

# ANALYSIS OF FACTORS AFFECTING AGRO-PASTORAL ENTREPRENEURS' INCOME IN AFAR REGIONAL STATE OF ETHIOPIA: A CASE STUDY OF SMALL BUSINESS ENTREPRENEURS.

Prof. B. Mohan VenkataRam<sup>1</sup> & Teferi Hailesslasie Assefa<sup>2</sup>

<sup>1</sup>Professor, Department of Commerce and Management Studies, Andhra University, Visakhapatnam, India.

<sup>2</sup>Assistance Professor at Samara University, Ethiopia.

Received: February 01, 2019

Accepted: March 09, 2019

**ABSTRACT:** This research paper consists of the analysis and presentation of the empirical findings which are processed from quantitative sources of data. The main objects were analyzed the factors affecting the income of agro-pastoral entrepreneurs', who are owners of small business enterprises. Sampling selection, sampling design, tools and processes of data collection has been described, which is multi-stage stratified sampling techniques followed by enumeration area adopted. The sample size is 100 agro-pastoral entrepreneurs'. The data were collected using questionnaires, observations and discussions. In addition, ideas and opinions were gathered from interviews with officials and other individuals involved in the entrepreneurship development of small businesses enterprises. The data analysis based on multiple linear regression models. Model of econometric analysis was employed to identify factors that affect the owners (agro-pastoral entrepreneurs) of small business enterprise income. Which implies that the is more of quantitative qualitative in its nature. The results were explained well by the multi-linear regression model, which is explaining 93.76% to the dependent variable (income). From thirteen explanatory variables were seven of them statistical significant at level of 5% and one was significant at 10 % ( Table3.1). Therefore, it is recommended that government bodies(regional and federal) should provide for capacity and performance building of agro-pastoral entrepreneurs engaged in agricultural sector of small business enterprises by giving requisite training and other needed activities for sustainable economic contribution to the domestic as well as global economy.

**Key Words:** : agro-pastoral entrepreneur, agricultural sector, entrepreneurship, and small business.

## Introduction

Importance of entrepreneurship is more and more known as the driver of economic incremental, efficiency, innovation and reduces unemployment, and it is accepted as a key point of economic dynamism (Man *et al.*, 2008). Generating new ideas into economic opportunities is the crucial question of entrepreneurship. The past data shows that economic improvement has been radically advanced by pragmatic people who are entrepreneurial and innovative, able to exploit opportunities and willing to take risks (Hisrich, 2015). The vital role of entrepreneurship and an entrepreneurial background in economic and social value development has often been underestimated. In the years, on the other hand, it has become increasingly noticeable that entrepreneurship indeed shares to economic development. Nevertheless, significant numbers of enterprises were owned by men (ILO, 2006).

According to the Ethiopian Central Statistics Authority (2004), almost 50% of all new jobs created in Ethiopia are attributable to small businesses and enterprises, and roughly 49% of new businesses that were operational between 1991 and 2003 were owned by entrepreneurs. According to Aregash as cited in Eshetu and Zeleke (2008), 98% of business firms in Ethiopia are micro and small enterprises.

Ethiopia is among the poorest countries in the world. It has come through deep-rooted famine, hunger, economic crises, political instability, conflicts, and wars which have resulted in the backwardness and the poverty of the country (Kebede, 2015). Study specifically emphasis on factors that affect the performance of pastoral entrepreneurial income in small business enterprise, particularly in the Afar regional state of Ethiopia. This study is aimed to fill the gaps by identifying specific factors that are responsible for resilience in Small operated by pastoral entrepreneurs, and shade light on pastoral specific differentials that affect their income. Entrepreneurship is a combiner of different resources from industries and the local interplay between entrepreneurs and their spatial contexts (Welter, 2011). Furthermore, the support given by government and private institutions for small business owners to increase their income was assessed very well.

## 1.1. Objective of the study

### 1.1.1. General objective

The general objective of this paper is to analyze the agro-pastorals entrepreneurial income of small business enterprises in the Afar Regional State, Ethiopia.

### 1.1.2. The specific objective

To examine the major factors that affect agro-pastoral income volume of entrepreneurs in the study area.

## 2. Materials and Method

### 2.1 Description of the Study Area

Geographically, the Afar Regional state is located in the northeastern part of Ethiopia. The total geographical area of the region is about 270,000 km<sup>2</sup> (CSA, 2008). It is geographically located between of Latitude: 11°48'59.99"N Longitude: 41° 24' 59.99" E.

The region shares common international boundaries with the State of Eritrea in the north-east and Djibouti in the east, as well as regional boundaries with the Regional States of Tigray in the north-west, Amhara in the south-west, Oromia in the south and Somali in the south-east. It is also one of the lowest elevations in Africa and is located in the north of the Afar Region.

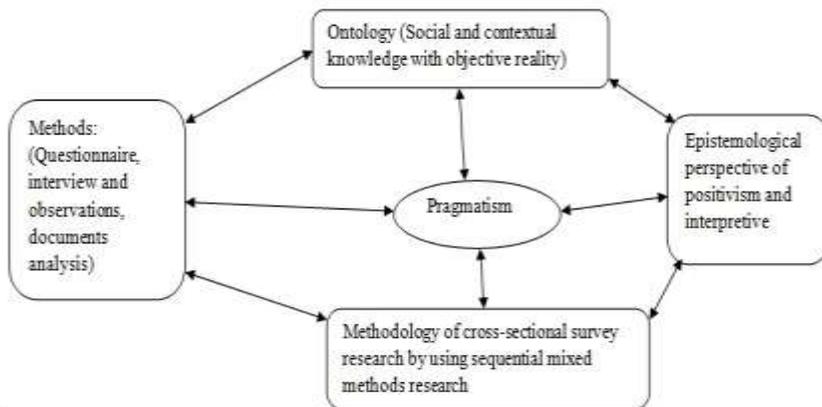


Figure-1: map of the study area

Afar Regional State is populated with roughly 1.4 million people (CSA, 2008). Nearly 87 percent of the population are rural mainly dependent on pastoral and agro-pastoral livelihood systems. Of the total population in the regional state, women constitute about 44%. While men constitute 57%. In terms of age distribution, about 43 percent of the population is young, below the age of 15 years. The region has an estimated density of 14.59 people per square kilometer.

## 2.2 Research paradigm and philosophy

Every researcher has his/her own view of what constitutes truth and knowledge. These views guide our thinking, our beliefs, and our assumptions about society and ourselves, and they frame how we view the world around us, which is what social scientists call a paradigm (Schwandt, 2001). A research paradigm that guides this research is pragmatism for transformative philosophical view, appropriateness to multiple reality development of small business enterprise using any mixed methods research. A researcher is advised to make explicit for its paradigm that shows the basic set of its beliefs and views for reality and truth. A paradigm also shows the reason why for specific ontology, epistemology and methodology were used in the study (Cresswell 2009; Keklik, 2018). Better suitability for the study of multi-spatial small enterprise and multi-disciplinary fields of entrepreneurship which need different instruments (questionnaire, interview and observation) and perspectives (small business enterprise, agriculturalist, industrialist, politicians or policy makers, business man in the small business); allows researcher to emphasize the research problem and use all available approaches, methods, different world views, different assumptions and different data collection and analysis methods (Figure-2).



Source: Adapted from (Johnson and Onwuegbuzie 2004)

Figure-2: Philosophical worldview of the study

### 2.3 Data Types and Collection

The research method of the study is mixed methods research (MM) that combines both quantitative and qualitative methods. However, quantitative, qualitative and MM approaches have their own individual procedure, approach, reasoning and argument. The goal of the researcher in qualitative approach is to develop theoretical concepts and patterns from observed data, usually inductive reasoning. On the other hand, a researcher in quantitative study uses the macro-level theory or policy to study local context application called deductive approach. In deduction, it is argued that a researcher can hypothetically explain any single set of empirical observations by a number of alternative explanations ((Bhattacharje 2012; Miller and Brewer 2003).

The data used for this study collected from both primary and secondary sources. Primary data were collected from all primary data sources through structured questionnaires, group discussion and direct observation.

### 2.4 Sampling techniques and sample size.

Multi-stage, stratified sampling approaches were used to select the survey sample. Because of heterogeneity among respondents, multi-stage stratified sampling technique was applied in 100 entrepreneurs in order to obtain a representative sample. Considering the working sectors of the small business owners and their locations/town to town or Woreda to Woreda, the stratified random samplings was used to select the items from each stratum to constitute a sample. In the list frame approach stratified random sampling with districts as strata, enumeration areas (5) as primary sampling units and the agro-pastoral entrepreneurs (600) were as secondary sampling units is implemented.



Source: Adopted from World Health Organization, & UNICEF. (2014); Nowbar *et al.* (2014)

Figure-3: Enumeration areas

Samples were selected through purposive sampling method with the confidence level of 95% and an error limit of 0.05. After this, by adopting the proportionally to population size of agro-pastoral entrepreneurs, were indomitable, as follow:

**Table 1: Sample Distribution of Agro-pastoral Entrepreneurs**

S/n	Village Name	N. owners (600)	Sample size (100)	Direction from the Town	Mode of Pastoral economy
1	Abala	150	25	North east	Agro-pastoral
2	Ashayta	100	17	East	Agro-pastoral
3	Elidar	90	15	West	pastoral
4	Awash	150	25	South	Agro-pastoral
5	Dalefage	110	18	North west	pastoral

Source: CSA.2016; Ministry of Agriculture and Rural Development, 2017/18

## 2.5. Method of Data Analysis

In order to analyze data collected from the sample; the obtained data is processed in the way that is appropriate for analysis for the whole survey operation. Data processing includes manual editing, coding, data entry, cleaning and consistency checking. The researcher makes all these activities, to achieve the objective of study. The data was compile and summarized using econometric analysis, with statistical tools with the help of software package STATA.

### Multiple linear regression Model

These econometric models were used to analyze to the **Agro-pastoral** entrepreneurs. Multiple linear regression models are specified as  $Y=f$  (access to credit, family size, and land size, education of the entrepreneur, and herd size...).The econometric model specification of entrepreneurial income will estimate by:

$$Y = \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k + \varepsilon$$

Where Y= annual income of the entrepreneur

$\beta$  = a vector of estimated coefficient of the explanatory variables

X= a vector of explanatory variables

$\varepsilon_i$  = disturbance term

## 3. Results and Discussion

### 3.1 Factors Affecting Income of Agro-pastoral entrepreneurs

Income is measured for a time period of 12 months and includes both cash and in-kind contributions. Multiple linear regression models show the relationship between the dependent variable and multiple (two or more) independent variables (Garba, 2018). The justification for using multiple linear regression model is that income are continuous dependent variables and they are expected to take a non-zero value for all agro-pastoral entrepreneurs (Endale, 2011).Various variables are assumed to determine the income of Agro-pastoral entrepreneurs. To analyse the regression model, some basic assumptions needed to be tested. One of the assumptions that needed to be tested was the normality test (appendix-1).

The study used the variance inflation factor to check multicollinearity among continuous variables and contingency coefficient to check multicollinearity among discrete variables. According to the test results, multicollinearity was not a serious problem both the continuous and discrete variables (appendix-1).if vif lies between 1 up-to 10, no multicollinearity if  $vif < 1$  or  $> 10$ , then there is multicollinearity.

As a result, access to government service was substituting by new variable is called residuals (ur), because the new independent variable make more explained for the dependent variable. It is good predictors to the dependent variable and overall significance of the model.

Thirteen explanatory variables were used to determine the owner/manager of income for their capital and consumption. Among these variables education, land size, labour, improved seed, agricultural experience, diseases of livestock and crops, access to credit etc were affected and significant.

Table 3.1 Estimates of multi linear regression model

Source	SS	df	MS	Number of obs =	100
Model	4.1504e+10	13	3.1926e+09	F(13, 86)	= 99.48
Residual	2.7601e+09	86	32094512.4	Prob > F	= 0.0000
				R-squared	= 0.9376
				Adj R-squared	= 0.9282
Total	4.4264e+10	99	447114729	Root MSE	= 5665.2

annualincome	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
education	-4983.786	1789.296	-2.79	0.007	-8540.79 -1426.783
landsize	469.8087	154.8595	3.03	0.003	161.9582 777.6592
labour	4744.545	488.4733	9.71	0.000	3773.492 5715.598
herdsize	136.7045	116.6698	1.17	0.245	-95.22739 368.6363
improvedseed	36.36654	6.731866	5.40	0.000	22.98403 49.74904
familysize	169.4824	418.1975	0.41	0.686	-661.8666 1000.832
agriexperience	781.875	419.0378	1.87	0.065	-51.14458 1614.895
diseaseslc	4279.276	2110.377	2.03	0.046	83.98507 8474.566
creditaccess	-4199.917	1951.753	-2.15	0.034	-8079.874 -319.9605
fertilizer	-442.1801	494.7144	-0.89	0.374	-1425.64 541.2797
chemi_herbici	1004.759	693.8555	1.45	0.151	-374.5802 2384.098
govensupport	-2350.814	1595.978	-1.47	0.144	-5523.512 821.8845
irrigationacces	-3032.19	1321.194	-2.30	0.024	-5658.636 -405.7435
_cons	1025.269	6674.217	0.15	0.878	-12242.64 14293.17

The overall goodness of fit the regression model is measured by the coefficient of determination (R-square = 0.9376). It tells what proportion of the variation in the dependent variable, or regress and, is explained by the explanatory variable. As shown the above table (table 3.1) variance in the dependent variable that comes from the set of independent variables in the model. R-squared lies between 0 and 1, the closer it is to 1, and the better is the fit (Hofer, 2015). Hence, The overall model goodness of fit represented by model count R-square is very good and over 93.76% of the Agro-pastoral entrepreneurs were correctly predicted out of the 100 small business owners/managers.

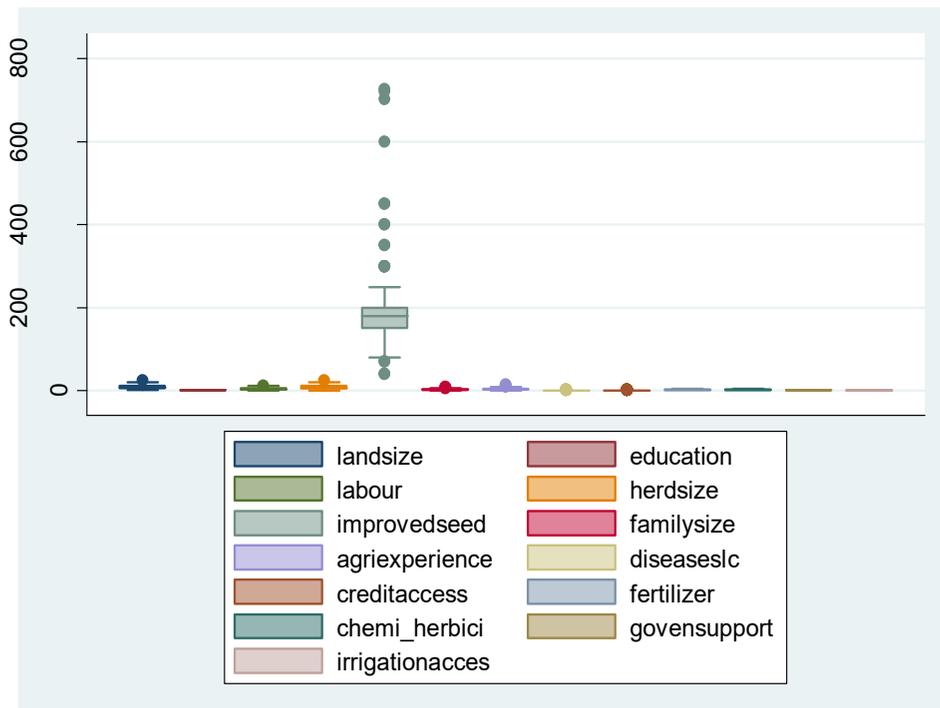


Figure-4: Box graph of the independent variables source: survey result 2018/19

Accordingly, 93.76% variation in the amount of small business owners income is well explained by the explanatory / independent variables and the model is good for prediction purpose. Some variables like;

**Education status of entrepreneurs:** Education has shown negative coefficient effect on the amount Agro-pastoral income and significant at the level of 1%. On average, if the entrepreneur gets not educated, the amount of income decreased by 4983.786 birr than the educated. The result further indicated that, education has improved the producing capacity to small business owners' ability to acquire new idea in relation to market information and improved production which in turn enhanced productivity and thereby increased their income and marketable supply of product. This result is controversial with the study of Assefa (2009), who explained if Avocado producer get educated, the amount of avocado increased that is individual has got income and supplied to the market also increases, which suggest that education improves level of sales that affects the marketable surplus.

**Land size** According to the regression results shown in Table 3.1, land holding size is the determinant factor for crop production (income) in the study areas. The result indicates that, as the landholding size increases the income of small business owners also increase by 469.808 birr. An increase in the size of the land is expected to affect income and welfare of Agro-pastoral entrepreneurs positively. According to Najafi (2003), income production can be increased extensively through the expansion of areas under cultivation.

**Labor:** The coefficient of labour in the above table 3.1 presented which indicate a hopeful relation to the amount of entrepreneur's income. Agro-pastorals entrepreneurs checked the availability of labour for their best advantage and significance at 1%. The positive and major relationship between the variables indicates that as the labour available productivity of agro-pastoral entrepreneurs' income increased by 4744.545 birr.

**Improved seed:** is important determinant factor of Agro-pastoral entrepreneur's income. It is significant variable of the regression model. It has shown negative coefficient effect on the amount Agro-pastoral income and significant at the level of 1%. The result indicates that small business owners of Agro-pastoral entrepreneur's who utilized improved seeds have got 36.4 birr more income compared to Agro-pastoral entrepreneur's who did not get it.

**Agricultural experience:** of owners has positive effect on entrepreneurial and small business success and better agricultural experience or background tends to be more productive and practical experiences enables them to enhance their production management and advanced human skills. Experienced agro-pastoral entrepreneurs increase their income by 781.875 birr than none of experienced agro-pastoral entrepreneurs and significant at the level of 10%. **Diseases of livestock and crops:** it is important determinant factor of Agro-pastoral entrepreneur's income. Table 3.1 depicts direct relationship between diseases and income, which is affected and significant at the level of 5%. Rural agro-pastoral entrepreneurs frequently experienced with different types of diseases which may affect theirs' income inversely, that in turn leads to a reduction in income of entrepreneurs. Diseases that affect livestock and diseases that damage field crop lower the entrepreneurs' income and exposed the entrepreneurs' into unforeseen contingencies.

**Access to credit:** Table 3.1 reveals an inverse relationship between dependent variable (income) with the independent variables (credit). The results show a negative and significant relationship between access to credit and income of entrepreneurs. Access to credit was significant at 5% level meaning that the incomes of entrepreneurs were decreased by 4199.917 birr than none of access to credit sampled entrepreneurs. The negative sign could be due to other factors such as interest rate, short period of repayment, financial skill, bank availability, reluctant to increase credit and cattle ownership. There could also be a possibility of other variables influencing each other (multicollinearity), thus giving a negative and significant sign.

**Access to Irrigation:** is important determinant factor of Agro-pastoral entrepreneur's income. The model result shows that increasing irrigated land by a hectare leads to decreased on the dependent variable or in crop income by 3032 birr. The negative sign could be due to other factors such as fertilizer application, labour, water availability and cattle ownership. There could also be a possibility of other variables influencing each other (multicollinearity), thus giving a negative and significant sign. Reason a highly fragmented land, intensification and lack of improved seed, poor land management at large lack of technology may decrease the income. Irrigation was found to be significant at 5% level meaning that irrigation plays a major role in enhancing income in communal areas.

Linear regression assumes a linear relationship between independent variable(s) and dependent variable. Link test is important to test, because link-test tests of model specification. It basically checks whether we need more variables in our model by running a new regression with the observed dependents against  $y$ -hat predicted and  $y$ -hat-squared as independent variable. If the  $p$ -value of hat-square is not significant then we fail to reject the null hypothesis and conclude that our model is correctly specified.

Table 3.2 link test to model specification

Source	SS	df	MS	Number of obs	=	100
Model	4.4195e+10	2	2.2097e+10	F(2, 97)	=	30844.81
Residual	69491461.5	97	716406.819	Prob > F	=	0.0000
				R-squared	=	0.9984
				Adj R-squared	=	0.9984
Total	4.4264e+10	99	447114729	Root MSE	=	846.41

annualincome	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
_hat	.9954946	.0109147	91.21	0.000	.973832 1.017157
_hatsq	6.67e-08	1.50e-07	0.44	0.658	-2.32e-07 3.65e-07
_cons	36.75309	147.0045	0.25	0.803	-255.0101 328.5163

Source: survey result 2018/19

After generating or predict the un-standardized and standardized residuals of model, overall goodness of fit the multi linear regression model represented by model count R-square is very good and over 99 % were correctly predicted the dependent variable that is income of entrepreneurs as shown below table (table 3.3).

**In-short:**

- R<sup>2</sup> provides the proportion of variability explained by using independent variables (0.999) in table 3.3
- R<sup>2</sup> measures the ability to predict an individual dependent variables using its independent variables
- F-Test of Regression coefficient: Whether the independent variable associated with it is contributing significantly to the variance accounted for in the dependent variable or statistical significance of the overall model (Model F-test) (p-value:0001) from the STAT result below table 3.3 some predicted variables have discussed below:

**Predicted fertilizer Application:** a negative and significant effect on the probability of income and it is significant at 1%. The negative sign could be due to other factors such as fertilizer application, labour, water availability and other related reasons.

**Predicted family size:** has positive effect on entrepreneurial and small business success and better agricultural background tends to be more productive and practical experiences enables them enhance their production, management, and advanced human skills. When family size increase the income of entrepreneurs increase by 165.82 birr and significant at the level of 1%. Family size is important labour source of small business enterprise owners.

Table 3.3 Estimates of multi linear regression model with new variable

Source	SS	df	MS	Number of obs	=	100
Model	4.4195e+10	13	3.3996e+09	F(13, 86)	=	4198.67
Residual	69632771.8	86	809683.393	Prob > F	=	0.0000
				R-squared	=	0.9984
				Adj R-squared	=	0.9982
Total	4.4264e+10	99	447114729	Root MSE	=	899.82

annualincome	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
education	-5238.587	282.869	-18.52	0.000	-5800.912 -4676.262
landsize	464.198	24.58944	18.88	0.000	415.3158 513.0802
labour	4658.193	77.02514	60.48	0.000	4505.072 4811.314
herdsize	140.973	18.52536	7.61	0.000	104.1459 177.8002
improvedseed	35.69335	1.066779	33.46	0.000	33.57267 37.81404
familysize	165.8198	66.42261	2.50	0.014	33.77599 297.8636
agriexperience	878.6887	65.73341	13.37	0.000	748.015 1009.362
diseaseslc	4194.139	335.0729	12.52	0.000	3528.036 4860.242
creditaccess	-2601.546	257.6733	-10.10	0.000	-3113.784 -2089.309
fertilizer	-538.7792	77.88375	-6.92	0.000	-693.607 -383.9514
chemi_herbici	1097.761	109.7503	10.00	0.000	879.5843 1315.937
irrigationacces	-3648.028	199.0654	-18.33	0.000	-4043.757 -3252.299
ur	1	.0171275	58.39	0.000	.9659517 1.034048
_cons	-3361.609	948.6908	-3.54	0.001	-5247.544 -1475.674

This is the source of variance, Model, Residual, and Total. The total variance is partitioned into the variance which can be explained by the independent variables (Model: R-square) and the variance which is not explained by the independent variables. Note that the Sums of Squares for the Model and Residual add up to the Total Variance, reflecting the fact that the Total Variance is partitioned into Model and Residual variance. Technically, linear regression estimates how much dependent variable changes when independent changes one unit.

#### 4. Conclusion and Recommendation

The research results unveiled the determinants of income to agro-pastoral entrepreneurs. Based on the study's econometric analysis, the following variables were found to be in determining the income of the individual small business entrepreneurs in the area: education, land size, labour, improved seed, diseases of livestock and crops, access to credit, and agricultural experience affected the amount income at different significant levels.

The findings also included challenges and opportunities of small business enterprise owners (agro-pastoral entrepreneurs) in the agricultural sectors. The challenges are shortage of inputs (such as improved seed), poor quality of medicine for both livestock and crops, lack of modern technology and skilled man power, which respondents responded. The basic opportunities are existence of fertile land and potential in natural resources in the area.

Therefore, it is recommended that government bodies (regional and federal) should provide on capacity and performance building of agro-pastoral entrepreneurs engaged in agricultural sector of small business enterprises by giving training and other needed activities for sustain economic contribution to local as well as global economy.

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**APPENDEX-1 Model Goodness of Fit**

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. summarize
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Variable	Obs	Mean	Std. Dev.	Min	Max
annualincome	100	21648.9	21145.09	120	90000
education	100	1.62	.4878317	1	2
landsize	100	9.01	4.659074	2	25
labour	100	4.02	2.589723	1	12
herdsize	100	8.62	5.233497	1	25
improvedseed	100	207.28	124.3561	40	726
familysize	100	3.46	1.500303	1	9
agriexperi-e	100	4.06	2.688622	1	15
diseaseslc	100	1.16	.3684529	1	2
creditaccess	100	1.21	.4093602	1	2
fertilizer	100	2.49	1.611167	1	5
chemi_herb-i	100	2.37	1.177697	1	5
govsupport	100	1.69	.4648232	1	2
irrigation-s	100	1.41	.4943111	1	2

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Source	SS	df	MS	Number of obs	=	100
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familysize	169.4824	418.1975	0.41	0.686	-661.8666 1000.832
agriexperience	781.875	419.0378	1.87	0.065	-51.14458 1614.895
diseaseslc	4279.276	2110.377	2.03	0.046	83.98507 8474.566
creditaccess	-4199.917	1951.753	-2.15	0.034	-8079.874 -319.9605
fertilizer	-442.1801	494.7144	-0.89	0.374	-1425.64 541.2797
chemi_herbici	1004.759	693.8555	1.45	0.151	-374.5802 2384.098
govsupport	-2350.814	1595.978	-1.47	0.144	-5523.512 821.8845
irrigationacces	-3032.19	1321.194	-2.30	0.024	-5658.636 -405.7435
_cons	1025.269	6674.217	0.15	0.878	-12242.64 14293.17

```
. vif
```

Variable	VIF	1/VIF
labour	4.94	0.202585
agriexperi-e	3.92	0.255405
education	2.35	0.425492
improvedseed	2.16	0.462584
chemi_herb-i	2.06	0.485501
creditaccess	1.97	0.507849
fertilizer	1.96	0.510276
diseaseslc	1.87	0.536181
govsupport	1.70	0.589069
landsize	1.61	0.622760
irrigation-s	1.32	0.760084
familysize	1.21	0.823521
herdsize	1.15	0.869550
Mean VIF	2.17	

```
. predict yhat
(option xb assumed; fitted values)
(1 missing value generated)
```

```
. predict ur, resid
(1 missing value generated)
```

```
. predict sr,standar
option standar not allowed
r(198);
```

```
. predict sr,rstandar
(1 missing value generated)
```

. linktest

Source	SS	df	MS	Number of obs =	100
Model	4.1618e+10	2	2.0809e+10	F(2, 97)	= 762.87
Residual	2.6459e+09	97	27277495.8	Prob > F	= 0.0000
				R-squared	= 0.9402
				Adj R-squared	= 0.9390
Total	4.4264e+10	99	447114729	Root MSE	= 5222.8

annualincome	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
_hat	.8772155	.0652525	13.44	0.000	.7477073 1.006724
_hatsq	1.94e-06	9.48e-07	2.05	0.043	5.83e-08 3.82e-06
_cons	943.6405	890.7693	1.06	0.292	-824.29 2711.571

. imtest, white

White's test for Ho: homoskedasticity  
against Ha: unrestricted heteroskedasticity

chi2(99) = 100.00  
Prob > chi2 = 0.4530

Cameron & Trivedi's decomposition of IM-test

Source	chi2	df	p
Heteroskedasticity	100.00	99	0.4530
Skewness	32.76	13	0.0019
Kurtosis	2.61	1	0.1061
Total	135.37	113	0.0745

. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Ho: Constant variance  
Variables: fitted values of annualincome

chi2(1) = 9.88  
Prob > chi2 = 0.0017

. avplots

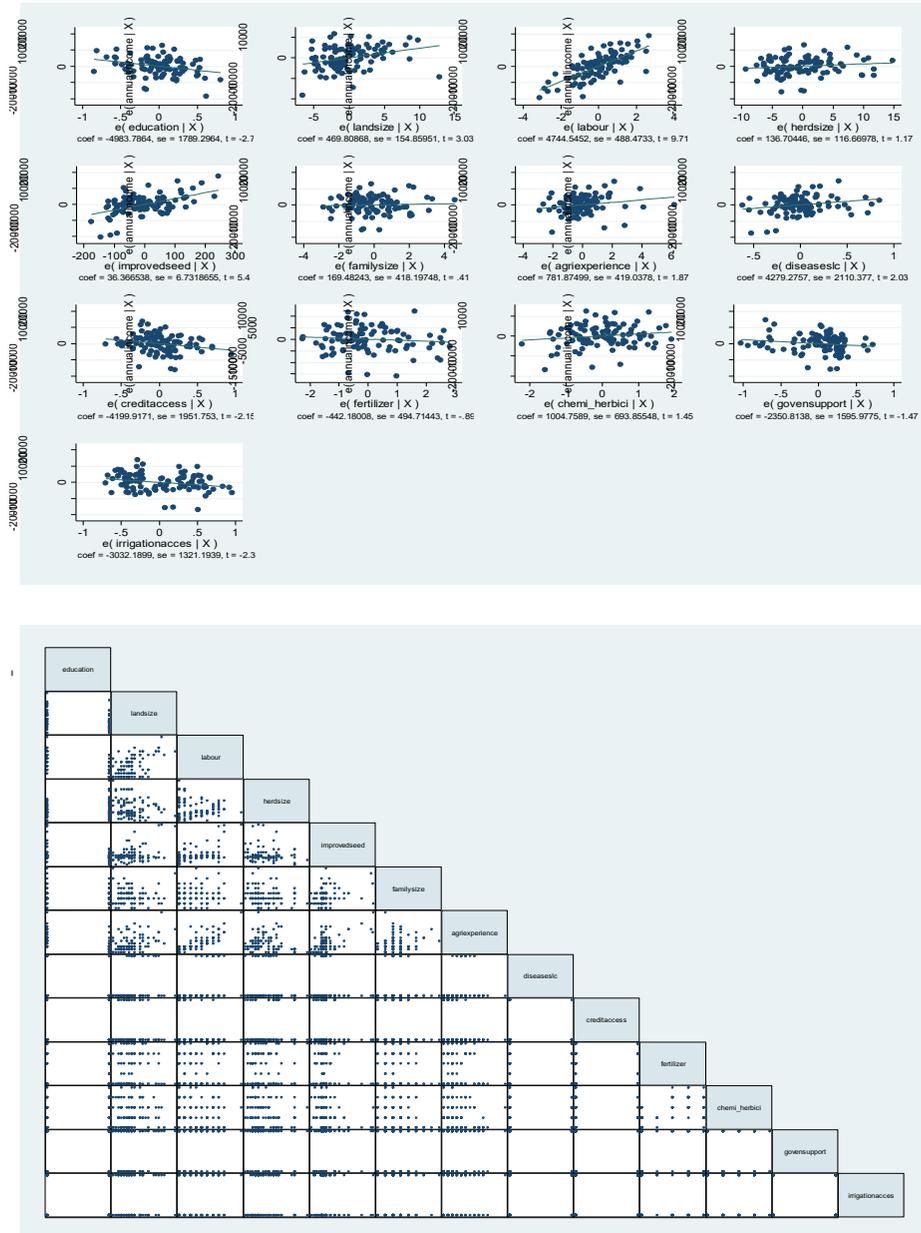
. graph matrix education landsize labour herdsiz improvedseed familysize agriexperience diseaseslc creditaccess fertilizer chemi\_> herbici govnsupport irrigationaces

. graph matrix education landsize labour herdsiz improvedseed familysize agriexperience diseaseslc creditaccess fertilizer chemi\_> herbici govnsupport irrigationaces, half maxis (ylabel(none)xlabel(none))

. reg annualincome education landsize labour herdsiz improvedseed familysize agriexperience diseaseslc creditaccess fertilizer ch> emi\_herbici irrigationaces ur

Source	SS	df	MS	Number of obs =	100
Model	4.4195e+10	13	3.3996e+09	F(13, 86)	= 4198.67
Residual	69632771.8	86	809683.393	Prob > F	= 0.0000
				R-squared	= 0.9984
				Adj R-squared	= 0.9982
Total	4.4264e+10	99	447114729	Root MSE	= 899.82

annualincome	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
education	-5238.587	282.869	-18.52	0.000	-5800.912 -4676.262
landsize	464.198	24.58944	18.88	0.000	415.3158 513.0802
labour	4658.193	77.02514	60.48	0.000	4505.072 4811.314
herdsiz	140.973	18.52536	7.61	0.000	104.1459 177.8002
improvedseed	35.69335	1.066779	33.46	0.000	33.57267 37.81404
familysize	165.8198	66.42261	2.50	0.014	33.77599 297.8636
agriexperience	878.6887	65.73341	13.37	0.000	748.015 1009.362
diseaseslc	4194.139	335.0729	12.52	0.000	3528.036 4860.242
creditaccess	-2601.546	257.6733	-10.10	0.000	-3113.784 -2089.309
fertilizer	-538.7792	77.88375	-6.92	0.000	-693.607 -383.9514
chemi_herbici	1097.761	109.7503	10.00	0.000	879.5843 1315.937
irrigationaces	-3648.028	199.0654	-18.33	0.000	-4043.757 -3252.299
ur	1	.0171275	58.39	0.000	.9659517 1.034048
_cons	-3361.609	948.6908	-3.54	0.001	-5247.544 -1475.674



Adj R2 (not shown here) shows the same as R2 but adjusted by the # of cases and # of variables. When the # of variables is small and the # of cases is very large then Adj R2 is closer to R2. This provides a more honest association between X and Y.

4) Two-tail p-values test the hypothesis that each coefficient is different from 0. To reject this, the p-value has to be lower than 0.05 (you could choose also an alpha of 0.10). In this case, expense, income, and college are not statistically significant in explaining SAT; his is almost significant at 0.10. Percent is the only variable that has some significant impact on SAT (its coefficient is different from 0)

5) The t-values test the hypothesis that the coefficient is different from 0. To reject this, you need a t-value greater than 1.96 (at 0.05 confidence). You can get the t-values by dividing the coefficient by its standard error. The t-values also show the importance of a variable in the model. In this case, percent is the most important.

6) Root MSE: root mean squared error, is the Sd of the regression. The closer to zero better the fit.