Research Article

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The Impact of Agricultural Improvement Intervention Through Market Development on the Livelihoods of Rural Farmers in Ethiopia: A Propensity Score Maching Application

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Abstract: A market development program to enhance production, productivity and income of rural peoples was jointly implemented by the government and NGOs in rural Ethiopia from 2009 to 2012. It was claimed to be successful on different occasions creating an interest among policy makers, development practitioners and researchers to quantify the impacts of the intervention. Accordingly, in 2013, data were collected from a total of 201 farm households comprising both participating and non-participating but comparative groups of farm households. The current study aimed at answering the questions of what changes were brought in the organizational and institutional aspect of the agricultural input/output marketing in the pilot implementation areas as a result of the intervention had not been in place. Using Propensity Score Matching (PSM), after controlling for the initial differences, the result of our impact estimate revealed that the program significantly raised the intensity of input use, productivity, commercial orientation and proportion of sales of most of the commodities of intervention for participant households leading to a significant increase in cumulative net income by about 10%. Although the results have shown that the program had succeeded in achieving the ultimate objective of the program, further research is recommended to elicit information on how the benefits were distributed among the different categories of participants and the relative contribution of each commodities of intervention to the outcome variables.

Keywords: Impact, Market Development, PSM

Introduction

The recent move towards the liberalization of foreign direct investment in developing countries and the subsequent structural adjustment programs in many Sub-Saharan African countries have liberalized their economies and formulated poverty reduction strategies that are intended to open-up new marketled opportunities for economic growth. Like many developing countries, Ethiopia has undergone several structural adjustment programs in the past few decades that aimed at bringing economic growth thus reduce poverty. A pillar of the country's recent rural development strategy has been the active promotion of marketing cooperatives as a means of commercializing smallholder agriculture.

The recently formulated strategy of the country has emphasized on the transformation of subsistence agriculture into market oriented patterns of production as a basis for long-term development of the agricultural sector. Currently, several programs are under way both by government and nongovernment institutions so as to realize the strategy. In view of this, the regional research institute and government of Oromia initiated a joint program on introduction of improved agricultural technologies and input/output marketing to facilitate the development of marketable commodities implemented from 2009 to 2012.

The project focused on the value chain approach by encouraging the involvement of actors along the value chains so that the experience generated would be scaled up to similar areas in the region. Kofale district of the Arsi Zone was selected based on its potential for the selected commodities of interventions which includes inset and fruit cultivation, apiculture and fattening implemented as a pilot project primarily to raise the income level of participant households through market development. The current study seeks to answer two research questions; what changes were brought in the

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Wole Kinati (Correspondence) wolekinati@gmail.com institutional aspect of agricultural input/output marketing in the pilot district as a result of the intervention? And what would have been the market orientation, participation, productivity and income outcomes of participating households if the intervention had not been in place?

Research Methodology

Data Sources, Sampling and Collection Techniques

The study used both qualitative and quantitative data collected from secondary and primary sources. Secondary data related to the study were collected from project reports, Zonal and regional offices of Agriculture and Rural Development and APEDO of the pilot zone. Whereas primary data were collected from randomly selected farm households from both participants and non-participants using formal survey by the project staff.

In doing so, all the five pilot kebels where the project implemented and another five Kebeles outside the project area within the same pilot district were selected as control based on their similarity in socioeconomic and agroecological characteristics with the target kebeles. Moreover, in selecting the control kebeles, their accessibility to main road and agricultural extension services, and their potential opportunity for the specific commodity of intervention were considered. In addition, their geographical location (non-adjacent kebeles) was taken into account so that information flow from participant to non-participant kebeles minimized. Following the identification of the participant and eligible non-participant, a total of 201 farm households (100 from participant and 101 from nonparticipant households) were randomly drawn based on probability proportional to sample size. In the months of February and March, 2013, the project staff administered the same structured questionnaire to the selected participant and non-participant households in order to collect data on a variety of topics.

Using the structured questionnaire, information on outcome variables and different topics that include household resource endowments, access to agricultural and markets services, and demographic characteristics of the respondents were collected from both groups. In addition to the data collected by the questionnaire, use of structured informal communications through telephone and e-mails was made with project staff, district and kebele experts, and representatives of farmers' associations in order to generate additional information that was useful to understand and better describe the overall project situations and enrich the interpretations of the result of qualitative analysis.

Analytical Methodology

The qualitative information generated from secondary sources and informal interviews on changes in the institutional aspect of agricultural input and output marketing in the district as a result of the intervention were narrated and described qualitatively. These results from the qualitative analysis were also used to supplement the results from the quantitative analysis. Moreover, descriptive statistics such as mean, standard deviation, percentages and cross tabulations were used in analyzing the data collected through formal surveys by employing SPSS.

In order to deal with the research questions at hand, a non-experimental method called propensity score matching (PSM) was employed as the best alternative analytical method available to estimate the impact of the intervention based on the available data at hand. We selected PSM among the available nonexperimental methods because of three reasons: (1) baseline date was not available for the project, (2) treatment assignment was not based on random, and (3) PSM is assumed as the second best alternative available to that of experimental design in minimizing selection bias (Baker, 2000).

Using the propensity score estimated by the use of logit model, match pairs are constructed using alternative kernel matching algorithms which was found to be suitable for the data at hand. Then the impact of an intervention was computed as the difference between the simple mean of the outcome variable of interest for participant and non participant households. Accordingly, ATT is obtained by averaging these differences in outcome variable/s (Y_i) across the *k* matched pairs of households as follows:

$$ATT = \frac{1}{K} \sum_{i=1}^{K} [Y_i^{i \in D=1} - Y_i^{i \in D=0}]$$

The result computed by this equation can be taken as the impact of the program and hence a positive or negative value of ATT suggests that participant households have higher or lower of outcome variable Y_i than non-participants.

Choice of Variables for Logit Model, Indicators of Outcome Variables and thier Measurment

In general, the choice of covariates for the propensity score model should be based on theory and previous empirical findings (Black and Smith, 2004; Heckman et al, 1998). It is suggested that only variables that affect simultaneously the treatment status and the outcome variable need to be included (Sianesi, 2004).

Given that unconfoudedness assumption¹ requires the outcome variable(s) to be independent of treatment assignment conditional on the propensity score and thus one must choose a set of covariates that credibly satisfy this condition. In other words, only variables that are unaffected by treatment need to be included in the model. To ensure this, therefore, variables should either be fixed over time (time invariant) or measured before participation. For the current study, since there have been no data available before intervention for the program, only time invariant household characteristics were feasible to include in the model and hence variables that are fixed over time were used.

In the current study, four variables were considered as outcome indicators. These are productivity, market surplus, net income and proportion of resources allocated (as indicators of market orientation).

Intensity and productivity is measured by the quantity of inputs used for the market oriented commodities of interventions and the ratio of a measure of total output quantity to measure of the quantity of total input (Liverpool-Tasie et al, 2011). The project has facilitated input supply by engaging and supporting the different actors so that participant households had access to agricultural inputs which are very important to increase productivity. Households required extra labor in addition to the family labor for specific commodities like *inset* especially during peak season (like harvesting). Therefore, for this particular commodity, the intensity of labor use was measured using person days.

Marketed surplus, according to Wolday (1994) is the quantity of a commodity actually sold in the market without meeting farmers' consumptions and utilization requirement. The project intervention is expected to improve the quantity of produce taken to the market and this market surplus was measured as the percentage increase in volume. Household net income is the net income generated as a result of household's participation in the program and measured in Birr. It is the difference between the total revenue and the total cost incurred by the household for the generation of that revenue for the commodities of intervention. Following the approaches adopted by Berhanu and Dirk (2009), the proportion of land allocated for specific commodities, possession of improved bee hives for apiculture and the number of sheep allocated for fattening were used

to estimate the impact of the program on the market orientation behavior of participant households.

Results and Discussion

Institutional Arrangements

Involving and linking value chain actors along the value chain

The project facilitated and supported the involvement of these actors along the value chain to enable them play the important different roles that support target households so that farmers had improved access to a variety of services so that their agricultural production and productivity could be improved; thier market involvement would be enhanced and ultimately thier income level would be raised. It was observed from the interview held with key informants, there were better involvement of key stakeholders along the value chains of commodities of intervention which resulted in better production and productivity improving income levels of participant households. The different stakeholders involved and the roles they played during the intervention as reported and witnessed by district experts and farmers' representatives was summarized below in Table 1.

¹ The unconfoudedness assumption states that conditional on X, non-participant outcomes have the same distribution that participants would have experienced if they had not participated in the programme and vice versa (Caliendo and Kopeinig, 2008).

Stakeholders	Role and responsibilities	Types of commodities supported	Level of thier involvement
Kebele administration	Mobilize farmers, facilitate linkage between farmers and other supporting actors, support learning and experience sharing events	All target commodities	High
District office of agriculture & rural development	Provide technical support, support other actors involved in the program, facilitate and support different activities useful to farmers	All target commodities	High
Research centers	Provide training, technical backup, basic improved technologies and host experience sharing tours/visits	All target commodities	High
Livestock Development Agency	Provide technical support and market information	Small ruminant fattening and apiculture	Medium
Concentrate feed & by- product suppliers	Supply concentrates feed to farmers engaged in fattening activities	Small ruminant fattening	High
Public & private veterinary service providers	Provide veterinary services to target households facilitated by development agents	Small ruminant fattening	Medium
Local saving and credit groups (informal)	Provide financial services to target households and needy private traders involved in the value chain facilitated by the project	All target commodities	High
Village level input suppliers (private)	Supply locally produced important agricultural inputs demanded by target households	All target commodities	High
Local honey traders	Buy honey from target households and sell to other middlemen or supermarkets	Apiculture	Medium
Local carpenters and foundation sheet sellers	Construct improved bee hives and produce foundation sheet supported by experts from research centers and sell to beekeepers	Apiculture	High
Farmer cooperatives	Provide different inputs demanded by farmers & collect and market products from members with premium price	All target commodities	High
OCSSC	Provide credit services and financial management trainings to target households	All target commodities	Low

Table 1. Types and roles of stakeholders involved along the value chains of commodities of intervention

Source: Own based on online consultation with OBoARD and Kebele leaders, farmers' representatives and secondary sources

However, although the project creates business opportunities for small scale traders so that target households' access to agricultural inputs would be improved, peer group collateral arrangement hampered revolving of credit funds as a result of delayed loan repayment by some of the traders. They also not well aware of the working principles that OCSSC follows in providing credit services. Hence, some of the traders quit their work affecting farmers' access to the inputs as the district officials witnessed (online interview, 13 July 2013). Reducing the size of collateral group to optimum number, looking for other options as alternative to group lending, for example encouraging and introducing private saving could be explored. Moreover, in order to improve the linkage between the organized small scale traders, financial service providers and other actors in the system, integrating saving and credit and financial management trainings into rural financial service provision is essential.

Enhancing farmers' capacity

In order to enhance the production and productivity of the target households, the project recognized the importance of continued capacity building through different means. Accordingly, different trainings on a variety of topics were facilitated and organized throughout the project life. As part of capacity building, several experience sharing and study tours were also conducted for selected farm households so that they were later used as resource farmers for their community to teach other farmers in their vicinity. Research centers were used as the main actors in this regard. Apart from providing improved technologies,

they involved in the capacity building programs of the project by sending trainers and technical advisors throughout the training programs. As a result, target households were benefited from the training programs in the course of exercising the application and use of new technologies (OBoARD, 2013).

Emperical result

The descriptive analysis of the effect of the program on outcome variables suggests that participant households performed much better in most of the outcome variables (look at Annexes Table 5). However. similar analyses of household characteristics revealed that there are also substantial differences in the underlying characteristics of participant versus non-participant households. Therefore, based on a simple comparison of means without controlling for these differences, it is impossible to identify causality and to attribute the observed differences in all the outcome variables to the impact of the program. Hence, in the subsequent sections we presented an econometric analysis that was used to estimate the causal impact of participation in the program mainly on household productivity, market orientation and participation, and income outcomes.

Estimating treatment effect on the treated

The results of our estimate of the impact of agricultural improvement intervention through market development after controlling for observable confounding factors suggest that the program was found improving intensity of input use, productivity, commercial orientation and proportion of sales of most of the commodities of intervention for participant households eventually increasing their income (Table 2). Specifically, we found a statistically significant program effect for intensity of input use for inset cultivation and small ruminant fattening (P<0.01). This result is in line with the findings of Deschamps-Laporte (2013) and Mendola (2006). In the context of the study area, input used for these program activities, inset cultivation and small ruminant fattening, was mainly accessed by program participant households through marketing from other sources facilitated by the program. This means that the program has improved the average use of these inputs for participant households. Moreover, as argued by Goetz (1992), is being a net buyer in the market determine the extent of once market participation. Higher market participation drives more productivity by providing incentives for the households (Reardon and Timmer, 2005).

Similarly, the empirical analysis for the productivity of commodities of intervention for which data is available suggests that there is statistically significant difference between participant and non-participant households. The program was found improving the productivity of inset and honey by about 12% and 9% for participant households respectively (P<0.01 and P<0.1). The result for *inset* productivity is, of course, in line with one's expectation as the previous results of input use for this particular commodity is significantly higher for participant than that of nonparticipant households. However, the striking result for the productivity of honey for which there is no statistically significant difference in terms of input use between the groups might be attributed to the difference in management practices between them as a result of the simultaneous capacity development intervention for participant households as discussed under the qualitative analysis section.

In the same way, our analysis also clearly demonstrated that the program had a significant and posetive effect on the quantities of produce taken to the market for *inset*, honey and fattend small ruminants. More specifically, participant households increased the proportion of their produce marketed on average by 4%, 12% and 18% respectively for the indicated commodities of intervention. This implies that the program enhenced target household's participation in the market as a result of higher productivity.

Based on the concept of commercialization measurement which states that commercialization can be measured in terms of the degree of allocation of the different resources such as labor and land to competing agricultural activities and total sales of agricultural commodities (Keister and Nee, 2001), we measured the effect of the program on the level of households' commercialization by comparing these indicators between the two groups. Accordingly, our estimate revealed that the program has achieved improving the levels of resource allocated to and possession of market oriented commodities. More precisely, the program helped participant households to increase the allocation of land and small ruminant for market oriented activities by about 14% and 44% respectively while improving the possession of improved beehives by about 30%. The result is also significant at a 1% and 10% probability levels respectively (Table 2). Households' decision to increase resource allocation and possession of commercial oriented resources, in this case, could be stimulated due to market signals as a result of their improved access to market facilitated by the program (Berhanu and Dirk, 2009; Pingali, 1997). Moreover, the involvement of relevant actors across the value chains as depicted by the results of our qualitative analysis could also be part of the reason.

Table 2. Estimated ATT for the outcome variables							
		Nonparticip					
Outcome variables	Participant	ant	Difference	S.E	t-value		
Intensity of Input use							
Intensity of labor use for inset							
cultivation (PD)	108.677	89.6455	19.0319	6.363	2.99***		
Additional tools used for inset							
cultivation (No.)	3.3596	1.0484	2.3112	0.159	14.51***		
Value of input used for apiculture	62 1020	56 5250	5 6590	20 56	0.20		
(DIII) Quantity of cotton meal used for	02.1950	30.3330	5.0580	28.30	0.20		
fattening(Kg)	97.6136	3.7869	93.8268	8.984	10.4***		
Value of input use for fattening (Birr)	847.024	83.6408	763.3839	91.13	8.4***		
Value of input use for fruit(Birr)	61.4944	56.2478	5.2466	28.44	0.18		
Productivity							
Productivity of inset (Quintal/ha) Productivity of improved hives	1413.15	1242.827	170.3203	70.21	2.43**		
(Kg/hive)	28.468	25.7934	2.6754	1.477	1.81*		
Commercial Orientation							
Land allocated for inset (%)	0.6713	0.5754	0.0960	0.040	2.39***		
Possessions of improved hives (%)	0.4270	0.2987	0.1283	0.074	1.73*		
Sheep allocated for fattening (No.)	5.2830	2.9711	2.3120	0.427	5.41***		
Proportion of sales							
Sale of inset (%)	0.8232	0.7812	0.0420	0.012	3.41***		
Sale of honey (%)	0.6981	0.5832	0.1149	0.040	2.89***		
Sale of fattened small ruminant (%)	0.9433	0.7573	0.1827	0.052	3.54***		
Sale of fruit seedling (%)	0.5815	0.5702	0.0112	0.278	0.04		
Average net income							
Total net income	5757.38	5200.388	556.9964	94.65	5.9***		

*Note: ***, ** and * means significant at the 1%, 5% and 10% probability levels, respectively Source: Own calculation based on the survey data*

As stated earlier, the ultimate objective of the current program under consideration was to improve the income of participant household from increased participation in the production and marketing of commercial oriented agricultural inputs and outputs. Based on the available data, we measured the impact of the program on the income of participant households. Accordingly, the result of our estimation indicated that the program has significantly increased the cumulative net income of households who participated in the program by about 10% (P<0.01). This finding was consistent with the findings reported by Egziabher et al (2013) who evaluated the impact of the IHEP program on the income of participant households in the northern part of Ethiopia and reported similar results. The effect of the program on net income of participant households is, of course, in line with one's expectation since the program succeeded in significantly improving the levels of input use, resource allocation, productivity, and market participation of its target households.

Conclusion and Recommendation

This study provides crucial insights into and important evidence on the impact of agricultural improvement interventions through market development on the livelihoods of farmers in rural Ethiopia using cross sectional data collected in the beginning of 2013. Using matching estimator, the study evaluated the program implemented jointly by the Regional Bureau of Agriculture and Research Institute between 2009 and 2012.

The qualitative analysis has shown that the program has improved the linkages and interaction among different actors along the value chains of the commodities of intervention. By doing so, participant households' access to different agricultural inputs and outputs marketing services have been enhanced although the level of involvement and service delivery by some of the actors (like OCSSC) are not satisfactory as pointed out by respondents as a results of the institutional arrangements in place.

After controlling for these initial differences, our impact estimate using PSM suggested that the program significantly raised the intensity of input use, commercial orientation, productivity, and proportion of sales of most of the commodities of intervention for participant households eventually increasing their income. Although the results of our impact estimation confirmed that the program had succeeded in improving the income level (the ultimate objective of the program) of participating households, further evidences are required that elucidate how the benefits were distributed among the different categories of participants like poor, rich and women within the targeted households. As evidences from literature pointed out that there are firm criticizes about the popular understanding that assumes participation of the poor in development interventions ensures equitable benefit (Cleaver and Hamada, 2010). Similarly, it is also interesting to investigate through further research the reason behind why households with relatively large family size are less likely to participate as this study revealed. Moreover, it is also apparent that further study is required with sufficient sample size to explore the relative contribution of each commodities of intervention that might help the regional government in order to consolidate efforts in the course of extending the experience of the program as the current study did not capture these due to lack of data. Finally, it is also worthy revisiting the institutional arrangements adopted by rural financial institutions like OCSSC to further enhance households' access to financial services.

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Annex

Projec	t targeted Kebeles			Non	-targeted (Control) Keb	oeles	
Sample Kebeles	Participant	Ν	%	Sample	Total eligible HHs	Ν	%
-	HHs			Kebeles	-		
We/Bendelichu	131	16	16	Garmama	1882	32	32
Ro/Ashoka	270	31	31	Wamanye	1200	21	21
				Alkeso			
We/Abosa	233	28	28	Quma Mamo	1313	23	23
We/Wolu	151	18	18	Abosa	918	16	16
				Adamonye			
Benjo Ashoka	56	7	7	Guchi	544	9	9
Total	841	100	100	Total	5857	101	101

Table 1. Sample size by Kebele

Table 2. Variables used for Logit Model

Variables	Description	Types and Measurements
Dependent variables		
TYPFRMER	Participation in the intervention	Dummy, 1 if yes, 0 otherwise
Independent variables		
SEXHH	Sex of the respondent	Dummy, 1 if male, 0 otherwise
AGEHH	Age of the household head	Discrete, in years
EDULVLHH	Education level of household head	Dummy, 1 if read and write, 0 otherwise
TOTLFMSZ	Total family size of the household	Discrete, number of household members
EXPFRMG	Farming experience of the household head	Discrete, in years
SZEOWNLN	Total land owned	Continuous, in hectare
DISTMKTN	Distance to the nearest market	Continuous, in kilometers
DISTEXTO	Distance to extension office	Continuous, in kilometers

Table 3. T-test for equality of means between groups (continuous variables)

HH characteristics	Participant		Nonpa (1	Nonparticipant		Difference in means	
	Mean	STD	Mean	STD	Mean	STD ²	_
Age of HH head (years)	43.95	8.710	44.090	7.482	-0.139	1.145	-0.121
Total family size	5.240	2.046	6.390	2.249	-1.146	0.303	-3.78***
Farming experience of HH	22.71	6.927	22.850	6.842	-0.141	0.971	-0.146
head (in years)							
Size of ownd land (ha)	1.213	0.950	1.024	0.643	0.194	0.115	1.688*
Distance from market center (km)	1.500	1.518	2.376	1.996	-0.876	0.250	-3.51***
Distance from extension office (km)	2.306	1.297	3.452	1.722	-1.147	0.215	-5.34***

Note: *** and ** means significant at the 1%, 10% probability levels, respectively (t-test is used for differences in means)

² STD for mean difference = $\sqrt{\frac{STD_1^2}{N_1} + \frac{STD_2^2}{N_2}}$

HH		Participant		Nonpart	Nonparticipant		Total	
characteristics	Category	Ν	%	Ν	%	Ν	%	
Sex of HH head	Male	90	90	84	84	174	87	2.017
	Female	10	10	17	17	27	13	
Educational level of HH head	Can read & write	94	94	87	87	181	90	3.47***
	Cannot read & write	6	6	14	14	20	10	

Table 4. Chi-square test for equality of proportions between groups (dummy variables)

Source: Own calculation based on the survey data

	Table 5. t-t	est for eq	uality of me	eans between	groups for	outcome variables
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Outcome variables	Participant households		Nonparticipan	t-test	
	(N=100)		(N=101)		
	Mean	SE	Mean	SE	t-value
Intensity of input use					
Intensity of labor use (PDa) for inset	107.4900	2.9200	91.2400	4.6900	2.937***
Additional farm tools used for inset cultivation (No.)	3.3100	0.1270	1.1300	0.0820	14.457***
Value of input used for apiculture (Birr)	122.5300	24.9840	65.4000	25.6580	1.5950
Quantity of cotton meal used for fattening(Kg)	89.4900	8.5810	4.1600	1.5870	9.779***
Value of fattening input use (Birr)	776.8820	81.7204	78.2720	26.3108	8.137***
Value of input use for fruit (Birr)	68.4800	19.3130	58.6100	17.2420	0.3810
Productivity					
Productivity of inset (Quintal/ha)	1435.740	58.7620	1291.030	33.3900	2.141**
Productivity hives (Kg/hive)	28.2400	0.7870	25.5800	0.8610	2.278**
Commercial orientation					
Land allocated for inset (%) Possessions of improved hives	0.6694	0.0301	0.5988	0.0192	1.979**
(%)	0.4200	0.0500	0.3000	0.0460	1.823*
Sheep allocated for fattening (No.)	5.3500	0.2570	3.5700	0.3380	4.208***
Proportion of sales					
Sale of inset (%)	0.8235	0.0081	0.7853	0.0070	3.556***
Sale of honey (%)	0.7186	0.0255	0.5839	0.0225	3.959***
Sale of fattened small ruminant (%) Sale of fruit seedling (%)	0.94333 0.08	0.01177	0.75148 0.09	0.03587 0.021	5.082*** -0.255
Average net income					
Total net income	5778.02	47.58	5196.06	66.67	7.105***

Note: ***, ** and * means significant at the 1%, 5% and 10% probability levels, respectively (t-test are used for differences in means), ^a person days

Variable	Obs	Mean	Std. Dev.	Min.	Max.	
Total	201	0.498	0.247	0.025	0.970	
Participant	100	0.617	0.210	0.134	0.970	
Nonparticipant	101	0.379	0.220	0.025	0.863	

Table 7. The balancing test before and after matching

Variable	Bej	fore matching	r	After matching			
	Treatment	Control	t-value	Treatment	Control	t-value	
Continues Variables							
pscore	.62652	.62166	0.17	.58011	.48711	1.23	
Age of HH head	43.911	43.376	0.47	43.292	43.568	-0.14	
(III years) Total family size (No.)	5 2376	5 0801	0.44	5 4607	5 0287	0.51	
Farming experience of HH	22.723	22.713	0.01	22.191	22.441	-0.07	
head (years)							
Size of owned land (ha.)	1.2122	.95911	2.15**	1.0873	1.0602	-0.20	
Distance from the nearest market center (km)	1.4851	1.4554	0.13	1.5899	1.9489	-0.63	
Distance from extension	2.298	2.296	0.01	2.4674	2.8464	-0.85	
office (km)			1			2	
Dummy Variabels	Treatment	Control	X^2	Treatment	Control	X^2	
Sex of HH head (%)	.90099	.86139	0.87	.89888	.86293	0.26	
Educational level of HH	.94059	.9505	-0.31	.93258	.92962	-0.11	
head (%)							

Note: ** means significant at the 5% probability level

Source: Own calculation based on the survey data