

Measuring 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 survey-based food security survey at the national level. The survey was administered to a nationally-representative sample of over 112,000 households. This paper describes the methods used to construct the indicators of food insecurity and analyzes the correlates of food insecurity and hunger among Yemeni 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 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 insecure. We compare our results to previously-published prevalence estimates and determinants of poverty in Yemen and find some major differences, suggesting that poverty and food insecurity may be identifying different aspects of household need and deprivation.

ملخص

أصبحت اليمن أول دولة في منطقة الشرق الأوسط وشمال أفريقيا تطور وتنفيذ استطلاع مباشر على أساس استطلاع الطعام على المستوى القومي. وقد تم إجراء الاستطلاع على عينة قومية ممثلة بأكثر من 112000 أسرة. وتصف هذه الورقة الأساليب المستخدمة في بناء مؤشرات عدم الأمن الغذائي وتحليل ارتباط عدم الأمن الغذائي والجوع بين الأسر في اليمن. وتشير النتائج إلى انتشار عدم الأمن الغذائي والجوع في اليمن بصورة واسعة. وقد اتسمت الأسر التي تعاني من عدم الأمن الغذائي بكثرة الأطفال وقلة عدد أفراد الأسرة، وكانت أكثر عرضة للاعتماد على العمل المؤقت والتصنيف كأسر لا تعمل بالزراعة. ومن بين الأسر التي تعمل بالزراعة كانت تلك التي ترأسها امرأة أو رجل في مرحلة الشباب أكثر عرضة لعدم الأمن الغذائي، بينما تلك التي يرأسها أفراد ذوي مستوى مرتفع من التعليم أقل عرضة لعدم الأمن الغذائي. ونحن نقارن نتائجنا بالتقديرات السائدة ومحددات الفقر في اليمن والتي تم نشرها في السابق، ونخرج باختلافات كبيرة، تشير إلى أن الفقر وعدم الأمن الغذائي قد يعرفان مظاهر مختلفة من إحتياج وحرمان الأسر.

1. Introduction

Household food insecurity has typically been identified by one of three ways: (1) through measuring of income and food expenditure which identify whether households earn enough or spend enough on food, (2) through nutritional assessments of household members, including body-mass indices, dietary intake, and nutrient deficiencies, and (3) through survey-based measures of food security, in which households are asked questions to determine whether they have access to the quantity and quality of food needed for an active and healthy life. The first method represents an indirect assessment of food insecurity inferred through income and expenditure data. The second two methods represent direct measures of food insecurity, relying on direct evidence of undernourishment and reduced access to food.

There has been increased interest in the use of direct survey-based measures of food security in recent years. During 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), spurring efforts to monitor and track food insecurity and hunger. Around the same time, the successful development and implementation of a direct survey-based measure of food security in the United States attracted international attention as one viable way through which 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 of its own. The 2003 Yemen food security survey was administered to a sample of over 112,000 households as part of a national Food Insecurity and Vulnerability Mapping System¹. The survey questionnaire included 16 questions, six of which formed the basis for six household food security indicators. Other MENA countries have started developing similar measures of food insecurity, including Lebanon, Palestine, and Syria. Countries currently developing or considering survey-based measures of household food insecurity and hunger would benefit from a better understanding of the Yemeni experience.

This paper describes the Yemen food security indicators and analyzes the correlates of food insecurity among households in Yemen. The paper identifies several issues in the survey methodology and suggests strategies for improving the survey in future rounds and in the event the survey is adapted to other countries in the region. Section 2 discusses what is meant by hunger and food insecurity and how they can be measured through survey-based instruments. Section 3 describes how these survey-based measures differ from traditional measures of poverty and undernutrition. Section 4 presents an overview of the economic and food security situation in Yemen at the time of the survey. Section 5 introduces the FIVIMS survey data and describes the empirical methodology of the paper. Section 6 analyzes the correlates of food insecurity in Yemen. Section 7 compares aggregate measures of food insecurity and poverty across governorates. Section 8 concludes and outlines the policy implications of our study.

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. Measuring Hunger and 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. FAO defines food insecurity and vulnerability as follows (FIVIMS, 2004):

Food security: individuals in a household have (at all times) physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life.

Food insecurity: individuals 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.

Vulnerability: the full range of factors that place people at risk of becoming food insecure. Vulnerability also includes people's ability to cope with stressful situations.

Direct survey-based measures estimate the degree of a household's food security 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. Examples include: In the previous 12 months, did you worry that the household would run out of food before you had money to buy more? In the previous 12 months, did children in the household not eat enough, for lack of food? In the previous 12 months, did adults cut the size of their meals, for lack of food? In the previous 12 months, did children not eat for an entire day, for lack of 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 needed 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 1995, the United States developed a survey-based measure of food insecurity which has been the focus of much research and interest worldwide. It has been used as a template to guide the development of survey instruments in other countries, including Yemen. The U.S. Food Security Survey Module is based on a set of 18 questions, which form the basis of the U.S. Food Security Scale. Eight of the 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, known as Rasch modeling, 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: households show no or minimal evidence of food insecurity. Households that provide affirmative responses to 0-2 questions are classified as food secure.

Food insecure without hunger: food insecurity is evident in households' concerns and in adjustments to food management, including reductions in diet quality, but with no or limited reductions in the quantity of food intake. Households with children that provide affirmative responses to 3-7 questions, and households with no children that provide affirmative responses to 3-5 questions, are classified as food insecure without hunger.

Food insecure with hunger: food intake is reduced to an extent that implies that one or more household members are experiencing the physical sensation of hunger due to lack of resources. Households with children that provide affirmative responses to 8-18 questions, and households with no children that provide affirmative responses to 5-10 questions, are classified as food insecure with hunger.

The U.S. food security measure is used to estimate annual prevalence rates of food insecurity and hunger 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, 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).

Questions in the Yemen food security survey were influenced by questions from the U.S. food security survey module, but they were modified to fit the unique circumstances of the country. 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 on household food insecurity²:

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.

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 head of household, 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.

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.

The survey also included questions on coping strategies and types of foods normally eaten by the household. The Yemen food security survey differs from surveys in other countries in that it has a more limited number of questions. However, this does not necessarily present a drawback, because the questions included in the Yemen survey are mostly threshold items that clearly distinguish between the various levels of severity³.

Questions about household food security were only asked to 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 their food insecurity. 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 venerable or food insecure. To address this issue, we use censored regression techniques in addition to standard regression analysis.

3. Comparing the Different Measures of Food Insecurity

Prior to the recent increases in the adoption of direct survey-based measures of food security, household food insecurity was typically inferred from measures of income and food expenditures, which identify whether households earn enough or spend enough on food, and from nutritional assessments of household members, including body-mass indices, dietary intake, and nutrient deficiencies. Each measure has a role to play in assessing household food insecurity and each had distinct advantages and disadvantages.

Poverty and Food Poverty

Hunger and food insecurity are often considered part of the overall problem of income-determined poverty (European Commission, 2003). While the two concepts are related, they address different aspects of the more general issue of household need and deprivation⁴.

³ A number of questions from the U.S. Food Security Survey Module have been found to change over time in terms of the ordering of their severity. This problem may lead to inconsistent estimates over time and across subgroups of the U.S. population (Wilde, 2004).

⁴ Indeed, in some cases, poverty measures might be considered part of the problem of food insecurity. For example, poverty thresholds in the U.S. are based on low-cost food plans from the 1950s (Citro and Michael, 1995, pp. 110) and have since been adjusted annually for inflation, but have otherwise remained unchanged.

Households that are counted among income-poor are not necessarily food insecure. Poverty estimates often do not include support obtained through public or community-based food assistance programs and they often do not capture food support provided by extended family members and friends. Thus, households that appear to have little in the way of income or expenditures, may actually be food secure.

Likewise, households facing food insecurity may not necessarily be counted among the poor. Nord and Brent (2002) note that 20 percent of U.S. households classified as food insecure had midrange or high incomes. Most of these households were food insecure due to transitory factors reflecting constrained access to food, such as uneven incomes and changes in household composition during the year, and which were not reflected in annual income estimates. Ribar and Hamrick (2003) find that changes in poverty and food insufficiency are related but distinct processes, capturing different dimensions of economic hardship⁵.

Attempts to use food poverty estimates instead of poverty do not overcome these problems. A household is said to be “food poor” if it did not have enough income or spending to purchase even enough food to provide the basic 2,200 calories per person per day (World Bank, 2002). This, more or less, simply represents a scaling down of the poverty threshold, and is better explained as describing incidences of extreme poverty.

Still, poverty and food insecurity appear to be highly correlated and the wide availability of data on poverty makes it a good starting point for estimating household food security.

Direct Nutritional Outcomes

Nutritional assessments of household members have long provided information about food insecurity and malnutrition. While they represent direct measures of food insecurity, they too have several disadvantages over survey-based measures.

First, nutritional deficiencies and dietary quality do not necessarily reflect food insecurity. They could instead be the result of poor eating habits and increased reliance on refined grains that lack nutritional density, resulting in micronutrient deficiencies and high rates of anaemia and stunting. This is increasingly the case in MENA countries. Body-mass indices are also not an ideal indicator of food security. In some countries, individuals living in food insecure households (especially children) are more likely to be overweight than individuals living in food secure households. The reasons appear to be two-fold. First, individuals in food insecure households tend to exhibit binge-bust eating habits, consuming greater quantities of food when food is available but still experiencing food deprivation at certain times of the month or year. Second, individuals in food insecure households tend to purchase less expensive varieties of food which tend to have higher fat and carbohydrate contents resulting in greater incidences of obesity while at the same time resulting in micronutrient deficiencies.

Second, nutritional assessment measures may not capture episodic hunger. Blood samples and estimates of wasting taken at the time of a survey may not show that a household experienced temporary shortages of food earlier in the year. A third disadvantage of using nutritional assessments is that it is more expensive and time consuming to measure physical attributes (height, weight, etc.) and conduct blood tests than it is to ask questions about household eating behaviours. It may be financially difficult for countries, especially developing countries, to conduct nutritional assessments on a regular basis using samples large enough to generate reliable national and sub-national estimates.

⁵ Food insufficiency refers to a single-question measure of food deprivation that predates the food security measures currently being adopted.

Still, nutritional assessments provide valuable detailed information on the health and nutritional status of a population and direct survey-based questions cannot substitute for the types of information generated by these assessments.

Direct Survey-Based Measures of Food Insecurity

Direct survey-based questions of household food security are increasingly being used to complement data on poverty and undernutrition. These direct questions are proving to be a cost-effective method of assessing hunger and food insecurity among households and have been found to be highly correlated with a variety of health and nutritional outcomes.

These measures also suffer from disadvantages. For example, based on a limited number of studies, survey-based indicators of food insecurity were not much better than poverty estimates at predicting various nutritional outcomes (Bhattacharya et al., 2002). Experiencing hunger for limited periods of time does not immediately translate into undernourishment. Again, this suggests that poverty and food insecurity represent different aspects of need and deprivation, which can complement (rather than substitute for) one another.

4. 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 many impediments to economic growth and development in Yemen, three stand out. 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. Primary school enrollment in Yemen was only 61 percent and secondary school enrollment only 37 percent in 1998, 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. In addition, another 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, 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. Poverty is not evenly distributed across the country. Of the

16 governorates covered by the HBS, poverty rates were highest in Taiz (56 percent), Ibb (55 percent), Abyan (53 percent), and Laheg (52 percent). Poverty rates were found to be lowest in Al-Baida (15 percent).

Prior to the FIVIMS survey, household food insecurity in Yemen was measured indirectly by studying food poverty. A food poverty line represents the cost of a food basket containing calories equal to 2,200 calories per person per day. Households that spent less than the cost of this basket on their food purchases were considered “food poor”. 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 the age of 5 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 on 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.

5. Survey Data and Empirical Methodology

The 2003 FIVIMS 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 of which 84,837 are agricultural households and 27,389 are non-agricultural households.

Agricultural households, as defined by the survey, include any household engaged in some agricultural activity. This definition is not at all synonymous with “rural” households. Agricultural households, as defined by the survey, predominate throughout Yemen in both rural and urban areas. For agricultural households only, the food security questionnaire was administered in conjunction with the 2003 Agricultural Census, providing additional household-level data. All 20 governorates, including Sana’a City, were covered by the survey. However, the survey does not include non-agricultural households from the Al-Jawf governorate due to problems with data reliability.

The food security questionnaire also 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 head of household, educational attainment and main occupation of the head of household, 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 approach of this paper will be mostly descriptive, in line with the paper’s goal of introducing the concept of survey-based food insecurity. The analysis will focus on identifying prevalence estimates of food insecurity and hunger in Yemen and studying their

correlates. The analysis will be conducted at the household-level using multinomial logistic regression. Households are classified according to three mutually exclusive states of food security: food secure ($S=0$), food insecure with moderate hunger ($S=1$) and food insecure with severe hunger ($S=2$). The empirical analysis uses multinomial logistic regression to compare the probability of two of the outcomes to the probability of the third (omitted) outcome, in this case $S=0$ ⁶. 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 and 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 food insecurity. Future work will incorporate coping strategies into a more rigorous analytical analysis. Employment-related variables might also be endogenous, but following previous food security research, we include them in our empirical analysis. Leaving them out does not appreciably alter our main findings.

Two sets of un-weighted 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 instrument⁷. An inverse Mills ratio was estimated and, in the second step, included in the logistic regression model discussed above.

The final part of the paper compares our empirical results to previous results that rely on alternative measures of food insecurity (poverty, food poverty, and undernutrition). The analysis will mostly compare prevalence estimates at the national and governorate-level.

6. Empirical 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

⁶ 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 severe 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.

⁷ 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 governorate dummies.

day without food for lack of food, indicating that they suffered severe hunger during the year. In these results, 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. For moderate hunger, a positive association is only evident when comparing households with 1-3 members to larger households. 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. A greater share of food insecure households obtains the bulk of their food from other sources not mentioned in the survey and a smaller share obtains the bulk of their food from more than one source. These findings suggest that food insecure households may face significant barriers to obtaining food. 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 size of leased and endowment (wakf) lands is also associated with lower rates of food insecurity. However, households that use small areas of leased and wakf lands were more likely to be food insecure, probably indicating that they tended to be more disadvantaged. This disadvantage was then mitigated the larger the land area used. Likewise, households that owned small numbers of livestock and poultry tended to be more food insecure, but their food insecurity declined the larger the numbers of livestock and poultry they owned.

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). Having a different main occupation appears to be a resource that helps shield agricultural households from severe hunger. Households with a female head were more likely to be food insecure at all levels compared to households headed by a male.

Finally, the prevalence of food insecurity declines sharply the higher the educational attainment of the agricultural head of household. The incidence of severe hunger declines from 9 percent for agricultural households with an illiterate head to 4.4 percent for households headed by an adult with a pre-high school diploma to only 1.9 percent for households headed by an adult with a university degree.

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. Larger households are also less likely to be food insecure with severe hunger compared to smaller 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, 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 heads of households whose main occupation is not farming. This could 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 head of household is associated with lower odds of food insecurity with severe hunger. Resources in the form of land and poultry are associated with lower odds of food insecurity, especially food insecurity with severe hunger. The results for livestock, however, 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.

7. Comparisons with Previous Results:

Households classified as poor are not necessarily food insecure and households classified as food insecure are not necessarily poor. One reason for this is that poverty estimates measure spending during a given period of time (typically a year). Food insecurity, however, can be a temporary phenomenon. A non-poor household with annual spending above the poverty line may experience cash flow problems for a few days during the year and, as a result, household members may be forced to reduce food consumption during that time.

In 1998, an estimated 42 percent of households in Yemen lived below the poverty line (World Bank, 2002). In addition, 17.6 percent of households were found to be “food poor”, meaning that they did not spend enough to purchase enough food to provide the basic 2,200 calories per person per day (World Bank, 2002). The prevalence estimates of subjective food insecurity (48 percent) and food insecurity with hunger (21.7 percent) are not outside the range that would be expected given the prevalence estimates of poverty and food poverty.

Poverty in Yemen was found to be concentrated in rural areas, among large households, and among households with high child-to-adult ratios (World Bank, 2002). Our analysis of the

FIVIMS survey data suggests that the number of children is associated with higher odds of food insecurity. However, the number of household members was found to be associated with *lower* odds of food insecurity. Agricultural status was also found to be associated with lower odds of food insecurity (although agricultural status in the FIVIMS survey does not correspond to rural status in the poverty study).

There are also substantial differences 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 concentrated 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 (Ibb) was among the governorates with the highest levels of food insecurity and poverty!

Additional insights can be obtained by plotting the prevalence estimates of poverty and food insecurity by governorate. Figures 1 and 2 plot food insecurity prevalence estimates by poverty rates and food poverty rates, respectively. The figures indicate that there is no correlation between the two sets of indicators at the governorate level. Figure 3 plots the poverty rate against the food poverty rate across governorates. The strong association suggests that food poverty is very much an outgrowth of poverty rates and should not, on its own, be taken as a proxy for food insecurity.

Together, these simple comparisons suggest that there might be differences between the determinants of poverty and food insecurity. Food insecurity and poverty, while certainly related, may identify different aspects of household need and deprivation. Focusing on poverty estimates alone may not provide an accurate assessment of the location and characteristics of food insecure populations. Verifying these differences for certain will require poverty and food security indicators to be included together in the same household survey. There are currently efforts underway to include a number of food security questions in Yemen's 2005 Household Budget Survey.

8. Conclusions and Policy Implications

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 to use smaller areas of land and own fewer heads of poultry.

There was no correlation 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.

The FIVIMS survey results and data analysis suggest a number of policy implications.

Monitoring: Food insecurity is highly prevalent in Yemen and should be incorporated into the government's national strategy for poverty reduction. The institutionalization of a food insecurity monitoring system would provide useful information to the Yemeni government, international development agencies, and non-profit organizations about the prevalence, geographical location, and characteristics of food insecure populations.

Education: Educational attainment was associated with lower levels of food insecurity among agricultural households. Policies that encourage higher levels of educational attainment are promising avenues for improving the food security situation in Yemen.

Employment: Regular employment, as compared to temporary employment, was associated with lower odds of food insecurity and hunger. In addition, having multiple sources of income was found to be a resource against food insecurity. The government could consider providing employment services for at-risk households, initiating food-for-work programs, and creating incentives for households to diversify their income sources.

Family Planning: Food insecurity was highly correlated with the number of children in a household. This highlights the importance of family planning in Yemen, which has the highest fertility rate in the MENA region (estimated at 6 children per woman in 2002).

Qat Consumption: While we expect the presence of 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 qat consumption and food insecurity together in upcoming surveys in order to study this important relationship.

Poverty and Food Insecurity: A better understanding of the relationship between poverty and food insecurity is needed at the household level. This could be done by including a number of food insecurity questions in future household budget surveys.

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Figure 1: Plot of Food Insecurity and Poverty Rates by Governorate

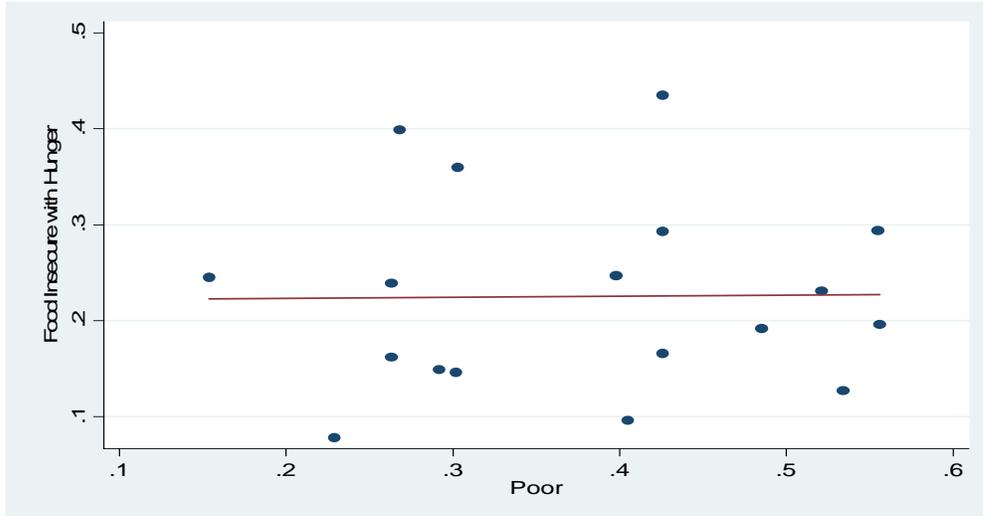


Figure 2: Plot of Food Insecurity and Food Poverty Rates by Governorate

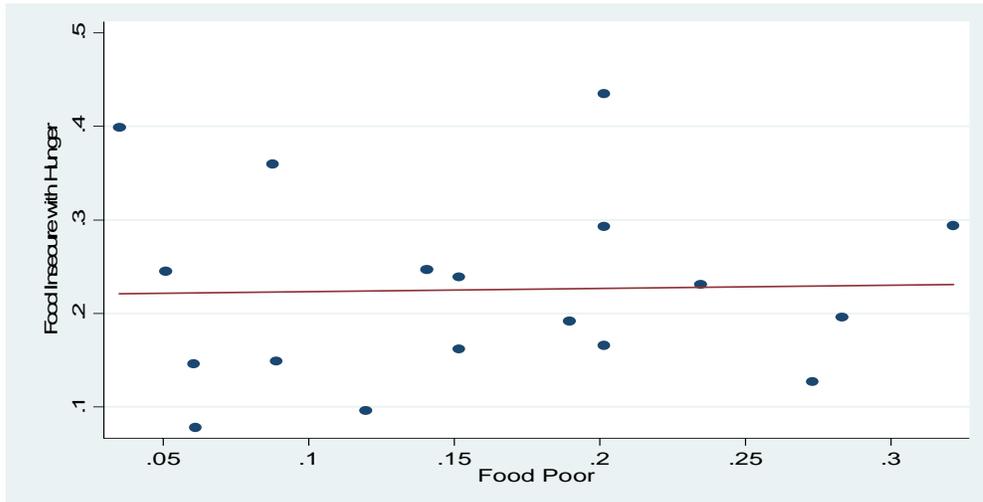


Figure 3: Plot of Poverty and Food Poverty Rates by Governorate

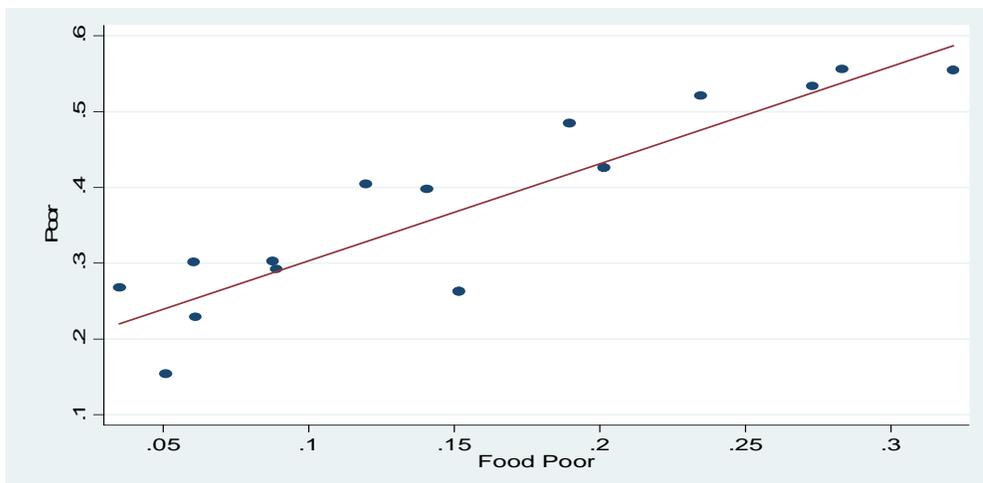


Table 1: Descriptive Statistics for All Households (Weighted)

	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	Households Classified as Food Insecure or Vulnerable				
			All Food Insecure & Vulnerable	Vulnerable	Food Insecure Households		
					All Food Insecure	Moderate Hunger	Severe Hunger
All Agricultural HHs	84,837	59.3%	40.7%	20.5%	20.2%	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%
Gender of Head							
Male	82,006	59.6%		20.4%		12.8%	7.2%
Female	2,830	51.6%		23.0%		15.0%	10.4%

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'd): 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.