International Journal of Business and Economics Research
2022; 11(3): 140-149
http://www.sciencepublishinggroup.com/j/ijber
doi: 10.11648/j.ijber.20221103.15
ISSN: 2328-7543 (Print); ISSN: 2328-756X (Online)

Determinants of Farmers' Potato Marketing in Kofale District, West Arsi Zone, Oromia Regional State, Ethiopia

Asfaw Negesse Senbeta

Department of Socio-economics Oromia Agricultural Research Institute Adami Tulu Research Center, Batu, Ethiopia

Email address:
bls23asfaw@gmail.com

To cite this article:
Asfaw Negesse Senbeta. Determinants of Farmers' Potato Marketing in Kofale District, West Arsi Zone, Oromia Regional State, Ethiopia. *International Journal of Business and Economics Research*. Vol. 11, No. 3, 2022, pp. 140-149. doi: 10.11648/j.ijber.20221103.15

Received: April 26, 2022; **Accepted**: May 26, 2022; **Published**: June 8, 2022

Abstract: Agriculture in Ethiopia is dominated by smallholder and largely subsistence farmers who are intended to meet household food consumption. To increase the smallholder farmers' income and reduce rural poverty, subsistence agriculture needs improvement through increasing production and productivity of potatoes. Therefore, improving the smallholder farmers' potato production and marketing is required, in order to improve access to food and sustainable livelihoods. The overall objective of this study was to analyze status of commercialization factors influencing farmers' potato production and marketing in Kofele district. To conduct the study, primary data was collected from 150 randomly selected household heads through semi-structured questionnaire. The district average potato production is 52 quintals / household. All sample potato producers in the study area produce using rain-fed. The sample households allocated more cultivated land for potato production next to barley. Regression analysis linear model (OLS) indicated potato production significantly affected by education level, ownership of livestock, total family size for production and land allocated for potato production positively and significantly. The potato supply to market significantly and negatively affected by family size while amount of potato produced, frequency of extension contact and access to market information affect it positively. The study indicated that the government, stakeholders and concerned bodies need to focus on facilitating increase productivity of potatoes, improving livestock production, strengthen extension service and disseminate market information to producers so as to improve potato production and marketing.

Keywords: Kofale, Marketing, Multiple Regression and Smallholders

1. Introduction

1.1. Background of the Study

Global production of potatoes was 388 million tonnes, led by China with 64% of the world total. Now the biggest potato producer, and almost a third of all potatoes are harvested in China and India is secondary producer [1]. In Africa the top producers were Algeria and Egypt. The current average potato yield in Africa has been reported to be about 13.22 t ha-1 which is well below the maximum yield of 20.11 t/ ha. Ethiopia is 9th potato producer country in Africa [1]. In Ethiopia, we identified three seed potato systems, namely informal, alternative and formal. The informal seed potato system is a seed potato system in which tubers to be used for planting are produced and distributed by farmers without any regulation. This seed system exists in all potato growing areas of Ethiopia. It is the major seed potato system.

Ethiopia has a variety of vegetable crops growing in different agro ecological zones produced through commercial as well as small farmers both as a source of income and food [2]. However, the type is limited to few crops and production is concentrated to some pocket areas. The production of vegetables varies from cultivating a few plants in the backyards for home consumption up to a large-scale production for domestic and export markets [3].

The potato holds great promise for improving the livelihoods of millions of smallholder farmers in the highlands of Ethiopia. The potential for high yield, early maturity, and excellent food value give the potato great potential for improving food security, increasing household income, and reducing poverty [4]. The crop's genotypic variation and relatively short vegetative period allows farmers to find an appropriate season for its cultivation under a wide range of weather patterns and less predictable climates.

Potato is also the fastest growing staple food crop and source of cash income for smallholder farmers in Ethiopia. It is a critical crop in terms of food security [5]. In developing countries and under marginal growing conditions, potato is a cheap source of nutrients, thus playing an important role in guaranteeing food security, income generation, and employment opportunity [6]. Potato's short cropping cycle allows it to serve as a hunger-breaking crop, and makes it suitable for intercropping and double cropping, especially in cereal-based production systems in Africa and Asia [7]. Like many other countries in the world, potato is a very important food and cash crop especially on the highland and mid altitude areas of Ethiopia [8].

Potato variety adoption is also influenced by market preferences [9]. Our study found that the requirements of target markets have a significant impact on potato varietal diversity at the household level. Potato skin color is one of the main determining factors for variety preference in Shashemene, a hub of the national potato market. More than 98% of the farmers in this district grow white skin varieties, because that is what sells in the national market. For farmers who have access to markets, surplus produce can be sold immediately after harvest [10].

West Arsi zone produce 4.5% of vegetables and 21% of root crops out of area coverage at regional level. From total area coverage by vegetables and root crops potatoes cover about 86.86 percent. The average productivity of potatoes is 97.74 quintals per hectares which is less than the average productivity at national level is 137.68 quintal per hectare [11]. Hence, taking into account the importance of vegetable crops this study is intended to analyze level of production and marketing in the study area.

1.2. Statement of the Problem

In some commodities, such as specific fruits and vegetables, the oligopolistic nature of the market structure involves just a few intermediary buyers who control a significant aspect of the supply chain, thus reaping the largest portion of the benefit. In addition, due to an absence of wide scale commodity grading and standardization, price incentives related to product quality are limited, resulting in low quality outputs that do not attract premium prices in domestic markets, and make it difficult to access export markets. This also results in high transaction costs and limited transparency as market actors are forced to negotiate with imperfect information. This usually puts smallholder famers at a disadvantage, given their limited economies of scale and sophistication when dealing with large wholesale buyers [12].

Kofale district have high potential in potato production, favorable climate condition, available rain-fall and the government also gave attention to increase production to achieve food security at household level. Even though there is potential in production and opportunities in potato production and marketing there is limited study on determinants of production and marketing these commodities in the area. Therefore, identification of the determinants of smallholder farmers' potato marketing are crucial to improve producers' income by improving their production decision.

1.3. Objectives of the Study

The overall objective of this study was to analyze factors affecting potato marketing in Kofele district.

The specific objectives of the study were:

1. To assess potato production status of smallholder farmers in the study area;
2. To identify determinants of Potato production and
3. To identify the determinants of marketing in kofale district.

2. Research Methodology

In this chapter description of study area, types and sources of data, methods of data collection, sample procedure, and sampling size, methods of data analysis and variables definition and hypothesis are presented.

2.1. Description of the Study Area

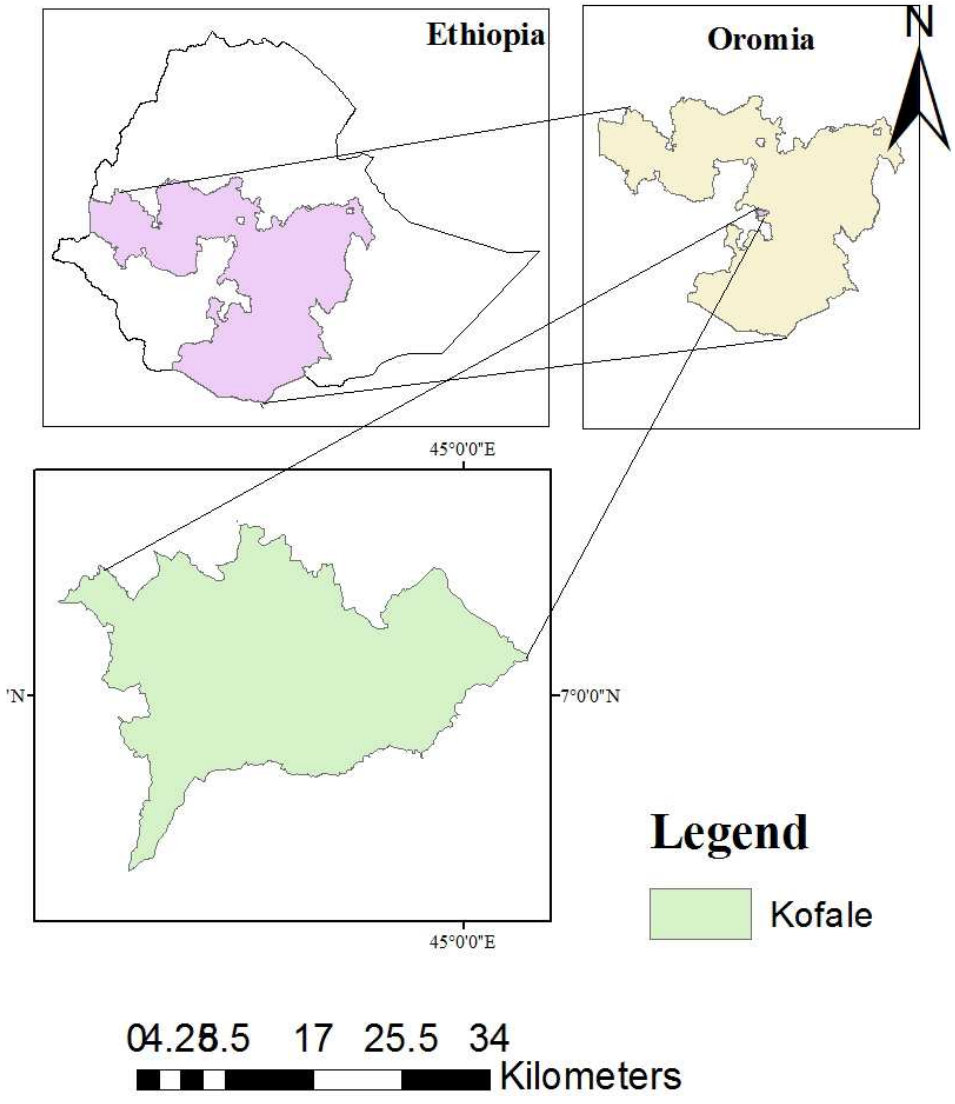
The study was conducted in Kofele district, West Arsi zone of Oromia National Regional State, Ethiopia. Kofele district is located at 305 km from Addis Ababa towards Southern direction. The major agro-ecologies of the district are high land (90%) and mid-land (10%) having clay loam soil type of 90% and the remaining 10% t red and black. The district was found within 2460 to 2790 m-a-s-l. It receives an average rainfall of 1800 mm per annum with minimum 2000mm per annum and maximum 3050mm per annum. The district has bi-modal rainfall distribution with small rains starting from March/April to May and the main rainy season extending from June to September/October. The average temperatures were 19.5°C per year with minimum of 17°C and maximum of 22°C [13].

The land use pattern of the district shows that 33,599 ha is cultivable, 21,631ha grazing land, 5,157 ha is covered by forest, bushes and shrubs, and 5,913 ha is being used for other purposes such as encampments, and infrastructure facilities. From cultivated land about 7890 ha for potato production and about 790 ha head cabbage production in 2017 production year. The district features a crop-livestock mixed farming system. The types of crops widely grown in the district are barley, potato, maize, enset, normal cabbage (Etiopian kale) and head Cabbage. The main staple crops for food are enset, barley, maize and potato while potato, head cabbage and malt barley for market. The productivities of major crops in kofale district are maize 60 quintals per hectare, barley 35 quintals per hectare, potato 165 quintals per hectare and head cabbage 110 quintals per hectare [13].

2.2. Data Types, Sources and Methods of Data Collection

Both primary and secondary data were used for this study. Semi-structured questionnaire was employed to collect primary data on the demographic, socioeconomic, institutional and physical characteristics of a representative sample of households. The questionnaire was designed and

pre-tested in the field for its validity and content, and to make overall improvement of the same and in line with the objectives of the study. After necessary corrections made on the questionnaire, enumerators were given one day training to the objectives and content of the interview schedule. Secondary data relevant for this study was collected from Kofele district office of agriculture and natural resource, CSA, and from published and unpublished sources.



Source: Own sketch Arc map version 10.1, 2018.

Figure 1. *Map of the study area.*

2.3. Sampling Procedure and Sample Size

Two stage sampling procedure was used to select sample households. In the first stage, from 22 *kebeles* producing both potato and head cabbage in the district four sample *kebeles* were randomly identified in collaboration with concerned experts from district office of agriculture and development agents. In the second stages 150 sample households were randomly selected from four sample *kebeles* based on probability proportional to size sampling technique. The sample size was determined based on [14] formula:

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

Where: n = is the sample of both potato and head cabbage producer households that will be taken from both potato and head cabbage producer households in the district, N = is the total number of potato and head cabbage producer households in the district and e = 0.08 is the level of precision.

The total number of households is 4340, so sample size is calculated as follows:

$$n = \frac{4340}{1+4340(0.08)^2} = \frac{4340}{28.8} = 150.$$

Therefore, 150 sample households were selected randomly formal interview.

Table 1. *Sampling frame and sample size.*

Name of sampled kebeles	Total potato and head cabbage producers households (number)	Proportion sampled Households (%)	Number of sample household heads (number)
Germama	719	28.67	43
Wamagn Alkeso	619	24.67	37
Koma Bitacha	602	24	36
Gurmicho	568	22.67	34
Total	2508	100	150

Source: DOANR and Own computation, 2018.

2.4. Methods of Data Analysis

Descriptive statistics and econometric model were used for analyzing the data.

2.4.1. Descriptive Statistics

Descriptive statistics was applied to describe the characteristics of the sample households and assess differences or similarities among the households. Descriptive statistics such as mean, standard deviations, minimum and maximum values, frequencies, and percentages were used to describe the households.

2.4.2. Econometric Model Specification

This part of the analysis deals with the understanding of the factors affecting production of potato by smallholder farmers in Kofale district. Quantity of potato produced is a continuous variable that represents the actual potato produced by individual households measured in quintals (100kg). Multiple linear regression model (OLS) was appropriate to analyze factors affecting production of potato because all sampled households is producers of potato. However, when some of the assumptions of the Classical Linear Regression (CLR) model are violated, the parameter estimates of the above model may not be Best Linear Unbiased Estimator (BLUE). Thus, it is important to check the presence of heteroscedasticity, multicollinearity and endogeniety problem before fitting important variables into the regression models for analysis.

$$Yi = b0 + biXi + \mu i \quad (1)$$

Where

Y = Quantity of potato produced, Xi= explanatory variable included in the model and μi =Error term.

Under econometric analysis, multiple linear regression analysis was used to analyze the effect of the hypothesized independent variables on supply of potato output to the market as dependent variable. Therefore, the mathematical specification of the model is

$$Y = \beta o + \beta 1X1 + \beta 2X2 + \beta 3X3\ldots + \beta nXn \quad (2)$$

Where Y= dependent variable, βo= the slope of the equation, β1...β2….βn= coefficients to estimates, X1….X2… Xn= independent variables.

2.4.3. Variable Hypotheses and Descriptions

Table 2. *Summary of variables description and hypothesis.*

Dependent Variables	Unit/ type	Variables Description
Quantity of potato produced	**Continuous**	**Quintals**
Explanatory Variables Description of variables		**Exp sign**
Sex	Dummy, 1 for male and 0 for female	+
Land under production	Continuous, cultivated land in hectares	+
Potato production farming experience	Continuous, experience of production in years	+
Education	Continuous, education status years of schooling	+
Family size	Continuous, number of family members living together	+/-
Access input supply	Dummy, Yes=1, 0=No	+
Access to market information	Dummy, Yes=1, 0=No	+
Frequency of extension contact	Continuous, number of extension contact	+
Participation in farmer groups	Dummy, Yes=1, 0=No	+
Livestock owned	Continuous, tropical livestock unit	+/-
Off and non-farm income	Dummy, Yes=1, 0=No	-

Table 3. *Summary of variables description and hypothesis.*

Dependent Variables	Unit/ type	Variables Description
Quantity of Potato supply to market	**Continuous**	**Quintals**
Explanatory Variables Description of variables		**Exp sign**
Sex	Dummy, 1 for male and 0 for female	+
Land under production	Continuous, cultivated land in hectares	+
Potato production farming experience	Continuous, experience of production in years	+
Education	Continuous, education status years of schooling	+
Family size	Continuous, number of family members living together	+/-

Dependent Variables	Unit/ type	Variables Description
Quantity of Potato supply to market	**Continuous**	**Quintals**
Explanatory Variables Description of variables		**Exp sign**
Distance to all weather roads	Continuous, in kilometres	-
Access to market information	Dummy, Yes=1, 0=No	+
Frequency of extension contact	Continuous, number of extension contact	+
Amount of potato produced	Continuous, amount produced in quintals	+
Livestock owned	Continuous, tropical livestock unit	+/-
Off and non-farm income	Dummy, Yes=1, 0=No	-

3. Results and Discussion

This chapter presents the findings of the study and discusses in comparison with the results of earlier similar studies.

3.1. Descriptive Statistical Results

Demographic and Socio-economics Characteristics of the Sample Household

In this sub-section, descriptive statistical results of variables such as sex, potato production experience, family size, potato production, family size, land allocated for production, livestock unit, distance to weather roads, education status, access to extension services, market in The results of descriptive statistics analysis indicated that formation, credit and social participation are presented and discussed.

The mean potato production in the study area was 52 quintals per sample households which range 3 to 135 quintals. The potato farming experience of the sample respondents was about 13.02 years. The average number of family size for the sample respondents were about 8.7 which is very large size. This result showed that as religion views most farmers in study area not aware about family planning and practice of polygamy which leads them to more children. The average land allocated for potato production was 0.46 hectares from the total cultivated land of 1.34 hectares. The mean livestock possession was about 7.91 TLU (Table A1) that implies livestock is the main contribution in the study area. The average distance all-weather roads from farm gate was 3.85 kilometers. The sample households in study area are sale their product at farm gate, as a result there is a problem of road directly connects from farm site to all-weather road (Table 4).

Table 4. *Summary of descriptive Continuous variables.*

Continuous variable	Mean	Std.Dev.
Potato production experience (Years)	13.02	7.77
Amount of Potato produced (Quintals)	51.95	34.36
Family size (Numbers)	8.77	3.99
Land allocated for potato (Hectares)	0.46	0.2
Number of livestock (TLU)	7.91	3.92
Distance to Weather roads (Kilometer)	3.84	0.73

Source: Own survey result, 2018.

Only about 19.33% participated in non/off-farm activities. This indicated that the sample respondents in study area mainly depend on farming activities. About 90% of sample households were literate and 10% illiterate that implied literate households are easily understand extension service to adopt technology. About 55.33% of sample respondents' access to extension service by different extension service providers. About 60% of respondents participate in different social organizations. Only 36% of sample farmers were access to credit services and 62% of them access to market information by using their mobile phones, friends, social media and own observation from markets (Table 5).

Table 5. *Summary of descriptive dummy variables.*

Dummy variables	Percent	
	Yes	No
Off/non-farm	80.67	19.33
Education	90	10
Access to extension service	55.33	44.67
Social participation	60	40
Access to credit	36	64
Access to market information	62	38

Source: Own survey result, 2018.

3.2. Potato and Head Cabbage Production and Marketing

Kofale is one of the potential areas for potato production of west Arsi zone. Potato is produced for the purpose of consumption and sale in the study area while head cabbage is mostly for sales. The major crops produced in Kofale district are barley, maize, potato, head cabbage, normal cabbage (Ethiopian Kale), enset and carrot. Sample households allocated more land for barley, potato and head cabbage which was on average 0.56, 0.46 and 0.5 hectares respectively. The area allocated to those crops shown Figure 3.

All of the sample potato producers in the study area produced potato twice a year by rain-fed (January and June). Both local and improved varieties were used for potato production of the study area. Currently, improved potato varieties being grown in Kofale district are Gudane and Jalane whereas; the major local varieties grown are Bule, Nech ababa and China. From local varieties Bule is grown mostly for home consumption whereas, China and Nech ababa was commonly produced for market. From total sample households about 80% used local seeds of potato while only 20% used improved seeds in 2018 production year. About 40% of sample households used both improved and local seeds. From local seed users about 75.76%, 30% and 11.36% use Bule, China and Nech Ababa respectively. From improved seed users about 91.17% used Gudane variety and only 8.33% used Jalane variety.

Average price of potato products were 306.71 ETB Per quintals. Average cost of local variety seeds bule, Nech

Ababa and China were 345.5,436 and 389.75 ETB per quintal respectively while average cost of improved seeds (Gudane and Jalanne) 397.5 ETB per quintal. This result shows presence of gap between potato product price and seed price. Sample farm households do not store seeds for production, they store temporary only for consumption purpose.

Traditionally they believed that productivity decreases if they use own saved seeds. As a result sample farmers reported that they buy seeds and faced shortage of supply of potato seeds during planting.

About 48.67% sample respondents apply organic fertilizer on prepared land for potato production before planting. Organic fertilizers were farm yard manure about 75.34%, compost 19.18%, crop residue 2.74% and 6.85% both compost and farm yard manure were used by sample farmers. The sample households used in organic fertilizers like DAP, UREA and recently introduced NPS in both potato production. The average price of DAP, UREA and NPS were 1302, 1250 and 1370 ETB per quintal respectively. About 56% potato producer sample respondents used family labor by helping each other as labor exchange respectively. The remaining percent of respondents used hired labor during potato production. From total sample respondents, about 70% of them perceived increasing trends in potato production in the past five. All the respondents' produced potato each year continuously.

The result further shows that the major opportunities of potato and head cabbage production and marketing in the study area were availability of rain fall reported by about 85.81% respondents and favorable climate conditions reported by 14.19% of respondents. The major constraints potato producer sample farmers faced were shortage of supply of improved seeds reported by 29.33%; disease problem reported by 28.67%; rest problem reported by 14%; high production cost reported by 14.67%; low price at harvesting time reported by 10%, cold temperature 2% and decrease in productivity reported by 1.33%.

About 81.33% and 89.33% of respondents sold potato and head cabbage product at farm gate respectively while remaining percent sold at village market, district market and at road side. The average total cost of sample household potato production is 15,055.12 ETB per hectare and the gross value was 36,906.54 ETB per hectares. This result implies that potato having significant in generating income for farm household in the study area (Figure 3).

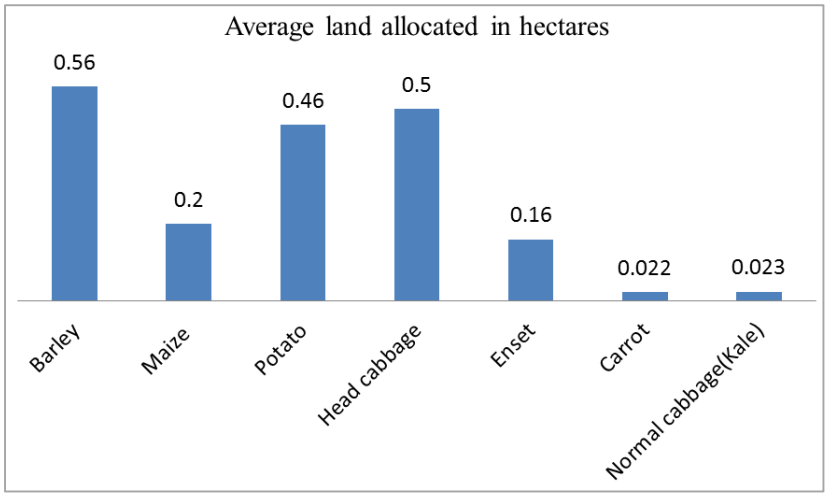


Figure 2. *Land allocation for different crops in hectares.*

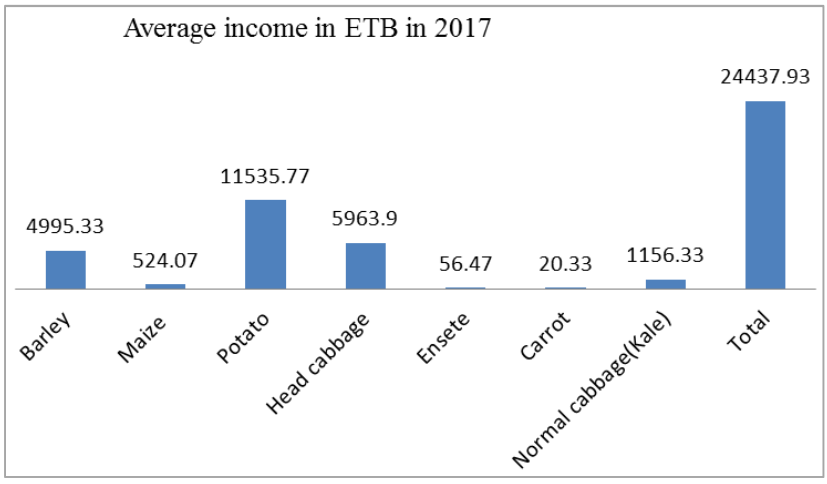


Figure 3. *Average cash annual income of sample households from sales of different crops.*

3.3. Results of the Econometric Model

In this section, regression analysis was used to identify factors determining sample households potato production in the study area.

3.3.1. Determinants of Potato Production in Kofale District

Analysis of factors affecting quantity of potato production was found to be important to identify factors constraining potato production. Prior to fitting multiple linear regressions, the hypothesized explanatory variables were checked for existence of multicollinearity, heteroscedasticity and endogeniety problem. The problem of endogeniety occurs when an explanatory variable is correlated with the error term in the population data generating process, which causes, the ordinary least squares estimators of the relevant model parameters to be biased and inconsistent. The source of endogeniety could be omitted variables, measurement error and simultaneity [15]. Both Hausman test and Durbin-Wu-Hausman (DWH) test were applied to check the presence of endogeniety. In case of this study, there is no endogeniety problem from the explanatory variables included in the model that could cause endogeniety bias if OLS is applied. The VIF results (Table A2) indicate that, there was no serious multicollinearity problem among the explanatory variables included in the model because all VIF values are less than 10. If there is presence of multicollinearity between independent variables, it is impossible to separate the effect of each parameter estimate in the dependent variables. It is thus, important to test multicollinearity between explanatory variables. Furthermore, all the variables were tested for the problem of heteroscedasticity using the Breuch-Pagan test and there was no heteroscedasticity problem. So since there is no heteroscedasticity problem in the data set, the parameter estimates of the coefficients of the independent variables are BLUE. Also, the model specification was carried out using the Ramsey-reset test, and the result is insignificant (prob >F= 0.421) revealed that there were no omitted variables in the model. Outliers were checked using the box plot graph so that there were no serious problems of outliers and no data get lost due to outliers.

Therefore, OLS method was used to identify factors affecting potato production by smallholder farmers in the study area since all assumption was fulfilled. As depicted in Table 6 the model was statistically significant at 1% probability level indicating the goodness of fit of the model to explain the relationships of the hypothesized variables. Coefficient of multiple determinations (R^2) was used to check goodness of fit for the regression model. Hence, R^2 indicates that 67.9 percent of the variation in the quantity of potato produced was explained by the variables included in the model.

The result of regression model indicated that potato production significantly affected by education level, ownership of livestock, total family size for production and land allocated for potato production (Table 6).

Table 6. *Determinants of potato production (OLS estimates).*

Variables	Coefficient	Std. Err	P > t
Constant	33.689***	9.151	0.000
Sex	3.248	6.787	0.633
Education status	0.888*	0.511	0.084
Farming experience	0.103	0.235	0.660
Family size	1.078*	0.547	0.051
Availability of inputs	0.026	0.755	0.973
Livestock holdings (TLU)	0.965*	0.545	0.079
Land allocated for potato production	116.395***	10.099	0.000
Frequency of extension contact	-0.252	1.468	0.863
Access to market information	2.388	3.989	0.550
Participation in social organization	5. 787	3.919	0.142
Participation in non/off-farm activities	-3.140	4.618	0.498
Number of observation 150			
F (11,138) 26.56			
Prob> F 0.0000***			
R-Squared 0.679			

*** and *: implies statistical significance 1% and 10% levels respectively
Source: model result, 2018.

Education level: Education is a human capital which is continuous variable and expressed in formal years of schooling of the household head. It is hypothesized that education enhances the skill and ability to better utilize market information, which may reduce marketing costs and make it more profitable from commercialization. Education is expected to have a positive impact potato production. The result showed that Education of households has significant effect at 10% significant level on potato production with expected positive sign. Thus, the result implied that, as farmers' education increase by one unit, the quantity of potato produced increased by 0.888 quintals, keeping others factors constant. This means that the farmers with more educated have higher ability to produce potato products than others less because easy understand and apply extension advice provided by different experts. This result is in line with the finding of [16].

Family size: Family size represents the total number of individuals in the household. Large family size was expected to have positive influence on potato production through availability of labor for producing surplus high value cash crops for the market. The result showed that Family size has significant effect at 10% significant level on potato production with expected positive sign. Thus, the result implied that, farmers' labor force increase by one person, the quantity of potato produced increased by 1.078 quintals, keeping others factors constant.

Livestock holdings: Livestock holding size, which is a proxy for measuring wealth status of household head, is found to have positive and significant influenced on potato production at 10% level of significance suggested that livestock provides manures as manure is the main nutrient used by farmers for crop production. This result implies that for each additional tropical livestock unit, the potato production would decrease by 0.698 quintals keeping all other factors constant. This result is in line with the finding of [16].

Size of land allocated for potato production: Size of land allocated for potato production is found to have a positive and significant influenced potato production at 1% level. This implies that one hectare additional land allocated for potato production would increase potato yield by 116.395 quintals, keeping other factors constant. The reason could be access to more arable land that encourages farmers to produce more potatoes. This result is in line with the finding of [16].

3.3.2. Determinants of Potato Marketing in Kofale District

Therefore, OLS method was used to identify factors affecting potato production by smallholder farmers in the study area since all assumption was fulfilled. As depicted in Table 6 the model was statistically significant at 1% probability level indicating the goodness of fit of the model to explain the relationships of the hypothesized variables. Coefficient of multiple determinations (R^2) was used to check goodness of fit for the regression model. Hence, R^2 indicates that 89.3 percent of the variation in the quantity of potato produced was explained by the variables included in the model.

The result of regression model indicated that potato marketing significantly affected by family size, amount of potato produced, frequency of extension contact and access to market information (Table 7).

Table 7. *Determinants of potato marketing (OLS estimates).*

Variables	Coefficient	Std. Err	P > t
Constant	-4.681	6.932	0.501
Sex	-3.296	3.343	0.326
Education status	0.117	0.353	0.645
Farming experience	-0.078	0.116	0.503
Family size	-0.579**	0.277	0.038
Amount produced	0.815***	0.042	0.000
Livestock holdings (TLU)	-0.173	0.274	0.529
Land allocated for potato production	-5.530	6.897	0.424
Frequency of extension contact	2.744***	0.733	0.000
Access to market information	3.706*	1.975	0.063
Distance to all-weather roads	0.947	1.301	0.468
Participation in non/off-farm activities	0.181	0.042	0.937
Number of observation 150			
F(11,138) 105.19			
Prob> F 0.0000***			
R-Squared 0.893			

***,** and *: implies statistical significance 1%, 5% and 10% levels respectively
Source: model result, 2018.

Family size: Family size represents the total number of individuals in the household. Large family size was expected to negative influence on potato supply to indicated that the higher the number of household members, the more they were consumed their production. The result showed that Family size has significant effect at 5% significant level on potato production with expected negative sign. Thus, the result implied that, farmers' family size increase by one person, the quantity of potato supplied to market decreased by 0.579 quintals, keeping others factors constant. This result is in line with the finding of [16].

Amount of Potato produced: It is continuous variable quintals of potato production in the survey year. It was expected positive influence on potato supply to market. The result showed that amount of potato produced has significant effect at 1% significant level on potato production with expected positive sign. Thus, the result implied that, increase in production by one quintal, the quantity of potato supplied to market decreased by 0.815 quintals, keeping others factors constant. This result is in line with the finding of [17].

Frequency of extension contact: It is continuous variable number of extension contact in production year. Agricultural extension contact are expected to enhance farmer skills and knowledge, link farmers with modern technology and markets, and ease liquidity and input supply constraints expected to positive effect on potato marketing. The result showed that Frequency of extension contact has significant effect at 1% significant level on potato marketing with expected positive sign. Thus, the result implied that, extension contact increase by one unit, the quantity of potato supplied to market increased by 2.744 quintals, keeping others factors constant. [18] Founded that accessibility to extension by the farmers was significant and positively influenced farmer's orientation towards market.

Access to market information: This is a dummy variable taking a value of 1 if the farmer had access to market information and 0 otherwise. It is hypothesized to affect the probability and level of commercialization of the farm households positively both in terms of crop output sales and input purchases. Households with better information access (facing less fixed transaction cost) are more likely to participate in cash crop production and expected to have positive effect on the potato marketing. The result showed that Frequency of extension contact has significant effect at 10% significant level on potato marketing with expected positive sign. Thus, the result implied that, access to market information increase the quantity of potato supplied to market increased by 3.706 quintals, keeping others factors constant. In this study ownership of communication equipment such as telephone, radio and television are used as a proxy to access information. This result is in line with the finding of [18].

4. Conclusions and Recommendations

This chapter summarizes the whole findings of the study and makes conclusions based on the results of the descriptive and econometric model. It also highlights some important policy recommendations to enhance farmers' production and marketing decision.

4.1. Conclusions

Agriculture in Ethiopia is dominated by smallholder and largely subsistence farmers who are intended to meet household food consumption. To increase the smallholder farmers' income and reduce rural poverty, subsistence agriculture needs improvement through increasing production and productivity of potatoes. Therefore, improving the smallholder farmers' potato production and marketing is required, in order to improve access to food and

sustainable livelihoods. The overall objective of this study was to analyze status of commercialization factors influencing farmers' potato production and marketing in Kofele district. To conduct the study, primary data was collected from 150 randomly selected household heads through semi-structured questionnaire. Secondary data were also collected from different sources including CSA, DOANR, and from published and unpublished sources to supplement primary data. In this study both descriptive statistics and econometric analysis were employed. The primary data was analyzed using descriptive statistics and multiple linear regression.

This study has identified household determinants of potato production and marketing in Kofale district, West Arsi zone, Oromia Regional state, Ethiopia. The district average potato production is 52 quintals/household. All sample potato e producers in the study area produce using rain-fed. The sample households allocated more cultivated land for potato production next to barley. Regression analysis linear model (OLS) indicated potato production significantly affected by education level, ownership of livestock, total family size for production and land allocated for potato production positively and significantly. The potato supply to market significantly and negatively affected by family size while amount of potato produced, frequency of extension contact and access to market information affect it positively.

4.2. Recommendations

Based on the findings of this study, the following recommendations are made.

Land allocated to potato productions significantly affected amount of potato produced, so farmers better to increase the land allocation for commodity to increase their production potentials.

Access to market information significantly affected farmers supply to potato to market positively. The government should give price and market information by different means of information providers' instruments as well as create market integration to enhance farmers' participation decision and the level of market participation.

Livestock holding significantly affected sample potato producers positively. The study suggested strengthening the existing livestock providing improved health services, better livestock feed (forage), targeted credit and adopting agro-ecologically based high-yielding breeds and disseminating through artificial insemination in the area.

Frequency of extension contact influenced farmers supply potato to market study area. Therefore, the agricultural development office need to increase extension service by providing service like input supplies, production, marketing and give practical professional support to enhance farmers' production and marketing of potato production.

Finally Amount of potato produced affected sample households potato supply to market significantly and positively. Research centers provide improved potato varieties to improve the productivity of farmers to boost production that increase level of market participation.

Appendix

Table A1. *Conversion factors used to compute tropical livestock units (TLU).*

Livestock Categories	Conversion factor
Cow/Ox	1
Bull	0.75
Heifer	0.75
Calf	0.2
Horse/Mule	1.1
Camel	1.25
Sheep/Goat	0.13
Donkey	0.7
Poultry	0.013

Source: Stork *et al*., 1991.

Table A2. *Multicollinearity test.*

Variables	VIF	1/VIF
Potato farm experience	1.67	0.598042
TFSZ	1.66	0.601039
TLU	1.68	0.596472
Ecuc	1.45	0.692015
Extefreq	1.47	0.678976
AMInformation	1.42	0.704811
TLPP	1.51	0.663938
Sex	1.36	0.734500
Social	1.37	0.731460
Pnonoff-farm	1.23	0.812047
Dallwheather	1.17	0.854345
Acredit	1.12	0.892756
Input availability	1.12	0.895711
Mean VIF	1.42	

References

[1] FAO (Food and Agriculture Organization of the United Nations).2019. FAOSTAT database http://faostat.fao.org/site/567/default.aspxancor, accessed 25 Dec, 2019.

[2] Almaz Giziew, Workneh Negatu, Edilegnaw Wale and Gezahegn Ayele, 2014. Constraints of Vegetables Value Chain in Ethiopia: A Gender Perspective: *International Journal of Advanced Research in Management and Social Sciences,* Vol. 3, No. 12. Available on www.garph.co.uk

[3] Dawit, A., Abera D., Lemma D., and Chemdo A., 2004. Domestic vegetable seed production and marketing. Research Report No 5. EARO, Ethiopia. 17p.

[4] Devaux, A., P. Kromann, O. Ortiz. 2014. Potatoes for sustainable global food security. Potato Research. doi: 10.1007/s11540-014-9265-1.

[5] Birch P. R. J., Bryan G., Fenton B., Gilroy E., Hein I., Jones J. T., Prashar A., Taylor M. A., TorranceL., Toth I. K. 2012. Crops that feed the world. Potato: are the trends of increased global production sustainable? Food Security, 477-508.

[6] Lutaladio N., Castaidi L., Potato: The hidden treasure. J. Food Comp. Anal. 2009. Improving potato seed tuber quality and producers' livelihoods in Hararghe, Eastern Ethiopia. *Journal of New Seeds* 7 (3): 31–56. in Kenya and Uganda. Working paper.

[7] Cromme, N.; Prakash, A. B.; Lutaladio, N.; Ezeta, F. 2010. Strengthening potato value chains: technical and policy options for developing countries. Food and Agriculture Organization, Viale delle Terme di Caracalla, 00100.

[8] Borgal H. B., Arend C., Jacobi K., Kulazia S., Lemaga A., Mogaeka B. L., Prante W. 1980. Production, marketing and consumption of potato in the Ethiopia highlands' (Holleta, Awassa, and Alemaya), Center of Advanced training in agricultural development technology, University of Berlin.

[9] CIP (International Potato Center). 2008. Farmers practices and adoption of improved varieties.

[10] Semagn Asredie Kolech, Donald Halseth, Walter De Jong, Keith Perry, David Wolfe, Fentahun Mengistu Tiruneh and Steffen Schulz. 2015. Potato Variety Diversity, Determinants and Implications for Potato Breeding Strategy in Ethiopia. *Am. J. Potato Res.* 92: 551–566. DOI 10.1007/s12230-015-9467-3.

[11] CSA (Central Statistical Agency). 2017. The Federal Democratic Republic of Ethiopia central Statistical Agency agricultural sample survey report on area and production of major crops 584 Statistical Bulletin 2016/2017 (2009 E.C.) Volume I.

[12] ATA (Agricultural Transformation Agency). 2017. Market service. The Agricultural Transformation Agency of Ethiopia.

[13] DOANR (District Office of Agriculture and Natural Resource). 2018. Reports of Kofale district office of agriculture, 2017. Kofale, Ethiopia.

[14] Yamane., T. 1967. Statistics: An introductory analysis, 2nd Ed., New York: Harper and Row.

[15] Maddala, G. S. 2001. Introduction to Econometrics. Third Edition, John Will.

[16] Aman Tufa, Adam Bekele and Lemma Zemedu. 2014. Determinants of smallholder commercialization of horticultural crops in Gemechis district, West Hararghe zone, Ethiopia. *African Journal of Agricultural Research*, 9 (3): 310-319.

[17] Wondim Awoke and Desselgn Molla. 2018. Market chain analysis of potato and factors affecting market supply in West Gojam Zone, Ethiopia. *Journal of Development and Agricultural Economics* Vol. 11 (2), pp. 43-51.

[18] Agwu, N. M., Anyanwu, C. I. and Mendie, E. I. 2012. Socio-economic determinants of commercialization among smallholder farmers in Abia state, Nigeria. *Greener Journal of Agricultural Sciences,* 2 (8): 392-397.