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Factors Affecting Potato Market Outlet Choices of Smallholder Potato Producers in Elfeta District, West Shoa Zone, Oromia Regional State, Ethiopia

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Abstract

Regardless of the real production and the economic importance of potato, enhancing potato producers to actively participate in increasing the level of marketing of potato is not well addressed in the study area. Thus, the aim of this study was to identify market outlet choices of small holder potato producers in the Elfeta District of West Shoa zone, Oromia regional state Ethiopia. The primary data were collected from sample of 150 potato producers using random sampling method through structured questionnaires. The data were analyzed using descriptive statistics and econometric models. The result of Multivariate Probit indicated that the likelihood of sampled household heads select collectors, wholesalers, retailers and consumers as market outlets were 39%,55%,49% and 46% respectively. The joint probability to select all outlets were 1.1% and the joint probability of failure to select all outlets were 2.3%. The result of Multivariate Probit indicated that education level of the household heads, family size, current market price of potato, distance from the market and post-harvest value addition activities were significantly influenced collectors outlets. Education level of the household head, family size, current market price of potato and farm size were significantly affected wholesalers outlets. Distance from the market were significantly influenced the retailers outlets. Based on this finding, the study recommended that the government should enhance developing market infrastructure in the form of establishing producer collection point in order to support poor farmers for faster delivering of their product.

Keywords: Market outlet choice; Potato; Multivariate probit model

Introduction

Marketing plays an important role in agricultural commercialization and accessibility of the market for commodities allows specialization of production, which in turn increases productivity and efficiency. Well-functioning market leads to efficient allocation of scarce resources and maximization of the general welfare of the society. Proper functioning market will only occur when enough markets and efficient market outlets exist for the sale of produced output and no single entity can individually influence the price [1].

Marketing of agricultural products consists primarily of moving products from production sites to points of final consumption. In this regard, the market performs exchange functions as well as physical and facilitating functions. The exchange function involves buying, selling and pricing. Transportation, product transformation and storage are physical functions, while financing, risk bearing and marketing information facilitating marketing [2].

Market channel is a business structure of interdependent organizations from the point of product origin to the consumer with the purpose of moving products to their final consumption destination [3]. The analysis of marketing channels is intended to provide a systematic knowledge of the flow of goods and services from their origin (producer) to their final destination (consumer). This knowledge is acquired by studying the participants in the process, i.e. those who perform physical marketing functions in order to obtain economic benefits [4]. Potato is number one non-grain food commodity and economically important crop of the world [5]. 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 [6].

Potato is one of the major vegetable export products. It is traded in local market and export outlets, which is an essential activity of the farming households where it generates income and has contributed to the development of potato sector [7]. For instance, increasing of export of potato to Somaliland and Djibouti is major motive for potato farmers in Eastern Ethiopia [8]. Potato, which is available for home consumption is found in different forms throughout the country. Fresh and processed potato are found in graded, washed, sorted, packed, branded forms. Frozen crisps (locally made, imported from whole potatoes or reconstituted) in supermarkets; boiled or fried potato at home; chips at restaurants are found in the urban areas of Ethiopia [9].

In the study area, potato is the main crop which comes first in terms of area coverage as compared to other vegetables crops produced in the district [10]. Farmers produce potato for household food consumption and as source of cash income. Despite the production potentials and importance of potato crop for the country as well as the study area, there has been limited performance of farmers in potato marketing. In order to maximize the benefits producers may earn, they have to make appropriate decisions as to where they should sell their product.

However, there are various factors that affect households' decision to select appropriate market outlet choice for delivering their products

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to the market. Identifying these factors and available market outlet choice in the study area is very important in terms of identifying possible areas of interventions that may help farmers to maximize benefits out of their potato production and marketing activities. Various studies on the determinants of smallholders' commercialization of smallholders' agricultural commodities and market outlet choices were conducted in different regions of Ethiopia on *teff*, wheat, and maize and haricot bean and potato. However, such studies that address the market outlet choice problems of small holder potato producers have not been undertaken in Elfeta district.

There is no adequate information on determinants of smallholders' commercialization of potato producers and factors that affect market outlet choice potato producers in the study area. As well as there is apparent knowledge gap as regards to factors determining the degree of commercialization of potato producers and market outlet choice of potato producers in the study area. As a result, this research has been initiated to identify factors market outlet choice of smallholder potato producers in Elfeta district, West Shoa Zone, Oromia regional state, Ethiopia.

Methodology

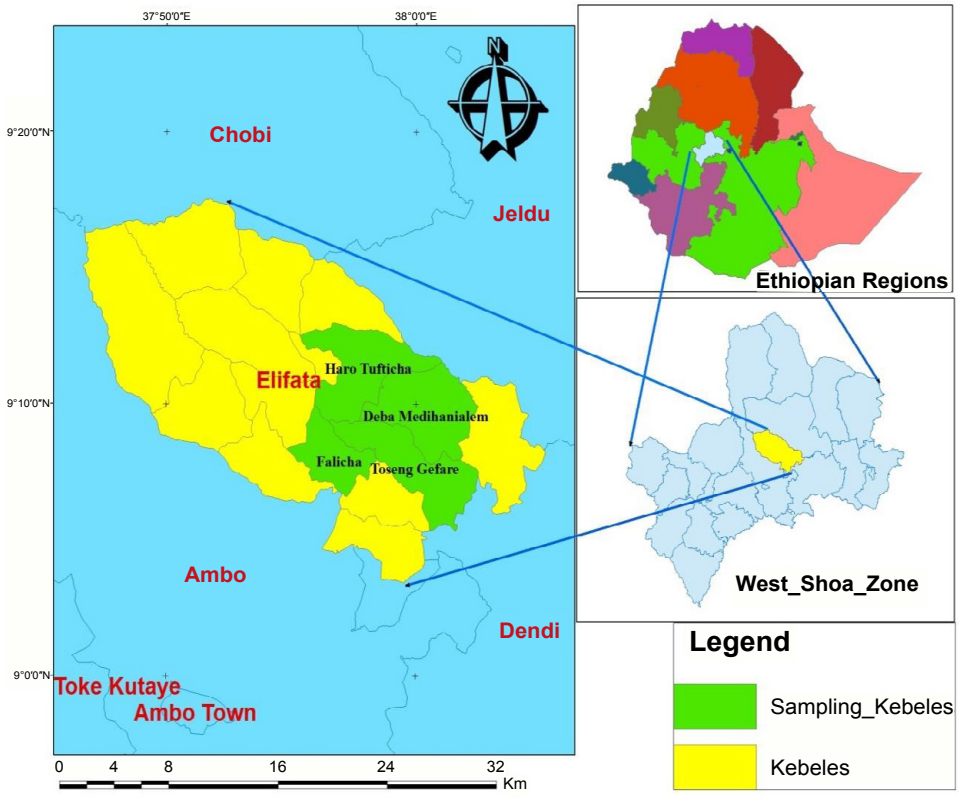
Description of the study area

The study was conducted in Elfeta district, West Shoa zone of Oromia National Regional State, Ethiopia. Elfeta district is located at 112 km from Addis Ababa towards west direction. It has an estimated area of 393.4 km^2; it is bordered in the South by the Dendi district, in the West by Ambo district, in the North by Jeldu district, in the East by Chobi district [10].

The district has a total of 17 kebeles of which 15 are rural based kebeles administration areas and 2 are town kebeles. Total human population of the district is estimated at 75,902 of whom 37,649 are males and 38,253 females. Of the total households 88.36% are rural agricultural households (CSA). The altitude of the district varies from 1500-3268 m above sea level. It receives an annual rainfall of 800-1172 mm, and has an annual temperature range of 11-23°C. The district has three agro-ecologies which is Dega (45%), Weina Dega (40%) and Kola (15%) [10].

The soils types in the district are predominantly red (40%), black (20%), sand soil (25%), brown (10%) and others (5%). The district is characterized by subsistence mixed farming system in which production of both crops and livestock is common economic activity. The total land of the district is estimated to be 39342 ha, out of which 260,042.2 ha is cultivated land, 8150.8 ha is grazing land, 1609 ha is forest and 3540 ha is covered with others [10].

The district is known for its high production potential of crops and livestock. Crop production takes the lion's share of consumption and income generation of the household. Cereals crops widely produced in the area include *tef,* wheat, barley and maize, pulse crops like, faba beans and Niger are the major crops grown. Moreover, vegetables and root crops produced in the area include onions, potato, tomato, pepper, cabbage, sweet potato and Carrot. Annual crops are predominant and rain-fed agriculture is mainly practiced using animal power. Livestock production is also another source of income and food source next to crop production (EDAO) (Figure 1).



(Source: Adopted from Arc GIS computation and Ethiopian map (2019)).

Figure 1: Location map of the study area.

Sources and types of data

Both primary and secondary data were used for this study. Primary data were collected from randomly selected potato producers in four rural kebeles, from potato traders and consumers in the district. Secondary data was collected from Elfeta District Agriculture and Natural Resource office, Irrigation and Development Authority, District Trade and Market Development Office and Central Statistical Authority (CSA), published literatures and websites

Methods of data collection

Primary data was collected using informal and formal surveys and key informants interviews. For informal survey Rapid Market Appraisal (RMA) technique like focus group discussion and key informant interview were used with checklists. The formal survey was undertaken through formal interviews with randomly selected potato producers and purposively selected potato traders and consumers using a pre-tested semi-structured questionnaire for each group. The KIIs were conducted with selected relevant with six experts of the district (two from district agricultural development office, two from Development Agents (DAs), and two from trade and development Office). Focus group discussions were hold with 10 members from selected kebeles to collect relevant data for the study.

Eight enumerators were trained from selected kebeles for data collection. Before data collection, the questionnaire was pre-tested on five farmers to evaluate the appropriateness of the design, clarity and interpretation of the questions, relevance of the questions and to estimate time required for an interview. Subsequently, appropriate modifications and corrections were made on the questionnaire.

Sample size and sampling methods

The two stage random sampling techniques were used to selected sample household heads. In the first stage out of 15 rural based kebeles and two town kebeles, 11 potato producer kebeles were identified and four kebeles were selected randomly from potato producers kebeles. In the second stage from the selected kebeles using household list of the sampled kebeles 150 sample potato producers were selected randomly using probability proportional to sample size (PPS) sampling techniques based on Cochran formula at 95% confidence level with maximum degree of variability of 0.5 and level of pension 8% [11].

$$n = \frac{(z\alpha/2)^2 S^2}{e^2} \quad (1)$$

Where n=Sample size; Z=Confidence level (α=0.05)=1.96; e=8% is precision level and S^2=Variance (0.5*0.5)=0.25

$$n = \frac{(1.96)^2 \times 0.5^2}{(0.08)^2} = 150$$

In addition to sample producers, 15 sample traders and 25 sample consumers were selected from Elfeta district (Bake and Gute town) using purposive sampling methods to generate addition information to support primary data obtained during survey time (Table 1).

In addition to producers sample respondents', based on their availability and size of data, the sample respondents of traders and consumers were selected using purposive sampling method in order to obtained additional information about determinants of smallholder potato producers' commercialization and market outlet choice. From Elfeta district, Bake and Gute town 15 traders and 25 consumers were selected. Finally, the ultimate sample of households at each kebeles was taken proportionally, and data was collected from a total of 190 respondents of potato producers, traders and consumers.

Methods of data analysis

To investigate factors affecting market outlet choice of sample household's Multivariate probit model was used. Multivariate Probit model simultaneously models the influence of a set of explanatory variables on choice of market outlets, while allowing for the potential correlations between unobserved disturbances as well as the relationship between the choices of different market outlets [12]. In the study area, small holder potato producers face different choices of market outlets like: wholesalers, consumers, collectors and retailers. Thus, in this study since potato is one of the cash crops that enable producers to choose more than one outlets that are not mutually exclusive to get better price. Considering the possibility of simultaneous choices of outlets and the potential correlations among these market outlet choice decisions multivariate probit model (mvprobit) is appropriate and was applied to capture household variation in the choice of market outlets and to estimate several correlated binary outcomes jointly.

The observed outcome of market outlet choice can be modeled by the following random utility formulation. Consider the i^{th} farm household (i=1, 2, N), facing a decision problem on whether or not to choose available market outlets. Let Uo represent the benefits to the farmer who chooses wholesalers and let Uk represent the benefit of farmer to who choose the K^{th} market outlets: where K denotes choices of collectors (Y1), wholesalers (Y2), retailers (Y3) and consumers (Y4)

The farmers decide to choose the K^{th} market outlet if

$Y_{it}=Uk-Uo>0$.

The net benefit (Y_{ik}) that the farmer derives from choosing a market outlet is a latent variable determined by observed explanatory variable (Xi) and the error term (εi)

$Y\text{-}_k = xi'\beta k + (6)$

(k=Y_1, Y2, Y_3, Y4)

Where, in this study, Y_1=Collectors, Y_2=Wholesalers, Y_3=Retailers and Y_4=Consumers. Using the indicator function, the unobserved preferences in the above equation translates into the observed binary outcome equation for each choice as follows

$$= \begin{cases} 1 \text{ if } xi'\beta k + \varepsilon i > 0, \\ 0 \text{ if } xi'\beta k + \varepsilon i \leq 0 \end{cases} \quad (7)$$

(K=$Y1$, $Y2$, $Y3$, Y4)

No.	Name of selected kebeles	Number of household potato producer	Proportion of sampled household (%)	Numbers of sampled households
1	HaroTufticha	768	35.3	53
2	DabaMedalelmi	625	28.7	43
3	XosanyiGefare	413	18.7	28
4	Fallicha	372	17.3	26
	Total	2178	100	150

Table 1: Sampling frame and sample size determination (Source: EDAO (2019)).

Where: x' is a vector of explanatory variables;

β denotes the vector of parameters to be estimated; and

εi are random error terms distributed as multivariate normal distribution with zero mean and unitary variance.

Yi is a set of binary dependent variables such that: Y1=Collectors, 1 for the farmer who choose collectors, 0 otherwise; Y2=Wholesalers, 1 for the farmer who choose wholesalers, 0 otherwise, Y3=Retailers, 1 for the farmer who choose collectors, 0 otherwise and Y4=Consumers, for the farmer who choose consumers, 0 otherwise. In multivariate probit model, where the choice of several market outlets is possible the error terms jointly follow a multivariate normal distribution (MVN) with zero conditional mean and variance normalized to unity (for identification of the parameters) where ($\mu y1$, $\mu y2$, $\mu y3$, $\mu y4$) $MVN \sim (0, \Omega)$ and the symmetric covariance matrix Ω is given by:

$$\Omega = \begin{vmatrix} 1 & \rho y1y2 & \rho y1y43 & \rho y1y4 \\ \rho y2y1 & 1 & \rho y2y3 & \rho y2y4 \\ \rho y3y4 & \rho y3y2 & 1 & \rho y3y4 \end{vmatrix} \quad (1)$$

Particular interests are off-diagonal elements in the covariance matrix, which represents the unobserved correlation between the stochastic components of the different type of outlets. This assumption means that the above equation generates a MVP model that jointly represents decision to choose particular market outlet. This specification with non-zero off-diagonal elements allows for correlation across error terms of several latent equations, which represents unobserved characteristics that affect the choice of alternative market outlets. Following the form used by Cappellari and Jenkins, the log-likelihood function associated with a sample outcome is given by:

$$LnL = \sum_{i=0}^{N} \omega i Ln \Phi \left(\mu i, \Omega \right) \quad (2)$$

Where ωi is an optional weight for observation i, and Φ is the multivariate standard normal distribution with arguments μi and Ω, where μi can be denoted as;

$$\mu i = (ki1\beta 1xi1, 2\beta 2xi2, ki3\beta 3xi3, ki4\beta xi4), While\ \Omega ik=1 \text{ for j=k and} \quad (3)$$

$$\Omega jk=\Omega kj=kikjk\rho jk \quad (4)$$

$$for j \neq k,\ k=1, 2, 3 \ldots .With kik= 2yik-1$$

Hypothesis, variable selection and definitions

Hypothesis, variable selection and definitions are given in Table 2.

Results and Discussion

For identifying factors affecting farmers market outlet choices 12 independent variables were used in the model. The Wald test ($\chi 2$ (44)=121.76, p=0.000) is significant at the 1% probability of significance, which indicates that the subset of coefficients of the model is jointly significant and that the explanatory power of the factors included in the model is satisfactory. Thus the MVP model fits the data reasonably well. Also, the model is significant because the null that choice decision of the four potato market outlets is independent was rejected at 1% significance level. The results of the likelihood ratio test in the model (LR chi^2 (6)=29.42, $\chi 2$>p=0.0001) indicates the null that the independence between market outlet choice decision (ρ21=ρ31=ρ41=ρ32=ρ42=ρ43=0) is rejected at 1% significance level and there are significant joint correlations for two estimated coefficients across the equations in the models. This confirms that separate estimation of choice decision of these outlets is biased, and the decisions to choose the four potato marketing outlets are interdependent household decisions.

Separately considered, the ρij value shows the degree of correlation between each pair of dependent outlets. as indicated in Table 2, theρ21 (correlation between the choice for wholesalers and collectors outlet), ρ32 (correlation between the choice for retailers and wholesalers outlet) and ρ43 (correlation between the choice for consumers and retailers outlet) were negatively and significantly interdependent at 1% significance level whereas ρ42 (correlation between the choice for consumers and wholesalers outlet) was negatively and significantly interdependent at 5% significance level.

The simulation results also indicate that the probability that potato producers choose wholesalers, retailers, consumers and collectors market outlet were 55%, 49%, 46% and 39% respectively. The results of the joint probabilities of success and failure of the four outlets were 2.3% and 1.1% respectively. Based on the result of MVP model in Table 2, among of 11 explanatory variables included in the model, five variables affected significantly collectors outlet, four variables affected significantly wholesalers outlet, one variable affected significantly retailers' outlet and three variables affected significantly consumers market outlet choice at different significance level.

Family size of the household (HHFSIZE)

Family size has negative and significant relation with the likelihood of choosing collectors and consumers' outlet at 5% probability level. While it positively and significantly impact with the likelihood of choosing wholesaler outlet at 10% probability level. The model result indicated that an increase of family size by one adult equivalent increases

Variables	Types	Measurement	Expected
SEXHH	Dummy	1 if the household head is male; 0 otherwise	±
EDUCLHH	Continuous	Grades completed	±
HHSIZE	Continuous	Number of family member	±
EXPER	Continuous	No of years	±
NLOWNED	Continuous	TLU	±
FSIZP	Continuous	Hectare	±
DISTMA	Continuous	minutes	±
ACREDIT	Dummy	1=yes, 0=no	±
EXCONT	Continuous	Frequency	±
NONFARIN	Continuous	ET Birr	±
CMPP	Continuous	ET Birr	±
PHVA	Dummy	1=yes, 0=no	±

Table 2: Summary and hypothesis of independent variable for market outlet choices (Source: Own computation (2019)).

the likelihood of selling to wholesaler by 0.144, while the likelihood of selling to collectors' and consumer's outlet decreases by 0.201 and 0.143 respectively. This result indicates that having large family size was better for delivering output to the wholesale market rather than choosing collectors and consumer's market outlet. This finding confirm with the finding of Melkamu who found that having large family size positively related with likelihood of choosing wholesaler outlet and Addisu found that having large family size negatively influence the likelihood of choosing consumer outlet [13,14].

Education level of household head (EDLHH)

Education level is negatively and significantly influences the likelihood of potato producers selling to collectors' outlets at 1% probability level. While it influences the likelihood of choosing wholesalers market outlets positively and significantly at 5% probability level. The study results indicated, an increase in years of schooling of the sampled households by one year, decrease the likelihood of potato producers to sell to collectors market outlets by 0.162, while increase the likelihood of selling potato to wholesalers by 0.095. It reflects that, being educated enhances the capability of producers in making decisions with regarding to the choice of potato marketing outlets to sell their produce depend on the benefit they obtain. This finding is in line with the finding of Addisu and Melkamuu who found that, education level of the household head has positive and significant effect in choosing, wholesaler outlets at 1%, while it has negative relationship with the likelihood of choosing collector outlets at 1% level of significance [13,14]. And it also confirm with the findings of Chala and Calchisa who found that education status of the household heads has positive and significant impact with the likelihood of choosing wholesaler outlets [15].

Land size allocated for potato production

Land size allocated for potato production is positively and significantly relationship with the likelihood of potato producers choosing wholesalers outlet at 5% probability level. The model result showed that, an increase in one hectare of farm land allocation for potato production increases the probability of selling to wholesales outlet by 0.562. The finding result showed that those household potato producers who allocated more hectares of land for potato production would produce more output and they likely to sell to wholesalers outlet who purchase large amount than retailer outlet. This result is similar with the finding of Addisu who found that an increase in land allocation for the production of potato increases producers' likelihood of choosing wholesalers outlet [16].

Distance to the nearest market

Distance from the market is positively and significantly related with likelihood of producer selling to collector at 10% probability level and it is negatively and significantly correlated with likelihood producers selling to retailer outlets at 5% level of significance. It reflects that household located at far away from the nearest market center faces difficultly in delivering their potato produce to retailer due to lack of transportation facility at the time of harvest. As the result they sell to collectors' outlet in their locality. The implication of the positive relation of distance and likelihood of choosing collector was due to the fact that collectors purchase at farm gate from the producers during the harvesting time. This implied that with the increase in distance to market potato producers choose to sell to collectors rather than selling to other market outlets that associated with incurring higher of transportation costs. This result confirm with the findings of Melese et al. and Bezabih et al. who found that distance from the nearest rural market is negatively related with the onion and potato producers likelihood of choosing retailer outlet respectively [17,18].

Current market price of potato

Current market price of potato is negatively and significantly influences the likelihood selling potato producers to collectors and consumers outlet at 1% probability level, while it influences the likelihood of choosing wholesalers' outlet positively and significantly at 1% significance level. The model result indicated that a decrease of current market price of potato in one birr/quantal, decrease of the probability of selling to collectors and consumers by 0.019 and 0.013 respectively, While increases the likelihood of selling potato to wholesalers by 0.01. The negative relation may be due to the reason that as the current price of potato increases the collectors and consumer will buy small amount of the produce and the producers choose other market outlets. This finding is similar with the findings of Addisu who found that average current farm gate price of onion is negatively and significantly influenced the consumers' outlet at 10% significance level [16]. But this finding contradicts with the finding of Melkamu who found that current market price of potato positively and significant associated with the likelihood of choosing consumers outlet at 10% significance level [13].

Post-harvest value addition (PHVA)

Post-harvest value addition activities like sorting, transporting, storage and packaging of potato negatively correlated to collector outlets and positively correlated to consumers' outlet choice at 5% and 1% significance level respectively. The result of the model indicated that those sampled potato producers practice post-harvest value addition will increase the likelihood of selling to consumers outlet increases by 0.815, while the likelihood of selling their produce to collectors outlet decreases by 0.675 Potato producers who added value on their potato product were found more likely to sell their produce to consumers and less likely to sell to collectors. This finding is in line with the finding of Melkamu which implies that the positive relationship with the consumers' outlets and negative relationships with the collectors [13]. It indicates that collectors purchase mostly fresh potato at farm gate to sell to immediate actors after adding some value on the product and consumers the last chain actors need relatively better quality product (Table 3).

Conclusion

Particular to the study area, potato production is the major component of farming system. The study was undertaken with the specific objective of identifying determinants of commercialization of potato producers. A series of survey was carried out and the data was collected from a total of 150 sample households that was randomly drawn from four kebeles by using two stage sampling techniques. Both primary and secondary data were used. STATA 14 Software was used to run Multivariate Probit model.

The result of Multivariate Probit indicated that the likelihood of sampled household heads select collectors, wholesalers, retailers and consumers were 39%, 55%, 49% and 46% respectively. The joint probability of to select all outlets were 1.1% and the joint probability of failure to select all outlets were 2.3%. The result of multivariate probit also indicated that education level of the household heads, family size, current market price of potato and post-harvest value addition activities were negatively and significantly influenced the collectors outlets.

Variables	Collectors		Wholesalers		Retaliates		Consumers	
	Coef.	SE	Coeff.	SE	Coef.	SE	Coeff.	SE
SEXHH	0.176	0.418	0.006	0.41	0.144	0.369	0.216	0.37
EDUC	-0.162***	0.055	0.095**	0.045	0.031	0.041	-0.001	0.041
FSIZE	-0.201**	0.086	0.144*	0.078	-0.054	0.073	-0.143**	0.072
FXPRNCE	-0.016	0.015	-0.007	0.014	0.001	0.013	-0.019	0.013
LIVESTOCK	0.039	0.033	0.032	0.031	0.039	0.028	0.026	0.028
FRSIZE	0.009	0.268	0.562**	0.235	-0.205	0.207	-0.063	0.211
DSTMKT	0.008*	0.004	-0.005	0.004	-0.009**	0.004	0.003	0.004
FECONT	0.02	0.076	-0.072	0.066	-0.015	0.063	0.06	0.062
NINCOME	-0.028	0.028	0.001	0.022	-0.018	0.02	-0.005	0.022
CMKTP	-0.019***	0.005	0.010***	0.004	-0.001	0.004	-0.013***	0.004
PHVA	-0.675**	0.308	-0.031	0.272	-0.165	0.26	0.815***	0.279
Cons	7.731***	2.065	-4.855***	1.558	1.145	1.394	5.021***	1.534
Predicted probability	0.39	0.55	0.49	0.46				
Joint probability (success)								0.11
Joint probability (failure)								0.023
Number of drawn(#)								5
Number of Observations								150
Likelihood								-318.995
Wald chi2(44)								121.76
prob.>chi2	0.0000***							
Estimated correlation matric								
ρ1		ρ2			ρ3		ρ4	
ρ1	1							
ρ2	-0.38***(0.13)	1						
ρ3	0.07(0.14)	-0.39***(0.12)			1			
ρ4	0.027(0.13)	-0.32**(0.13)			-0.36***(0.13))		1	
ρ21=ρ31=ρ41=ρ32=ρ42=ρ43=0, chi^2=29.42								
Note: *** and ** indicate statically significance at 1%, 5% and level of significance respectively								

Table 3: Multivariate profit estimation for determinants of potato market outlet choice (Source: Model result output (2019)).

While distance from the market were positively and significantly affected the collectors outlets. Education level of the household head, family size, current market price of potato and farm size were positively and significantly affected the wholesalers outlets. Distance from the market and farm size were negatively and significantly influenced the retailers outlets. Post-harvest value addition activities and number of livestock owned were positively and significantly affected the consumer outlets.

Recommendation

As the result of the model indicated that distance to the nearest to the market has important determinants of potato commercialization and market outlet choice of potato produce in the study area. Therefore, the government should enhance on improving rural infrastructure and developing market infrastructure in the form of establishing producer collection point in order to support poor farmers for faster delivering of their product. The multivariate probit result indicated that smallholder farmers in the study area have been affected by different factors to choose appropriate marketing outlets to sell their potato product. Therefore, the government should invest on providing adult education, improve road infrastructures, developing nearest potato market, establishing modern storage (potato ware house) to enhance post-harvest value addition activities and increase access of market transport facility is important to improve the delivery of potato to appropriate market outlet.

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