

Full Length Research Paper

Red pepper marketing in Siltie and Alaba in SNNPRS of Ethiopia: factors affecting households' marketed pepper

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Abstract

This research attempted to examine red pepper marketing in Alaba and Siltie with the specific objective of identifying factors affecting volume of pepper supply. Heckman two stage model was used to investigate factors affecting pepper market participation decision and quantity supply of pepper. One of the most important variables influencing the decision to participate in pepper market was pepper production. Consequently, extension work should focus on encouraging farmers to participate in pepper production especially, there was a need to increase disease resistant variety and disseminate these technologies to potential areas. Cereal crop yield was adversely affected probability of market participation. Keeping their specialization and social role in pepper production potential areas is necessary. Moreover, pepper production and extension contacts were the determinant factors of the quantity of pepper supplied. Therefore, policies that would improve pepper production capacity by identifying new technologies and create stable demand for surplus production would enhance farmers' decisions on marketable surplus. Non farming income and number of livestock affected the quantity of pepper supplied negatively. Thus, policy should be designed on integrated farming system to minimize income risk and to improve the livelihood of the farmers.

Keywords: Heckman Two-Stage model, market participation, pepper supply, SNNPRS, Ethiopia.

INTRODUCTION

The total production of pepper in the country for the year 2005/06 Ethiopian main cropping season (Meher) was estimated at 1790283 quintals. Rain fed pepper production in 2005/06 production was 777602 quintals In SNNPRS. This accounted 43% of the country's production (CSA, 2006). In Ethiopia, the production of pepper is constrained by variable seasonal conditions. The 2005/06 yield of pepper was very high, around 22qt/ha in the country, which was greater than the previous years' yield (13 qt/ha). Though low yield is also caused by the deterioration of the varieties, new improved varieties were not released for more than 20 years (Roukens, 2005). However, this situation caused to affect the quantity of supply of pepper.

As a result, the variation in its supply on rural and urban market is considerable. The high potential areas of Ethiopia can produce enough pepper to meet the needs of the people in the deficit areas. However, the poor agricultural marketing system, disease, and unstable price of pepper discourage farmers to produce more. Agricultural marketing is the main driving force for economic development and has a guiding and stimulating impact on production and distribution of agricultural produce.

Improved information and marketing facilities enable farmers to plan their production more in line with market demand, to schedule their harvests at the most profitable times, to decide which markets to send their produce to and negotiate on a more even footing with traders and also it enables traders to move produce profitably from a surplus to a deficit market and to make decisions about the economics of storage, where technically possible.

The possible increment in output resulting from the

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Table 1. Description of independent variables used in the Heckman selection model

Variables	Description	Values	Percent/ Mean (SD)	Expected relation
SEX	Sex of household head	1=male, 0=female	94	Male positive/ Female negative
AGE	Age of household head	Number of years	42.18 (14.16)	Positive
EDU_CAT	Education of household head	1=yes, 0=otherwise	65	Positive
FAM_SIZE	Family size	Man equivalent	6.56 (2.58)	Negative/Positive
NONF_INC	non-farm income	1=yes, 0=otherwise	12	Negative/Positive
CREDITOT	Credit access	1=yes, 0=otherwise	11	Negative/Positive
EXT	Extension service	1=yes, 0=otherwise	40	Positive
INF_NEA	Market information	1=yes, 0=otherwise	64	Positive
T_PEPPIER	Size of output	Kg	116 (135)	Positive
T_LAND	Size of land holding	Hectares	1.82 (0.9)	Positive
TLU	No. of livestock	TLU exclude number of oxen	5.49 (4.32)	Negative/Positive
CROP_YIE	Productivity of cereal crops	Quintal per hectare	9.3 (8.5)	Negative
PRICE	Average price of pepper in 2003/04	Birr	13.91 (9.69)	Positive
SOLMKTDI	Market distance	Walking minutes	1.15 (0.30)	Negative

Source: Own computation from 2004/05 survey

introduction of improved technology could not be exploited in the absence of convenient marketing conditions. A good marketing system is not limited to stimulation of consumption, but it also increases production by seeking additional output. Despite the significance of red pepper in farmers' income, determinants of market participation of the households did not study. This study has the purpose of investigating the factors affecting red pepper supply to the markets in Alaba, Siltie, and Addis Ababa which will reduce the information gap on the subject and by contributing to work better understanding on improved strategies for reorienting marketing system for the benefit of small farmer development and traders and may aid the policymakers.

Data

The study is based on data collected the 2004/2005 from a household. Primary data collected from farmers focused on factors affecting market supply, size of output, access to market, market information, annual income from non farming activities, livestock ownership, land holding, extension service contact, credit access, family size, production of food grain, etc. from farmers using pre-tested questionnaire. The characteristics of the variables across all farmer differentiated by the choice of

the pepper market participation option and the hypotheses formulated for the present study are presented in Table 1.

METHODOLOGY

Heckman Two-Stage model

In this study, the Heckman's sample selection which proposed by (Heckman, 1979) was employed. The model was developed within the context of a supply equation

$$Y_i = X_i\beta_i + \varepsilon_i, \quad i = 1, \dots, n \quad (1)$$

Where: Y_i is a quantity supplied to the markets
 X_i observed variables relating to the i^{th} person's supply,

β_i is a vector of factors known to influence a household's supply to the market,
 ε_i is random error term

Y is observed only for seller households, i.e. only households who supplied pepper to the market. The 'selection equation' for entering the pepper market might be:

$$Y^*_i = Z_i\beta_i + \mu_i \quad (2)$$

Where Y_i^* is the latent variable entering to the market, β_i is a vector of factors known to influence a household decision to participate in pepper market,

Z_i is unknown parameter to be estimated in the selection model,

μ_i is the error term

The Heckman model also uses the following assumptions:

$$(\varepsilon, u) \sim N(0, 0, \sigma_\varepsilon^2, \sigma_u^2, \rho_{\varepsilon u}) \quad (3)$$

That is both error terms are normally distributed with mean 0, variances as indicated and the error terms are correlated where $\rho_{\varepsilon u}$ indicates the correlation coefficient.

(ε, u) is independent of X and Z

The error terms are independent of both sets of explanatory variables.

$$\text{Var}(u) = \sigma_u^2 = 1$$

μ_i is assumed to be jointly normally distributed with ε_i and contains any unmeasured characteristic in the selection equation. The model for Y is the one we interested in, but Y is only observable if $Y_i^* > 0$. Thus the observed dependent variable Y is

$$Y = \begin{cases} Y_i^* & \text{if } Y_i^* > 0, \\ 0 & \text{if } Y_i^* = 0 \end{cases} \quad (4)$$

If we ignore the sample selection problem and regress Y on X using the observed Y 's only, then the OLS estimator of β_i will be biased. To control or correct for potential bias emerging from sample selectivity, the second stage regression adds the inverse Mills ratio (IMR) calculated from the Probit model as an additional regressor. The IMR will be computed as:

$$\lambda = \frac{\phi(Z_i u)}{\Phi(Z_i u)} \quad (5)$$

where λ denotes the inverse Mills ratio (IMR), ϕ is the normal probability density function (PDF), $\Phi(\cdot)$ is the standard normal cumulative density function (CDF). Z_i is a vector of factors known to influence a household's decision to participate. A significant coefficient of the IMR indicates that the selection model must be used to avoid inconsistency. If $\rho = 0$ then there is no evidence of the selection bias and the regression reverts to OLS. The new equation for the second stage regression equation is then given by:

$$Y = \beta X_i + \lambda (\delta Z_i) + \varepsilon_i \quad (6)$$

RESULT AND DISCUSSIONS

Descriptive

The descriptive statistics of the variables used in the

Heckman Two stage Model are summarized in Table 1. About 94% of sample household were male. The average age of the sample households was 42. The educational background of the sample household heads is believed to be an important feature that determines the readiness of household heads to accept new ideas and innovations. About 65% the sample household heads were literate (religious school 43.6%, read and write 10.8% and the other 10.8% formal education). The available data indicates that average family size in each household is 7 members. The result indicated that non-farming is the next major source for 12% of the total sample households. Access to credit, agricultural extension, and market information are the most important factors that promote production and productivity thereby increasing marketable surplus and ultimately farm income. However, only 11% of the total sampled household had received credit and 40% of had extension contact in relation to pepper production. Table 1 revealed that 64% of the total sampled households had pepper price information about the nearby market price before they sold their pepper. The average quantity production of pepper per sample household was 116 kg in 2004/05. As the table shows, the average farm size in sample study area was 1.82 hectares per household. In terms of Tropical Livestock unit (TLU) almost 100% of the total sampled household had an average of more than 5 livestock excluding number of oxen. The average productivity of cereal food crop in the small household was 9.3 quintal per hectare. Previous year's price helps farmers to decision on their pepper production; as a result the average price of pepper in 2003/04 was Birr 13.91 per kg. The households transport pepper to the nearest markets, either carrying sack themselves or using donkeys, over a distance of 1.15 hours on an average.

EMPIRICAL RESULTS

Determinants of pepper market participation decision

Results of the Probit model are summarized in Table 2. In the first stage, households decide whether they will be sellers, or not. The Probit model was highly significant with a χ^2 -value of 213.1239 and correctly predicted 95% of the observed outcomes. As hypothesized, pepper production influenced the farmers' decision to participate in pepper market positively. This is explained by the fact that pepper is the major cash crop for the majority of farmers and shows that the higher the output, the higher is the farmer willing to participate in the market. Similar findings by some scholars that the volume of production positively influenced surplus market participations (Wolday, 1994; Singh and Rai, 1998; Omiti et al., 2009; Astewel, 2010).

Table 2. Maximum likelihood estimates of Probit model

Variables	coefficients	t-ratio	Marginal effect
Constant	0.8772	0.524	4.498E-05
SEX	-0.6341	-0.867	-1.015E-05
AGE	0.0008	0.078	4.307E-08
EDU_CAT	0.0388	0.097	2.067E-06
FAM_SIZE	-0.1022	-0.720	-5.242E-06
NONF_INC	-0.4552	-0.896	-8.546E-05
CREDITOT	0.0026	0.246	1.330E-01
EXT	0.4788	1.218	2.556E-05
T_PEPPER	0.0649	6.233***	3.329E-06
T_LAND	-0.1959	-0.754	-1.004E-05
TLU	-0.0319	-0.658	-1.637E-06
CROP_YIE	-0.1174	-2.466**	-6.018E-06
PRICE	0.0113	0.073	5.801E-07

Log-likelihood function-9.756451 Chi-squared 213.1239
 Restricted log likelihood -116.3184 Predicted Success 95%
 Significance level 0.0000000 Number of observation 250
 *** and ** indicate statistically significant at 1%, and 5% respectively

Source: Own computation from 2004/05 survey data

Productivity of cereal crops

The productivity of cereal crops influenced pepper market participation negatively. The implication is that the low productivity of food crops increases pepper market participation, which is in line with the expectation that a family who faces low productivity in grain production will face food grain shortage that needs to be compensated through purchase of food grains. The cash source in turn can be from the sale of cash crops like pepper.

Factors affecting quantity of pepper sold

The second stage estimation is summarized in Table 3 and it indicates that the decision of how much households sell. Each decision has been studied by using a selection model which included the IMR calculated from a Probit estimation of the decision to sellers into the supply equations. There are 14 potential explanatory variables (8 continuous and 6 dummy) including IMR (LAMBDA). Out of these 5 variables: production of pepper, non farming income, extension contact, livestock and inverse Mill's Ratio, had significant effect on quantity of pepper supplied. The F-test value 5.11 for the selection model was highly significant and the adjusted R² was 99.07%.

Non-farming income

As hypothesized, non-farm income of the household heads negatively affected quantity supplied. On average, if a pepper producer gets non-farming income causes a

4.55 kgs reduction in the quantity of pepper supply. This may be explained by the fact that farmers who have better non-farm income will not tend to generate cash from sell of agricultural commodities (pepper) rather from their non-farm income. Similar studies identified that access to other income negatively related to sales volume of milk, kales and maize in Kenya and banana market in Uganda (Omiti et al., 2009; Komarek, 2010).

Extension contact

the other significant variable was extension contact, which affected positively the marketed supply of pepper. On average, if a pepper producer gets extension contact the amount of pepper supplied to the market increases by 4.8113 kgs. This suggests that access to get extension service avails information regarding technology which improves production that affects the marketable surplus. The result similar of Siziba et al. (2011) finding that extension contact of smallholder farmer in sub-Saharan Africa increased the volume of cereal sold in the market.

Production of pepper

As hypothesized the regression coefficient of pepper production variable was positively related with quantity supplied and significantly at 1% probability level which is the similar significance level. The result shows that a one kg increase in the pepper production causes a 0.9710 kgs increase in the amount of marketed supply. Total pepper production influenced the amount of marketed supply of pepper positively showing that farmers who

Table 3. Estimates of selection model

Variables	Coefficient	Standard deviation	t-ratio	Marginal effect
Constant	-5.5281	8.2933	-0.667	-5.5281
SEX	-1.4928	3.7463	-0.398	-1.4928
AGE	0.0621	0.0667	0.932	0.0621
EDU_CAT	2.1165	1.9876	1.065	2.1165
FAM_SIZE	0.1661	0.7568	0.219	0.1661
NONF_INC	-4.5428	2.5851	-1.757*	-4.5428
CREDITOT	-2.5770	2.6278	-0.981	-2.5770
EXT	4.8113	1.7743	2.712***	4.8113
INF_NEA	-0.8691	1.9392	-0.448	-0.8691
T_PEPPER	0.9710	0.0072	135.078***	0.9710
TLU	-0.4932	0.2070	-2.383**	-0.4932
CROP_YIE	-0.2137	0.1898	-1.126	-0.2137
PRICE	0.0892	0.8135	0.110	0.0892
SOLMKTDI	0.0040	0.0096	0.419	0.0040
LAMBDA	7.7730	3.7503**	2.073**	7.7730

R-squared = 0.99074 Adjusted R-squared = 0.9901 Rho = 0.61003

Probability value = 0.00000 F-value 5.11 *** Number of observations 250

Log-L = -973.9455 Restricted (b=0) log-L = -1565.333

***, ** and * show the values statistically significant at 1%, 5% and 10% respectively

Source: Own computation from 2004/05 survey data

produce more sell also more, which is consistent with the general expectation. These results are consistent with the findings of (Pender and Dawit, 2007; Adugna, 2009; Assefa, 2009; Omiti et al., 2009; Astewel, 2010) who confirmed that increasing agricultural productions increases volume of sales.

Number of livestock

This variable influenced the quantity of pepper supply negatively. This is mainly due to the fact that farmers with more TLU tend to specialize in livestock production reducing the importance pepper production as means of cash generation. The result shows that a unit increase in the livestock causes a 0.4932 kgs decrease in the amount of marketed supply. Ouma et al. (2010) observed that livestock adversely affected volume of banana sold in Central Africa. However, some scholars revealed that ownership of livestock was positively related to the level of cereal sales market participation (Makhura, et al., 2001; Alene et al., 2008; Siziba et al., 2011).

Inverse Mill's Ratio

The inverse Mill's Ratio affects the quantity supplied positively with 5% significance level and it indicates that in Heckman two-stage model, the correction for selectivity bias is significant.

CONCLUSIONS AND POLICY IMPLICATIONS

The results indicate the relative importance of each of the variables discussed on the Heckman two-stage model, the study had identified the determinants of participation decision on pepper market and its effect on the quantity supply. Pepper production is the most important and significant variable influencing the decision and intensity of participation in pepper market positively. Moreover, extension contact is the significant increase with the quantity of pepper supplied. This highlights the need extension workers advertising to encourage farmers to increase their production and participate in pepper market. Strengthening of market extension (linking farmers with markets, building marketing capacity of farmers, etc.) is necessary. And it is necessary to provide information and enhance the knowledge and skills of farmers and other institutional changes ought to be made. However, food crop yield adversely affected pepper market participation decision. Keeping households specialization and social role in pepper production potential areas is necessary like other crops, such as teff from Ada' and Becho, butter form Sheno, honey form Gojam, etc. Non-farming income and number of livestock are the significant determinants of the quantity of pepper supplied negatively. This suggests that policies that promoting integrated farming system to diversify and improve income of the households. The coefficient associated with the inverse Mill's ratio was

significant, indicating that the influence of unobservable factors in the farmers' decisions to participate was significant.

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