and Andrea, 2002). CIA is also termed as Confoundedness Assumption, which states a set of observable covariates that are not affected by treatment (in this case participation of SHFs in CF), and the outcomes (net- income difference[6] measured in terms of Ethiopian Birr (ETB). This assumption means that the households and the potential outcome (Amare and Simane, 2018) only base the selection on observable characteristics and the variables that affect the treatment assignment, which is made by the participation decision made. Therefore, the common support condition entails the existence of sufficient overlap in the characteristics of the treated and untreated units to find adequate matches or a common support.

Four commonly employed matching algorithms namely the nearest neighbour matching, radius matching, kernel-based matching and stratification or interval matching were used to assess the impacts of CF on income (i.e. the difference in income by farmers' earned before and during CF). The Nearest Neighbor Matching (NNM)[7] method was used to match each farmer's from the participant group (treated) with the farmers from non-participant groups (control) having the closest propensity score. The matching was done with or without replacement of observations. However, NNM faces the risk of bad matches if the closest neighbour is far away, which means that it depends on the propensity range (i.e. the shorter the matching range to the NNM, the better the match is). However, this risk can be reduced by using a Radius Matching (RM) method, which imposes a maximum tolerance on the difference in propensity scores and matching within the default radius. Here, some treated units may not be matched, if the dimension of the neighbourhood (i.e. the radius) is too small to contain control units. To avoid such problems, the Kernel-based Matching (KM) method is used, which is a weighted average of all farmers in the participant group to construct a counterfactual, was employed. The major advantage of the KM method is that it produces ATT estimates with lower variance since it utilizes greater information; its limitation is that some of the observations used may result in poor matches. Finally, stratification matching or interval matching as underscored in (Caliendo and Kopeinig, 2005; Rosenbaum & Rubin, 1983) was conducted to divide and put in range the propensity score in interval. Thus, the treated and the control units have on average the same propensity score (Sascha & Andrea, 2002). Sascha

[6] The natural log of income difference denoted as "Income diff" is the difference between the income earned before the smallholder farmers' participated in contract farming and the income earned during contract farming. Thus, the impact analysis or evaluation of income situation depends on this "Income diff".

[7] NNM is one of the average treatment effect techniques employed in Propensity Score Matching Methods (PSM) and denoted as Nearest Neighbour Matching; RM for radius matching; KM for Kernel Matching and STM for stratification matching

and Andrea (2002) further stated that the blocks identified in the algorithm that estimates the propensity score can be employed and within each interval because both the treated and the control units are there. In the end, the difference between the treated and the control is computed to obtain the average ATT of each block with weight given by the distribution of treated units across blocks. However, one of the drawbacks of this method is that it may discard the observations in blocks where both the treated and the control units are absent.

In the third stage, some overlapping common support conditions is identified while applying PSM. As clearly stated in Priscilla et al. (2012) that the common support area is the area where the balancing score has a positive density for both treatment and comparison units. In the fourth stage, the treatment effect was estimated based on the matching estimator selected on the common support region.

Table 2: Definitions and values of variables considered in the propensity score matching

Variable	Definition	Values and units of measurement
Outcome variable		
Income difference	Income difference computed from income earned from After and during CF	It is a natural log of income difference
Treatment variable		
PNP	Participant and non-participant	Contract Participant and non-participant stallholder farmers
Independent variables or predictors		
Peasant Association	Peasant association by Kebeles	It is a categorical variable where 1 = for Germama; 2 = for Kuriftu Hida and 3 = for Adulala Hake
GenderHHHs	Gender of household heads	It is a dummy variable which takes value of 1 for male and 0 otherwise
AgeHHHs	Age of household heads	It is a continuous variables measured in years
MaritalstaHHs	Marital status of household heads	It is categorical variable that takes 1 = married; 2 = not married; 3 = divorced; 4 separated; and 5 = widowed.
EducHHHs	Educational level of household heads	A categorical variable that takes 1= Illiterate; 2 for Grade 1-4; 3=Grade 6-8; 4=Grade 9-10; 5=Grade and 6=Above Grade 12)
Family Size	Number of Persons in a family	A continuous variable refers to Total number of people who are currently living within a family
HeadsCattle	Number of cattle owned by household heads	A continuous variable measured in Total Livestock Units using conversion factor
Access Credit	Access to credit and financial services	A dummy variable that takes 1 if the household heads have access to credits and 2 for not receiving credits
AccExtnPack	Access to Extension packages	A dummy variable 1 if Access to extension packages and 0 Otherwise
Size of farmland	Hectares of cultivated land	A continuous variable measured in hectares
AccetoAgrTec	Access to Agricultural technologies	A dummy variable that takes 1 for access to agricultural technologies 0 Otherwise
WealthstatHHHs	Wealth status of household heads	A categorical variable that takes 1 for Poor; 2 for medium and 3 for rich

Source: Based on Wendimu et al., 2016 and Priscilla et al., 2012

RESULTS AND DISCUSSIONS

Socioeconomic features of respondents

In this section, we briefly discuss about the general background of socioeconomic features of respondents (i.e. Contract and non-contracted farmers) as depicted in table 3 and 4 below. The data in table 3 revealed that there was significant difference in age of participant and non-participant SHFs in terms of age of households, family size of households, and total number of livestock as measured in Total Livestock Unit (TLU) and the net-income they obtained. For example, the mean age of participant respondents is 42.64213 with standard deviation of 11.838 as compared to 43.36612 with standard deviation of 0.4961 of those non-participant respondents. Moreover, the average number of family size of participant households is 6.87 as compared to that of on-participant respondent households, which is 6.51. Regarding the total number of livestock, the participant households on average owned 7.3934 and that of non-participant respondent is 6.38855. In table 3, it is revealed that education of household heads, access to agricultural technologies, access to extension service packages, access to markets, use of different land management systems, access to irrigation, use of fertilizers and relying on different agronomic practices significantly differ among the participant households and the non-participant ones.

Table 3: Descriptive statistics of continuous variables used in the regression model

Variable	Participants (N= 192)		Non-participants (N=176)			*t*-value	*Sig.*
	Mean	SD	Mean	SD	*Difference*		
Age of hhhs (Years)	42.64213	11.838	43.36612	0.4961	1	57.064	0.000
Family size of hhhs(number of households in a family)	6.87	1.49	6.51	1.64	0.36	86.438	0.000
Total number of livestock in TLU	7.3934	4.8545	6.3885	3.2615	1	24.129	0.000
Net income (in Birr)	24389.56	14.2582	10256.20	7.2562	14,133.36	27.100	0.000

*****Significant at 1% level**

(Source: Authors calculation based on field survey, 2018)

Table 4: Descriptive statistics of categorical variables used in the regression model

Variables		Participants (192)	Non-participants (176)	Chi-Square	Sig.
PAs	Germama	68(35.4)	68(38.6)	1.543	0.462
	Kuriftu Hida	65(33.9)	66(37.5)		
	Adulala Hake	43(22.4)	58(32.9)		
Gender of HHHs	Male	135(70.3)	126(71.5)	5.466	0.019
	Female	41(21.4)	66(37.5)		
Age of HHs in Years	15-30 Youth	41(21.4)	26(14.8)	8.334	0.015
	31-64 Early Elderly	119(61.9)	155(88.1)		
	65 and above Elderly	16(8.3)	11(6.1)		
Education of HHHs	Illiterate	39(20.3)	18(10.2)	32.809	0.000
	Grade 1-4	45(23.4)	68(38.6)		
	Grade 5-8	73(38)	60(34.1)		
	Grade 9-10	15(7.8)	46(26.1)		
	Grade 11-12	4(2.1)	-		
Access to credits	Yes	161(83.9)	174(98.9)	0.082	0.775
	No	15(7.8)	18(10.2)		
Access to agricultural technologies	Yes	167(87)	130(73.9)	43.559	0.000
	No	9(4.7)	62(35.2)		
Access to extension service packages	Yes	168(87.5)	176(100)	8.921	0.003
	No	8(4.2)	-		
Access to markets	Local	81(42.2)	176(100)	125.981	0.000
	Cooperative unions	69(35.9)	4(2.2)		
	Brokers	26(13.5)	-		
Use of land management systems	Yes	167(87)	22(12.5)	255.841	0.000
	No	9(4.7)	170(96.6)		
Access to irrigation	Yes	122(63.5)	59(33.5)	20.024	0.000
	No	54(28.1)	75(42.6)		
Use of fertilizers	Yes	163(84.9)	124(70.5)	9.574	0.002
	No	13(6.8)	-		
Agronomic practices	Yes	160(83.3)	126(71.6)	12	0.001
	No	16(8.3)	-		

,**, Significance at 10%, 5% and 1% level.**

(Source: Authors computation from field survey, 2018)

Estimation of propensity score through probit model

After conducting the propensity score, the NNM, the RM, the KM and the STM were used to match the control group (non-participant) to that of the treated groups (participants) based on their propensity score results, which are similar for both. For successful matching processes, all the four matching methods used avoided the unmatched non-participants that lead to the reduction in the sample size for the post-matching impact analysis. Thus, the area or the region of *common support is [0.08701617, 0.99926507]* and to this end the balancing property was satisfied.

Table 5: Result of propensity score through probit regression model

PNP[8]	**Coef.**	**Std. Err.**	***z*-value**	***Sig.***
Peasant associations	-1.55489	0.2190956	-7.10	0.000
Genderhhhs	0.2451455	0.1939662	1.26	0.206
Agehhhs	-0.0098797	0.0066723	-1.48	0.139
Marstathhs	-0.2951113	0.0939054	-3.14	0.002
Educhhhs	-0.4746961	0.1010539	-4.70	0.000
Family size of hhhs	0.1178503	0.0494407	2.38	0.017
Total Livestock in TLU	0.0096038	0.0173068	0.55	0.579
Size of Farmlands in hectares	-0.6815597	0.1525837	-4.47	0.000
Access to extension packages	3.025842	0.417926	7.24	0.000
Access to agricultural technologies	-1.348069	0.3357604	-4.01	0.000
Access to credits	1.028179	0.4075705	2.52	0.012
Wealth status of hhhs	-0.0002502	0.1337624	-0.00	0.999
_cons	3.19295	1.192521	2.68	0.007
Probit regression model				
Number of obs. = 368				
LR chi2(12) = 169.31				
Prob > chi2 = 0.0000				
Pseudo R2 = 0.3341				
Log likelihood = -168.76714				

Source: Computed from field survey data, 2018

[8]PNP refers to Participant and Non-Participant smallholder farmers' in Contract Farming arrangement and it signifies the treatment variable employed in the Propensity Score Matching through Probit regression model.

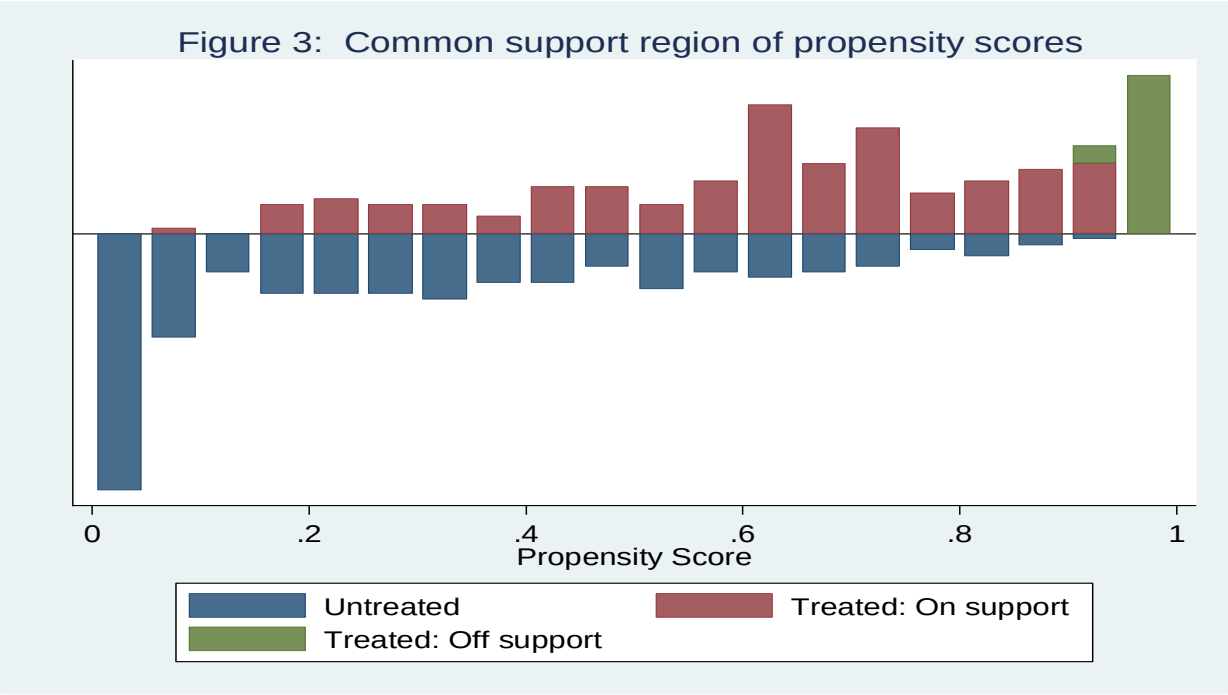

Figure 3: Common support region of propensity scores
(Source: Constructed from Survey data, 2018)

The result approved that there is a considerable overlap in common support. As depicted in figure 3, the distribution of the propensity scores of the matched and unmatched individuals in both groups (i.e. treated and untreated groups) clearly exhibited an overlap. The result in figure 3 also indicated that there are individuals out of the common support. Moreover, there are untreated, treated (on support) and treated (off support) individuals. Thus, these indicated that there was a sufficient overlap in the propensity score among the participant and non-participant smallholder farmers. Fortunately, one can observe that the upper half of the graph is for the treated or participant groups and the bottom half portrayed the untreated and the non-participants showing the densities of the scores are on the y-axis and the common support regions on the x-axis.

Evaluation of Income Difference through treatment effects by matching methods

Table 5 below indicated the impact on the net-income in terms of income difference among before and during SHFs participation in CF in the study areas. The impact evaluation was estimated through the four impact estimation or evaluations models namely: the NNM, the RM, the KM and the STM) models. Based on the post matching result, the NNM revealed that the participation in CF negatively and significantly affect the net-income obtained from their participation in CF. This means, the estimation of NNM indicated that the involvement of SHFs into CF reduced their net-income by 24.3% (i.e. 7236.226 Ethiopian Birr). In the same token, the RM model conducted to measure the impact was negatively and significantly affected the net-income earned by the respondent farmers. The RM result shown that as compared to the before participation situation the participation of farmers in CF reduced their income by 29.6% (i.e.7946.533 Ethiopian Birr). The discussions made with the FGDs further confirmed that the net-income obtained from CF is reducing from year to years affecting farmers' interest to engage in CF for the future.

This reduction in net-income is because of unclear and transparency problems (for example:- pricing, languages for wording the agreements) in the CF design or specification, low level of knowledge, awareness problems from the side of SHFs, the higher production cost incurred in CF processes. In addition, due to lack of policy and legal frameworks related to CF, it immensely contributed towards the reduction in the net income respondents earned of participants from their participation in CF.

Moreover, the results obtained in the KM model is negatively and significantly affect the income the farmers get from their participation in CF. The result further revealed that the net-income SHFs got from CF was reduced by 30.2% that is approximately around 8866.499 Ethiopian Birr. Furthermore, the stratification or interval matching model indicated that it reduced net-income by 28.3% (i.e. 8350.758 Ethiopian Birr). This study is incongruent with the study empirical study done by FAO (2015) on CF and USAID (2015) that SHFs engagement of SHFs in CF has increased their income. Unfortunately, the reduction in net-income of SHFs negatively affected the livelihood of SHFs. This implied that their livelihood improvement on sustainable base is in greater challenge.

Table 6: Impacts Evaluation through treatment effects

Outcome indicators	Matching algorisms	Matched samples		Impact (ATT)	Standard error	*t*-test
		Affected	Not-affected			
Income Difference	Nearest neighbour matching	176	67	-0.243	0.061	-4.003
	Radius matching	176	130	-0.296	0.073	-4.051
	Kernel matching	176	130	-0.302	0.038	-7.862
	Stratification matching	176	130	-0.283	0.041	-6.756

Source: Computed from survey data, 2018

Therefore, one can conclude that the impact of participation in Malt Barley and Sugarcane CF result in the 28.1% on average in reducing net-income SHFs obtained from their involvement in CF schemes in the study locations. This study is incongruent with the study empirical study done by FAO (2015) on CF and USAID (2015) where SHFs engagement of SHFs in CF has increased their income up to 44 per cent. However, this does not mean that CF contributed to their overall livelihood in terms of new ways of production, input utilization, technology transfer and other spillover effects (i.e. fertilizer use:-150-200 Kg per hectare based on the size and fertility of farmland). The FGDs and the KIIs underscored that high production cost in terms of high credits on agricultural inputs deducted from the income earned from SHFs contributed for the net-income reduction. Thus, the results suggested that in order to increase the participation of SHFs in Malt Barley and Sugarcane CF arrangement, the policy makers and agro-processing firms should design better CF specifications. In addition, raising the knowledge, skills and technical capacities of farmers', increase the prices of products per quintal (i.e. 1115 ETB per Quintal for Malt Barley and 60 ETB per Quintal for Sugarcane), and reduce the production costs incurred in the overall production, which ultimately increases the net-income obtained from CF arrangements is paramount important. The SHFs should also

work closely with the agricultural experts and development agents working in the areas of Malt Barley and Sugarcane CF schemes.

Impact of contract farming on net income

The study analyzed the impacts of CF on the net income earned by farmers from their participation in CF. Table 4 and 6 presented the *t* test and *Chi-square* results comparing the participant, and non-participant sampled farmers in CF. Results revealed that there are positive and significant differences in age of household heads, family size of household heads, and heads of cattle in TLU. Moreover, the net-income that participants and non-participants earned revealed that it is positive and significantly affected the sampled household net-income. Furthermore, the participants and non-participant sampled households differ in the type of CF arrangements in peasant associations: Malt Barley for Kofele; Sugarcane CF for Kuriftu Hida and Adulala Hake. The results also show that the participants and non-participant farmers significantly differ in the mean income they earned where the participants earn a mean of 24,389.56 ETB with standard deviation of 14.2582 ETB and the non-participants get 10, 256.20 ETB with standard deviation of 7.2562. The *t* test results also indicated that there are statistically significant differences among the participants and non-participants in earning net-income in the study areas.

However, the discussions made with FGDs and the KIIs revealed and underscored that in both CF arrangements (i.e. Malt Barley and Sugarcane) the participants in CF earns less income. The results of the propensity score impact analysis (treatment effects) of the impact of CF on the net income before CF as compared the net income during CF, their participation in CF reduced their net income by 28.1%. Despite the differences on types of CF, this study was not consistent with some studies conducted on CF studies with regard to increase in net income such as Abebe et al., 2013; Bellemare et al. 2012; Jones and Gibbon 2011; Miyata et al., 2009; Saigenji & Zeller 2009; Wainaina et al. 2012;. However, this study is consistent and comparable with Wendimu et al. (2016), which focused on the analysis of a compulsory CF scheme in Ethiopia. In their study, they found that the participation of SHFs in CF significantly reduced their income because of 'forced" CF arrangement. One of the case informants from Sugarcane out grower scheme or CF explained about the net-income he earned in the following way.

> *I lived in Wonji Shewa area for more than 50 years. I entered into sugarcane CF in 2008 G.C. Before 3 to 4 years back, the net-income I earned from Sugarcane CF was far better than the one we earns now. This is because, the Wonji Shewa Sugarcane Cooperative deducts the cost of production and I am earning less. is of course creating a problem on our income and sustain our livelihood through this CF scheme* (Case informant, 64 Years Old, MHHH, Kuriftu Hida PA).

Determinants of participation of farmers in contract farming

Because of the nature of participant, non-participants and the CF arrangements in the study areas, it is paramount important to consider and control the effects for reliable impact estimates. In order to provide information on the decision of sampled households to participate and not to participate in CF scheme and improve their income, the probit model was used in the analysis. As depicted in table 4 of the result of the parameter estimates revealed

estimation of propensity score through probit regression model. Three important determinant factors such as the socioeconomic, institutional and policy environments affected CF in the study areas.

The Socioeconomic factors

These includes the peasant associations, age of household heads gender of household heads, educational status of household heads, marital status of household heads and family size, farmland size, heads of Cattle and wealth status of households are among the socioeconomic factors that that impacted CF in the study areas.

The result of the probit model estimates indicated that gender of heads of sampled households is positively and not significantly associated to the income obtained because of their participation in CF. This is statistically not significant due do the fact that both male headed and female headed households have similar chance of getting into the CF arrangement. This is, however, incongruent with the study done by (Priscilla et al., 2012), where gender is positively affected the likelihoods of participation in CF arrangements. The results of the probit model indicated that family size of household heads positively and significantly influenced the participation decision in CF schemes. This is statistically significant at 5% ($p<0.017$).

Peasant associations, age of household heads, marital status of household heads, educational level of household heads, and size of farmlands were negatively and significantly affected the likelihood to participate in CF arrangement. The results revealed that an increase in years of education by 1 year would reduce the likelihood of respondent households' participation in CF by 0.47, taking other factors constant. This is because educated sampled respondents' are more likely have a better understanding on CF design or specifications; the risks and challenges associated with participating in CF schemes. Contrary to the current study, Arumugam et al. (2011), Escobal and Cavero (2012) found that level of education positively and significantly attributed to the participation in CF. While, the studies by Miyata et al. (2009) and Wiainaina et al. (2012) are consistent with our finding and found that education of household heads negatively and significantly affect CF participation decisions.

Size of farmland is another variable considered in the estimation of propensity score. The results showed that a unit increase in size of farmland resulted in a decrease of the probability of participation in CF by 68.2%. Likewise, the study by Kiwanuka and Machethe (2016), is consistent with our study and revealed that an additional hectare to a farmland size decreases households participation in CF. The probit model result indicated that farmers' decision to participate in such CF is negatively and significantly influenced by the size of farmland they owned ($p<0.000$). The FGDs clearly pointed out those farmers with large farmland size do not interested to participate in CF; rather they are more interested in profitable fruits and vegetable production in the areas.

Gender of household heads, heads of cattle as measured in TLU[9] (Total Livestock Unit) and wealth status of households are not statistically significant determinants of respondent SHFs' participation in CF. More males

[9] Total Livestock Units (TLU) is measurement unit that helps to measure live heads of cattle with animal category and its conversion factor. Thus, according to Strock et al. (1991): Calf=0.25 TLU, Heifer=0.75 TLU, Cow/Ox=1.00

participate in CF as opposed their females headed household counter parts. This result of this finding is consistent with Priscilla et al. (2012) that the likelihood of participation of male and female-headed households is about 0.25. However, difference is insignificant and very small. Regarding gender of household heads, there are some incongurencies. A studies by Arumugam et al. (2011) and Freguin-Gresh et al. (2012) also indicated that gender have insignificant effects on participation into CF.

On the other hand, Bellemare (2012) established and documented that younger household heads were more likely participated in CF. However, Katchova & Miranda (2004) reversed the story indicating and documented the insignificant relationship. This findings clearly depicted that SHFs have access to agricultural land and own farmlands in the study areas. Total livestock as measured in TLU was another factor that was not affecting the participation of respondent households in CF. This was because the existing family labor was employed on the CF fields and farm related activities and no one taken care of livestock in the study locations. Furthermore, wealth status of household heads was not statistically significant and not affected the participation situation and the net-income obtained from CF, because, most of the sampled heads of households do not employ their wealth basis for their participation in CF. The studies by Wainaina et al. (2012) and Arumugam et al. (2011) revealed wealth of households as productive assets insignificantly affected CF participation and these studies are in consistent with our study. Conversely, few studies claimed that households with better wealth endowment are likely to involve in CF than those with relatively poor wealth ground (Escobal & Cavero, 2012), while (Bellemare, 2012; Wainaina et al., 2012 & Wang et al., 2011) established an insignificant link between CF participation and wealth status of SHFs.

In general, various studies conducted at different corners of the world examined the effects of CF on net-income earned by SHFs. This study report revealed a substantial positive impact on total income of households and these studies are incongruent with our study (Michelson 2013; Bellemare 2012; Kalamkar 2012; Wainaina et al., 2012; Miyata et al., 2009; Xu & Wang, 2009). Our study is also inconsistent with the studies conducted by (Leung et al., 2008; Zhu 2007; Ramaswami et al., 2006; Birthal et al., 2005; Simmons et al., 2005; Tripathi et al., 2005; Singh, 2002; Warning & Key, 2002).

This study revealed a decrease in net-income. It affected the net-income of SHFs obtained from Malt Barley and Sugarcane CF, because the Malt Barley and Sugarcane CF participants encountered the overall reduction of net-income by 28.1%. There were imbalance of payment between cost of production as compared to agricultural income earned from CF. The FGDs underscored that most of the time the cost of productions (i.e. cost of inputs, transportation cost, storage cost and so on) is by far greater than the income obtained from agricultural crop in the contract. The FGDs discussed and the interviews made with KIIs underlined that those farmers with better wealth were more or less interested to involve in other horticultural activities, non-farm and off farm activites other than CF. Even though the wealth status is negative, it is not statistically significant in affecting the participation of farmers' in CF. However, the overall result of this study is inconsistent with the study conducted by Priscilla et al.

TLU , Horse=1.10 TLU, Donkey =0.70 TLU, Sheep/Goat=0.13 TLU, Chicken=0.013 TLU, Bull=1.00 TLU and Mule=0.70 TLU

(2012) where the impact of CF on the income of SHFs engaged in poultry contract farming have a positive influence on the net income or revenue in particular and welfare of SHFs in general. Ramaswami et al. (2006) underscored that the impact and influence of various determinant factors on participation of CF may emanate from the difference in types of commodities in the CF arrangement (i.e. Malt Barley and Sugarcane in the case of current study).

The Institutional Factors

Access to extension packages, access to credits and financial services and access to agricultural technologies were the major determinant factors that affected CF in the study locations. Access to extension packages was another explanatory variable that positively and significantly related to the participation of respondent households into CF arrangements. Thus, having access to extension service packages increased the likelihood of participation by 3.03, other things being constant. It was statistically significant at 1% probability level ($p<0.000$). Similarly, having access to credits and financial services positively and significantly affected the participation of respondent households into CF arrangements ($p<0.012$). The results revealed that SHFs with better access to credits increased the probability of participation by 1.03 than those who do not have access to credits and financial services, which mean CF excluded the poor farmers to engage in CF.

Moreover, access to agricultural technologies negatively and significantly influenced the participation situations. The results revealed that the likelihood of participation for having access to agricultural technologies is reduced by 1.35 and it is statistically significant at $p<0.000$. Thus, it negatively and significantly affected the likelihood to participate in CF arrangement. A result of study by Kiwanuka and Machethe (2016) revealed that access to production enhancing facilities, extension service and improved agricultural technologies negatively affected the participation situation in CF. The study was congruent with the study by Kiwanuka and Machethe (2016).

Policy environments

Public policies, strategies, legal frameworks and presence of guidelines influence the market strategies and forms of transaction used between smallholder farmers and agro-processing firms (Ton et al., 2015). There are no specific policies, guidelines, regulations and legal frameworks that scrutinizes the overall CF arrangements in Ethiopia. During FGD discussions made with participants of FGDs, the policy environment was not favorable and there were no clear guidelines in managing contracts with respect to CF arrangement in Ethiopia in general and the study areas in particular. The findings obtained from the FGDs and KIIs were consistent with the previous studies done by Nijhoff (2010), Nijhoff and Trienkesen (2010) and USAID (2012) where CF arrangement in Ethiopia lacks policy strategies and legal frameworks that are specifically designed to address CF business arrangement.

According to USAID (2012), there are only two countries namely Morocco and Spain that have Ad hoc legislation on CF and Ethiopia does not have such enabling policy environment. As a result, either of the parties (i.e. be agri-business firms or SHFs) can easily breaches the contract that in turn affects the sustainability of CF business arrangement. In the case of Sugarcane CF arrangement, the absence of policy strategies and legal frameworks seriously affected SHFs, where the SHFs easily leave their farmland in the proximity of irrigation schemes if they were not agreed to work as outgrower with Wonji-Shewa sugar factory. The discussions made with FGDs and the

KIIs interview, the SHFs simply quit the outgrower scheme without compensation. Moreover, there are no exit strategies put in place that handles such circumistances. Thus, the absence of such policy ground paves ways for all parties (the agri-business firms, cooperative unions and smallholder farmers) to very easily breach the agreement they agreed in the CF arrangement.

CONCLUSIONS AND POLICY IMPLICATIONS

Agricultural commercialization as a means of improving agricultural production and income plays a crucial role in shaping livelihood of SHFs through better access to agricultural inputs, access to credits; technical assistance, market facilitation and networking perhaps ensure sustainable development goals. However, there is hardly any evidences that deals with the contribution of CF) as a practice of sustainable agricultural commercialization. This study employed primary data to analyze the impacts of CF on the net income (i.e. income difference before CF and during CF) earned by SHFs and its subsequent effects on the overall livelihood and sustainable agricultural commercialization. We conducted the current study to explore the net-income earned and livelihood improvements taking the case of Malt Barley and Sugarcane CF at Kofele and Adama districts of Oromia Regional State of Ethiopia. Consequently, the study identified the determinant factors that affected the participation of SHFs in CF arrangements. Moreover, the study employed propensity score matching (PSM) to analyze the impact of CF on the net-income earned by SHFs and measured in terms of income difference among the treated and the untreated groups because of their participation in CF schemes.

The overall result revealed that sampled households heads that participated in CF arrangements experienced a decrease in net income. The overall impact of the treatment effect measurement indicated that the net-income of the participant SHFs, who participated in CF faced a reduction of income by 28.1% on average. This was attributed to the high production cost deducted at the time of supplying the output to the cooperatives or agribusiness firms. However, it served as a tool in accessing family labour use and getting access to farmland in the study areas. Thus, there are two sides of argument, where policy makers perceived CF as a means of labour use (Bellemare, 2012). ADS (2014) strongly argued and considered CF as a way out in promoting agricultural commercialization through CF.

Thus from the results, we argue that if CF arrangement is not designed and managed well, it would result in a decrease of net income earned by farmers and well designed and managed CF immensely raise the net income of SHFs. In order to increase the participation of smallholder farmers engaged in CF arrangement, the policy measures should focus on better CF specifications or design and good management that have the capacity to raise the net income of SHFs. In addition, enhancing the knowledge and skills of farmers', increase the prices of products per quintal and reduce the production costs incurred in the overall production, which ultimately increases the net-income obtained from CF arrangements is paramount important. It is also very important to conduct research on why the SHFs are not interested to continue their participation in contract farming especially in Sugarcane CF arrangements. Because, their interest to discontinue their participation may emanate from the low level of income they earned and the imbalances of power between the agribusiness firms and the SHFs engaged in CF in the study locations, despite

their access to agricultural inputs, supply of agricultural technologies, technical assistance and access to credits. These of course affect sustainable livelihood of SHFs and negatively affect agricultural commercialization. Furthermore, there is no policy and legal frameworks designed specific to oversee and guide the overall processes in CF arrangements are regional and country level. Thus, it is paramount important to design specific CF arrangement policy and legal frameworks that scrutinize the overall contract farming processes, increases the net income obtained from CF arrangements and challenges emanated from the implementation of any CF arrangements.

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AUTHORS' CONTRIBUTIONS

Getachew Megersa generated the idea and designed the study. Getachew Megersa carried out data collection, data analysis, and write-up. Engdawork Assefa played a role of reading and revisited the manuscript. Both authors read and approved the manuscript.

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