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A model for predicting food security status among households in developing countries

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Abstract

Food security prediction has been challenging aspects in developing countries particularly in African countries such as Tanzania. Consequently, government lack proper stimulated information that is necessary in making decision on efforts required for stabilizing food situation and status in their countries. Scientifically it has been observed in research and practical that this is caused by lack of proper mechanisms, tools and approach suitable for modeling and predicting food status among households. This paper proposes a logistic regression based model for analysis and prediction of food security status. The proposed model is empirically test using practical data collected from one district in Tanzania.

Keywords: Food security, Demographic variables, Capital endowments, Odds ratio, Reference category

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1. Introduction

1.1. Background to the research problem

Food security is defined as access by all people at all times to enough food for all for an active, healthy life (World Bank, 1986). Two components of food security are availability (through domestic production, storage and or trade), and food accessibility (through home production or purchase in the market) (Rukuni and Eicher, 1987). Johnson (1986) defines food security as the degree of accessibility to food, adequacy in quality and quantity, to fulfill the dietary requirements of all household members during the whole year. Access to food is intimately related to access to resources necessary for the procurement of food, which implies the command over goods and services necessary for their pursuits. In other words, access to food depends on income, whether in cash or kind (Tilakaratne, 1985). Developing and testing food determinant at the household level has always been the efforts of myriad of writings (Maxwell, 1996). In line with the literature this study also predicts the food security status among the households assuming the role of demographic variables and capital endowments of the households (Haile et al., 2005).

Food security has not been achieved by almost all countries in the world. However, the problem is more pronounced in sub- Saharan Africa. It was estimated that in Africa about 204 million people were identified as undernourished between the years 2000 and 2002 in which 86 million were from east side of continent including Somalia, Ethiopia, Sudan, Kenya and Tanzania (Kaduma, 2006). According to Murray (2002), most of the people who live in poor countries are engaged in a continuous struggle to secure livelihood in the face of uncertain social, economic and often political circumstances. Consequently, these countries face chronic food insecurity because of the environmental hardships found in both rural and urban areas (FAO, 2000). The issue of food insecurity has been serious in Africa as Rosegrant et al. (2005) point out that more than 200 million Africans suffer from malnutrition. In Tanzania, in particular, the Household Budget Survey Report of 2002, disclosed that 19 per cent of the Tanzanian population was below the food poverty line of Tanzania Shillings 5,295 per adult per day on the basis of the year 2000 prices, and below caloric energy consumption of 2,020 Kilocalories per adult equivalent per day (Kayunze and Salisali, 2006).

1.2. Literature review

Tanzania is a poor developing country, with agriculture as the backbone of her economy. About 90 per cent of its population is engaged in agriculture which accounts for about 50 per cent of the GDP as well as generating about 80 per cent of the total export earnings (Kamugisha, 2001). Although agriculture is the backbone of the Tanzanian economy, the small holder producers in rural areas produce food for their own subsistence, and most of the households experience food shortages. Food insecurity persists with about 20.4 per cent of the population falling into the category of the people poor in terms of food (Migiro, 2004). According to the united republic of Tanzania (National Population Policy Report of 2006), the proportion of people who cannot meet their own basic food requirements is about 19 per cent of the total population. Moreover, the proportion of people with incomes that cannot satisfy their basic needs (that is food, shelter, clothing, primary education for children and essential health services) is 36 per cent. When this situation is

compared to that observed in the 1991/92 HBS, there has been a slight progress manifested in the urban areas, particularly in Dar es Salaam. However, the situation in rural areas has remained almost the same. Moreover, few literature reviews are hereby cited for clear justification for variables to be included in the model as follows;

***Household Size*:** The bigger the size of the household the more the pressure on the consumption than on the labour that contributes to production will be. Thus a negative correlation between the household size and food security is expected as food requirements increase in relation to the number of persons in a household (Paddy, 2003). Age of the household head; it is measured in years. Older people have relatively richer experiences of the social and physical environments as well as greater experience of farming activities (Haile et al., 2005). That is, when household heads get older, they are expected to have stable economy in farming. "Moreover, older household heads are expected to have better access to land than younger heads, because younger men either have to wait for land redistribution, or have to share land with their families" (Haile et al., 2005, p. 6).

Sex: In rural areas women play an important role in ensuring food security at the household level. They are responsible for providing food through production or earning income by purchasing it, processing and preparing food for their families. Despite these roles, women have little access to resources and power in decision making about household food security compared to men (Kaduma, 2006). Quisumbing and Meinzen-Dick (2001) assert that giving women the same access to physical and human resources as men could increase agricultural productivity, just as increases in women's education and improvements in women's status over the past century have contributed to more than half in the reduction of child malnutrition rate

Social capital: Among the factors that determines the house hold productivity and food security is the availability of labour. This is especially in the subsistence oriented households given the necessary landholding and rainfall. Therefore, this study presumes that accessibility of labour will have positively affect food security Chen (1991).

Physical Capital of the Household: These include the number of livestock possession, oxen possession as well as farm land size of the households. Kang'ara et al. (2001) reported that livestock contributes to households' economies in different ways; for example, livestock act as a source of pulling power, cash income, supplementary food and means of transport. Besides, livestock are considered as a means of security and means of coping during crop failure and other calamities. A study by Kassa et al. (2002) found that households which own livestock have good food security status as well as sustainable farming. Moreover, households' crop production is significantly affected as a result of oxen that aid as a pulling force in many developing countries. However, animal traction power has been used to enable households to cultivate greater areas of land and implement agricultural operations on time. Therefore, a positive relationship exists between oxen ownership and food security (Govereh and Jayne, 1999). Farm size; the farm land size affects food security status of the household**.** It is likely that farm land size has a positive effect on food security status of households. Food production can be increased extensively through expansion of areas under cultivation Najafi (2003)

Financial capital: Credit can be used as a consumption smoothing mechanism in the event of food shortage in the household. Households which are members of associations are in a better position to access financial resources to make investments in their farm and to bridge the food gap in times of scarcity (Zeller and Sharma, 2000).

Regarding an employment status: According to FAO (1999), employment in off-farm and non-farm activities is crucial for expansion of the sources of farm households' livelihoods. In this case modern of production by providing the households with an opportunity to use the required inputs. It also minimizes the danger of food shortage during the time of unanticipated crops failure through food purchases. In many countries, African countries inclusive, a great chance of famishment for themselves and their families during periods of chronic or transitory food insecurity has always been avoided and reduced to a great extent because of diversification of sources of income that has been a strategy for survival for such a long time (Devereux 1993, Maxwell and Frankenburger, 1992). In the current study, employment was categorized as fully employed in government or private, self- employed, seasonally employed and not employed at all.

According to Najafi (2003), household head's access to education could lead to awareness of the possible benefits of making agriculture a modern enterprise through advanced technological inputs, enhancing farmers to follow instructions on fertilizer packs and shall be used to diversification of household incomes which, in turn, would enable household food supply appropriately.

2. Data and estimation model

The study was conducted at Mvomero district of Morogoro region in Tanzania. Mvomero District was chosen based on the fact that, out of the twenty eight Districts councils and two Municipalities in twelve regions in Tanzania Mainland whose populations were food insecure and needed immediate interventions Mvomero was one of them. This is based on the report of United Republic of Tanzania Food Security and Nutrition Assessment for 2010 (URTFSNA, 2010). Primary data related to demographic variables and capital endowment of the household was collected by means of structured questionnaire. The target population was all households found in the study area. A multistage sampling was used in this study. Simple random sampling was used in the first stage, followed by purposively sampling used to choose one ward of seventeen and two villages out of five. Finally systematic sampling was used to choose households to be included in the study. From each selected village a probability proportional to size was used to select the required number of households to be included in the sample. A total of 382 households were estimated as a representative sample size for the entire study.

The collected data were edited to detect errors and omissions and thereafter coded prior to analysis by using Statistical Package for Social Sciences (SPSS) 15.0. The binary logistic regression analysis was used to predict the dependent variable given the set of predictor variables. Since Y is a binary variable, it is reasonable to assume that it has a Bernoulli distribution with parameter π = P (Y = 1), that is, π is the probability of success (a household to be food secure) for given values $x_1, x_2, x_3, \ldots x_k$ of the explanatory

variables. Logistic regression allows one to estimate the probability of an event occurring from the logit link regression model.

$$\ln \frac{\pi_i}{1-\pi_i} = \beta_0 + \sum_{j=1}^{k} \beta_j X_{ij} \qquad i = 1, 2, 3.....n, \quad j = 1, 2...k$$

Since $0 \le \pi_i \le 1$ it follows that

$\ln \frac{\pi_i}{1-\pi_i} \quad \in (-\infty, \infty)$

where: π_i stands for the probability of household *i* being currently food secure; X_{ij} are factors determining the food security status for a household *i*; $\beta_j s`$ stand for parameters to be estimated; Y_i stand for observed food security status of household *i*; β_0 is a constant term.

This study used few variables or predictors having been included in the binary logistic regression model are clearly described (Table 1).

Table 1. Explanatory Variables Included in the Binary Logistic Regression Analysis

Age	Age of the head of household in years
Sex	Sex of the household head specified as 1=male, 0= Female
Education level	Education level attained by household heads (years of school)
Household size	Household size (number of persons in the family)
Informal saving groups	Membership to informal saving group: 1= a member, 0 = not a memeber
formal saving groups	Membership to formal saving group: 1= a member, 0 = not a memeber
Loan	loan: 1=taken bank loan, 2= not taken bank loan
Bank account	bank account operation: 1= operates a bank account, 2= does not operate a bank account

3. Empirical findings

In this study the bivariate analysis results were used to highlight the degree of association between food security status and the set of predictors. However, it is unscientific to make a valid conclusion. Thus, social/financial capital possessed by households of bank account and employment status of the household heads were found to have a statistically significant association with the household food security status at the 5 per cent level of significance when tested using chi-square test whereas loan taken by the household head, informal saving groups and formal saving groups were not statistically significant associated with the households` food security status. Social and financial capital information regarding chi-square test has been summarized in Table 2.

Table 2. Association between Food Security Status and Social/financial Capital

			Food security status		χ^2, P-value
Predictors	**Number of households**	**% Total**	**% Not food secure**	**% Food secure**	
Bank account					**16.536, (0.000**)**
Operate	69	18.1	15.0	3.1	
Not operate	313	81.9	46.0	35.9	
Loan					**0.408, (0.523*)**
Taken a bankloan	38	9.9	6.5	3.4	
Not taken loan	344	90.1	54.5	35.5	

means not statistically significant at $\alpha = 5\%$* ***Source: Field work, 2011*

*** means statistically significant at $\alpha = 5\%$*

The demographic variables such as sex, household size, age of the household head, human capital (education level) have been presented using chi-square test (Table 3).

Table 3. Association Between Food Security Status and Demographic Variables

			Food security status		χ^2, P-value
Variables	**Number of households**	**% Total**	**% Not food secure**	**% Food secure**	
Sex					**0.384 (0.535*)**
Male	149	39	23	16	
Female	233	61	38	23	
Household size					**4.438 (0.035**)**
1 to 5	110	28.8	15.2	13.6	
6 or more	272	71.8	45.8	25.4	
Age (years)					**32.074 (0.000**)**
25 or less	51	13.4	7.6	5.8	
26-30	81	21.2	16.8	4.5	
31-35	51	13.4	9.2	4.2	
36-40	64	16.8	11.8	5	
41-60	94	24.6	11.8	12.8	
61+	41	10.7	3.9	6.8	

** Statistically not significant (P> 0.05)* ***Source**: Field work, 2011*

*** means statistically significant (P< 0.05)*

Despite those variables being significant statistically under chi-square test, they still have to be subjected to logistic regression analysis for plausible conclusions/prediction purposes. The effect of each independent variable was indicated by the odds ratio for each of the variable relative to the reference category. The odds for an event refer to the ratio of the probability of an event occurring to the probability of the event not occurring. It gives the relative amount by which the odds of the outcome increase (odds ratio greater than 1) or decrease (odds ratio less than 1) when the value of the predictor value is increased by a unit.

The odds for an event is defined by $\frac{\pi}{1-\pi}$.

For the current study the odd ratios were used to interpret the relative risk of each independent variable relative to a reference category for a categorical variable. These variables included the age of the household head, education level, employment status household size and possession of a bank account (see Table 1).

The variables in the equation in Table 4 give us information about the contribution or importance of each of our predictor variables. The Wald statistic is used as a measure of importance of the variable in the study. The higher the value the more the important it is. For each of the odds ratios, Exp (B), shown in the table there is a 95 per cent confidence interval (95.0% CI for Exp (B)) displayed, giving a lower value and an upper value. In simple terms this is the range of values that we can be 95 per cent confident that it encompasses the true value of the odds ratio.

Education status of the household head is one of the indicators of development of human capital. The findings revealed that the human capital of the household was positively and statistically significantly related to food security status of the household (P-value = 0.012 and 95 per cent CI 1.201 to 4.489). The probability for a household to be food secure tends to increase with an increase in the level of education. This means that the households whose heads attained secondary/post secondary education were 2.322 times more likely to be food secure as compared to those household headed by primary school levers.

As far as bank accounts are concerned, it was found that households, who had at least one member operating a bank account, could be used in the prediction of the household food security status. The findings showed that, respondents who had at least one member operating a bank account were 3.021 (=1/0.331) less likely to be food secure compared to those household heads whose members were not operating bank accounts (P-value = 0.006 and 95 per cent CI 0.152 to 0.723). This may be the case because rural inhabitants in sub-Saharan Africa do not operate bank account since they rely much on crop harvests to fulfill hunger.

As regards the age groups, it was revealed that age of the household heads was statistically significantly related to food security status. The results showed that the households with people in the youngest age group of 26 to 30 years were 3.717 (=1/0.269) times less likely to become food secure compared to those with people in the age group of 41 to 60 years (P-value = 0.001 and 95 per cent CI 0.124 to 0.582). Similarly, the results indicated that household heads aged 36 to 40 years were 2.3148 (=1/0.432) times less likely to become food secure compared to 41 to 60 years (P-value = 0.026 and 95 per cent CI 0.207 to 0.905). In this study, the youngest age group faced more food insecurity than the older age group. The young persons are not food secure probably because they have no experience with problems and do not posses enough land that is suitable for crop cultivation compared to older people.

Table 4. Estimated Logistic Regression Equation of the Households Food Security Status and Explanatory Variables

Variables	B	S.E	Wald	Sig	Exp(B)	95% C.I for EXP(B)
Education level				**0.059**		
Primary	**RC**					
no formal education	-0.213	0.416	0.262	0.609	0.808	0.357-1.828
Adult education	0.494	0.494	0.893	0.345	1.639	0.588-4.570
Secondary/post seconadry	0.843	0.336	6.276	**0.012****	**2.322**	1.201-4.489
Bank account						
Not operate	**RC**					
Operate	-1.105	0.398	7.701	**0.006****	0.331	0.152-0.723
Age group				**0.009**		
41-60	**RC**					
26-30	-1.313	0.394	11.115	**0.001****	0.269	0.124 - 0.582
31-35	-0.521	0.411	1.603	0.205	0.594	0.265 - 1.330
36-40	-0.838	0.377	4.957	**0.026****	0.432	0.207 - 0.905
25 0r below	-0.186	0.399	0.217	0.641	0.83	0.380 - 1.815
61 or more	0.07	0.455	0.024	0.877	1.073	0.440 - 2.615
Household size						
6 or more	**RC**					
1-5	0.474	0.286	2.734	**0.040****	1.606	0.916 - 2.816
Employment level						
Self employed	**RC**			**0.006**		
Government/private	-0.863	0.505	2.914	**0.028****	0.422	0.570 - 1.136
Seasonally employed	-0.899	0.649	1.915	0.166	0.407	0.140 - 1.454
Not working	-0.225	0.507	0.196	0.658	0.799	0.296 - 2.158

***Source**: Field work, 2011; ** means statistically significant at $\alpha = 5\%$ 5% and * means statistically not significant at $\alpha = 5\%$, RC = Reference Category*

The household size is an important factor which determines food security status. Normally, the larger the household size the more the pressure on the household for the scarce resources available. In this study, the household size was coded as small if there were between 1 and 5 members (which are the national average household size of households) while big household size was assumed to have 6 members or more. The findings indicated that the respondents with small households sizes were 1.606 times more likely to be food

secure compared to households with big families (P-value = 0.040 and 95 per cent CI 0.916 to 2.816) in the study area.

As regards employment status, it was found that the household headed by people who were fully employed in either the government or private sector were 2.370 (=1/0.422) times less likely to be food secure compared to those household heads who were self employed (p-value = 0.028 and 95 per cent CI 0.57 to 1.136 CI). The government/private category is shown by the largest Wald test whose value is 2.914 compared to other categories and this signifies how important the category is to influence the food security status. The self employed group were food secure probably because they are flexible to perform both farm and non-farm activities.

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3.1. Prediction model

The major primary concern in this study was to use the logistic model to predict the outcome for any new observation. In order to check whether the model is well fitted to the data or not, a classification table was used. A classification table shows the number and percentage of observed cases that are correctly or incorrectly classified. The outcomes in this study were either a household being not food secure or food secure, respectively. The assessment of how good the model is for the prediction of food security is given in Table 5.

Table 5. Model Discrimination Classification Table

		Food Security Status		
Observed		Not food secure	Food secure	% Correct
Food security status	Not food secure	192	41	82.4
	Food Secure	65	84	56.4
Overall percentage correct				**72.3**

Source: *Field work, 2011*

With reference to Table 5 above, the overall accuracy of this model to predict food security status (with a predicted probability of 0.5 or greater) is 72.3 per cent. That is called the probability of correct classification. The probability error rate model classification is (100 per cent-72.3 per cent= 27.7 per cent). The sensitivity

is given by 84/149 = 56.4 per cent and the specificity is given by 192/233= 82.4 per cent. A positive predictive value is 84/125=67.2 per cent and the negative predictive value is 192/257=74.7 per cent.

4. Conclusions

By using logistic regression analysis, age and household size appeared to have the power to predict food security status in the household. Households with few members were found to be 1.606 times more likely to be food secure than those having more members. Households headed by person aged 26 to 30 years old were found to be 3.717 times less likely to be food secure compared to those headed by persons aged of 41 to 60 years old. Households headed by persons between 26-30 years olds were somehow more likely to be food secure compared to those headed by persons aged 36 to 40 years old who were 2.3148 times less likely to be food secure. The education of the head of the household was found to be 2.322 times more likely to affect household food security status. This means that the probability of the household to be food secure increases with an increase in the education level of the head of the household. It is believed that, education helps to shape the attitude and mind of the head, which in turn may enable the head to adopt new agricultural technologies such as fertilizer, using improved seed, pesticides and storages.

The odds ratio for households among whom at least one member was operating a bank account was found to be 3.021 times less likely to be food secure compared to those who were not operating bank accounts. This may be the case because in rural areas a small proportion of people operate a bank account and the rest depend on crop harvests as a source of income and consumption. On the other hand, the respondents whose household heads were fully employed in either government or private sector were 2.370 times less likely to be food secure compared to those who were self- employed. This may also be the case because self employed people are able to perform multi- tasks compared to those who are just depending on remunerations from their employers. Finally, the study recommends the following critical issues to be done. Firstly, another study is required be done incorporating the urban component and even other rural areas to come up with an in-depth analysis of the factors affecting household food security status in other parts of Tanzania because food insecurity is becoming exceedingly manifested at household level as time goes. Also, the issue of climate changes as worldwide agenda is a big menace nowadays hence it has a great significant impact on crops production. Thus, future researchers should think of having in-depth investigation to ascertain its impact on households`food security since the majority of Tanzanians depend on rain fed agriculture.

References

Chen, M.A. (1991), *Coping with Seasonality and Draught,* New York, Sage Publications.

Devereux, S. (1993), "Goats Before Ploughs: Dilemmas of Household Response Sequencing during Food Shortages", *Institute for Development Studies Bulletin,* Volume 24 No. 4, pp. 52-59.

FAO (1999), *North and South Gonder-Food Security Assessment in Parts of the Tekeze River Watershed.* UNITED NATIONS DEVELOPMENT PROGRAMME, Emergencies Unit for Ethiopia, Assessment Mission: May 26- June 7, 199, Addis Ababa, Ethipia.

FAO (2000), *The State of Food and Agriculture*, Rome, Food and Agriculture Organization of the United Nations.

Govereh, J. and Jayne, T.S. (1999), *Policy Synthesis: Effects of Cash Crop Production on Food Crop Productivity in Zimbabwe: Synergies or Trade-Offs.* Michigan State University, *USAID*.

Haile, K., Alemu G. and Kudhlande, G. (2005), "*Causes of Household Food Insecurity in Koredegaga Peasant Association, Oromia Zone, Ethiopia"*, Working Paper, Department of Agricultural Economics, The University of the Free State, 2005

Johnson, U. (1986), *Nutrition, Household Food Security and Women: Experience from Tanzania,* Dar es Salaam, UNICEF.

Kamugisha, C.A. (2001), *Household Coping Strategies for Food Security in Hazardous areas of rural in Kagera rural Tanzania.* Un published PhD Thesis, University of Dar es Salaam, Tanzania

Kang'ara, J.N., Ngoroi, E.H., Muturi, J.M., Amboga, S.A., Ngugi, F.K. and Mwangi. I. (2001), *The Role of Livestock in Soil No Fertility, Biodiversity, Land use, Cultural and Welfare change in Nduuri Embu,* Embu Regional Research Centre Kenya Agricultural Research Institute (KARI), Kenya.

Kassa, H., Gibbon, D. and Singh, B.P. (2002), "Livestock Improve Household Food Security and Sustainability of Ethiopian Small Farms", *Journal of Sustainable Agriculture,* Volume.21, No.2, pp. 35-36.

Kayunze, K.A. and Salisali, B. (2006), "Organizations and Farmer's Access to Agricultural Technologies for Food Security: The Case of Meatu District in Tanzania, *Journal of Management and Development Dynamics*, Volume. 18 No.1, pp. 46-66.

Maxwell, S. (1996), Food security: A post modern perspective. *Food Policy*. Vol. 21 No. 2, pp. 155-170

Maxwell, S. and Frankenberger, T. (1992), *Household Food Security: Concepts, Indicators Measurements,* New York, UNICEF and IFAD Dan Strum Gardanni, Inc.

Migiro, A. (2004), *Gender Equity and Equality: A Getway to assessing food and nutrition security in east and central Africa 2020.* The Case of Tanzania*.*

Murray, C. (2002), *Rural Livelihoods: In the Companion to Development Studies* (Edited by Desai, V and Potter, R.B); Arnold Publishers, London, Oxford University Press Inc.

Najafi, B. (2003), "*An Overview of Current Land Utilization Systems and Their Contribution to Agricultural Productivity"*. Report of APO Seminar on Impact of System on Agricultural Productivity. Agricultural Productivity Organization (APO), Iran.

Paddy, F. (2003), *Gender Differentials in Land Ownership and Their Impact on Household Food Security: A Case Study of Masaka District*, MA Dissertation, Uganda Press, Baltimore and London. Available on http://www.troz.unihohenheim.de/research/Thesis, retrieved on 5th December, 2010

Quisumbing, A.R. and Meinzen-Dick, R.S. (2001), *Empowering women to Achieve Food Security,* Washington D.C.: International Food Policy Research Institute. http://www.ifpri.org/2020/focus/focus06.htm

Rosegrant, M.W., Cline, S.A., Li, W., Sulser, T.B. and Valmonte-Santos, R.A. (2005), Looking Ahead Long Term Prospects for Africa's Agricultural Development and Food Security. 2020 Discussion Paper 41, International Food Policy Research Institute (IFPRI), Washington, DC.

Rukuni, M. and Eicher, C.K. (1987), *Food security for Africa:*, UZ/MSU Food Security Project. University of Zimbabwe publications. Harare.

Tilakaratne, S. (1985), "Access to Resources for Food Interaction between Households and Macro- Process", in Eide W.B., G.Holmboe-Ottesen, A.Oshaugh, D. Perera, S. Tilakaratne and M. Wandel (eds), *Introducing Nutritional Considerations into Rural Development Programmes with Focus on Agriculture*, Norway, University of Oslo.

United Republic of Tanzania (URT) (2006), *National Population Policy,* Ministry of Planning, Economy and Empowerment, Dar es Salaam Tanzania.

World Bank (1986), "Poverty and Hunger: Issues and Options for Food Security in Developing Countries". Washington, D.C: The International Bank for Reconstruction and Development/The World Bank.

Zeller, M. and Sharma, M. (2000), "Many Borrow, More Save, and All Insure: Implication for Food and Micro-Finance Policy", *Food Policy*, Volume 25 No. 2000, pp. 143–167.