

## Determinants of Income among Potato Producers in Dedo and Seka Chokersa Districts of Jimma Zone, Ethiopia

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**ABSTRACT:** Potato is vital crop for income and food security in parts of Ethiopia by virtue of its ability to mature earlier than most other crops. This study aimed to identify factors that determine amount of income earned by household's from potato in Dedo and Seka Chokersa districts of Jimma zone, Ethiopia. For this study 152 potato producers were randomly selected, quantitative and qualitative data were collected from primary and secondary sources. Primary data was collected through interview schedule from potato producing farmers. Descriptive and econometric data analysis was used to convert raw data into information. Tobit model was employed to identify determinants of income earned by households from potato farming. The results of econometric analysis shows that active family labor, access to credit, number of extension contact and access to market information influenced amount of income earned by household's from potato significantly and positively. Distance from market center and age of house hold head affected amount of income earned from potato farming negatively. Therefore, concerned bodies should provide training for development agents and speed up the frequency of contact with potato farmers, strengthen the financial capability of potato farmers. Initiate active family labor involvement in potato production and marketing activities; improve infrastructures (road and telecommunications) of rural village to increase household's income from potato farming.

**KEY WORDS:** Income: Potato; Tobit model

### INTRODUCTION

Potato (*Solanum tuberosum*L.) is the world's most important root and tuber crop worldwide. Hundreds of millions of people in developing countries depend on potatoes for their survival, its cultivation is expanding strongly in the developing world, where cultivation and nutritive content has made it a valuable food security and cash crop for millions of farmers (FAO, 2009). Potato is one of economically most important crop in Ethiopia that plays a key role as source of food and cash income for small- holder producers. There is a huge potential for potato to contribute economic growth (Agajie *et al.*, 2008). Potato is an important crop for food security and source of income in parts of Ethiopia by virtue of its ability to mature earlier than most other crops at time of critical food need (Asresie *et al.*, 2015; Biruk, 2013). A number of factors related to institutional, social and organizational situations influence contribution of potato to household's income, preliminary study shows that major factors that contribute to the low income of potato farmers were low market supply, low price due to long market chain dominated by traders and brokers who have a relatively strong financial power, and limited market access. Even though a lot of activity was done especially on improved varieties adoption and agronomic practices in southwestern part of the country but the contribution of this crop to households income is not assessed in a sufficient manner, this study was proposed to narrow the information gap on the subject and will contribute more to understand the commodity contribution for smallholder farmers. The objective of this study was to identify factors that determine income earned by household's from the commodity in Dedo and Seka Chokersa, Jimma zone, Ethiopia.

### METHODOLOGY

#### Description of the study area

The study was undertaken in Dedo and Seka Chokersa districts of Jimma zone.

Dedo district is 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.

Seka Chokersa district is located at a distance of 375 km, south -West of Addis Ababa. It is bounded by Gomma and Manna district in the North, Gera district in the South, Dedo district and Jimma town in the East and Shabe Sombo district in the West.

It is situated at an altitude ranging from 1580 to 2560 meters above sea level (Meaza, 2015).



Figure 1. Map of regions in Ethiopia, zone and study districts respectively

**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 producer (farmers), traders and small scale processors. Besides the primary data, secondary data on different variable was obtained from published and unpublished sources. Primary data was collected through interview schedule containing close ended and open ended question. Key informant interview with experts of different concerned organization and focus group discussion consists of male and female, literate and illiterate were held.

**Sampling procedures**

A total of 4 *kebeles* each two from Dedo and SekaChokorsa were randomly selected accordingly, 83 and 69 potato producers from Dedo and SekaChokorsa respectively. Then, 152 sample farmers were selected randomly based on proportional to the population size of the selected *kebeles*. Yamane (1967) sample size determination formula was used to calculate sample size.

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

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

$$N = 6275, n \approx 152 \text{ \& } e = 8\%$$

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

| Name of <i>Kebeles</i> | Number of producer | Number of sample household |
|------------------------|--------------------|----------------------------|
| GarimaGudda            | 2729               | 66                         |
| Ilala                  | 699                | 17                         |
| DaboYaya               | 1388               | 34                         |
| BuyoKachama            | 1459               | 35                         |
| Total                  | 6275               | 152                        |

Sources: Own design based on secondary data from District office of Agriculture and Natural Resource (2016)

**METHOD OF DATA ANALYSIS**

In this study, descriptive methods were employed in analyzing data from the survey. Descriptive statistics were used to describe different characteristics of the sample households.

Econometric analysis, Tobit maximum likelihood estimation was employed for analyzing determinants of income earned from potato by smallholder farmers.

**Specification of the Tobit model for income earned from potato by smallholder farmers**

Tobit model is used when the dependent variable is bounded but continuous within the bounds.

$$Y_i^* = \beta_o + \sum_{i=1}^n \beta_i X_i + \epsilon_i \text{-----(2)}$$



$$Y_i = \begin{cases} Y_i^* = \beta_0 + \sum_{i=1}^n \beta_i X_i + \epsilon_i, & \text{if } Y_i^* > 0 \\ 0 & \text{if } Y_i^* \leq 0 \end{cases} \quad \epsilon \sim N(0, \sigma^2) \quad \text{----- (3)}$$

Where  $Y_i$  the amount of income obtained from potato selling (dependent variable);  $Y_i^*$  is latent variable which is not observable,  $\beta_0$  is the intercept,  $\beta_i$  is the coefficient of  $i^{th}$  independent variable,  $X_i$  is the vector of independent variable determining amount of income obtained and  $i$  is 1,2,3 ...  $n$  and  $\epsilon_i$  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.

(1) The marginal effect of an explanatory variable on the expected value of the dependent variable is:

$$\frac{\partial E(Y_i)}{\partial X_i} = F(z) \beta_i \quad \text{----- (4)}$$

Where,  $z$  represents  $\frac{\beta_i X_i}{\sigma}$  (Maddala, 1997)

(2) The change in intensity of participation in generating income from potato with respect to a change in an explanatory variable among farmers that engaged in generating income from potato farming.

$$\frac{\partial E(Y_i/Y^* > 0)}{\partial X_i} = \beta_i \left[ 1 - Z \frac{f(z)}{F(z)} - \left( \frac{f(z)}{F(z)} \right)^2 \right] \quad \text{----- (5)}$$

Where,  $F(z)$  is the cumulative normal distribution of  $z$ ,  $f(z)$  is the value of the derivative of the normal curve at a given point (i.e., unit normal density),  $z$  is the Z score for the area under normal curve,  $\beta_i$  is a vector of Tobit maximum likelihood estimates and  $\sigma$  is the standard error of the error term.

(3) The change in the probability of participation in earning income from potato farming as independent variable  $X_i$  changes is

$$\frac{\partial F(z)}{\partial X_i} = f(z) \frac{\beta_i}{\sigma} \quad \text{----- (6)}$$

**Hypothesis and definition of variables**

**Dependent variables**

**Income obtained from potato farming:** -It is a continuous variable which represents the actual amount of income obtained from potato by the farm household in the survey year.

**Table 2.** Definition and hypothesis of independent variables

| Variables                        | Measurement                  | Impact on income |
|----------------------------------|------------------------------|------------------|
| Age of the household head        | Year                         | +                |
| Sex of the household head        | Dummy:1=if male; 0=otherwise | +                |
| Amount of Active labor available | Man equivalent               | +                |
| Education of house hold          | Year                         | +                |
| Frequency of extension contact   | Day                          | +                |
| Distance from market center      | \Kilometer                   | -                |
| Farm size allocated for potato   | Hectare                      | +                |
| Access to market information     | Dummy:1=if male; 0=otherwise | +                |
| Access to Credit                 | Dummy:1=if male; 0=otherwise | +                |
| Non- farm income ‘’000’’         | Amount of birr obtained      | +                |

RESULTS AND DISCUSSION

Farmers’ characteristics by income earned from potato

An independent-samples t-test was used to compare the mean score, on some continuous variable and Chi-square test is applied to determine whether there is a significant association between the two categories in the sample.

Table 3. Characteristics of farmers based on income earned from growing potato

| Continuous Variables                  | Earners<br>(n=133) | Non<br>(n=17) | Earners<br>(n=152) | Overall<br>(n =152) | t/p – value |
|---------------------------------------|--------------------|---------------|--------------------|---------------------|-------------|
|                                       | Mean               |               |                    |                     |             |
| Age                                   | 48.18              | 48.11         | 48.18              | 48.18               | -0.03       |
| Family size                           | 9.44               | 8.02          | 8.18               | 8.18                | 3.00***     |
| Active labor                          | 3.82               | 2.79          | 3.70               | 3.70                | -2.44       |
| Land allocated                        | 0.11               | 0.41          | 0.38               | 0.38                | -3.86       |
| Extension contact (#)                 | 1.53               | 4.83          | 4.46               | 4.46                | -3.13       |
| Distance from market center           | 25.74              | 9.16          | 11.04              | 11.04               | 9.76***     |
| Education level                       | 3.32               | 0.59          | 3.01               | 3.01                | -3.13       |
| Income from livestock sale            | 12183.12           | 10364.13      | 10570.28           | 10570.28            | 0.85        |
| Total Gross income from farming       | 16155.35           | 33192.06      | 31261.24           | 31261.24            | -2.69       |
| Dummy Variables                       | %                  |               |                    |                     | p – value   |
| Sex of household head (Male, %)       | 92.48              | 76.47         | 90.67              | 90.67               | 4.57**      |
| Access to credit (Yes, %)             | 37.59              | 17.65         | 35.33              | 35.33               | 2.62        |
| Access to market information (Yes, %) | 40.60              | 5.88          | 36.67              | 36.67               | 7.82***     |

\*\*\* & \*\* represent significance at 1% & 5 % probability level and n is a sample size.

Source: Own computation of survey data (2016)

The study showed that average age of farmers that earns income from potato was 48.18 and for those of non-earners were 48.11 years which does not have statistical significant difference among them (Table 3).The earners interviewed had average family size of 9.44 and the average family size of non-earners was 8.02 the difference in mean found was statistically significant. 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 earn income from potato and its extent. The average active labor force of earners in man equivalent was 3.82 and that of non-earners were 2.79 with no statistical 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 0.41 and 0.11 hectare for producers that earn income from potato and non-earners respectively. Having access to agricultural extension service initiate farmers to produce and supply their product. The t-test indicated that the average number of contacts farmers have with extension workers at their farm or get advice throughout the production process of potato for those household that earned income was 4.83 and 1.53 for non-earners was about 1.23 days per production year mean difference of extension contact frequency.

The average distance that most of the households traveled to sell their product was 25.74 and 9.16 kilometers for household that earned income from potato and non-earners respectively, with statistically significant mean difference between households at 1% probability level.

It is obvious that if a farmer attained formal education there is a possibility of increment in their productivity as they have better knowledge and skills than those who did not attend formal education. In addition, educated farmers are exposed to technologies that

will help them increase production and supply. The mean educational level (grades) of producers that earned income from potato was 3.32 years and that of non – earners were 0.59 years respectively.

The average farm income of potato producers that earned income from potato was 33192.06 Birr/year and the average farm income of the non- earners were 16155.35 Birr/year. The major sources of cash income were from the sale of other home cereals and livestock sale.

The availability of credit service to farmers has its own contribution in enhancing production and productivity of agricultural product. Credit is an imperative source for financing farming activities of smallholder farmers but, due to religion view the need of credit was limited to 34.87 % of the sampled households. The result of chi-square test indicated that about 37.59 % farmers that earned income from potato had access to credit and 17.65 % non- earners had access to credit.

It is clear that market information is a necessary tool for farmers. Price obtained by producer depends on the reliability, source and channels of market information. Moreover, farmers marketing decisions are based on market price information, and poorly integrated markets may convey inaccurate price information, leading to inefficient product movement. The proportion of farmers that has access to market information for farmers that earned incomes from potato were 40.60% and that of non-earners was 5.88 %.The chi-square test indicates that there is a significant difference between farmers that earned income from potato and non-earners at 1% significance level.

**Determinants of income earned by household’s from potato farming**

The econometric analysis was applied to investigate factors affecting actual amount of income obtained from potato by small holder farmers. In this study Tobit model was employed to identify these factors. Out of 10 important explanatory variables included in the Tobit model, about 6 variables were found to be statistically significant; - age of the household, distance from market center , active labor, credit access ,frequency of extension service and access to market information were influenced amount of income earned by producers from potato farming (table 4 ).

**Table 4.** Maximum likelihood estimates of Tobit model for income earned from potato farming

| Explanatory Variables        | Coefficient     | Standard Error | Marginal effect <sup>1</sup> | Marginal effect <sup>2</sup> | Change in Probability |
|------------------------------|-----------------|----------------|------------------------------|------------------------------|-----------------------|
| Age of house hold head       | -113.57 ***     | 42.44          | -109.73                      | -96.76                       | 0.00                  |
| Sex of house hold head       | 843.88          | 1568.12        | 815.39                       | 719.00                       | 0.01                  |
| Educational level (years)    | 123.80          | 126.78         | 119.62                       | 105.48                       | 0.00                  |
| Land allocated for potato    | 904.08          | 260.20         | 873.55                       | 770.29                       | 0.01                  |
| Active family labor          | 21780.49**<br>* | 1558.19        | 21044.99                     | 18557.36                     | 0.36                  |
| Access to credit             | 2972.50***      | 1004.99        | 2872.12                      | 2532.62                      | 0.05                  |
| Distance from market center  | -222.85***      | 65.43          | -215.32                      | -189.87                      | 0.00                  |
| Number of extension contact  | 593.75***       | 107.36         | 573.70                       | 505.89                       | 0.01                  |
| Access to market information | 3512.78*        | 1812.38        | 3394.16                      | 2992.95                      | 0.06                  |
| Non- farm income ‘’000’’     | -40.88          | 104.04         | -39.50                       | -34.83                       | 0.00                  |
| Constant                     | -2816.09        | 3180.36        |                              |                              |                       |
| Sigma                        | 4572.88         | 278.98         |                              |                              |                       |

Number of observation =152  
 Log likelihood = -1313.2916  
 LR chi2 (10) = 269.61  
 Left-censored observations=19  
 Prob> chi2 = 0.0000  
 Uncensored observations=133  
 Right -censored observations = 0

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

Source: Own computation from the survey, 2016

**Age of the household head:** The expected influence of age assumed was positive but survey result showed that age negatively influenced the income earned from potato at 5% level of significance, keeping other factors constant a one year increase in age results a decrease in income earned from potato by 109.73 birr among the whole sample and by 96.76 among the household that gain income from potato. The negative influence of age indicates that as gets older it is difficult to engage in production and marketing of potato due to bulky nature of the commodity. It is similar with the study result of Abdi (2016), who stated that an aging farmer is less energetic to participate in the farm and encountered shortage of investment cost were the main reason of elderly farmers have less income from potato production.

**Active family labor:** As hypothesized active family labor influenced income from potato positively at 1% significant level. A one man equivalent increases in active labor in the family of household result in an increase in income from potato by 21044.99 birr among whole sample and by 18557.36 birr among households that earned income from potato selling and also increases the probability of participation in generating income from potato by 36 %.Larger number of active labor in the family helps to carryout production and marketing activity.

**Access to credit:** As hypothesized the influence of credit access on income from potato was positive and significant at 5%. The result revealed that those who have got credit access would increase the income from potato by 2872.12 birr among the whole sample and by 2532.62 among households that earned income from potato selling and increases the likelihood to participate in generating income from potato by 5%.

**Distance from market center:** has a significant negative effect on amount of income from potato. If the proximity from the farm to market increases by one kilometer, amount of income from potato decreases by 215.32 birr among the whole sample and by 189.87 among households that earned income from potato selling. The result is in line with Getachew (2015) who explained that distance to the nearest market center (expressed by minute foot walking to the center) had negative effect on gross income from potato seed tuber. The result is also similar with Shimeles (2010) that explained that when the producers is far from market center, either the producer is not willing to produce or it sales at the price offered in the immediate market which has negative impact on income from potato by small holder producers.

**Number of extension contact:** As expected the influence of number of extension contact on amount of income from potato was positive and significant at 1% level. The result revealed that a unit( a day) increase in contact of development agent results in 573.70 birr increment in amount of income from potato among the whole sample and by 505.89 birr increase among household that generate income from potato and also increases the probability of participation in income generation from potato farming by 1 %.The result is in line with Getachew (2015) who indicated that access to extension service concerning potato increase amount of net income earned from potato seed tuber. The finding is also consistent with the study of Abdi (2016) which indicates that extension service participation increase the value of income generated from potato.

<sup>1</sup>The effects of change in the explanatory variables on the expected value of the dependent variable among the whole sample

<sup>2</sup>The change in intensity of participation in income earning with respect to a change in explanatory variable among household that earn income from potato farming.



## CONCLUSIONS AND RECOMMENDATIONS

Income earned by households from potato farming was significantly and positively influenced by active labor, credit access frequency of extension service and access to market information, also negatively affected by distance from market center and age of the household.

Based on the findings of this study, the following recommendations were forwarded.

Initiate active family labor engagement in potato production and marketing activities to increase household's income from potato farming. Therefore district agriculture and natural resources and irrigation authority office should work to increase active labor participation in potato production and marketing.

Strengthen the financial capability of potato farmers by providing sufficient loan. Therefore, micro finance institutions should provide adequate credit service for potato producers according to their need.

Reinforce extension service provisions through speeding up the frequency of potato farm visit. Therefore, district agriculture and natural resources and irrigation authority office should work to increase frequent contact of potato farmers by agricultural extension workers.

Improving infrastructures (road and telecommunications) of rural village by constructing all weather road and enlarge network coverage to enhance market access of producers. Therefore, the district administration office, road authority and other concerning body should work to improve road and telecommunications service of the area.

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