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THE IMPACT OF IMPROVED HARICOT BEAN VARIETY ON INCOME AMONG FARMING HOUSEHOLDS IN SOUTHERN ETHIOPIA

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ABSTRACT

Agricultural intensification and increase its productivity can be achieved through better farm management practices and increased use of improved technologies like chemical fertilizers, high yielding varieties, pesticides and organic mineral. Improved crop verities are crucial to increase agricultural productivity. Be this as it may, however, information on impact of technology adoption in a given society is important for focusing future research, extension, and development efforts aiming at benefiting Ethiopian farmers**.** This paper was conducted in order to identify whether or not improved variety is positively and significantly contributing to the income acquisition process of farm households in the study area using both descriptive statistics and multivariate econometric analysis based on data obtained from 120 farming households which are interviewed by applying multistage sampling technique. Since impact assessment is not free from selection bias (selectivity problem), the researcher has already tested for selectivity problem using Heckman Selection model. Thus Heckman selection model is first run and surprisingly the stata result revealed that the dependent variable is never censored because of selection. The result of the study has succinctly revealed that adoption positively and significantly, even at one percent, affects the income acquiring processes of farmers. Hence it is recommended that, coupled with infrastructural facilities, concerned bodies should be highly involved in a widespread distribution of improved seeds to farmers.

Key words: Income, improved Varity, Haricot bean, Heckman

Introduction

Back ground of the study

In order to feed the rapidly growing population and combat with the problem of poverty, the most plausible means is through agricultural intensification (increasing the productivity of area under production). Agricultural intensification can be achieved through better farm management practices and increased use of improved technologies like chemical fertilizers, high yielding varieties, pesticides and organic mineral. Improved crop verities are crucial to increase agricultural productivity. Agronomists believe that improved seeds are the nucleus of all improvements where the potential impact of other farm inputs depends. The use of good quality seeds and improved varieties is widely recognized as fundamental to ensure increased crop production and productivity for centuries (EEA/EEPRI, 2007). One of the main causes for low productivity of Ethiopia agriculture, and hence low income and high level of poverty, is the low level of improved technology utilization. The use of improved technologies helps to increase productivity and shift the production function upwards thereby playing a great role in the nation's attempt to attain food security and eradicate poverty. This is especially more so in a situation

where both labor and land productivities are at a very low level. (Bezabih, 2003; Nigsse and Mulat, 2003; Abebe and Mulat, 2003; Azam, 1996).

Agricultural intensification has a lot to do with the Millennium Development Goal of the United Nations in general and Ethiopia in particular. Poverty reduction, hunger eradication, and technology transfer are among the issues high on the global agenda on sustainable development after the approval of the Millennium Declaration by the General Assembly of the United Nations (UN, 2000). This declaration resulted in the formulation of eight Millennium Development Goals (MDGs): a set of goals and targets to guide international policies. Some of the most important issues of MDGs are poverty, hunger and technologies transfer. These, in developing countries, are strongly linked to agricultural sustainable development at national, regional or local levels. (Rosebud et al, 2006)

When we come to Ethiopia, the development strategy of the country strongly hinges on the development of small holder agriculture. The government has been promoting the new extension program as an effective mechanism to bring about the desired growth in the agricultural sector. The intervention is composed of a package of improved technological inputs such as chemical fertilizers, improved seeds, better cultural practices, and expert support. Progressively a number of peasants are joining the project; hence it is hoped that agricultural productivity could be significantly increased. (Abebe and Mulat, 2003; EEA/EEPRI, 2007; Edilegnaw, 2003).

Statement of the problem

The success of any policy intervention to bring about a technological change in agriculture depends on the extent of adoption and diffusion of new technologies and the degree to which it has impacted the wellbeing of technology adopters. The technology must be adopted by a significant number of peasants before it could bring about any meaningful change in output growth and address equity considerations, and then after, it should be evaluated as to how well or bad it has affected the lives of adopters.

Studies on adoption of new technologies and its determinants are extensively conducted. (Abebe and mulat, 2003; Dessalegn, 2008; Infates et al, 2009; Kaliba et al, 1998) However, there remains a lot when it comes to studies on the impact of adoption of improved seed on income and poverty. (Beyene, 1998; Matusche, et al, 2007) Beyene studied on the Impact of Agricultural Extension on maize production; and Matusche, his associates conducted their study on Adoption and Impact of Hybrid Wheat in India. There is limited studies as to the impact of improved haricot bean in Ethiopia on income and poverty.Therefore, it is worthwhile to investigate impact analysis of adoption of technologies by farm households.

Objectives of the study

The study generally aims at assessing the impact of improved haricot been on income and of farm households using a quantitative analysis supplemented by qualitative approach.

Specifically it is aimed at examining the impact and the extent of improved haricot bean on income by using both descriptive statistics and multivariate econometric analysis.

Scope of the study

This is a micro level study limited to Hawassa Zuria. Moreover, the study will be based only on 120 randomly selected households from the specified area. On the other hand, Ethiopia has a wide variation in adoption and income acquisition structure for the different agricultural products. Therefore, it is quite difficult to make generalizations from studies made in such a small area. However the area selected for the study is representative for areas that share its characteristics in the country. Hence, it is hoped that the result could be applicable to some locations having similar circumstances. The study approach would draw on a priori knowledge of how the agricultural section functions and an empirical knowledge of adoption behaviors of farmers.

Data and Methodology

The study area

This is a micro level study that has been conducted in Hawassa Zuriaworeda. This woreda is one of 18 woredas found in Sidama Zone. It is characterized by food insecurity. Besides this woreda is also known for its production of haricot bean. The study is based on 120 randomly selected households from the specified area.

Analytical frame work

To appraise the impact of improved technology adoption on the lively hood of farmers the choice of appropriate model to use depends on how the treatment was disseminated. Following the impact assessment literatures the most plausible assumption in this case is that of selection on observables. This is because farmers decide to adopt new varieties based on anticipated benefits they would drive by adopting. However this anticipated benefit cannot be observed, hence the need for an instrument which will be independent of productivity, income and poverty but would affect them only through adoption. Most studies have assessed the impact of technology adoption by simply examining the differences in mean outcomes of adopters and non-adopters or by using simple regression procedures that include the adoption status variables among the set of explanatory variables. We have also followed the same procedure.

Data Type, Data source and Sampling Design

Both primary and secondary data are used in conducting the study. The main source of the data for this study, however, is the questionnaire survey conducted on a sample of farmers of Hawassa Zuria woreda. Secondary data on yield, use of improved seed, situational environment and several other relevant issues is to be obtained from agricultural development offices in the study area. This is in order to fill the gap and substantiate the findings from the primary data as deemed appropriate. The study has employed a multistage sampling technique to select a sample of 120

farmers. In the first stage Dore Bafana kebele is purposively selected form 23 kebeles that are found in Hawassa ZuriaWoreda. In the second stage a certain number of peasant Associations (PAs), are selected randomly. These will then be stratified in to groups based on their proximity to the major town of the district, and peasant associations from each stratum will be selected randomly .In the final stage, farm households are be selected using systematic random sampling.

Result and Discussion

Descriptive Statistics analysis

The study is intended to identify extent and the impact of agricultural technologies on income of farm households by using both descriptive statistics and multivariate econometric analysis.

In this section , descriptive statistics such as mean, standard deviation, percentage, frequency tabulation, and t test of paired means were employed Evaluation of the impact of an agricultural technology in the subsequent discussions is undertaken with reference to certain characteristics of the sampled farmers that are deemed to reflect their economic and social conditions. The selected characteristics are household age, total number of adult individuals in a given household, educational level of the household head, total farm size, distance of the household residence from the nearest market, off farm income , participation in an extension program and technology adoption

Household demographic characteristics

In order to understand the sample households, it is worthwhile to describe their demographic characteristics. Household's personal and demographic variables are among the most common household characteristics which are mostly associated with farmers' adoption behavior. From this category of variables, sex, age, education, family size and location were reviewed in this study.

As can be understood from Table 1, out of the total of 200 respondents in the sample, 162 respondents were men and the rest 38 were women. Thus the gender structure reveals that the sampled households are dominantly headed by male. It amounts to 81% of the total sample. When we come to age, as is indicated in Appendix I, the average age of respondents is 42 years with the standard deviation of 11.49. The maximum age of the respondents 78 years while the minimum age was 23 years.

One can also observe from the table below that 22 % of the sampled households are illiterate while 72 % had stayed in school at primary level of education. The remaining 1 % and 5% of the respondents attended formal education up to the level of 7-8 and above 8 years of schooling, respectively. With more than 90% of the sampled households equal to or below general primary education, there remains a lot to be done.

Table 1. Demographic characteristics of the respondents

Variable		Frequency	Percent	Cumulative percent
Age	Below 20	0	0	0
	20-30	41	20.5	20.5
	31-40	86	43	63.5
	41-50	38	19	82.5
	51-60	25	12.5	95
	Above 60	10	5	100
	Total	200	100	
Sex	Male	162	81	81
	Female	38	19	100
	Total	200	100	
Education	Illiterate	44	22	22
	1-6	144	72	94
	7-8	2	1	95
	Above 8	10	5	100
	Total	200	100	
Family size	1-3	1	0.5	0.5
	4-6	133	66.5	67
	7-10	66	33	100
	Above 10	0	0	100
	Total	200	100	

Source: Own survey and calculation

In this study, the average family size of the sample households is 6.persons (Appendix I). The maximum family size was 10 while the minimum is 3 persons. The family size of the study area is fairly large. Almost more than 65 % of the sampled households have more than the average family size of the study area. As far as technology adoption is concerned family labor plays a more important role than family size. Accordingly appendix I reveals that the average family labor is 3 for the total sampled households.

Econometric Analysis

Heckman selection model is first run and surprisingly the stata result revealed that the dependent variable is never censored because of selection. Thus there is no selectivity bias and hence OLS is justified. The stata result of OLS is depicted in the table that follows.

It was hypothesized that a number of variables affect income of a given household. These are: sex of the household head(**SEXHH**),the age of the household head **(AGEHH),** educational level of the household head (**EDCN),** number of adults in the household **(NADLT)** ,total farm size owned by the household (**LSIZE),** Off farm income **(OFFIN)**, Price of Maize sold **(PRIMZ),** Membership to association(**ASSON**), Access to and utilization of credit (**CRDIT**), Participation in an extension visit (**EXTEN**), frequency of Market visit (**FMART**), On farm income

(**ONFIN**), ownership of own land (**OWLND**) distance of the household residence from the nearest market (**DISMKT**) , and adoption of improved Maize seed (**ADOPT**) .

These variables hypothesized to affect farm households' income acquisition were selected to fit into the OLS model. Having, first run the model with the whole set of variables intact, it resulted in an unexpected relationship between the dependent variable and the explanatory variables. In a cross-sectional data, like this, socio-economic variables usually have the problem of multicollinearity and unexpected sign. Thus a test for multicollineariy revealed that there is perfect multiculinearity between **LSIZE** and **OWLND,** the variable ONFIN is also found to be irrelevant and hence they are dropped from the analysis.

Finally fourteen variables namely: **SEXHH**, **AGEHH, EDCN, NADLT**, **LSIZE, OFFIN**, **PRIMZ, ASSON**, **CRDIT**, **EXTEN**, **FMART**, **OWLND, DISMKT**, **ADOPT** were used in the model whose goodness of fit revealed that it is the better model.

The Econometric results in Table 2 revealed that all of the variables expected to affect income acquisition are of the expected sign except for education. Among the variables hypothesized to affect income acquisition eight variables namely: **AGEHH, NADLT** , **PRIMZ, ASSON**, **EXTEN**, **FMART**, **OWLND,DISMKT**, **ADOPT** positively and significantly impact income acquisition .The R^2 and adjusted R^2 of 68 % and 65% respectively with F-value of 0.000 tells us that our model as a whole is credible and statistically significant.

The variable of interest, which is the research question of the study, is ADOPT. It answers the question whether or not adoption of improved maize variety affects income acquisition of farm household. The result of the study has succinctly revealed that Adoption positively and significantly, even at one percent, affects the income acquiring processes of farmers. According to the study an average non-adopting farmers may increase their amount of income by about 12%, keeping all else equal, by using better yielding seeds.

Table 2: OLS result of the Income Model

Source	SS	df	MS	Number of obs =	200
				F(13, 186) =	30.50
Model	14990.5003	13	1153.1154	Prob > F =	0.0000
Residual	7031.01974	186	37.8011814	R-squared =	0.6807
				Adj R-squared =	0.6584
Total	22021.52	199	110.660905	Root MSE =	6.1483

INCME	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
SEXHH	.785659	1.425904	0.55	0.582	-2.027365	3.598683
AGEHH	.0994857	.0502224	1.98	0.049	.0004069	.1985646
EDUCN	-.5102328	.2208345	-2.31	0.022	-.9458951	-.0745705
NADLT	1.036223	.4064565	2.55	0.012	.2343655	1.83808
LSIZE	.0130431	.4422675	0.03	0.977	-.8594623	.8855484
OFFIN	.0063037	.014211	0.44	0.658	-.0217317	.0343392
PRIMZ	.1085307	.0158949	6.83	0.000	.0771733	.1398881
ASSON	18.7269	2.878468	6.51	0.000	13.04826	24.40554
CRDIT	.9774723	1.033962	0.95	0.346	-1.062329	3.017273
EXTEN	5.579193	2.842557	1.96	0.051	-.0286041	11.18699
FMAKT	2.786244	.4979127	5.60	0.000	1.803961	3.768526
DISMKT	1.581921	.5565545	2.84	0.005	.4839498	2.679891
ADOPT	11.73317	1.432432	8.19	0.000	8.907266	14.55907
_cons	-81.65618	8.823015	-9.25	0.000	-99.06222	-64.25013

Comparison of the expected income of adaptors and non-adopters

Table 3 computed the expected income of adopters and non-adopters with a test of hypotheses. Accordingly the expected income of adaptors is 8735 Birr while that of non-adaptors is 2396. Birr. The difference is 6339Birr per year and this difference is statistically significant at one percent. The stata output reveals that we reject the null (that says the difference between the expected outputs of non-adopters over adopters is zero) in favor of an alternative hypothesis that says the difference is less than zero (i.e. expected income of adaptors is greater than that of the non-adopters).This result further confirmed that improved agricultural technology has significant impact on income of farm households.

Most studies have assessed the impact of technology adoption by simply examining thedifferences in mean outcomes of adopters and non-adopters or by using simple regressionprocedures that include the adoption status variables among the set of explanatoryvariables. We will also follow the same procedure i.e. we will employ Propensity Score matching technique which ideal when there is no base line survey.
Table 3: Mean comparison test

Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	56	2396.429	176.5419	1321.119	2042.631	2750.226
1	144	8735.833	351.6935	4220.322	8040.644	9431.023
combined	200	6960.8	327.2915	4628.601	6315.395	7606.205
diff		-6339.405	575.3795		-7474.063	-5204.746

diff = mean(0) - mean(1) t = -11.0178
Ho: diff = 0 degrees of freedom = 198

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0
Pr(T < t) = 0.0000 Pr(|T| > |t|) = 0.0000 Pr(T > t) = 1.0000

Source: own survey and computation

Implications

The finding of this paper revealed that the main factor that gives significant explanation for the variation in income, keeping all else equal, is improved seed variety which is the source of an active potential for farm productivity, especially in the study area where the question of optimum utilization of technology is of great shortage. It is very emphatically recommended to enhance the widespread distribution of improved seeds to farmers. This is highly recommended because, as was revealed in the study, adoption has a large and statistically significant impact on farmers' income acquisition. Thus, in developing countries like Ethiopia, widespread adoption of yield-enhancing agricultural technologies is one way to alleviate poverty and to ensure food security.

Appendix

Appendix I: Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
SEXHH	200	.81	.3932854	0	1
AGEHH	200	40.95	11.49295	23	78
HHSIZE	200	6.03	1.653107	3	10
NADLT	200	3.035	1.200408	0	8
LSIZE	200	2.4062	1.124966	.25	7
OFFIN	200	31.525	41.03926	0	150
INCME2	200	6960.8	4628.601	440	16280
PRIMZ	200	440	37.85718	350	600
ASSON	200	.96	.1964509	0	1

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