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DETERMINANTS AND LEVEL OF SMALLHOLDERS' ANCHOTE MARKET PARTICIPATION IN GIMBI DISTRICT OF SOUTHWESTERN ETHIOPIA: HECKMAN TWO STAGE ANALYSIS

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Abstract: Anchote is one of the root crops grown in southwestern parts of Ethiopia. Even though market participation has got a due attention by government, smallholder farmers' participation in fair market is still below the requirements. This study aims to identify determinants of smallholder anchote farmers' market participation decision and their level of participation. Both primary and secondary data were collected from 162 randomly selected anchote farmers. Descriptive statistics and heckman two stage models were used to analyze the data. The econometric model result revealed that decision of anchote market participation were significantly determined by quantity of anchote produced, access to extension service, age of household head, ownership of transportation facilities and lagged price. On the other hand, the extent of anchote market participation were significantly determined by sex of household head, quantity of anchote produced, access to market information, income from other crops and family size. Therefore, enhancing farmers' access to market information, boosting the production and productivity of anchote through better extension services and infrastructures, awareness creation on gender balanced market engagement and improvement in transportation facilities are the critical points that should get policy attentions in the study area.

Keywords: *Anchote, market, determinants, Heckman two stage model, Ethiopia*

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INTRODUCTION

Anchote is one of the root crops which is mainly grown for cultural food consumption in southwestern Ethiopia. Nowadays the crop is being commercialized in addition to its production for subsistence consumption. Many smallholder farmers are generating their income from anchote marketing (Mengesha et al. 2012).

Markets have a lion share in the improvement of smallholder farmers' livelihoods. It is a means of income generation, rural employment, having access to technology and information disseminations (Bonabanas et al., 2013).

Smallholder market participation facilitates the linkage among the agricultural inputs and output sectors (Gebremedhin and Jaleta, 2010). Market participation has different advantages for the participating farmers. It offers them many incentives, market information like price and the demand for their products. This further helps them in linking with fair markets and fair prices. Fair markets and prices further motivate the farmers to increase their production level and help them to maintain their food security.

Increasing smallholders' market participation got a policy attention as a means of poverty reduction and food security enhancements in Ethiopia. Studies confirmed that there is a direct correlation between farmers' market participation and welfare improvements. Nevertheless, due to subsistence production and higher transaction costs,

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farmers' market participation is very minimal (World Bank, 2008).

Even though Anchote has a high potential for food insecurity reduction, little attention was given for the crop in the study area (Yassin et al., 2013). Farmers' market participation was limited by different factors. Factors like high transaction costs and related market imperfections hindered them from market participation.

Research studies on anchote market participation and level of market participation is very limited in the study area (Abreham et al., 2014). Majority of the studies on this crop were focused on production systems, its cultural and nutrition values. Information on factors determining the anchote market participation in the study area is missed.

Therefore, this study was conducted to investigate the determinants of farmers' anchote market participation decision and the level of their participation in Gimbi district of western Wolega zone.

RESEARCH METHODS

This study was conducted in Gimbi district which was located at about 441 km west of Finfine, capital city. The district has an estimated area of 1,183.44 square kms; bordered on the south by Haru district, on the west by Lalo Asabi district, on the north by the Benishangul Gumuz Regional State and on the east by the East Wolega Zone. The District has a total of 32 kebles of which 30 are rural based farmers administration areas. The total population of the district and households were estimated to be 74,623 and 18,301 respectively where 97 percent of the total households were rural agricultural households (CSA, 2017).

The district's climate is mainly characterized by lowland and midland agro-ecological zones. The minimum and maximum annual temperatures were 14^{o}c and 26^{o}c respectively, and the mean annual rainfall ranges from 800 to 2000 mm. The District has diverse agro ecological zones ranging from *Kola* (30%) to *Weina dega* (70%). Gimbi District was known for its high potential in coffee, sesame, maize, anchote and yam production.

Sources and types of data

Both primary and secondary sources were used. The primary data were obtained from sample anchote producing respondents, key informants and FGD participants.

Secondary data sources were collected from Gimbi district trade and market development office, District and zonal offices of agriculture, custom agency, Bako agricultural research center, Centeral Statistical Agency and their publications. Different relevant published and unpublished reports, bulletins, and websites were also used to generate relevant information on anchote.

Sampling techniques

Multi-stage sampling technique was used to select sample farm households. Gimbi district was selected purposively based on large production of anchote in western Wolega zone by 2017/18. Next, 18 anchote producing kebeles were identified among the 30 kebeles in the district with the help of development agents. Then six anchote producing kebeles (Wara Sayo, Chuta Gochi, Tole, Jogir, Bikiltu Tokuma and Aba sena) were selected randomly. Finally, 162 sample anchote farmers were selected using simple random sampling.

Cochran's (1963) sample determination formula was followed since the populations in the selected kebeles are more than 1,000.

$$n = \frac{z^2 P(q)}{d^2} \qquad 1$$

Where, n = sample size, Z = statistical certainty (1.96) for an error risk of 5 percent level of significance, p = estimated proportion of anchote smallholder farmers (12%), q = 1-p, d = margin of error, expressed as a fraction of 0.05.

Then $n = \frac{(1.96)^2 0.12(1-0.12)}{(0.05)^2} = 162$

The proportion and the number of sample households from six kebeles were summarized in the following table.

Data collection methods

Data was collected under close supervision of the researchers. Three focus group discussions were conducted based on pre- determined checklists and 10 key informants were interviewed from three different institutions in the district.

Table 1. Sample distribution of anchote producers in Gimbi District

Kebeles	Anchote farmers	Proportions	Sample households
Wara Sayo	758	0.16	27
Chuta Gochi	667	0.15	23
Tole	726	0.16	26
Jogir	656	0.14	23
Bikiltu Tokuma	823	0.18	29
Aba Sena	977	0.21	34
Total	4607	1	162

Source: Authors' computations (2018)

Methods of data analysis

Descriptive statistics and econometric models were used to analyze the data collected.

Econometric analysis

Many studies argued that heckman two-stage model is more appropriate than the other models since it arranges a sample selection bias by computing lambda (λ) and considered it as an independent variable to adjust for self selection (Dawit, 2012).

Heckman two-stage was employed for this study to identify anchote farmers' market participation and their level of participation. The first stage of the heckman model estimates the participation decisions having two options either participate =1 or not participate = 0.

The second stage of the heckman model deals with level of market participation revealing the quantity of anchote supplied to the market. The new variable lambda shows the effect of all not estimated attributes related to the market participation and level of market participation.

Probit model specification

This model is used to deal with limited dependent variables. It was employed in this study to identify factors determining the participation decision of anchote marketing in the study area. Anchote market participation decision of the respondents was taken as the dependent variable with value of 1 if the farmers participated and 0 otherwise.

The Probit participation model (participation decision function) is used to develop an index (Z) of factors affecting farmers' decision to participate in anchote market. From Z, lamda, which is related to the conditional probability that a household would participate (given a set of independent variables) is determined.

$$\lambda_i = \frac{\phi(Zi)}{1-\Phi(Zi)} = \frac{\phi(Zi)}{\Phi(-Zi)'} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad 2$$

$$Z_i = \frac{Xi\beta}{(\delta_\varepsilon)^{\frac{1}{2}}}$$

Where: λ_i is the inverse Mill's ratio, ϕ and Φ are the density and distribution functions for the standard normal variable, β is a vector of regression parameters for variable X, and δ is the standard deviation of the error term.

The OLS model specification

In the second stage of the Heckman model, OLS was estimated to identify the level of participation measured by the amount of anchote sales in the market.

The model is specified as;

$$Y_i = x_i \beta_i + \mu\lambda_i + \varepsilon_i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad 3$$

Where: Y_i farmers' quantity of anchote supplied to the market, X_i are the explanatory variables, β_i is unknown parameters to be estimated, μ is a parameter that shows the impact of participation on anchote quantity supplied to the market by farmers, ε_i is the error term.

Variable definitions and hypothesis

Two dependent variables and 12 independent variables were considered for this study.

Dependent variables

- ***Farmers' participation decision in anchote* marketing:** This is dummy variable in the probit model that takes a value 1 if a household participated in anchote marketing and 0 otherwise.
- ***Level of market participation*:** It is continuous variable which is measured in quintal (100kg) reflecting the quantity of anchote supplied to the market.

Table 2. Summary of independent variables used in heckman two-stage the model

Variables	Type	Definition/Measurements	Hypothesis
Quantity of anchote produced	Continuous	Quintals	+
Age of household head	Continuous	Years	+/-
Sex of the household head	Dummy	1=male, 0=female	+
Distance to the nearest market	Continuous	Km	+
Education level of the household	Continuous	Grades	+
Access to market information	Dummy	1= if have access, 0 otherwise	+
Access to extension services	Dummy	1= if get access 0 otherwise	+
Income from sales of other crops	Continuous	Birr	+/-
Ownership of transport facilities	Dummy	1= if they own, 0 otherwise	+
Family size	Continuous	Number	-/+
Lagged price of anchote	Continuous	Birr	+
Non/off farm income	Continuous	Birr	+

Source: Authors' computation, (2018)

RESULTS AND DISCUSSIONS

Demographic and socio-economic characteristics of sample households

Out of the total of 162 sampled households, 64.8% and 35.2% of them were participants and non participants in anchote market respectively. From the overall anchote producers, 138 were male headed and 24 were female headed farmers households, and among market participants, 91.4% were males whereas, 8.6% were female headed households. On the other hand, out of (57) 35.2% non participants, (42) 73.7% of non-anchote market participants were found to be male and (15) 26.3% were female headed households. The chi-square test result shows that sex was statistically significant at 1% significance level. The result indicating that being male increases market participation.

Land holding

The land size of sampled farmers allocated for anchote production varies from 0.08 to 1.10 hectare and the average size for sampled farmers was found to be 0.2 hectare.

The average yield of anchote produced by the sampled households in the study area was estimated to be 9.3 quintals/ha with significant variability among the different kebeles. The yield is much lower than the average national yield 5.8 ton per ha.

Table 3: Demographic and socio-economic characteristics of sample households (dummy variables)

Characteristics	Participants	Non-participants	Total	χ^2
Sex of household head				9.055***
Male	96	42	138	
Female	9	15	24	
Access to extension services				77.1***
Yes	93	11	104	
No	12	46	58	
Access to market information				10.452*
Yes	55	29	84	
No	50	28	78	
Transportation ownership				15.9***
Yes	82	27	109	
No	23	30	53	

Source: Authors' computation, (2018)

Table 4. Demographic and socio-economic characteristics of sample households (continuous variables)

Characteristics	Participants	Non-participants	Total	Min.	Max.	t- ratio
	Mean	Mean	Mean			
Quantity produced in quintal	11.1	5.9	9.3	4.5	60	3.713***
Age of household	42.5	42.7	42.6	22	72	-0.133
Distance to the market	41.9	41.8	41.8	5	120	0.023
Education level	5.1	3.9	4.3	0	13	2.037**
Income from sale of other crops	22,857.1	14,279.4	19,839	1,000	106,000	3.466***
Family size in numbers	5.6	5	5.4	2	15	1.556
Lagged price in birr	288.6	252.3	275.8	0	450	2.810***

Source: Authors' computation (2018)

Marketing channels analysis

Eight marketing channels were identified in the study area. The estimated volume of production of anchote was about 22,300 quintals in the year 2017/2018. About 9,758 quintals of anchote was marketed in the study district.

Table 5: Land holding and ownership of the respondents

Land status	Mean	Stand. dev	Min.	Max.
Land allocated for anchote	0.2	0.19	0.08	1.10
Total land holding	3.6	2.2	1	10

Source: Authors' computation (2018)

The following market channels were identified in the study area;

1. *Producers----------Consumers (102.9 quintals)*
2. *Producers---------Retailers----------Consumers (96.7 quintals)*
3. *Producers---------Retailers----------Local processors------Consumers (110.8 quintals)*
4. *Producers --------Local processors------Consumers (45.1 quintals)*
5. *Producers---------Collectors--------Wholesalers------Retailers------Consumers(71.9 quintals)*
6. *Producers---------Wholesalers----------Retailers-------Consumers (77.9 quintals)*
7. *Producers---------Wholesalers----------consumers (141.7 quintals)*
8. *Producer---------Collector----------Wholesaler---consumer (130.4 quintals)*

The first channel is found to be the shortest channel at which producers directly sell their produce to consumers sharing about 13.23% of the total anchote marketed in the study. The second channel shared about 12.4% of total anchote marketed in the study area. In channel 3, anchote farmers have access to sell their output directly to local processors. Since local processors may purchase large volume of products, this opens window for farmers to produce more and participate more in anchote market. It stands for about 14.5 % of total anchote marketed.

Econometric model results

Determinants of anchote market participation

The model shows that all the parameters were jointly significant in explaining the dependent variable at less than one percent significance level. The predicted probability (Prob > chi-square = 0.0000), reveals that the model fulfills the criteria of 'goodness-of-fit'.

Farmers' decision to participate in the anchote market was significantly determined by age of the household head, quantity of anchote produced, lagged price of anchote, access to extension service and ownership of market transportation facilities.

The marginal effect of quantity of anchote produced depicted that keeping the other factors constant, a unit increase in quantity of anchote produced increased the probability of farmers' market participation decisions by 5.13 %. This further implies that more production encourages smallholder market participation and crop commercialization.

Table 6: Probit model outputs of determinants of anchote market participation

Variable	Coef.	Margins	Std. Err.	Z	P>|z|
Quantity produced(quintal)	0.557	0.051***	0.010	4.00	0.000
Age of household(year)	-0.039	-0.004*	0.002	-1.85	0.064
Sex of household(1=male, 0=female)	-1.883	-0.173	0.235	-0.74	0.461
Distance from market(Km)	0.008	0.0007	0.001	0.96	0.336
Education status(Grade attended)	-0.093	-0.009	0.006	-1.50	0.134
Access to market information(1=yes,0=no)	0.294	0.027	0.049	0.54	0.587
Lagged price(Birr)	0.006	0.0005**	0.000	2.00	0.045
Extension contact	1.503	0.138***	0.035	3.91	0.000
Income from other crops	8.81e-07	8.11e-08	2.13e-06	0.04	0.970
Transportation	1.052	0.097**	0.046	2.08	0.037
Family size	-0.068	-0.006	0.009	-0.69	0.492

*Number of obs=162, LR chi^2 (11) =156.35, Prob >chi2=0.0000, Log likelihood = -26.89785, Pseudo R^2 = 0.7440, ***, ** and * are statistically significant at 1%, 5% and 10%, respectively.*
Source: Authors computation, 2018.

Lagged price of anchote also singnificantly determined the anchote market participation decisions. Large lagged prices in the year 2017 can stimulate production and market participation of anchote for 2017/18. A unit increase in the lagged price of anchote increases the probability of farmers participating in the market by 0.053 %.

The study shows that access to extension service significantly affected farmers' market participation decision. The coefficient of marginal effect indicated that, access to extension service would increase the likelihood of farmers participating in the anchote market by 13.8 %. The finding is in line with study by Christopher *et al.* (2014).

The model result further implied that, age of household head had been negatively associated with market participation of anchote producers and it was statistically significant at 10% level. This indicates that as age of anchote farmer increases by one year, the probability of participating in the market decreases by 0.36%. This finding is consistent with Berhanu et al. (2011) who have reported that age of household is negatively related with market participation.

Determinants of level of anchote market participation

The coefficient of Mills ratio (Lambda) in the heckman two-stage result is significant 1% significance level. This indicates sample selection bias, existence of some unobservable farmer characteristics determining farmer's likelihood to participate in anchote market and thus affecting the level of participation. The adjusted R-squared is 0.65, indicating that about 65 % of the variations in level of anchote market participation was explained by the explanatory variables.

The model output shows that sex of household head, quantity of anchote produced, access to market information, income from other crops, family size and mills ratio (lambda) were positively determined the level of anchote market participation.

The quantity of anchote produced positively and significantly determined the extent of market participation at 10% level of significance. As quantity of anchote produced increases by one quintal, the level of farmers' participation in market increases by 0.557 quintals keeping the other factors constant. This is consistent with the findings of Adugna (2009) who reported that an increased amount of tomato and papaya yield enhances marketed supply of these commodities significantly.

As farmers get access to market information, the anchote supplied to market increased by 3.92 quintals. The result is similar with the study of Zelalem (2008) who found that those farmers with better market information are in a better position to supply their surplus production to the market.

On the other hand, a male head of a household significantly increases anchote quantity supplied to market by 45.3 quintals as compared to that of female-headed households. This is consistent with the finding of Mahlet *et al*. (2015) who found that gender of the household head positively and significantly influenced marketed supply of potato.

The inverse mill's ratio determined the level of market participation positively and significantly at 1%

probability level showing the existence of sample selection bias and the correction for selectivity bias is significant in the model. The overall goodness of fit for the heckman selection model is statistically significant at a probability of less than 1% probability level implying the joint explanatory variables included in the model explains the level of anchote market participation correctly.

Table 7: OLS outputs of determinants of level of anchote market participation

Variable	Coef.	Std. Err.	Z	P>|z|
Quantity produced(quintal)	0.557***	0.139	4.00	0.000
Age of household(year)	0.294	0.543	0.54	0.589
Sex of household(1=male, 0=female)	0.452**	1.126	2.18	0.029
Distance from market(Km)	0.008	0.008	0.96	0.338
Education status(Grade attended)	0.093	0.064	1.44	0.148
Access to market information(1=yes,0=no)	0.039*	0.022	1.75	0.080
Lagged price(Birr)	0.068	0.101	0.68	0.496
Extension contact	0.691	1.022	0.68	0.499
Income from other crops	0.000***	0.000	2.68	0.007
Transportation ownership	0.714	0.705	1.01	0.311
Family size	0.006*	0.003	1.91	0.056
Lambda	2.326***	0.887	2.62	0.009
_cons	3.714	3.081	1.21	0.228

*Number of obs = 162, Censored obs = 57, Uncensored obs =105, Wald chi2 (13) = 884.59, rho = 0.8672, sigma = 2.6820191, ***, ** and * are statistically significant at 1%, 5% and 10%, respectively.*

Source: Authors computation, 2018

CONCLUSION AND SUGGESTIONS

Conclusion

Smallholder anchote farmers market participation in the study area was determined by quantity of ancote produced, access to extension services, age of household heads, ownership of market transportation facilities and lagged price of anchote while the level of market participation in anchote marketing was determined by sex of household head, quantity of anchote produced, access to market information, income from other crops and family size of the household head. Therefore, these factors must get due attentions by the concerned bodies to commercialize smallholder anchote farmers and boost the benefit of market participations in the study area.

Sugesstions

The following recommendations were forwarded from this study for policy makers, development practitioners and researchers in the study area.

a. Strengthening extension services to enhance the production and productivity capacity of anchote farmers in the study area should get critical attention just to improve smallholders' market participations.
b. Transportation facilities should be improved to commercialize smallholder farmers. Therefore, the government should intervene to improve the marketing infrastructures.
c. Farmers marketing organization and unions should be promoted and established in the study area to increase farmers' market linkage and participation.
d. Awareness creation on sources of market information, how to select appropriate market channels and how to get fair price should be given by development agents and market experts in the study area.
e. Strong policy frames targeted on best extension systems, access to market information, gender balances and farmers' income diversification mechanisms should be formulated to boost intensive commercialization of smallholder farmers in the study area.

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