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THE EFFECT OF SHOCKS: AN EMPIRICAL ANALYSIS OF ETHIOPIA

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ABSTRACT

Besides striving for the increase of production and development, it is also necessary to reduce the losses created by the shocks. The people of Ethiopia are exposed to the impact of both natural and man-made shocks. Following this, policy makers, governmental and non-governmental organizations need to identify the important shocks and their effect and use as an input. This study was conducted to identify the food insecurity shocks and to estimate their effect based on the conceptual framework developed in Ethiopia, Amhara National Regional State of Libo Kemkem District. Descriptive statistical analysis, multiple regression, binary logistic regression, χ^2 and independent sample t-test were used as a data analysis technique. The results showed eight shocks affecting households which were weather variability, weed, plant insect and pest infestation, soil fertility problem, animal disease and epidemics, human disease and epidemics, price fluctuation problem and conflict. Weather variability, plant insect and pest infestation, weed, animal disease and epidemics created a mean loss of 3,821.38, 886.06, 508.04 and 1,418.32 Birr, respectively. In addition, human disease and epidemics, price fluctuation problem and conflict affected 68.11%, 88.11% and 14.59% of households, respectively. Among the sample households 28,1 % were not able to meet their food need throughout the year while 71,9 % could. The result of the multiple regression models revealed that weed existence (β = –0,142, p < 0,05), plant insect and pest infestation (β = –0,279, p < 0,01) and soil fertility problem (β = –0,321, p < 0,01) had significant effect on income. Asset was found significantly affected by plant insect and pest infestation (β = –0,229, p < 0,01), human disease and epidemics (β = 0,145, p < 0,05), and soil fertility problem (β = –0,317, p < 0,01) while food production was affected by soil fertility problem (β = –0,314, p < 0,01). Binary logistic regression model revealed that food availability of the households was highly affected by the asset (Exp(B) = 1,00, p < 0,1), and food production (Exp(B) = 1,379, p < 0,01).

KEY WORDS

shocks, effect, Ethiopia, food availability, binary logistic, multiple regression

CLASSIFICATION

JEL: C12, D13, H31

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INTRODUCTION

A shock is defined as a ‘sudden event that impacts on the vulnerability of a system and its components’. In case of slow onset hazards it is ‘when the event passes its tipping point and becomes an extreme event’ [1]. Shocks are natural, social, economic, and political in nature. They can occur as slow or rapid onset shocks or longer-term stresses or trends and can be idiosyncratic or covariate in nature. Shocks can be transitory, seasonal, or structural, and their frequency, severity and duration can vary widely [2]. Shock includes human health shocks, natural shocks, economic shocks, conflict, and crop and livestock health shocks [3].

Shocks are usually localized and therefore threaten the livelihoods of only parts of the population directly affected through loss of household assets, market access, and income earning opportunities, among others [4]. Shocks can destroy assets directly (in the case of floods, storms, civil conflict, etc.). They can also force people to abandon their home areas and dispose off assets (such as land) prematurely as part of coping strategies [3].

The Horn of Africa is acutely vulnerable to food security crises that arise from complex causes, including swift shocks from the vagaries of climate, particularly exposure to drought and flooding, and slower moving stresses like the complex nexus of rapid population growth, land fragmentation, natural resource degradation, and conflict [5].

Due to recurrent natural and manmade hazards, degradation of natural resources, lack of land and labor fertility and other related reasons many Ethiopian people live with food insecurity problems [6]. Even though there are some variations across regions drought, flood, erosion, frost, crop pests, livestock pests, input access, input price rise, death and illness are the most important shocks in Ethiopia [7].

The study area, Libo Kemkem, is among the food insecure areas of Amhara region. Productive Safety Net Program and other interventions have been practiced for food insecure households. However, they could not build their resilience to protect themselves from shocks and food insecurity is still the major problem of the area.

The identification of shocks and their effect should be a prerequisite and an input for food security building activities. Despite this, it does not gain adequate consideration neither at country level nor at local level. In view of this, study was conducted to identify the shocks in the Libo Kemkem district and to estimate their effect.

CONCEPTUAL FRAMEWORK OF THE STUDY

Conceptual framework was constructed to show the relationship between variables and to shape the study. The independent variables, crop shocks, animal shocks, human shocks and economic shocks affect food production, income and asset of the household directly and food availability indirectly, Figure 1. Households affected by shocks could have low food production, income and assets possession and this affects household food availability status from production, purchase or shared out negatively. The working hypothesis of this study is stated as: shocks have direct effect on food production, income and assets and indirect effect food availability of households.

METHODOLOGY

STUDY AREA

This study was undertaken in Ethiopia, Amhara National Regional State of Libo Kemkem District. Based on the data from Libo Kemkem District Agriculture and Rural Development

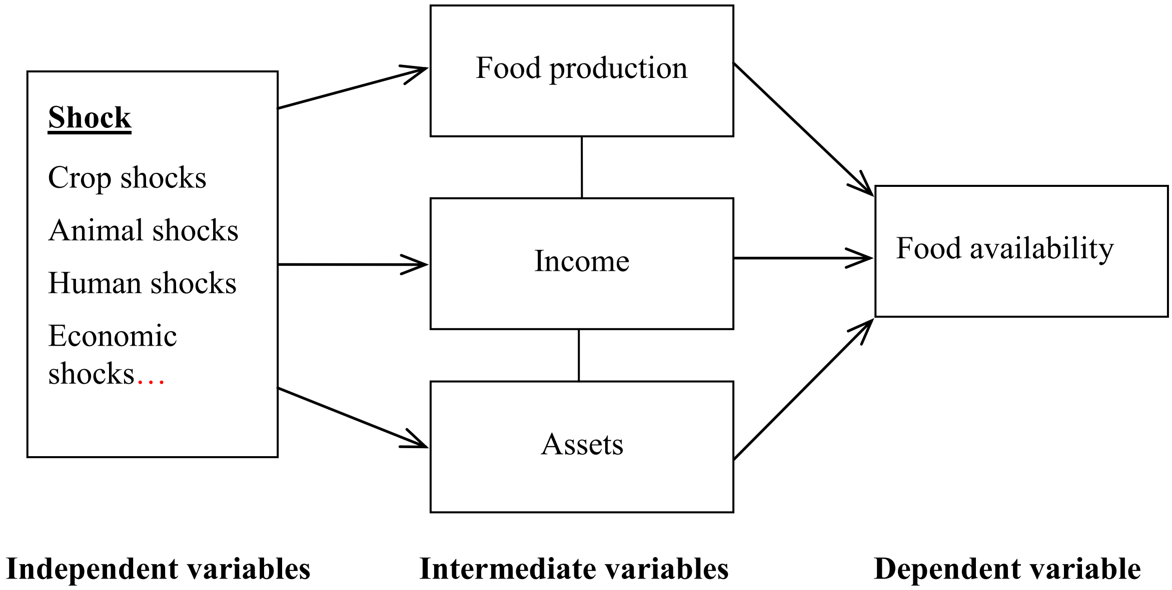

Figure 1. Conceptual framework of the study.

Office [8], the population of the district is around 225 499. The district is adjacent to West Belesa in the South, Fogera and Ebenat in the West and East, respectively, and Lake Tana in the West [9]. Addis Zemen is the center of the district and it is found 652 km from the country capital Addis Ababa and 80 km from the regional capital Bahir Dar.

METHODS OF SAMPLING AND DATA COLLECTION

Data of this study was obtained from field survey. Using two stage random sampling technique 185 households were selected for the study. First, three kebeles were randomly selected as a representative of the district. Then, the sample households were selected proportionally from each kebele. A semi-structured questionnaire was used as a data collection tool. Data collectors randomly selected the households to be interviewed.

DATA ANALYSIS TECHNIQUE

Data obtained was analyzed through descriptive statistical analysis, multiple regression, binary logistic regression, independent sample t-test and χ^2. Descriptive statistics were computed to describe some of the variables in the form of mean, standard deviation and percentage. Independent sample t-test was used for the purpose of comparison of mean differences between food available and food non available households with regard to continuous variables. Likewise χ^2 was used for dummy variables. The data analysis was done using SPSS version 16.

The multiple regression models were used for this study to analyze the effect of shocks on intermediate variables. Multiple regression is the instrument of choice when the researcher believes that several independent variables interact to predict the value of a dependent variable and when the dependent variable is measured on continuous scale. Thus, three multiple regression models were run to observe the effect of shocks on income, food production and assets.

The general formula for multiple regression models is given as follows

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n + \varepsilon, \quad (1)$$

where Y_i denotes the dependent variable, β_0 is the constant term, X_1 to X_n denote the explanatory variables, β_1 to β_n are the coefficients associated with explanatory variables and ε is the observable random error term or disturbance.

The multiple linear regression models were estimated using the ENTER method and F-test computed to observe the significance of the models. Diagnostic tests were also carried out to check for multicollinearity of the variables included in the model.

Binary logistic regression was used to estimate the effect of intermediate variables on the dependent variable (food availability). The dependent variable is measured in terms of dummy variables; 0 for food non available and 1 for food available, based on their food availability status throughout the year. The analysis of the logistic regression model shows that, changing an independent variable alters the probability that a given household becomes food available. The equation of logistic regression is

$$Z_\mathrm{i} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + ... + \beta_n X_n + U_i, \tag{2}$$

where β_0 is an intercept, β_1, β_2, …, β_n are slopes of the equation in the model, X_1, X_2, …, X_n are intermediate variables and U_i is a disturbance term.

RESULTS AND DISCUSSION

FOOD AVAILABILITY SITUATION

Food availability refers to the physical presence of food stocks in desired quantities [10]. The results showed that of the total 185 households, 52 households (28,1 %) were not able to cover their food need by their own throughout the year. The remaining 133 households (71,9 %) had the ability to cover their food need all over the year.

THE EXISTENCE AND EFFECTS OF SHOCKS

The studyidentified eight shocks and among these weather variability, weed, plant insect and pest infestation and soil fertility problem were crop shocks. Animal disease and epidemics was animal shock and price fluctuation problem was economic shock. In addition, human disease and epidemics and conflict were categorized under human shocks[1].

The effect of the shocks on food production was measured by comparing the gained production with that of expected production if that shock never happened. Since the households cultivate different type of crops, it is difficult to estimate their crop production loss in kilograms and sum. Thus, the extent of each crop loss converted into its respective price value and summed to gain the total crop loss in Birr[2].

More than three-fourths (83,78 %) of the sample households were affected by weather variability. The sample households lost a mean of 3 821,38 Birr estimated production damage due to early emergence, delay, excessiveness of rain (flood) or any other form of weather variability.

Plant insect and pest infestation was recorded on 112 (60,54 %) sample households while weed had an effect on 82 (44,32 %) households. Plant insect and pest infestation and weed also created a mean loss of 886,08 Birr and 508,48 Birr, respectively.

In addition, animal disease and epidemics affected 98 (52,97 %) sample households and create a mean loss of 1418,32 Birr.

Further, two human shocks affecting households were indentified. These shocks, human disease and epidemics and conflict affected 126 (68,11 %), and 27 (14,59 %) sample households, respectively. The sample households had a mean illness score of 0,615. In addition, the economic shock price fluctuation problem had affected 163 (88,11 %) households (Table 1).

Figure 2 shows the existence of the shocks in households. Price fluctuation problem was the primary shock existing in 88,11 % of households. Weather variability and soil fertility problem were the second and third shocks in occurrence, respectively. In contrast, conflict was recorded as the least existing shock occurring only in 14,59 % of sample households.

Table 2 depicts the mean score of the sample households with regard to the effect of the shocks aggregated by food availability. Independent sample T-test and χ^2 were employed to show the relationship between the food availability and the shocks. The results indicated that only soil fertility problem had statistically significant relationship with food availability at less than 1 % probability level.

Table 1. The existence and effect of shocks on sample households ($N = 185$).

No	Type of shock	Existence of the shock				Mean effect of the shock, Birr	Total effect, Birr
		No		Yes			
		No.	%	No.	%		
Crop							
1	Weather variability	30	16,22	155	83,78	3 821,38	70,6955
2	Weed	103	55,68	82	44,32	508,48	94,0680
3	Plant insect and pest infestation	73	39,46	112	60,54	886,08	16,3925
4	Soil fertility problem	53	28,65	132	71,35		
Animal							
5	Animal disease and epidemics	87	47,03	98	52,97	1 418,32	262,389
Human							
6	Human disease and epidemics	59	31,89	126	68,11	0,6149 illness score	113,76 illness score
7	Conflict	158	85,41	27	14,59	0,21	39
Economic							
8	Price fluctuation	22	11,89	163	88,11		

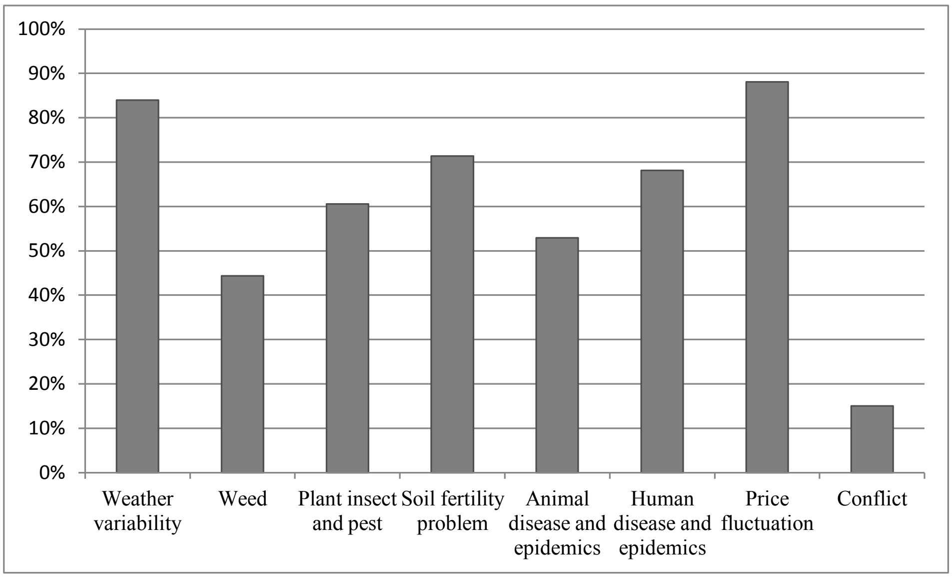

Figure 2. The existence of the shocks in sample households in percents ($N = 185$).

Table 2. Distribution of sample households by food availability and shocks ($N = 185$).

Type of shock	Variable type	Variable definition	Food non-available ($N = 52$)		Food available ($N = 133$)		Total sample ($N = 185$)		t-value (χ^2)
			Mean	SD	Mean	SD	Mean	SD	
Weather variability	Continuous	Crop production loss due to the shock, in Birr	5 833,94	20 583,59	3 034,51	3 452,25	3 821,38	11 294,97	–1,521
Weed	Continuous	Crop production loss due to the shock, in Birr	485,15	826,69	517,59	1092,30	508,48	1022,53	0,193
Plant insect and pest infestation	Continuous	Crop production loss due to the shock, in Birr	745,58	1651,91	941,02	1862,25	886,08	1803,33	0,662
Soil fertility problem	Dummy	0, no soil fertility problem, 1 otherwise							6,225*
Animal disease and epidemics	Continuous	Animal production loss due to the shock, in Birr	1660,23	3 293,13	1323,74	3 572,86	1418,32	3490,93	–0,588
Human disease and epidemics	Continuous	The effect of human disease and epidemics in terms of illness score	0,75	0,74	0,56	0,71	0,615	0,722	–1,571
Price fluctuation problem	Dummy	0, no price fluctuation problem, 1 otherwise							1,218
Conflict	Continuous	Number of conflicts	0.23	0,65	0,20	0,57	0,211	0,593	–0,285

*significant at probability level 1 %

FOOD PRODUCTION, INCOME AND ASSET

Description of and correlation between food production, income and asset

The sample households gained an annual mean income of 5 864,95 Birr. The Food available households earned a mean of 6 869,29 Birr while the food non available households gained 3 296,17 Birr. Besides, the sample households possessed a mean of 11 753,46 Birr estimated assets while 6 093,21 Birr and 13 966,49 Birr were the estimated asset possessions of the non food available and food available households, respectively.

In addition, the households produced food which was sufficient enough for a mean of their 8,99 months food need. The food non available households produced food for a mean of 7,13 months while the food available households produced a mean of 8,99 months food. The independent sample T-test result shows that there was a significant difference in the mean of food non available and food available households at less than 1 % probability level in the income, asset and food production (Table 3).

In order to identify the degree of association between intermediate variables correlation analysis was computed. All of the 3 cells in the correlation matrix were positively and significantly correlated at less than 1 % probability level (2-tailed) (Table 4).

Table 3. Distribution of sample households by income, assets and food production ($N = 185$).

Variable	Food non-available ($N = 52$)		Food available ($N = 133$)		Total sample ($N = 185$)		t-value
	Mean	SD	Mean	SD	Mean	SD	
Income, Birr	3 296,17	2 818,24	6 869,29	9 162,55	5 864,95	8 063,63	–2,757*
Assets, Birr	6 093,21	5 866,81	13 966,49	16 310,82	11 753,46	14 594,22	–6,477*
Food production, months	7,13	2,41	9,71	2,45	8,99	2,693	–3,391*

*significant at probability level 1 %

Table 4. Correlation between assets, income and food production ($N = 185$).

Variable	1	2	3
Food production (1)	1		
Income (2)	0,359*	1	
Assets (3)	0,395*	0,616*	1

*significant at probability level 1 % (2-tailed)

Food production had a positive relation with income of the household ($r = 0{,}359$, $p < 0{,}01$) and asset ($r = 0{,}395$, $p < 0{,}01$). This is due to the possibility of converting food production in to income. Some of the produced food which is beyond the household need will be taken to the local market and sold. In addition, assets are used as an input for food production activities. Human labour, livestock and farming equipments can be used as an input. Also, fertilizers, pesticides and herbicides are purchased for crop production.

Assets showed a strong positive relationship with income of the household ($r = 0{,}616$, $p < 0{,}01$). The possible reason for this is the ability of assets to be used as a generation of income source for the household. Livelihoods of the households depend on their asset possession and these livelihoods create income for the household. Also income could be used as a source of asset. The income could be vested for the creation or development of assets.

The effect of shocks on food production, income and assets

Multiple linear regression models were used to estimate the effect of shocks on intermediate variables. Three multiple linear regression models, for income, asset and food production, were computed (Table 5). These three models showed 22,9 %, 19 % and 12,7 % of the variation, respectively. Multicollinearity tests conducted showed that there was no strong correlation between variables. The result of F-test revealed the significance of all of the models at less than one percent significance level.

Out of eight shock variables included in the income model, three shocks were found to have a significant effect on income of the household. Plant insect and pest infestation (β = –0,279) and soil fertility problem (β = –0,321) were found significant at less than one percent probability. In addition, weed existence (β = –0,142) was found to have a significant effect on income at less than 5 % probability level.

The direction of coefficient of all of these significant variables showed a negative relation with income of the household. With constant condition of other variables, a one standard deviation unit increase in plant insect and pest infestation, soil fertility problem and weed existence_resulted in the decrease of household income by 0,279, 0,321 and 0,142 standard deviation units, respectively.

There are some possible reasons for this. First the household incur some cost for the management of these shocks. Insecticide, pesticide, herbicides and fertilizer invested to manage these shocks. Also employed human power could be used for weeding. These are additional costs which has effect on net income of the households. In addition, agricultural land with such shocks creates low income in rent out.

Likewise, the second multiple regression model, asset, come up with three significant shocks. Plant insect and pest infestation (β = –0,229) and soil fertility problem (β = –0,317) were found to negatively and significantly affect assets at less than 10 % probability level. This is due to the damage created by the pests and insects on stored agricultural output. Also some pests and insects reduce the quality of agricultural land. In addition, soil fertility problem reduces the quality of agricultural land which is natural asset.

However, human disease and epidemics (β = 0,145) were found to positively and significantly affect asset at less than 5 % probability level. The result of this shock is in contrast to expected. The possible reason for this is the frequent occurrence of disease and epidemic on the non productive segment of the households. It was recorded that most of the victims were children and elders who have less role in asset creation and protection.

In the third model, food production was found to be significantly affected by soil fertility problem (β = –0,314) at less than 1 % probability level. Soil fertility is one of the essential requirements of crop production. Due to overploughing, the land has lost its fertility. Losing this quality of soil creates a huge reduction on the production. Some of the households produced less than the mean expected production as a result of this.

INCOME, ASSET, FOOD PRODUCTION AND FOOD AVAILABILITY

Binary logistic regression was used to show the effect of intermediate variables (food production, income and asset) on food availability (Table 6). The model χ^2 value was 40,232 and it was significant at less than 1 percent probability level. It also had a prediction success of 75,7 %.

The result showed that asset (Exp(B) = 1,000, P < 0,1) and food production (Exp(B) =1.379, P < 0,01) significantly affected food availability of the households. With constant condition of other things, the odd ratio in favoru of food availability increased by 1,000 and 1,379 when the asset possession increased by one Birr and food production increased by one month, respectively.

Table 5. Multiple linear regression estimates ($N = 185$).

Independent variables	Model 1: Income		Model 2: Asset		Model 3: Food production	
	Standardized coefficient	t-value	Standardized coefficient	t-value	Standardized coefficient	t-value
(Constant)		5,951		6,403		14,660
Weather Variability	0,006	0,085	–0,016	–0,232	0,042	0,595
Weed	–0,142	–2,116*	–0,081	–1,178	–0,060	–0,844
Plant insect and pest infestation	–0,279	–4,095**	–0,229	–3,283**	–0,075	–1,043
Animal disease and epidemics	–0,065	–0,977	–0,081	–1,184	0,048	0,669
Human disease and epidemics	0,022	0,325	0,145	2,064*	0,114	1,570
Price fluctuation problem	–0,090	–1,305	0,004	0,063	0,011	0,152
Conflict	–0,062	–0,924	–0,054	–0,791	–0,090	–1,264
Soil fertility problem	–0,321	-4,651**	–0,317	–4,489**	–0,314	–4,284**
R^2	0,229		0,190		0,127	
F-test	6,516**		5,169**		3,193**	

*significant at probability level 1 %
**significant at probability level 5 %

Table 6. Logistic regression estimates of factors affecting food availability ($N = 185$).

Variables	B	S.E.	Wald	Sig.	Exp(B)
Assets	0,000	0,000	2,858*	0,091	1,000
Income	0,000	0,000	0,193	0,661	1,000
Food production	0,322	0,076	17,943**	0,000	1,379
Constant	–2,316	0,624	13,776	0,000	0,099
Log likelihood	–89.769				
χ^2	40,232**				
Prediction success	75,7 %				
R^2	0,195 (Cox and Snell), 0,281 (Nagelkerke)				

*significant at probability level 1 %
**significant at probability level 10 %

The rural households spent most of their food production to cover the need of the family. Thus it is not surprising to see a strong effect of food production on availability. In addition, assets had positive significant effect on food availability. The reason for this is the ability to found food_from shared out. Households shared their land and/or livestock and they got some percent of the crop production for their consumption.

CONCLUSIONS

The study was employed to identify shocks and their effect based on the conceptual framework developed in Ethiopia, Amhara National Regional State of Libo Kemkem District. Through semi structured interview eight shocks were identified as affecting households in the study area. Among these weather variability, weed, plant insect and pest infestation and soil fertility problem were crop shocks. Animal disease and epidemics was an animal shock and price fluctuation problem was a socio economic shock. Human disease and epidemics and conflict were categorized under human shock.

Weather variability creates a mean loss of 3 821,38 Birr while plant insect and pest infestation, weed and animal disease and epidemics creates a mean loss of 886,06 Birr, 508,04 Birr and 1 418,32 Birr respectively. In addition, human disease and epidemics, price fluctuation problem and conflict affect 68,11 %, 88,11 % and 14,59 % of households, respectively.

The results of the study show that 28,1 % of the households were not able to cover their food need while 71,9 % had the ability to cover their food need all over the year. Among the shocks only soil fertility problem had statistically significant relationship ($p < 0,01$) with food availability.

The result of the multiple regression models for income revealed that food production affected by weed existence ($\beta = -0,142$, $p < 0,05$), plant insect and pest infestation ($\beta = -0,279$, $p < 0,01$) and soil fertility problem ($\beta = -0,321$, $p < 0,01$). Asset was found to be affected by plant insect and pest infestation ($\beta = -0,229$, $p < 0,01$), human disease and epidemics ($\beta = 0,145$, $p < 0,05$), and soil fertility problem ($\beta = -0,317$, $p < 0,01$) while food production was affected by soil fertility problem ($\beta = -0,314$, $p < 0,01$).

The food availability of the households was significantly affected by the asset (Exp(B) = 1,00, $p < 0,1$) and food production (Exp(B) = 1,379, $p < 0,01$).

REMARKS

[1]Human disease and epidemics was measured by the illness score constructed [11].
[2]Birr is the currency of Ethiopia.

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