

SURVEY RESULTS ON HUNGER AND FOOD INSECURITY IN YEMEN*

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Abstract: Yemen has become the first country in the MENA region to develop and field a direct food security survey at the national level. The survey was administered to a representative sample of over 112,000 households. The results indicate that food insecurity and hunger are widespread in Yemen. Food insecure households tended to have more children and fewer household members, were more likely to rely on temporary employment, and were more likely to be classified as non-agricultural. Among agricultural households, households headed by a female or young adult were more likely to be food insecure, while those headed by persons with higher levels of educational attainment were less likely to be food insecurity.

1. Introduction:

There has been increased interest in the use of direct survey-based measures of food security in recent years. At the 1996 World Food Summit, signatory nations called for global reductions in hunger and food insecurity and agreed to develop national Food Insecurity and Vulnerability Information and Mapping Systems (FIVIMS) to monitor and track food insecurity and hunger. Around the same time, the development of a direct survey-based measure of food security in the United States attracted international attention as a way that monitoring could be accomplished at reasonable cost (Bickel et al., 2000, Nord et al., 2002a).

Direct survey-based measures of household food security are being developed and used in a growing number of countries, including Bangladesh, India, and Uganda (Nord, et al., 2002b). Yemen has become the first MENA country to develop and field a national food security survey. The 2003 survey was administered to a sample of over 112,000 households as part of a national FIVIMS [1]. The survey questionnaire included 16 questions, six of which formed the basis for six household food security indicators. Survey-based food insecurity measures are being developed in other MENA countries, including Lebanon, Palestine, and Syria. Countries that are considering introducing measures of household food insecurity and hunger would benefit from a better understanding of the Yemeni experience.

This paper describes the Yemen food insecurity indicators and analyzes the correlates of food insecurity among households in Yemen.

2. Defining and Calculating Food Insecurity:

The 1996 World Food Summit called upon signatory nations to reduce the number of undernourished people suffering from hunger worldwide by half by 2015. This goal was further incorporated into the United Nations' Millennium Development Goals. The resulting World Food Summit Action Plan recommended that Food Insecurity and Vulnerability Information and Mapping Systems (FIVIMS) be developed at the global, national, and sub-national levels. FIVIMS would help national agencies, international organizations, and other concerned parties identify populations with high prevalence rates of food insecurity and vulnerability in individual countries. The system would also provide information about the causes of food insecurity across countries and identify possible actions to alleviate the problem.

A food insecure household means that one or more household members are undernourished as a result of their lack of access to adequate food and/or inadequate food utilization. This includes those whose food intake falls below their minimum calorie requirements as well as those with energy or nutrient deficiencies resulting from inadequate or unbalanced diets (FIVIMS, 2004).

Direct survey-based measures of food insecurity estimate the level of a household's food insecurity through a series of questions designed to identify whether household members experienced reductions in the quantity or quality of food over a specific period of time (usually one year) as a result of their lack of access to food or resources to obtain food. Countries may adopt different operational definitions of food insecurity and hunger which translate into different survey questions that reflect the unique circumstances and priorities of these countries.

Nord et al. (2002b) note that food security questionnaires do not need to be identical in order for the results to be comparable. All that is required for survey results to have an equivalent meaning across countries is for specific *threshold items* to be similar across surveys. In other words, food security surveys only need to have three or four key questions in common for their results to be comparable.

In the early 1990s, the United States developed a survey-based measure of food insecurity that has helped guide the development of survey instruments in other countries, including Yemen. The U.S. measure is based on a set of 18 questions. Eight questions focus on the food security of children in a household. Households with no children are only asked 10 questions. A type of nonlinear factor analysis is used to generate a common food security scale (Hamilton, 1997b). This scale is then used to classify households into three levels of food security (Bickel et al., 2000): food secure, food insecure without hunger, and food insecure with hunger. The U.S. food security measure has been used to track annual prevalence rates of hunger and food insecurity across the U.S. (Hamilton et al., 1997a; Nord, Andrews, and Carlson, 2002, 2003). The measure has also been used to study a variety of issues, such as the determinants of hunger and food insecurity (Kabbani and Yazbeck, 2004), the effect of public assistance programs on food insecurity (Kabbani and Yazbeck, 2004 and 2005; Borjas, 2004; Nord, 2001), and whether food insecurity affects child development (Dunifon and Kowaleski-Jones, 2003; Stormer and Harrison, 2003) and educational outcomes (Winicki and Jemison, 2003).

The FIVIMS survey module contained 16 items, including ten questions that directly assess household food insecurity and hunger (Appendix A). Six of these questions were used to construct six indicators household food insecurity [2]:

- *Vulnerable to Food Insecurity*: a household is said to be vulnerable to food insecurity if, during the previous 12 months, there was a time when the respondent feared not having enough food for his/her family for the following month.
- *Subjectively Food Insecure*: a household is classified as subjectively food insecure if, in the previous 12 months, family members could not afford to eat what they normally eat.
- *Food Insecure with Moderate Hunger*: a household is said to be food insecure with moderate hunger if, during the previous 12 months, one or more household members did not have a meal in a day because there was not enough food.
- *Food Insecure with Severe Hunger*: a household is said to be food insecure with severe hunger if, during the previous 12 months, one or more household members did not eat for an entire day because there was not enough food.
- *Food Insecure with Moderate Hunger among Children*: a household is said to be food insecure with moderate hunger among children if, during the previous 12 months, one or more children did not have a meal in a day because there was not enough food.
- *Food Insecure with Severe Hunger among Children*: a household is said to be food insecure with severe hunger among children if, during the previous 12 months, one or more children did not eat for an entire day because there was not enough food.

Questions about household food security were only asked of households that had been classified as subjectively food insecure (48 percent of the sample). The logic was that households that could afford to eat what they normally eat were “food secure” and there was no need to ask them additional questions. In retrospect, some households that indicated that they could afford to eat what they normally eat may have responded affirmatively to subsequent questions about reductions in food intake. Thus, with the exception of the prevalence estimates of subjective food insecurity, the number of households identified as vulnerable or food insecure in the FIVIMS data represent lower-bound estimates of the number of households that were truly vulnerable or food insecure. To address this issue in our empirical analysis, we use censored regression techniques in addition to standard regression methods.

3. The Economic Situation in Yemen:

The Republic of Yemen is among the poorest and least developed countries in the World. In recent years, Yemen has made major strides in terms of growth and development, but still lags behind most MENA countries. Gross Domestic Product (GDP) per capita was only \$465 in 2000, up from \$416 in 1997 (Ministry of Planning and Development, 2001). Yemen has a population of over 19 million people, over 70 percent of who live in rural areas. Population growth is estimated at 3 percent per year and over half the population is below the age of 15. The fertility rate was estimated at 6 children per woman in 2002, the highest in the region.

Among the many impediments to economic growth and development in Yemen, three stand out as deserving special mention. First, the country has increasingly relied on revenues from limited oil reserves. The share of oil and gas increased from 13 percent of GDP in 1995 to 34 percent in 2000. Oil and gas revenues now account for almost 90 percent of government revenue and have contributed to delays in the implementation of structural reforms (Khan and Chase, 2003). The second major obstacle to economic development is the high production and consumption levels of qat, a drug-like leaf. Qat production has contributed to the decline of the agricultural sector. Its intensive use of water is creating problems in an already water-scarce region and its widespread consumption has been associated with higher rates of poverty and malnutrition (Khan and Chase, 2003). The third obstacle is low levels of educational attainment. In 1998, primary school enrollment in Yemen was only 61 percent and secondary school enrollment only 37 percent, and over 50 percent of the adult population was illiterate (World Bank, 2003).

Most of the current information on poverty in Yemen comes from the 1998 Household Budget Survey (HBS) and the 1999 National Poverty Survey, with the former providing the more nationally representative estimates. Based on the HBS, 42 percent of households in Yemen lived below the poverty line in 1998. This confirms Yemen’s status as one of the poorest countries in the world. Additionally, 25 percent of the population was near-poor and vulnerable to falling into poverty if they experienced a shock to their incomes. A recent study by the World Bank (2002), based primarily on the 1998 HBS data, suggests that poor families in Yemen are more likely to live in rural areas, to have large households, and to have large child-to-adult ratios.

Prior to the FIVIMS survey, household food insecurity in Yemen was measured indirectly using food poverty rates. Since food is such a basic commodity, food poverty lines are indicators of

extreme poverty. In 1998, 17.6 percent of households in Yemen were estimated to be food poor (World Bank, 2002). Nutritional measures also highlight the extent of food insecurity in Yemen. A majority of the population consumes less than the standard 2,200 calories per person per day (Ministry of Planning and Development, 2001). According to the 1997 Demographic and Maternal and Child Health Survey (DHS), 51 percent of children under 5 years old were stunted (under-height for age) and 46 percent of children were underweight. These estimates represent only a slight improvement from 1979, when stunting among children was estimated at 56 percent and underweight at 58 (World Bank, 2003).

The statistics on poverty and malnutrition suggest that food insecurity is widespread in Yemen. However, there is little *direct* evidence about the extent of household hunger and food insecurity or the characteristics and geographic location of the food insecure populations. Using a direct measure of food security would provide policy makers and international organizations with important information about the status and nature of hunger and food insecurity in Yemen.

4. Survey Data and Empirical Methodology:

The 2003 FIVMS survey was administered by the Yemeni government's Central Statistical Organization (CSO) to a nationally representative sample of 116,734 households, of which 112,413 households were successfully interviewed. This paper excludes a small number of households with invalid and inconsistent information, resulting in a sample size of 112,226, including 84,837 agricultural households and 27,389 non-agricultural households. Agricultural households, as defined in the survey, include any household engaged in some type of agricultural activity. This definition is not at all synonymous with "rural" households.

The food security questionnaire included questions about the number of household members and children, household eating habits, and coping strategies (see Appendix A). Additional variables from the Agriculture Census include age, gender, and marital status of the household head, educational attainment and main occupation of the household head, and household-level resources, such as land ownership and the number of livestock and poultry. These variables are only available for agricultural households.

The empirical analysis is conducted at the household-level using multinomial logistic regression. Households are classified into three mutually exclusive states of food security: food secure ($S=0$), food insecure with moderate hunger ($S=1$), and food insecure with severe hunger ($S=2$). Multinomial logistic regression compares the probability of two outcomes to the probability of the third (omitted) outcome, in this case $S=0$ [3]. The model estimates the following two equations:

$$(1) \quad \ln [\text{Prob}(S_i=1) / \text{Prob}(S_i=0)] = \alpha_0 + \alpha_1 X_i$$

$$(2) \quad \ln [\text{Prob}(S_i=2) / \text{Prob}(S_i=0)] = \beta_0 + \beta_1 X_i$$

where X_i is a vector of household characteristics that includes most of the variables discussed above, but not household eating habits or coping strategies. The reason is that these variables are

endogenous. Rather than being determinants of food insecurity, they represent actions and behaviors that households take in order to deal with or avoid food insecurity.

Two sets of unweighted regressions were conducted. The first used the full sample and assumed that households that were classified as subjectively food secure (i.e. they indicated that they could afford to eat what they normally eat) were in fact “objectively” food secure (i.e. members did not skip meals or go entire days without food sometime during the prior year). The second set of regressions only used the sample with valid responses to the “objective” food security questions. To deal with the problem of selection, Heckman’s two-step procedure was used. First, we ran a linear probability model on subjective food insecurity using the governorate in which the household was located as an instrument [4]. An inverse Mills ratio was estimated and, in the second step, included in the logistic regression model discussed above.

5. Estimation Results:

The FIVIMS survey indicates that 42 percent of households in Yemen were food insecure or vulnerable to food insecurity (Table 1). These households feared that they would not have enough food to eat sometime during the previous 12 months. At least 21.7 percent of the households indicated that household members skipped at least one meal for lack of food, indicating hunger. At least 7.9 percent of households included members that went an entire day without food for lack of food, indicating that they suffered severe hunger during the year. In these statistics, subjectively food secure households were classified as food secure. The results therefore represent lower bound estimates of the prevalence rates of food insecurity in Yemen.

There is a weak positive association between household size and hunger. Prevalence rates of severe hunger rise steadily from 6.5 percent for households with 1-3 members to 9.3 percent for households with more than 16 members. There is a strong positive association between the number of children and food insecurity with both moderate and severe hunger. Prevalence rates of severe hunger increase from 5.1 percent for households with no children to 7.5 percent for households with 1-2 children to 12.5 percent for households with 7 children or more.

Reliance on temporary employment is associated with more severe levels of food insecurity. Non-agricultural households are slightly more likely to be food insecure, especially with severe hunger. The ownership and size of private land holdings are both associated with lower prevalence rates of food insecurity among agricultural households (Table 2). The incidence of severe hunger is lower for agricultural households whose main occupation was not farming (6.3 percent) compared to those whose main occupation was farming (8.2 percent). Finally, the prevalence of food insecurity declines sharply the higher the educational attainment of the agricultural household head.

Logistic regression results generally support our descriptive findings, with some notable differences. Table 3 presents the multinomial logistic regression results for food insecure households with both moderate and severe hunger. Results are presented for both the full sample (assuming subjectively food secure households were indeed food secure) and for the subjectively food insecure sub-sample, correcting for selection bias. The significance of the inverse Mills

ratio confirms the presence of selection bias. However, the empirical results for the full sample do not differ much from the results for truncated sub-sample.

Agricultural households are less likely to be food insecure with severe hunger compared to non-agricultural households. The number of children in a household is strongly associated with higher odds of food insecurity at both moderate and severe levels. The results for children correspond to our descriptive findings. On the other hand, while the prevalence rates of food insecurity with severe hunger are greater for large households, once other variables are controlled for, our regression results find that larger households are less likely to be food insecure with severe hunger.

Compared to households relying on temporary employment as the main source of bulk food, households relying on regular employment, sale of own produce, commercial activity, remittances, and multiple sources all had lower odds of food insecurity with moderate and severe hunger. Households relying on other sources were more likely to be food insecure. Households engaged in own production of food were less likely to be food insecure with moderate hunger but more likely to be food insecure with severe hunger. This suggests that food insecurity with severe hunger represents more than simply a markup of food insecurity with moderate hunger and it would be worthwhile to study their determinants separately. The pseudo-R squares associated with the various regressions were between 0.03 and 0.06.

Table 4 presents the regression results for agricultural households with the expanded set of control variables from the Agricultural Census. The relationships between food insecurity and the number of children and the main sources of food are largely maintained. However, the number of household members is no longer a significant correlate of food insecurity.

Agricultural households headed by a female or a youth (under 30 years old) are significantly more likely to be food insecure with severe hunger compared to households headed by a male or an older adult, but not significantly more likely to be food insecure with moderate hunger. Agricultural households headed by a person whose main occupation is farming are more likely to be food insecure with severe hunger compared with household heads whose main occupation is not farming. This could either mean that rural households are more likely to be food insecure or that households with multiple sources of food are less likely to be food insecure.

Educational attainment of the household head is associated with lower odds of food insecurity with severe hunger. Resources in terms of land and poultry are associated with lower odds of food insecurity, especially food insecurity with severe hunger. However, the results for livestock are mixed. This might be due to the fact that livestock resources display a great deal of variation across governorates, which makes them susceptible to colinearity with the inverse Mills ratio.

Finally, it is worth noting that substantial differences were found in the geographic distribution of the poor and food insecure populations in Yemen. In 1998, poverty rates were highest in the governorates of Taiz (56 percent), Ibb (55 percent), Abyan (53 percent), Laheg (52 percent), and Dhamar (49 percent). Food insecurity, on the other hand, was highest in the governorates of Shabwah (43.5 percent), Saadah (39.9 percent), Haja (36.0 percent), Ibb (29.4), Al Mahrah (29.3), and Al Hodeidah (24.7 percent). Only one governorate out of 20 (Ibb) was among those

with the highest levels of food insecurity and poverty. This suggests that poverty and food insecurity, while certainly related, may identify different aspects of household deprivation. Focusing on poverty rates alone may not provide an accurate assessment of the location and characteristics of food insecure populations. Verifying these differences for certain will require including poverty and food security indicators together in the same household survey.

6. Conclusions:

In 2003, Yemen became the first country in the MENA region to administer a nationally representative food security survey. Food insecurity was found to be widespread in Yemen. Around 21.7 percent of Yemeni households were found to be food insecure with hunger, meaning that one or more household members skipped a meal for lack of food sometime during the previous 12 months. Around 7.9 percent of households were found to be food insecure with severe hunger, meaning that one or more household members went an entire day without eating for lack of food sometime during the previous 12 months.

Food insecure households tended to have more children and fewer members, were likely to rely on temporary employment, and were more likely to be classified as non-agricultural. Among agricultural households, households headed by a female or young adult were more likely to be food insecure. Households with heads whose main occupation was not farming and who had higher levels of educational attainment were less likely to be food insecure. Food insecure households tended use smaller areas of land and own fewer heads of poultry.

The empirical results suggest that policies that encourage educational attainment and family planning may be promising avenues for reducing food insecurity in Yemen. Family planning may be especially fruitful because Yemen has the highest fertility rate in the MENA region (estimated at 6 children per woman in 2002).

Finally, no correlation was found between the geographical distribution of poor and food insecure populations in Yemen. This suggests that focusing on poverty rates alone may not provide an accurate assessment of the location and characteristics of food insecure populations. Also, while we expect there to be an association between qat consumption and household food insecurity, questions on qat consumption were not asked in the 2003 survey. The Yemeni government should include questions on both qat consumption and food insecurity in upcoming household budget surveys in order to study their relationship to one another and to poverty.

Endnotes:

1. The FIVIMS survey was conducted by the Yemeni government's Central Statistical Origination (CSO), which received technical support from the Food and Agriculture Organization of the United Nations and financial assistance from the European Community.
2. Of the remaining questions, one asked households that feared not having enough food whether they got all or only part of the food they needed. This question may have helped identify food insecure households without hunger. However, it was a follow-up to two other questions and responses were not consistent across household types. Another question asked whether children in the household had enough to eat. This might have been used to identify food insecure households without hunger among children. However, it would have resulted in a child indicator that was constructed differently than the household indicator. Two other questions asked whether food insecurity fell more heavily on adult males or females in the household. However, responses depended on who the survey respondent was. When the respondent was the (typically) male household head, he was more likely to indicate that it was the males who bore the burden of food insecurity. When the respondent was the spouse, she was more likely to indicate that it was the females of the household who bore the burden of food insecurity.
3. Using an ordered logit would have involved estimating specific cut points. The estimated parameters from the "food secure / food insecure with moderate hunger" comparison would represent a markup of the parameters of the "food secure / food insecure with sever hunger" comparison. Kabbani and Yazbeck (2004) found different associations at different levels of food insecurity. Thus, here we use the less restrictive multinomial logit model.
4. Geographic location was used as an instrument because one reason that households might or might not be able to afford to eat what they normally eat is changes in local economic and weather conditions. Indeed, regression results for households that were subjectively and objectively food insecure were similar across most household characteristics. However, we found substantial differences between them with respect to governorates.

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Table 1. Descriptive Statistics for All Households (Weighted)

	Sample Size	Households not Classified as Vulnerable	Households Classified as Food Insecure or Vulnerable				
			All Food Insecure & Vulnerable	Vulnerable	Food Insecure Households		
					All Food Insecure	Food Insecure with Moderate Hunger	Food Insecure with Severe Hunger
All Households	112,226	57.6%	42.4%	20.8%	21.7%	13.8%	7.9%
Household Size							
1-3 Members	11,523	62.4%		19.5%		11.5%	6.5%
4-6 Members	29,482	56.8%		21.3%		14.1%	7.8%
7-9 Members	36,366	56.3%		21.3%		14.3%	8.0%
10-12 Members	21,739	56.7%		20.5%		14.4%	8.5%
13+ Members	13,116	57.6%		20.0%		13.7%	9.1%
Number of Children							
No Children	19,469	64.9%		19.1%		10.9%	5.1%
1-2 Children	31,449	58.6%		21.1%		12.7%	7.5%
3-4 Children	36,191	54.7%		21.8%		14.8%	8.7%
5-6 Children	17,278	51.6%		20.8%		17.4%	10.1%
7+ Children	7,839	49.2%		20.4%		17.9%	12.5%
Main Source of Food							
Own production of food	5,170	62.6%		20.3%		8.4%	8.7%
Agricultural produce	19,448	64.1%		20.2%		9.8%	5.9%
Regular employment	18,945	68.8%		18.0%		8.9%	4.3%
Temporary employment	34,087	40.9%		25.5%		21.1%	12.5%
Commercial activity	4,659	81.4%		13.0%		4.7%	0.9%
Remittances	4,773	79.1%		14.0%		5.1%	1.8%
Others sources	9,209	41.7%		23.5%		21.5%	13.3%
More than one source	15,722	66.1%		18.3%		10.7%	4.9%
Agricultural Status							
Non-Agricultural HH	27,389	53.6%		21.4%		15.8%	9.2%
Agricultural HH	84,837	59.3%		20.5%		12.9%	7.3%

Table 2. Selected Descriptive Statistics for Agricultural Households (Weighted)

	Sample Size	Households not Classified as Vulnerable	Classified as Food Insecure or Vulnerable		
			Vulnerable	Food Insecure Households	
				Moderate Hunger	Severe Hunger
All Agricultural HHs	84,837	59.3%	20.5%	12.9%	7.3%
Size of Private Land					
No Private Land	24,932	53.5%	21.9%	15.5%	9.1%
Very Small (< 1,000)	12,582	59.2%	19.8%	14.0%	7.0%
Small (< 4,000)	16,834	60.3%	21.3%	11.5%	6.9%
Medium (< 10,000)	12,050	63.0%	19.9%	10.6%	6.5%
Large (>= 10,000)	18,439	66.0%	18.3%	10.3%	5.4%
Size of Leased Land					
No Leased Land	70,661	60.8%	19.7%	12.3%	7.2%
Very Small (< 1,000)	4,726	51.0%	23.8%	16.1%	9.1%
Small (< 4,000)	5,518	50.6%	25.3%	15.7%	8.3%
Medium (< 10,000)	2,131	55.4%	23.9%	14.1%	6.7%
Large (>= 10,000)	1,801	59.5%	22.0%	13.3%	5.2%
Size of Wakf Land					
No Wakf Land	80,559	59.2%	20.5%	12.9%	7.3%
Very Small (< 1,000)	2,488	56.7%	21.0%	14.6%	7.7%
Small (< 4,000)	1,374	64.7%	18.8%	10.3%	6.2%
Medium (< 10,000)	271	70.4%	20.8%	5.2%	3.6%
Large (>= 10,000)	145	73.9%	15.3%	9.4%	1.4%
Number of Livestock					
No Livestock	43,580	59.4%	20.3%	12.8%	7.5%
1-2 Heads	22,164	56.8%	20.7%	14.1%	8.3%
3-10 Heads	14,708	60.6%	21.5%	12.0%	5.8%
11-20 Heads	2,527	67.6%	18.3%	9.3%	4.8%
21+ Heads	1,858	70.5%	16.8%	8.9%	3.9%
Number of Poultry					
No Poultry	48,742	59.4%	20.1%	12.9%	7.7%
1-5 Heads	5,889	55.1%	21.0%	14.6%	9.3%
6-10 Heads	6,315	57.9%	20.9%	13.7%	7.5%
11-20 Heads	7,318	59.0%	21.3%	13.2%	6.6%
21-50 Heads	8,264	60.6%	21.4%	12.1%	5.9%
51+ Heads	8,309	63.0%	20.7%	11.0%	5.3%
Education of Head					
Illiterate	42,471	53.7%	22.3%	15.0%	9.0%
Basic Literacy	23,868	63.0%	19.4%	11.3%	6.2%
Grade School	4,961	58.5%	23.1%	12.5%	5.9%
Junior High School	4,944	63.7%	18.7%	12.2%	5.4%
Pre-HS Diploma	972	69.8%	17.0%	8.8%	4.4%
High School Degree	4,429	66.8%	17.9%	10.1%	5.2%
Post-HS Diploma	1,321	75.0%	13.1%	7.2%	4.7%
University	1,687	82.9%	11.0%	4.3%	1.9%
Main Type of Work					
Farming	49,354	57.6%	21.3%	12.9%	8.2%
Non-Farming	35,247	61.2%	19.6%	12.9%	6.3%

Table 3. Multinomial Logistic Regression – All Households

	Full Sample – Assuming Subjectively Food Secure are Food Secure (N=112,225)				Subjectively Food Insecure Sub-sample, using Heckman Two-step Procedure (N=54,598)			
	Food Insecure with Moderate Hunger		Food Insecure with Severe Hunger		Food Insecure with Moderate Hunger		Food Insecure with Severe Hunger	
Agricultural Household	-0.308	(0.021) **	-0.420	(0.025) **	-0.037	(0.024)	-0.167	(0.028) **
Number of HH Members								
<i>1-3 Members Omitted</i>								
4-6 Members	0.132	(0.039) **	-0.019	(0.047)	0.016	(0.043)	-0.119	(0.051) *
7-9 Members	0.059	(0.040)	-0.143	(0.049) **	-0.058	(0.045)	-0.243	(0.053) **
10-12 Members	0.039	(0.044)	-0.179	(0.054) **	-0.024	(0.049)	-0.227	(0.058) **
13+ Members	-0.121	(0.050) *	-0.336	(0.061) **	-0.126	(0.056) *	-0.331	(0.066) **
Number of Children								
<i>No Children Omitted</i>								
1-2 Children	0.239	(0.032) **	0.632	(0.042) **	0.043	(0.036)	0.452	(0.046) **
3-4 Children	0.504	(0.033) **	0.865	(0.044) **	0.194	(0.038) **	0.583	(0.048) **
5-6 Children	0.756	(0.039) **	1.136	(0.050) **	0.375	(0.045) **	0.788	(0.055) **
7+ Children	0.875	(0.049) **	1.410	(0.060) **	0.443	(0.056) **	1.021	(0.067) **
Main Source of Food								
<i>Temp Employment Omitted</i>								
Regular Employment	-0.517	(0.032) **	-0.713	(0.039) **	-0.165	(0.037) **	-0.427	(0.045) **
Sale of Own Produce	-0.406	(0.031) **	-0.359	(0.036) **	-0.170	(0.034) **	-0.168	(0.039) **
Own Production of Food	-0.655	(0.059) **	-0.038	(0.056)	-0.378	(0.061) **	0.185	(0.059) **
Commercial Activity	-0.866	(0.077) *	-1.955	(0.142) **	-0.218	(0.084) *	-1.430	(0.148) **
Remittances	-0.791	(0.073) **	-1.345	(0.109) **	-0.301	(0.078) **	-0.943	(0.114) **
Other Sources	0.187	(0.034) **	0.205	(0.038) **	0.144	(0.034) **	0.170	(0.039) **
Multiple Sources	-0.333	(0.033)	-0.558	(0.042) **	-0.016	(0.037)	-0.302	(0.046) **
Inverse Mills Ratio					-0.892	(0.048) **	-0.725	(0.058) **

Standard errors are in parentheses. * Significant at the 5% level; ** Significant at the 1% level.

Table 4. Multinomial Logistic Regression Analysis – Agricultural Households

	Full Sample – Assuming Subjectively Food Secure are Food Secure (N=84,340)				Subjectively Food Insecure Sub-sample, using Heckman Two-step Procedure (N=39,219)			
	Moderate Hunger		Severe Hunger		Moderate Hunger		Severe Hunger	
Number of HH Members								
<i>1-3 Members Omitted</i>								
4-6 Members	0.171	(0.050) **	0.028	(0.061)	0.020	(0.056)	-0.102	(0.066)
7-9 Members	0.109	(0.052) *	-0.042	(0.064)	-0.006	(0.058)	-0.141	(0.069) *
10-12 Members	0.080	(0.056)	-0.048	(0.070)	0.021	(0.063)	-0.095	(0.075)
13+ Members	-0.082	(0.064)	-0.109	(0.078)	-0.113	(0.071)	-0.135	(0.084)
Number of Children								
<i>No Children Omitted</i>								
1-2 Children	0.336	(0.040) **	0.720	(0.052) **	0.058	(0.045)	0.467	(0.057) **
3-4 Children	0.615	(0.042) **	0.939	(0.056) **	0.219	(0.048) **	0.586	(0.061) **
5-6 Children	0.866	(0.048) **	1.174	(0.063) **	0.379	(0.055) **	0.736	(0.069) **
7+ Children	1.001	(0.059) **	1.363	(0.074) **	0.475	(0.068) **	0.891	(0.083) **
Main Source of Food								
<i>Temp Employment Omitted</i>								
Regular Employment	-0.439	(0.046) **	-0.385	(0.055) **	-0.175	(0.049) **	-0.197	(0.059) **
Sale of Own Produce	-0.339	(0.036) **	-0.376	(0.042) **	-0.155	(0.038) *	-0.246	(0.044) **
Own Production of Food	-0.561	(0.062) **	0.032	(0.061)	-0.334	(0.064) **	0.191	(0.064) **
Commercial Activity	-0.899	(0.110) **	-1.436	(0.174) **	-0.363	(0.116) **	-1.057	(0.179) **
Remittances	-0.769	(0.085) **	-1.202	(0.127) **	-0.378	(0.089) **	-0.915	(0.130) **
Other Sources	0.148	(0.044) **	0.135	(0.051) **	0.107	(0.044) *	0.106	(0.051) *
Multiple Sources	-0.316	(0.039) **	-0.571	(0.049) **	-0.043	(0.042)	-0.378	(0.053) **
Education Level of Head								
<i>Illiterate Omitted</i>								
Basic Literacy	-0.241	(0.026) **	-0.338	(0.032) **	-0.071	(0.030) *	-0.198	(0.035) **
Grade School	-0.167	(0.048) **	-0.491	(0.063) **	-0.053	(0.055)	-0.402	(0.068) **
Junior High School	-0.129	(0.049) **	-0.485	(0.065) **	0.053	(0.057)	-0.341	(0.071) **
Pre-HS Diploma	-0.330	(0.115) **	-0.575	(0.151) **	-0.012	(0.132)	-0.314	(0.165)
High School Degree	-0.322	(0.057) **	-0.542	(0.072) **	-0.055	(0.065)	-0.340	(0.079) **
Post-HS Diploma	-0.548	(0.109) **	-0.542	(0.129) **	-0.090	(0.124)	-0.165	(0.142)
University	-0.852	(0.110) **	-1.152	(0.151) **	-0.188	(0.125)	-0.588	(0.162) **

Table 4 (Cont). Multinomial Logistic Regression Analysis – Agricultural Households

	Full Sample – Assuming Subjectively Food Secure are Food Secure (N=84,340)				Subjectively Food Insecure Sub-sample, using Heckman Two-step Procedure (N=39,219)			
	Moderate Hunger		Severe Hunger		Moderate Hunger		Severe Hunger	
Female-headed Household	0.153	(0.059) **	0.418	(0.065) **	0.070	(0.067)	0.327	(0.072) **
Main Work is Farming	0.020	(0.025)	0.283	(0.032) **	-0.049	(0.029)	0.224	(0.034) **
Size of Private Land								
<i>No Private Land Omitted</i>								
Very Small (< 1,000)	-0.101	(0.033) **	-0.249	(0.041) **	0.067	(0.038)	-0.101	(0.045) *
Small (< 4,000)	-0.237	(0.032) **	-0.366	(0.040) **	-0.133	(0.036) **	-0.282	(0.043) **
Medium (< 10,000)	-0.268	(0.037) **	-0.394	(0.045) **	-0.140	(0.042) **	-0.276	(0.049) **
Large (>= 10,000)	-0.204	(0.033) **	-0.372	(0.041) **	-0.084	(0.038) **	-0.246	(0.045) **
Size of Leased Land								
<i>No Leased Land Omitted</i>								
Very Small (< 1,000)	0.135	(0.045) **	0.089	(0.054)	-0.025	(0.050)	-0.076	(0.059)
Small (< 4,000)	0.142	(0.042) **	-0.061	(0.053)	-0.050	(0.047)	-0.246	(0.057) **
Medium (< 10,000)	0.006	(0.068)	-0.368	(0.093) **	-0.038	(0.076)	-0.419	(0.099) **
Large (>= 10,000)	-0.141	(0.077)	-0.512	(0.106) **	-0.170	(0.086) *	-0.546	(0.113) **
Number of Livestock								
<i>No Livestock Omitted</i>								
1-2 Heads	-0.076	(0.026) **	-0.113	(0.031) **	0.105	(0.030) **	0.043	(0.035)
3-10 Heads	-0.172	(0.032) **	-0.284	(0.040) **	0.020	(0.037)	-0.113	(0.044) *
11-20 Heads	-0.392	(0.075) **	-0.425	(0.091) **	0.032	(0.085)	-0.026	(0.099)
21+ Heads	-0.381	(0.086) **	-0.599	(0.109) **	0.284	(0.101) **	0.028	(0.122)
Number of Poultry								
<i>No Poultry Omitted</i>								
1-5 Heads	-0.003	(0.041)	-0.029	(0.049)	-0.044	(0.046)	-0.075	(0.054)
6-10 Heads	-0.048	(0.040)	-0.149	(0.051) **	-0.092	(0.046) *	-0.193	(0.055) **
11-20 Heads	-0.059	(0.039)	-0.216	(0.050) **	-0.111	(0.043) *	-0.268	(0.053) **
21-50 Heads	-0.082	(0.038) *	-0.217	(0.048) **	-0.137	(0.043) **	-0.272	(0.052) **
51+ Heads	0.015	(0.041)	-0.062	(0.051)	-0.157	(0.046) **	-0.228	(0.055) **
Inverse Mills Ratio					-0.829	(0.054) **	-0.588	(0.065) **

Standard errors are in parentheses. * Significant at the 5% level; ** Significant at the 1% level.

Appendix A: The 2002 FIVIMS Yemen Questionnaire:

Q1. How many members are there in your household?

Total number of members

Number of children

Q2. How many meals does your family normally eat per day?

1	2	3	4
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Q3. What types of food does your family usually eat in these meals?

	First Meal	Second Meal	Third Meal	Fourth Meal		(6)	(7)
(1)	(2)	(3)	(4)	(5)			
Bread						0	1
Rice						0	1
Other Cereals Preparations						0	1
Milk						0	1
Chicken						0	1
Meat						0	1
Fish						0	1
Eggs						0	1
Pulses						0	1
Vegetables						0	1
Fruits						0	1

Q4. What is the main source for obtaining the bulk of your food requirement (circle one answer)?

- (1) Own production of food
- (2) Sale of agricultural produce
- (3) Salary from fixed (regular) employment
- (4) Salary from temporary work
- (5) Income from commercial activity
- (6) Remittances
- (7) Rent receipts
- (8) Others
- (9) Several sources

Q5. In the last 12 months, did it happen that your family could not afford to eat what you normally eat?

- (1) Yes → Continue the Interview
- (2) No → Stop the Interview and go on to the next household

- Q6. If the answer was “yes” to question 5, what did you do in that case?
- (1) Ate less quantity of normally-eaten food
 - (2) Ate same quantity of cheaper food
 - (3) Ate less quantity and cheaper food
- Q7. In the last 12 months, was there a time when you feared that you would not have enough food for your family for the next month?
- (1) Yes, Often → Continue the Interview
 - (2) Yes, Sometimes → Continue the Interview
 - (3) No → Stop the Interview and go on to the next household
- Q8. When you feared that you would not have enough food for the family, what did you do and on what did you rely (depend) mostly to get the food you needed?
- (1) Additional work to get money
 - (2) Borrowed money
 - (3) Borrowed food
 - (4) Accepting help from friends and relatives
 - (5) Selling some assets or personal household goods
 - (6) Accepting Charities
 - (7) Could not do any thing
- Q9. Did you get all the food you needed or only part of it?
- (1) All → Stop the Interview and go on to the next household
 - (2) Part → Continue the Interview

** (Questions numbered 10, 13, and 16 pertain only to families with children.)*

- *Q10. Did the children in your household not eat enough, because there was not enough food (in your household)?
- (1) Yes, Often → Continue the Interview
 - (2) Yes, Sometimes → Continue the Interview
 - (3) No → ~~Stop the Interview and go on to the next household~~
- Q11. During the past 12 months, did it happen that you or any other adult in your family did not have a meal in the day because there was not enough food?
- (1) Yes, Often → Continue the Interview
 - (2) Yes, Sometimes → Continue the Interview
 - (3) No → Skip ahead to question (13)
- Q12. If the answer to Question 11 is ‘Yes, Often’ or ‘Yes, Sometimes’, what was the gender of the adults who skipped the meal?
- (1) Male and female
 - (2) Males only
 - (3) Females only

*Q13. During the last 12 months, did it happen that any of your children did not have a meal during a particular day because there was not enough food?

- (1) Yes, Often → Continue the Interview
- (2) Yes, Sometimes → Continue the Interview
- (3) No → Stop the Interview and go on to the next household

Q14. During the past 12 months, did it happen that you or any other adult in your family did not eat for a whole day because there was not enough food?

- (1) Yes, Often → Continue the Interview
- (2) Yes, Sometimes → Continue the Interview
- (3) No → Stop the Interview and go on to the next household

Q15. If the answer to Question 11 is 'Yes, Often' or 'Yes, Sometimes', what was the gender of the adults who did not eat for the whole day because there was not enough food?

- (1) Male and female
- (2) Males only
- (3) Females only

*Q16. During the last 12 months, did it happen that any of your children did not eat for the whole day because there was not enough food?

- (1) Yes, Often
- (2) Yes, Sometimes
- (3) No