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Primary Producers' Cooperative as Marketing Strategy to Increase Income of Small Scale Farmers: A Case Study on Potato Seed Tuber Jeldu District of West Shewa Zone of Oromia, Ethiopia

Getachew Biru*
Agricultural Socio-economic Researcher Bako Agricultural Research Centre, Bako, Ethiopia

Jemma Haji
Associated Professor, Haramaya University, Haramaya, Ethiopia

Abstract
The study presents the role of primary producers' cooperative as marketing strategy to increases small scale farmers income from their produce. The primary data from Jeldu district of west Shewa zone of Oromia regional state was generated from 120 randomly selected small scale farm households. These randomly selected farm households were drown from two groups: seventy one of them were selected from cooperative members group and the rest forty nine of them were selected from non cooperative members of potato seed producers. The analysis was made using descriptive statistics and econometric model using STATA software version 10. Descriptive analysis made for income; which was generated from potato seed tuber marketing, shows differences among cooperative participants and non participants small scale farm households in potato seed tuber marketing. Heckman two stage models was employed to identify factors affecting participation in cooperative of small scale farm households and the extent of effects of these factors on gross income from potato seed tuber of participant. Accordingly, the result of first stage Heckman two model shows that, family size, proximity to market centre, farming experience, land allocated for potato seed tuber and extension service were key determinants of choice of participation in primary producers' cooperative. In the second stage of the two stage model, proximity to market, land allocated for potato seed tuber, family size and extension service were found to influence gross income of primary producers' cooperative participants of small scale farm households. Therefore, policies intended to increase farmers' access to market, developing and improving market infrastructures, strengthening exiting cooperatives, establishing and encouraging participation in primary producers' cooperative and improving extension service system could be recommended to more increases income from their produce.
Keywords: potato seed tuber, potato and Heckman treatment model.

Introduction

The development of Ethiopian economy is heavily dependent upon the speed with which agricultural growth is achieved. This is because agriculture is the basis of the country's economy therefore; this economy is highly influenced by the performance of the agricultural sector. The rate of agricultural growth in the country in turn depends on the speed with which the current subsistence oriented production system is transformed into a market orientated production system (Berhanu *et al.,* 2006)

Cognizant of this fact, the current government of Ethiopian believed that agriculture is the starting point for initiating the structural transformation of the economy and formulated the current Agricultural Development Led Industrialization policy (ADLI). This policy emphasizes on modernizing smallholder agriculture and intensifying yield productivity through the supply of appropriate technology, certified seeds, fertilizers, rural credit facilities and technical assistance on full package technology. Inauguration of a nationwide agricultural extension program, transmission of laws that liberalized procurement and distribution of inputs (fertilizers and certified seeds), and efforts to increase and avail rural credit facilities for farmers were some components of this policy to enhance production and productivity of agricultural sector economy of the country (FSS, 2002).

In addition to the above mentioned polices, the government of Ethiopian gives emphases on promoting the development of the market oriented production and developing different marketing strategies. Among those different marketing strategies, forming primary producers' cooperatives to enhance bargaining power of small scale farm households has got priority attention; therefore, different non-government organization and cooperative promotion agency of government body has been working to establish and strengthening these cooperative.

Therefore, this paper is going to investigate the contribution of cooperative marketing to the increment of income of cooperative participant of small scale farm households. The work was through by considering cooperative participants and non-participants of small scale farm households of Jeldu district West Shawa Zone of Oromia regional state on marketing of potato seed tuber. The objectives of this study were to identify factors affecting primary producers' cooperative marketing participation and its effect on gross income of participation of cooperatives.

The study was undertaken in central highland of Oromia regional state Ethiopian, where potato seed tuber has been among the cash crop. Jeldu district, which is located at 72km to the east of Ambo (Zonal town) and 115 Km west of Addis Ababa, was the target district for this study. The district is characterized by its mountain, plateau, and hills and has three types of soil type such as nitosol, veritisol and sandysol. According to the data from Agricultural Development Office, the elevation of the district on average is 2800m and gets rainfall of the highest and the lowest 2000mm and 900mm annually respectively. The district comprises mixed farming zones where crops are grown for food and cash, and livestock are kept for complementary purpose, as a means of security during food shortage, and to meet farmers' cash needs. The dominant crops grown in the district are ware potato, potato seed tuber, wheat, barley, teff, sorghum, maize, field beans, peas, chickpeas, and potato, sweet potato, onion, garlic, enset etc.

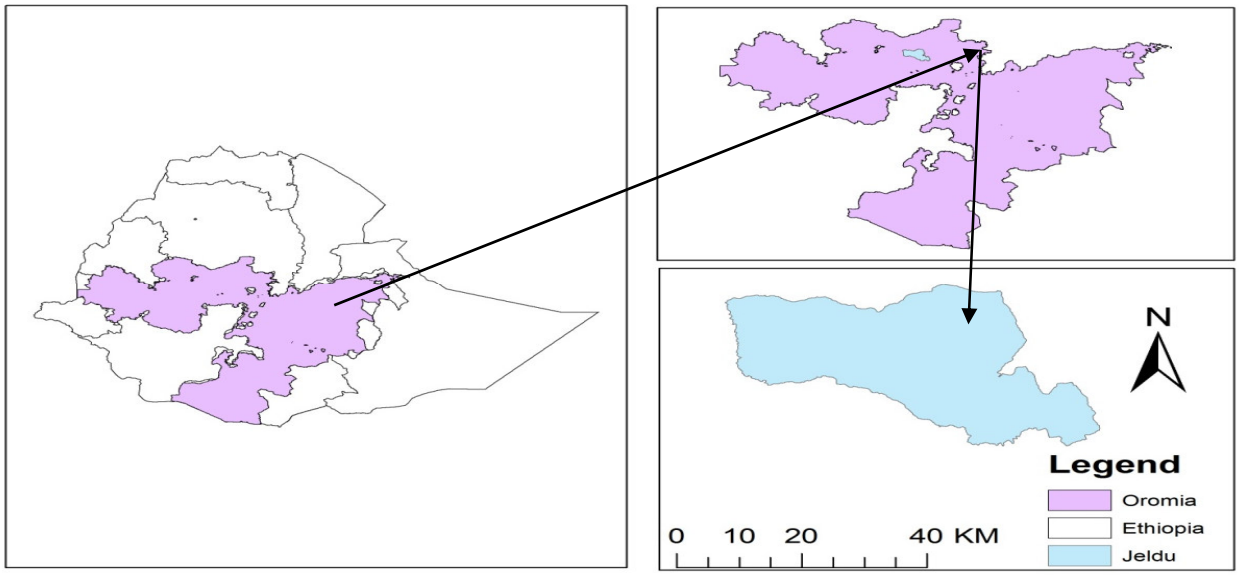

Figure 1. Geographical location of the study area

The study was used information on different variables such as data on potato seed tuber production, potato seed tuber marketed, prices of potato seed tuber supplied, and distance to district market, distance to all weather roads, age of the household head, extension service, educational status of the household head, family size, access to market information, credit facility, and etc which were generated from small scale farm households. The survey was undertaken through formal interviews from randomly selected small scale farm households both from cooperative members and non-members.

For this study, in order to select a representative samples that should represent the population and meet the objective of the study a multi-stage sampling technique were implemented. In the first stage, with the consultation of the district agricultural experts, development agents and local seed business project in Jeldu, out of 38 PAs 4 highland representative PAs in which the major two inclusive primary producers' cooperative on potato seed tuber production and marketing were selected purposively. In the second stage, from purposively identified or selected 4 PAs, small scale farm households producing potato seed tuber were stratified in to participants of primary producers' cooperative and non-participants of primary producers' of potato seed tuber. In the third stage, from the identified or selected 4 PAs and stratified farmers 48, 28, 27 and 17 sample farmers were selected each randomly using probability proportionality to size from those PAs.

Different data analysis techniques were employed for this study, accordingly the use of ratios, percentages, means, range, variances and standard deviations, were used for descriptive analysis. Econometric method was employed to identify factors affecting participation of small scale farm households in cooperative marketing and effect of factors on gross income from potato seed tuber of participants of those farmers. Since non-members have no gross income from primary producers' cooperatives being no way to sale their seed to cooperative and not get price advantage, but the members of primary producers' cooperative have gross income which is different from the non members of primary producers' cooperative by supplying their potato seed tuber to primary producers' cooperative that offers high price for the members which non members didn't offered. Here self-selection bias arises here, from dropping non primary producers' cooperative members therefore, heckman two step model was employed for this study.

Heckman two step showed the bias that results from using non-randomly selected samples to estimate behavioral relationships and developed a two-stage estimation procedure to correct for self selection bias (Wooldridge, 2002). The first step of the two-step approach runs a probit model type of marketing participation or channel choices using all the observations. Then it was used to calculate the inverse Mills ratio term, which in

turns controls for selection bias and the parameters were estimated by maximum likelihood methods.

In the second stage, the outcome equation is estimated by ordinary least squares where the outcome equation includes both the original X_i whose coefficients were the parameters of the first stage model and value of the inverse Mills ratio. The technique employed in this study is presented as follows:

$P_i^* = \gamma\omega_i + \varepsilon *$ (1)

$Y_i = \beta X_i + \delta P_i + \varepsilon 2_i *$; is observable if $P_i^* > 0$ (2)

Where

P_i^* is a latent (unobservable) variable representing farm household discrete decision whether to participate in primary producers' cooperative or non participation in primary producers' cooperative which has a dichotomous P_i realization so that $P_i = 1$ if farmers participate in primary producers' cooperative and $P_i = 0$ otherwise) hence;

ω_i *a*re the variables determining participation in the probit model,

γ is unknown parameter to be estimated in the probit regression model,

Y_i is a gross income of farmers due to participating in primary producers' cooperative,

X_i are the explanatory variables determining the gross income from potato seed tuber supply to primary producers' cooperative

β is unknown parameter to be estimated in the gross income from potato seed tuber supply to primary producers' cooperative,

δ is a parameter that shows the effect of participation choice on the gross income from potato seed tuber supply to primary producers' cooperative and

$\varepsilon *$ and $\varepsilon 2_i *$ are random error terms for the first and the second stage respectively.

Results

Socioeconomic characteristics of sample household

Age of the household head of sample respondents ranged from 18 to 70 years with mean of 37.13 years and standard deviation of 10.17. The average ages of cooperative member and non-member was found to be 37.48 and 36.61 years with the standard deviations of 9.32 and 11.36, respectively. The mean difference, i.e., 0.46 was found to be statistically insignificant among cooperative members and non-members (Table 1).

The man equivalent (ME) of the economically active family labor (16-64 years) was calculated for the sample respondents based on Bekele, (2001) as depicted under Appendix table 1. The average number of economically active labor force for cooperative member and non-members were 3.22 and 2.94, with standard deviations of 1.56 and 1.99, respectively and that of the total sample was 3.12 with a standard deviation of 1.75. The size of labor force in the household is expected priori to contribute for productivity of potato tuber seed. However, in this study significant difference was not observed with regard to the size of labor force between cooperative member and non-members (Table 1).

Family size of the sample respondents ranged from only one (single farmer) up to 14 persons, with an average family size of 6.58 and a standard deviation of 2.70. The average family size in the sample was higher than the average family size of the district which was 6.06 (CSA, 2008). The average family size of the cooperative members and non-members was 7.15 and 5.73, with standard deviations of 2.63 and 2.56, respectively and with mean difference of 2.92 that was found to be statistically significant at 1% (Table 1).

The respondents' average experience in potato seed tuber production for market was 4.38 years with standard deviation of 2.34. Furthermore, the average farming experience of cooperative was 5.05 years with standard deviation of 2.51, while for the non-members was 3.36 with standard deviation of 1.63. The mean difference, 4.09, in farming experience was statistically tested and it was found to be significant between cooperative members and non members at 1% (Table 1).

When we look at the distribution of means of years of schooling, the total average educational level was 5.90 years of schooling with standard deviation of 3.48. The mean educational level of cooperative member was 6.10 years and that of non members was 5.61 years with 3.42 and 3.58 standard deviations respectively. The study hypothesized those farmers who had higher education level show keenness to grasp new ideas and to try to be a member and exploit the market advantage through membership. This could explain the variation with regard to membership decision of cooperative. But, in this study it was found that there exists insignificant difference between cooperative members and non members in relation to education level.

Table1. Sample respondents' age, family age groups and size, labor availability, farm experience on potato seed tuber and years of schooling

Variables	Cooperative members		Non-members		T- value	Total sample	
	Mean	Std. Dev.	Mean	Std .Dev.		Mean	Std .Dev.
AGH (in years)	37.48	9.32	36.61	11.36	0.46	37.13	10.17
0 – 10	2.99	1.33	2.23	0.86	3.35	2.69	1.22
11 – 15	1.83	.89	2.00	1.10	0.70	1.89	0.97
16 – 60	3.48	1.69	3.27	2.11	0.60	3.40	1.87
ME (active labor)	3.22	1.56	2.94	1.99	0.86	3.12	1.75
>60	1	0	1.2	0.44	1.11	1.10	0.30
FS	7.15	2.63	5.73	2.56	2.92***	6.58	2.70
FEX (in years)	5.05	2.51	3.36	1.63	4.09***	4.38	2.34
YS (in years)	6.10	3.42	5.61	3.57	0.77	5.9	3.48

Source: own survey result, ***, *significant at 1% and10%, FS = family size, FEX = Farm experience in potato seed tuber, YS = Year of schooling

Results of Econometric Models

Determinants of participation in primary producers' cooperative

As outlined in the methodology, treatment regression model (Heckman two step) was applied to estimate gross potato seed tuber income from primary producers' cooperative participation. The gross income model was estimated jointly with the model for participation choices. Therefore, this section presents the results for participation choices before discussing income effects.

Once the decision is made about the variables to be included in the model, the data analyses were carried out using STATA by applying the maximum likelihood estimator. The results of the maximum likelihood estimations of the probit model for determinants of farm household decisions of participation choice are presented in Table 20. The table reports the estimated coefficients, Z-value, Marginal effects and some goodness of fit measures for the model.

Various goodness of fit measure was checked against econometric problems. Accordingly, the data was checked for multicollinearity test for all variables was done using Variance Inflation Factor (VIF), Breusch-Pagan test was also used to detect the presence of hetroskedasticity and Durbin-Wu-Hausman chi-square test was used to test the endogeneity.

In a production function analysis, a high correlation between some of the explanatory variables is expected and collinearity among economic variables is an inherent age old problem leading to problem of multicollinearity. Some have suggested that multicollinearity is not necessarily a problem unless it is very high (Gujarati, 2004). However, the values of VIF for all variables entered into the model were low and below 10, which indicate the absence of severe multicollinearity problem among the explanatory variables.

Endogeneity problem exists when an independent variable in the model is explained by another variables included within the equation. The test result indicated that there was no problem of endogeneity in the model. Similarly the log-likelihood ratio test was applied to assess the overall joint significance of the independent variables in explaining the variations in the potato seed tuber farm household in marketing channel choice. The null hypothesis for the log-likelihood ratio test is that all coefficients are jointly zero. The model chi-square tests applying appropriate degrees of freedom indicate that the overall goodness-of-fit of the probit model are statistically significant at a probability of less than 1%. Moreover, the result showed that probit model predicts about 81.21% of cases correctly into participant and 73.58% in to non-participant categories.

The probit regression estimates confirm that out of 13 explanatory variables included in the model 5 of them were found to be significantly affecting the probability of producer participation in primary producers' cooperative of potato seed tuber. Among significant explanatory variables, accessibility of market to the nearest primary producers' cooperative market purchasing centre expressed in walking minute (ACTM) affect negatively, family size of the respondent household (FSI) and land allocated for potato seed tuber (LAPS) were found to be associated positively in favour of participation in primary producers' cooperative of potato seed tuber with expected sign. Similarly, as expected, potato seed farming experience (FEX) and access to extension service (EXS) were found to influence positively.

Accessibility to the nearest primary producers' cooperative market purchasing centre (expressed by minute foot walking to the centre) had negative effect on value chain marketing participation and significant at 1% level. The marginal effect of the variable, -0.01003 imply that if the time taken by the producers to arrive at cooperative's purchasing centre increases by a unit, the probability of producer selling to value chain marketing category (cooperative) decreases by 1.003%, keeping other variables constant. In other words, it increases the propensity of producer selling to traditional marketing category (especially to farmer traders in locality). This is

because producers want to reduce transportation cost and save time. Different findings were in agreement with this study. Gezahagn, (2010) and Tru, (2009) who conducted research on factor affecting choices of Groundnut in Easter Ethiopia and fresh lychee marketing channels in Vietnam respectively agree with this finding.

The family size in the household was significant and positively influenced the propensity to participate in primary producers' cooperative of potato seed tuber at 5% level of significance. The marginal effect of this variable implied that, a unit increase in family member can lead 6.5% increases in the probability of the potato seed tuber producer household to sell his/her product to primary producers' cooperative of potato seed tuber holding other factors constant. This may due to the fact that households with a number of family members could participate and contribute their efferent as the production of potato seed tuber consume much labour (it is labour intensive commodity).

Land size allocated for potato seed tuber was found to be significant statistically at 10% probability level with marginal effect of 0.23551. The finding of the result showed that if land size allocated for potato seed tuber increase by one hectare, the probability of producer selling to primary producers' cooperative of potato seed tuber increases by 23.55%, keeping other variables constant. This is probably true, since producers those who allocated more land for potato seed production expected to produce more seed; which in turns affect the quantity of the product to be sold. Consequently, it attracts attentions of primary producers' cooperative because economies of scale (availability of larger quantity of potato seed tuber to be sold at a time minimizes transaction and transportation costs over smaller quantity) in collecting potato seed provided that the product meets their requirements (market preference).

Table 1. Probit model for determinates of participation

Variables	Coefficients	z	P >z	Marginal effect
ACTM	-0.0273***	-2.70	0.00	-0.01003
SEH	-1.0432	-1.21	0.22	-0.38274
AGH	0.0109	0.50	0.61	0.00398
ELHH	0.0224	0.41	0.68	0.00822
FSI	0.1761**	2.08	0.03	0.06456
FEX	0.2609***	2.75	0.00	0.09575
LAPS	0.6419*	1.77	0.07	0.23551
NOXOW	0.1104	0.45	0.65	0.04048
EXS	1.9999***	5.11	0.00	0.73369
CRA	-0.4039	-0.64	0.52	-0.14817
TLU	-0.0642	-1.27	0.20	-0.02353
TAC	0.2904	0.59	0.55	0.10190
MIFOA	-0.9647	-0.31	0.75	-0.35393
CONS	-0.7276	-0.22	0.82	

Number of observation = 120, Probability > chi2 = 0000, LR chi2 (12) = 78.98, Log likelihood = -41.660096, Pseudo R2 0.49 ***, **, and * indicate statistically significant at 1%, 5% and 10% probability levels, respectively. Value chain channel users = 81.21%, traditional channel users =73.58%, over all predicted Success = 58.84%. Source: own survey computation from 2011 data.

The extension services of development agents expressed by extension contact that farm household of potato seed tuber received by household per year was found to be significant statistically at 1% probability level with marginal effect of 0.73369 which is consistent with proposed direction. The finding of the result showed that a contact increase in frequency of contact received by the household can lead 73.37% increases in the probability of the household to sell their potato seed tuber to primary producers' cooperative keeping other variables constant. This big figure may be due to the fact that extension supports on potato seed tuber being considered as market oriented production and income diversification activities in the study area.

Effects of participation in primary producers' cooperative on income from potato seed tuber gross

Two stage Heckman model is used to examine the factors affecting the decision to participate in primary producers' cooperative and its effect on the income level of farm households gross income, simultaneously. Effectively addressing this problem and controlling for sample selection bias in the second stage regression requires the selection of at least one variable that uniquely determines the discrete choice of marketing channel for potato seed tuber produce by the household as it is applicable in the study by Gezahegn, (2010). Hence, to identify the model, farm household farming experience on potato seed tuber was excluded from the income function.

Accessibility to the nearest primary producers' cooperative purchasing centre/market centre (expressed by minute foot walking to the centre) had negative effect on gross income from potato seed tuber and significant at 5% level as expected. The marginal effect of the variable, -29.5451 imply that if the time taken by the producers to arrive at cooperative's purchasing centre/market centre increases by a unit, the gross income of producer from potato seed tuber decreases by 29.55, keeping other variables constant

The family size in the household was significant and positively influenced the gross income producers and significant at 5% level of significance. The marginal effect of this variable implied that, a unit increase in family member can lead to 186.30 increases in the gross income from potato seed tuber for producer farm household. This may due to the fact that households with a number of family members could participate and contribute their efferent as the production of potato seed tuber need much labour (it is labour intensive commodity).

Land size allocated for potato seed tuber influences gross income of producer positively and significantly at 1% level of significance. The result indicates that as land size allocated for potato seed tuber increases by one hectare, the gross income the household gain from potato seed tuber increases by Birr 739.40, ceteris paribus. More land often implies more output and this can positively affect farm income leading to higher household gross income. The finding of this study is in consensus with very recent scholar findings of Gezahegn, (2010) who studied factors influencing gross income of farm household from groundnut in Eastern Ethiopia and Olomola, (2010) who studied contract farm scheme effect on per capita income of cotton farmers in Nigeria.

Availability of extension service on potato seed tuber has positive effect on marketed gross income of potato seed tuber at 5% level of significance. The marginal effect of this variable indicate that access to extension service concerning potato seed tuber increase amount of net income earned from potato seed tuber by Birr 1349.30 than those households who did not have access to extension, other variables being constant.

Finally, the coefficient of the selection hazard variable (LAMBDA) is not statistically significant indicating the absence of sample selection bias in this model and showing suitability of OLS in the second stage of Heckman model.

Table 2. Second stage Heckman estimation of factors influencing potato seed tuber gross income from participation

Variables	Coefficients	z	P > z
ACTM	-29.5451**	-2.36	0.02
SEH	-1196.26	-1.29	0.20
AGH	4.3561	0.22	0.82
ELHH	70.5026	1.36	0.17
FSI	186.3208**	2.05	0.04
LAPS	739.4023***	3.43	0.00
NOXOW	-70.5984	-0.34	0.73
EXS	1349.292**	2.06	0.04
CRA	125.9584	0.21	0.83
TLU	-34.5499	-0.70	0.49
TAC	-116.043	-0.28	0.78
MIFOA	-1872.558	-1.41	0.16
LAMBDA	-135.1068	-0.31	0.76
CONS	5915.57***	3.18	0.00
rho	-0.02329		
sigma	523.6998		

Source: own survey computation, **, *** = significant at 1% and 5%

Policy Implications

The policy implications to be drawn from this study are based on the significant variables from the analysis of the study. To start with, dissemination of modern input technologies, seed rate and land supply/accessibility are essential in increasing the production of potato seed tuber. Therefore, transportation roads and inputs distribution networks need to be reorganized to improve potato seed tuber production.

In connected to market participation choice, family size of the respondent household, land allocated for potato seed tuber, potato seed farming experience, proximity to selling centre and access to extension service to enhance the probability of producers to supply their seed produce to primary producers' cooperative. Hence, producers should increase their participation in the above mentioned variables to be benefited from market participation choices. Lastly, improving transportation and market information access to the farmers is essential to make potato seed tuber market efficient in addition to developing road infrastructures.

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