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Staple Crops Prices versus Smallholders' Constrained Agricultural Output Maximization: Case of Enderta Woreda, Tigray, Ethiopia

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Abstract:
The international and the domestic market in Ethiopia is experiencing an alarming price rise in all agricultural and industrial goods and services. The price rise,at least theoretically, is expected to motivated farmers to produce more agricultural output. Here, our objective is mainly to examine the effect of crop prices on farmers agricultural output maximization. To examine important question, we have collected primary data from 260 respondents from four Tabias of EndertaWoreda selected using systematic random sampling. Supplementary secondary data was collected from Tigray Agricultural Marketing Promotion Agency (TAMPA). We have applied seemingly unrelated regression technique to see the output maximization of wheat, barley and teff in the study area. In a multi-equation regression analysis since the error terms are assumed to correlate, seemingly unrelated regression model is used to address the effect of these error terms correlation on the estimation result. The result of this estimation shows price of wheat, barley and teff have a significant positive effect all at one percent level of significance on wheat output maximization, barley output maximization and teff output maximization respectively. Land size, ownership of oxen, demand for oxen, distance from the next market, amount of money paid to purchase fertilizer, irrigation use have their own contribution on these staple crops output maximization. Providing market price information to farmers, transport services and using resources like land efficiently are some of the policy implication we forwarded.

Keywords*: Output-maximization, seemingly unrelated regression, Smallholder*

1. Introduction

The international market is experiencing aspectacularsurge in the price of manyfood commodities since 2005(Janvry and Sadoulet, 2009). An important policy issues are to identify who is being hurt and benefited by such food price rise.

Urban and rural non-farm households are most likely to be the main losers from the price change and proportionately more so the poorer since they have higher food budget shares. The conventional expectation which believes that the rise in food price should benefit farm households is the fact that the main activity of these households is agriculture and agricultural business. Despite the conventional expectation, the actual benefits are dependent on different factors like market and institutional setup in the economy. Food markets have been subject to many complications, and Ethiopia have faced very large rise in average food prices over the last few years. This price rise has had large effects on farmers, market participants and consumers. Recently, farm households started to benefit from food prices rise but what matters is that the agricultural produce is not satisfying the prevailing food commodity demand. Moreover, the food price rise is assumed to be the main factor to motivate farmers to produce more through adopting improved agricultural technologies and intensively using their available land and cheap man labor resources.

The recent increase in food price can induce the followingimportant sets of questions; Firstly, we can ask whatthe main causes of food price rise are? Second, does the price rise primarily from technological or resource use inefficiency or weather related shocks? Third, does business community speculation lead to increased or decreased food price? Fourth, does food price rise improve welfare of farmers, traders, consumers or vice versa? what are the welfare effects of increased food price for farmers, traders and consumers?

The main agenda of this study is not to address all the questions raised above, but to examine the current knowledge on the causes and effects of food price rises, to investigate the extent to which particular current economic factors contribute to price rise or variation,

and to estimate whether the prevailing food price variation, in the study area, is inducing agricultural production maximization constrained by marketing, input, and weather shocks.

2. Importance of the Study

Rural household in the study area is dependent solely on agricultural activity. Household in this area is engaged to produce agricultural produces both for household consumption and market which is for mere subsistence. Given the limited resources of land and capital and the staple crops demand in the market agricultural production needs to be maximized. Examining the household's agricultural produce maximization given the resources constraints enable to identify the major factors that hinder the maximization problem is imperative both to the household and practitioners. This study is important to the rural household to understand the prevailing market conditions. The result and recommendations of this study can be used by policy makers and practitioners so that rural household farmers can benefit from policy adjustments.

3. Problem Statement of the Study

Productivity growth and competitiveness among farmers is instrumental in the development of food items. In practice, when the production of food items has commenced, there is little room for adjustments in production until the next harvest season. Because of the biological production cycle, the short-run response to price signals from the market is likely to be limited.

Therefore, one would expect that the supply to be substantially more flexible and therefore more elastic in the long run, as farmers can then adjust to the new economic signals.

If production capacity depends critically on some fixed factors, there will be limited opportunities to respond to increasing prices in the short run.As the level of investment is chosen based on the information available before production begins, it may later turn out to be suboptimal compared with the realized yield level and market prices. Furthermore, if capital clearly defines production capacity and it is being fully utilized, there will be limited opportunity to respond to increasing prices in the short run in which capital represents a considerable capacity restriction in staple food production.Despite the efforts done by the government to increase smallholders' productivity, the food demand gap is filled by importing some food items like wheat. Many studies confirmed that smallholder farmers use resources efficiently and optimize production. The secret behind to produce an optimal level is mainly water use efficiency. Other factors such as efficient use of labor, land, improved agricultural inputs and technologies, and markets are some of the significant factors which have either effect on production maximization. Government is providing inputs such as fertilizer and introduces improved agricultural technologies including the improved seeds usually on credit basis; working on connecting farmers to the market; and introducing new water bank systems for better productivity. Many studies indicate that these government policy interventions result an increased overall agricultural yield outweighing the reservation of farmers to adopt the policy interventions surrounded by capital constraint to refund the loans in bud harvest season.

Another production maximization factor, at least theoretically, is the ideawhich believed that producers maximize yield whenever there is high market price of yield. Clearly, there exist a gap between food items demand and supply which is thus far beyond the policy interventions. Here, detail analysis on production maximization in relation to the theory is crucial. As far as the knowledge of the researchers, this dimension of farmers' production maximization in the study area is not fully addressed; and hence this study is keen to examine whether grains' price can result(initiate) farmers' production maximization with the prevailing constraints or not.

4. Objective of the Study

The general objective is to examine the relationship between staple food price and smallholders' constrained production maximization

Specifically, the study aims at

- Estimating the effect of staple food price on staple crops particularly on what, barley, and teff yield maximization.
- Identifying factors that affects production maximization other than own price of the staple food crops under consideration

5. Methodology of the Study

5.1. Method Of Data Collection

This research has collectedprimary information from sample population fromfourKebelles of the Woreda; namely Dergeajen, Chelekot, Debremearnet and Arato with population size of 1127, 766, 1000, and 1597 respectively over which 260sample size are selected using systematic random sampling technique. The number of respondents per Tabiaareproportionally distributed among the four Tabias. We have collected secondary information from the Woreda andTigray Agricultural Marketing Promotion Agency (TAMPA).

5.2. Theoretical Specification of Yield Maximization

This paper uses the dual approach to production maximization analysis. The approach involves estimation of a Yield function from cross-sectional data (that show Inter-farm variation in effective prices) (Sadoulet and de Janvry, 1995). Maximum yield and factor demand functions, from which yield supply and input demand elasticities are estimated, are then derived analytically. This approach is mainly used in cases with limited information on relevant primal variables and where possible estimation problems are associated with the production function approach (Chambers, 1988; Sadoulet and de Janvry, 1995).

Using the yield function, Lau (1978) has shown that the restricted profit function, defined as the excess of total value of yield over the costs of variable inputs, is maximized as:

$$Q(p, w; z) \qquad (1)$$

Where, Q, p, w and z represents yield of the staple crops, vectors of yieldprice, input prices and quantities of fixed factors of production like land respectively.

This function depicts the maximum yield of these crops that the farmer could obtain given prices, availability of fixed factors and the production technology.

The maximization these staple crops yield thereby optimization of the profit function in equation (1) gives the yield-maximizing level of yield supply and input demand functions respectively
as:

$$Y_m(p, w; z) = \frac{\partial Q(p, w; z)}{\partial p_m} \qquad (2)$$

and

$$-X_n(p, w; z) = \frac{\partial \pi(p, w; z)}{\partial w_n} \qquad (3)$$

Where, m and n index the yields and variable inputs respectively.

A normalized restricted profit function (defined as the ratio of the restricted profit function to the price of the yield), π*, can be specified in the case of single yield. It depicts the maximized value of normalized profits given normalized (relative) prices of the variable inputs, w^* and the quantities of fixed factors, i.e.,

$$Q^* = Q^*(w^*; z) \qquad (4)$$

from which the factor demand equations are derived as:

$$-X_n(w^*; z) = \partial Q^*(w^*; z)/\partial w^* \qquad (5)$$

In the case of multi-yield normalized profit function, the numerator is the yield price of the n^{th} commodity. Normalization has the purpose of removing any money illusion - in other words, producers respond to relative price changes. Normalization also reduces the demand on degrees of freedom, by effectively reducing the number of equations and parameters to estimate.

This study is going to adopted the translog functional form of the yield maximizing function, which has a convenient property of being flexible both in the sense of allowing for theoretical restrictions to be tested and offering a second order approximation of any function.

The normalized restricted yield maximizing function in translog form involves a system of *seemingly unrelated regression* where contemporaneous correlations across equations error terms are assumed.

The SUR model is usually estimated using the feasible generalized least squares (FGLS) method where two steps are run. The first step run ordinary least squares regression for the matrix. The residuals from this regression are used to estimate the elements of matrix.

In the second step we run generalized least squares regression for the matrix using the variance matrix.

This estimator is unbiased in small samples assuming the error terms ε_{ir} have symmetric distribution; in large samples it is consistent and asymptoticallynormal with limiting distribution.

5.3. The Model

Suppose there are m regression equations in the classical perspective

$Y_{ir} = x_{ir}\beta_i + \varepsilon_{ir}$, i = 1,…m

Here *i* represents the equation number, *r* = 1, …, *R* is the observation index and we are taking the transpose of the x_{ir}column vector.

Each equation *i* has a single response variable y_{ir}, and a k_i-dimensional vector of regressors x_{ir}.

If we stack these *m* vector equations on top of each other, the system will take form

$$\begin{matrix} Y_1 \\ \vdots \\ Ym \end{matrix} = \begin{pmatrix} X_1 & \cdots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \cdots & X_m \end{pmatrix} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

The assumption of the model is that error terms ε_{ir} may have cross-equation contemporaneous correlations. Here y_1, y_2,…$y_m$represent maximized yields, specifically y_1, y_2 and y_3 represents the maximized yield of wheat, barley and teff respectively.

6. Variables and Their Hypothesis

Variable name	Description	Measurement	Expected sign in relation to the dependent variable
Wheat	Dependent variable	Quintal	
barley	Dependent variable	Quintal	
teff	Dependent variable	Quintal	
hage	Independent variable	Years	-ve
Children going to school	Independent variable	Number	-ve
Land	Independent variable	Thimad	+ve
oxen	Independent variable	Number	+ve
Demand for oxen	Independent variable	Birr	+ve
Distance from the next market	Independent variable	Kilometer	-ve
Off farm income per month/household	Independent variable	Birr	+ve
Price of wheat	Independent variable	Birr	+ve
Amount of fertilizer used	Independent variable	Quintal	+ve
aid	Independent variable	Birr	-ve
Oxen supplied to local market	Independent variable	Birr	+ve
Credit use	Independent variable	Birr	+ve
Labor demand	Independent variable	Birr	-ve
Family size	Independent variable	Number	+ve
Gender	Independent variable	Dummy (1 for female, 0 otherwise	-ve
Horoyo(water bank)	Independent variable	Dummy 1=yes, 0 otherwise	+ve
Irrigation use	Independent variable	Dummy 1 = yes, 0 otherwise	+ve
Price of barley	Independent variable	Birr	+ve
Price of teff	Independent variable	Birr	+ve
Other agriyield	Independent variable	Quintal	+ve

Table 1: variables included in model estimation
Source: Researcher's own description

The hypothesized effects the variable included in the estimation of the model and their expected signs are in table 1 above

7. Result Discussion and Analysis

7.1. Summary Statistics

The demographic characteristics of the study population are summarized as follows.As it can be seen in table 2 below, the mean age of 260 population respondents is 50.12, at which the mean family size is approximately 5.34. The mean oxen ownership of the respondents is 1.92. The average income earnings from off farm activities is Birr 246.15.

```
. sum barley wheat teff incomemonth donkey oxen fsize hage

    Variable |       Obs        Mean    Std. Dev.       Min        Max
-------------+--------------------------------------------------------
      barley |       260    9.888462    2.425544         5         15
       wheat |       260    5.926923    1.737183         2         15
        teff |       260    3.296154    1.115348         2          7
 incomemonth |       260    246.1538    207.2634         0        600
      donkey |       260    1.742308    .8559007         0          3
-------------+--------------------------------------------------------
        oxen |       260    1.923077    .6819842         1          3
       fsize |       260    5.346154    1.222135         3          7
        hage |       260    50.12308    11.05655        29         78
```

Table 2: Summary Statistics of Respondents
Source: Researchers' own estimation

7.2. Estimation Results and Discussion

There are two main facts or motivations for the use of seemingly unrelated regreession. First of all, it is to gain efficiency in estimation by combining information on different equations. The second motivation is to impose and/or check restrictions that involve parameters in different equations.

There are two crucial conditions where OLS and seemingly unrelated regression becomes similar

- When there are no cross-equation correlations between the error terms (the matrix is known to be diagonal).In this case the system becomes not seemingly but truly unrelated.
- When each equation contains exactly the same set of regressors. If they have the same regressors, the estimators turn out to be numerically identical to OLS estimates. If these two cases are true, estimating the seemingly unrelated regression is not reasonable because estimates turn out to be equivalent to the equation-by-equation OLS. The equations areseparately estimated equation by equation and jointly to check if the variances of the matrix are different so that the error terms from these equations are correlated. These estimations show the variances are different when estimated jointly and equation by equation (see index) which indicates that the error terms are correlated and economical to run the seemingly unrelated regression.

  In this seemingly unrelated regression, wheat, barley and teff are taken as the staple crops in the study area. The main target of this joint estimation is to see the effect of own prices on the profitability of smallholder farmers on these three main staple crops in the study area where the estimation results are explained in detail below

7.2.1. Production of Wheat

Wheat is one of the predominantly produced crops in the study area. The average household wheat production of the respondents is 5.92 quintal (see table 1). As it can be seen from table 3, there are different factors which affect wheat production.

- **Own Price of Wheat:** The classical assumption is that when everown price of a good increases, the supply of that good increases maintaining normal good assumption. In this estimation, the null hypothesis is that the estimation coefficients (the parameters) are zero. Looking the seemingly unrelated regression result, the coefficient of the own price of wheat is different from zero which indicates own price of wheat is significant at one percent. This means, smallholder farmers produces more wheat motivated by price of wheat itself. In other words, if price of wheat increases by one birr, this increase in price will motivate to increase wheat yield approximately by 0.53 percent.
- **Distance (in kilometer)** to the next market has negative effect on wheat yield at tenpercent level of significance which can be interpreted as if distance to the next market increases by one kilometer, wheat yield decreases by 4.7 percent. This might happen due to different reasons; of which, farmers living in a far distance from their next market may not get suitable means of transport, they may lack also appropriate market information or the frequency they are visited by extension agents can also be less.
- **Income per month** of the household that is earned from off farm activities is significant at five percent level of significance where the mean income earned per month as indicted above is approximately birr 246.15. The result which says the null hypothesis is rejected can lead us to interpret the idea as if income earned by the household per month increase by birr one, wheat yield increases by 0.1 percent.
- **Oxen Demand:** Farmers with or with no oxen can hire oxen from their locality for the purpose of producing crops. Our estimation indicates that farmers who hire oxen during their farming activities can produce more yield than the ones who do not. The coefficient of the explanatory variable known as demand for oxen by a farm household is different from zero at one percent level of significance. Specifically speaking, when the household increase a single employment paid on daily basis to hire oxen, be in pair or single but measured in terms of money, the amount of wheat yield increase approximately by 57.66 percent.

  Finally, wheat, as it is explained above, is the main staple crop which is produced both for consumption and market. According to Tigray Agricultural Marketing Promotion Agency (TAMPA), there is an increasing trend of wheat yield simultaneously there is wheat price rise in the region. One important question is that whether the supply of wheat satisfies the prevailing demand of wheat consistent with the classical price theory or not. The estimation coefficient of wheatprice confirms that if price increases, wheat yield simultaneously increases thereby profitability of smallholder farmers from wheat production increases.
- **Other variables:** The estimation result also indicates that *land, oxen, goat ownership, the number of children going to school, the amount of fertilizer in quintal and gender of the household head* coefficients are some other variables which show positive signs even though they are not significant.
- **Household Age:** The estimation result of wheat on the household age indicates negative relationship. Although the coefficient of household age shows insignificant, anyone can conclude that the more the household head becomes older, the less will be the wheat yield (they have inverse relationship).
- **Aid:** In the study area, there are different development packages helping the rural society. Unlikethe objectives of these different packages, the parameter to aid indicates a negative relationship with wheat yield which implies households who get aid in different forms produce less wheat than who do not.

- **Constraints of Wheat Production Maximization**: the main constraint variables specified for this maximization are amount of money paid to purchase fertilizer, the ownership of donkey, distance from the next market, off farm household income earned per month, education level of the household head, and the ownership of oxen

7.2.2. Production of Barley

- ***Price of Barley:***Barley is another main staple crop in the study area where the respondents mean produce of it is approximately 9.89 quintal per one harvest season. Similar to wheat, barley production (profitability of farmers) is positively affected by its ***own price***. Consistent to the hypothesis, the seemingly unrelated regression shows that the coefficient of barley price variable is significant at one percent level of significance. This result shows there exist a strong positive relationship between barley yield and barley price which induces high motivation to smallholder farmers to produce more so that gain more profit from barley.
- ***Labor employment*** from the market by the household is an explanatory variable which indicates that the coefficient of the explanatory variable (market demand of labor by the household) is different from zero at one percent level of significance where the dependent variable(barely yield) and the explanatory variables shows positive relationship between them.
- ***Supply of oxen to the local market:*** Smallholder farmers participate off farm activities to earn income to afford the payment for consumption or for other inputs. One of these activities is supplying their oxen to the market on daily basis. Our regression result indicates that the coefficient of oxen supply to the local market measured in terms of money (oxen can supplied in pair, single but all measured in terms money the unit payment for pair per day) is significant at ten percent level of significance. If farmers supply their pair of oxen to the local market, yield of barley increases approximately by 31.8 percent. This might be because if farmers earn extra income from the market by supplying their oxen, they may purchase other agricultural inputs which enhance yield of barley which one of the dominantly produced in the locality.
- ***Credit use:*** in the study area, there are different mechanisms that provide farmers credit to adopt different agricultural inputs; these are local institutions and government agents mainly known as Dedebit Credit and saving Institution (DECSI a known local microfinance institution in the study area), farmers' union and some other government packages. The aim of such loans is to make farmers productive and capable to purchase farm inputs thereby increase their farm yields. In this regard there are different research outcomes; some confirmed that credit use increases crop production and some other do not confirm this. Our regression result shows that the coefficient of the credit use variable is different from zero at five percent level of significance which implies that as loan of a farmer increase by a single birr, the yield of barley decreases approximately by 69.25 percent.This can be because farmers taking credit can divert their loan to different other activities like producing market oriented none crop agricultural yield as well as the loan can also be diverted to consumption which can in effect lead the household to loan dependency.
- ***Other explanatory variables:*** variables like family size, land ownership, gender (a dummy variable which is one for female and zero for male) affect barley yield positively though their coefficients are not significant.
  Household head age, using Horoyo(a local name to a small well containing water collected during rainy season to supplement rain fall shortage in the harvest season), irrigation use are not significant variables in the estimation while the sign is shows negative relationship. Regarding the inverse relationship of the age of the household and barley yield, it is logical to accept that a person who becomes older is less energetic to produce crop yield than or equally with the youngest ones. The inverse relationship of irrigation use and Hororyo with barley yield can be because most of the time people use water from irrigation and Horoyo to water vegetableand some other crops like maize which is traditionally accustomed in the study area. Farmers with Horoyo and access to irrigation can produce fewer crops due to the comparative advantage from producing other marketable agricultural yields which their benefit can outweigh the benefit from barley and other less cash crop yields.
- **Constraints of Barley Production Maximization:**the maximization constraints for this crop production are set as land size owned, getting training, distance from the next market, radio ownership of the household to get easy access of information, credit use, irrigation use and amount of money paid to purchase improved seed.

7.2.3. Production of Teff

Teff is an ordinary consumption in the study area and Mekelle city, the capital of Tigray region. Similar to other staple food production, teff production is constrained by different constraints. We focus on some specific factors that can have significant effect teffyield maximization; price of teff, amount of fertilizer used, land ownership are among others.

- **Price of Teff:** since 2008,price of teff rises very rapidly all over the country which have significant effect both on consumption and production. The prevailing demand of teff along other important factors leads its price to rise. The seemingly unrelated regression result confirms that own price of teff have positive effect on teffyield. The coefficient of teff price indicates positive relationship with teffyield at one percent level of significance. It can be interpreted as if price of teff increases by a single birr, smallholder farmers will increase their teffyield approximately by 0.2 percent.
- **Land ownership:** similar to the highly populated areas of the region, land is scarce and main factor of crop production. Our estimation confirms that land ownership and teff production have positive relationship. The estimation parameter of the land ownership variable is different from zero at ten percent level of significance which rejects the null hypothesis. If a farmer increases her/his farming land ownership by one Tsimad, she/he will increases teffyield approximately by 10 percent which implies that land ownership increases the profitability of smallholder farmers from teff.

- **Other agricultural yield:** in thestudyarea, diversified types of agricultural yields are produced. Some of them are cash crop types like vegetable, cabbages and maize produced mainly using irrigation water sources. The local market invites the farmers to produce the cash crop so that they can increase their profit from agriculture. Producing such types of crops reduces the time farmers allocated to produce staple crop yield such as teff. The estimated parameter of other agricultural yield variable is significant at 1 percent level of significance where its coefficient sign indicates strong negative effect to teffyield. The main reason for the negative relationship between teffyield and the other yield variable can be due to the diversified farming of farmers.
- **Household family size:** this is another important factor which determines teffyield and profitability. The coefficient of this explanatory variable is different from zero at ten percent level of significance where the dependent and independent variables have inverse relationship. This inverse relationship can be because as household size increases, majority of the household members might divert their time to produce cash crop yield. Another reason can be land allocation to produce teff; most of the time teff is produced relatively in less proportion their land which implies whatever the size of the household, the size of plot of land allotted to produce teff remains the same or its variation can be insignificant.
- **Other variables:** according the estimation regression result, the amount of fertilizer used in farming, the amount of oxen shared, ownership of camel, using Horoyo are some other insignificant variables which have positive relationship with dependent variable.
- **Constraints of Teff production Maximization:** land ownership, ownership oxen, amount of money paid to purchase improved seed and use of Horoyo (water bank) are the main constraints set while running the seemingly unrelated regression.

Variable name	Coef.	Std. Err.	z	P>|z|
Wheat: Dependent variable in the first equation				
hage	**.0075747**	**.0091025**	**0.83**	**0.405**
childrensc~g	**.0335186**	**.089141**	**0.38**	**0.707**
ownland	**.0482213**	**.0837741**	**0.58**	**0.565**
oxen	**.1140378**	**.14654**	**0.78**	**0.436**
ddoxen	**.5766344**	**.109322**	**5.27**	**0.000**
dismarket	**-.0471155**	**.0271605**	**-1.73**	**0.083**
incomemonth	**.0024043**	**.0005146**	**4.67**	**0.000**
pricewheat	**.0052795**	**.0009102**	**5.80**	**0.000**
fertiamount	**.0006994**	**.0018713**	**0.37**	**0.709**
goat	**.0347032**	**.0258941**	**1.34**	**0.180**
aid	**-.0600852**	**.1996792**	**-0.30**	**0.763**
Barley: Dependent variable in the second equation				
hage	**-.0145448**	**.0131098**	**-1.11**	**0.267**
fsize	**.1229727**	**.1192111**	**1.03**	**0.302**
ownland	**.1888584**	**.1191825**	**1.58**	**0.113**
labddmkt	**.8900696**	**.1859589**	**4.79**	**0.000**
gender	**.0991914**	**.3527067**	**0.28**	**0.779**
pricebarl	**.0096375**	**.0012243**	**7.87**	**0.000**
ssoxen	**.3182141**	**.1882218**	**1.69**	**0.091**
credituse	**-.692544**	**.3008938**	**2.30**	**0.021**
horuser	**-.3951291**	**.2854233**	**-1.38**	**0.166**
irriuse	**-.3102497**	**.2904109**	**-1.07**	**0.285**
Teff: Dependent variable in the third equation				
hage	**.0033368**	**.0062204**	**0.54**	**0.592**
fsize	**-.0968612**	**.056693**	**-1.71**	**0.088**
otheragrio~t	**-.1849208**	**.0579948**	**-3.19**	**0.001**
fertiamount	**.0018692**	**.0012621**	**1.48**	**0.139**
oxenshared	**.0488934**	**.0791398**	**0.62**	**0.537**
ownland	**.1005876**	**.0580484**	**1.73**	**0.083**
priceteff	**.0020174**	**.0003427**	**5.89**	**0.000**
camel	**.0183394**	**.0832842**	**0.22**	**0.826**
horuser	**.0171254**	**.1338472**	**0.13**	**0.898**

Table 3: Seemingly unrelated regression result of of three equations
Source: Researcher's own estimation (2013)

8. Conclusion

The main findings are concluded in a brief way in this section. The main hypothesis proposed beforehand was that an alarming rise of price of staple crops induces high production of these crops. In the markets around the study area, demand for these staple crops exceeds the supply which causes continuous price rise which again induces another critical question whether farmers are maximizing yield or not.

- Looking the relationship between wheat production and its own price, price is the main factor to maximize yield of wheat. So farmers equipped with market (price) information tend to increase their yield of wheat.
- Similarly barley and teff prices are again the significant factors to increase yield of barley and teff respectively. Therefore, our conclusion to this aspect is that if price of these staple crops increases, farmers yield and thereby profit from these crops is maximized led by the prices provided that farmers are aware of the current price of these staple crops in the study area.
- Variables such as demand for oxen, per month income earned from off farm activities have positive effect on wheat production similar to wheat price. This implies that farmers who have the capacity to hire oxen from the market and farmers who participate in other economic activities than farming can produce more than the ones who do not. number of children going to school, land, oxen, amount of fertilizer adopted positive contribution while age of the household and aid have negative contribution wheat yield.
- Distance to the next market confirms farmers nearer to all weather road and market produces more than the ones who live in a far distance in regard to wheat production.
- Household labor demands from the local market, household supply of oxen to the local market are variables which have significant positive effect on barley yield. We have concluded that access to extra labor and extra income generated by selling oxen played a great contribution to yield maximization of barley.
- Loan taken by the respondents have significant negative effect on barley yield maximization which lead us to conclude loan is diverted to other cash crop produce.
- Variables other than teff price such as other agricultural yield negatively affects teffyield which can be concluded as one indicator of resources (labor, time and other inputs) diversion.
- Land the scare resource is determining the yield of teff which leads to conclude that small portion of land ownership of farmers motivate them to increase their teff production.

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