American Research Journal of Agriculture
ISSN (Online) : 2378-9018
Volume 3, Issue 1, 14 Pages

AMERICAN RESEARCH JOURNALS
An Academic Publishing House

Research Article Open Access

Determinants of Input Commercialization as Buyers of Agro-chemicals and improved seed: Evidence from Farm Households' of Ambo and Toke Kutaye Districts, West Shewa Zone, Ethiopia

Chala Hailu[*1], Chalchisa Fana[1]

[1]Lecturers at Department of Agribusiness and Value Chain Management
College of Agriculture and Veterinary Science, Ambo University, Ethiopia
[*]*Caalaa2012@gmail.com*

Received Date: July 3, 2017 Accepted Date: July 12, 2017 Published Date: August 02, 2017

Abstract: This study tried to investigate 'Determinants of Smallholder Commercialization as Buyers of Agro-chemicals and improved seed in Ambo and Toke-Kutaye Districts'. Its' main objective is to examine factors determining smallholder input market participation and level of commercialization. A total of 291 sampled households randomly selected from both districts for an interview using semi-structured questionnaire. Double-Hurdle model was used for analysis of decision to participate and level of commercialization of inputs. The findings from probit regression model analysis revealed that being male, being model farmer, literate, livestock ownership, and frequencies of extension contact had positive sign and significantly affect the probability of being buyers of chemical fertilizer. Similarly, livestock ownership, access to credit services, and frequencies of extension contact had positive sign and significantly affect the probability of being buyers of improved seed while land size had negative sign and significant. The probability of being buyers of herbicides is influenced by livestock ownership and had positive sign while family size, and distance from home to input market had negative sign. In the second hurdle, the result of Truncated Regression Model revealed that, being male, being model farmer, family size, land size, livestock ownership, access to credit services, frequencies of extension contact, membership to farmer cooperative, distance from home to input market are key determinants of level of commercialization of inputs as buyers. Synthesis of double-hurdle model result revealed that being model farmer, land size, livestock ownership, and farmers' cooperatives were main determinants of smallholder input commercialization as buyers.

Keywords: Chemical fertilizer, Commercialization, Herbicides, Improved seed, & Smallholders.

Introduction

Background of the Study

Agricultural productivity is one of the key determinants of high and sustained agricultural growth, over the longer term (Adeleke et al., 2009). Evidently, the expansion of smallholder farming can lead to a faster rate of poverty alleviation, by raising the incomes of rural cultivators and reducing food expenditure, and thus reduces income inequality (World Bank, 2008). However, average smallholders in Sub-Saharan Africa (SSA) is characterized by production of only one ton of cereal per hectare – less than half of what an Indian farmer produces, less than a fourth of a Chinese farmer's production, and less than a fifth of an American farmer's production that indicates stagnant growth and weak transformation in agricultural commercialization(World Bank, 2007).

The spectrum of agricultural commercialization lies on either the output or input side. For instance, a farming household can become commercialized by increasing their marketed produce if participated in output market. On the other hand, they become more commercial by increasing their usage of purchased agricultural inputs (Von Braun and Kennedy, 1994). Possibly, as farms become more commercial, as the result of participation in input market they tend to rely less on own-produced inputs and instead depend more on markets to supply their inputs (Pingali and Rosegrant, 1995).

Nevertheless, the lack of access to improved input and output markets is a key driving force for the less transformation of the agricultural sector from subsistence to commercial production. (Adeleke et al., 2009). This is due to, the gradual soaring in price and waste of inputs such as seed and fertilizers reduces input market participation and efficiency in crop productivity (UNDP, 2007). Particularly in Ethiopia, the mode of payment to buy fertilizer is significantly on cash bases which are indicated as 100%, 82%, 66% and 23% for Oromia, SNNP, Amhara, and Tigray regions respectively while the credit availability is 66%, 11%, 6%, and 0% for Tigray, SNNP, Amhara, and Oromia respectively (ATA, 2012).

Further, the decision of smallholders use of purchased seed, fertilizer, and insecticides is also varies widely by crop and land size (ATA, 2012). For example, teff receives the share with almost 40 percent of fertilizer use, followed by wheat (26 percent), maize (17 percent), barely (9 percent) and sorghum (3 percent) (ATA, 2012). Moreover, price of farm produce, market access conditions, farm size and high cost or liquidity shortage are affecting level of improved input utilization (Abott, 1993; Nwagbo and Achoja, 2001; Gebremedhin and Jaleta, 2010; ATA, 2012). Generally, smallholder farmers agricultural productivity is bounced down by less input market participation that scantly investigated exceptional to Langyintuo and Mungoma, 2006, Gebremedhin and Jaleta, 2010, and Bui and Isabelita, 2016. Furthermore, particular to the study areas, no study has conducted earlier regarding either output or input market participation so that this study tried to fill the literature and research gap in input commercialization as buyers having the following objectives.

- To examine the determinants of smallholder farmers' input market participation decision: focusing on buyers of chemical fertilizer, herbicides, and improved seed.
- To identify the determinants for the level of input commercialization among input market participants: focusing on the value of chemical fertilizer, herbicides, and improved seed purchased among buyers of input market participants.

Methodology

Description of the Study Areas

This study was carried out in Ambo and Toke Kutaye districts of West Shewa zone of Oromia National Regional State. *Ambo district* is located at 8°56'30" - 8°59'30" N latitude and 37° 47'30" - 37°55'15" E longitude in central Oromia, Ethiopia, 114 km west of Addis Ababa. The district has 32 rural kebeles and Ambo town is the administrative capital. According to the CSA (2007), national census report, the total populations for the district is 108,406, of which 54,186 are men and the remaining 54,220 are women. On the other hand, *Toke Kuatye* is located between latitude of 08° 59' 01.1' N and longitude of 37° 46' 27.6' E. The district has 31 rural kebeles of and *Guder* is the capital town. The total human population of the district is 119,999, of which 59,798 were men and 60,201 were women; and 15,952 or 13.29% of its population were urban dwellers (CSA, 2007). Generally, livestock and crop production is the dominant agricultural livelihood in both districts (DAO, 2016).

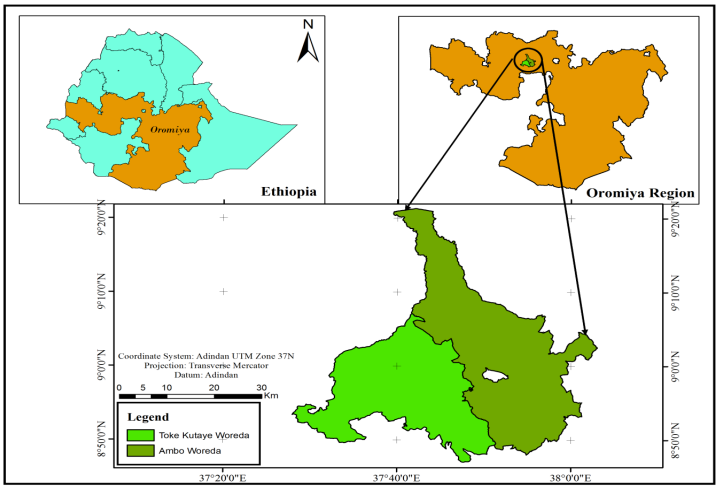


Fig 1. *Map of the Study Area*

Source: College of Agriculture, & Veterinary Science GIS laboratory

Sampling Methods and Procedures

For this study, three-stage sampling technique was employed. At the beginning, Ambo and Toke- Kutaye districts were selected purposively due to its agro-ecology representativeness for cereal production such as teff, wheat and maize which are highly consuming agricultural inputs. Next, kebeles in the districts were categorized into three agro-ecology namely, high-land, mid-land and low-land. Finally, a total of 291 farm households were selected randomly using Probability Proportional to Sample size using Yamane formula (Yamane, 1967).

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

Here the sampling error is 8% (0.08) considering the budget, accuracy and time utilization for the research.

Table 1. *Summary of the Sampled Kebeles and Respective Sampled Households*

S/N	*District*	*Agro-Climate*	*Total Rural kebele*	*Sampled Kebeles' based on 10% probability level*	*Total House-hold based on CSA, 2007*	*Sample size using PPS*
		High-land	10	Elamu Goromti	634	44
				Gosu-Qora	893	61
		Mid-land	17	Amaro	577	40
	Ambo	Low-land	5	0		
1	***Total***		***32***		***2104***	***145***
		High-land	8	Maruf	659	44
				Lenca	580	39
		Mid-land	17	Birbirsaf Doggoma	940	63
	Toke-Kutaye	Low-land	6	0		
2	***Total Kebele***		***31***		***2179***	***146***
	Total Sample Size					**291**

Source: Ambo and Toke-Kutaye District Agricultural Office (DAO, 2016)

Hint: kebele is the lowest administration level

Methods of Data Collection and Sources

Both primary and secondary sources of data collection were used. The primary data was designed to capture information on household socio-economic and demographic characteristics, and other institutional factors. It contained both open and closed-ended questions to answer the specified objectives. In addition, secondary information was collected from Ambo and Toke-Kutaye agricultural office, farmers' cooperative, Central Statistics Agency (CSA) and published and unpublished sources to build the methodological write-up about the types of input purchased, district information, and village level price of inputs. On top of these personnel observations and focus group discussion were used to complement the discussion of the findings.

Method of Data Analysis

Descriptive Analysis

The socio-economic, demographic characteristics; and other factors were presented using descriptive statistics such as percentages, mean, and standard deviation.

Econometric model specification

The double-hurdle model assumes that smallholder farmers make two sequential or independent decisions with regard to buy inputs (agrochemicals and improved seed), and level of commercialization. Each hurdle is conditioned by the smallholder farmer's socio-economic and environmental as well as institutional characteristics. The model considers the possibility of zero outcomes in the second-hurdle arising from the individuals' deliberate choices or random circumstances. The model assumes that zero values can be reported in both decision stages (Green, 2003). Standard probit model to assess the household input market participation (i.e. purchase of agrochemicals and improved seed) and its specification is given below following Wooldridge (2002); and the empirical model used to estimate the Probit model or the first hurdle equations is given below.

Where, the index equation is written as,

$$y_1^* = \beta_1 X_{1i} + \varepsilon_{1i} \qquad (1)$$

Where, y^*_1 is a latent discrete participation choice variable that denotes binary censoring, which is the utility the farmer gets from participating in the purchase input market. $X_i i$ is a vector of explanatory variables hypothesized to influence use of purchased agro-chemicals and improved seed, $\beta_i i$ is a vector of parameters and $\varepsilon_i i$ is the standard error term.

$$yi = \begin{cases} 1 \text{ if smallholder farmer participate in purchase of inputs; } y^*>0 \\ 0 \text{ if } y^* \leq 0 \text{ (otherwise} \end{cases} \qquad (2)$$

In the second stage, Truncated Regression model was employed to examine the factors that influence the level of commercialization is given as:

$$S^* = Xi\lambda + \mu i, \mu i N(0, \delta^2) \qquad (3)$$

Si = S*i if S*i>0 and yi =1; 0 otherwise

Where: Si is the level of input commercialization which depends on latent variable S*i being greater than zero and conditional to the decision to commercialize yi; λ is parameter to be estimated. Truncation reduces variance compared to variance in the un-truncated distribution.

Table 2. *Summary of Variables used in Double-Hurdle model.*

Variables Code and Type	Description	Measurement	Expected Sign
INPUMKT (dummy dependent)	Dependent variable indicating the probability of participating in purchased agro-chemicals and improved seed equal to 1 if households purchase it; 0 otherwise	1= Yes; 0= No	
VCEP (continuous dependent)	Dependent variable indicating the value of agro-chemicals and improved seed purchased	Ethiopian Birr	
AGEHH (Continuous)	Age of the household head	Number of years	+/-
SEXHH (Continuous)	Sex of the household head	1= male ; otherwise =0	+
EDUCA (Dummy)	Educational status of the household head	1= literate; 0= illiterate	+
FAMSIZE (Discrete)	Total family size of the household head	Number	-
LANDSI (Continuous)	Area of crop land used under fertilizer & improved seed application	Hectare	+
TLIVSTOK (Discrete)	Total number of livestock owned by the household	TLU	+
DROAD (Continuous)	Average two-way distance from household home to input market	walking hours	-
ACREDT (Continuous)	Households access to credit services	1= Yes; 0= No	+
FREXT(Continuous)	Frequency of extension service contact bi-weekly	Number of contact	+
COPMEM (Dummy)	Households membership to farmers cooperative	1= Yes; 0= No	+
ACMKTINFO (Dummy)	Households access to market information	1= Yes; 0= No	+
VLSHH (Dummy)	Village level Status of the household	1=Model farmer; otherwise= 0	+

Result and Discussion

Descriptive and Inferential Statistics Analysis

The expenditure cost paid by the household to buy chemical fertilizer, improved seed, and herbicides is on average about ETB 2990.32, ETB 668.92, and ETB 94.98 respectively. And chemical fertilizer shared the maximum household input cost while herbicide is low. The average age of the household was high at 44.88 years (table 3) reflecting more productive age occupied input commercialization. In addition, 92% of the households who purchase inputs were male headed while 8% of them were female headed. Regarding to households educational status, 85% of the households were literate who attended formal education while 15% of them were illiterate. Notably, we found 54% of model farmer households who were purchased chemical fertilizer, improved seed, and herbicides. On average households family size that have average member of 6.59 involved in input purchase showing that more family member plays important role in diversifying income earned which used to buy inputs.

Wealth characteristics such as land size, and number of livestock owned by households is significant in deciding amount of input required. On average households who have 1.95 ha of crop land and 5.09 livestock in TLU participated in purchase of chemical fertilizer, improved seed, and herbicides. It indicates that more crop land and number of livestock calls for using more units of inputs. Principally, income generated from sale of livestock and its products helps to capacitate households to purchase inputs. The proportion of households who accessed credit service to purchase chemical fertilizer, improved seed, and herbicides were 32%. It reflects that the remaining 68% of the households do not access credit to purchase inputs which tells that direct purchase is the dominant among the households. The frequency of extension contact by household is on average 2.54 times bi-weekly revealed that the existence of maximum supervision from agricultural extension workers during crop sowing season.

On the other hand, 75% of the household who purchase chemical fertilizer, improved seed, and herbicides were members of farmers' cooperative at village level. This shows that farmers cooperative are the key suppliers of agricultural inputs that easily accessed its members. Access to market information is also important factor to influence the quantity of input demanded by households. Accordingly, 79% of households access market information to purchase chemical fertilizer, improved seed, and herbicides while the remaining 21% do not access market information. Finally, on average households spent 0.64 hour from home to input market to purchase chemical fertilizer, improved seed, and herbicides. As illustrated on (Table 3) the minimum hours spent is 0.03 and the maximum is 4.34. Thus, distance factors to access input market is significant impact on quantity of inputs purchased and availability on time as per required.

Table 3. *Descriptive statistics for Explanatory Variables used in the model*

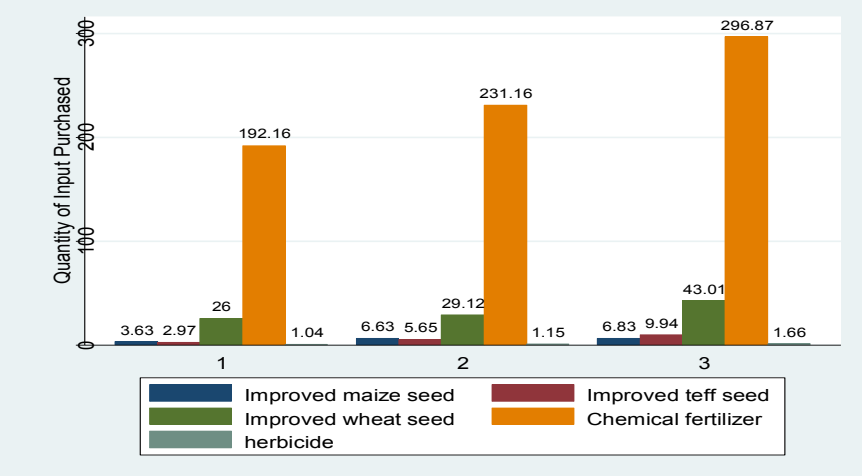
Variable	Mean	Std. Dev.	Min	Max
VSEED	668.60	674.11	0	3125.25
VFERTI	2990.32	1584.96	0	8380
VHERBI	94.98	75.93	0	390
AGEHH	44.88	11.97	22	76
SEXHH	0.92	0.27	0	1
EDUCA	0.85	0.36	0	1
VLSHH	0.54	0.50	0	1
FMSIZE	6.59	2.48	2	16
LANDSI	1.95	1.37	0.5	9
TLIVSTOCK	5.09	3.17	0	19.2
ACREDIT	0.32	0.47	0	1
FREXT	2.54	1.88	0	12
COPMEM	0.75	0.43	0	1
ACMKTINF	0.79	0.41	0	1
DROAD	0.64	0.70	0.03	4.3

Source: *STATA result from survey data, 2016/17. The value of purchased inputs is in Ethiopian Birr (ETB*).

In the following (figure 1) illustrated that the mean value of input purchased in kilogram by total cultivated area of land. Remarkably, as cultivated land increases, the quantity of inputs purchased by households would increases regardless of intensity of use. This can justify that the relative importance of cultivated land in determining the

level of input purchased. Those households who have less than or equal to1 ha of land purchased 3.63 kg of improved maize seed. However, there was no mean difference in quantity of maize seed purchased for those who have greater than 1 ha land. This might be due to in both districts maize is not the primary grown crop that shares large hectares of land. Nevertheless, recently farmers are pertinent to adopt and use new improved teff seed variety. Household purchases more teff seed as cultivated land size increases. That means, farmers prioritize the production of cereal crops in surplus for sale. Those who have less than or equal to 1ha of land buys 2.97kg of teff seed while those who have greater than 3 ha buys 9.94 kg. Profoundly, the agro climatic condition of the study areas is conducive for wheat production and shows that it is high value crop. Accordingly, farmers buy more kilogram of wheat subject to more available cultivated land. On average households who posses more than 3 hectare of cultivated land purchase 296.8 kg (approximately 3 quintals) of fertilizer though, the quantity of herbicides purchased is more or less similar for all land size.

Fig 2. *Mean of Input Purchased by area of cultivated Land in hectare.*



Source: Own computation Survey data 2016/17; Hint: 1= (0.5 – 1ha), 2= (>1- 3ha), 3 = (>3 – 9ha

Determinants of Inputs Commercialization as Buyers

Econometric Results

Factors affecting farm households' decision to participate in input buyers was estimated by maximum likelihood method using Double Hurdle Model (DHM). Marginal effect was used to explain the result; as coefficient of the probit model are difficult to interpret since it measure the change in the unobservable y* associated with a change in one of the explanatory variables. The model chi-square tests applying appropriate degrees of freedom indicate that, the overall goodness-of-fit of the probit model are statistically significant at 1% and 10% probability level. Pseudo R^2 values indicate that, the independent variables included in the regression explain 29.05%, 26.27%, and 9.12% variations in the likelihood to purchase chemical fertilizer, improved seed, and herbicides respectively. The results of probit estimation shows, the likelihood of household participation in chemical fertilizer, improved seed, and herbicides purchase was affected by sex, educational status, village level status, family size, land size, tlu, access to credit, frequency of extension, and distance from nearest market.

Sex of the household (SEXHH)

The dummy sex of households increases the likelihood of participating in chemical fertilizer commercialization as buyers by 77.7% and significantly at 1% probability level. This shows that being a male has more access

to buy chemical fertilizer as compared to female because of male decisional role in farming, and access to information, which helps in adoption of agricultural technologies in the course of farming experience. This finding is similar to, Bui and Isabelita, 2016, argued gender has positive effect on input commercialization in Vietnam. However, it is contrary to Edward, 2014 in that sex of the household had negative influence on agricultural commercialization.

Educational Status (EDUCA)

Literate households expected to engage more in input commercialization than illiterate one. Thus, being the farm household become literate increases the likelihood of participating in purchase of chemical fertilizer by 14.3% and significant at 10% probability level. Education provides to understand the adoption of technology package to enhance crop production. Deininger and Okidi (2001) reported a negative but not significant relationship between the farmers' level of education and expenditure on fertilizers. However, education positively correlated to input purchase especially in developing countries including Uganda (UBoS, 2010). Similarly, Bui and Isabelita, 2016 argue that consistently, the educational level of non-poor households have a positive and significant impact on the degree of input commercialization in Vietnam.

Village level Status of the Household (VLSHH)

A model farmer adopts and use improved agricultural technologies prior to increasing farm productivity. Thus, dummy model farmer can increase the likelihood of participating in purchase of chemical fertilizer by 70.7% and significant at 10% probability level. It is apparent that model farmer decisional role to use full package of agricultural technologies particularly fertilizer is high relative to non-model farmers. So that the motivational medal awarded by government yearly to model farmers sheds light on competition with neighbor farmers.

Number of family size (FMSIZE)

An increase in number of family size of the household reduces the likelihood of participating in purchase of herbicides by 17% and significant at 5% probability level. Large family size is an opportunity to provide family labor to eliminate weed from crop land which tends to save the cost incurred to purchase herbicides. The sign in this study is similar to Abafita *et al*., 2016 in their study of market participation decision and Bui and Isabelita, 2016 also found positive sign and influence input commercialization.

Size of Cultivated Land in Hectare (LANDSI)

Size of cultivated land owned by the household affects input commercialization in-terms of level of input usage. So that a unit increases in cultivated land size, increases the likelihood of participating in commercialization of improved seed by 5.1% and significant at 1% probability level. It indicates households' pursue to cover total crop land with improved seed with objectives of yield maximization. The finding in this study is consistent to Ataul and Elias, 2015, and Michael *et al*., 2007 in their study of market participation decision in that land size has positive sign.

Total Number of Livestock in TLU (TLIVSTOCK)

An increase in number of livestock increases the likelihood of participating in purchase of chemical fertilizer, improved seed and significant at 10% and 1% probability level. Similarly, it increases the likelihood of participating in purchase of herbicides and significant at 10 % probability level. Generally, the importance of owning considerable number of livestock helps households to generate income from sale live animals and their products that used to purchase agricultural inputs. The result in this study is consistent to Kefiyalew, 2011 in which livestock in TLU has positive influence on adoption of inputs in their study.

Access to Credit Services (ACREDIT)

The dummy access to credit services increases the likelihood of participating in improved seed commercialization by 6.1% and significant at 5% probability level. It was observed that improved seed dealers (private dealers) provide short-term credit to buy seed in the study areas. However, the credit agreement is varied based on the potential buyers to pay back. Above all, the positive sign that we have for this variable would indicate availability for credit paves accessibility of farm households to purchase improved seed. The finding is similar to Abafita *et al*., 2016; and Bui and Isabelita, 2016 in their study of smallholder commercialization in Ethiopia.

Frequency of Extension Contacts (FREXT)

This is significant variable that increases the likelihood of commercialization of improved seed and significant at 1% probability level. Farmers were how often they contacted bi-weekly to agricultural extension workers. And thus, there was positive sign for chemical fertilizer and negative for herbicides though not significant. However, the positive sign and its significant for improved seed justified that awareness created by extension workers per contact time encourages farm households to adopt and use improved seed. Langyintuo and Mekuria (2005) and Geofrey, 2011 argue that, the level of expenditure on fertilizer that was found to be positive and significant in relation to extension services access. Similarly, Bui and Isabelita, 2016 argued the existence of positive relationship between input commercialization and extension service.

Distance from Households Home to Input Market (DROAD)

The distance from farm household home to input market was negatively affecting the decision to participate in purchase of herbicides by 8.1% and significant at 5% probability level. We observed that in both districts the suppliers' of herbicides are private traders who centered at main district towns that put dragging effect to purchase timely and as per required. Though not significant, the variable bears positive sign for improved seed and chemical fertilizer may be because of farmers' cooperative playing principal role in rural kebeles to supply it. Anyhow, the finding in this study is conforming to Edward, 2014; and Adio and Olarunde, 2014, that distance from market had negative influence on commercialization.

Table 4. *Decision to participate in input commercialization as buyers*

Variables	Dummy Dependent Variables for probit regression											
	Buy Chemical Fertilizer =1; otherwise = 0				Buy Improved seed=1; otherwise=0				Buy Herbicides=1;otherwise=0			
	Coef.	Robust Std.Err.	P>|z|	dy/dx	Coef.	Robust Std.Err.	P>|z|	dy/dx	Coef.	Robust Std.Err.	P>|z|	dy/dx
AGE	-0.011	0.009	0.255	-0.002	-0.005	0.009	0.608	-0.007	-0.007	0.008	0.378	-0.001
SEX	2.463	0.422	0.000***	0.777	0.708	0.376	0.156	0.151	0.374	0.352	0.369	0.073
EDUCA	0.579	0.263	0.063*	0.143	0.001	0.292	0.996	0.001	0.079	0.295	0.796	0.013
MOFARM	0.394	0.228	0.094*	0.770	0.039	0.239	0.869	0.006	0.231	0.239	0.337	0.037
FMSIZE	-0.013	0.045	0.769	-0.003	0.004	0.049	0.942	0.002	-0.109	0.055	0.047**	-0.017
LANDSI	0.038	0.089	0.666	0.008	0.356	0.160	0.001***	0.051	-0.031	0.105	0.769	-0.004
TLIVSTOK	0.069	0.039	0.085*	0.014	0.291	0.062	0.000***	0.042	0.077	0.039	0.063*	0.012
ACREDIT	-0.123	0.262	0.647	-0.025	0.476	0.251	0.047**	0.061	-0.215	0.237	0.393	-0.036
FREXT	0.119	0.064	0.067*	0.024	0.333	0.123	0.001***	0.048	-0.024	0.048	0.614	-0.004

COPMEM	-0.413	0.312	0.137	-0.073	0.497	0.279	0.132	0.086	0.228	0.315	0.502	0.039
ACMK-TINF	-0.192	0.360	0.565	-0.036	0.068	0.349	0.850	0.010	-0.109	0.319	0.720	-0.016
ACROAD	0.227	0.308	0.483	0.048	0.111	0.303	0.724	0.017	-0.641	0.285	0.010**	-0.084
Number of obs = 291					Number of obs = 291				Number of obs = 291			
Wald chi2 = 54.63					Wald chi2 = 41.78				Wald chi2 = 20.10			
Prob>chi2 = 0.000					Prob>chi2 = 0.000				Prob>chi2 = 0.065			
Pseudo R2 = 0.2905					Pseudo R2 = 0.2627				Pseudo R2 = 0.0912			

Source: Own Survey Data computation, 2016/17

([d]) dy/dx is for discrete change of dummy variable from 0 and 1

**** 1% significant level; ** 5% significant level; and * 10% significant level*

Determinants of Level of Input commercialization as Buyers

Here separately treated the level of input commercialization interms of valuing the amount of Ethiopian Birr spent to buy inputs by farm households. Inputs were valued at their local input delivery price set by farmers' cooperative and local traders. The model was statistically significant at 1% level indicating the goodness of fit of the model to explain the relationships of the hypothesized variables, in terms of at least one covariate. The estimation result also showed that, level of input commercialization as buyers were influenced by household specific characteristics, household wealth characteristics, institutional and infrastructure characteristics.

Accordingly, Sex of the household head, was positive and statistically significant at 10% probability level. On average male headed households spends about ETB 415.69 more to buy improved seed relative to female headed households. That means, males headed households spend more money on purchase of improved seed relative to non buyers reflecting the rate of adoption of newly released variety of seed is higher given wealth of the household. Likewise status of household in the village as model farmer was positive sign and significant at 10% and 1% probability level for chemical fertilizer and improved seed respectively. Model farmer household head on average spends, about ETB 411.14 to purchase chemical fertilizer, and ETB 616.84 to purchase improved seed more than non-model farmers. It indicates that model farmers persuaded to use full agricultural package in order to raise yield per hectare keeping other things remain constant.

Family size of the household had negative sign and significant at 10% probability level. The negative sign obtained to buy improved seed shows, the higher the number of family members' raises domestic expenditure so that households uses the opportunity cost of money to fulfill other family requirement. On the other hand, the more economically dependable members in the family the more family income constrained to buy improved seed. Moreover, more family members competing, the limited amount of income earned by the households that consequently reduced the amount Birr allotted to buy improved seed. Providing that, an increase person to the household member decreases the expenditure value on improved seed by about ETB 56.57.

Regarding the household wealth, land size in hectare was positive and significant at 1%, 10%, and 5% probability level on buying value of chemical fertilizer, improved seed, and herbicides respectively. Land size is a fixed asset that owned by households and subjected to various use. Hence, a household decision to maximize yield per hectare of land size led to use of full agricultural technology package. Accordingly, an increase in land size subject to crop diversification led to increase the efficient use chemical fertilizer, improved seed, and herbicides thereby spent on average about ETB 663.44, ETB 108.85 and ETB14.84 respectively.

On the other hand, total number of livestock in TLU was positive impact on buying value of chemical fertilizer, improved seed, and herbicides and significant at 10% probability level. An increase in livestock number would have positive impact on earning income from livestock and their products. Hence, an increase in number of livestock, increases households buying of chemical fertilizer, improved seed, and herbicides on average by about ETB 151.98, 91.56, and 8.02 respectively. This shows that the fortunate income emanated from sale of livestock and their products would give farm households advantageous position to buy agricultural inputs.

The dummy access to credit services found to be negative sign and significant at 10% probability level. In study areas, option to acquire chemical fertilizer through credit service is negligible thus farmers buy chemical fertilizer directly on cash bases. Here, the negative sign may indicate that the less the credit availability would limit the financial requirement to purchases chemical fertilizer thus induce households to spent on average about ETB 349.39. The frequency of extension contact significantly affecting the level of input purchase particularly herbicides. It is found to be significant and positive sign at 1% probability level.

Hence, the increase in frequency of agricultural extension contact, increases households purchasing value by about ETB 6.61 than others. It indicates households who frequently contact to agricultural extension service might acquire knowledge and information about availability of different herbicides and on types of weeds applied. Being a membership of farmer cooperative significantly affects value of input purchased by households. It affects significantly purchasing value of both chemical fertilizer and improved seed at 10% probability level while 5% probability level for herbicides. The variable has positive sign in all dependent variables inputs.

Being membership to framers cooperative increases the purchasing value of chemical fertilizer, improved seed, and herbicides on average by about ETB 445.95, ETB 476.37, and ETB 31.07 respectively than non membership to cooperative. It indicates the role of cooperative to its membership is so advantageous that members benefited to acquire farm inputs. Access to market information also significantly affecting level of commercialization of inputs at 5% probability level and has positive. On average households who access to market information spends Birr 631.85 to buy chemical fertilizer than those who do not access it. It shows access to market information helps farmers to identify the delivery time, availability, and its price to get ready the financial requirement to purchase. Distance from households home to input market also another physical factors affecting level of input commercialization. It is significant at 1% probability level and has negative sign. Those households who far away from input market reduce their spending to purchase improved seed on average by Birr 540.39 relative to those who are nearest to it. This indicates that location factor supplemented by missing the delivery information time limits households to reduce their spending and forced them to use local seed.

Table 5. *Level of input commercialization as Buyers of Chemical Fertilizer, Improved seed, and Herbicides*

Results of level of input commercialization from truncated Regression model												
	Value of Chemical Fertilizer in Birr				Value of Improved seed in Birr				Value of Herbicides in Birr			
Variables	Coef.	Robust Std.Err.	Z	P>|z|	Coef.	Robust Std.Err.	Z	P>|z|	Coef.	Robust Std. Err.	Z	P>|z|
AGE	5.602	7.781	0.72	0.472	-0.652	7.198	-0.09	0.928	-5.581	0.461	-1.26	0.208
SEX	271.648	389.185	0.70	0.485	415.698	246.013	1.69	0.091*	9.987	18.388	0.54	0.587
EDUCA	-393.581	278.726	-1.41	0.158	-215.493	213.35	-1.01	0.312	-7.991	11.474	-0.70	0.486
MOFARM	411.144	225.239	1.83	0.068*	616.841	171.798	3.59	0.000***	10.695	13.091	0.82	0.414
FMSIZE	37.833	45.719	0.83	0.408	-56.571	29.725	-1.90	0.057*	-0.031	2.469	-0.01	0.990

LANDSI	263.448	93.225	2.83	0.005***	108.857	61.649	1.77	0.077*	14.843	6.285	2.36	0.018**
TLIVSTOK	151.985	42.428	3.58	0.000***	91.562	30.53	3.00	0.003***	8.017	2.636	3.04	0.002***
ACREDIT	-349.395	209.186	-1.67	0.095*	169.243	180.702	0.94	0.349	-0.495	11.825	-0.04	0.967
FREXT	3.082	48.791	0.06	0.950	20.883	33.479	0.62	0.533	6.608	2.541	2.60	0.009***
COPMEM	445.956	250.872	1.78	0.075*	476.367	273.71	1.74	0.082*	31.073	14.314	2.17	0.030**
ACMARKET	631.856	315.885	2.00	0.045**	227.165	199.871	1.14	0.256	18.443	15.098	1.22	0.222
ACROAD	358.723	272.994	1.31	0.189	-540.394	384.966	-2.92	0.003***	-3.532	12.84	-0.28	0.783
/sigma	1372.187	75.798	18.1	0.000***	769.851	79.003	9.74	0.000***	63.835	5.323	11.99	0.000***
Number of obs = 244 Wald chi2(12)= 1256.80 Prob >chi2 = 0.000					Number of obs = 197 Wald chi2(12)= 143.92 Prob >chi2 = 0.000				Number of obs = 201 Wald chi2(12)= 575.11 Prob >chi2 = 0.000			

Source: Own Survey Data computation, 2016/17

**** 1% significant level; ** 5% significant level; and * 10% significant leve*

Conclusion and Recommendations

Conclusion

In the study areas internal and external factors to smallholder farmers contribute the affinity of input purchase. Hence, chemical fertilizer and improved seed is relatively more purchased than herbicides despite of price soaring to inputs. Therefore, being model farmer, size of landholding, number of livestock owned and household's membership to farmers' cooperatives plays significant role in input market participation and level of commercialization.

Recommendations

Based on the findings, the following recommendations are forwarded. Firstly, being a model farmer motivates households to be more competitive in farm business. So that value addition activities should be emphasized to gear specialization of farm. Family size of the household puts negative impediments to commercialization of inputs through affecting family limited resource allocation. Thus, the existing access to family planning in rural areas should be promoted. Resources like landholding and number of livestock owned by households signaling positive implication on commercialization of inputs. Thus, the application of improved inputs on high value crops makes households to be commercial farmer. Furthermore, improving the quality of livestock breed and feed enhances income generation and capable to meets budget requirement to purchase inputs. In addition, improvement should be required from farmers' cooperative plays interms of technical support and on time delivery of inputs. Finally, there should be improvement requirement on expansion of rural road facilities, market information service, and technical skill-gap of extension workers on value addition activities.

Acknowledgment

First and foremost I would like to express our gratitude to almighty God for enabling me to complete this research work successfully Next, I have strong gratitude to Ambo University who gave me an opportunity to fund the research and make it smoothen to complete the work. Finally, I have also recognition for the deliberation of staff members of Agribusiness and Value Chain Management department for all achievements.

References

Abott, J.C. (1993). Financing Fertilizer Distribution Network. In Abott, J.C. (ed) Agricultural and Food marketing in Developing Countries, Selected Reading, U.K. CTA International Publication.

Abafita, J., Atkinson, J, and Kin, C.-S. (2016). Smallholder commercialization in Ethiopia: Market Orientation and participation, International Food Research Journal 23(4); 1797-1807.)

Adeleke S., Abdul B. K., and Zuzana B., 2009. Smallholder Agriculture in East Africa: Trends, Constraints and Opportunities, ADBG (African Development Bank Group), Working paper Series No.105, April, 2010.

Adio, M. O. and L. Olarinde, O.(2014). Heterogeneous Impact of Institutional Services on Input Use Intensity and Commercial Transformation among Smallholder Farmers in Oyo State, Nigeria using Heckman Two stage Estimation. Faculty of Agricultural Sciences, Department of Agricultural Economics, Ladoke Akintola University of Technology. M. B 4000, Ogbomoso, Nigeria. International Journal of Research (IJR) Vol-1, Issue-10 November 2014 ISSN 2348-6848 M. O. PP 927.

ATA (Agricultural Transformation Agency) (2012). Research for Ethiopian Agriculture Policy (REAP), Analytical Support ATA. Input Use in Ethiopia, Result for the 2012 ATA Baseline Survey, 19 April 13, IFPRI, Washington, DC.

Ataul, G. O, and Elias H. (2015). Market Participation Decision Of Smallholder Farmers And Its Determinants In Bangladesh, Economics of Agriculture. UDC: 631.1.017.3:339.3(549.3).

CSA (Central Statistical Agency) (2007). Summary and statistical report of 2007 population and housing census. Federal Democratic Republic of Ethiopia population and census commission, PP 1650- 1680.

Deininger, K. and Okidi, J. (2001). Rural Households: Incomes, Productivity, and Nonfarm Enterprises. In Reinikka R and Collier P (Eds.), Uganda's Recovery: The Role of Farms, Firms, and Government. Fountain Publishers, Kampala, Uganda.

Diao X and Hazell P. (2004). Exploring Market Opportunities for African Smallholders. 2020 Africa Conference Brief No. 6. IFPRI (International Food Policy Research Institute), Washington, DC, USA.

Dorward, A. and Kydd, J. (2002). Locked in and locked out: Smallholder Farmers and the New Economy in Low Income Courtiers. Paper Presented at the 13th International Farmer Management Congress. July 7th-12th. Available at IFPRI (International Food Policy Research Institute). Seed system Potential in Ethiopia: Constraints and Opportunities for Enhancing production; Working Paper, 2010.

Edward M. (2014). Market Information and Extent of Agricultural Commercialization: Empirical Evidence from Smallholder Farmers in Effutu Municipality of Ghana. American Journal of Experimental Agriculture 4(12): 1680-1696, 2014.

Gebremedhin, B., Jaleta, M. (2010b). Smallholder commercialization: Does Market Orientation Translate into Market Participation? International Livestock Research Institute (ILRI), Improving Productivity and Market Success (IPMS) of Ethiopian Farmers Project Working Paper No. 22, Nairobi, Kenya.

Geofrey O. (2011). Improved Inputs Use, Productivity and Commercialization in Uganda Maize Production. A Dissertation Submitted to the Directorate of Research and Graduate Training for the Award of the Degree of Doctor of Philosophy (Economics) of Makerere University; October 2011.

Greene, W.H. (2003). Econometric Analysis, 4th ed., Prentice Hall, pp.640 – 642.

Kefyalew Endale (2011). Fertilizer Consumption and Agricultural Productivity in Ethiopia Ethiopian Development Research Institute (EDRI), Working Paper 003, Addis Ababa, Ethiopia.

Langyintuo, A. and Mekuria, M. (2005). Modeling Agricultural Technology Adoption Using the Software STATA. CIMMYT-ALP Training Manual No. 1/2005 (Part Two). International Maize and Wheat Improvement Center, Harare, Zimbabwe.

Magingxa, L., and A. Kamara (2003). "Institutional Perspectives of Enhancing Smallholder Market Access in South Africa", Paper Presented at the 41st Annual Conference of the Agricultural Economic Association of South Africa(AEASA) held in Pretoria, South Africa.

Michael M. Waithaka Æ Philip K. Thornton Keith D. Shepherd Æ Nicholas Ndiwa. N (2007). Factors Affecting the Use of Fertilizers and Manure by Smallholders: The Case of Vihiga, western Kenya Agroecosyst (2007) 78:211–224 J. ISSAAS Vol. 22, No. 1: 1-15 (2016).

Nwagbo, E.C. and Achoja, F.O. (2001). Correlates of Sustainable Fertilizer Consumption Among Smallholder Farmers: An Econometric Approach". A paper presented at the Annual conference of Nigeria Association of Agricultural Economists at the University of Nigeria Nsukka 11 – 13th June.

Pingali LP and Rosegrant MW. (1995). Agricultural commercialization and diversification: Process and polices. Food Policy 20(3):171–185.

Resnick, D. (2004). "Smallholder African Agriculture: Progress and Problems in Confronting Hunger and Poverty", DSGD Discussion Paper No 9, Washington D.C., USA, International Food Policy Research Institute.

UBoS (2010). Uganda National Household Survey: Socio-economic Module. Abridged Report. Kampala, Uganda: UBoS.

UNDP (2007). Uganda Human Development Report 2007, Rediscovering Agriculture for Human Development, Kampala, Uganda, United Nations Development Programme.

Von Braun J and Kennedy E. (1994). Agricultural commercialization, economic development, and nutrition. Johns Hopkins University Press, Baltimore, Maryland, USA.

World Bank (2007). World Development Report. Agriculture for Development, Washington DC, USA.

World Bank (2008). World Development Report 2008: Agriculture for Development. Washington D.C.

Woodridge, J.M. (2002). Econometric Analysis of Cross-sectional Data and Panel Data.MIT Press, Cambridge and London.

Yamane, T. (1967). Statistics: An Introductory Analysis, 2nd Ed., New York: Harper and Row.

Citation: **Chala Hailu, and Chalchisa Fana.** *"Determinants of Input Commercialization as Buyers of Agro-Chemicals and Improved Seed: Evidence from Farm Households' of Ambo and Toke Kutaye Districts, West Shewa Zone, Ethiopia." AMERICAN RESEARCH JOURNAL OF AGRICULTURE (2017), PP:1-14*