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Determinants Of Food Security In Kilte Awelalo, Ethiopia

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Abstract: ***Majority of globe's poor in most developing countries live in rural areas majorly depending on undersized farms as main source for income and food. Improving agricultural productivity of these smallholding farmers is one means of enhancing households' food security. Food insecurity and undernourishment are present crucial policy challenges in Ethiopia. The study's main aim is to assess the determining factors of smallholding farmers in their strive to achieve food security. Kilte Awelalo was taken as a study area and three Tabias were selected. The total sample number of households from these three Tabias was 370 and a formal interview schedule was employed to collect relevant primary inputs. Accordingly, the study found variables like land size, educational attainment, livestock holdings, irrigation and participation in formal and informal institutions as major impacting factors.***

Keywords: Rural Food Security, Livelihoods, BMI

I. INTRODUCTION

Majority of globe's poor in most developing countries live in rural areas majorly depending on undersized farms as main source for income and food. Improving agricultural productivity of these smallholding farmers is one means of enhancing households' and national food security. Food security is a growing concern for majority developing nations in the globe and similarly food insecurity and undernourishment are present crucial policy challenges in Ethiopia. According to A. Sen, (1981) food security has gone beyond the notion of physical food supply so as to incorporate access which is determined by food entitlements, vulnerability and sustainability. For developing nations as a whole, the total share of undernourished people in the total population has declined from 23.3% in 1990-92 to 12.9%. A pronounced decline in number of undernourished was perceived majorly from developing nations despite the significant population growth (FAO, 2015).

The Sub-Saharan Africa has the highest prevalence of undernourishment though there has been seen a betterment in the last two decades. Undernourishment has declined from 32.7% to 24.8% in 2014. The five countries in Africa with the highest undernourishment are Ethiopia, Tanzania, Nigeria, Kenya and finally Uganda (Birara E., 2015). Ethiopia is frequently affected by food deficits where on average 5 million people require food aid each year. Additional to this, due to El-nino impact, the number of population who are in need of direct food aid has increased to 15 million (Federal Democratic Republic of Ethiopia, 2015).

Various factors can be put in plain words towards the increasing food insecurity condition in Ethiopia. The interaction between high population growth pressure, fragmentation of land holding sizes, environmental degradations and others have led to a very significant decline on household's crop productivity and food security condition. Combining these aforementioned challenges with recurring droughts over years, have substantially eroded the productive assets of households where by affecting community assets like forests and pasture leading to an escalating environmental degradation and high pressure on farm. In similar lines, smallholder farmers are unable to cope up with seasonal shortfalls because of less accumulation of savings and assets like food and livestock holdings, even in good days.

The major objective of this study is assess the major determining factors of food security basing on the primary data collected by using interview schedule from 370 smallholding farmers in selected areas in Kilte Awelalo Woreda. Concomitantly, the study has tried to highlight major determinants food security in the study areas in three major

categories; Adequacy in supply by Months of Adequate Household Food Provisioning (MAHFP), consumption by Food consumption Score and finally utilization determinants by using BMI (Body mass index).

II. MODEL SPECIFICATION

For this study, food security determinants model has been designed in three phases accordingly to the three major food security components; Access, Availability and utilization. Household's Food Consumption Score (FCS) value is used as a dependent variable to see households access to sufficient and nutritious food.

Food Access (FA) = Food Consumption Score (FCS) + ϵ …1

Food access (FA) is not observable where as food consumption score (FCS) is observable, and thus FA is the latent variable. Therefore, by employing the typical threshold food consumption score as a base,

If FA < 21 ⟶ (P) Poor food consumption
If 21<FA <35 ⟶ (B) Borderline food consumption…..2
If FA >35 ⟶ (A) Acceptable food consumption

We can follow to estimate likelihood function in form of assuming the error terms are independent

$$L=\prod_{i=1}^{n_1}\Phi(21-X\beta)\prod_{i=1}^{n_2}\Phi(21-X\beta)-\Phi(35-X\beta)\prod_{i=1}^{n_3}1-\Phi(35-X\beta) \quad \text{.....3}$$

Food Availability (FAV) = Months of Adequate Household Food Provisioning (MAHFP) + ϵ……4

MAHFP is count type which is the number of months where a given household has adequate food provision for its household members.

$$f(Y_i)=\frac{\mu^Y e^{-\mu}}{Y!} \quad \text{.....5}$$

Where Y= 0, 1, 2, 3,….

$Y!$ is "Y factorial" where $Y!=Y \times (Y-1) \times (Y-2) \times 2 \times 1$

Accordingly, the Poisson regression model is given by;

$$\text{Prob}(Y_i=y_i|x_i)=\frac{e^{-\lambda_i}\lambda_i^{y_i}}{y_i!} \quad \text{.....6}$$

Where the Y_i is the count index of months of adequate food availability in a given year and X_i are independent variables which determine the number of months of adequate food supply. The, log-likelihood function is as follows;

$$\ln L=\sum_{i=1}^{n}\left[-\lambda_i+y_i x'_i\,\beta-\ln y_i!\right] \quad \text{.....7}$$

Regarding food utilization of households, a body mass index (weight for height) is used as a dependent variable to assess the utilization which is the third component of food security.

BMI (Utilization) = $X_0\beta_0+\varepsilon$ ……. 8

Where X_0 and β_0, represent observed independent variables and their parameters respectively. The error vector (ε) represents the average effect of all unobserved variables. Taking the natural logarithm of both sides, we will get the log likelihood function (LL),

$$LL=\sum_{Y=1}\ln[P(\varepsilon_i<X_{0i}\beta_0)]+\sum_{Y=0}\ln[1-P(\varepsilon_i<X_{0i}\beta_0)] \quad \text{.....9}$$

A range of demographic and socio-economic variables that are expected to influence or else determine the household food security status were incorporated as independent variables.

III. RESULTS AND DISCUSSION

In Ethiopia, the debate over the causes and determinants of food insecurity has stimulated a highly antagonistic viewpoints between the development thinking and the academic disciplines over the past few decades, giving a rise to proliferation of economic, demographic, cultural and political prominence across food security literatures. The root factors of the problem at household, regional and national level are quiet complex. The key causes can be grouped into three major types as socioeconomic, natural causes and policy factors (Ellis F., 2000).

With regard to determining factors of food consumption pattern among the smallholding farmers, 8 variables were found to have a significant impact on the probability of better food consumption.

Food Con SC.	Coef.	Std. Err.	Z	P>z	[95% Conf.	Interval]	dy/dx
_Iedun_2	-2.671609	1.610733	-1.66	0.097***	-5.828588	.4853691	-.7771452
_Iedun_3	.6616691	.3952457	1.67	0.094***	-.1129982	1.436336	.178649
_Iedun_4	-2.137606	5.843498	-0.37	0.715	-13.59065	9.315439	-.7040206
HH size	-.2607563	.1228461	-2.12	0.034**	-.5015303	-.0199823	-.077886
Land size	1.078707	.2149779	5.02	0.000*	.6573582	1.500056	.3222021
_Ifertilit~2	-.4858679	.3949284	-1.23	0.219	-1.259913	.2881775	-.1478293
_Ifertilit~3	2.169628	.5203194	4.17	0.000*	3.189435	1.149821	.6879182
Main Mkt. Dist.	.5744457	.1152093	4.99	0.000*	.3486396	.8002519	.1715828
Irrigation	1.829938	.3583362	5.11	0.000*	1.127612	2.532264	.5533563
Improved seed	-.9463196	1.137396	-0.83	0.405	-3.175574	1.282935	-.1945339
Safety net	-.2311191	.5110746	-0.45	0.651	-1.232807	.7705687	-.0690336
Total livestock	.2938816	.0508392	5.78	0.000*	.1942386	.3935247	.0877803
Off-farm act.	-1.473713	.6823117	-2.16	0.031**	-2.81102	-.1364071	-.4401877
_cons	-2.876809	1.603423	-1.79	0.073	-6.01946	.2658416	
Probit regression					Number of obs = 370		
					LR chi2(13) = 294.31		
					Prob > chi2 = 0.0000		
Log likelihood = -60.703814					Pseudo R2 = 0.7080		
Marginal effects after Probit					y = Pr(Food Con. SC.) (predict) = .77660885		

Source: Survey result, 2016

*NOTICE: *, ** and *** significant at 1%, 5% and 10% significance levels, respectively*

Table 1: Estimates of Maximum-Likelihood Probit model of Food Consumption Score

The significant variables were Education level, Household size, higher fertility, distance from main market, irrigation, livestock holdings and off-farm activities participation. The study found an inverse relation between household size and food consumption score of households implying as the number of household size increases by 1, food consumption of a household decreases by 7.7%. Household size is a very crucial factor in determining food availability condition at household level especially in rural areas like of the study areas'. As the number of member living under the same roof increases, the number of mouths to be fed increases

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where by decreasing the food availability of the household (Ellis F., 2000). It was also found farm land has a high significance where households with an additional farm land size of 0.25 Ha have a 32.2% better chance increasing their food consumption. Other similar studies have also revealed farm land size as one of the major significant factors which stands as a mark for the wealth difference among households in the study areas (Stephen D., 2010). Moreover, the survey revealed that comparing households with a highly fertile farm land to the households with a less fertile land, food consumption score of households with a fertile farm land increases by 68.8%. Fertility level of the farm land is also one big factor which plays an important role in the food availability condition of households (Kidane, H., Alemu, Z.,& Kundhlande G., 2005).

Furthermore, the estimated distance from the main market to the households' residence was also found to be highly significant at 1% level of significance, as distance increases by 1km, food consumption score of households increases by 17.1%. The smallholding farmers in the study areas are highly dependent on rain fed agriculture as majority of them are highly unaware and incapable to afford and employ irrigation system in their production. Correspondingly, the study found that irrigation is one of the highly decisive and positively significant factor at 1% level of significance where food consumption score of households who are employing irrigation is superior by 55.3% than those who do not employ. The total number of livestock holding measured in total livestock unit was found to be highly significant at 1% significance level and as the number of total livestock holdings increases by 1 livestock unit, food consumption score increases by 8.7%.

MAHFP	Coef.	Std. Err.	Z	P>z	dy/dx	Std. Err.	z	P>|z|	X
Age	.00422 22	.0022 291	1.89	0.058 *	.02720 74	.01436	1.90	0.058	53.83 24
Sex	-.07173 05	.0934 136	-0.77	0.443	-.46222 46	.60184	-0.77	0.442	1.154 05
_Iedun_2	-.31396 84	.1171 832	-2.68	0.007 **	-1.7600 98	.56745	-3.10	0.002	.0432 43
_Iedun_3	.00252 7	.0647 116	0.04	0.969	.01629 02	.41732	0.04	0.969	.3459 46
_Iedun_4	-.15848 08	.1250 791	-1.27	0.205	-.95132 56	.69794	-1.36	0.173	.0459 46
HH size	-.00894 26	.0144 225	-0.62	0.535	-.05762 5	.09292	-0.62	0.535	5.470 27
Cultiv. Land size	.05376 24	.0187 647	2.87	0.004 ***	.34644	.12085	2.87	0.004	2.314 86
_Ifertilit~2	-.01297 17	.0634 203	-0.20	0.838	-.08350 43	.40788	-0.20	0.838	.4216 22
_Ifertilit~3	.25017 83	.0844 898	2.96	0.003 ***	1.5668 35	.51476	3.04	0.002	.3756 76
Total liv.	-.00184 49	.0070 142	-0.26	0.793	-.01188 85	.0452	-0.26	0.793	7.205 41
No of oxen	.00852 95	.0428 797	0.20	0.842	.05496 3	.27631	0.20	0.842	1.351 35
Irrigation	.29749 64	.0585 554	5.08	0.000 ***	1.9303 15	.38186	5.06	0.000	.4891 89
Improved sd	-.31118 59	.1013 357	-3.07	0.002 ***	-2.2140 87	.79362	-2.79	0.005	.8054 05
Agri. Ext.	-.15465 27	.0576 851	-2.68	0.007 **	-.99656 83	.37092	-2.69	0.007	1.454 05
Fertilizer	.35652 6	.1039 423	3.43	0.001 ***	2.0396 45	.52479	3.89	0.000	.8486 49
For-credit	-.01924 03	.0658 671	-0.29	0.770	-.12398 26	.42442	-0.29	0.770	1.681 08
Safety net	.00506 2	.0542 175	0.09	0.926	.03261 89	.34937	0.09	0.926	1.345 95
Food aid	.09319 73	.0504 254	1.85	0.065 *	.60055 49	.32476	1.85	0.064	1.621 62
Off-farm act	.01089 91	.0599 236	0.18	0.856	.07023 31	.38615	0.18	0.856	1.659 46
_cons	1.6480 19	.2866 411	5.75	0.000					

Poisson regression — Number of obs = 370; LR chi2(19) = 276.94; Prob > chi2 = 0.0000; Log likelihood = -724.91795; Pseudo R2 = 0.1604

Marginal effects after Poisson y = predicted number of events (predict) = 6.4439099

Source: Survey result, 2015

*NOTICE: *, ** and *** significant at 1%, 5% and 10% significance levels, respectively*

Table 7.2: Estimates of Maximum-Likelihood Poisson regression of MAHFP

MAHFP indicator tries to capture the changes in households' ability to deal with vulnerability in such a way to guarantee that food is available above minimum level all year round. Households below the food poverty threshold generally have less than 9months (ACF, 2010). The Poisson regression revealed that from 16 explanatory variables, 9 of them; Age, Education, Cultivated land size, Fertility, Irrigation, Improved seed, Fertilizer, Access to agriculture extension service and Food aid were found to be significant in impacting the MAHFP in the study areas. Age of the household head was found to be significant at 10% level of significance, and the marginal effect implies that a one year increment in the age of the household head, households will have a 0.027 months (6 days per month) better MAFHP. Though, age of the household head is significant statistically, but policy wise it is a twaddle. With regard to the educational attainment of the household head, education level of "Read and Write" was found to be significant at 5% level of significance. Household heads with educational level of "Read and Write", were found to have a negative relation with MAFHP. Household heads with this educational level were found to have MAHFP of less 1.7 months in a given year.

Regarding to the cultivated land size of households, it was found to be highly significant at 1% significance level with a positive relation where households with an additional of 0.25Ha cultivated land were found to have MAFHP of additional 10.5 days. The extent of land fertility is also one of the highly significant determinants and household with a highly fertile land were found to have MAHFP of additional 1.56 months within a year. Moreover, irrigation was also found to be a highly determining factor of MAHFP positively at 1% level of significance and it was found that MAHFP of households who use irrigation is higher with 1.9 months. Furthermore, households who employ fertilizer were found to have a higher MAHFP of 2.03 months. Lastly, households who participate in food aid programs were found to have a better MAHFP with 0.6 month comparing to those who do not.

A study conducted in Laelay Maichew *woreda*, Tigray region revealed that out of 16 selected explanatory variables to analyze total calorie availability (adult equivalent/day) only 5 variables were found to be highly significant; age of household head, number of Total Livestock Unit / Household, use of improved seeds, number of adult equivalent/household and the farm land size in hectare were found to be highly significant. Family size also contributed to devastating household food insecurity in the Woreda (Shishay K. and Messay M., 2014).

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For this study to assess the determining factors of nutritional adequacy and the root causes for energy deficiency in the selected sample households in the three study areas, Body Mass Index (BMI) was employed. The body mass index, as the name implies it is the ratio between weight and height squared and is a good parameter to evaluate chronic energy deficiency. Information on the nutritional status of a community is crucial to have a wide-ranging idea about development process, as under nutrition is one of the major health dilemmas of most developing countries (Dipak K. et.al, 2006)

Log BMI	Coef.	Std. Err.	t	P>t
_IAge~8-14	.0542174	.0143779	3.77	0.000*
_IAge~15-25	.3365039	.0169568	19.84	0.000*
_IAge~26-45	.3838889	.0124229	30.90	0.000*
_IAge~46-64	.4125283	.0153721	26.84	0.000*
_IAge~>65	.4209486	.0165631	25.41	0.000*
_Iedun~2	.0561416	.0175714	3.20	0.001*
_Iedun~3	.0056495	.0116433	0.49	0.628
_Iedun~4	.0629409	.015314	4.11	0.000*
_Iedun~5	.0595313	.0435525	1.37	0.172
_Iedun~6	.3258541	.0392242	8.31	0.000*
Household size	.0068446	.0023007	2.97	0.003*
Farmland size	-.0105599	.0039329	-2.69	0.007*
Total livestock	.0004992	.0009332	0.53	0.593
MAHFP	.0041595	.003067	1.36	0.175
FCS	.0002788	.0010692	0.26	0.794
Main Road	.0005128	.002816	0.18	0.856
Off-farm Activity	.0108974	.0090232	1.21	0.227
Food aid	-.0765338	.0091625	-8.35	0.000*
Safety net|	.004883	.0087105	0.56	0.575
Agri. Extension	.0034506	.0092877	0.37	0.710
Improved Seed	.0431482	.0168676	2.56	0.011**
Fertilizer	-.0044926	.016286	-0.28	0.783
Irrigation |	-.0352959	.0112009	-3.15	0.002*
_cons	2.599786	.0391001	66.49	0.000

Source: Survey result, 2015

*NOTICE: *, ** and *** significant at 1%, 5% and 10% significance levels, respectively*

Table 3: Log-Linear regression result for Determinants of BMI

The study found various significant variables such as education level, household size, land size, food aid and use of improved seeds and irrigation. Regarding education attainment, "Read and Write" and "9-12 level" were found to be significant positively at 1% level of significance and its coefficient reveals that as a household member education level increases to "Read and write", BMI will also increase by 5.6%. Household size was also found to be highly positively significant at 1% level of significance on BMI of households in the study areas. That is as the number of household member increase by one, BMI also increases by 0.6%. Though household size is significant statistically, but policy wise it is limited due to its very low impact on BMI of households. Land size was also found to be highly significant at 1% level of significance which determines the BMI of households in the study areas. Surprisingly, the effect of land size holdings on BMI was found to be negative implying a more land size leads to a more labor force and energy and statistically it was found that as land size is increased by 0.25ha BMI decreases by 1.05%. Households who are participating in food aid programs have a less BMI, where statistically it was found that food aid participants have a less BMI by 7.65% that those who do not.

IV. CONCLUSION

Ethiopia is perhaps well known as the destination of some of the devastative famines in African history; as a symbol for a contemporary African poverty and failure of governance. The country is facing severe problems of food insecurity which manifests itself as the lowest kilocalorie per capita intake in Africa. The Tigray regional state where the study sites were located has also one of the poorest regional economies record in the country. Vast number of households in the region were only able to produce sufficient food for less than six months of the year to meet their basic requirements.

Taking this into consideration, the study has tried to depict the impacting factors basing on the three indices which were employed to assess the food security status of the smallholding farmers in Tigray region. It was found that eight variables were having a significant impact on food consumption patterns of the farmers, namely; education level, household size, high land fertility, distance from main market, irrigation, total number of livestock, and participation in off-farm activities. Regarding Months of Adequate Household Food Provisioning (MAHFP) nine variables were found to have a significant impact. These variables were age, education level, land size, farmers with highly fertile land, irrigation, improved seed, fertilizer, access to agriculture extension service and food aid were found to be significant in impacting the MAHFP in the study areas. Finally, concerning the determining factors of Body Mass Index (BMI) of household members, education level, household size, land size, food aid and use of improved seeds and irrigation were found to be significant at distinct levels of significance.

V. SUGGESTIONS

One of the most crucial step is the need for a more collaboration of government bodies with NGO's, civil society groups and the private sector to promote people's participation and to make the whole process of implementation transparent and accountable to people. The involvement of women in economic activities is very negligible and formation of self-help groups in the communities will help them to act

collectively towards meeting their livelihood needs. Cash crops production should be encouraged by development agents in the study areas through provision of improved seeds, material support and market linkages coupled with trainings on entrepreneurial and commercial skills. Count of landless and undersized farmland holdings was highly prevalent and policies should be designed or revision of land reform policies are necessary to increase per household farmland holding sizes such as voluntary resettlement programs and others. Especial emphasis should be given for cash for work programs to protect households majorly from productive assets depletion and in parallel the in exchange cash provision should be increased in way that can at least provide the minimum poverty wage. Modern agricultural inputs such as irrigation, improved seeds and fertilizers should be more provided in a subsidized manner coupled with trainings on their adoption especially with regard to irrigation. Agricultural extension trainings and visits need to be redesigned in a way that won't affect working time and other crucial times of the smallholding farmers. Lastly, habitual food consumption patterns should loosen up through trainings and awareness creation programs on nutritional values of food for an enhanced food consumption pattern.

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