RESEARCH REVIEW JOURNALS
Volume-03
Issue-12
December -2018

ISSN: 2455-3085 (Online)
RESEARCH REVIEW International Journal of Multidisciplinary
www.rrjournals.com [UGC Listed Journal]

Econometric Analysis of the Determinants of Commercialization of Agricultural Output: Evidence from Small Holder Farmers in Sidama Zone, Southern Ethiopia

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ARTICLE DETAILS

Article History
Published Online: 10 December 2018

Keywords
Commercialization, Agriculture, Maize, Probit, Regression, Southern Ethiopia

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ABSTRACT

When viewed from the point of view of agricultural produce, the concept of agricultural commercialization primarily hinges on the process of maximizing the proportion of agricultural production that is made available for buyers in the output market. The contemporary view of market participation of farmers or commercialization of agriculture as typical feature of transforming the agricultural sector is quite over and above the question of whether or not a cash crop is present to a certain extent in a production system. Even though the commonest types of commercialization are occurring either occurring on the output side of production where by production over and above consumption is maximized and that has contributed for an increased marketed surplus or it may also occur on the input side with where by one is inclined the increased use of purchased inputs, this study, however, is focused on the output side of marketed Maize by small holder farmers in Southern Ethiopia. Thus the study was conducted in order to identify factors influencing the market participation (commercialization) of Maize farmers in the study area by focusing on the marketed surplus of maize output of farm households using a probit model and cross sectional data collected from a randomly sampled farmers of Boricha wereda, of Sidama Zone, Ethiopia . The econometric result of the probit model indicated that three variables are significant at various level of significance. These are education level of household head (EDUHH), total quantity of crops produced (QTITY) and price of maize sold (PRIMZ.). Hence it is recommended that these factors, if well addressed, have tremendous implication for agricultural transformation program of Ethiopia.

1. Introduction

Commercialization of agricultural output is the process whereby farmers are engaged in producing primarily for sale in nearby or distant markets without giving prime importance to meet their own need for consumption. In this case commercialization entails a process of involving alteration of the goal of agriculture to market oriented production whose consequence is paramount in terms of income, consumption and widening the choice matrix of the rural household. Be this as it may however, farm households at subsistence level also participate in commercialization by supplying certain proportion of their output to the market from their subsistence level. In this research, however, we study the level of commercialization of rural households of their farm produce of maize whose prime production is subsistence. Even though the prime goal of maize production is for subsistence level, there still exists some level of commercializing involved among rural farm households (Gebreslassie et al, 2015; Goletti et al, 2003).

The underlying assumption of the study is that small holder farmers differ in in their level of agricultural output and thus in their decision of commercialization. The causes of the diversity are attributable to various demographic, social, economic, or institutional factors.

This being the case, therefore, this article tried to uncover the reasons behind such diversity in terms of commercialization among small holder rural farm households by so looking at determinants of commercialization using a probit model.

2. Model Specification

Discrete regression models are models in which the dependent variable assumes discrete values. Econometricians have developed a model that best captures the behavior of a discrete dependent variable. For the simple discrete dependent variable, econometric literatures have the three most commonly used approaches to estimating such models are the linear Probability model, the Logit model and the probit model. The linear probability model has an obvious limitation in that the estimated probability values can lie outside the normal 0 to 1 range and it also assumes that the marginal or incremental effect of explanatory variables remains constant. Thus this model is discarded from the set of alternative models. The Logit and Probit models are the convenient functional forms for models with binary dependent variable. The choice between the two is one of mathematical convenience. The study, however, will employ the probit model. (Amemiya, 1981; Gujarati, 2007; Wooldridge, 2009; Gerard et al, 1990).

The probit model is generated by a simple latent model of the form shown below

$$y_i^* = X'\beta + \epsilon \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (1)$$

$$y_i = \begin{Bmatrix} 1 \; if \; y_i^* > 0 \\ 0 \; otherwise \end{Bmatrix} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (2)$$

Where

y_i^* is the latent variable or unobserved variable; y_i is the i^{th} farmer and its value is 1 if she/he participating in commercialization of agricultural output and 0 otherwise; X' is a vector of explanatory variables; β is a vector of parameters

to be estimated and ϵ is the error term which is normally distributed with mean 0 and variance δ^2

With the assumption of normal distribution function, the model to estimate the probability of observing a farmer who participates in commercialization can be stated as:

$$P(y_i = 1|X) = \Phi(X'\beta) = \int_{-\infty}^{x'\beta} \frac{1}{\sqrt{2\pi}} \exp(-z^2/2)dz \dots\dots\dots (3)$$

Where p is the probability that the i[th]farm household who is participating in commercialization and 0 otherwise

The specific probit model for the commercialization decision can be defined as:

$$y_i = \beta_0 + \beta_1 AGEHH + \beta_2 SEXHH + \beta_3 EDUHH + \beta_4 FMSZE + \beta_5 HHLBR + \beta_6 FRSZE + \beta_7 MASSN + \beta_8 EXTEN + \beta_9 ACRDT + \beta_{10} MKTDS + \beta_{11} OFINC + \beta_{12} TRPLU + \epsilon_i \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (4)$$

Where AGEHH age of the household, SEXHH represents sex of the household head, EDUHH is education of the household, FMSZE is family size, HHLBR is household labor, FRSZE farm size, MASSN is membership to association, EXTEN represents extension , ACRDT is access to credit, MKTDS is market distance, OFFINC is off farm income and TRPLU is tropical livestock unit.

3. Hypothesis

The description of these explanatory variables, their measurement and expected sing of their relationship with the dependent variable is presented in the table below.

Table-1
Independent variables and expected sign

IDVAR*	Type*	Measurement*	HYP*
AGEHH	C	Number of years	-
SEX HH	D	1 male , 0 female	+
EDUHH	C	Year of schooling	+
FMSZE	C	Number of individuals	+
HHLBR	C	above the age of 12	+
QTITY	C	quintals	+
FRSZE	C	Number of hectares	+
MASSN	D	1 member,0 if not	+
EXTEN	D	1 for access, 0 if not	+
ACRDT	D	1 for access, 0 if not	+
MKTDS	C	Number of hours	_
OFINC	D	1 if in farm income, 0 if not	–
IMPSD	D	1 adopts, 0 otherwise	+
PRICE	D	Ethiopian birr	+
TRPLU	C	Scale	+

Where: IDVAR is for independent variables, C is for continuous, D is for dummy, HYP is hypothesis or expected sign.

4. Result and Discussion

The discussion above sufficiently addressed the model relevance, model specification and econometric specification of the probit model and also the question of hypothesis with respect to the relationship between the dependent and independent variable. The probit model is dummy dependent variable which is one if the rural household head participates in commercialization and zero otherwise. The probit model is thus estimated according to equation (4) of the above discussion and it is estimated using maximum likelihood estimation technique. The result is depicted in the table below.

Table- 2
Probit Maximum likelihood Estimation of commercialization decision

Dependent variable : **participation in commercialization (SLDMZD)**				
Independent variables	**Coefficient**	**Standard Error**	**t-stat**	**P Value**
AGEHH	-0.0231077	.0170039	-1.36	0.174
SEXHH	0.1954044	.561824	0.35	0.728
EDUHH	0.1208529	.06775	1.78	0.074 ***
FMSZE	0.1039887	.1356226	0.77	.0.443
HHLBR	-0.1280551	.1337656	-0.96	0.338
QTITY	0.1655023	.0658325	2.51	0.012 **
FRSZE	0.3663482	.4717113	0.78	0.437

MASSN	-0.4780167	.454487	-1.05	0.293
EXTEN	0.0533136	.5176473	0.10	0.918
ACRDT	-0.2758627	.3680102	-0.75	0.453
MKTDS	-0.0447252	.0305281	-1.47	0.143
OFINC	-0.0777361	.3767729	-0.21	0.837
IMPSD	0.0537876	.6128458	0.09	0.930
PRIMZ	0.0062688	.0010692	5.86	0.000 *
TRPLU	-0.0827441	.0714737	-1.16	0.247
Constant	-1.663086	1.491264	-1.12	0.265
Number of observation = 203				
LRchi2 (12) = 128.55				
Prob> chi2 = 0.0000				
Pseudo R2 = 0.5683				

*, **, *** significant at 1%, 5% and 10 % respectively

Source: Own survey and computation, 2018

In the definition of variable and depiction of expected sing, the study, intuitively, has already hypothesized that several variables are deemed to affect participation namely the age of the household head (HHAGE), sex of the household head (SEXHH), educational level of the household head (HHEDC), the household size or family size (HHSZE), household labor (HHLBR) total farm size owned by the household (FRSZE), membership to association (MASSN), extension visit (EXTEN), access to credit service (ACRDT), proximity to the nearby market (MKTDS), off farm income (OFINC) and tropical livestock unit (TRPLU)

These variables hypothesized to affect farmers' decision to commercialize or not their farm produce were selected to fit the probit model. Before the analysis the model was checked for the presence of multicollinearity using variance inflation factor and correlation coefficient. Furthermore a test of model adequacy is also used.

The result indicated that there is no serious multicollinearity problem. When coming to model adequacy, the likelihood ratio chi-square of 128.80 with a p-value of 0.0000 tells us that our model as a whole is statistically significant than a model with only the constant term. This is further evidenced by the frequencies of actual and predicted outcomes of commercialization. Accordingly, therefore, the model correctly predicts 92% of the total observation. Thus all the three model diagnosis test consistently supported the credibility of the model in addition to the theoretical justification made on the relevance and authenticity of the model already.

The probit regression of participation in commercialization decision results in Table 2 above depicts that of all the fifteen variables used in estimation of commercialization decision using the probit model, only three of them were found to be significant at various level of significance. In addition to this four of the fifteen variables are not of the expected or hypothesed sign, irrespective of their significance. Among the variables that are of the expected sign, three of them are significant at various level of significance. These are education level of household head (EDUHH), total quantity of crops produced (QTITY) and price of maize sold (PRIMZ.)

In this study our variable of importance is adoption of improved maize variety (IMPSD). It is revealed in the table above that it is not significant.

The above table can tell us only the direction of the relationship between dependent variable and a set of independent variables. Thus far we have seen the direction of relationship pertaining to commercialization decision and its determinants. In order to interpret the quantitative implications of the determinants of commercialization decision, we need to compute the partial effects, using marginal effects for continuous explanatory variables and average effects for binary explanatory variable. The partial derivatives (marginal effects) of the variables on the probability of farmers' participation decision to commercialize their farm produce are computed at the means of the variables for all observation and this is displayed in Table 3 below.

Table- 3

Partial effect for probit model of commercialization decision

Dependent variable : **participation in commercialization (SLDMZD)**				
Independent variables	$\frac{dy}{dx}$	**Standard Error**	**Z**	**P-value**
AGEHH	-0.0046768	.00352	-1.33	0.184
SEXHH	0.0435281	.13728	0.32	0.751
EDUHH	0.0244598	.01303	1.88	0.060 ***
FMSZE	0.0210466	.02679	0.79	0.432
HHLBR	-0.0259175	.02633	-0.98	0.325
QTITY	0.0334965	.01154	2.90	0.004 *
FRSZE	0.0741464	.0933	0.79	0.427

MASSN	-0.0869073	.074	-1.17	0.240
EXTEN	0.0109611	.10784	0.10	0.919
ACRDT	-0.0588595	.08186	-0.72	0.472
MKTDS	-0.0090521	.00619	-1.46	0.144
OFINC	-0.0161041	.08002	-0.20	0.841
IMPSD	0.0109792	.12645	0.09	0.931
PRIMZ	0.0012688	.00031	4.13	0.000*
TRPLU	-0.0167468	.01465	-1.14	0.253

*, **, *** significant at 1%, 5% and 10 % respectively

Source: Own survey and computation, 2018

It is a well-known fact and very much intuitive that education enables individuals to be able to make an informed and rational decisions. It paves the way for an access to information on new ideas pertaining to output, markets, prices, and the like. It also enhances the farmers' ability to rationally process them. Therefore, the more the household head is educated the more likely he/she is to acquire, analyze and properly evaluate the due advantage and disadvantage of commercialization of their farm produce. This intuitive argument is evidenced by the econometric result of the above table. Accordingly the table above the coefficient of the partial effect education (EDUHH) is positive and significant at ten percent level of significance. Keeping all other factors constant an increase in year of schooling by one year increases the probability of commercialization of by fairly two percent for an average farm household head .This result is also confirmed by other researchers like Oliver and Georgina (2013) in their studies on the determinants of agricultural commercialization among the rural poor with special emphasis on the role of ICT and collective action initiatives and gender perspective in Kenya reveled education and commercialization are positively and significantly related

The coefficient of the partial effect of total crop produced (QTITY) is positive and significant implying that as the farm household produced increases the probability of participation in commercialization increases. The table above depicts that as a farmer's produce increases by one quintal the likely hood of adoption decreases by 3.4 %. Total quantity of farm produce has a positive correlation with the amount of crops available for sale. This is in close conformity with the classical age old theory of microeconomics of the theory of production.

The coefficient of the partial effect of price of maize sold (PRIMZ) is positive and significant at one percent level of significance implying that as the farm household gets high prices for their produce his or her probability of selling their farm produce increases. The table above depicts that as the price of maize sold increases by 20 Birr per quintal, the probability of commercialization increases by 2.5%. The positive and significant relationship between price and quantity supplied is inherent in the classical economic theory of supply. In fact the law of supply states that as price increases quantity supplied increases too.

5. Conclusion

The implication that can be made is that education, training and /or increasing the reasoning and logical capacity of farmers, formally or otherwise will have a profound effect in galvanizing agricultural commercialization. Obviously Agricultural commercialization refers to the process of increasing the proportion of agricultural production that is sold by farmers, hence it takes boosting agricultural output using different possibilities at hand to increase both the probability and level of agricultural commercialization of farm households.

Acknowledgement

I am very much cognizant and appreciative of the immense support, advice, encouragement and guidance I received from my research Guide Dr. N, Subba Rao. I would like also to thank the ministry of education of Ethiopia for funding my research expense. Last, but not least, I would like to express my deepest gratitude to my wife, Welela Zerihun, for single handedly shouldering the responsibility of catering for the needs of our family while graciously letting me focus on my research undertaking.

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