# Impacts of Contract Farming on the Income and Output of Smallholder Coffee Farmers: The Case of Oromia Region, Jimma Zone, and Limmu Sekka Wereda

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## Abstract

*Contract farming is a form of vertical coordination primarily aimed at improving the productivity and income of smallholder farmers. However, the empirical evidence that the economic and social benefits of this type of agriculture for smallholder farmers are mixed and questionable. Therefore, this study was conducted to evaluate the impact of contract farming on the income and output of small-scale coffee growers. Both descriptive statistics and propensity score matching were used to analyze the data. The study's findings show that the contract farming program has resulted in a significant increase in coffee income and average productivity of households engaged in contract farming. The results show that access to credit, access to training and land used for coffee production significantly influence household participation in contract farming. Contrary to our expectations, access to extension did not have a significant impact on household participation in contract farming. The distance to market of the control group was slightly shorter than that of the treated group. We conclude that the contracting company needs more work to improve these two important variables.*

*Keywords*:  Contract farming, smallholder coffee farmers, propensity score matching

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# Introduction

Ethiopian coffee production is predominantly characterized by a traditional farm management system, limited use of fertilizers and pesticides coupled with a manual coffee cultivation system and drying method. Coffee production systems in the country are generally categorized into four areas i.e., forest coffee, semi-forest coffee, garden coffee, and plantation coffee. Forest coffee is a wild coffee grown under the shade of natural forest trees and it does not have a defined owner (Tefera and Tefera, 2010).

Coffee production in Ethiopia is concentrated mainly in the Oromia and the Southern Nations, Nationalities, and People's Region (SNNPR). Smallholder producers are responsible for about 90% of production while the remaining comes from private and government-owned large-scale farms (USAID, 2010). In Ethiopia, the coffee farm management system and agronomic practices are traditional (Alemseged, 2013; Alemayehu, 2014). Coffee production is affected by factors such as poor harvesting, weak infrastructure, lack of credit service, and inadequate extension services, as a result, the productivity and financial gain of farmers are still not yet well improved.

The existing literature explained that an out-grower scheme through contract farming is an efficient method for increasing the productivity and income of smallholder farmers and as a result improving their livelihood. Contract farming provides different services to the smallholder farmer such as better farm advice and technical support; access to farm inputs either in credit or cash; introduction to improved technologies which are otherwise expensive; opportunities to use hired agricultural machinery; and access to improved planting material or breeds (Glover & Kusterer, 1990; Massacre& Henson, 2005; Melese, 2012; Prowse, 2012; Sáenz-Segura, 2006; Seba, 2016). As a result, smallholders increase their productivity and production and get higher and more regular cash incomes. Similarly, Slangen et al., (2008) and Ton et al., (2008) explained that access to the market, credit, new technologies, and risk reduction are some of the benefits for farmers from contract farming.

Like in any other coffee-growing area of the country, the coffee production of small-scale farmers in the study area is constrained by poor harvesting systems, low productivity, and the quality of the coffee product. As a result, the income and livelihoods of small-scale farmers are not yet

improved. In addition, Ethiopia coffee production is affected by factors such as poor infrastructure in the coffee growing areas, lack of credit service, materials, facilities, modern/appropriate coffee processing technologies and machinery, lack of value addition on primary and finished coffee products and weak and ineffective linkage among actors involved in the coffee industry in the country (Jose D., 2012).

To address these problems government of Ethiopia has made a reform in the coffee marketing and quality control system of the country, one of the solutions proposed by the government is the contract farming scheme. Some volunteer large coffee farms are also engaged in contract farming schemes. However, the empirical proofs show that the economic and social benefits of contract farming for smallholder farmers are mixed.

Studies by Eaton and Shepherd (2001), Bijman (2008), Simmons (2002), and Little and Watts (1994) suggested that contract farming (CF) may improve farmer productivity, reduce production risk and transaction costs, and increase farmer incomes. Contrary, Singh (2002), revealed that CF may undermine farmers' relative negotiation power and increase health, environmental, and financial risk through exposure to monopolistic markets, weak contract environments, and unfamiliar agricultural technologies. Despite the potential drawbacks, international organizations such as the World Bank have promoted CF as a poverty reduction tool.

In Africa, contract farming is widely practiced as it is in many developing countries (Wainaina, 2012). However, there are conflicting views regarding its positive effects on the welfare of smallholder farmers. Some authors, for example, argue that contract farming is beneficial to smallholder farmers since it enables farmers to access local and global markets (Key and Rusten, 1999; Warnings and Key, 2002; Gulati et. al., 2005; Minot, 1986; Minot and Roy, 2006; Minot et. al., 2009). On contrary, Little and Watts (1994) and Singh (2002), argue that it is a means of exploiting farmers through large agribusiness. Guo et.al, (2005) support this idea by saying that contract farming is only advantageous to large scales farmers. There are limited empirical studies measuring the impact and inclusiveness of contract farming on smallholder coffee farmers in the country. Therefore, proper analysis of the factors determining smallholder coffee farmers' participation in CF and its impact on their income and output is important for the design and

implementation of policies and strategies in Ethiopia. This study, therefore, examined whether contract farming has improved the economic and social welfare of smallholder coffee producers in the study area, and the extent to which contract farming increased the income and output of smallholder coffee farmers.

## Literature Review

Singh (2002), defines contract farming as a system for the production and supply of agricultural produce under forward contracts, the essence of such contracts being a commitment to provide an agricultural commodity of a type, at a time and a price, and in the quantity required by a known buyer. Such contracts can be either written or verbal, specifying the production or marketing conditions. On the one hand, contract farming allows agribusinesses a certain degree of control over production and marketing without owning a farm which allows them to ensure the availability of supply at the required quality, quantity, and time. On the other hand, the contract can solve the critical problem of farmers–especially smallholders–to access inputs, credits, and extension services.

Similarly, Eaton and Shepherd (2001) define contract farming as "an agreement between farmers and processing and/or marketing firms for the production and supply of agricultural products under forward agreements, frequently at predetermined prices. As stated by Bellemare (2012), contract farming is an institutional arrangement where downstream agribusiness firms delegate the production of primary agricultural products to farmers under contracts. It is an input and supply agreement contract that improves the access of the smallholder farmers to resources; e.g. yield-enhancing inputs, credit, information, services, and product markets. Non-price factors involved in the contracts, such as technical assistance, training, and education could further help farmers to improve their efficiency, productivity, and profitability (Ruben and Sáenz-Segura, 2008). Eaton and Shepherd (2001) identified five types of contract farming models, each one of them further discussed by Bijman (2008) as follows:

- The Centralized model in which an agribusiness (processor and/or exporter) buys from many smallholder farmers under strict quality control and predetermined quantity. The involvement of agribusiness can vary from the mere provision of seeds up to providing

different services and technologies at various stages. Nevertheless, the model mostly follows a production-management specification contract which is characterized by extensive technical support, inputs provision, and close control of the production process.

- The Nucleus estate model is a variation of the centralized model where an agribusiness owns the plantation and is involved in farming from their own estate and contracting other small farmers to mainly supplement supply for their own processing.

- Multipartite models – in this model various organizations might be involved in this model, ranging from government/statutory bodies, financial intermediaries, agribusiness, and farmers. This model fits the poor and smallholders best as the integrated effort of many actors reduces the burden of contracting parties.

- The Informal model is usually characterized by individual entrepreneurs and/or small companies with informal contracts, usually on a seasonal basis. Unlike the above models, this model has limited resources for strong vertical coordination so its success usually depends on the support provided by the government or other service providers. In this model material and technical input provision is commonly limited to seeds and basic fertilizers, grading, and quality control. This model may also include trader-farmer arrangements whereby the trader buys up (part of) the farmers' harvest before the actual harvest has taken place. This arrangement comes down to the trader providing credit to the farmer with the farmer repaying the credit in crops harvested. The interest rate of this credit is included in the price that is agreed on. This price is therefore usually substantially lower than the market price.

- The Intermediary model: this is an infusion of an informal and centralized model. It involves three parties; such as the buyer, the middleman, and the farmer. Vertical coordination problems like the supply of inputs and support services normally arise, and farmers might not benefit from technology transfer and market-related prices as the middleman might strive to maximize his/her margins.

The contract farming models discussed above operate under different arrangements of contract types that are not mutually exclusive. Melese (2010), Bijman (2008), Eaton and Shepherd (2001),

and Key and Runsten (1999) have distinguished 3 widely-used types of contracts: market specification contracts, resource providing contracts, and production management contracts.

- Market specification contracts usually specify quality, price, and timing with minimal or non-provision of inputs. Producers oversee most of the decisions to be made in production. As a result, they bear most of the risk. However, it brings significant benefits for both contracting parties by allowing market information flows between them. On the one hand, these contracts provide the producer with demand-side information related to consumers' tastes, crop variety, quality, quantity, timing, and price. On the other hand, the buyer will be able to access information related to supply conditions. Such contracts are mostly used in informal models of contract farming.

- Resource specification contracts usually specify that buyers will provide inputs and extension services at various stages of production to producers on credit. The inputs and extension services will have to be paid for when the crops are sold. The contract might give a certain degree of decision-making power to each party at different stages, and the risks are also allocated accordingly. For farmers, this type of contract reduces the risk of coordination because inputs, credit, and extension services are provided. In turn, the buyer profits from lower selling prices, and reliable supplies of required quality and quantity at the right time. This kind of contract is generally used by well-established entrepreneurs in informal and centralized models of contract farming. Timely delivery of inputs and services is a key to success.

- Production-management contracts involve higher levels of coordination than the other two types of contracts and the buyer makes decisions about production and harvest. In this contract, the buyer provides technological guidelines on the production process. Equally, the buyer assumes most of the risk. However, in practice, things often work out differently.

According to Eaton and Shepherd (2001), Singish (2002), and Bijman and Ton (2008), the main objective of contract farming is to overcome certain problems and constraints that small-scale farmers face in farming. The existing literature indicates that there are different benefits that smallholder farmers and processors obtain from contract farming. In general, both parties are likely to choose contract farming instead of vertical integration or spot market exchange when transaction costs and risk can be minimized (Singh, 2002). The main potential benefits that farmer

gets from contract arrangement includes market security, access to technical assistance, access to capital skill transfer, and income stability.

Recently several studies have been conducted to explore the impact of contract farming using econometric analysis. Moses (2014) examined the effectiveness of a contract farming arrangement for tobacco farmers in the Mazowe district in Zimbabwe. Findings from this research show that contract farmers had better production volumes when compared to non-contract farmers. This performance was attributed to intervention by contracting firms.  Similarly, Wainaina, Okello & Nzuma (2012) have investigated the impact of contract farming on smallholder poultry farmers' income in Kenya. Their study found that participation in contract production indeed improves the welfare of participating farmers. These findings imply that contract farming can reduce rather than entrench rural poverty as some studies have suggested. Gibbons et al. (2009) also analyzed the revenue effect of participation in smallholder contractual organic cocoa production in Uganda. They found that there was a positive revenue effect of contract farming. Moreover, they revealed that contract farmers have exposure to improved farming techniques that can enhance their yields.

Seba (2016) conducted a study on the impact of contract farming on chickpea growers in Ethiopia and found the positive effect of participation in CF on household cash revenue. Ramaswami et al. (2006) conducted a study on the analysis of the efficiency and distribution of contract farming of poultry production, in the state of Andhra Pradesh India; and found that contract production is more efficient than non-contract production. In addition, the study found that there was an income difference between the two groups. Farmers also gain appreciably from contracting in terms of higher expected returns and lower risk.

## Research Methodology

The research design used for this study is quasi-experimental. The study used descriptive, inferential statistics and econometrics estimation. Descriptive statistics like mean, standard deviation, and percentiles have been used to explain the basic characteristics of the channel members. In an econometric analysis, the study used a propensity score matching estimation technique to match participating and non-participating households in contract farming from observable factors. Different tests like F, chi-square and t-test statistics have also been used to supplement or testify to the significance of the results.

The study applied a multi-stage random sampling technique to select the sample. In the first stage, out of the four districts of the Jimma zone, Limmu Seka was selected on purpose because of the present contract farming arrangement in the district. In the second stage, two of the kebele in the district (Chaka and Lebu kebele) were selected because of their proximity to the contract farming firm. In the final stage, the total households in the two kebeles were stratified into two strata: contracted and non-contract coffee farmers. Following Yamane (1967), the study determined a 245-sample size. From the total sample size, 92 smallholder farmers who are participating in the contract farming (treated group), and 53 non-contract coffee producers (control group) were selected randomly.

## Definitions of Variables

**Dependent variables**: The dependent variable in this study is the participation status of smallholder coffee producers in contract farming. It takes 1 if farmers participated in contract farming and take 0 if farmers didn't participate in contract farming.

**Independent variables:**

Gender: It takes the value 1 if male, 0 if female

Age: Household head's actual age in years

Education level of the household head: measured by the actual level of schooling in years. We expect the probability of producing coffee to increase if the household head is educated and know-how and understands the advanced and modern ways of production techniques.

Family size of household (FSOHH): This is an independent continuous variable measured in the number of persons in the household consist. The larger size families require more amount of income for their livelihoods and participate in coffee production (picking), processing until final selling highly as compared to small size families. Given the state of technology and other factors of production, the higher the amount of labor utilized the higher the level of output (Desta, 2004).

The number of working families: it is a proxy and continuous variable which shows that having more working family members increases the probability of participating in coffee production.

Landholding size: those who have more farm size are most likely to produce coffee, keeping the effects of other variables constant; and continuous variable.

Price of coffee: is the farm gate/harvest price of coffee and is hypothesized to be directly and positively related to the production amount of coffee because of the law of supply.

Access to credit: it is a proxy and dummy variable; the farmers who have access to credit are more likely to produce more coffee, assuming other things remain constant. Since access to credit enables smallholder farmers to finance the purchase of inputs and other farm equipment, hence encourages farmers to produce a given cash crop like coffee.

Access to training services: it's a dummy variable. If the farmers have training services from a contracting firm, the more coffee they can produce, holding other things constant.

Availability of Extension Service: this is a binary dummy variable. It is hypothesized that extension service in coffee production is positively related to the yield quantity of coffee. This is because such services are rendered to farmers to increase their technical knowledge of coffee production and marketing.

Market center and all-weather road distance (MRDHH): its continuous variable measured by kilometer. It is indicating the delivery point where contracting farmers deliver their coffee products to the contracting firm or nearest market where non-contracting farmers sell their coffee.

Outcome Variables (Impact Indicator Variables):

Outcome variables are variables that result from participation in contracting farming. Under this study, two different impact indicator variables have been used to assess the impact of contract

farming on participant smallholder coffee farmers. These are the income of smallholder farmers and the quantity of output (yield) per hectare.

The yield of coffee: is an outcome variable and it is the total quantity of coffee produced (since coffee is a commercial crop, supply is almost equal to production) expressed in kilogram per hectare.

Income: Income smallholder Farmers from coffee, expressed in local currency (ETB)

## Results and Discussions

**Demographic characteristics of the households:**

In this section, the demographic characteristics of households for both contracted and non-contracted coffee farmers are presented. Result from Table 1 shows that the average age of the household head is 47.83 and 47.46 for the participant in CF (Contact Farming) household and non-participant in CF households, respectively. The result indicates that there is no significant difference in the distribution of household head age between participant and non-participant households. The result also shows that CF participant household has larger family size than non-participant households. On average, the family sizes of the treated respondents and the control group are 7.25 and 6.51, respectively. As indicated in Table 1, the difference in household size for the two groups is significant at a 1% significant level.

**Table 1**

*Demographic Characteristics of Participant and Non-Participant for Continuous Variables*

| Variable | Obs. | Mean | Std. Dev. | Min | Max | Obs. | Mean | Std. Dev. | Min | Max | t-value |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Participant** | | | | | **Non-participant** | | | | | |
| Age | 92 | 47.83696 | 5.4273 | 36 | 58 | 153 | 47.464 | 7.7493 | 34 | 62 | 0.6853 |
| HH size | 92 | 7.25 | 0.70516 | 6 | 8 | 153 | 6.51634 | 1.9571 | 1 | 10 | ***0.0006 |

Source: Own Survey, 2017

As indicated in Table 2, out of the total 92 CF participant households, 17 (18.48%) were female-headed and 75 (81.52%) were male-headed households. While female-headed and male- headed households of non-participant respondents were 27 (17.65%) and 126 (82.35%), respectively.

From the total of 245 sample households, married households have the highest percentage than single, divorced, and windowed households in the sample. About 77.17% and 74.51% of households were married participants and non-participant households, respectively. The result shows that marital status does not have a significant difference between the two groups.

Regarding literacy level, out of the total (245) respondent household headed, 73.46% (180) were literate; at least can read and write. While the remaining 65 (26.54%) households can't read and write.

**Table 2**

*Demographic Characteristics of Participant and Non-Participant for Categorical Variables*

| Gender | Participants | | Non- participants | |
|---|---|---|---|---|
| | Frequency | Percent | Frequency | Percent |
| Female | 17 | 18.48 | 27 | 17.65 |
| Male | 75 | 81.52 | 126 | 82.35 |
| **Marital Status** | Participants | | Non- participants | |
| | Frequency | Percent | Frequency | Percent |
| Married | 71 | 77.17 | 114 | 74.51 |
| Others, (single, divorced and windowed) | 21 | 22.83 | 39 | 25.49 |
| **Reading and Writing (Literacy level)** | Participants | | Non- participants | |
| | Frequency | Percent | Frequency | Percent |
| Yes | 68 | 73.91 | 112 | 73.20` |
| No | 24 | 26.09 | 41 | 26.80 |

Source: Own Survey, 2017

**Farmland size and Number of family members who participated in coffee production:**

The land is a primary source of livelihood for all rural households. It was assumed that the larger the farm size is, the higher the possibility to produce more coffee and make a higher income. On the other hand, the larger the number of family members participating in farm management and harvesting activity, the higher the production volume and quality of the coffee product that the family member can produce. In this section, the size of land owned by contracted and non-

contracted farmers and the way how they acquired it was discussed. The number of family members who participated in the coffee production process was also analyzed and presented.

As shown in Table 3, the average hectares of land owned by contracted farmers was 2.23 hectares while non-contracted farmers owned 1.84 hectares of land, of which 1.96 and 1.69 hectares of farmland were used for coffee production by contracted and non-contracted farmers, respectively. The t-test result shows total land owned by the family and land used to produce coffee has a significant difference between the two groups at a 1% critical level.

Regarding the number of family members of the respondent who participated in coffee production, on average 4.27 and 3.83 of contracted and non-contracted family members participated in the coffee production process, respectively. The result is statistically significant at a 5% level.

**Table 3**

*Summary Statistics of Households' Coffee Farming Characteristics*

| Variable | Contract Farmer N = 92 | | Non-Contract Farmer N = 153 | | t-value |
|---|---|---|---|---|---|
| | Mean | S. Dev | Mean | S. Dev | |
| The number of Family members who participated in coffee production. | 4.27 | 1.1300 | 3.83 | 1.3802 | **0.0102**\*\* |
| Years of household head education level | 3.10 | 0.2856065 | 3.46 | 0.2172921 | 0.3208 |
| Total land owned by the family | 2.23 | 0.66703 | 1.84 | 0.70143 | **0000**\*\*\* |
| Total land used to produce coffee | 1.96 | 0.50781 | 1.69 | 0.67052 | **0.0012**\*\*\* |

Source: Own Survey, 2017
Notes: *** statistically significant at 1 % and ** 5%, respectively

**Household Income and Coffee Output Performance:**

Data extracted from own survey in Table 4 shows that over single production year, contract farmers outperformed non-contract farmers in terms of average production output per hectare, the average kilogram of coffee sells, and the selling price of a coffee per kilogram. The objective of the research was to indicate if indeed there was a significant difference between the two groups in

terms of yield and income and if the contract farming arrangement had an impact on the coffee farmers' output (yield), sales amount, and average selling price of coffee. The result shown in Table 4 shows the significant difference in mean values between the two groups at a 1% significance level.

**Table 4**

*Summary of Household Income and Coffee Output Performance*

| Variable | Contract Farmer N = 92 | | Non-Contract Farmer N = 153 | | t-value |
|---|---|---|---|---|---|
| | **Mean** | **S. Dev** | **Mean** | **S. Dev** | |
| Average Coffee output /hectare | 3022.989 | 379.5421 | 2587.379 | 139.4643 | 0.000*** |
| Average Kg of coffee sales | 5975.057 | 1780.85 | 4354.357 | 1677.701 | 0.000*** |
| The average selling price of coffee/kg | 10 | 0.000 | 8.98 | 0.0800 | 0.000*** |
| The household total income from coffee sales | 59,733.99 | 17816.46 | 39384.01 | 15007.65 | 0.000*** |
| Market distance | 2.36 | .8216 | 2.28 | 1.5822 | 0.6647 |

Source: own survey, 2017
Notes: *** statistically Significant at 1% leve1

**Source of farmland:**

Respondents were asked how they acquired farmland; of the 245 respondents, 72.65% of them replied that they acquired their farmland through inheritance, 13.47% bought from others, and the rest 13.88% offered from the local government.

**Respondent's view on the coffee price calculation:**

The result in Table 5 shows that the majority of contracted farmers (84.78%) were satisfied with the determination (calculation) of the price of coffee, 7.61% were highly satisfied, and the remaining 7.61% have a neutral position. Concerning the view of non-contracted farmers, 66.01% were satisfied with the way the coffee price was determined, 10% have a neutral position, and 27.45% were unsatisfied.

**Table 5**

*Level of Satisfaction with The Way Sales Price Determined*

| Groups | Response | Frequency | Percentage | Valid percentage | Cumulative percentage |
|---|---|---|---|---|---|
| **Participant** | Highly satisfied | 7 | 7.61 | 7.61 | 7.61 |
| | Satisfied | 78 | 84.78 | 84.78 | 92.39 |
| | Neutral | 7 | 7.61 | 7.61 | 100 |
| | Unsatisfied | - | - | - | 100 |
| | Highly unsatisfied | - | - | - | 100 |
| | **Total** | **92** | **100%** | **100%** | **100%** |
| **Non-participant** | Highly satisfied | - | - | - | 0 |
| | Satisfied | 101 | 66.01 | 66.01 | 66.01 |
| | Neutral | 10 | 6.54 | 6.54 | 72.55 |
| | Unsatisfied | 42 | 27.45 | 27.45 | 100 |
| | Highly unsatisfied | - | - | - | 100 |
| | Total | 153 | 100% | 100% | 100% |

Source: Own Survey, 2017

**Service Characteristics of Coffee Farming between Groups**

Table 6 shows the farmers' responses on the types of services provided through the institutions for contracted and non-contracted farmers. The contract farming program provides credit and extension service, and coffee production training courses intensively to own members of the household. It is confirmed by participant households through 89.14%, 79.3%, and 95.65% frequency, respectively. While 43.79%, 66.01%, and 66.01% of non-contracted respondents confirmed that they have got access to credit, extension service, and coffee production training programs, respectively. Regarding credit sources, only 43.79 % of non-contracted respondents accessed credit from government micro fiancé institutions; while the remaining 56.21% has no credit access at all. Contrarily, most of the participant households (93.47 %) get credit services from contract farming firms. This implies accessibility of credit services is the major difference in contract farming programs between participant and non-participant households. In addition, the survey results in Table 6 show that 79.3 % of contract farmers had access to extension services from a contracting firm, while 66.01% of non-contract farmers accessed extension services from a government institution (Wereda agriculture extension office).

**Table 6**

*Services Provided for Participants and Non-Participants in Contract Farming*

| Description | Option | Contract | | Non-contract | |
|---|---|---|---|---|---|
| | | **Frequency** | % | **Frequency** | % |
| Did you get a credit | Yes | 82 | 89.14 | 67 | 43.79 |
| | No | 10 | 10.86 | 86 | 56.21 |
| | **Total** | **92** | **100%** | **153** | **100%** |
| Did you get an extension service | Yes | 73 | 79.3 | 101 | 66.01 |
| | No | 19 | 20.7 | 52 | 33.99 |
| | **Total** | **92** | **100%** | **153** | **100%** |
| Access to the coffee production training program | Yes | 88 | 95.65 | 101 | 66.01 |
| | No | 4 | 4,35 | 52 | 33.99 |
| | **Total** | **92** | **100%** | **153** | **100%** |
| Source of credit | Government loan/grant | - | | 67 | 43.79 |
| | Bank loan | - | - | **-** | - |
| | Contract farming | 86 | 100 | **-** | - |
| | No credit source | - | - | 86 | 56.21 |
| | **Total** | **86** | **100%** | **153** | **100%** |
| Source of extension service | Gov. extension workers | - | - | 86 | 100 |
| | CF extension workers | 73 | 79.3% | - | - |
| | Both | - | - | - | - |
| | Others…. | - | - | - | - |
| | **Total** | **92** | **100%** | **153** | **100%** |
| Source of inputs | Government | - | - | 14 | 9.15 |
| | CF firm | 92 | 100 | - | - |
| | Self | - | - | 90 | 58.82 |
| | Friends | - | - | 24 | 15.69 |
| | None | - | - | 25 | 16.34 |
| | **Total** | **92** | **100%** | **153** | **100%** |

Source: Own Survey, 2017

Regarding the source of inputs, a hundred percent of contract farmers have got their inputs from a contracting firm.  While 58.82 percent of non-contract farmers source their inputs. This again confirms that the contract arrangement is a resource and marketing contract. The contracting firm provides inputs and extension services thereby exercising an extensive influence on the farmer's operations which positively impacts their productivity and the quality of the coffee they produce. Coffee farmers use different types of inputs to increase production and productivity. In an open-ended question, both CF participants and non-participants were asked what type of inputs they used in the 2016/17 production season.  About 100% of the participant group and 83% of the non-participant group have confirmed that the main type inputs they have used are selected seed verities, seedlings, compost (natural fertilizer), farm tools such as sickle, spade, saw and pruning shave and coffee packaging materials.

**Contract Farming:**

The literature indicates that there are different reasons for farmers and processors to be engaged in contract farming. In general, both parties are likely to choose contract farming instead of vertical integration or spot market exchange when transaction costs and risk can be minimized (Singh, 2002).  In this subsection of the study, how contract farmers engaged in contract farming programs, the primary reason for contract farmers participating in CF arrangement, participant's view on the economic characteristics of CF, and prospects of contract farming arrangement (program) are analyzed, interpreted, and presented.

**How participants engaged in CFA and their primary reason for joining the program**

CF participants were asked whether they have experience in CFA and currently participating in this program, and all (100%) of them replied that they have previous experience in CF and are currently a member of the CF program.   All (100%) of the participant farmers confirmed that they opted to join to CF program and have been approached by a contracting firm. These farmers were approached by the contracting firm to participate in the CFA.  All members of the peasant were approached in this way and had a right to accept or reject the offer. Table 7 reports the primary reasons the participating respondents asked what motivated them to join the CFA. The most frequently point out reasons were better and stable prices, guaranteed market, training, credit access, and increasing output (yield).

**Table 7**

*Participants' Reasons for Joining The CFA*

| Reasons for joining CFA | % of participating respondent |
|---|---|
| Better and stable price of coffee | 92 % |
| Guaranteed Market | 88% |
| Source of credit | 83% |
| Access to training and new technology | 78% |
| Increasing output (yield) | 79% |

Source: Own Survey, 2017

Regarding constraining factors CFA, the majority of the contracted farmers replied that contract companies have the final say on quality and can reject 'sub-standard' commodities which they can allocate a lower grade. Farmers will just accept because there is nothing to compare with. Members are also strictly requested to sell their coffee to the contracting firm, side selling isn't allowed.

**Participant's Attitude on Economic Characteristics of Coffee Farming**

To measure participants' views on the economic characteristics of CF, we have used the Likert scale. The variables were subjected to a Likert scale of 1 to 5, where 1= strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree. For interpretation purposes, the mean response of < 1.5 implies strongly disagree, while a mean response of 1.5 – 2.4 implies disagree. A mean response of 2.5 – 3.5 implies neither agree nor disagree (it's uncertain), a mean response of 3.5 - 4.5 means agree and finally, a mean response of > 4.5 infers strong agreement. The result in Table 8 shows that all farmers that are found in the CF program either agreed or strongly agreed on the economic characteristics of coffee farming with mean values of greater than 4.00 and above. Especially, the collection of harvested coffee on time, delivery of products as agreed, and timely payment practices are implemented effectively in the contracting firm of the study area through mean values of 4.36, 4.33, and 4.22, respectively. The mean value of other variables also indicates participant's positive attitudes towards the economic characteristics of the CF program of the study area. This is strong evidence that indicates participants are getting economic benefits from engaging in contract farming.

**Table 8**

*Summary of HH attitudes on Economic Characteristics of CF*

| What is your view regarding the following service? | Contract Farmer | | |
|---|---|---|---|
| | N | Mean | S.Dev |
| 1. Seed provided on time | 92 | 4.00 | 0 |
| 2. Quality of the seed provided is good | 92 | 4.07 | 0.2665 |
| 3. Level of technical advice is adequate | 92 | 4.04 | 0.2050 |
| 4. Training provided is adequate | 92 | 4.00 | 0 |
| 5. Collection of the product after harvest is timely | 92 | 4.36 | 0.6240 |
| 6. Payment is timely | 92 | 4.33 | 0.6162 |
| 7. I delivered all products as agreed | 92 | 4.22 | 0.4222 |
| 8. Credit facility is adequate | 92 | 4.02 | 0.6240 |
| Total | 92 | | |

*Source:* Own Survey, 2017

**Contract Farming effects beyond Income and Output**

Different literatures suggest that apart from the change in the quantity of output and income, contract farming programs can bring different types of benefits to participant farmers. In this regard, the respondents of this study were asked what other types of benefits they are getting from their participation in the contract farming program. About 100% of program participant farmers confirmed that in addition to an increase in income and quantity of output, they have got better access to credit facilities, training and technical advice, communication facility, preferred market, other inputs, and new technology. About 92.39%, 88.04 %, 75%, and 47.83% of the respondents replied that they have got access to social network participation, better health care, and better child education, respectively. Only 47.83% of the respondent replied that they are free from production risk while 53.17 said they are still having production risk.

**Table 9**

*The Effects of CF on Other Indicators of HH Well-being*

| Request | Option | Frequency | Percent |
|---|---|---|---|
| Farm Income | Yes | 92 | 100 |
| | No | - | - |
| Access to credit | Yes | 92 | 100 |
| | No | - | - |
| Social network (position) participation | Yes | 85 | 92.39 |
| | No | 7 | 9.61 |
| Access to extension service | Yes | 92 | 100 |
| | No | - | - |
| Access to training | Yes | 92 | 100 |
| | No | - | - |
| Access to communication facilities | Yes | 92 | 100 |
| | No | - | - |
| Access to preferred (better) market | Yes | 92 | 100 |
| | No | - | - |
| Access to technical advice | Yes | 92 | 100 |
| | No | - | - |
| Access to other farm inputs | Yes | 92 | 100 |
| | No | - | - |
| Access to new technology | Yes | 92 | 100 |
| | No | - | - |
| Access to better health care (family) | Yes | 81 | 88.04 |
| | No | 11 | 11.96 |
| Access to better child education | Yes | 69 | 75 |
| | No | 23 | 25 |
| | No | - | - |
| Free from production risk | Yes | 44 | 47.83 |
| | No | 48 | 52.17 |

Source: Own Survey, 2017

**Participants` willingness to continue in Contract Farming Arrangement**

Data collected to check how participants are willing to continue with the existing program and whether the program is sustainably continued. As shown in Table 10, about 42.05% of contract farmers were highly willing to continue under the contractual-based farming program and the remaining 57.95% of total respondents also indicated a sign of willingness to continue if they get

the opportunity and exist in the coming production season. This indicates, there is no sign of dissatisfaction among contract farmers. Therefore, existing CFA doesn't have a risk of program discontinuity in the study area.

**Table 10**

*How likely is the HH to Continue in the CF program?*

| Decision | Contract Farmers | | | | | |
|---|---|---|---|---|---|---|
| | Highly likely | Likely | I don't know | Unlikely | Highly unlikely | Total |
| **Response frequency** | 39 | 53 | - | - | - | 92 |
| **Percentage** | 42.05% | 57.95% | - | - | - | 100% |

Source: Own Survey, 2017

**Prospects and challenges in managing contract farming:**

The third analysis of this study is to investigate the prospects and challenges in managing contract farming. As shown in Table 10, the majority of contracted farmers are willing to continue with the contract farming program. During the key informant interview session, when asked what the prospect and challenge of contract farming is, top management officials of the contracting firm replied that violation of the contract terms and condition, negligence in maintaining the agreed quality of coffee, sale of contracted coffee output to outside the contract (side selling) by some of the contracted farmers and inadequate government support are some of the challenges on managing the operations of CFA. Regarding the prospects of CFA, the top management official of the firm confirmed that members' willingness to continue with the contract farming program is one of the major potentials of managing CFA. Contracted farmers' awareness of the benefit of the CFA, their willingness to abide by the rules and regulations of the contract, and timely supplying the amount and the type of coffee agreed upon in the contract are some of the positive for managing contract farming programs. As explained by top managers of the contracting firm, the new and recent coffee marketing and quality control reform issued by the government which encourages vertical integration between smallholder farmers and large-scale commercial farms is another prospect to manage the operation of the CF program positively.

**Two Sample T-tests on Outcome Variable before Matching:**

This study employed a two-sample t-test to check whether a contract farming program has a significant impact on the annual income and yield (output) of smallholding farmers. As shown in Table 11 the mean value of annual coffee income of the treated group equals 59,733.99 ETB and the control households are 39,384.01 ETB, the result shows that the treated group's annual income is higher by 20,349.98 ETB compared with the control group. Similarly, the mean value of annual coffee output (yield) of the treated group is 3,022.989 kilograms while it is 2,587.379 kilograms for the control groups. The mean difference indicates that the treated group's annual output is higher by 435.61 kilograms than the control household group. The difference in both annual income and output is significant at a 1% critical level. This indicates that contracted farmers have better output and income than non-contracted farmers

**Table 11**

*Two Sample T-Tests on Income and Output (Yield) Before Matching*

| Outcome Variables | Groups | Obs. | Mean | Std. errs. | Std. dev. | T-test |
|---|---|---|---|---|---|---|
| **INCOME** | 0 | 153 | 39384.01 | 1213.297 | 15007.65 | -9.57*** |
| | 1 | 92 | 59733.99 | 1857.494 | 17816.46 | |
| | **Mean difference** | | 20349.98 | 2126.308 | | |
| **(OUTPUT)YIELD** | 0 | 153 | 2587.379 | 11.27494 | 139.4634 | -12.8415*** |
| | 1 | 92 | 3022.989 | 39.57 | 379.5421 | |
| | **Mean difference** | | 435.61 | 33.9221 | | |

Source: Own Survey, 2017
Note: *** denotes statistically significant at the 1%

## Econometric Estimation Results:

**Estimating a model of program participants**

The pseudo–$R^2$ value is indicated as 0.28, this implies that the low $R^2$ value indicates the selected household doesn't have many different characteristics and is easy to find a good much between

participant and non-participant groups. To estimate the propensity score matching of participants with non-participant households, the binary probit model was used. In this study, the participant households in the contract farming program is the treatment variable, it takes the value 1 and 0 for non-participant. The probit result of participation in the contract farming program is presented in Table 12. The observable household characteristics used for estimating propensity score matching is gender, year of schooling of household, credit access, extension access, market distance(km), training access, and land used for coffee production (hectare). As shown in Table 12 credit access, training access and land used for coffee production have significantly affected the participation of households in a contract farming program. These are some of the factors influencing farmers to participate in CFA.

Contrary to our expectation, extension access doesn't have a significant effect on household participation in contract farming programs. Results indicate that 79.35 of participant farmers gets access to extension service for contracting firm. The study indicates that extra work is needed by the contracting firm to improve the extension service provided to the contracting farmers.

**Table 12**

*Probit Result Participation in the Contract Framing Program*

| Covariant | Coefficient | Std.Err | Z |
|---|---|---|---|
| Gender | -.1988518 | .249877 | -0.80 |
| Year of schooling | -.0179877 | .0357691 | -0 .50 |
| Credit Access | 1.943939 | .3557218 | 5.46 *** |
| Extension Access | -1.454135 | .3932001 | -3.70 |
| Market distance | -.0393122 | .0734747 | -0.54 |
| Training Access | 1.274341 | .3312348 | 3.85 *** |
| Land used for coffee pro. | .375621 | .1566354 | 2.40 *** |
| Cons | -1.999273 | .4655034 | -4.29 |
| LR chi2 | 91.31 | | |
| Prob>0 | 0 | | |

Source: Own Survey, 2017
Notes: ***denotes significance at a 1% level

**Defining the Region of Common Support and Balancing Test**

As shown in Table 13, all the control households are included in support, while from the total treated observation, 10 households or 10.86% are off support, while 82 households (89.13%) are on support.

**Table 13**

*Common Support Region*

|  | Income | | | Yield (output) | | |
|---|---|---|---|---|---|---|
|  | **Off** | **On** | **Total** | **Off** | **On** | **Total** |
| **Untreated** | 0 | 153 | 153 | 0 | 153 | 153 |
| **Treated** | 10 | 82 | 92 | 10 | 82 | 92 |

Source: Own Survey, 2017

Each treated unit is matched only with the control unit whose propensity score falls into a predefined common support region of the propensity score matching. As we can see from the ATT result in table 14, on the common support region, the contract farming treated household's average income is 32.7% higher than the control household, significant at 1%. Regarding coffee yield (output), the contract farming household's average coffee production output is 16.4% higher than the control group, significant at a 1% level.

**Table 14**

*ATT with a Common Support Range Income and Output*

| Variable | Sample | Treated | Controls | Difference | S.E. | T-stat |
|---|---|---|---|---|---|---|
| Income | Unmatched | 59733.9946 | 39384.0111 | 20349.9835 | 2126.30778 | 9.57 |
| | ATT | 59304.2073 | 39863.8317 | 19440.3757 | 4000.9339 | 4.86 |
| Output | Unmatched | 8.00700996 | 7.85698851 | .150021443 | .010869444 | 13.80 |
| | ATT | 8.00501236 | 7.84071195 | .164300407 | .016924634 | 9.71 |

Source: Own Survey, 2017

To confirm the ATT result, it needs to check the balancing by using ``pstest``, which helps to know by how much the bias was eliminated. As shown in Table 15, the mean bias of the data, which indicates the matching was good.

**Table 15**

*Specification Tests for the Propensity Score*

```
---------------------------------------------------------------------------------
                Unmatched |      Mean              %reduct |    t-test    | V(T)/
Variable         Matched | Treated Control   %bias  |bias| |   t    p>|t| | V(C)
-----------------------------+-------------------------------------+----------------+----------
gender              U |  .81522   .82353   -2.2            | -0.16  0.870 |    .
                    M |  .81707   .81707    0.0    100.0   |  0.00  1.000 |    .

SchoYear            U |  3.1087   3.4641   -13.1           | -0.99  0.321 |  1.04
                    M |  3.3293   3.5244    -7.2    45.1   | -0.48  0.634 |  1.20

CreAcce             U |   .8913   .43791   109.1           |  7.85  0.000 |    .
                    M |  .87805   .87805    0.0    100.0   |  0.00  1.000 |    .

ExtenAcc            U |  .79348   .66013    30.1           |  2.24  0.026 |    .
                    M |  .89024   .89024    0.0    100.0   |  0.00  1.000 |    .

MktDista            U |  2.3641   2.2869     6.1           |  0.43  0.665 | 0.27*
                    M |   2.35    2.4756   -10.0   -62.7   | -0.63  0.527 | 0.28*

TrainAcc            U |  .95652   .66013    81.0           |  5.67  0.000 |    .
                    M |  .95122   .95122    0.0    100.0   |  0.00  1.000 |    .

LaUsCoff            U |  1.962    1.6958    44.8           |  3.28  0.001 | 0.57*
                    M |  1.9482   1.9774    -4.9    89.0   | -0.36  0.721 | 0.71

---------------------------------------------------------------------------------|
* if variance ratio outside [0.66; 1.51] for U and [0.64; 1.55] for M

---------------------------------------------------------------------------------
 Sample     | Ps R2  LR chi2  p>chi2  MeanBias  MedBias     B      R    %Var
------------+--------------------------------------------------------------------
 Unmatched | 0.281   91.13   0.000     40.9     30.1     140.0*  0.52    67
 Matched   | 0.003    0.77   0.998      3.2      0.0      13.6   0.57    33
---------------------------------------------------------------------------------
* if B>25%, R outside [0.5; 2]
```

Figure 1 shows the comparison of density estimation of both treated and untreated groups before matching and after matching was done. On the other hand, Figure 2 presents the histogram of propensity scores to check if there is enough overlap between treated and control groups. As shown in the graph, there is enough overlap or common support between the two groups
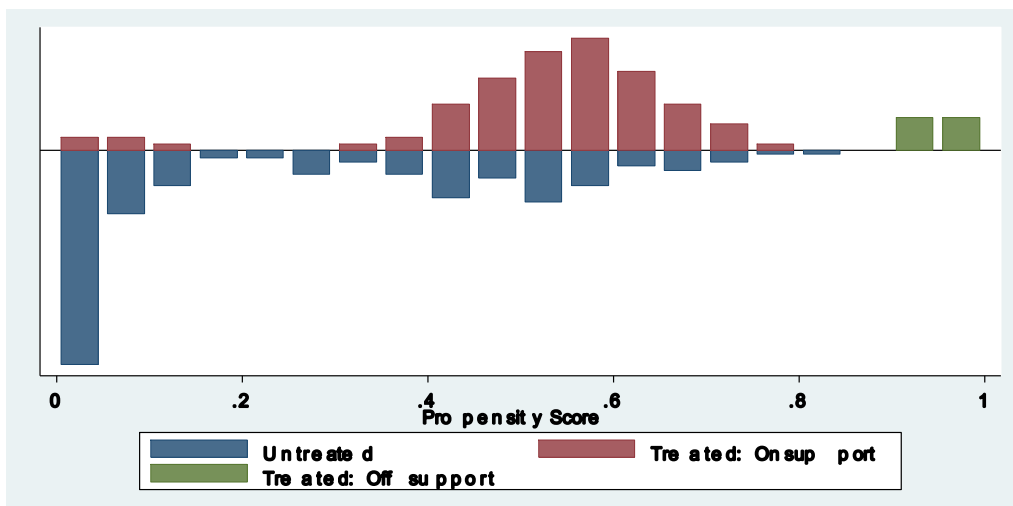
**Figure 1**

*Propensity Score Before and After Matching*
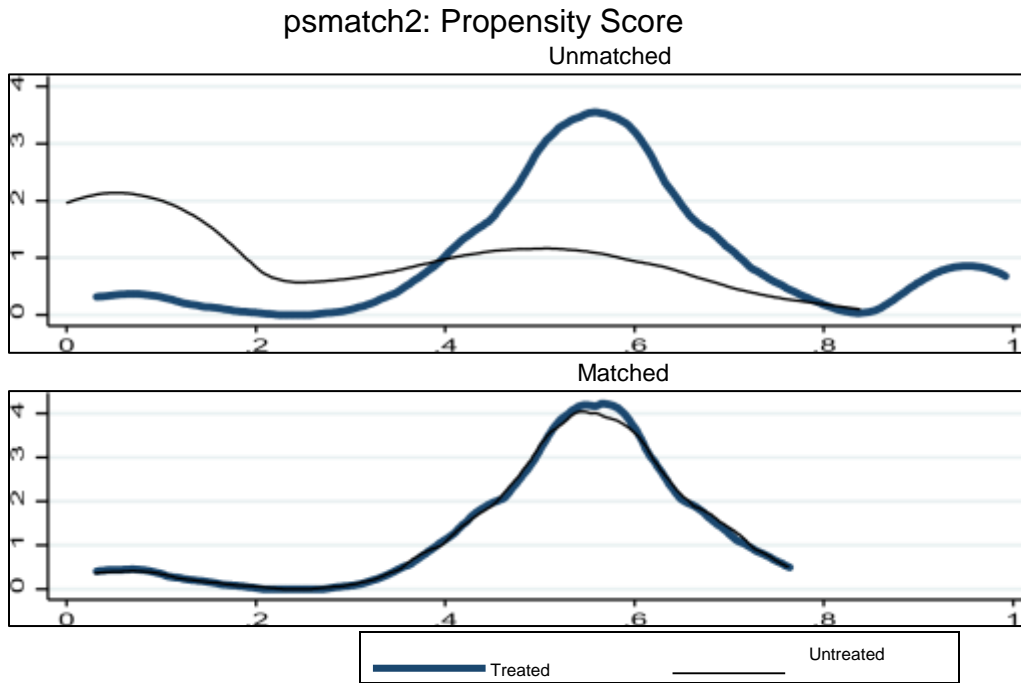


Source: Own Survey, 2017

**Figure 2**

*Common Support*



Source: Own Survey, 2017

**Matching Participant and Non-Participant Households**

A different matching estimator was used to matching the treated and control group in the common support region. According to Dehejia and Wahba (2002), the final choice of a matching estimate was guided by different criteria such as the balancing test is equally mean, a low pseudo-$R^2$, and a large sample size being preferred.

**ATT Estimation of Income using the Four Matching Methods**

To estimate the average treatment effect of the intervention (contract farming on the income and output) on the treatment group, we have used different matching algorithms. This includes Nearest-neighbor matching, Caliper or radius, stratification and Kernel matching. "attnd", "attr", "attk" and "atts" respectively (Khandker*et al*, 2010).

Table 15 shows 140 matched observations in the nearest neighbor matching, 215 observations in Kernel matching and Stratification matching, and 56 in Caliper or radius matching. As per NNM, RM, KM, and SM the participant household income is higher by 18,194, 19,931, 19,221, and 17,804 ETB than the non-participant respectively, the results are statistically significant at 1% level, as the t-value in Nearest-neighbor is 4.919, Caliper or radius 4.845, under Kernel matching 5.778 and Stratification matching 6.358

Therefore, the study chooses kernel matching and stratification matching methods as per a large matched sample size. On average, the treatment effects on the treated group range of income 19,221 ETB by Kernel Matching method and 17,804. ETB by the Nearest stratification matching method. This means on the average income from coffee production of participant households has increased by 19, 221 - 17804 ETB. This indicates that the contract farming project has brought a significant impact on the participant households' income. This study is consistent with the study done by Seba (2016) who stated that participation in CFA had a substantial positive impact on the household cash revenue of chickpea growers who engaged in contract farming arrangements. Similarly, the study by Ramaswami et al. (2006) revealed that contract production is more efficient than non-contract production. According to this study, the contract participant gains more appreciable income than that the nonparticipant.

**Table 15**

*Average Treatment Effect on Household Income Using Different PSM Algorithms*

| Matching Method | Number of Treatment | Number of Control | ATT | Std. Err. | t-value |
|---|---|---|---|---|---|
| Nearest-neighbor matching | 92 | 48 | 18194.371 | 3698.749 | 4.919*** |
| Caliper or radius matching | 29 | 27 | 19931.750 | 4114.046 | 4.845*** |
| Kernel Matching | 92 | 123 | 19221.223 | 3326.378 | 5.778*** |
| Stratification or Interval matching | 92 | 123 | 17804.707 | 2800.227 | 6.358*** |

Source: Own Survey, 2017

Notes: **** means Statistically significant at 1%

 **ATT Estimation of Coffee Output using the Four Matching Methods**

As indicated in Table 16 below the number of matched observations in the nearest neighbor matching is 140, 215 observations in Kernel matching and Stratification matching, and 56 in Caliper or radius matching. The PS matching result tells us that participants' households in contract farming of coffee production show a significant positive impact on coffee production growth or output increment.  As per NNM, RM, KM, and SM, the participant household coffee output is higher than the non-participant by 16.5%, 18.9%, 15.8%, and 16% respectively at a 1% significant level, as the t-value Nearest-neighbor 10.676, Caliper, or radius 7.001, under Kernel matching 11.873 and Stratification matching 11.895. Therefore, the study chooses SM and KM methods as per the large matched sample size. On average treatment effects in the treated group range from 16% Stratification Matching method to 15.8% in the kernel Matching method. This means on the average output of coffee production of participant households has increased by 16% - 15.8%. This indicates that the contract farming project has brought a significant impact on an increase in the outputs of the participant households.  In this regard, the research findings of Moyo Moses (2014), confirmed that contract farmers had better production volumes when compared to non-contract farmers.

**Table 16**

*Average treatment effect on coffee Output (Yield)*

| Matching Method | Number of Treatment | Number of Control | ATT | Std. Err. | t-value |
|---|---|---|---|---|---|
| Nearest-neighbor matching | 92 | 48 | 0.165 | 0.015 | 10.676*** |
| Caliper or radius matching | 29 | 27 | 0.189 | 0.027 | 7.001*** |
| Kernel Matching | 92 | 123 | 0.158 | 0.013 | 11.873*** |
| Stratification or Interval matching | 92 | 123 | 0.160 | 0.014 | 11.695*** |

Source: Own Survey, 2017
Notes: *** Statistically significant at 1%

**Summary of ATT of Coffee Contract Farming Participation on HH Income and Output**

In this section, the treatment effect of participating in a coffee contract farming project is summarized. The table below reveals the impact estimation results of the effect of the intervention on the outcome variables (household income from the sale of coffee and coffee output) across the four-matching algorithm. Several studies analyze the effect of contract farming on farmers' income and most of these studies find a significant positive effect. Likewise, the result of this study reveals that there is a positive significant difference between the participant (treated) and non-participant (control) households. This indicates that the contract farming program has a significant contribution to income and output growth in the participants' households.

**Table 17**

*Summary of ATT By Each of the Matching Algorithms*

| Matching Method | Estimated Impact on the outcome variable | |
|---|---|---|
| | Income for coffee | Output (Yield) |
| **ATT (Nearest-neighbor matching)** | **18194.371\*\*\*** | **16.5%\*\*\*** |
| No. Treated | 92 | 92 |
| No. Control | 48 | 48 |
| Standard error | 3698.749 | 0.015 |
| t-value | 4.919 | 10.676 |
| | | |
| **ATT (Caliper or radius matching)** | **19931.750\*\*\*** | **18.9%\*\*\*** |
| No. Treated | 29 | 29 |
| No. Control | 27 | 27 |
| Standard error | 4114.046 | 0.027 |
| t-value | 4.845 | 7.001 |
| | | |
| **ATT (Kernel Matching %)** | **19221.223\*\*\*** | **15.8%\*\*\*** |
| No. Treated | 92 | 92 |
| No. Control | 123 | 123 |
| Standard error | 3326.378 | 0.013 |
| t-value | 5.778 | 11.873 |
| | | |
| **ATT (Stratification or interval matching)** | **17804.707\*\*\*** | **16%\*\*\*** |
| No. Treated | 92 | 92 |
| No. Control | 123 | 123 |
| Standard error | 2800.227 | 0.014 |
| t-value | 6.358 | 11.695 |

Source: Own Survey, 2017

Notes: \*\*\* significant at 1% level

**Checking Robustness of Average Treatment Effect**

There are several ways to check the robustness of the findings. One approach is to estimate the propensity score equation. Another way to check the robustness of the average treatment effect is to apply direct nearest-neighbor matching instead of estimating the propensity score equation. If both methods give similar results, then the findings are assumed to be more reliable (Khandker*et al*, 2010).

As shown in Tables 18 and 19, the nnmatch result is consistent with the result provided by different methods. The "Z'' value of both outcome variables is highly insignificant, having a P-value <1.

**Table 18**
*nnmatch result for income*

| Income | Coef. | Std. Err. | z | P>|z| | [95% Conf. Interval] | |
|---|---|---|---|---|---|---|
| SATT | 25561.07 | 3704.947 | 6.90 | 0.000 | 18299.51 | 32822.64 |

Source: Own Survey, 2017

**Table 19**
*nnmatchresult for logoutput*

| logoutput | Coef. | Std. Err. | z | P>|z| | [95% Conf. Interval] | |
|---|---|---|---|---|---|---|
| SATT | 0.1729624 | 0.0236901 | 7.30 | 0.000 | .1265306 | .2193942 |

Source: Own Survey, 2017

**Testing the Matching Quality or Balance of Propensity Score and Covariant**

The purpose of matching is to balance the treatment and control groups on the observation characteristic (Bryson et al, 2002). After selecting the best performance matching algorithms next to check the balance of the propensity score. As stated earlier the main purpose of PS estimation is not to obtain predictions of the selection of treatment but rather to balance the distribution of relevant variables. By considering a different test method checking the balance such as reduction of mean, standard biases between the matched and unmatched group, using t-test and chi-square are commonly used balancing tests to check the quality of means between the treated and control group.

**Balancing Test for Propensity Score Matching**

As we can see in Table 20, the t-value of all covariates are statistically insignificant, this indicates that after matching the difference between the mean of the treated and control households has been minimized. Therefore, we can justify that the matching quality or balancing with PS for all covariates has been satisfied.

**Table 20**

*Propensity Score and Covariant balance*

| Variable | Unmatched Matched | Mean | | % bias | % reduction bias | T-Test | | V(T)/VC |
|---|---|---|---|---|---|---|---|---|
| | | Treated | Control | | | t | p>t | |
| Gender | Unmatched | .81522 | .82353 | -2.2 | | -0.16 | 0.870 | . |
| | Matched | .81707 | .81707 | 0.0 | 100.0 | 0.00 | 1.000 | . |
| Year of Schooling | Unmatched | 3.1087 | 3.4641 | -13.1 | | -0.99 | 0.321 | 1.04 |
| | Matched | 3.3293 | 3.5244 | -7.2 | 45.1 | -0.48 | 0.634 | 1.20 |
| Credit acc. | Unmatched | .8913 | .43791 | 109.1 | | 7.85 | 0.000 | . |
| | Matched | .87805 | .87805 | 0.0 | 100.0 | 0.00 | 1.000 | . |
| Extension access | Unmatched | .79348 | .66013 | 30.1 | | 2.24 | 0.026 | . |
| | Matched | .89024 | .89024 | 0.0 | 100.0 | 0.00 | 1.000 | . |
| Market distance | Unmatched | 2.3641 | 2.2869 | 6.1 | | 0.43 | 0.665 | 0.27* |
| | Matched | 2.35 | 2.4756 | -10.0 | -62.7 | -0.63 | 0.527 | 0.28* |
| Training access | Unmatched | .95652 | .66013 | 81.0 | | 5.67 | 0.000 | . |
| | Matched | .95122 | .95122 | 0.0 | 100.0 | 0.00 | 1.000 | .. |
| Land used for coffee | Unmatched | 1.962 | 1.6958 | 44.8 | | 3.28 | 0.001 | 0.57* |
| | Matched | 1.9482 | 1.9774 | -4.9 | 89.0 | -0.36 | 0.721 | 0.71 |

Source; Own Survey, 2017

## Conclusions and Recommendations

This research sought to investigate the impact of contract farming on the income and output (yield) of smallholder coffee producers in southwest Ethiopia, Oromia zone, limmu Seka Wereda (district). The objective was to evaluate if contract farmers had superior performance to non-contract farmers. An attempt has also been made to identify factors influencing household participation in a contract farming scheme. The prospect and challenges of managing CFA in the study area have also been investigated by this research study.

The research design used for this study is quasi-experimental. The researcher has used the descriptive, inferential statistics and econometrics model. Descriptive statistics like mean, standard deviation, and percentiles have been used to explain the basic characteristics of the channel members. In an econometric analysis, the researcher used the propensity score matching model, because the study used observable factors in both participating and non-participating households and the understudy doesn't have baseline data to use the difference in difference method. Different tests like chi-square and t-test statistics have also been used to supplement or testify to the significance of results obtained from the models specified.

In a two-sample t-test analysis, it is identified that the contract farming program has a significant impact on the annual income and yield (output) of smallholding farmers. The income and quantity of yield of participant farmers are higher by 34 % and 14.38 %, respectively than the non-participant group. There the mean difference is statistically significant at 1%.

To estimate the propensity score matching of participants with non-participant households, the binary probit model was used. The observable household characteristics used for estimating propensity score matching is gender, year of schooling of household, credit access, extension access, market distance(km), training access, and land used for coffee production (hectare). The result revealed that credit access, training access, and land used for coffee production have significantly affected the participation of households in a contract farming program. These are some of the factors influencing farmers to participate in CFA. Contrary to our expectations, extension access doesn't have a significant effect on household participation in contract farming programs. Results indicate that 79.35 of participant farmers gets access to extension service for contracting firm. The result also shows distance to the market of the control group is a lit bit shorter

than the treated. We conclude that extra work is needed by the contracting firm to improve on these two important variables.

The average treatment effect on the treated (ATT) result after matching shows there is a statistically significant difference between the treated and control group in-terms of income and quantity of output (yield). As per NNM, RM, KM, and SM the participant household income is higher by 18,194, 19,931, 19,221, and 17,804 ETB than the non-participant respectively the results are statistically significant at 1% level, as the t-value in Nearest-neighbor is 4.919, Caliper or radius 4.845, under Kernel matching 5.778 and Stratification matching 6.358. Similarly, NNM, RM, KM, and SM the participant household coffee output is higher than the non-participant by 16.5%, 18.9%, 15.8%, and 16% respectively at a 1% significant level, as the value Nearest-neighbor 10.676, Caliper, or radius 7.001, under Kernel matching 11.873 and Stratification matching 11.895.

From this research finding it can be concluded that the contract farming project has brought a significant increase in the participant households' income and quantity of output (yield) in the study area.

The third analysis of this research study focused on investigating the prospects and challenges of managing CFA. Findings from the key informant interview indicate that violation of the contract terms and conditions, negligence in maintaining quality, and sale of contracted coffee output to outside the contract (side selling) by some of the contracted farmers are some of the challenges on managing the operations of CFA, government support to contract framing project is also weak. As per the information obtained from the interview, the contracted farmer's awareness of the benefit of CFA, their willingness to abide by the rules and regulations of the contract, and timely supplying the amount and the type of coffee agreed upon in the contract are some of the prospects for managing contract farming program. The new and recent coffee marketing and quality control reform issued by the government which encourages vertical integration between smallholder farmers and large-scale commercial farms is another prospect to manage the operation of the CF program.

Based on the findings of this study and the conclusion drawn, the following recommendations are forwarded:

- The result of this research study shows that the contract farming scheme brought a significant change in the coffee income and yield of contracted smallholder farmers, therefore the zonal, regional, and federal governments should create a conducive environment and establish policies and regulations for contract farming projects. They should closely work with and provide all necessary support for contracting firms. The suggested support includes the development of infrastructure like all-weather roads, electric and telephone lines, and agricultural research services.

- As shown in the finding of the study credit access, training access and land used for coffee production have significantly affected the participation of households in a contract farming program.  Therefore, due emphasis must be given by the contracting firm and government policymakers on these policy variables.

- *Strengthen the extension service:* To reach contract coffee farmers with improved technologies and to increase their awareness about better production systems, a strong extension service is important. However, the result of this study indicates that the existing extension service is not that strong enough. Strengthening the extension service can help to easily disseminate the required knowledge to increase productivity. In this regard, the contracting firm extension agents should regularly contact and provide effective technical support to all members of the CFA.

- *Market distance:* During this survey study no complaints were raised by contracted farmers for the market distance, however, the findings of this study depict that the distance to the primary market for non-contact firms is a lit bit shorter than the contract farmers, this shows a negative relationship between market distance with the contract farming program. Therefore, the contracting firm should establish a coffee collection point nearby to smallholder coffee farmers. This will create a conducive situation and environment for contracted farmers for efficient coffee transactions, farmers can deliver their products without exerting extra effort. It can also be an attraction to non-contract farmers to join to CFA,

- *Insurance in the contract:* In this survey study 47.83%of contracted farmers said that they still have production risk. Hence contracting firm, as one of the benefits packages it provides to its member farmers, must include crop insurance in the contract to protect smallholder farmers from the risk of floods and storms, and the like.

- As mentioned in the previous section, the government has made a reform in the coffee marketing and quality control system of the country, this reform encourages vertical integration between smallholder farmers and large-scale commercial farms through a contract farming scheme. However, the exporting firms which don't have coffee firms, are not legally allowed to have vertical integration with smallholder coffee growers. These firms have direct contact with foreign buyers and different export outlets. Therefore, to shorten the value chain in the trading system and befitting smallholder farmers from the coffee export business, we recommend vertical integration between exporting firms and smallholder farmers through a contract firm program.

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