International Scholars Journals

African Journal of Agricultural Marketing ISSN: 2375-1061 Vol. 3 (8), pp. 241-251, August, 2015. Available online at www.internationalscholarsjournals.org © International Scholars Journals

Full Length Research Paper

Gender role in market supply of potato in Eastern Hararghe Zone, Ethiopia*

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Accepted 28 June, 2015

Potato is an important vegetable that is produced for food security and income generation. Both men and women households are the major actors in potato production and marketing. However, there are different factors that affect the households' production and supply. In this regard, various research results have identified major causes that hinder sufficient production and marketing. But the results do not reveal the gender difference among households in the production and marketing. The analysis of this study is based on a survey of 400 household heads from three randomly selected districts of Eastern Hararghe zone. Descriptive statistics and linear regression model with Ordinary Least Square were used to analyze determinates of supply. Result of the descriptive statistics showed that there are differences between households in terms of age, dependency ratio, access to market information and quantity produced. The estimate of OLS result reveals that, the amount of potato produced, livestock holding and farming experience are some of the significant variables that affect the households' level of potato supply positively and negatively at different probability levels. Hence, identifying the various factors in the production and supply of potato will help the households in maximizing their benefit and improve their capacity.

Key words: Quantity supplied, potato, household heads, quantity produced, ordinary least square, Eastern Hararghe zone.

INTRODUCTION

Potato is a major vegetable crop and most diverse in the world (IYP, 2008). Worldwide more than 320 million tons of potatoes are produced annually on 20 million hectares of land (FAO, 2010). Moreover, potato is grown in more than 100 countries and ranks 4th among the worlds' most important staple food crops after rice, wheat, and maize (FAOSTAT,2007), and it has been recognized as one of the main crops to alleviate hunger in the world. In Africa, most of the production is concentrated in East Africa (70%), followed by South Africa (21%) and West Africa (8%) (FAO, 2010).

Ethiopia has suitable edaphic and climatic conditions for the production of high quality ware and seed potatoes (Tekalign, 2010; Endale et al., 2008). Moreover, in 2013/14, the area under potato production in Ethiopia was about 66,745 hectares with an average national yield of 117 quintal per hectare for the main cropping season

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(CSA, 2014). Most highlands with altitudes ranging from 1,500 - 3,000 meters above sea level (m.a.s.l) and annual precipitation of 600 - 1,200 millimeters (mm) are suitable for potato cultivation (Medhin et al., 2001; FAO, 2008). Eastern Oromiya is a major potato producing area. It covers the eastern highlands of Ethiopia, which includes Fedis, Haramaya, Kombolcha, Kersa, Meta, Kurfa Chelle, Grawa, and Jarso (Bezabih and Hadera, 2007). Furthermore, the area under potato production in East Hararghe was 2,207.12 hectares with an average yield of 193 quintal per hectare (CSA, 2014).

Potato constitutes a major ingredient in every meal of the households in Eastern Oromiya. The presence of a regional domestic market and cross-border and export market outlets to the neighboring countries like Djibouti and Somalia have contributed to the development of potato culture in Hararghe (Tekalign, 2010). Export as well as local marketing of potato is an essential activity of the farming households where it generates income. Out of the total volume of potato marketed to Somalia, 75 percent is supplied from East Hararghe and about 25 percent from the central part of Ethiopia including the Rift Valley and Shashemene (Bezabih, 2008). However, the supply is neither sufficient nor constant to satisfy the demand of the market at both market outlets.

Given the economic and social importance of potato, men and women farmers managed their farms in a better way so that they can be prominent in the production and supply of potato. In a married household, men and women work together to produce potatoes; men devote their efforts to activities requiring more physical effort such as land preparation, but many tasks are shared (Amaya, 2009). However, farm managed by women are generally characterized by low level of mechanization and technological inputs, which often translate into low productivity (FAO, 2006). Even though, both households face various constraints that hamper their effective production and supply, women-owned businesses face greater constraints and receive far fewer services and less support than those owned by men (Bardasi et al., 2007; Ellis et al., 2006; World Bank, 2007a,b). These disadvantages reduce women's effectiveness as actors in value chain and also restraint their overall engagement in market activities. Yet, quantitative analysis of gender deferential in potato supply to the market has not been studied in eastern Oromiya. The major objective of the paper is, therefore, to assess the effect of gender on market supply of potato. Moreover, this paper aims at assessing the factors that hinder male and female headed households from effective potato production and marketing, how the factors affect them and why the factors affect them differently.

METHODOLOGY

Sampling procedure, type of data and method of data collection

The study was conducted in Eastern Oromiya National Regional State of Ethiopia. A multi-stage random sampling technique was used to select the districts, rural kebele and sample household heads. In the first stage, study districts from the zone were selected purposively based on their higher potato production potential as compared with other districts. Accordingly, Kombolcha, Kersa and Haramaya districts were selected for the survey. In the second stage, 12 potential kebeles[1] were randomly selected from the selected districts. In the third stage, 400 household heads were randomly selected where the sample gender representation was based on the proportion of male and female headed households *i.e*., 372 male headed households and 28 female headed households. The sample households were drawn randomly from each kebele based on probability proportional to size sampling techniques.

Both qualitative and quantitative data were collected from primary and secondary data sources. Primary data were collected from sample farm households using pre-tested structured interview schedule, focus group discussions and observations. The primary data were firsthand information collected through individual contact in their vicinity. The data collected include producers' household characteristics, quantity produced, potato production characteristics, quantity supplied and access to markets and information. Besides, relevant secondary data sources like government and non-government reports, relevant text books, journals and bulletins were reviewed to supplement the survey data at different times of the study period.

Data analysis

To measure factors affecting market supply of potato by farm households, a linear regression model was employed. A number of household and institutional factors are identified as the main features that affect the market supply of potato. This model was chosen for a reason that the dependent variable i.e. quantity supplied is continuous (Gujarati, 2003) and other assumptions of OLS are fulfilled in the field survey data. Moreover, different studies on market supply used Ordinary Least Square (OLS) regression to assess determinants of market supply of agricultural products (Kinde, 2007; Betelihem, 2013; Mahilet, 2013). Therefore, the study chooses linear regression model to analyze the major causes of market supply of potato.

The econometric model specification of supply function takes the following form.

$$Yi = \alpha + X_i\beta + U_i \quad (1)$$

Where Y_i = is the amount of potato supplied to market

[1]Kebele is the administrative structure below district. A cluster of kebeles form a district.

X_i = explanatory variables determining the amount of market supply

α = intercept

β = coefficient of i th explanatory variable

U_i = unobserved disturbance term

The estimates of coefficients of the regression equation obtained using the method of Ordinary Least Squares. OLS assumes that the random term follows normal distribution with zero mean and constant variance. The successive values of the random term are also assumed to be independent. The OLS assumes also that the explanatory variables are non-stochastic and they are not perfectly linearly related to one another (Gujarati and Sangeetha, 2007). It is hypothesized that male and female farmers produce and supply different quantities of potato to the market to maximize their gross income. However, the households' decision to supply is influenced by various factors. Therefore, the main hypothesis variables for the study are listed below.

Dependent variable

Quantity supplied to market (QtySupp): It is a continuous variable measured in quintal and represents the actual supply of potato by farm households to the market in the survey year.

Independent variables

Education of the household head (EduHH): It is a dummy variable that measures whether a farmer has attended formal education or not (Table 1). It assumes a value of 1 if the household head attended formal education and 0 otherwise. It is believed that if a farmer attained formal education of any level there is a possibility of increment in their productivity as they have better knowledge than those who did not attend formal education. In addition, educated farmers are exposed to better technologies that will help them increase production and supply. There are many studies that show the relationship between education and quantity supplied to a market. For instance, Yeshitila (2012), has indicated that there is a positive relationship between education and vegetable marketing. Similar studies conducted by Gizachew (2005) and Rehima (2006), revealed that formal education has positive relationship with household market participation and marketed volume. It is also found that the more the producers of Paddy got educated the more the supply in the market and it is also indicated that education improves level of sales that affects the marketable surplus (Astewel, 2010). Therefore, in this specific study, formal education is expected to have a positive relationship with quantity of potato supplied to the market.

Gender of the household head (GenderHH): It is a dummy variable which takes a value of 1 if the household is headed by male and 0 otherwise (Table 1). Both men and women participate in potato production where male headed households are believed to have better tendency than female headed households in production and supply of potato. Lack of capital, access to credit and extension services and size of the land can be mentioned as some of the reasons for the variance occurred between the households. The study conducted by Gizachew (2005), indicates that there is a negative relationship between sales of volume of milk and male-headed household. Study by Mamo and Degnet (2012), also showed that sex is a determinant factor in the household head in the livestock market. Furthermore, the study made by Dawit (2010), discovered that sex of the household head is one of the factors that positively affect the probability of marketable supply of poultry in Alamata and Atsbi Womberta woredas of Tigray. A study done by Lewis et al., (2008), stated that gender difference and the marketing styles at Oklahoma wheat producers showed that men tend to sell more grain frequently than women. Therefore, the effect of sex of the household heads on marketed supply of potato in the study area will be determined.

Women empowerment (WomenEmp): It is a dummy variable taking the value of 1 if woman is empowered in the household and 0 otherwise. Empowered women have a chance to decide and access to different production inputs, better communication and acquiring knowledge from different institutions and having better time schedule to supply product to the market. Moreover, empowered women are expected to produce more and supply better than disempowered women in the households. However, this may not be always true in the situation that women have small pieces of land, low access and linkage with extension agents, and hence low quantity produced. Therefore, women empowerment effect on marketed supply of potato is undefined will be determined based on context specific data.

Family size (FamSize): This refers to the number of household members and it is a continuous variable that is measured in man equivalent Storck et al., (1991), that is the availability of active labor force in the household, which affects the farmer's marketed supply. As potato is a vegetable crop, it is a labor intensive activity for both the production and market supply. Accordingly, household heads that have active labor force tend to supply more potato to the market than others. Thus, family size is expected to have positive impact on the amount of agricultural products sold. The study conducted by Fantahun (2010), also indicates that large family size has an effect in decreasing the supply of malt barley in Amhara region. Furthermore, study by Wolday (1994), showed that household size has significant positive effect on quantity of "*tef*" marketed and has negative effect on quantity of maize marketed. Another study by Gezahagn (2010), also details that family size has positive effect on the households' gross income from the production of groundnut. Hence, in this context, the effect of family size has positive effect on

marketed supply of potato (Table 1).

Dependency ratio (DependR): This variable is the ratio of the number of children below 15 years of age, disabled members and elders above 65 years of age to the number of economically active family members (15-65 years of age). An increase in dependency ratio in the household affects the quantity supply in a way that more shortage of labor in production of potato. Thus, dependency ratio is expected to have negative effect on households' marketed supply of potato.

Farming experience of the household head (FarmExper): It is a continuous variable that indicate the farming experience of the household head in years (Table 1). A household with better farming experience in potato cultivation is expected to adopt new recommendations for securing higher yield than those with less farming experience. A study conducted by Ayelech (2011), indicates that farmers with longer farming experience are expected to be more knowledgeable and skillful and are more successful in their production. Thus, farming experience is expected to have positive relation with marketed supply of potato in the study areas.

Livestock holding (TLU): This is a continuous variable that measures the total number of livestock owned by a household in terms of tropical livestock unit (TLU) (Table 1). Households that have high TLU are expected to have a better wealth status in the society. Livestock holding in a household is useful as it increases fertility status of the soil as a result of usage of organic manure and as a source of income from sale of livestock and its products. This particular variable creates an opportunity for a household to use organic manure in addition to inorganic fertilizer so as to increase potato production. Therefore, the variable is expected to have positive linkage with the amount of potato supplied to the market.

Availability of irrigation (AvIrrigat): This is a dummy variable which takes a value of 1 if the households have access to irrigation 0 otherwise. It is one of the most important inputs for potato production in the study area, where producers have a chance to produce more than one time per year. The study by Tadesse (2011), shows that, the farmers who have access to irrigation are using it for production of high value cash crops in West Hararghe Zone. Thus, this variable is hypothesized to have positive influence on potato supplied.

Access to market information (AccMktInf): It is a dummy variable taking a value of 1 if the household has access to market information and 0 otherwise. The better the information the farmers have about the products marketing, the higher would be their supply. Moreover, farmers marketing decisions are based on market price information, but poorly integrated markets may convey inaccurate price information, leading to inefficient product movement (Abraham, 2013). However, information dissemination might not be the same at once to benefit all equally. A study by Muhammed (2011), also reveals that if wheat producers get accurate market information, the amount of wheat to be supplied to the market increases. Similarly, study by Mahilet (2013), indicates that marketable surplus of malt barley producers who have access to market information are greater than those who did not. Thus, we can hypothesize that access to market information will have a positive implication on marketable supply of potato.

Access to credit (AccCred): This is a dummy variable that takes the value 1 if the household receives loan for potato production and 0 otherwise. Farmers who have access to credit would increase their financial capacity as it assists to make proper decision regarding purchasing of modern input to increase production and volume of supply. The study by Alemnewu (2010) and Muhammed (2011), pointed out that if pepper and *tef* producers have access to credit, the amount to be supplied to the market would increase. We also hypothesize here that access to credit has positive influence on the level of production and sales.

Distance to the nearest market (DisMkt): It is a continuous variable measured in kilometer that the farmers are required to travel in order to sell their product and spend some time in the market. The closer the market area the lesser the transportation and transaction costs and time spent. Moreover, there is no doubt that transportation has great importance for marketing agricultural product. The study by Shilpi and Umali (2007), found that the likelihood of sales at the market increases significantly (positively) with an improvement with market facilities and a decrease in travel time from the village to the market. The study by Mahilet (2013), stated the analysis of value chain of malt barely also indicated that if the proximity from the farm to market increases, the volume of malt barley supplied to the market decreases. In this study, the variable is expected to have a negative relationship with farm level marketed supply of potato (Table 1).

Quantity of potato produced (QtyProd): It is a continuous variable measured in quintals within a year 2013/14. An increase in output level increases the marketed supply of the crop. The studies of Abay (2007); Adugna (2009) and Ayelech (2011), pointed out that the amount of tomato, papaya, avocado and mango produced by farming households has augmented significant marketable supply of the agricultural products. The higher output the farmer obtain, the higher would be the marketed amount. In addition, different studies Kindie (2007); Bosena (2008) and Assefa (2009), disclosed that the amount of sesame, cotton and honey produced by households are significantly and positively affected by marketable supply of each of the products. Though similar study is lacking in potato, we hypothesize that the quantity of potato produced can have a positive effect on marketed supply.

Off/Non- farm activities (OffNonFarm): It is a continuous variable which refers to the income obtained by the sample households from off/non-farm activities. Increased availability of opportunities for off/non-farm

Table 1. Summary of dependent and independent variables used in Linear Regression model.

Variables	Definition	Values	Expected sign
Dependent variable			
QtySupp	Quantity supplied to the market	Amount sold in quintals	
Independent variables			
EduHH	Educational level of household head	1 if attended formal education, 0 otherwise	+
GenderHH	Gender of the household head	1 if male, 0 otherwise	+/-
WomenEmp	Women empowerment index in the households	1 if women empowered, 0 otherwise	+/-
FamSize	Total active labor force in the household	Man equivalent	+
DependR	Non-active labor force in the household	Ratio of non active to working labor	-
FarmExper	Farming experience of household head	Number of years since started farming activity	+
TLU	Livestock holding in the household	Tropical livestock unit	+
AvIrrigat	Availability of irrigation facilities	1 if yes, 0 otherwise	+
AccMktInf	Access to market information in the household	1 if access to information, 0 otherwise	+
AccCred	Access to credit in the households	1 if the household take loan, 0 otherwise	+
DisMkt	Distance to the nearest market	Number of kilometer	-
QtyProd	Quantity potato produced by the households	Quintals	+
OffNonFarm	Off/non-farm activities in male headed households	Birr per year	-

Source: Own computation from survey data (2012/13)

employment have negative relationship with supply of potato (Table 1). Most of the time, farmers are engaged in different income generating activities along with their main task of farming. They buy khat, vegetables, fruits, etc from other farms in their vicinity and sell with better price to other market places in the cites. In addition, this other income generating activities are assumed to have inverse relationship with marketed supply of vegetable crops. Different studies have identified that access to other income sources is negatively related to the sales volume of milk, kales and maize in Kenya and banana market in Uganda (Omiti et al., 2009; Komarek, 2010). As we can infer from the study of Rehima (2006), stated that if pepper producer have non-farm income, the amount of pepper supplied to the market decreases. Therefore, the effect of this variable on the market supply of potato at farm level could be negative. In general, the definition of variables and the hypothesized signs of influence on potato market supply are summarized in Table1.

RESULTS AND DISCUSSIONS

Descriptive statistics

The mean age of the sample household heads was 35.74 years with the minimum and maximum age of 20 and 70 years, respectively. The average age of male household heads was 35.38 years compared to 40.5 years for female headed households with the mean age difference between the two groups being statistically significant at 1percent level. This indicates that most of the household heads were within the vibrant age category. Male headed households have almost similar farming experience (27.27 years) as compared with female headed households (26.79 years) which shows that the household heads have rich experience on potato production and marketing in the zone with no significant difference between the gender of the household heads (Table 2).

The mean family size of the total sample households was 5.81 persons ranging from 2 to 13. On average, male headed households have relatively larger family sizes (5.94) than the female household heads (4.11) with mean difference of 5.81 persons (Table 2). Labor availability or active labor force is a prominent input for potato production as well as marketing. The average man equivalent in the zone was 2.66 with standard deviation of 1.21, where male headed households have better active labor availability than female headed households. The dependency ratio also ranges from 0-6 with the mean values of 1.28 and 2.79 for male and female household heads, respectively with significant mean difference at 1percent significance level (Table 2).

Table 2. Demographic characteristics of sample producers.

Variables	MHHs*		FHHs*		Total		
	Mean	SD*	Mean	SD	Mean	SD	t- value
Age (Years)	35.38	10.10	40.50	7.71	35.74	10.03	2.62***
Farming experience (Years)	27.27	1.93	26.79	2.01	27.26	1.92	-0.95
Family size	5.94	2.19	4.11	1.07	5.81	2.18	-1.60
Dependency ratio	1.28	0.91	2.79	1.13	1.39	1.00	8.29***
Economically active labor force (ME)	2.72	1.21	1.53	0.43	2.66	1.21	11.64***

* MHH= Male headed household; FHH= Female headed household; SD= Standard deviation
*** indicate the level of significance at 1 percent.

The sample households in the study area comprise 93 percent male headed households and 7 percent female headed households. This indicated that female headed households are not widely engaged in potato production and marketing. Educational background of the sample households is essential to develop positive attitude towards adopting improved technologies, build up communicative skill and use of necessary information to increase production and productivity. The chi-square result revealed that education is a dummy variable that shows statistically significant difference between the households at 1 percent level of significance. About 65.1 percent and 28.6 percent of sample male and female headed households, respectively, were attending formal education (they can read and write). The female headed household is characterized by higher proportion of not attending formal education than the male headed households.

Based on the survey result, the average land holding of the sample households was found to be 0.531 hectares with standard deviation of 0.410 ranging between 0.06 and 2.88 hectares. The mean land holding owned was 0.538 ha and 0.437 ha for male and female headed households, respectively. In the year 2012/13, the mean average land used for vegetable crops is 0.036 hectares with standard deviation of 0.066, where there is no statistically significant difference. Specifically, land under potato was 0.139 hectares with standard deviation of 0.097, where there is no statistical significance difference among male and female headed households. Moreover, major cereal crops like sorghum, maize, wheat and khat were dominantly grown on the farm of the households in the study districts. The data discloses that the mean land areas allocated *for khat (Catha edulis)* and maize have statistically significant difference among male headed and female headed households at 5 and 10 percent level of significance. In this regard, male headed households have allocated better land size for khat and maize than female headed households. In addition, 56 percent of the sample households have medium fertility of the land and it has statistical significant difference at 1percent level of probability.

Livestock rearing is another important income generating source that almost all the sample households were engaged in. The total livestock holding measured in terms of TLU was found to be 2.69 with standard deviation of 2.11 which is relatively large as compared to the small land holding allocated for grazing purpose and continuous expansion of crop land. Moreover, the average livestock holding was 2.79 and 1.31 TLU for male and female headed households respectively with statistical mean difference at 1percent level of probability.

Market information is an important component for the timely supply of agricultural products and to satisfy the demand of the market. The households have different access to market where the benefit also varies. In the study areas, access to market information shows statistical differences between male headed and female headed households at 5percent level of probability (Table 3). On average, 48.5 percent of the sample households have at least potato price information from the nearby local market. In addition, more than half of the sample male headed households have access to market information by different means of communication like mobile phone.

Farm households took credits from different credit institutions like Microfinance, cooperatives and informal money lenders for various purposes. From the sample households, 41.2 percent used the money for the purchase of farm inputs like improved seeds, fertilizers (Urea and DAP), chemicals (pesticides and herbicides) and farm implements (*Akafa* and pumps), where as 16.5 percent used to purchase livestock such as goats, sheep, and cow either for fattening or to increase the number of livestock to generate income from sell of the animals and their products. As the data indicated, on average, 60.5 percent of the sample households had access to credit where the proportion of male headed households who accessed credit was, 59.7 percent (Table 3) with the reason that male headed households have better capital to invest on. Moreover, the average distance that most of the households used to travel to sell their product to the nearest market was about 6.67 kilometers, where it is 6.66 and 6.78 kilometers for male and female headed households, respectively, with no statistically significant mean difference between households.

Table 3. Institutional characteristics of sample households.

Variables	MHHs (N= 372)		FHHs (N= 28)		Total (N= 400)		χ^2-value
	N	%	N	%	N	%	
Access to market information	188	50.5	8	28.6	196	48.5	5.025**
Access to credit	222	59.7	20	71.4	242	60.5	1.505

** indicate the level of significance at 5 percent

The result of the survey reveals that, quantity produced and off/non- farm income generation activities are some of the variables that show 1 and 10 percent level significant difference between male and female headed households (Table 4). The average quantity produced in the households is 37.2 quintals per seasons where the male headed households had better chance to produce and supply potato to the market (38.7 quintals) than the female headed households since they produced 17.7 quintals. From the total quantity produced, on average, 30.7 quintals was supplied to the nearby market by the sample households i.e., 32.1quintals and 11.4 quintals by male and female headed households, respectively. The total yield of the households was 267.1 quintal per hectares.

Rural farm households earn cash income from different sources where, off/non-farm income generation activities are among them. The survey result (Table 4) shows that the income that is generated from this source was 1,135.50 Birr in 2012/13 with standard deviation of 3,739 Birr. Female headed households had better income (2,660.71 Birr) than the male household heads (1,020.70 Birr) with a significant mean difference at 10 percent level of probability.

Women empowerment is a process in which women gain greater share of control over resources material, human, intellectual and financial resources and control over decision making in the household, community, society, nation and to gain power (Pooja and Rathod, 2013). Women Empowerment Agricultural Index (WEAI) was calculated by adopting the two sub indexes i.e. 5DE (Five domains) and GPI (Gender Parity Index) from (IFPRI, 2012) which was developed by Alkire et al., (2012), that discussed about how to compute women empowerment in agriculture. The first index assesses the degree to which women are empowered in five domains of empowerment (5DE) which reflects the percentage of women who are empowered and, among those who are not, the percentage of domains in which women enjoy adequate achievements. Each of the domains has indicators with their corresponding weights. The domains are Production (Input in productive decisions and Autonomy in production), Resources (Ownership of assets, purchase, sale, or transfer about credit, access to and decision about credit), Income (control over use of income), Leadership (group member, speaking in public), and Time (Workload and leisure).

The second index GPI reflects the percentage of women who are empowered or whose achievements are at least as high as the men in their households. For those households that have not achieved gender parity, the GPI shows the empowerment gap that needs to be closed for women to reach the same level of empowerment as men. Such index excludes female headed households. The benchmark of WEAI and its sub indexes is an individual empowerment if he or she enjoys adequate achievements in 80 percent or 0.80 of the weighted indicators or more.

The survey result reveals that empowerment index in the households has statistically significant difference between households at 1 percent level of probability. From the total sample households, on average, 92.6 percent of women were not empowered and 6.4 percent were empowered. This is due to the large sample size of male headed household where women in these households do not have equal access and control over resources. The data also shows that on average 53.6 percent of women in female headed households were empowered than women in male headed households. This is due to the fact that female headed households have full access and control over resources than women in male headed households. On the contrary, on average 97 percent of women in the male headed households were not empowered as every resource in the household are fully controlled by the male.

Econometric result

Potato in the study district is produced by male and female household heads for different reasons. Agricultural production and marketing are essential means of livelihood for both male and female headed households. The current survey output indicated that, the difference in the supply of potato by male and female headed households is due to the fact that women have less quantity produced than male headed households. Besides quantity produced, there are various constraints that hinder their maximum supplies to the market, and thus identifying and making critical analysis of the causes of the difference in the supply is necessary.

Table 4. Potato produced and income from off-nonfarm activities of male and female households**.**

Variables	MHHs Mean	MHHs SD	FHHs Mean	FHHs SD	Total Mean	Total SD	t- value
Quantity produced (Qt)	38.7	35.7	17.7	14.2	37.2	35.0	6.438***
Off/non-farm activities (Birr/year)	1020.70	3614.34	2660.71	4949.84	1135.50	3739.0	1.719*

***and * indicate the level of significance at 1 and 10 percent, respectively.

Linear regression specified in Equation (1) was estimated using the OLS method to assess the effect of gender on market supply of potato. Prior to running the model, all the hypothesized explanatory variables were tested for the existence of multicollinearity and heteroscedasticity problems. However, the result shows that there is no serious problem in the model output. Coefficient of determination (R^2) was used to check goodness of fit for the regression model. Hence, R^2 for potato was 0.966 which indicates that 97 percent of the variation in the farm level marketable supply of potato was attributed to the variables included in the model. It also clarifies that potato is the major cash crop for the majority of producers and shows that the higher the output, the higher is the producers willing to supply to the market. Similar findings explained the direct or positive relation between volume of production and market supply of the products by (Omiti et al., 2009; Wolday, 1994; Bosena, 2008; Rehima and Dawit, 2012).

As it can be observed from the econometric result in Table 5, a total of 13 hypothesized explanatory variables (7 continuous and 6 dummy) were included in the model to explain the household level determinants of market supply of potato. Out of these variables, six were found significantly influence farm level marketed supply at 1, 5, and 10 percent probability levels. These variables include gender of the household, farming experience, livestock holding (TLU), access to market information, quantity produced and access to credit. The signs of the parameter of the significant variables are similar with the hypothesis except for livestock holding (Table 1).

Gender of the household head positively and significantly influenced marketed supply of the households at 10 percent probability level. In the study areas, both male and female household heads were engaged in potato production and marketing. The data shows that supply of potato to the market is higher for male-headed households by 2.76 quintals as compared to that of female-headed households, keeping other variables constant. This is due to the fact that male headed households have better financial capability, better land size, better extension contacts, and better access to market information. Therefore, we can infer from the analysis of the model that male household heads supply more potato to the market as compared to female household heads. Hence, this finding is congruent with the study by (Dawit, 2010; Lewis et al., 2008; Muhammed, 2011).

As expected, farming experience of the household heads was found to be positively and significantly associated with the quantity of potato supplied to the market at 5percent level of probability (Table 5). As producer's farming experience increases by one year, the amount of potato supply also increases by 0.308 quintal, keeping other variables constant. This is mainly due to the fact that more experienced households have better accumulated wealth that can be used for purchasing production inputs (fertilizer, seeds, irrigation pump), access to information related to the use of new recommended packages and pricing of the product. It is also believed that more experienced household heads are wise in resource use, has better skill of potato production and likely to have positive effect on market participation and marketed supply of potato than less experienced ones. This result is also supported by Abay (2007), who indicated that as farmers' experience increases the volume of tomato supplied to the market also increases. In addition, Abraham (2013), indicated that farming experience and the amount of supply have positive and significant relationship with vegetable production. Moreover, one year increment in production of vegetables maximize marketable surplus of vegetables of households by 0.362 quintal (Tadesse, 2011).

Livestock holding (TLU) affects the amount of potato supply negatively and significantly at 1percent probability level. This implies that, on average, a unit increase in livestock ownership causes 0.41 quintal decrease in the amount of supply of potato, keeping other factors constant (Table 5). It is known that livestock production is one of income generating activity in the rural community where producers with an increased number of livestock create an opportunity to generate their income by sales of livestock by-products and live animals. This implies that there is an indication in the specialization of livestock production than potato production and supply for income generation. Moreover, livestock production and potato production compete for the scarce land and water resources so that most of the time farmers have to make choices. To strengthen the above finding, Rehima (2006), indicated that a unit increase of livestock causes a decrease in the volume supply of pepper. In a similar way, Ouman et al., (2010), observed that livestock hold-

Table 5. Determinants of marketed supply of potato by farm households.

Variables	Coef.	Std. Err.	t- value
Education of HH	0.198	0.643	0.31
Women Empowerment	0.406	1.440	0.28
Gender of HH	2.765*	1.512	1.83
Family size	-0.329	0.276	-1.19
Dependent Ratio	-0.166	0 .342	-0.48
Farm Experience	0.308**	0 .157	1.96
Livestock holding	-0.411***	0 .150	-2.73
Availability of irrigation	-0.550	1.597	-0.34
Distance to market	0.304	0 .266	1.14
Access to market information	1.413**	0 .658	2.15
Access to credit	1.587**	0.637	2.49
Quantity produced	0.883***	0.010	91.04
Off/non-farm income	0.000	0.000	0.37
_Constant term	-14.273**	5.157	-2.77
Number of observation	400		
F(13, 386)	852.88		
Prob>F	0.000		
R-Squared	0.9664		
Root MSE	5.9009		

Dependent variable is quantity supply of potato in quintal. ***, ** and * are statistically significant at 1%, 5% and 10% level, respectively. Source: Own computation from survey data.

holding is adversely affected by the volume of banana supplied to the market in Central Africa. Nevertheless, some scholars indicate that livestock holdings (TLU) is positively related to the level of cereal, cotton, and sesame sales in market participation (Siziba et al., 2011; Alene et al., 2008; Larsen, 2006; Makhura et al., 2001; Kindie, 2007).

As hypothesized, the model result specifies that access to market information has positively and significantly influenced the amount of market supply of potato at 5 percent probability level (Table 5). The data also revealed that if the producers get market information, the amount of potato supplied to the market also increases, on average by 1.413 quintal keeping others constant. This shows that access to market information like where to sell, how to sell and price information plays a pivotal role in deciding the amount of potato to be supplied to the market. This finding is in line with Muhammed (2011), who illustrated that access to market information significantly increases marketable supply of *tef* in Halaba Special district. Similarly, the study by Abraham (2013), indicated that access to market information by household heads increases marketed supply of potato significantly in Habro and Kombolcha district.

The result also indicated that quantity produced affects marketed supply positively and significantly at 1percent probability level (Table 5). The survey result indicates that a one quintal increase in potato production results in 0.883 quintal increase in amount of marketed supply, keeping other factors constant. These shows that the more the households produce, the more they supply to the market. This is due to the fact that almost all producers have an objective to generate income from what he/she produced as there is consistency in the general expectation. In a similar way, previous studies by Omiti et al., (2009); Astewel (2010); Rehima and Dawit (2012); Adugna (2009); Ayelech (2011); Wolelaw (2005) and Assefa (2009), indicated that consistent increase in agricultural production positively and significantly increase the amount of marketed potato supply.

The result also indicates that, access to credit has positive and significant influence on the market supply of potato at 1percent significant level. From this result it can be deduced that those households with better access to loan have better chance to increase their market supply by 1.587 quintal than those who do not have access (Table 5). Most of the time, access to credit in the households is determined by cash on hand that is usually

used for purchasing improved varieties, fertilizers, chemicals and labor wage *etc*. Moreover, there are different credit associations in rural areas that provide loan to benefit producers so that they can improve their livelihood. Earlier studies Legesse (1992); Tesfaye and Shiferaw (2001) and Rahmeto (2007), also revealed that credit is one of the factors that affected the probability of adoption of improved varieties, quantity of fertilizer and haricot bean, respectively. Similarly the study by Muhammed (2011), indicated that access to credit positively and significantly affected the amount of wheat sold to the market.

CONCLUSIONS AND IMPLICATIONS

The study was conducted in Eastern Hararghe Oromiya regional state of Ethiopia to determine the gender role in market supply of potato. The result reveals that both male and female headed households participate in the production and supply of potato but there are various factors that affect the quantity supplied to the market. Age of the households, dependency ratio, economically active labor force and quantity produced are some of the variables that are statistically significant which indicates the differences in the socio demographic characteristics between households. Moreover, the result of the model also shows that gender of the households, farming experience, livestock holding, market information, quantity produced and access to credit are major factors statistically and significantly determining the quantity of potato supplied to the market. Quantity produced is highly determined by quantity supplied where the households decide to supply after satisfying the household consumption and seed for next year.

The result of the study became an indicator for program designers and implementers who have direct relation with potato producers to maximize their benefit. Livestock production is one of the enterprises where the households generate income. Increasing the livestock holdings in the households' creates an opportunity to produce organic fertilizer (compost) used to increase potato production. Organic fertilizer is rarely applied by the farm households for production of agricultural products even though almost all households are aware about the steps of preparation. Thus, increasing the livestock holding and train how to prepare and apply compost are essential achievement for the households to secure better quantity of production for supply.

Lack of strong institutional support lagged the rural farm households from executing farm activities on time. Brief and recent information about credit and market like price are essential to motivate producers to supply potato to the market on time and also collect benefit immediately. Due to this, there is inconsistency in supply among the households. Therefore, in the rural areas, there should be strong institutions used to deliver recent and major information that benefit producers in production and supply of potato to the market.

Both male and female headed households used their labor in production and supply of potato. However, the extent of participation in production activities are varies among the households. In most of the cases, male headed households are very efficient and effective in production as well as supply where economically active labor force is much higher and dependency ratio are lower as compare with female headed households. However, with the current situation of female headed households, there should be gender focused interventions that support, encourage and give priority for increasing production, supply and minimize differences among the household heads.

ACKNOWLEDGEMENTS

The authors would like to thank to Haramaya University for providing the chance to pursue the study and financial support from Sasakawa Africa Fund for Extension Education (SAFE).

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