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The impact of commercialization of smallholder farming on the welfare of Households in Ethiopia: the Case of Lemmo Woreda, Hadiya Zone

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Abstract

The study aimed to analyze the impact of the commercialization of agriculture on the welfare of households in Lemo Woreda of Hadiya zone. To this end, primary data were collected from 295 households using a structured survey questionnaire. Out of 295 respondents, 147 were participants in commercialization and 148 were non-participants. The collected data were analyzed using descriptive statistics and PSM econometric model. The average amount of income of participants is greater by 12,220 Birr per year than non-participants. Moreover, the study also analyzed the factors that determine participation in the commercialization of agriculture using a log it model. Accordingly, thirteen variables were analyzed in the model that was hypothesized to determine households' participation in the commercialization of agriculture. Even though there are efforts to enhance commercialization of smallholder agriculture, a lot still needs to be done to improve the level of commercialization since the overwhelming majority of smallholders are not well integrated with the market yet.

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Introduction

Nowadays, it is widely believed that the economic growth and development of most developing countries relying on the agricultural sector cannot be ensured without commercializing smallholder agriculture(von Braun, 1994; Pingali and Rose grant, 1995; Timmer, 1997, Moti *et al.,* 2009).Market participation is an important first step in determining the degree of smallholder commercialization (Gutu, 2016).According to Pingali (1997), cited in Moti *et al.* (2009), subsistence agriculture may not be a viable activity to ensure sustainable household food security and welfare in the longrun. Commercialization allows more participation of individuals and poor households in the domestic and international exchange economy and results in higher average farm income and lowers farm income inequality (Hazell *et al.*, 2007). The welfare gains from market-oriented production come up from specialization that builds on and ensures comparative advantages, the potential for large-scale production, and from dynamic technological, organizational and institutional change effects that arise through the flow of ideas due to exchange-based interactions (Goitom, 2009).For several years, focus was given to the enhancement of production and productivity so as to pave the way for smallholder commercialization. That was based on the evidence from around the world that smallholder farming, which is the main source of livelihoods, was seen to be as efficient as larger farms when farmers have received similar support services and inputs (seed, fertilizer, and credit) so as to improve their production and productivity (World Bank, 2007).

In Ethiopia, there have been many efforts to integrate farmers into the market since the 1950s. In the 1950s, the attention had been on enhancing productivity and decreasing economic dependence on agriculture, whereas, in the 1960s, it shifted to an agro-industrial economy and increment of foreign earnings (Sharp *et al.*, 2007:4 9). In the 1970s, attention shifted to smallholder potential after inefficiencies were observed in mechanized farms. In the 1980s, the country adopted the socialist agricultural development strategy following the rise of the Derg regime to power. Since the coming to power of the current government in the 1990s, a strong focus has been given to smallholder farming and poverty reduction and supporting agricultural intensification (Sharp *et al.*, 2007:49). Ethiopian government has prioritized commercialization of farming as a policy agenda since 2005 and this priority is demonstrated by the central place this issue has gained in the second Poverty Reduction Strategy Paper (PRSP) (Sharp *et al.*, 2007).

Ethiopia's Growth and Transformation Plan I (GTP I) (2010/11-2014/15) retained agricultural sector growth as the prime driver of economic growth. The sector's strategy was further informed by the Agriculture Growth Program (AGP) and lessons drawn from the implementation of the past development plans (FDRE, 2010).Similarly, under current GTP II (2015/16 – 2019/2020), the same plan is made to mobilize all possible efforts to ensure adequate agricultural input supply and strengthen agricultural extension services so as to boost productivity and then commercialization. This clearly indicates that agriculture continues to be a source of growth and poverty reduction.

Few studies assessed the welfare impact of the commercialization of smallholder farmers in the study area. Therefore, the main objective of this study was to examine the impact of the commercialization of smallholder agriculture on the welfare of households in the study area.

Methodology

Description of the study area

The study was conducted in Lemo woreda, Hadiya zone, Southern Nations Nationalities and Peoples Regional (SNNPR) State of Ethiopia. Lemo Woreda is bordered by the North Silte Zone, the South Kembata Xembaro Zone, the North-West Misha Woreda, the East Shashogo Woreda and the West Gombora Woreda. The administrative center of the Woreda is Hosanna. This Woreda has a total population of 165265, of whom 81590 (49.3%) are men and 83675(50.7%) are women. From this, 107,422(64.9%)

are urban inhabitants and the remaining are rural inhabitants. The study area geographically lies between Latitude 07° 41 ′ N and Longitude 037º 31′E. The topography of the study area is rugged highland and hilly areas with a slope range of 2 to 30%. Generally, the terrain is mountainous, undulating and very much prone to soil erosion. Hosanna City in Lemo Woreda is the capital of the Hadiya zone. It is situated 230 km south of Addis Ababa, the capital of Ethiopia (Lemo Woreda Office of Agriculture Rural Development, 2020).

Sampling technique and sample size

Two-stage sampling technique was used to select the sample households where kebeles were selected through a random sampling technique and then households were selected from the sample kebeles following the same procedure to arrive at targeted respondents.

Accordingly, 6 kebeles were selected randomly from the Woreda for the study. The sample size was 295 households which were determined by using the formula provided by Yamane (1967),

$$n = \frac{N}{1 + N(e)^2} = \frac{165,265}{1 + 165,265(0.06)^2} = 277.312$$

Data type and source of data

Both qualitative and quantitative types of data were used in the study. Primary data from sample respondents using questionnaire household surveys and secondary data from journals and reports were used to assess the impact of commercialization on welfare households.

Data analysis

The analysis was done employing different descriptive statistical techniques and econometric models using STATA 13 software. In the descriptive analysis part, statistical tools like averages, sums, percentages t-tests and chi-square tests were used. To analyze the welfare outcome of the commercialization, econometric models such as propensity score matching (PSM) and logit model were employed.

The basic idea of the propensity score matching method is to match program participants considered as a treated group (market participant, in our case) with non-participants (control group)typically using individual observable characteristics. Each program participant is paired with a small group of non-participants in the comparison group that is most similar in the probability of participating in the program. This probability (called propensity score) is estimated as a function of individual characteristics, typically using a statistical model such as log it or probit. According to Shahidur *etal. (*2010), the implementation of PSM involvessixsteps. These are an estimation of the propensity score, defining the region of common support, choosing a matching algorithm, testing matching quality, calculating the average treatment effect on treated and sensitivity analysis.

The logit model for this study was identified as follows with variables of the study:

$$Y_i = Ln\left(\frac{P_i}{1 - P_i}\right) = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \cdots + \beta nXn + \mu i$$

Where Y= the predicted probability of the event (farmers' market participation), which is coded with 1= participant; and 0= non-participant.

1 – Y= the predicted probability of the other decision (non-participation)

β0= Constant, βn= Coefficients of explanatory variables, Xn= Predictor variables, μi= Error term.

Hypothesis of variables

The dependent variable is defined as a binary outcome of those households that participate in market (=1) and those that participate as buyers or remain autarkic (=0).

Results and discussion

General characteristics of households

The mean ages of market participant and non-participant households were 36.85 (5.23) years and 46.53 years (7.21), respectively (Table 2). This has

differed significantly among households. The t-test result indicates that there was significant mean difference between market participant and non-participant households in their age. This indicates that younger farmers are more likely to participate in the market than older farmers. It may be due to the fact that younger farmers may be more innovative and have entrepreneurial attitudes than older farmers. A study conducted Birhanu (2020) indicated that younger farmers are characterized as innovative, which enables them to make decisions on the adoption of new agricultural technologies than older farmers. This may help them to participate in the market than older farmers.

Table 1. Summary of definitions, measurements and expected signs of variables.

Definition of the variables	Measurement of the variables	Expected sign
Dependent Variable(Participation)	Yes/No	
Independent Variables		
Sex of household head	Dummy,1= male and 0 = female	+
Age of household head	Continuous	-
Education level of household	Dummy, 1=litterate 0 =illetrate	+
Total land size	Continuous	+
Total value of food crops produced	Continuous	+
Total value of cash crops produced	Continuous	+
Use Improved Seeds	Dummy, 1= if used fertilizer0= if not used fertilizer	+
Apply Irrigation	Dummy,1= apply irrigation0= not apply irrigation	+
Household labor size	Continuous (in terms of adult/men equivalent)	+
Ownership of Livestock	Continuous(TLU)	+
Member of Extension Package	Dummy, 1= if member0= if not member	+
Use Fertilizer	Dummy,1= if used fertilizer0= if not used fertilizer	+
Access to transport	Dummy, 1= have access 0= have no access	+
Non-farm participantion	Dummy,1= if participated0= if not participated	-

The mean (SD) household labor sizes of market participant and non-participant households were 7.26 (1.65) and 6.95 (1.45), respectively. It implies that the mean family labor size of participant households and non-participant households were not significantly different. The mean (SD) value of food crops produced by market participant and non-participant households were 19,986 (4230) and 10465 (3546), respectively. The t-test result indicates that there was a significant mean difference between market participants and non-participant household sin their value of food crops produced. Similarly, the mean (SD) value of cash crops produced by market participant and non-participant households were 25,268 (9356) and 9256 (2853), respectively. The t-test result indicates that there was a significant mean difference between market participant and non-participant house hold sin their value of cash crops produced. A study conducted by Goitom (2009) revealed that households with high value of production tend to participate in the output market more than those with lower production levels.

Table 2. Descriptive statistics for continuous variables.

Market participant, N=147			Non participant, N=148		
Category	Mean	SD	Mean	SD	t-value
Age	36.85	5.23	46.53	7.21	4.35***
Household labor size	7.26	1.65	6.95	1.45	0.67
Total value of food crops produced	19986	4230	10465	3546	2.53***
Total value of cash crops produced	25268	9356	9256	2853	5.83***
Total land size	2.15	0.85	1.27	0.48	1.77**
Ownership of Livestock	4.91	0.86	4.63	0.78	0.68

Source: Own survey result, (2021)

*** and ** significant at 1% and 5%, respectively.

The mean (SDs) land sizes of market participant and non-participant households were 2.15 (0.85) hectares and 1.27 (0.45) hectares, respectively. It implies that the mean land size of participant households and non-participant households were significantly different. This finding was similar to the study by Dil *et al.* (2010), which showed that households with larger farm sizes were able to sell a larger share of their production as compared to households with smaller farm sizes. The mean (SDs) livestock ownership measured by tropical livestock unit (TLU) of market participant and non-participant households were 4.91 (0.86) and 4.63 (0.78), respectively. It implies that the mean livestock ownership of participant households and non-participant households were not significantly different.

Table 3. Descriptive statistics for dummy and discrete variables.

	Market participants, N=147			Non participant, N=148		
Variable	Characteristics	N	%	N	%	Chi-square
Sex	Male	140	95.2	144	97.3	0.53
	Female	7	4.8	4	2.7	
Education	Literate	102	69.4	98	66	0.96
	Illiterate	45	30.6	50	34	
Use improved seeds	User	122	83	86	58	9.95**
	Non user	25	17	62	42	
Irrigation	Apply irrigation	58	40	2	1.3	1.25
	Not apply irrigation	89	60	146	98.7	
Member of extension	Member	123	83.7	38	25.7	0.025
	Non member	24	16.3	110	74.3	
Access to credit	Have access	120	81.6	60	40.5	8.89***
	Have no access	27	18.4	88	59.5	
Access to transport	Have access	118	80.3	46	31	12.56***
	Have no access	29	19.7	102	69	

Source: Own survey result, (2021)

*** and ** significant at 1% and 5% respectively.

Of market participant households, 95.2% were male-headed households and 4.8% were female-headed households. On the other hand, non-participant male-headed and female-headed households were 2.7% and 97.3%, respectively (Table 3).The chi-square test indicated that there was no significant difference in sex between market participant households and non-participant households. Among market participant households, 69.4% and 30.6% of households were literate and illiterate, respectively. On the other hand, 34% and 66% of non-user households were illiterate and literate, respectively. Similarly, sex is insignificant in determining farmers' participation in the output market.

Table 4. Logit results of household market participation.

COMMER	Coefficient	Robust Std. Err	Odds Ratio	P-value
SEXHH	0.0400639	0.6838787	0.9607281	0.959
AGE	0.0653821	0.0217198	1.067567	0.005
EDUC	0.0482508	0.0410566	1.049434	0.240
HHLSZ	0.0059438	0.0699608	1.005962	0.932
LANDS	0.5370418	0.262898	1.710938	0.041
IMPSD	0.6691178	0.2955187	1.952514	0.024
TVFCRP	0.3626813	0.0903502	1.437178	0.000
TVCCRP	0.2756281	0.0799855	1.359273	0.000
IRRIG	0.1254138	0.266556	1.133617	0.638
ACCRDT	0.8852312	0.4268426	2.423545	0.038
ACCTR	0.1120394	0.0463132	1.118557	0.016
TLU	-0.035729	0.5327192	1.028319	0.7532
PANFAR	-0.0443267	0.6725643	1.652277	0.8422

Sample size (N) = 295 Pseudo R2 = 0.1603 Wald chi2 (13) = 40.35 Prob > chi2 = 0.0000 Log likelihood = -171.69517.

The use of improved seed is also one of the factors that affect the participation of farmers in the output market. Of market participant households, 83% were improved seeds users and 17% were non-users. On the other hand, among non-participant farmers, 58% were users and the remaining 42% were non-users. The chi-square test indicated that using improved seeds is one of the factors that determine farmers' participation in the output market. A study conducted by Goitom (2009) revealed that the use of improved seeds enhances the agricultural productivity of smallholder farmers. With enhanced productivity, farmers have a better chance of achieving surplus production for sale. Out of market participant households, 40% used irrigation and 60% did not use irrigation. Similarly, from non-participant households, 98.7 % did not use irrigation and the remaining 1.7% only used irrigation.

The chi-square test indicated that there was no significant difference in the use of irrigation between market-participant households and non-participant households. Irrigation enhances the commercialization of agriculture (Gebreselassie and Ludi, 2010), but in the study area, irrigation is not widely practiced. This may be due to the topography of the area, which is not suitable for irrigation, or the lack of rivers or lakes in the study area.

Table 5. Distribution of estimated propensity score of households.

Group	Observation	Mean	STD	Min	Max
All household	295	0.4983051	0.2244507	0.0735467	0.9999721
Owner	147	0.6013314	0.2109874	0.125952	0.9999721
Non owner	148	0.3959749	0.1881123	0.0735467	0.9691548

Source: Own survey result, (2021).

Of market participant households, 83.7% were members of extension service and 16.3% were not members. On the other hand, out of non-participant households,74.3% were members of extension service and 25.7% were non-members.

The chi-square test indicated that there was no significant difference in membership of extension service between market participant households and non-participant households.

The survey result shows that 81.6% of market participant households had access to credit and 18.4% of market participant households had no access to credit services. On the other hand, 40.5% of non-participant households had access to credit and 59.5% did not have access to credit services.

The chi-square test indicated that access to credit is one of the factors that significantly determine farmers' participation in the output market.

Table 6. ATT estimation result of household commercialization of agriculture.

	Mean			
	Participant	Non-participant		
Outcome	Households	Household	ATT	*P*- value
Annual income	24,580	12,360	12469.1212	0.000

Source: Own survey result (2021).

The survey result shows that 80.3% of market participant households had access to transport and 19.7% of market participant households had no access to transport services. On the other hand, 31% of non-participant households had access to transport and 69% did not have access to transport services. The chi-square test indicated that access to transport is one of the factors that significantly determine farmers' participation in the output market.

Propensity score matching model

This section describes the econometrician analysis, which was applied to identify the impact of commercialization of smallholder agriculture on the welfare of households. It explains the estimation of propensity scores, defining common support regions, choosing matching algorism, testing matching quality and calculating average treatment effect on treated. Sensitivity analysis was also conducted to make sure the result was free from hidden bias.

Estimation of propensity score

The logistic regression result in Table 4 below revealed that there were different variables that determine households participation in the agricultural output market. Age of household head, land size, the total value of food crops produced, the total value of cash crops produced, access to transport, access to credit and use of improved seeds were the factors that significantly determined the probability of participation of households in the market.The odds ratio of land size indicates that a hectare increase in land size increases the odds- ratio in favor of participation in the market by 1.71units.This finding was similar to the report of IFPRI by Chapoto *et al.* (2013) and Jayne and Muyanga (2012) cited in Gutu (2016), most of the agricultural production increases in Africa have been as a result of area expansion and not productivity growth. Empirical work in South Asia by Sharma *et al.* (2012) also found that one of the major constraints faced by smallholder farmers in responding to market-driven commercialization opportunities in the region included small and fragmentation of land holdings. The age of the household head affects households probability of market participation negatively and significantly ata 1% significance level. A study conducted by Workneh and Michael (2002) revealed that age is one of the demographic factors that significantly influence commercialization.

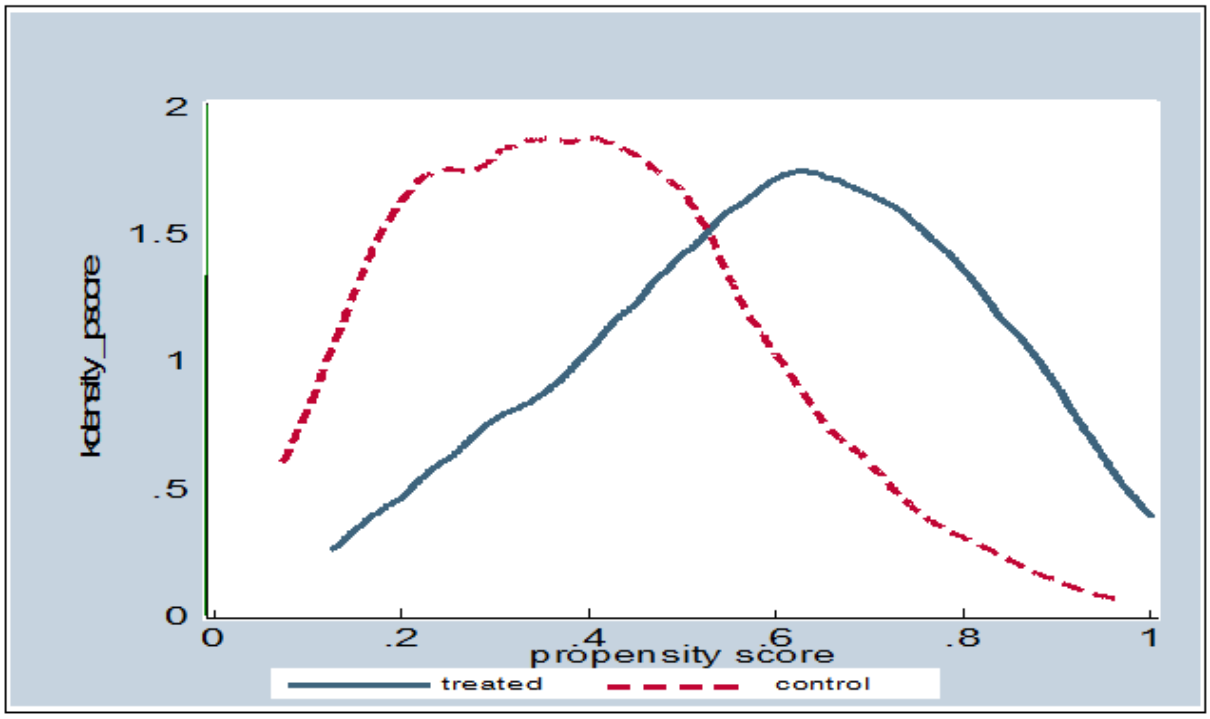

Fig. 1. Kernel densities of propensity scores of market participant and non-participant households.

The odds ratio of the logistic regression result of the total value of food crop indicates that an increase of one birr of the total value of food crop increases the odds ratio in favor of households' market participationby1.44.Similarly, an increase in one birr of the total value of cash crop increases the odds ratio in favor of households market participationby1.35. This result is similar to the findings of the study by Goitom (2009)indicated that as food crop and cash crop production increases by one birr each, total crop

sales increase by birr .25 and .76, respectively. In the same manner, the result of logistic regression shows that the odds ratio favors the probability of participation in the market by afactorof1.95 for those households who have access to transport. This implies that households who have access to transport are more likely to participate in the commercialization of their agriculture than those who have not, keeping the effect of other variables constant .Infrastructure is one of the factors that determine the process of commercialization (Jaleta *et al.,* 2009).A study conducted by Asfaw *et al.* (2010) revealed that distance, poor rural road networks, lack of appropriate transportation facilities and poor communication systems are negatively correlated with marketed surplus because of the increased transaction costs associated with marketing.

The result of logistic regression also shows that the household's odds ratio favoring the probability of market participation for market participant households is greater than non-participants by 1.95 units. This means households who use improved seeds are more likely to participate in the market than non-users. A similar study conducted by Goitom (2009) confirms this result. Similarly, access to credit increases the household's odds ratio favoring the probability of market participation by 2.42units.Thisimpliesthat households who have access to credit are more likely to participate in the output market than those households who have not. Access to credit is a key determinant of the adoption of most agricultural innovations and promotes the adoption of risky agricultural technologies through the relaxation of the liquidity constraint as well as through the boosting of the household's risk-bearing ability (Umali, 1993; Cornejo and McBride, 2002). However financial market in developing countries functions poorly and is less accessible to rural farmers (Awotide *et al.,* 2015). A study by Samuel *et al.* (2020) also showed that credit access stimulates higher commercialization.

The distribution of the propensity score for each household included in market participant and non-participant groups was computed based on the above participation model to identify the existence of a common support region. Fig. 1 depicts the distribution of the market participant household sand non-participant households with respect to the estimated propensity scores. Most of the market participant households were found in the middle and partly in the right and left side, while most of non-participant households were found in the left side of the distribution. The figure also shows that there is a wide area in which the propensity score of both the market participant and non-participant households' weresimilar.

Matching market participants with non-participant households

There are three tasks that should be done before matching market participant households with non-participant households. Estimating propensity scores based on identified explanatory variables for all sampled households is the first task, which was done in the previous section. Imposing common support conditions on the propensity score distribution of households with and without participation is the second task. Discarding observations whose propensity score is outside the common support region is the final task.Table5 below shows the distribution of propensity scores for all households. As shown in the table, the propensity scores vary between 0.125952-0.9999721forthe market participant, with a means core ofo.60. In contrast, the score varies between 0.0735467-0.9691548fornon-participanthouseholds, with a means core of 0.39.Thecommon support then lies between 0.125952- 0.9691548. This means that households whose propensity score is less than the minimum (0.125952) and larger than the maximum (0.9691548) are not considered for matching purposes. Based on this procedure, 12 households (4householdsfrom the market participant group and 8fromthe non-participant group) were discarded from the study in impact assessment.

Fig. 2 below shows the distribution of propensity score and common support region. The bottom halves

of the histogram show the propensity score distribution of non-participant households and the upper halves show the propensity score distribution of market participant households. The red colored (treated on support) and the green colored (untreated on support) indicate the observations in the market participant group and non- participant group that have a suitable comparison, respectively, where as the blue colored (treated off support) and the orange colored (untreated off support) indicates the observations in the market participant and non-participantgroup that does not have a suitable comparison respectively.

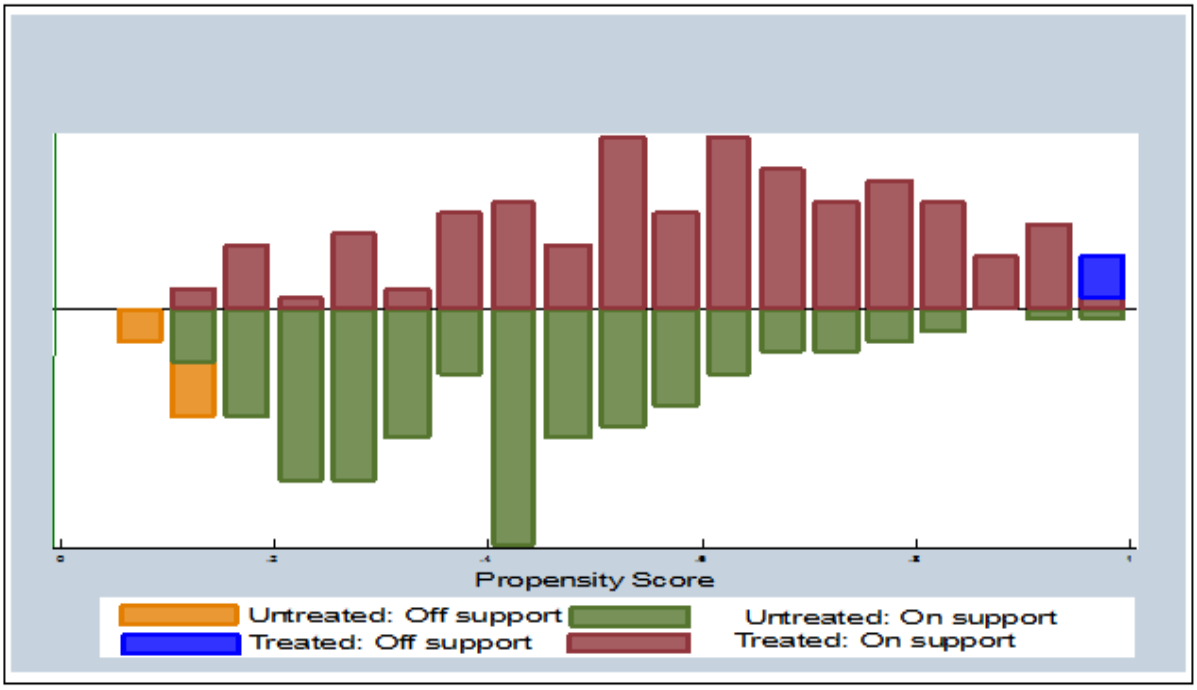

Fig. 2. Propensity score distribution and common support region for propensity score estimation.

Following the identification of the common support region, alternative matching estimators (algorisms) were tried to match market participants with non-participant households in the common support region. The final choice of match in algorism was guided by three criteria: namely, equal mean test (balancing test), pseudo $R^2$and size of the matched sample. Matching algorism, which balances all explanatory variables of groups (resulting in in significant mean differences between market participant and non-participant), bearsa low pseudo R^2 value and results in a large sample size is preferable (DehejaandWahba,2002).Based on those criteria, the nearest neighbor ofneighborhood3 was found to be the best estimator for this study. Therefore, the impact analysis procedure was done and is cussed by using the nearest neighbor ofneighborhood3.

The impact of commercialization on the income of the household

One of the indicators of the welfare of households is an annual income of the household which is expected to be affected by the status of market participants. Table 6 shows that the average amount of annual income is higher for market-participant households than for non-participant households. The ATT indicated in the table shows that market participant households got an average of 12,220Birr per year than non-participant households. The difference in the mean value of income between the market participant households and the non-participant households was positive and significant. Statistically, this was found to be significant ata 1% significance level. This indicates that commercialization has brought a significant and positive impact on the annual average income of households). A study by Goitom (2009)

also revealed that households with a high degree of commercialization have a higher consumption of basic non-grain items (such as sugar, salt, coffee and cooking oil); higher expenditure on shoes and clothes, education, durable goods, and housing.

Conclusion

The main objective of the study was to examine the impact of the commercialization of agriculture in Lemo Woreda of Hadiya zone. The ATT indicated that market participant households' annual average income is greater than non-participants by 12,220 Birr. Moreover, the study also analyzed the factors that determine participation in commercialization using a logit model. Accordingly, thirteen variables were analyzed in the model that was hypothesized to determine households' participation in the commercialization of agriculture. Even though there are efforts to enhance the commercialization of smallholder agriculture, a lot still needs to be done to improve the level of commercialization since the vast majority of smallholders are not well integrated with the market yet.

Notes

Disclosure statement

The authors declare no conflict of interest.

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