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The Role of Aid Allocation in Some Aspects of Food Security in Northern Ethiopia: Micro Analysis

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Abstract

Based on primary household food security survey data collected for five years from 450 households in two sub-districts of northern Ethiopia, the thrust of this study was to explore the role and problem of aid in achieving food availability, access and diversity. The Aggregate Household Food Security Index (AHFSI) constructed based on the Food Balance Sheet (FBS) showed that aid played an important role in terms of supply. Yet, regression models indicated aid alone had limited impact on the food access and consumption of households as measured by the Household Dietary Diversity Score (HDDS), which was associated with the Coping Strategy Index (CSI) of households. Model V, taking only the statistically significant variables, was not only the most statistically fit model, but also similar to the full model (Model IV) accounted for 74.3% of the variance in the level of food security. It is plausible to contend the food security status of rural households in the research sites would have positive outcomes if aid addressed socio-demographic factors of family planning and access to education (both literacy and school attendance) as well as agricultural input-economic factors of land conservation/utilization, supporting employment generation schemes for additional income, and improving farming inputs in fertilizer use and cattle ownership.

Key words: aid allocation, food security, the Millennium Development Goals (MDGs).

1. Background

This study examines the role and problem of aid allocated to Ethiopia to address food insecurity in availability, access and diversity, which is one of the fundamental sectors of the Millennium Development Goals (MDGs). The study views food security in an agrarian society as physical and economic access by the majority of people for enough and safe food. This enhances their utilization skills for an active life capable of developing coping strategies during stress or with an outbreak of disaster (FAO 1996). Aid is conceptualized in line with the Organization of Economic Cooperation and

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Development's (OECD) definition of official development assistance (ODA). ODA involves concessional flows with a grant element of at least 25% to developing countries for the essential purpose of promoting economic development and welfare (OECD 2006).

Ethiopia is probably better known for the images of starving and emaciated children and series of appeals for help from the international community than other issues. The prevailing assumption and question then is the country has received large flows of aid, and why it has not been able to feed its population by improving its food insecurity level. This study does not set the goal of dispelling such pervasive and deep-ingrained perceptions. Rather the aim is to examine the aid-food insecurity dyad and whether aid given to Ethiopia is meaningful in terms of addressing chronic food insecurity. With the risk of oversimplification, chronic food insecurity entails a crude morality rate of one in 10,000 per day with an increasing trend, between 15% and 20% of the population is malnourished, food access or availability is below 2,100 Kcal per day, dietary diversity is less than three food items a day, aggregate food security index is less than 65%, and water availability (for human usage only) shows less than 7.5 liter per day (FAO/USAID 2007).

Foreign aid has increasingly come under closer scrutiny both from critics and emphatic supporters. It has divided ideas on two extreme positions (The Economist 1994; Hansen and Tarp 2001; Dalgaard and Hansen 2001; Collier and Dollar 2002; Easterly, Levine and Roodman 2003; Burnside and Dollar 2004; Sachs *et al* 2004; Easterly 2006; Calderisi 2006; Riddell 2007; Banerjee 2007). Despite the controversies and debates, there is an upward increase in aid flows to developing countries since the end of the 1990s after a decade-long slump and aid fatigue.[1] There has been an inundation of pledges and initiatives for increased aid flows from the United Nations MDGs to the United Kingdom's Commission on Africa, the Group of 8 (G8) calls for increased aid, the United States Millennium Challenge Account (MCA) and others. By some estimates this is expected to be over 100 billion dollars a year (Kharas 2007). This appears to create a momentum towards highlighting the most critical and serious problems of food insecurity and hunger in the developing world.

One major development objectives of the MDGs is addressing food insecurity. The problem of food insecurity has long been identified as one of the most fundamental impediments of tackling poverty in countries that heavily rely on agriculture as the mainstay of their economy. The First World Food Summit in 1974 by leaders from around the world set the goal of 'eradicating' hunger within ten years. The disappointing results were revisited in the Second World Food Summit in 1996 in which heads of states, United Nation's agencies, the World Bank and non-governmental organizations (NGOs) pledged to 'halve' the number of chronically undernourished by the year 2015. The target was then adopted in one of the MDGs agreed by 189 countries in New York in 2000. Such an objective appears to be a 'grandiose scheme' although the expectation entails its attainment might roughly alleviate the food insecurity of more than twenty-two million people and save the lives of ten million people, of which six million are children under five, dying of hunger and food insecurity-

related diseases every year (Black *et al*. 2003; UN/SCN 2004).

Notably, such staggering data indicate food insecurity is by far a more critical and profound problem surpassing HIV–AIDS, tuberculosis and malaria combined as a major killer and cause of incapacitating the livelihood of households in developing countries. Despite recent upsurge in the price of food, globally real food prices have decreased and food availability per capita has increased, contributing to improvement in aggregate food security. At the same time, it is estimated that currently more than 850 million people worldwide are in chronic or acute food insecurity level. This figure suggests one in seven people are undernourished and go hungry (FAO 2006). It is also estimated global demand for food is expected to double in the coming five decades and agriculture will remain the major source of economic activity for more than 70% of the world's poor who live in rural areas (World Bank 2008).

This study intends to inform the aid debate and the overall issue of poverty as manifested by food insecurity. By using empirical data, it seeks to contribute to research done regarding aid and food (in)security in Ethiopia. A number of studies and research reports have shown the roles and limitations of aid flows to Ethiopia. Yet, most of these have been functionalist with less macro–micro empirical testing of how much and for what purpose aid has been given to the country, and how the aid allocation–priority need of recipients is associated with aid to address food insecurity (Berhanu 2001; Geda 2003). This paper is part of a larger project that combines analysis of the macro–micro link in aid allocation, and its role and problem in food insecurity. The presentation here only focuses on partial results at micro level.

I contend aid plays a role as an important source of supply for highly food–insecure countries like Ethiopia; however, it shows limitations in addressing the core problem of food insecurity in terms of access and diversity. This is probably due to two central reasons, and I mainly discuss here only one of them. One underlying reason constitutes the purpose of aid allocation and its narrow focus on short–term issues, which likely affects the prospects of aid and the MDGs in food security by leading to a cycle of less effective aid.

Since 1993 Ethiopia has adopted a policy of restricting the free distribution of food aid. The Disaster Prevention and Preparedness Agency (DPPA) stipulates any food distribution should constitute 80% of the payment through food–for–work (FFW) projects and the rest (20%) as a relief distribution to highly affected/vulnerable beneficiaries, and those who cannot participate in projects because of disabilities or age. Aid used to support food security strategies such as FFW projects only focuses on supplementing the supply side of food security. This tends to limit the contribution of aid in addressing other main components of food insecurity besides the widely discussed problems of targeting and selection. Agrarian communities in Ethiopia and especially in the northern regions of the country are chronically food insecure largely due to their vulnerability and fragile livelihood assets. Short–term provision of food for participating in FFW projects is efficient only in alleviating an

outbreak of hunger and sustaining the lives of households by creating temporary welfare safety nets.

The chief aspects of food security incorporated in this study were availability, access and consumption. The higher the outcomes in these three indicators, the higher will be the household dietary diversity score (HDDS). It is also assumed participating households in the projects with higher HDDS will have, *ceteris paribus*, increased coping strategies (and hence less vulnerability), but the projects alone are limited and ineffective to address such issues. Vulnerability in food security is viewed as the degree to which households are susceptible to losing, maintaining or improving their status vis-à-vis a certain threshold level indicating physical and economic access to enough and sufficient food for an active life (Horri 2005). It is the outcome of shocks plus inability to cope.

Aid flows to Ethiopia have been large in terms of GDP and government expenditure; however, they are small when the proportion of aid is seen from the need requirement and compared to aid given to other countries (Development Cooperation of Ireland 2007: 8). Flows of aid to Ethiopia have been volatile and unpredictable, which have largely consisted of emergency assistance mainly food aid. Between 1984 and 2006 food aid reached ten million metric tons which was between 10% and 15% of annual cereal production of the country (Barrett and Clay 2002). Cereals (93%) mainly wheat (80%) constituted the food aid composition (Clay and Molla 1999).

The rest of the paper is organized as follows. In section two I will scan factors that serve as determinants of food security besides aid, which is followed by discussion on the measurement of food security in section three. Section four outlines the surveys and the research settings, and section five introduces the assessment procedure. I present the findings in section six and a brief conclusion in the last part.

2. Determinants of Food Security

The literature in food security suggests availability, access and consumption are influenced by a number of supply-side and demand-side factors. Maxwell and Frankenberger (1992) described these factors as process and outcome indicators, respectively. Predictors in food security can generally be categorized as socio-demographic (household head, education and family size), agricultural input factors (land, cattle, water and fertilizer), and economic/income variables (non-farm income and credit).

Whether a household is headed by a man or a woman is assumed to influence the degree of access to and control over resources important to the level of food security. Chris Udry (1996) assessed the contribution of women in increasing food security, which costs households as much as 15% potential income (for Ethiopia see Hadley *et al.* 2007). Gender equality has a strong relationship not only with increasing the capacity of rural households to adopt viable coping strategies, but also with the overall poverty reduction interventions (Zuckerman 2001).

There is also a consensus some level of parental education is positively correlated to the food security status of a household's members although the results pointing which parent plays more role and what level of education yields better outcome are mixed. Using data from forty-eight developing countries, Muro and Burchi (2007: viii) examined how food security was related to the level of education, with a high correlation at the primary level and decreasing in importance/strength at higher levels of education. The level of education of mothers is assumed to have more weight than fathers (Alderman and Garcia 1994; Handa 1999). Kassouf and Senauer (1996) compared parental education and weights and heights of preschool children in Brazil where 24% of preschool children were stunted with moderate level of malnutrition in households that mothers had less than four years of education.

The demographic characteristics of a household directly affect the availability and consumption of food. It is possible that with large household size, available family labor may increase output; however, in agrarian communities with highly fragmented land ownership, large family size tends to increase consumption compared to supply. Teklu and Johnson (1988) found in Indonesia that an increase in household size led to the reallocation of resources from relatively high-priced/luxurious food items to staples.

The relationship between farm size and yield was analyzed based on the premise of the 'inverse relationship between farm size and output' (IR) by arguing average yields decrease when agricultural land increases. A. Sen (1962) compared agricultural output and farm size per hectare and showed the productivity of small plot holders. Subsequent research findings asserted size of agricultural land enhanced the productivity of rural communities. Subbarao (1982) found a positive relationship attributed to higher application of fertilizer and employment of cash-intensive inputs in large farms (also Bhalla and Roy 1988; Townsend *et al*. 1998; Van den Berg *et al*. 2006).

Owning cattle for rural households is also assumed to be significant as access to additional income, relative security in times of stress or crisis, source of food (meat, milk, butter), asset as soil fertility management (through manure), and as one element of wealth ranking. Specifically, owning draught and dairy animals such as oxen and cows serves as an important input for productivity and source of nutrition. Households in Kenya, for example, who had access to dairy animals consumed more milk and showed improved nutritional status of pre-school children in stunting (but not wasting) (Nicholson *et al*. 2004). Murphy and Allen (2003) showed the significance of animal-source food (ASF) for poor households as one component of dietary diversity.

The relationship between water availability and level of food security is straightforward. Lack of access to water supply is one prime cause of food insecurity (Wood *et al*. 2000). In Ethiopia households living in water stressed areas have average annual per capita water availability for all their needs limited to 1,000-1,600 m^3. As recently as the great famines of 1984/5, most rural households faced higher forms of water scarcity, which is defined as water availability of less than 1,000 m^3 per person per year (Rosegrant 1997; Shiklomanov, 2000; Strzepek *et al*. 2000). Households with access

to water from micro-dams are assumed to benefit more in terms of productivity and consumption.

Strasberg *et al.* (1999: 2) found out in rural Kenyan households that used 8 kg/acre fertilizer increased their productivity by 7% in the mean. Results in Niger also showed applying 4 kg/hectare of phosphorus (P) highly increased the income of smallholder farming households (Pender *et al*. 2008: 1). In Ethiopia, Mulat (1999) and Wolday (1998) presented evidence how fertilizer use decreased with a decline in the size of agricultural land. The average national fertilizer use in 2005 was less than 10 kg per hectare nitrogen (FAO 2008). However, the official figures were higher, claiming fertilizer use expanded from 21 kg per hectare in 1995 to 32 kg per hectare in 2004 and 2005 (MoFED 2006).

The impact of non-farm income on the food security of rural households has been ambiguous. A study of eleven rural households in Latin America presented evidence that non-farm income increased the total incomes of rural households by 40% (Reardon *et al*. 2001). In the Philippines Estudillo *et al*. (2006) argued the increase in non-farm income contributed to the fall in the proportion of poor households from 50% to 31% among farm households, and 63% to 24% among landless households. Using a bio-economic model in rural Ethiopian highlands, Holden, Shiferaw and Pender (2004) found out an increase in non-farm activities had positive impact on household income although this also brought a reduction in total agricultural production and farm inputs.

A multi-country study covering nine developing countries showed access to financial sources for poor households augmented their meager income for adequate food (Zeller and Sharma 1998). The study by Guha-Khasnobis and Hazarika (2007) looked into the relationship between credit availability and children's food security based on anthropometric nutritional z-scores. It was also reported that lending to households in two villages in India enhanced diversification of livelihoods and reduced vulnerability to stress (Garikipati 2008: 2621).

3. Measuring Food (In)security

Measurement of food (in)security is bedeviled by the tradeoff between reliability, sensitivity and accuracy of data on the one hand, and the bulky, expensive, complex, highly technical and time consuming data collection procedures, on the other. The proceedings of an international scientific symposium in Rome concluded 'no individual measure suffices to capture all aspects of food insecurity', and hence the most plausible way of reaching at a reliable and robust result is by adopting a set of indicators (FAO 2002). Food security exhibits a number of indicators, which are seldom clearly defined and universally accepted. The proliferation of indicators is further complicated by the problem of levels of measurement. Various studies use different levels of measures, ranging from regional to national, household and individual.

This study is based on household food security survey even though the household by itself poses difficulty of measurements. Unlike the neoclassical model of economics that takes the household as

maximizing a joint utility function, it is composed of individual units that have different vulnerability, consumption habits, coping strategies, food need and most importantly resource distribution (Maxwell and Frankenberger 1992: 4). This is true especially in patriarchal and agrarian societies similar to Ethiopia where men claim substantial economic decision-making power.

The study builds a framework of food security based on the first goal of the MDGs by incorporating it into a wider Aggregate Household Food Security Index (AHFSI). The MDGs in the first goal set halving the proportion of population undernourished as one of the targets. This is measured based on two main indicators. First, it measures food security by the prevalence of underweight children below five years of age (UCBF), and second it takes into account the proportion of population below minimum level of dietary energy requirement (MDER). These two indicators, however, are short of being reliable and accurate in terms of encompassing peoples' (in)ability to produce, and have physical and economic access to food. They are more of outcome indicators to utilize enough food for a healthy and active life. Broadening them to include production and access will show cumulative processes in the degree of households' food (in)security. A significant structural collapse and dysfunction of a community or society after a protracted/repeated abnormality in the production, consumption and distribution of resources mainly food constitutes famine.

The AHFSI derives its conceptual foundation from Sen's Poverty Index (Sen 1976). There is consensus in the literature that addressing poverty should be the priority focus of policy designs. The difficulty, however, was how to define and measure poverty. Conventional approach to measuring poverty employed non-discriminate or gross categories by identifying headcount ratio as a threshold to draw the poverty line. Individuals or households below this line were considered poor. Due to the multidimensional aspect of poverty, emphasis was placed on the physical denominators to draw the poverty line, such as income, nutritional intake and health. The shortcoming of this approach was it did not provide the extent of poverty among those below the poverty line. By introducing the poverty gap, Sen characterized poverty as possessing two properties. First, the monotonicity axiom stated as income decreases, the poverty level increases. Second, the transfer axiom pointed out as transfer from the poor to those with better income increases, the poverty level increases.

The AHFSI was extended by the Food and Agriculture Organization (FAO 1996) to appreciate the food security status of developing countries. With the existence of a sundry of food security measurements, this index attempts to combine supply, access and consumption, and gauge where countries stand in terms of their food security level. Although the index has been used in case studies (Thomson and Metz 1997), constructing indices for different countries needs to take into account aspects of food security measurements that are pertinent to the regions under examination. For example, when assessed based on calorie intake, a number of African countries appear to lag behind cases from Asian countries. The latter, however, show low scores if anthropometric measurements are used. This is related to what I have found in a research done on the determinant of vulnerability

and vulnerability to food insecurity in Bangladesh and Ethiopia. Above all, the index does not fully appreciate the consumption patterns and nutritional intake agrarian communities, which can be supported by HDDS. Besides constructing the index requires detailed and accurate data, which is expensive and time consuming to collect. This study adjusted all the measurements to fit the characteristics of the households in the research sites. It attempted to appreciate the extent of food insecurity of households falling below the threshold. This threshold was introduced using detailed analysis of consumption and coping strategies that require understanding, among others, the income, health, gender-cum-socio-economic status and education of individual households. Despite the shortcomings, the index can serve by providing an overall food security status of communities. This is the first attempt to develop a unique combination of AHFSI, HDDS and CSI for analyzing households' food insecurity.

The AHFSI is constructed based on the food balance sheet (FBS) of the research sites. It is composed of index measuring the estimated prevalence and intensity of food inadequacy with an ordinal index ranked from one to 100. An index close to 100 shows food security while zero signifies total famine. An AHFSI of sixty-five and below shows the existence of chronic food insecurity, while an index between sixty-five and seventy-five is seen as low level food security. Figures between seventy-five and eighty-five indicate medium level food security, and countries that are able to maintain index above eighty-five are highly food secure.

AHFSI is assumed to take the following form:

$$\mathbf{AHFSI = 100-[H\{G + (1-G)\, I^P\} + 0.5\, \Omega\, \{1-H\,[G-(1-G)\, I^P]\}]100}$$

where

- **H**: is a head-count of the proportion of the total population undernourished;
- **G**: is a measure of the extent of the food gap of the average undernourished shortfall in dietary energy supplies from national average requirements for dietary energy;
- $\mathbf{I^P}$ is a measure of inequality in the distribution of the individual food gaps of the undernourished, based on the Gini coefficient;
- **Ω**: is the coefficient of variation in dietary energy supplies, which gives the probability of facing temporary food shortage.

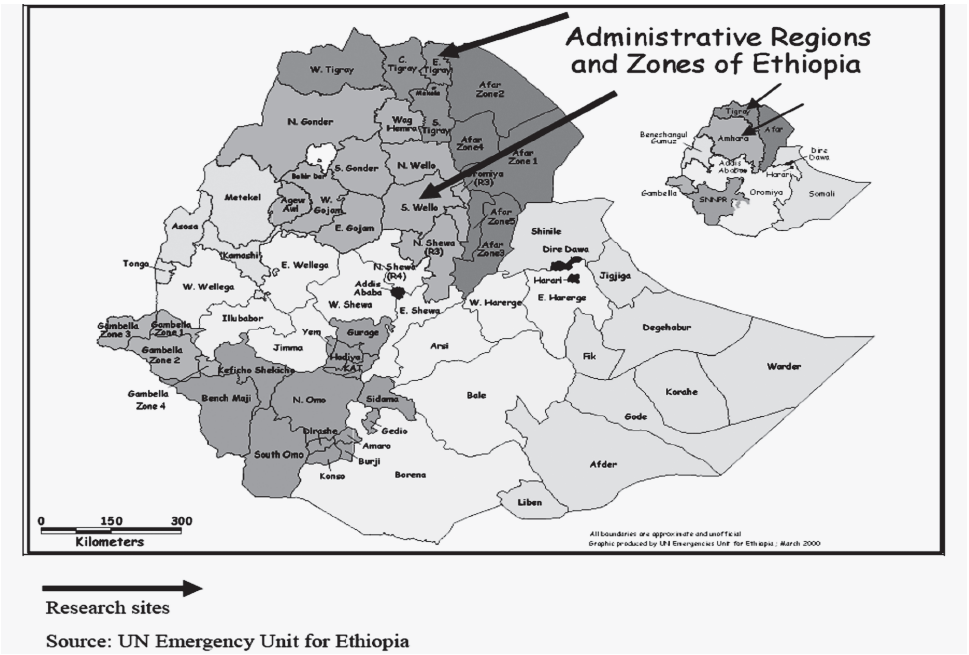
The AHFSI is limited in capturing factors that influence domestic utilization of food within a household. In order to lessen this limitation, the study uses HDDS, which measures the number of food groups or food items consumed by a household between the past seven days. This will help increase the reliability and scope of the data, and provide comparison of the different data sets. HDDS is a useful tool because its outcome can be valid 'in its own right'. It can also signify the level of improvement or otherwise in children's health as related to stunting and wasting, as well as the level

of hemoglobin concentration and risk of mortality from related diseases (see USAID 2002: 2). Yet, methodological problems remain unsolved regarding the absence of universally accepted standards as to what type of main food groups or food types should be employed. Second, HDDS shows changes in dietary energy consumption of households, but it has not been easy to empirically show the significance of HDDS in nutrient adequacy. A number of research studies employed cut-off points based on sensitivity/specificity analysis as well as Receiver Operating Characteristic (ROC) curves (for methodological discussions, see Hatloy *et al.* 1998; 2000; Hoddinott and Yohannes 2002; Torheim *et al.* 2003; Ruel 2003).

4. The Surveys and Research Settings

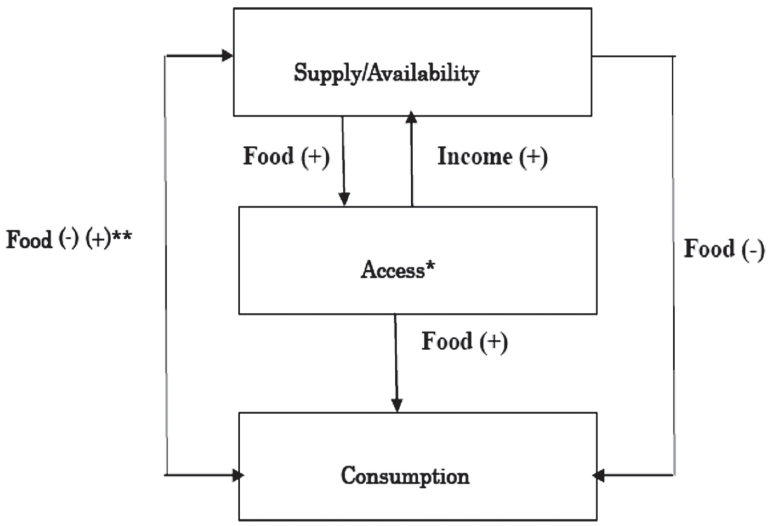
The household food security surveys were conducted in Ethiopia from 1995 to 2000 under the Institute of Development Research (IDR), Addis Ababa University in two regions of northern Ethiopia: eastern (*misrakawi*) Tigray (Tigray Region) and southern (*debub*) Wello (Amhara Region). These regions are vulnerable with weak coping strategies/capacities of rural households and higher average proportion of aid allocation. Agriculture and particularly food production constitutes the central income source of rural households. There have been more than forty major famines and food shortages in total in the country, among which fourteen occurred in northern Ethiopia, particularly in Tigray and Wello.

Map 1: Map of Ethiopia showing regions for the research sites



The surveys were conducted with frequent visits to the regions. Longitudinal structured questionnaires, interviews with key informants, group discussions and observations were employed to elicit information. The surveys covered a total of 510 households with 11.7% attrition and a total of 450 rural households participated in all rounds of the surveys from two *weredas* (sub-districts) of eastern Tigray and southern Wello. Two-hundred and twenty-five households were sampled in each sub-district. Atsbi Wonberta was covered in eastern Tigray, while southern Wello included Kalu sub-district. The surveys were conducted in two broad classifications of the households and phases. The classifications included project participating households (PPHs) and project non-participating households (PNPHs) in the FFW projects. The PPHs were in and out of the projects for various reasons, such as completion of projects to the inability to receive payments in time (hence voluntary withdrawal), the view FFW projects were no longer needed due to better opportunities and lack of time to participate. This observed counterfactual of PNPHs helped to comparatively and critically analyze the roles, significance and problems of aid. Such an approach, however, has the risk of causing selection bias, and some studies employed difference-in-difference (DiD) propensity score matching estimator to address the source of such problem. Since changes in household food security levels were checked during and after wide-range stress or crisis, it was possible to comparatively assess the production, access and consumption patterns of households in different seasons. For example, assessments were made before and after the big rain (*keremt*) from June to September, the hot and dry season (*bega*) from October through February, and after and before the little rain (*belg*).

Figure 1: Conceptual Framework of Food Security



Note: *Includes income and capabilities
**Indirect and blurred effect
Source: Author's framework

Overall, the conceptualization of food security in general and in the two research areas specifically can be represented by Figure 1.

In a food secure country, there is equilibrium among the supply/availability, access and consumption indicators. Household food availability is a function of national stock. Sufficient availability of food is a source of both consumption and income, which also increases diversification in consumption. Access constitutes both income as well as institutional and technological capacities which bolster productivity (Sen 1986). Increased consumption depletes availability, but consuming sufficient and nutritious food is assumed to lead to active and healthy working population for better productivity. However, this impact is indirect and mediated by a number of variables in health and labor (economic) policies of a country.

5. Assessment Procedure

To assess the impact of the projects on households' dietary diversity/food variety, the parameter was estimated based on the following model:

$$HDDS_i = \alpha + \beta_1 PORPAR_1 + \varepsilon \quad (1)$$

where *HDDS* is the dietary diversity/the food variety of household i for the last seven days of the surveys, α is the intercept, *PROPAR* is the dummy variable of participation in the project, and ε a random disturbance explaining the change in *HDDS* by other factors, which are uncorrelated to *PROPAR* and hence giving β an unbiased and consistent characteristics. While the above model may give us an appreciation of the relationship, the second model looks into the effect of socio-demographic factors, in particular education (*EDU*) measuring the education level of the household head by year of schooling, family size (*FAMSIZE*), indicating the family size of a household, and family-head (*HEAD*). I have given a value of one for those household heads who had traditional or religious schooling, which was assumed to have the level of a first grader in primary school:

$$HDDS_i = \alpha + \beta_1 PORPAR_1 + \beta_2 HEAD_2 + \beta_3 EUD_3 + \beta_4 FAMSIZE_4 + \varepsilon \quad (2)$$

The third model examines the relationships between specific agricultural-economic variables and the HDDS:

$$HDDS_i = \alpha + \beta_1 PORPAR_1 + \beta_2 LANDOWN_2 + \beta_3 CATTLE_3 + \beta_4 NONFAR_4 + \beta_5 FER_5 + \beta_6 WAT_6 + \beta_7 CREDIT_7 + \varepsilon \quad (3)$$

where *LANOWN* indexes the size of agricultural land owned and measured in hectares; *CATT* shows the number of cattle (both oxen and cow) owned; *NONFAR* is the average non-farm income of a household in Birr (the Ethiopian currency converted to US dollars); *FER* indicates the amount of

fertilizer used by a household in kilograms; *WAT* shows the water access to different sources which a household uses; *CREDIT* measures access to credit in US dollar; and ε is the random error term for other unaccounted factors. The fourth model shows the complete/full model (by including all the variables).

The significance of participating in the project can also be assessed by looking into whether HDDS is related to the CSI of households, the null hypothesis being projects have significant or important impact on the level of HDDS and hence enabling households to develop better CSI, which is measured both by severity (calculated based on the ranking of the strategies by the households) and frequency — how often households adopt the strategies (1＝Never (zero times per month); 2＝ rarely (once or fewer times per month); 3＝ sometimes (5－10 times per month); 4＝ frequently (more than 4 times a week).

$$CSI_i = \alpha + \beta_1 HDDS_1 + \varepsilon \tag{4}$$

The higher the CSI, the less the food security level of a household, and hence the more it is vulnerable. This is because higher values are attached to severe strategies with high frequency of their adoption. Households were asked to rank the extent of the severity of a total of eleven strategies and this was recorded for all rounds of the surveys. The CSI score indicates the sum of the scores of each mean multiplied by the corresponding value of the severity from one to eleven. Table 1 shows the variable definition and the mean/percentage of the variables in the different models.

6. Discussion of Findings

Household food availability or supply was measured by constructing the FBS of the research sites from 1995 to 2000. The average minimum requirement of 2,100 Kcal per day per person could be used as reference point for the individual differences naturally existent in a household. Net production or availability is a sum of total production of major staple diets in the two regions, post harvest lost, items used for seed or feed, and other food sources. Emphasis was given to cereals since households have access to aid in the form of cereals, and cereals represent the primary food production and consumption patterns of the regions. It is stable availability of cereals that influences access to and consumption of other food items either through production or purchase after sale of cereals received through aid. The main cereals in the areas are *teff* (*Eragrostis tef*), maize, barley, sorghum, wheat, finger millet, and *aja* (oats). The AHFSI was computed based on data from the surveys and secondary data extracted from the population census by the Central Statistical Authority (CSA), regional governmental and non-governmental offices.

Food utilization or consumption was assessed based on HDDS. The objective was to understand if income from aid contributed to diversification of dietary pattern either through increase in daily

Table 1: Variables Definition and Descriptive Statistics (n＝450)

Variables	Definition	Mean/Percentage
FARMSIZE	Household land ownership/access in hectare	1.19
FAMSIZE	The number of people in a household living and eating together.	6.21
EDU	Education in year of schooling of household head	1.35
CATTLE	Household cattle ownership	2.61
FER	Fertilizer used in kilogram	6.33
NONFARM	Non–farm income in US dollar	128.15
WATER (Dummy)	Household water access 1= if dam/irrigation 0= otherwise	27%
HEAD (Dummy)	Household head 1= female–headed 0= otherwise	33.3
CREDIT	Credit received in US dollar	19.48
PROPR (Dummy)	Whether a household participated in a project 1= yes 0= otherwise	50%
CSI	Coping Strategy Index showing the mean sum of severity (based on ranking) and frequency of adoption (monthly)	109.11
HDDS	Household Dietary Diversity Score showing the mean sum of food items consumed for the past 24 hours (for seven days)	5.72

consumption or sale/exchange of income from aid to buy other food items. It examined the impact on supply and its expected effect on consumption thereby enabling to detect the mean intakes of different items, the existence of inadequate consumption, and the relationships between dietary intake and anthropometric results (particularly stunting and wasting in children under five).

H was calculated based on the Body Mass Index (BMI) of households dividing the weight (W) in kilograms by height (H) squared in meters ($BMI = W/H^2$). Based on the sampled 225 households of Kalu in Wello and 225 households of Atsbi Wenberta in Tigray, 91 and 93 households were found undernourished, which was equal to 40.44% and 41.33%, respectively. In both sub–districts the measurement excluded children who were breastfeeding. For pregnant or lactating women, an allowance for extra calories needs was considered. Taking the total households to be equal to one, then the undernourished households (the value of H) will be .4044 in Kalu and .4133 in Wello and Tigray, respectively. Stunting and wasting of children were also serious both within the undernourished and the general sampled households. Stunting refers to proportion of children under five below minus 2 standard deviations (moderate and severe) and minus 3 standard deviations (severe) from the median height–for–age compared to a reference height for children of the same height. Wasting indicates proportion of children under five below minus 2 standard deviations

(moderate and severe) and minus 3 standard deviations (severe) from the median weight－for－height compared to a reference weight for children of the same weight. The reference standards are developed by the World Health Organization (WHO) and the US National Center for Health Statistics (NCHS) as well as data compiled by FAO. The sampled data showed stunting of 43% ＜－2 SD and 21% ＜－3 SD, and wasting of 8.3% ＜－2 SD and 2.5% ＜－3 SD.

Undernourished household's average food gap (value of G) was calculated based on the average availability of calorie requirement. The calorie intakes of the undernourished sample of 91 households in Kalu and 93 households in Atsbi Wenberta were then calculated, which was 1,350 and 1,344 Kcal, respectively. These figures were well below the minimum which was between 1,660 and 1,680 Kcal from 1990 to 2005 (FAO 2008). Mainly cereals were used for computing the calories. For example, *teff* has the calorie value of 367 and *gebs* (barley) 361 (measured in 100 grams edible portion). The gap between the average requirement and the average availability was computed to be 750 for Kalu and 800 for Atsbi Wenberta, which was then converted into percentage as 35.71% and 36%. Taking the average requirement to be equal to one, then the gap would be 0.3571 (with availability of 0.6429) and 0.3809 (with availability of 6191), respectively. The food availability ratio (FAR) from the FBS reflects the extent of the gaps.

The values of the Gini coefficient 0.41 for Kalue and 0.40 for Atsbi Wonberta were computed based on the average income of the households from the surveys. The values of coefficient of variation (CV), which are related to the probability of facing temporary food shortage, were 7 for Kalu and 8 for Atsbi Wenberta. These figures took into account the dietary diversity score, asset ownership (land and cattle) and coping strategy index (CSI) so as to reflect the degree/probability that the villages in question would face food shortage or stress.

Thus, the AHFSI for the sites in Kalu and Atsbi Wonberta was as follows:

Kalu	100 - [0.4044 {0.3571 + (1 – 0.3571) 0.41} + 0.5*7 {1 – 0.044 [0.3571 - (1 – 0.3571) 0.41]}] 100= 55.37%
Atsbi Wonberta	100 - [0.4133 {0.36 + (1 – 0.36)0.40} + 0.5*7 {1 – 0.4133 [0.36 - (1 – 0.36) 0.40]}] 100= 53.15%

With high dependency ratio on aid, the AHFSI for the two research sites showed households both in the rural communities of southern Wello and eastern Tigray were in chronic food insecurity status. The role of aid in enabling households to supplement food production and availability turned out to be positive. The FBS tables below show the extent that aid supplements availability, without which households would face high food deficits. The implication of this relationship was the need for substantial and long－term aid flows that focus on increasing the dietary diversity and coping strategies of households.

Based on FAO, USAID, and CSA of Ethiopia, and primary data from the field by surveying the

Table 2: Food Balance Sheet of households in Kalu (n＝225)

No.	Variables	1995	1996	1997	1998	1999	2000	Change
1	Production of cereals (in Qt.)	2500	2350	2000	1500	2200	2100	-0.63
2	Less 15% post harvest lost (in Qt) [a]	375	352.5	300	225	330	315	-
3	Less 10% seed and feed (Qt) [b]	250	235	200	150	220	210	-
4	Net production (1-2-3)	1875	1762.5	1500	1125	1650	1575	-0.63
5	Food Aid (both relief and FFW) (in Qt)	2200	2350	2500	3000	2400	1600	-3.35
6	Total Grain Available (4+5)	4075	4112.5	4000	4125	4050	3175	-3.68
7	Other Food Sources (Vegetables, Meat and Egg) [c]	20	21	30	13	30	15	12
8	Total Supply (6+7)	4095	4133.5	4030	4138	4080	3190	-3.68
9	Population [d]	1200	1225	1250	1290	1300	1354	-
10	Requirement of Food at 3 Qt per person	3600	3675	3750	3870	3900	4062	2.04
11	Food Balance (8-10)	495	458.5	280	268	180	-872	-111.31
12	Self-Sufficiency Ratio (4+7)/10	0.52	0.05	0.40	0.29	0.43	0.39	103.51
13	Food Availability Ratio (8/10)	1.14	1.12	1.07	1.06	1.04	0.78	-5.67

Table 3: Food Balance Sheet of households in Atsbi Wonberta (n＝225)

No.	Variables	1995	1996	1997	1998	1999	2000	Change
1	Production of cereals (in Qt.)	1850	2600	1700	1300	2100	1900	5.73
2	Less 15% post harvest lost (in Qt) [a]	277.5	390	255	195	315	285	-
3	Less 10% seed and feed (Qt) [b]	185	260	170	130	210	190	-
4	Net production (1-2-3)	1387.5	1950	1275	975	1575	1425	5.73
5	Food Aid (both relief and FFW) (in Qt)	5000	4500	7500	11,000	7200	6000	8.68
6	Total Grain Available (4+5)	6387.5	6450	8775	11975	8775	7425	5.23
7	Other Food Sources (Vegetables, Meat and Egg) [c]	18	15	12	10	19	21	7.86
8	Total Supply (6+7)	6405.5	6465	8787	11985	8794	7446	5.21
9	Population [d]	1442	1456	1499	1536	1596	1610	-
10	Requirement of Food at 3 Qt per person	4326	4368	4497	4608	4788	4830	1.86
11	Food Balance (8-10)	2079.5	2097	4290	7377	4006	2616	16.16
12	Self-Sufficiency Ratio (4+7)/10	0.32	0.45	0.29	0.21	0.35	0.30	4.97
13	Food Availability Ratio (8/10)	1.48	1.48	1.95	2.60	1.83	1.54	3.27

Note: Most FBS prepared for developing countries suffers from incompleteness and inaccuracy. They can only be taken as a simple indication of the pattern of food availability/supply (see Dowler and Seo, 1985).

[ab] Estimates based on surveys.
[c] Kilograms converted to quintals. Computation based on HDDS score.
[d] Connotes the sample population covered in the surveys.

Source: Author's calculation

consumption patterns of the households, I summarized the main food groups into cereals/grains; vegetables; fruits; meat; dairy products; oil/fats; and sugar/honey (cf. Arimond and Ruel 2002). The HDDS covered at least 0.1 gm from the fifty-five food items consumed. The data excluded food prepared, purchased and consumed outside the household as well as consumption/fasting during special occasions/festivals. Most adult males, especially husbands, ate alone or with their wives while other members of the households ate from one plate. Separate weighing or measurements of servings of food items were therefore difficult and estimates were made from samples of servings consumed

from the total population (cf. Kimhi 2004: 6). This was done first by converting the food scales used locally such as *chinet*, *kunna*, *silicha*, *kil*, *kubaya*, *sine*, *tassa* (*minilik*), *birchiko* etc into a common unit of kilogram. Then this was changed to edible portions for processing, which was converted into kilograms to calculate the corresponding calories (see ENI 1968; FAO 1968). Each of the seven food groups was assigned a maximum diversity score of seven (indicating the number of total observation days each with a twenty-four hour recall). In order to compute the score of each group, I divided the number of food items consumed by the total number of food items in each main food group and then multiplied this by seven. The total score indicates the sum of the scores of the seven main groups. Table 4 presents a summary of the regression results based on the different models.

Table 4: Regression results: Dependent variable HDDS (n=450)

Variables	Model I	Model II	Model III	Model IV	Model V
Constant	5.643***	5.856***	4.145***	4.700***	4.717***
	(.064)	(.123)	(.091)	(.124)	(.111)
HEAD	-	-.031	-	-.004	-
		(.070)		(.048)	
FAMSIZE	-	-.208***	-	-.121***	-.122***
		(.017)		(.012)	(.012)
EDU	-	.595***	-	.180***	.181***
		(.018)		(.017)	(.016)
LANOWN	-	-	.417***	.384***	.392***
			(.045)	(.043)	(.042)
CATT	-	-	.123***	.112***	.112***
			(.017)	(.016)	(.016)
NONFAR	-	-	.288***	.209***	.209***
			(.000)	(.000)	(.000)
FER	-	-	.131***	.088*	.107**
			(.005)	(.005)	(.004)
WAT	-	-	.042	.009	-
			(.029)	(.028)	
CREDIT	-	-	.037	.038	-
			(.000)	(.000)	
PROPAR	.065	.070*	.068**	.076**	.077**
	(.091)	(.067)	(.049)	(.046)	(.046)
Adjusted R^2	.002	.461	.709	.742	.743

Note: Numbers in parentheses indicate standard errors.
*p<.05
**p<.01
***p<.001

By employing a simultaneous-entry approach, the variables were fitted in the different models since the purpose was to understand to what extent projects were able to contribute or had limitations in improving the food security status of rural households vis-à-vis other variables. Correlation coefficients among independent variables were checked for possible problem of multicollinearity. The tolerance statistics was between the range of .331 and 1, the Variance Inflation Factors (VIF) values changed between 1.081 and 3.019, and the maximum Condition Index was 17.530. These figures were acceptable values and there was no problem of multicollinearity. Standard residuals were also checked for the existence of outliers.

From Table 4, the results of Model I can be interpreted as a 1% increase in project participation will have an effect of improving the household dietary score by 0.065%. This relationship underlined the limitation and small contribution of the projects, and this was further shown by the statistically insignificant result. Project participation as a variable alone influenced a mere 0.2% variance in HDDS. My finding differs from the result reported by Gilligan and Hoddinott (2007: 225) in Ethiopia based on difference-in-differences matching estimator in which project participation was reported to have increased total and food consumptions eighteen months after the 2002 drought. A cursory look at project participation by duration (how long households participate on average) and the frequency of participation (how many times households participate) revealed the mean duration of project participation was 123 (less than 11 months) while on average households participated 1.82 times. Sixty-nine percent of households used food items for consumption. The large proportion of food items consumed was cereals, and money earned after sale of items was used for buying food items.

As a related aspect, it is widely discussed by previous research studies that similar projects suffer from the problem of targeting, selection and on-time payment (Jayne *et al*. 2001; Barret *et al*. 2004; Holden 2005; Ashenafi 2006). Although this study did not statistically test the probability of households' project participation, interviewed households claimed bias in the selection process. The high involvement of government bureaus and officials in implementation and evaluation of projects offered limited political space for other agencies to confirm and address some of the easier and short-term difficulties. Interviewed households stated that households with relatively better food security status were part of the projects at the expense of more needy households, and there were cases where expectations for benefits in food payments led to intentionally avoiding/postponing agricultural activities (crop production). Particularly delay in payment affected the resource utilization/depletion of farming households and hence their consumption patterns. A large number of participating households spent considerable time on the projects which could have been used for other activities. The activities (terracing, afforestation, road maintenance, borehole digging, and micro-dam construction) required intensive labor and some of the interviewed households claimed they did not eat for the whole day while participating in the projects.

Introducing socio-demographic variables in Model II showed they accounted for 48.1% of variance in HDDS. As a predictor of households' dietary diversity, participation in the projects was statistically significant together with family size and education. As expected, education had a high statistical significance. Some level of education (both literacy and school attendance) enables household heads to be more aware of sanitary issues and diversification of food utilization. It is also related to their ability to access and process information such as food prices and disaster preparedness/prevention (food, disease, floods etc). In Ethiopia a study by Yamano *et al*. (2005: 285) showed each completed grade of mothers' education in the household was linked to an additional 0.16 cm growth of children aged 25-60 months. Christiaensen and Alderman (2004) also noted the effect of

female education was as twice more than male education by improving a child's height-for-age score by 0.03. Mekonnen *et al*. (2005: 24), however, indicated children in better educated male parents in Ethiopia were less stunted than better educated women parents. Measuring child mortality in Tigray region based on parental education, the finding from Kiros and Hogan (2000: 447) showed the rate was the highest among children with illiterate parents and this was found to be more critical during famine or food stress.

Family size was inversely related to household dietary level, and households with large family tended to have lower dietary scores. This was mainly due to the effect large members of households increased the need for more consumption, and most of the households were less capable of providing diverse dietary to all members, and particularly children. This was contrary to the finding of Christiaensen and Alderman (2004) who reported larger family size in Ethiopia led to better heights of children mainly because such households would benefit from economies of scale as well as better experience in parenting. A study by Ramakrishna and Demeke (2002: 139) in northern Ethiopia showed an increase in family size resulted in an increase in the probability of facing food insecurity by 36.25%. Kidane *et al*. (2004) also concluded in one region of southern Ethiopia when the average family size decreased from 6.7 to 5.7, there would be an improvement in the level of food security from 0.134 to 0.191.

Gender in the form of household head was, as expected, negatively related to dietary household even though the relationship was not statistically significant. My previous study on gender and resource access and control in Ethiopia also showed female-headed households lagged in efficiently utilizing land resources thereby affecting their food security status (Bashaw 2004). This is because identifying gender differences at the household level is an underlying feature of gender analysis with the potential to enhance the food security status of rural households, and most importantly the nutritional status of children (Johnson *et al*. 2000). This was supported by empirical research in Jordan and Malawi by Bisharat (1990) and Castle (1995), respectively. My finding in the current study was contrary to the result reported by Nyariki *et al.* (2002) in Kenya where households headed by women were more food secure.

In Model III dietary diversity was regressed against a set of agricultural-economic variables which explained 70.9% of the variance in the dependent variable. With the exception of water and credit availability, all the variables were statistically significant. Water access/availability and its relation with food security were assessed based on the role of micro-dam/irrigation for agricultural productivity and food consumption. The majority of the households relied on rain, spring/well/borehole/pond, and only 27% had access to dam/irrigation. With an increase in the availability of micro-dams and irrigation systems (along measures to address complementary problems such as salinity), water access would be expected to have a more positive impact than found out in the present study. Water access and utilization was also associated with the prevalence of water-borne disease

(diarrhea), water-based disease (bilharzias) and water scarce diseases (trachoma, scabies, flea and lice-borne infections).

Credit availability, although positively associated with dietary diversity, was not statistically significant. More than 62.2% of the households expressed fear of risk in taking credits. This probably was due to their vulnerability and fragile assets in paying back loans coupled with the strong social cohesion in which default leads to social ostracism. Poor households relied on informal lenders and traditional associations, such as *Idirs* (funeral associations) and *Iquibs* (rotating credit associations). The finding of this study was contrary to a previous research covering 819 households in Ethiopia who participated in a microfinance program. This study suggested although there was no clear-cut enhancement of coping mechanism, the program helped households improve their nutritional status and well-being (particularly females and their households) (Doocy *et al.* 2005: 2372).

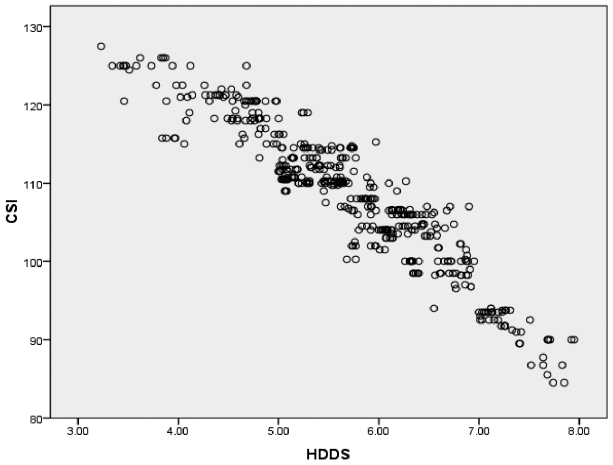
Agricultural land size, cattle ownership, non-farm income and fertilizer use were highly statistically significant. For agricultural land size, the finding of the current study was in line with the bulk of previous empirical studies on Ethiopia that concur the positive outcome. Regressed alone (by controlling other variables), land accounted for more than 60% of the variance in dietary diversity, and a one hectare increase in land would lead to 0.795 percent increase in dietary diversity. Particularly the study by Setotaw *et al.* (2003) showed by holding land quality/soil fertility constant, a 32% of improvement in the level of food security was observed for each additional unity of land cultivated (see also Croppenstedt and Mamo 1996; Hadgu 1996; Befekadu and Berhanu 2000; Abebe 2000). This was further supported by the finding that a one hectare increase in land size would contribute to a decrease in food insecurity by 57.66% (Ramakrishna and Demeke 2002: 139).

The equally strong statistical significance of agricultural inputs of fertilizer use and cattle ownership suggested the role of access to asset creation in food productivity that directly influences food consumption. Fertilizer use was limited where on average households used 6.37 kilograms of fertilizer. This was by far too small compared to other African and Asian rural households. Farmers of other countries in Africa use 9 kg/hectare while the figures for Latin American, South Asian, and Southeast Asian farmers indicate 86 kg/hectare, 104 kg/hectare and 142 kg/hectare, respectively (Kelly 2006). Access to cattle ownership was 2.6 on average where 42.8% of the households had 3 cattle. Given the large cattle population in the country and the importance of cattle ownership as a source of agricultural productivity, food consumption, and wealth ranking, cattle ownership was limited. More than 10% of the households did not own cattle. The average non-farm income was equal to the national per capita income of US$ 100, and the largest part of the income was indirectly earned through the sale of agricultural produce.

Model IV (the full model) consisting of all the variables showed with the exception of household head type, water and credit availability, all other variables were statistically significant. The model accounted for 74.2% of the variance in dietary diversity of rural households in the research sites. The

last model (Model V) was not only the most statistically fit model, but also similar to the full model accounted for 74.3% of the variance in the dependent variable. Thus, it is plausible to argue the role of project participation has the potential to bring results in improving the food security status of rural households in the research sites if aid allocation addresses family planning, agricultural land conservation/utilization, providing access to education both in terms of literacy and school attendance, employment generation schemes for additional income, and improving farming inputs in fertilizer use and cattle ownership (see also Kaluski 2002). Dietary diversity based on these variables was statistically significant in accounting for 88.4% of the variance in the CSI of households. A 1% increase in HDDS leads to a decline in .940% of CSI.

Figure 2: Dot Chart of the relationship between HDDS and CSI



Note: Markers show Mean

7. Conclusion

This study attempted to look into the contribution and problem of the large proportion of aid allocated to Ethiopia to address the core issues of food insecurity in two northern sub-districts of the country. While aid served as an important source of food supply to highly food deficit households, its contribution in terms of improving households' dietary diversity and thus their coping strategy was limited. The relationship was found to be statistically insignificant. It is worth emphasizing here aid and its allocation should be treated as one important component of addressing food insecurity, but surely not as a panacea for solving the problem, nor a bulwark against the overall poverty in agrarian developing countries. The tendency and expectation to view aid as the solution for such problems is unwarranted and illogical. This is because there is no empirical evidence showing a country, without some form of institutional (both structural and legal) establishments and policy frameworks, that was

able to achieve growth through foreign aid. Rather aid is a scarce resource for poor and vulnerable agrarian developing countries as one important element to strengthen the bases for asset creation.

The coping strategies covered in this study constituted seasonal approaches, and there is a need to focus on how households rebuild their long-term assets for the purpose of exploring ways of effectively enhancing the process of asset recreation. Above all, this study did not include the macro analysis and the role of government policies in influencing the manner in which aid was used in the country. Yet, the findings reflected the importance for the bulk of aid given to the country to emphasize the need priority of households by focusing on underlying socio-demographic factors (mainly education and family planning) and agricultural input-economic variables (agricultural land, cattle ownership, fertilizer use, and non-farm income).

Notes

1 The recent financial meltdown is expected to affect the level of aid allocation from major donor countries in the coming year(s).

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