ORIGINAL ARTICLE

Determinants of market participation among smallholder vegetable producers in Southwest Ethiopia

Ibrahim Aliyi*, Abduselam Faris, Assefa Ayele, Alemayehu Oljirra and Mulubrihan Bayessa

Jimma University, College of Agriculture and Veterinary Medicine, P.O. Box 307, Jimma, Ethiopia
*Corresponding author. ibrahimaliyi0202@gmail.com;

ABSTRACT

Market participation of smallholder farmers is important for Ethiopian economic growth. However, the market participation of smallholder farmers remains low, due to several problems. There is a need to deliberately improve the smallholder farmers' market participation and intensity of participation to facilitate stable incomes and sustainable livelihoods. In this study, the market-related factors that are problematic to smallholder farmers were investigated. A multi-stage sampling procedure was employed to select 420 samples of households randomly from nine kebele administrations. Both qualitative and quantitative data were collected from primary and secondary sources by using structured questionnaire. The double hurdle model was used to identify factors affecting the market participation decision and intensity of participation. The result indicates that market participation of smallholder farmers was significantly affected by the use of fertilizer, education status, land allotted for vegetable, membership in cooperatives, access to information, owing to a motor pump and transportation means. The intensity of market participation was significantly influenced by the use of fertilizer, education status, extension contact, distance to the market, uses of credit, and access to market information. Based on the findings it is recommended that the government and non-government organization have to improve land productivity by increasing the provision of inputs, strengthen the rural education system, delivering effective and proactive extension services, create reliable market information, provide good transport facilities for farmers, establish rural finance schemes to address the credit needs of smallholders and encourage farmers to form and maintain effective groups.

Key words: market participation, selected vegetables, smallholder farmers, southwest Ethiopia

INTRODUCTION

Agriculture is a key sector for Ethiopia's economy. The overall economic growth of the country is highly dependent on the success of the agricultural sector and the entire movement of the agriculture sector depends on the smallholder sub-sector. The sector offering employment to 72.7% of the population and contributing 43% to the GDP. Although agriculture has a long history in the country's economy, development of the sector has been hampered by a range of constraints which include land degradation, low technological inputs, weak institutions, and lack of appropriate and effective agricultural strategies (Amsalu, 2014). Despite these challenges, Ethiopia has favorable economic opportunities and prospects. The country has abundant natural resources, a low cost and trainable labor force, an emerging middle class, and a developmental State with an ambitious vision, commitment, and a strong sense of policy ownership (Getaneh and Sailaja, 2017).

Ethiopia has a variety of vegetable crops grown in different agro ecological zones by small farmers, mainly as a source of income as well as food. The poor farmers who produce the vegetable can benefit a lot and their livelihoods can be enhanced through the provision of continuous innovation processes of integrated vegetable production. The vegetable sector provide growth opportunities for Ethiopia in terms of both the expanding domestic market, regional and international markets, which is yet largely untapped. According to Ethiopian Revenue and Customs Authority (ERA, 2013), Ethiopia exported 220,213 tons of vegetables and generated USD 438 million. Diversifying and increasing horticultural production can help to overcome malnutrition and poverty by augmenting household consumption and also create new income and employment opportunities in the trading and processing sectors (Ganry et al., 2011; Parrot et al., 2011; Virchow, 2015). The Ethiopian Government attempts to promote the production and marketing of high-value agricultural products to increase competitiveness in domestic, regional, and international markets (MoFED, 2010).

The production of vegetables varies from cultivating a few plants in the backyards, for home consumption, to large-scale production for domestic market, regional and international markets. The area under vegetables was estimated to be 442,276.04 hectares with a total production of 53,001,366.96 tons (Cochrane and Bekele, 2018). The area under vegetables and fruits is less than one percent (i.e., 0.11%), which is insignificant as compared to food crops (EIA, 2012). However, the production of vegetables crops is much less developed than the production of food grains in the country. The majority of Ethiopian smallholders consider vegetable cultivation as supplementary to the production of main crops and the cultivation is fragmented and mostly managed by household labor (Bezabih and Hadera, 2007). In spite of the fact that vegetable production is crucial for the rural economic growth and poverty reduction, limited attention has been given to the sector. Correspondingly, MoFED (2010) argued that so far Public research on vegetable crops were negligible and major public policies and attention of extension agents were mainly focused on staple crop production.

Ethiopian vegetable output markets are characterized by inadequate transport network, inadequate market information system and underdeveloped industrial sectors. Smallholder vegetable producers have little information about the market demand, price and times to sell their products. The production-market linkage is very weak and farmer's opportunity to diversify their livelihoods from vegetable production is very much limited. This in turn reduces their ability to trade their products efficiently and to derive the full benefit from the marketable part of their production (Haji, 2008). Most poverty reduction strategies in developing countries are predicated on improving agricultural production and promoting market access and integration of smallholder producers in formal market exchange. Improved market access proves necessary for maintaining production incentives, permitting household specialization and enabling movement to high-value products and to value-added activities. As a result, sustained agricultural growth typically occurs where productivity-enhancing agricultural technology and favorable market incentives converge. However, small-scale producers often struggle to gain market access because they lack knowledge of market requirements or the skills to meet them. Furthermore, inadequate information flow and other obstacles prevent them from entering into new markets, or reduce the benefits they obtained from entry, reducing poverty among small-scale producers, are often designed to overcome some of these obstacles (Steven et al., 2012). Understanding the factors affecting market participation decisions as well as the extent of participation and how the bottlenecks associated with these factors can be alleviated is fundamental in improving marketing and the smallholder livelihood (Honja et al., 2017). Thus, the question of smallholder participation and level of participation in vegetable market is great importance to policymakers seeking to stimulate rural economic growth and poverty reduction (Barrett, 2008).

Southwest of Ethiopia, particularly Districts of Gomma, Dedo and seka chekorsa has a worthy potential in the production of vegetables. The main type of vegetables produced in the area is onion, potato, cabbage, green peppers, sweet potato, carrot, Garlic, etc. (Kebebew et al., 2011). Among the vegetables produced in the area, the emphasis of this research lies on potato, tomato, and cabbage, they are widely grown by smallholders as a means of enhancing family income and achieving food security (Jimma Zone Irrigation

Authority Office, 2019). Despite the significance of vegetable in the livelihood of many farmers in the area, contribution of vegetables production to farm income was not as much expected, smallholder farmers obtained low benefit from vegetable production, and this is due to the combined effect of demographic, socio-economic, institutions, and other related factors. In addition, due to their low endowment in production factors, such as land, water and capital assets, the majority of smallholder farmers produce low quantities of products that are poor quality, which leads to their products being neglected by output markets. Smallholder vegetable farms are based on low input – low output production systems. The use of improved seeds, high yielding varieties and other inputs such as fertilizer is not common in the vegetable farming. Technical training and extension services on improved crop husbandry techniques are not available. As a result average productivity levels are low in the vegetable small scale farming sector (EHDA, 2012).

Moreover, small-scale vegetable producers have little information about the market demand, price and times to sell their products, and most small-scale farmers have no means of transport to carry their produce to markets. Transportation problems result in loose of quality and late delivery, which in turn lead to lower prices. More importantly marketed supply of vegetables in the study area is subjected to seasonal variation where surplus supply at the harvest time is the main feature. Hence, it was quite important to identify the factors affecting market participation and intensity of participation in the development of sound policies with respect to agricultural marketing. Yet, there was no empirical data that validate the factors affecting market participation and intensity of participation in Southwest Ethiopia. Correspondingly, Haji (2008) argued that the detailed and systematic empirical studies on the vegetables production and marketing are scarce or non-existent in Southwest Ethiopia. Therefore, the main objective of the present study was to identify the factors affecting vegetable market participation and intensity of participation in southwest Ethiopia by answering the following key research question. What are the factors determine participation in vegetable market and intensity of participation? This study may be a valuable input to fill the research gap and add new empirical results to the scanty literature in the region, and generate evidence to policymakers and other non-governmental organization seeking to stimulate rural economic growth and poverty reduction.

MATERIAL AND METHODS

The Study Area

This research was conducted in Southwest of Ethiopia, particularly in three districts of Jimma zone including Gomma, Dedo, and Seka chokersa (Fig.1). Jimma Zone comprises 20 administrative districts with 2.5 million populations of which 94% are rural inhabitants (Population Census Commission, 2008). Jimma Zone covers a total area of 15,569 km²and receive mean annual rainfall ranging between 1,200- and 2,800-mm. Subsistence farming is the dominant form of livelihood in Jimma Zone for about 85% of the population. The area has suitable agro-ecological potential with the lowest drought risk rating in the country (Milas and Aynaoui, 2004). Cereal crops (maize, teff-*eragrostis tef*, sorghum, and barley), pulses (beans and peas), *cash crops (*coffee and chat), fruits and vegetable crops (banana, mango, orange, avocado, potato, tomato, cabbage, sweet potato, Garlic, paper, and onion) are widely grown by smallholder farmers (Kebebew *et al.*, 2011). Among the vegetables produced in the area, the emphasis of this research lies on potato, tomato, and cabbage. The choice of the crops intentionally based on their major production and marketability. They are the most important vegetable crops in the area because they contribute a significant benefit to the livelihood of smallholder farmers.

Sampling procedure and sample size determination

In order to realize the objectives of this study, from Southwest of Ethiopia, districts of Gomma, Dedo, and Seka chokersa were selected as the districts have enormous vegetable production potential. Among the vegetables produced in the area, potato, tomato and cabbage are the type of vegetables we considered for this study, they are widely grown by smallholders as a means of enhancing family income and household consumption. In the first step, with the help of district Agricultural experts, 27 *kebeles* which producing all the selected vegetable (potato, tomato and cabbage) were identified purposively from the three districts. In the second step, three *kebele*s from each districts and a total of nine kebeles from the three districts were selected randomly. Finally, to consider the target populations (to avoid probability of including non-producers of all the selected vegetables in the sample), only list of households that produce all the three vegetables from sample kebeles were considered. Then, by using simple random sampling technique 420 households that produce all the three vegetables were selected from each sample kebeles assisted by probability proportional to size (Table 1). The simplified formula provided by (Yamane, 1967) was used to determine the sample size. Accordingly, the required sample size at a 95% confidence level with a degree of variability of 5% and the level of precision equal to 5% were used to obtain a sample size required.

$$n_o = \frac{N}{1+N(e)^2} = \frac{9985}{1+9985(0.05)^2} = 385$$

Where n_o is the sample size, N is the total number of vegetable producer three districts of Jimma zone, e is the desired level of precision (e= 5%)? Besides this, the sample size was increased by 10% to compensate for nonresponse or for persons that the researcher would

unable to contact. In this way, the sample size was increased to 420.

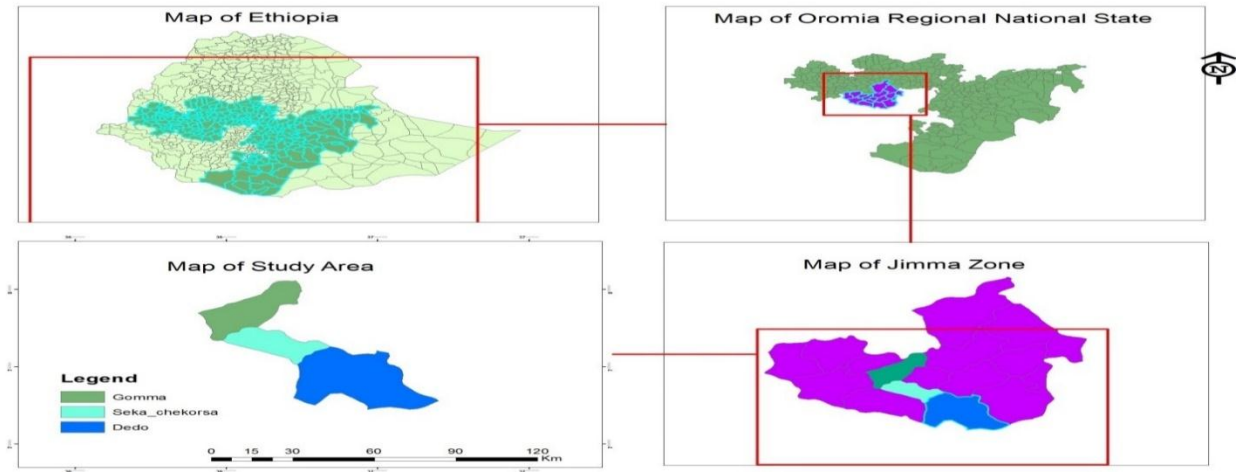

Figure 1: Geographic map of the study districts

Table 1. Number of households selected from sample *kebeles*

Name of the district	Name of the Kebele	Total number of vegetable producers	proportion	Sample Size of the household
Gomma	Ganji dalecho	1169	0.12	49
	Chami chego	1044	0.1	44
	Jimmate deru	947	0.09	40
Dedo	Waro Kolobo	1351	0.14	57
	Offole	1246	0.12	52
	Afaly Korti	1049	0.11	44
Seka chekorsa	*Dabbo Yaya*	1175	0.12	49
	Dabbo Gibe	1051	0.11	44
	Ushane qacce	953	0.1	40
Grand total		9985	1	420

Data types, sources, and methods of data collection

For this study, both quantitative and qualitative data types were collected from both primary and secondary sources. Primary Sources of data were collected from vegetable producers through interview schedules containing structured questionnaire by well-trained enumerators closely supervised by the researchers. Secondary sources of data were gathered from the central statistical authority (CSA), thorough reviewing journals, and examination of reports as well as records of published and unpublished documents.

Method of data analysis

In this study different descriptive methods and econometric model were employed to analyze the collected data

***Descriptive analysis*:**

Descriptive statistics such as frequency, mean, percentage, t-test, and chi-square test were used in the process of comparing socio-economic, demographic, and institutional characteristics of households.

Econometric model specification

In empirical studies, however, the econometric model applied to market participants in general typically adopts a two-step analytical approach. The reason for the application of the two-step analytical approach is that market participation is seen to embody two decision processes: the unobservable decision to participate and the observed degree or intensity of participation. The Double-hurdle model (DHM) and the Heckman sample selection model are the widely used models in the two-step approach. However, in this study the Double-hurdle model was chosen over Heckman sample selection model because there was no

sample selection problem in the data. Before running the Double Hurdle model, the validity of the model were tested to check whether the Double Hurdle model is appropriate or not. Accordingly, the results of the diagnostic test shows that the Inverse Mills ratio (LAMBDA) were not significant for all selected vegetable market participation (appendix table 1, 2, & 3) which implies that there was no sample selection problem in the data, the error term in the selection and outcome equation is not correlated. This indicates that there was no a sample selection bias, or there was no existence of unobserved factors that determine farmers' likelihood to participate in selected vegetable market and thereby affecting the level of participation. Therefore, the Double-hurdle model (DHM) was selected over the Heckman model because there was no sample selection problem in the data.

The Double-hurdle model, originally formulated by (Cragg, 1971) involves a two-step estimation procedure. In the first stage, the probit model was used to explore factors governing market participation decisions for a given reference period which is referred to as market participation decision in this study. In the second stage, the Truncated Regression Model was employed to explore the determinants of the quantity of vegetable that are marketed which is referred to as the intensity of market participation in this study. The double- hurdle model was specified and used as follows:

$d_i^* = x_1\beta_1 + u_1 i$

$u_{1i} \sim N(0, \sigma^2_1)$

$$d_i^* = \begin{cases} 1 & if \quad di^* > 0 \\ 0 & if \quad di^* \leq 0 \end{cases}$$

$y_i^* = x_2\beta_2 + v_{2i}$

$v_{2i} \sim N(0, \sigma^2_2)$

$$y_i = \begin{cases} 1 & if \quad yi^* > 0 \; and \; di = 1 \\ 0 & if \quad yi^* \leq 0 \end{cases}$$

The subscript i refers to the i^{th} household, d_i is the observable discrete decision of whether or not to sell a major vegetable crop, while di^* is the latent (unobservable) variable of d_i. yi^* is an unobserved, latent variable (desired quantity of vegetable sold), and y_i is the corresponding observed variable, the actual quantity of vegetable sold, x_1 and x_2 represent vectors of explanatory variables. $B1$ and β_2 are vectors of parameters to be estimated and u_1 and v_2 are random errors.

In the double hurdle model, the first hurdle estimates the decision of whether or not to participate in the market, conditional on market participation. The decision of whether to sell a major vegetable (a binary variable) is used to estimate the maximum likelihood estimator (MLE) of the first hurdle, which is assumed to follow a probit model. In the second hurdle, the continuous variable of quantity traded is assumed to follow a truncated normal distribution. Therefore, the MLE is obtained by fitting a truncated normal regression model to the quantity traded (Cragg, 1971). Measurement and expected signs of hypothesis variables were shown as below (Table 2)

Table 2. Measurement and expected signs of hypothesis variables in the models

Variables	Notation	Measurement	Expected sign
Dependent variables			
Market participation decision	MPRT	Dummy 1 = farmer participates in the market; 0= otherwise	
Intensity of market participation	QVM	Total quantity of vegetable marketed in kg	
Explanatory variables			
Sex of household head	SEX	Dummy 1 = Male; 0=otherwise	+
Age of household head	AGE	Number of years	+
Total Family size	TFSIZE	Number of persons	+/-
Education of household head	EDUC	Years of schooling	+
Vegetable farming experience	VFEXP	Number of years	+
Total Livestock Owned	TLU	Tropical Livestock unit(TLU)	+
Land allocated to vegetable	LSIZE	Hectare	+
Owing motor pump	OMPUMP	Dummy 1=yes,0=otherwise	+
Uses of credit	UCRDT	Dummy 1= yes,0=otherwise	+
Membership in cooperative	MEMCOOP	Dummy 1=Yes,0=otherwise	+
Distance to nearest market	DMTRKT	Walking hour	-
Access to market information	MRKINFO	Dummy 1=Yes,0=otherwise	+
Owing Transportation means	OTRM	Dummy 1=Yes,0=otherwise	+
Uses of fertilizer	UFRTZER	Dummy 1=Yes,0=otherwise	+
Extension contact	EXCONT	Number of Extension contact	

RESULT AND DISCUSSION

This section presents the major findings of the study. A detailed description of sample households' demographic and socioeconomic characteristics is presented. Further, econometric results on determinants of participation and intensity of participation in the selected vegetable output market are presented

Statistical test for continuous and dummy variables across market participation

The demographic and socio-economic characteristics of vegetable market participants and non-participants involved in different activities were described in Table 3. The participation of households in selected vegetable market is subject to the interactive effect of demographic, socio-economic and institutional factors. To examine the critical factors causing variation among market participants and nonparticipants, both t-test and chi-square test were used for continuous and dummy variables, respectively. Accordingly, among 420 sample respondents 62%, 58% and 56% of them were participated in potato, tomato and cabbage market, respectively. Out of the sample households, 91.7% of them were male headed whereas the rest 8.3% of them were female headed households. The statistical analysis showed that there is significant difference in percentage of sex of households in cabbage market participation and non-participate at 5% significance level. To assess the livestock holding of each household, the tropical livestock unit (TLU) per household was calculated. The mean livestock holding of the total sample of households was 6.31 TLU. The analysis of independent t-test revealed that there is a significant difference in livestock holding at 1% significance level between vegetable market participants and non-participants.

The average land allocated for potato, tomato and cabbage production by sample respondents were 0.25, 0.14, and 0.15 hectares per household, respectively. The analysis of independent t-test revealed that there was a significant mean difference in land size allocation for potato, tomato, and cabbage production at 1% significance level between market participants and non-participants. The mean farming experience of potato and tomato market participants was 14.3, and 9.95 years, while that of nonparticipants was 11.94 and 8.82 years, respectively. The statistical analysis showed that there was a significant mean difference between farming experiences of market participant household heads and their counterparts at a 1% level of significance.

The average family size of potato market participants was 4.8, while non-participants were 4.5 persons, respectively. In terms of family size, the independent sample t-test revealed that there is a significant mean difference between potato market participant and non-participant at 10% level of significance. The chi-square test for dummy variables indicated that there was a statistically significant mean difference between participants and non-participants in terms of access to market information, membership in a cooperative, use of credit, using fertilizer, owing motor pump and transportation means for potato, tomato and cabbage product at 1% significance level (Table 3). The percentage of participants is greater than that of non-participant for these variables.

Results of econometric model analysis

For this study, the Double-hurdle model (DHM) was selected over the Heckman sample selection model based on model diagnostic test results (appendix table 1, 2, & 3). The results of model diagnostic test shows that the Inverse Mills ratio (LAMBDA) were not significant for all selected vegetable market participation which implies that the error term in the selection and outcome equation was not correlated. This indicates that there was no a sample selection bias, or there was no existence of unobserved factors that determine farmers' likelihood to participate in selected vegetable market and thereby affecting the level of participation.

The hypothesized independent variables were also tested for the possible existence of a multicollinearity problem that is the situation where the explanatory variables are highly correlated among themselves. To check the association between continuous and discrete variables, Variance Inflation Factor (VIF) and contingency coefficients tests were used and no problem was observed. Whereas to check for the possible existence of a heteroscedasticity problem a Breusch-Pagan test was applied and showed the presence of the problem for potato and tomato level of market participation. Therefore, the model outputs for potato and tomato were estimated using robust standard errors to correct for heteroscedasticity. The results of the analyses are presented and discussed in the following sections.

Determinants of market participation decision in major vegetable market

The result of the Probit model estimation for the determinants of the probabilities of households to sell or not vegetable is presented in Table 4. The decision to participate in the select vegetable market was estimated by the maximum likelihood method. 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 less than 1% probability level. The marginal effect was used as a useful measure to explain the result as coefficients of the Probit model are difficult to interpret, since they measure the change in the unobservable y* associated with a change in one of the explanatory variables.

Results of the first stage of the double hurdle (Probit regression) model are presented in (Table 4).

Land allocated for Potato and cabbage production**:** As hypothesized, this variable affected the market participation significantly and positively at 1% and 5%level, respectively. It implied that as farmers allocated a one-hectare additional land for potato and cabbage production**,** would increase the farmers' likelihood of market participation by 94% and 47.5% respectively. This may be due to access to more arable land that will encourage farmers to grow more potato and cabbage, which leads to surplus production for the market. Similar to the study done by (Tufa et al., 2014) it was shown that there is a positive and significant relationship between land size and market participation in the horticultural crop's market.

Owing transportation means positively and significantly influences the farmers' likelihood to participate in potato, tomato, and cabbage market at 5%, 1% and 1% probability level respectively. Thus, a shift from lack of transportation means would increase the likelihood of market participation by 11.6%, 9.5%, and 19.1%, respectively. Ownership of transport means such as donkeys and animal carts have a positive impact on market participation by reducing the cost of transporting inputs from the market to the farm and output from the farm to the market. The finding is consistent with the finding by (Tura et al., 2016) that showed ownership of transport means lowers the proportional transaction costs, thereby enhancing the probability market participation of teff.

Membership in cooperative positively and significantly affects the decision to participate in potato, tomato, and cabbage market at 1%, 1% and 5% probability level, respectively. Hence, the marginal effect result indicates that being a member of cooperative increases the probability of participation in the potato, tomato, and cabbage market by 8.6%, 6.9%, and 20.7%, respectively. The implication is that membership in cooperative could have better access to market information, inputs, extension services, or technical advice and credit facilities important to production and marketing decisions. This agrees with the findings of (Agwu et al., 2012 and Adeoti et al., 2014) that being a member of a producer group motivates farmers to participate in the market through networking and provision of up-to-date information to members.

Applying fertilizer: as expected, this variable influenced potato market participation positively and significantly at 5% significance level. It was revealed that using fertilizer input for potato production, leads to increases in the probability of market participation by 0.3%. This implied that those farmers who had applied fertilizer, produced a surplus of potato production, more yields boost the farmer's likelihood to participate in the market. This in line with the findings of (Sindi, 2008) that using fertilizer enables producers to increase the quantity of output which in turn increases the market participation and surplus for the market.

Owing motor pump: as hypothesized, this variable was found to have a positive and significant influence on farmers' likelihood to participate in the potato, tomato and cabbage market at a 1%, 1% and 1% probability level. The marginal effects for this variable revealed that keeping other variables constant, owning of the motor pump increases market participation by 14.5% and 6.7% 15% respectively. This indicates that ownership of the motor pump enables farmers to produce more potato and cabbage products, this in turn increases the market participation of households. The study of (Debello, 2007) showed that owning a motor pump was positively and significantly affect horticultural products and marketing in Ethiopia.

The education of the household head positively and significantly affects the probability of potato market participation at a 5% probability level. It was revealed that a unit educational increment, leads to increases in the likelihood of market participation by 1.5%, all other factors held constant. This may be due to educated household heads having better market networking and bargaining power and good managerial skill of enterprises. This is in line with (Mutayoba and Ngaruko, 2015) who illustrated the positive influence of education on market participation of tomato in Tanzania.

The number of extensions contacts positively and significantly affects the decision to participate in the potato market at a 1% significance level. The result showed that as the number of extensions contacts increases by a unit, the market participation of household's increases by 9.1%. This is because extension workers usually provide information on market availability that enhance the farmers' knowledge and provide a range and choice of market opportunities. The study conducted by (Sebatta et al., 2014) indicated that the number of extensions visits from government workers had a positive and significant effect on the decision to participate and intensity of participation in the market.

Market information significantly and positively influences the probability of potato market participation of households at a 1% significant level. The result showed that access to market information increases the probability of market participation by 11.7%, all other factors being unchanged. Market information is a vital instrument during marketing because it informs the farmers about marketing conditions. The finding is consistent with the results of (Musah, 2013) who found that the existence of a positive relationship between market information and intensity of maize market participation in the upper west region of Ghana

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Table 3. Demographic and socio-economic characteristics of farmers across market participation

Variable	Potato market participation				Tomato market participation				Cabbage market participation			
	Part. N=261 Mean	N/part. N= 159 Mean	Total N=420 Mean	t-vale	Part. N =244 Mean	N/part N=176 Mean	Total N=420 Mean	t-vale	Part. N= 238 Mean	N/part. N= 182 Mean	Total N=420 Mean	t-vale
Age of household	39.64	38.73	39.30	0.87	38.81	39.98	39.30	-1.14	39.75	38.70	39.30	1.02
Distance to Market	0.63	0.66	0.64	-0.99	0.57	0.74	0.64	-5.2***	0.61	0.69	0.64	-2.47**
Family Size	4.80	4.50	4.69	1.775*	4.74	4.61`	4.69	0.81	4.73	4.63	4.69	0.64
Education	3.23	2.79	3.06	1.34	3.27	2.76	3.06	1.59	3.63	2.31	3.06	4.21***
Total Livestock Owned	7.26	4.74	6.31	7.17`***	7.17	5.12	6.31	5.83***	6.89	5.55	6.31	3.75***
Land allocated to vegetable	0.35	0.09	0.25	3.15***	0.18	0.08	0.14	2.92***	0.18	0.11	0.15	7.96***
Vegetable farming experience	14.29	11.94	13.40	3.92***	9.95	8.82	9.48	2.4**	9.68	9.73	9.70	-0.10
Extension contacts	1.43	1.11	1.31	2.28**	1.58	0.93	1.31	4.89***	1.55	0.99	1.31	4.17***
Dummy Variable	%	%	%	χ^2 -Value	%	%	%	χ^2 -Value	%	%	%	χ^2 -Value
Sex (Male)	90.80	93.10	91.70	0.67	93.40	89.20	91.70	2.40	87.80	96.70	91.70	10.66***
Owing motor Pump(yes)	20.70	20.80	20.70	0.00	27.90	10.80	20.70	18.15***	45.80	1.10	26.40	105.98***
Member of cooperative	63.60	15.10	45.20	93.85***	60.70	23.90	45.20	55.87***	56.70	30.20	45.20	29.24***
Market Information(yes)	74.70	15.10	52.10	140.74***	62.30	38.10	52.10	24.05***	63.40	37.40	52.10	28.12***
Uses of credit (Yes)	29.90	8.20	21.70	27.44***	28.30	12.50	21.70	14.99***	31.90	8.20	21.70	34.11***
Uses of fertilizer (Yes)	52.50	2.50	33.60	110.65***	41.00	2.80	25.00	79.3***	37.80	25.80	32.60	6.75***
Owing transportation (yes)	61.30	1.90	38.80	146.9***	54.90	16.50	38.80	63.62***	55.00	17.60	38.80	60.94***

N.B. ***, ** and * represents level of significance at 1%, 5% and 10% respectively.

Distance to the nearest market was found to be a negative and significant effect on the decision to participate in potato market at a 1% significant level. It was revealed that an extra one walking hour to the market would decrease the probability of a household's participation in the potato market by 11.7%. This implies that farmer households are located far from the market-facing high transportation costs and thereby leading to decide not to participate. The finding agrees with that of (Achandi et al., 2016) found that distance to the market has a negative and significant effect on both the farmer's decision to participate and the extent of farmer participation in the market.

Table 4. Regression result of double hurdle model for vegetable market participation

Variables	Potato			Tomato			Cabbage		
	Coef.	Robust Std. Err.	M/effect	Coef.	Robust Std. Err.	M/effect	Coef.	Std. Err.	M/effect
SEXHH	0.980**	0.389	0.085	3.250***	0.910	0.091	-0.192	0.832	-0.016
VFEXP	0.015	0.018	0.001	-0.012	0.068	0.000	0.153***	0.024	0.013
DISMRKT	-0.052	0.232	-0.005	-1.093***	0.395	-0.031	0.350	0.388	0.029
TFSIZE	-0.084	0.087	-0.007	-0.279*	0.162	-0.008	-0.140	0.101	-0.011
EDUC	0.168**	0.078	0.015	0.047	0.051	0.001	0.026	0.050	0.002
LSIZE	10.840***	3.362	0.942	4.608	4.513	0.129	5.796**	2.798	0.475
OTRM	1.331**	0.522	0.116	3.388***	0.706	0.095	2.331***	0.771	0.191
TLU	0.043	0.034	0.004	0.743***	0.175	0.021	0.024	0.039	0.002
UFRTZER	0.034**	0.018	0.003	0.018	0.026	0.000	0.012	0.010	0.001
OMPUMP	1.666***	0.505	0.145	2.399***	0.745	0.067	1.830***	0.544	0.150
EXCONT	1.047***	0.380	0.091	-0.090	0.156	-0.003	0.040	0.091	0.003
UCRDT	0.407	0.347	0.035	0.660	0.502	0.018	0.847**	0.378	0.069
MEMCOOP	0.987***	0.292	0.086	2.461***	0.538	0.069	2.525**	0.453	0.207
MRKTINFO	1.346***	0.272	0.117	0.144	0.407	0.004	0.143	0.285	0.012
_cons	-3.961***	0.774		-4.297***	1.033		-2.450**	1.198	
Number of obs =		420			420			420	
LR /Wald chi2(14) =		117.74			175.15			445.69	
Prob > chi2 =		0.000			0.000			0.0000	
Pseudo R2 =		0.7655			0.927			0.7754	
Log likelihood =		-65.3395			-20.8426			-64.5312	

***, ** and * are statistically significant at 1%, 5% and 10% probability level, respectively.

Sex of Household Head was found to be positive and statistically significant influence potato and tomato market participation at 5% and 1% level of significance, respectively. The positive sign shows that being a male head of a household significantly increase potato and tomato market participation by 8.5% and 9.1% respectively as compared to that of female-headed households, keeping other variables constant. This is consistent with the finding of Mahlet et al. (2015) who found that gender of the household head positively and significantly influenced potato market participation and marketed surplus.

Livestock holding: this variable was found to be positively and significantly influence the probability of tomato market participation decision at 1% significance level. The marginal effect shows that a unit increase in livestock holding (TLU) will result in rise of the probability of tomato farm household market participation by 74.3%. Livestock play a critical role in vegetable farming systems, as they provide manure that increase output of vegetable products. Moreover, livestock serves as a means of transportation, renting animals that support vegetable market participation. However, this finding has contrasted the views held by Mussema (2006) that farmers with more TLU tend to specialize in livestock production reducing the importance of pepper production as means of cash generation.

Family size is negatively associated with the probability of market participation at 10% level of significance. An increase in the household size by one person decreases likelihood of market participation by 0.8%. The larger family size lower marketed surplus than smaller family size, since the larger family size, the higher quantity consumed, and the less available for sales. This finding is consistent with that of Tura et al. (2016) who observed that family sizes have negative relationship with the probability of market participation decision.

Cabbage farming experience: this variable affected market participation significantly and positively at 5% level. The marginal effect of this variable revealed that on average, a one year increase in farming experience leads to a 1.3% increase in market participation, ceteris

paribus. This is probably due to the reason that as farmers are experienced with vegetable farming, they would be aware of the benefits of selling vegetable than those farmers with low farming experience. This result was in confirmation with the studies by Ayelech (2011), as production experience affected the amount of Avocado supplied to the market.

Factors affecting the intensity of market participation

To analyze the factor affecting the intensity of market participation, the second stage of the double hurdle (Truncated Regression) model was used. The regression result showed that the model was statistically significant at a 1% level indicating the goodness of fit of the model. Results of the second stage of the double hurdle (Truncated Regression) model are presented in (Table 5). Education of the household head was positively and significantly associated with the intensity of potato, tomato, and cabbage market participation at a 1%, 1% and 5% significance level, respectively. It was revealed that as the number of years spent in school by the household head increases by a unit, the intensity of market participation would increase by 1.09%, 1.78% and 1.39%, respectively. This implied that education increases the ability of farmers to gather relevant market information which would improve the knowledge and ability of the farmers in terms of better formulation and execution of farm plans, and acquiring better information to improve their marketing performance. This confirms the finding of (Tufa et al., 2014) who argued that education will endow the household with better production and managerial skills which leads to an increase in the extent of market participation.

Conditioned on the participation of the market, fertilizer application for potato and tomato production is positively and significantly associated with the intensity of market participation at 1% and 5% significance level, respectively. The result shows that farmers who have used fertilizer could sell 23.7% and 5% more potato and tomato than households who didn't apply fertilizer, respectively. This implies that farmers who have used fertilizer are able to produce enough marketed surplus. This confirmed with the finding of (Sindi, 2008) who found that using fertilizer enable producers to increase the quantity of output which in turn increases the market participation and surplus for the market.

The number of extension contact has a positive and significant influence on the intensity of tomato and cabbage market participation at a 10% and5% significance level (Table 5). Households who were visited more by extension agents sold 84.3% and 2.87% more tomato and cabbage than households who were visited less by extension agents, respectively. Extension contact enables the farmer to improve production methods leading to more output which in turn more likely to sell. This result is in line with the result of (Sebatta et al., 2014) who found that the number of extensions visits from government workers had a positive and significant effect on the decision to participate and intensity of participation in the market.

Livestock holding: This variable was found to be positively and significantly influence the intensity of tomato market participation decision at 1% significance level. The result indicated that a unit increase in number of livestock (TLU) owned by the households increases marketed surplus of tomato by 1.11%. Livestock play a critical role in vegetable farming systems, as they provide manure that increase output of vegetable products. Moreover, livestock serves as a means of transportation, renting animals that support vegetable market participation. A study by Makhura (2001) on maize marketed surplus suggests that an increase in the value of livestock owned leads to an increase in maize sale.

Access to market information has a positive association with the intensity of cabbage market participation at 5% significant level. Households who had market information sold 7.86% more cabbage than those who did not have access. Moreover, market information is a vital instrument during marketing because it informs the farmers about marketing conditions. The finding is consistent with that of (Moono, 2015) who found that access to information prior to selling was positively significant among rice farmers in Zambia.

Uses of credit were positively and significantly related to the intensity of tomato and cabbage market participation at a 1% and 5% significant level respectively (Table 5). Other things unchanged, the coefficient results for this variable revealed that uses of credit would increase the intensity of market participation by 6.56% and 7.53% respectively. This means that using credit is the major source to solve the financial problem that hinders the use of improved agricultural technologies. Therefore, households who have used credit can have a financial strength to purchase improved inputs, leading to produce a more marketed surplus. The result is in line with that of (Abera e al., 2016) who found that the use of credit was significantly and positively associated with the level of market participation.

Distance to the nearest market negatively and significantly influences the intensity of potato market participation at a 5% significant level. When the household is located an extra one hour away from the market, the quantity of potato sold decreases by 6.44%. It implies that as the distance from the nearest market increases, variable transport costs increase and this discourages smallholder farmers from selling high volumes of potato. This result is in line with the finding of (Mazengia, 2016) in which distance to the market negatively influences smallholder farmers' extent of maize market participation in northwestern Ethiopia

Cabbage farming experience variable was affected intensity of market participation significantly and

positively at 5% level. The result revealed that on average, a one year increase in farming experience leads to a 27.7% increase in intensity of market participation, ceteris paribus. This is probably due to the reason that as farmers are experienced with vegetable farming, they would be aware of the benefits of selling vegetable than those farmers with low farming experience. This result was in confirmation with the studies by Ayelech (2011), as production experience affected the amount of Avocado supplied to the market

Table 5. Regression result of double hurdle model for the intensity of market participation

Variables	Potato			Tomato			Cabbage		
	Coef.	Robust Std. Err.	Z	Coef.	Robust Std. Err.	Z	Coef.	Std. Err.	P>z
SEXHH	-1.672	1.843	-0.91	5.501***	1.795	3.07	-13.311**	4.966	-2.68
VFEXP	0.137	0.084	1.64	0.277**	0.135	2.05	0.335	0.336	1.00
DISMRKT	-6.441**	2.654	-2.43	-0.447	0.937	-0.48	-1.381	4.507	-0.31
TFSIZE	0.209	0.427	0.49	-0.284	0.306	-0.93	-1.147	1.053	-1.09
EDUC	1.086***	0.317	3.43	1.781***	0.337	5.28	1.394**	0.497	2.80
LSIZE	-0.005	0.448	-0.01	1.700**	0.714	2.38	20.133	16.222	1.24
OTRM	0.609	1.419	0.43	-0.320	1.386	-0.23	1.644	3.697	0.44
TLU	0.045	0.211	0.21	1.111***	0.204	5.45	-0.843	0.483	-1.74
UFRTZER	0.237***	0.020	12.11	0.05**	0.023	2.21	0.083	0.071	1.17
OMPUMP	10.091***	2.146	4.70	0.922	1.202	0.77	3.394	3.064	1.11
EXCONT	0.517	0.690	0.75	0.843*	0.463	1.82	2.780**	1.120	2.48
UCRDT	1.017	1.636	0.62	6.564***	1.291	5.08	7.530**	3.392	2.22
MEMCOOP	2.267*	1.241	1.83	2.489*	1.008	2.47	6.098	3.813	1.60
MRKTINFO	0.738	1.790	0.41	-0.962	1.283	-0.75	7.859**	3.792	2.07
_cons	3.261	3.326	0.98	-10.262**	3.496	-2.94	12.597	10.911	1.15
Limit: lower =			0			0			0
upper =			+inf			+inf			+inf
Number of obs =			261			244			238
Wald chi2(14) =			1642.33			515.02			57.39
Prob > chi2 =			0.000			0.000			0.000
Log likelihood =			-890.051			-752.2699			-947.9962

NB: - Dependent variable is total quantity of vegetable marketed in kg (transformed in quintal/100kg)
***, ** and * are statistically significant at 1%, 5% and 10% probability level, respectively.

Sex of Household Head was found to be positive and negative significant influence on tomato and cabbage intensity of market participation at 1% and 5% level of significance, respectively. The positive sign shows that being a male head of a household significantly increase intensity of tomato market participation by 5.5% as compared to that of female-headed households, keeping other variables constant. The negative sign shows that being a male head of a household significantly decreases intensity of cabbage market participation by 13.3% as compared to that of female-headed households, keeping other variables constant. The positive significant result is consistent with the finding of Mahlet *et al*. (2015) who found that gender of the household head positively and significantly influenced potato market participation and marketed surplus and the negative significant result is consistent with the finding of Gizachew (2005) who found that in Ethiopia female-headed households had a higher tendency to participate in the dairy market than male-headed households

Land allocated for tomato production positively and significantly affects the intensity of market participation at 5% probability level. The result is similar to expectation and a unit increases in the farm size increases the intensity of market participation by 1.7%. A farmer who has a large farm size would have high probability to allocate more land for production of vegetable. Similar to the study done by Masoku et al. (2001) it was shown that there is positive and significant relationship between land size and intensity of in the maize market

Owing motor pump variable was found to have a positive and significant influence on farmers' intensity of market participation at a 1% significant level. The result for this variable revealed that keeping other variables constant, owning of the motor pump increases intensity of market participation by 10.09% respectively. This indicates that ownership of the motor

pump enables farmers to produce more potato products, this in turn increases the intensity of market participation of households. The study of (Debello, 2007) showed that owning a motor pump was positively and significantly affect horticultural products and marketing in Ethiopia.

Membership in cooperative positively and significantly affects the intensity of potato and cabbage market participation at 10% significant level. The result indicates that being a member of cooperative increases the intensity of potato and cabbage market participation by 2.27%, and 2.49%, respectively. The implication is that membership in cooperative could have better access to market information, inputs, extension services, or technical advice and credit facilities important to production and marketing decisions. This agrees with the findings of (Agwu et al., 2012 and Adeoti et al., 2014) that being a member of a producer group motivates farmers to participate in the market through networking and provision of up-to-date information to members.

CONCLUSION

The study has identified the factors influencing household market participation decision and intensity of participation in southwest Ethiopia. Results of the double-hurdle model analysis showed that in the first hurdle the likelihood of household participation in potato, tomato, and cabbage market as a seller was commonly influenced by owing motor pump, owing transportation means and member of a cooperative. Using credit, Education, application of fertilizer, member of a cooperative, access to information and frequently access to extension service is important to smallholder farmers to improve their market participation and intensity of participation. Walking long distances to the market was found to be another inhibiting factor for taking a larger amount of the vegetable output to the market. Based on the findings of this study, the following policy measures are presented to enhance the household market participation decision and intensity of marketing. Government and non-governmental organizations should provide the fertilizer subsidy program to effectively increase the production of vegetables. In addition, extension service should be largely and frequently provided to farmers to improve their production methods. Ministry of Finance and Economic Development should establish a rural agricultural finance scheme aimed at addressing the credit needs of smallholder farmers. Farmers should form and maintain effective groups to influence market prices for their products through their collective bargaining power. Building the education capacity of rural farmers through arranging consecutive pieces of training or arranging another formal way of education such as the adult education system should be designed to enhance the knowledge of the farmers. The government and other stockholders should create a department solely for providing agricultural market information to make market information delivery effective. The government and other stockholders should consider expanding construction facilities like roads so that transportation will be easy for the market. The result concluded that male-headed households are in a better situation in market participation and level of participation compared to female-headed implying that giving due attention for female- headed households is required. Governmental and non-governmental organizations should target women while providing training and other extension service for farmers.

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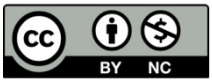

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