Determinants of Marketed Surplus of Potato Producers in Dedo District of Jimma Zone, Ethiopia

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Abstract: Potato is an important food security and a hunger reliever crop in Ethiopia, involvement in commercial agriculture helps for income and sustainable livelihoods of small holder farmers. Potato producers in Ethiopia face marketing challenges including limited access to markets and low surpluses for sale into the market due to different factors. The study aimed to identify factors that determine the marketed surplus of potato producers. Out of 53 rural kebeles in Dedo district, potato is produced in 20 kebeles, out of these 4 kebeles and 136 potato producers were selected randomly. Quantitative and qualitative data were collected from primary sources through interview schedule. Descriptive and econometric methods of data analysis were used to analyze data from survey. Tobit model was applied to investigate factors affecting actual amount of potato supplied by small holder farmers. Results of descriptive statistics revealed that out of the total sample producer 87.5% of sample household participated in supplying potato in the survey year. Out of 13 explanatory variables included in Tobit model, about 7 variables were found to be statistically significant;- age of house hold head, non-farm income, active family labor, land allocated for potato access to improved seed, access to credit and number of extension contact were influenced marketed surplus of potato. Initiate active family labor engagement, strengthen the financial capacity of potato farmers, increase frequency of extension contact and reinforce input supply system were recommended to increase marketed surplus.

Key words: Marketed Surplus · Potato · Tobit Model

INTRODUCTION

Agriculture is main economic pillar of the Ethiopian economy and the overall economic growth of the country is highly dependent on the success of the agricultural sector. The sector represents 42% of the gross domestic product of the country and about 85% of the population gains their livelihood directly or indirectly from agricultural production [1]. Being main income source for millions of people, Ethiopian agriculture remains low input, low-value and subsistence oriented and is vulnerable to frequent climatic shocks [2].

Potato is number one non-grain food commodity and economically important crop of the world [3]. Potato is an important crop for food security in parts of Ethiopia by virtue of its ability to mature earlier than most other crops at time of critical food need [4].

The estimated area under potato cultivation in 2013/14 production year was 179,159.27 ha with production of 1.61 million tons in *Meher* and *Belg* season [5]. There are five major potato production regions in Ethiopia: Central, Eastern Hararghe, Northwest Ethiopia, South Ethiopia and Western Ethiopia and production is mainly dependent on natural rainfall and smaller proportions of areas the crop is supported by irrigation [6].

The potato sub-sector in Ethiopia is facing with problems like diseases, lack of improved varieties, poor crop management practices, use of inferior quality seed tubers of unknown origin, inappropriate storage structure, poor seed system and poor research-extension linkage are among the key factors contributing to low yield, moreover unfair distribution of returns from potato marketing leads farmers to low gain from the product [7].

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Dedo district stands first in vegetable production in general and potato in particular. Even though the district has huge potential, the contribute of potato to farmers income was low due to low market supply, low price due to long market chain dominated by traders and brokers, limited market access. Identifying determinants of marketed surplus will help to point out different areas of intervention to improve the supply and enhance the income of farmers. Hence, this study intended to identify the determinants of potato marketed surplus by small holder farmers in Dedo district of Jimma zone, Oromia regional state, Ethiopia.

MATERIAL AND METHODS

The study was undertaken in Dedo district which is one of 22 districts of Jimma zone, Oromia regional state of Ethiopia. Located at a distance of 377 km from Addis Ababa, it is bordered with Kersa district in the north, Omo Nada district in east, SNNP regional state district in the south and Seka Chokersa district in west. It is situated in the south extreme of the zone. It has a total surface area of 1509 Km^2 about 49.1% of the district land is under cultivation while, 23.9%, 13.9% and 13.1% is occupied by forest, woodland and grassland respectively. Agro-climatic condition, consists of highland (47%), midland (35%) and lowland (18%) with altitude that ranges between 800-3000 masl. The dominant soil categories in the district are Orthic Acrisols (80%) and Orthic Vertisols (20%).The total population is estimated to be 360,745 out of which 179,390 and 181,355 are males and females, respectively in year 2016 [8].
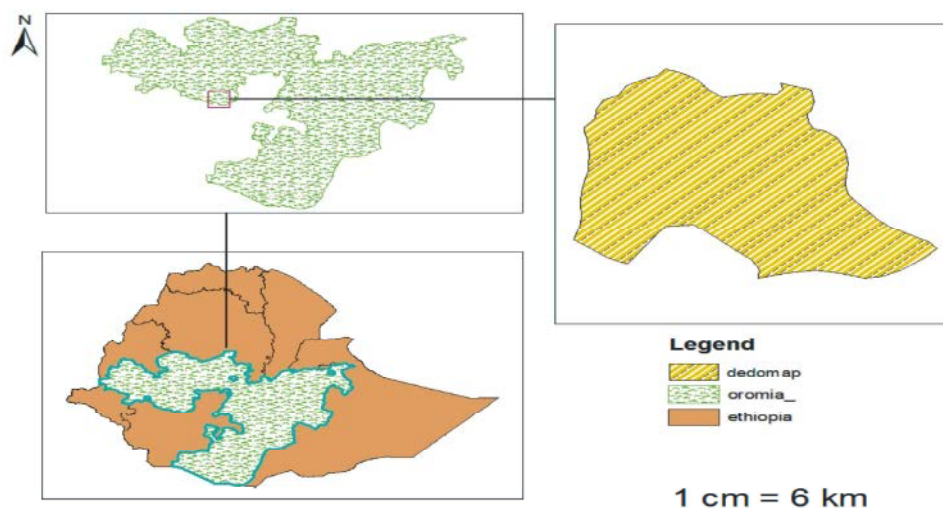

Fig. 1: Map of the study area.
Source: Adapted from Ethiopia map.

Data Types, Sources and Methods of Data Collection: For this study both quantitative and qualitative data types were collected, sources of primary data were potato farmers. Besides the primary data, secondary data on total land size and population were obtained from the central statistical authority (CSA), office of Agriculture and natural resources (DoANR) and irrigation authority office (DoIA) and other sources. Primary data was collected from farmers through interview schedule containing close ended and open ended question.

Sampling Procedure and Sample Size Determination: Out of the 53 rural *kebeles* in Dedo district 20 *kebeles* were producers of potato. Out of the 20 potato producing *kebeles*, 4 of them were randomly selected. Then, 136 sample farmers were selected randomly based on proportional to the population size of the selected *kebeles* (Table 1). Yamane [9] sample size determination formula was used to calculate sample size.

$$n = \frac{N}{1+N*(e^2)} \qquad (1)$$

where: - *n*–the sample size *N* – Potato producers *e*- the acceptable sampling error

N = 1070,*n* ≈ 136 & *e* = 8%

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

Kebeles	Potato producers	Sample
Geshe	220	28
Garima Gudda	267	34
Sito	283	36
Ilala	300	38
Total	1070	136

Source: Own design based on secondary data from DoANR (2016)

Method of Data Analysis: In this study, both descriptive and econometric methods were employed in analyzing data from the survey. To identify determinants of marketed surplus of potato by house hold head, the multiple linear regression model can be used, but in this study, all households were not participated in potato marketing due to this, Tobit model maximum likelihood estimation was used to identify determinants of marketed surplus of potato. Tobit is an important kind of limited dependent variable model which is roughly continuous over strictly positive values but it is zero for a nontrivial fraction of the population [10]. In this study about 12.5% of sample household didn't participate in supplying potato, from the total of 136 sample households, data are censored and Tobit estimation is appropriate.

Specification of the Tobit Model for Potato Marketed Surplus: Tobit model is used when the dependent variable is bounded but continuous within the bounds.

$$Y_i^* = \beta_o + \sum_{i=1}^{n} \beta_i X_i + \varepsilon_i \qquad (2)$$

where Y_i the quantity of potato supplied to the market (Dependent variable); Y_i^* is latent variable which is not observable, β_o is the intercept, β_i is the coefficient of ith independent variable, x_i is the vector of independent variable determining quantity supplied and i is 1,2,3 ...n and ε_i is error term. Tobit model output is not directly interpreted as that of OLS, since the estimated coefficients of Tobit is interpreted as the effect of the regressors on the latent variable. A change in explanatory variables has two effects; it affects the conditional mean of Y_i^* the positive part of the distribution and it affects the probability that the observation will fall in that part of the distribution.

Definition and Hypothesis of Variables
Dependent Variables
Quantity of Potato Marketed (MS): It is a continuous variable which represents the actual amount of potato supplied to the market by the farm household in the survey year.

Independent Variables: Different variables were expected to determine the amount of supply. A number of studies suggested that farmer's marketed surplus of agricultural commodity can be determined by a number of factors. Explanatory variables that were expected to affect the dependent variables in the context of the area are presented on Table 2.

RESULTS AND DISCUSSION

The study showed that average age of potato market participants was 48.3 and for those of non-participants was 48.7years which does not have statistical significant difference among them (Table 3).

The average amount of non-farm income earned by sample farmers was 2220 birr and that of potato market participants and non- participants was birr 243.412, 16090 respectively. The t-test result specified that there is a significant mean difference between potato market participants and non-participants at 1% probability level in terms of non-farm income this implies that non-participant households had higher non-farm income than market participant.

Since production is the function of labor and other factors, the availability and amount of active labor force in the household, which affects farmers' decision to market participation and its extent. The average active labor force of market participant in man equivalent was 3.79 and that of non-participant was 3.12 but there was no statistically significant difference between them.

It is obvious that land is one of the most important physical inputs of agricultural production and land size allocated for the crop of interest shows how farmers intended to produce the commodity. The t-test result specified that the mean of land allocated for potato production in the year 2015/16 was 0.42 and 0.11hectare for potato market participants and non-participants respectively.

Econometric Analysis: The econometric analysis was applied to investigate factors affecting actual amount of potato supplied by small holder farmers. In this study Tobit model was employed to identify these factors. Heteroscedasticity detection test were performed using IM-test in STATA 13 to check for heteroscedasticity, fitness of the model was checked and the assumption of null hypothesis that all predictors in regression model are jointly equal to zero is rejected at 1% level of significance. Out of 13 important explanatory variables included in the Tobit model, about 7 variables were found to be

Table 2: Definition, measurement and hypothesis of variables

Variables	Measurement	Expected influence on marketed surplus
Age of the HH	Year	+
Sex of the HH	1=if male; 0=otherwise	+
Non- farm income	Birr	-
Active family labor force	Man equivalent	+
Educational level of HH	Years of schooling	+
Number of extension contact	Days of contact	+
Distance from district market	Kilometer	-
Farm size allocated for potato	Hectare	+
Access to improved seed	1=if access; 0=otherwise	+
Number of oxen owned	Number of oxen	+
Perception on lagged price	1=if good ; 0=otherwise	+
Access to Irrigation	1=if access; 0=otherwise	+
Access to market information	1=if access; 0=otherwise	+
Access to credit	1=if take loan; 0=otherwise	+

Source: Own computation of survey data (2016)

Table 3: Characteristics of potato market participants and non-participants

	Participant (n=119)	Non Participant (n=17)	
Continuous Variables	Mean	*Mean*	t – value
Age	48.3	48.7	0.13
Farm experience	21.1	11.94	3.67***
Non- farm income ''000''	.243	16.08	7.78***
Family Size	7.93	9.78	3.98***
Active Labor force	3.79	3.12	1.60
Farm Size	0.42	0.11	7.95***
TLU	6.59	8.18	1.91
Number of Oxen	2.07	1.176	3.81 ***
Extension contact (#)	4.98	1.23	3.49***
Distance	9.01	26.17	-9.90 ***
Education	3.45	.589	3.20***
Income from crop sale	12198.5	3931.17	10.94***
Income from Livestock sale	10583.3	12092.76	-0.67
Annual income from farm	33,849.6	16023.94	6.58

*** represent significance at 1% probability level and n is a sample size.

Source: Own computation of survey data (2016)

statistically significant ;- age of house hold head, non-farm income, active family labor, land allocated for potato, access to improved seed, access to credit and number of extension contact, were influenced potato marketed surplus by producers (Table 3).

Age of the Household Head: The expected influence of age assumed was positive but survey result showed that age negatively influenced the marketed surplus of potato at 5% level of significance, keeping other factors constant a one year increase in age results a decrease in marketed surplus of potato by 0.125 quintal among the whole sample and by 0.110 among potato seller. As age of house hold increases the probability of participation in potato market would also decrease by 0.2%.The negative influence of age indicates that as the household head gets older it is difficult to engage in production and marketing

of potato due to bulky nature of the commodity. The result is in line with finding of Adugna [11] who indicated that as age of the household head increases the elasticity of marketable supply of onion decreases and also with Nuri [12] who indicated increase in age causes the marketed surplus of *kocho* to decrease.

Non-Farm Income: As hypothesized the influence of non-farm income on marketed surplus of potato was negative. The result of the study showed that one thousand birr increase in non-farm income decreases the marketed surplus of potato by 0.242 quintal among the whole sample and by 0.212 among potato sellers. As non-farm income of house hold increases the probability of participation in potato market would also decrease by 0.4%, at 10% level of significance. This implies farmers who engaged in non-farm income give less attention to

Table 4: Maximum likelihood estimates of Tobit model for potato marketed surplus

Explanatory Variables	Coefficients	Standard Error	Marginal effect[1]	Marginal effect[2]	Change in Probability
Age of house hold head	-0.130**	0.053	-0.125**	-0.110**	-0.002
Sex of house hold head	2.453	1.821	2.362	2.067	0.038
Educational level (years)	0.201	0.164	0.194	0.170	0.003
Non- farm income ''000''	-0.251*	0.132	-0.242*	-0.212*	-0.004
Active family labor	0.922***	0.321	0.888***	0.777***	0.014
Land allocated for potato	21.655***	1.858	20.852***	18.247***	0.336
Number of Oxen owned	0.491	0.566	0.472	0.413	0.008
Access to improved seed	2.016*	1.086	1.941*	1.699*	0.031
Access to irrigation	0.738	1.314	0.710	0.622	0.011
Access to credit	2.913**	1.255	2.805**	2.455**	0.045
Number of extension contact	0.580***	0.132	0.559***	0.489***	0.009
Perception on lagged price	0.603	1.174	0.581	0.509	0.009
Access to market information	1.120	1.234	1.079	0.944	0.017
Constant	-4.741	2.981			
Sigma	5.228***	0.338			

Log likelihood = -372.330 Number of observation =136   LR chi2 (13) = 226.90 Left-censored observations=17

 Prob > chi2 = 0.0000 Uncensored observations=119

 Pseudo R² = 23.35% Right -censored observations = 0

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

Source: Own computation from the survey, 2016

the production and marketing of potato. The result is contrary with Abraham [13] who suggested that non-farm income influences volume of cabbage supply significantly and positively. The result is in line with Rehima [14] who suggested that non-farm income of the household heads negatively affected quantity of pepper supplied.

Active Family Labor: As hypothesized active family labor influenced marketed surplus of potato positively at 1% significant level. A one man equivalent increases in active labor in the family of household result in an increase in marketed surplus of potato by 0.888 quintal among the whole sample and by 0.777 quintal among potato seller and also increases the probability of participation in potato market by 1.4%.Larger number of active labor in the family helps to carryout production and marketing activity which enhance supply of potato. The result is in line with Nuri [12] who explained a household with more number of labor produce more *kocho* and supply large volume of it to the market.

Farm Size (Land) Allocated for Potato: as hypothesized the size of land allocated for potato production by producer influenced marketed surplus of potato positively and significantly at 1% probability level. A one hectare increase of land allocation for potato production increases marketed surplus of potato by 20.852 quintals among whole sample and 18.247 quintals among potato sellers

and also increases the probability of participation in potato market by 33.6%.The result of the study is in line with Alemayehu [15] who explained that as farmers allocate more area of land for ginger, the marketable amount of ginger increases.

Access to Improved Seed: As hypothesized access to improved seed has positive impact on marketed surplus of potato at 10% significant level. The result revealed that those who have got access to improved seed would increase the marketed surplus of potato by 1.941 quintals among the whole sample and by 1.699 among potato sellers. Access to improved seed increases the probability of potato market participation by 3.1%. Farmer who has access to improved potato seed supply more, since improved seed technology has correlation with high productivity level and better ability to resist diseases.

The finding is in line with Kindie [16] who suggested access to improved agricultural inputs increases the market supply of sesame.

Access to Credit: As hypothesized the influence of credit access on marketed surplus of potato was positive and significant at 5%. The result revealed that those who have got credit access would increase the marketed surplus of potato by 2.805 quintal among the whole sample and by 2.455 quintal among potato seller and increases the likelihood to participate in potato market by 4.5%. This

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[1]The effects of change in the explanatory variables on the expected value of the dependent variable among the whole sample

[2]The change in intensity of market participation with respect to a change in explanatory variable among potato sellers

implies that credit access strengths marketed surplus of potato. The result is in line with Alemayehu [15] who suggested access to credit increases the amount of ginger supplied to market and also with Yeshitila [17] who explained that farmers who have access to credit are able to diversify their income sources and thus decide to engage in potato marketing.

Number of Extension Contact: As expected the influence of number of extension contact on marketed surplus of potato was positive and significant at 1% level. The result revealed that a unit (A day) increase in contact of development agent results in 0.559 quintal increment in marketed surplus of potato among the whole sample and 0.489 quintal increase among potato market participant and also increases the probability of participation in potato market by 0.9%. In view of the fact that extension contact supports production and marketing of potato through new agricultural technologies dissemination and capacity building. The result is contrary with Abraham [13] who suggested extension service given to the farmers reduces potato quantity produced and this in turn reduces potato supplied to the market and is in line with Alemayehu [15] who indicated the increase in number of extension contact increased the amount of ginger supplied to market.

CONCLUSION

Tobit Model was employed to identify the determinants of marketed surplus of potato. The results of econometric analysis indicates active family labor, land allocated for potato, access to improved seed, access to credit and number of extension contact influenced marketed surplus of potato significantly and positively and non-farm income and age of house hold head affects marketed surplus of potato negatively.

Recommendations: Based on the findings of the study, the following recommendation is forwarded.

Enhance farmers land allocation for potato and increase productivity through better land management practices, thereby increase sale volume of potato.

Initiate active family labor engagement in potato production and marketing activities to increase household's marketed surplus of potato.

Strengthen the financial capability of potato farmers by providing sufficient loan; provide adequate credit service for potato producers according to their need.

Reinforce extension service provisions through speeding up the frequency of potato farm visit and initiate input supply system especially improved potato seed and timely delivery with reasonable price.

Create awareness on utilization of non-farm income for production purpose.

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