Age and Gender Differences in Food Security

in a Low-Income Inner-City Population

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Abstract

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In a study of approximately 1,500 very disadvantaged families with children in Boston, Chicago, and San Antonio from 1999 to 2005, significant differences in levels of food security are found across children of different ages and genders. Using answers to unique survey questions about food security for a specific child in the family, food security levels are found to be much lower among older boys and girls than among younger ones, and to be lower among younger girls than younger boys but higher among older girls than older boys. Differences in money income, financial strain, nutritional needs, and other factors explain a large fraction of these differences, and some subgroups of families exhibit no differences in food security across different children at all. Nevertheless, many children in the worst-off families experience much higher levels of food hardship than others, which should be a source of social concern.

Although poverty in the United States was "discovered" in 1962 by Michael Harrington in his celebrated book, The Other America (Harrington, 1962), public concern with hunger became widespread only after a CBS documentary broadcast in 1968 on "Hunger in America." However, efforts to establish a measure of American households' secure access to food took almost 30 years and was finally fixed after a series of studies and reports by the U.S. Department of Agriculture in 1995 (National Research Council, 2006). The measure was based on a series of survey questions asked of a representative sample of households which asked if the adults or the children had experienced a range of food issues in the last twelve months, ranging from mild instances of not having enough to eat balanced meals to more severe instances of having to skip eating for an entire day. The questions were used to develop indicators of what is now called "food security," where the highest level of such security is defined as having "access by all people at all times to enough food for an active, healthy life." This level is measured in the survey questions as having no or few reports of food access problems or food limitations. Its converse is "Food Insecurity," which is indicated by multiple reports of food intake problems in the answers to the survey questions, including reduced quality, variety, or desirability of diet and possibly disrupted eating patterns and reduced food intake quantity (USDA, 2014).

The annual reports issued by the USDA since 1995 have shown an alarming rate of food insecurity. In 2012, for example, 14.5 percent of U.S. households were food insecure and about one-third of them (5.7 percent) had "very low food security," defined as having experienced a

number of the more severe events, such as reduced food intake and disrupted eating patterns because the household lacked sufficient money or other resources for food (Coleman-Jensen et al., 2013). In addition, these figures are higher than in 1998, when only 11.8 percent of households were food insecure.[1] The causes of food insecurity have been extensively studied and have shown that higher levels of food insecurity are associated with low income, not owning a home, low levels of education, and with living in a family with an unmarried household head, to name just a few of the correlates (see Kirkendall et al., 2013 and Gundersen and Ziliak, 2014, for recent discussions of this large literature).

However, a particular concern is for the consequences of food insecurity for children, for 20 percent of households with children were found to be insecure in 2012, much above the national average of all households. Indeed, considerable research has established the deleterious consequences of food insecurity for children, ranging from increased risk of being hospitalized (Cook et al., 2006) to having lower arithmetic scores in school (Alaimo et al., 2001) to behavioral problems such as aggression and anxiety (Whitaker et al., 2006), among many others.

One of the important gaps in the literature is knowing the differential prevalence of food insecurity for children of different characteristics. This gap exists because the USDA survey asks its respondents whether "the children" in the household experienced any of the problems mentioned in the questions. While it is the intent of the question for the respondent to answer affirmatively if at least one child experienced the problem, the interpretation given to the question by the respondent is unknown. More importantly, it provides no information on whether different children experience different degrees of food insecurity which, if it occurs,

[1] The questionnaire in years prior to 1998 was slightly different, so recent publications

would raise important questions about differential impact across children. As discussed further below, there has been fragmentary evidence on this question and some researchers have suggested that some children have higher caloric needs, leading to greater food insecurity, or that parents protect some children, particularly very young ones, from insufficient food intake.[2]

This paper reports new evidence on this question, focusing on whether food security differs among children by the age and gender of the child. This is made possible by a survey conducted of approximately 2,400 low-income households with children in the inner cities of Boston, Chicago, and San Antonio from 1999 to 2006. The survey was undertaken to assess the consequences of U.S. welfare reform in the mid-1990s but some of the USDA food security questions were included in the survey. However, unlike the official Census Bureau survey, the questions pertaining to children were asked about only one child in the family, and a great deal of information on that specific child was also collected (age, gender, etc.; see below). This allows, for the first time, a study of the correlates of food insecurity at the individual child level, and across all ages 0 to 18. While the results of this study pertain only to disadvantaged families in inner cities, those families are known, from other research, to be one of the most vulnerable groups to food insecurity and hence the results should be of significant interest to national policy.

The analysis below first discusses the data, then presents the main findings, followed by a discussion and a set of conclusions.

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such as Coleman-Jensen et al., only report trends since 1998.

[2] An established finding in the literature is that household food insecurity is positively correlated with having older children in the household (e.g., Nord (2009), which is indirect evidence that there are age differentials in food insecurity. Data limitations have been been a barrier to going further than this household-level correlation. For example, the National Health and Nutrition Examination Study obtained self-reports for children 12-17, but this does not permit comparisons with younger ages.

The Three-City Study

The Three-City Study (TCS) was a NIH-funded longitudinal survey of approximately 2,400 low-income families living in Boston, Chicago, and San Antonio. When they were first surveyed in 1999, each of the families had a household income below 200 percent of the poverty line, had at least one child 0 to 4 or 10 to 14 years of age, and were living in low- and moderate-income neighborhoods in the cities. The data constitute a random sample of the population with these characteristics. In addition, because the study was intended to focus on the children of low-income families after 1990s welfare reform, one child in the family in either the 0-4 or 10-14 age range was randomly selected for special data collection and was called the "focal" child. A large number of modules in the survey gathered information on this child, including food security questions.

The first wave of data collection took place between March and December 1999, the second wave between September 2000 and May 2001, and the third wave between February 2005 and February 2006. By the end of the survey, the children who were initially 0-4 had passed through the age categories up to 6-10, and the children who were initially 10-14 had passed through the age categories 16-20, thus providing us with a full age range of children 0-20 (although we exclude children 19 and 20 in our analysis below and therefore only analyze children 0-18). The survey collected a wide range of information on employment, income, family structure, welfare participation, and characteristics of the caregiver (usually the mother) of the

children in the family in each of the three waves of interviews. In addition, as described below, the interview collected data on several variables not present in most other studies but which will be shown to be important clues to the findings (e.g., financial strain of the family, family routines, and social networks).

Most of the families were headed by a single mother but a few married families were sampled as well. The vast majority of the sample was either Hispanic or Non-Hispanic Black and hence heavily minority, reflecting the characteristics of the low-income neighborhoods of the cities.[3] While, as noted above, the income cutoff was a relatively high 200 percent of the poverty line, the sample was very poor and disadvantaged, with quite low levels of education as well as poor physical and mental health.[4] While the trends in unemployment rates and welfare caseloads in the three states over the period 1999-2006 were similar to those in other states, the findings below should not be generalized to populations other than very disadvantaged, mostly Non-Hispanic Black and Black populations without further research.

Analysis and Findings

Construction of the Food Insecurity Variable. The TCS survey asked questions about food security which were not exactly the same as those in the official Census survey. Specifically, only 8 of the 18 official Census questions were asked. The 8 are shown in

[3] Details of the design can be found in Winston et al. (1999).

[4] Findings on the welfare receipt, employment, and income levels of the sample are summarized in Frogner et al. (2009). One study of food security with these data has been conducted (Depolt et al., 1999) but it did not focus on the age and gender characteristics of the child as this study does. Other studies using the data can be found on the project website at http://web.jhu.edu/threecitystudy).

Appendix Table 1. The first 4 questions are identical to 4 of those in the adult portion of the Census survey and were selected to reflect the questions about more severe hardships. The second 4 were drawn from the 8 in the child-related portion of the Census survey but were modified to ask about hardships only of the focal child in the household rather than all children. Once again, the 4 questions that were chosen were those concerning more severe hardships. The 8 questions were asked in identical form in all three waves of the TCS survey.

The focus on the more severe hardship questions, combined with the disadvantaged nature of the sample where food security can be expected to be low, leads us to focus on what the USDA has defined as "Very Low Food Security" (VLFS), which means that "food intake of one or more members was reduced and eating patterns disrupted because of insufficient money and other resources for food" and is indicated by answering (among households with children) 8 or more of the 18 Census food insecurity questions affirmatively (Coleman-Jensen et al. 2013). Because the TCS data only have 8 of the 18 questions, we construct a VLFS variable which is correlated with the USDA definition to the maximum extent. To make this determination, we obtained the data from the April 1999 Census survey--which is closest in calendar time to the first wave of the TCS survey--and selected those households with children, living in a metropolitan area, and with household income below 185 percent of the poverty line (a variable that was available in the Census survey) to approximate the TCS sample. For each of the resulting 1,113 households in the Census data, we constructed both a USDA VLFS indicator variable equal to 1 if 8 or more of the 18 questions were answered affirmatively, but also a set of VLFS indicator variables using only the 8 Census questions that were used in the TCS survey. Specifically, using only those 8 in the Census data, we constructed VLFS indicators for whether

1 or more, 2 or more, or 3 or more of the 8 TCS questions were answered affirmatively, and we then determined which of these indicators classified families most closely into the same VLFS categories as they were placed into using the full 18 questions.[5] Our results showed that the "error rate" was smallest for a definition using the subset of 8 TCS questions which classified a household as having VLFS if 2 or more of the 8 questions were answered affirmatively. For that definition, 81 percent of those classified as having VLFS also had VLFS by the 8-or-more-out-of-18-question USDA definition. Further, using this same 2-or-more-out-of-8 VLFS definition, 97 percent of those classified as not having VLFS were also not VLFS by the full USDA criterion. The overall misclassification rate, or error rate, was only 4 percent. In contrast, defining VLFS as having answered 1 or more of the 8 questions affirmatively resulted in a 7 percent misclassification rate (and only 57 percent of those classified as having VLFS from this definition were also classified as having VLFS by the USDA definition) and, going higher by requiring a household to answer 3 or more of the 8 questions affirmatively to be classified as VLFS resulted in a 6 percent misclassification rate. Other definitions resulted in even larger misclassification percents.

Applying this definition--namely, VLFS=1 if 2 or more of the 8 questions are answered affirmatively--to the TCS data themselves yields a VLFS rate of 8.8 percent. The Census sample we used for the analysis above has a VLFS rate of 9.4 percent, quite close.[6,7]

[5] Of course, the Census questions for children ask about all children whereas the TCS questions only ask about the focal child, so there is a necessary noncomparability in that sense.

[6] In a separate analysis, we estimated logit models on the CPS data first using the USDA definition of VLFS as the dependent variable and then using the 2-or-more-out-of-8 definition. The signs and magnitudes of the coefficients on covariates for family structure, race, income, regional location, education, ages of children, and other socioeconomic characteristics were not very different. In another analysis (Moffitt and Ribar 2014), we estimated a Rasch model on the

Data and Descriptive Statistics. For our analysis, we use the TCS data described above pooled over all three waves and analyze the determinants of VLFS over those waves.[8] From the full sample, we select a subsample for which the caregiver of the focal child was the same and present at all three waves, and we also restrict the sample to those where the focal child was 18 years old or less, which eliminates a few observations in the third wave where the child had reached age 19 or 20. Our final analysis sample has 1,463 children, for a total of 4,229 pooled observations over all three waves of the data.[9]

Some descriptive statistics for the sample are shown in Appendix Tables 2A to 2C. We divide the children into three age ranges, 0-5, 6-11, and 12-18, a common demarcation of the stages of childhood. About half the children are in the youngest category and about a fifth and a fourth in the latter two, respectively. The sample is equally divided by gender, but is disproportionately Hispanic and Non-Hispanic Black, as mentioned earlier. About a fourth of the children spent part of their week at a daycare center and almost 40 percent with someone other than the caregiver.

CPS data using both VLFS definitions and determined the Rasch scores for each. The scores for a 8-or-more-out-of-18 definition were in the same range as the scores for a 2-or-more-out-of-8 definition.

[7] The USDA also defines a variable called "Very Low Food Security Among Children," or VLFSAC, based upon how many of the questions asking specifically about food security among children are answered. The sample size in the TCS data is too small for an analysis of that indicator. A sensitivity test using the TCS child questions alone is nevertheless conducted in the estimation section below.

[8] As described below, we adjust the standard errors of our regression coefficients to account for the presence of the same children in the multiple waves.

[9] The sample is slightly unbalanced, with a few children not observed in the second and third waves. The small size of the unbalance arises from the very modest attrition rates in the survey, for 90 percent of those present in the first wave were reinterviewed in the second wave and 84 percent of those were reinterviewed in the third wave. A study of bias resulting from

As noted previously and as shown in Tables 2B and 2C, the households in the sample are very disadvantaged. The caregivers have very low levels of education (almost 40 percent do not have a high school education) and only a bit over a third are working. Only 30 percent are married and about a quarter have only fair or poor health. Household income is quite low and three-quarters of the households are in poverty. Almost half own a car but less than a fifth own a home. About a third received income from the Temporary Assistance for Needy Families (TANF) program and almost half participated in the Supplemental Nutrition Assistance Program (SNAP). Over 70 percent participated in the School Breakfast Program and almost three-quarters participated in the National School Lunch Program. Several of the other characteristics shown in the tables will be discussed more below when they are introduced into the analysis.

The means of the key variable in the analysis--whether the household was experiencing Very Low Food Security--are shown in Table 1. A little over 8 percent of all families experienced VLFS, with a slightly higher rate among families where the focal child was a boy (8 percent versus 7.6 percent). Still, the gender difference is statistically insignificant (10 percent level). But there are marked differences by age, with older children experiencing much higher rates of VLFS, both for all families and for those with boy and girl focal children. Over 11 percent of families where the focal child was 12-18 experienced VLFS, about double that of families with younger children and statistically different from those rates. The rate for families with 12-18 focal children was even higher if the child was male, almost 14 percent. But even where the older child was a girl, the VLFS rate was almost 10 percent and significantly higher than for families with younger focal children.

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attrition found few effects (Moffitt, 2004).

The gender gaps by age differ, with higher rates of VLFS among families with young girls and higher rates of VLFS among families with older boys. However, none of the gender differences are significant at the 10 percent level, although that for families with older children (12-18)--13.8 percent for families with boys and 9.6 percent for families with girls--is on the borderline of significance at 16 percent. In the multivariate analysis below, many of these gender differences will increase in statistical significance.

Multivariate Analysis: Basic Results. We estimate equations for VLFS on the pooled sample of 4,229 observations, using probit analysis because the dependent variable is dichotomous, and we employ a random effects specification to insure that the estimated standard errors properly account for the repeated observations for the same families. We begin by estimating models which have covariate controls only for the standard set of socioeconomic characteristics collected in most other surveys--race-ethnicity, income and asset characteristics of the family, family composition, participation in means-tested transfer programs, and the education, employment status of the caregiver. We will add the new and unique variables measured in the TCS separately.

Table 2 shows the results, first with a simple additive age-gender specification and then with age and gender interacted. Taking the control variables first, most results are similar to those in the literature. Having income below the poverty line and having an unmarried caregiver, for example, increase the probability of having Very Low Food Security, as does having a disabled caregiver. Having more adults in the family or having no children also increase that probability, while larger numbers of children decrease it. For participation in means-tested transfer programs, surprisingly, being a recipient of SNAP lowers the probability of

having Very Low Food Security. This is surprising because the consensus view in the literature is that selection bias generally causes this coefficient to be positive. The negative sign in this sample suggests that very little if any selection bias is likely present, and this may be, in turn, because of the homogeneous nature of the sample (all from inner city poor neighborhoods, all very disadvantaged).

Turning to the main results, column (1) shows that the strong age effects present in the raw means in Table 1 are maintained even while controlling for these covariates, with families with a younger focal child still having significantly lower probabilities of Very Low Food Security than those with children 12-18 (there is no significant difference between the 0-5 and 6-11 child families, however). Further, the coefficient on gender is insignificant, suggesting no average differences between families with girls and boys. Indeed, this has been found in some other studies as well (e.g., Nord, 2013), leading some analysts to conclude that there are no gender differences in food security in the U.S. But examining gender groups separately by age (column (2)) shows that this is most definitely not the case. While the same age pattern found for both genders combined is maintained within families with boys or girls (although the age gradient is much steeper for those with boys), families with a boy focal child 12-18 have significantly greater probabilities of Very Low Food Security than those with a girl focal child in the same age range (probit coefficient = -.353). Just the opposite is the case for families with very young children, where having a boy focal child 0-5 results in a lower probability of having Very Low Food Security than having a girl focal child in the same age range.[10]

[10] Any pairwise difference between two age categories for the same gender or between genders of the same age category which is statistically significant at the 10 percent level is indicated in the table. Any such comparison with no significance level shown is statistically

The magnitudes of these effects are difficult to ascertain from probit coefficients themselves, so Table 3 shows their implications for marginal effects, i.e., the age-gender differences in the probability of having VLFS. The age differences are large, especially for boys: families with older boys have from 6.5 to 7.7 greater percentage point rates of VLFS, which are nearly the same size as the unconditional differences in the means from Table 1. The gaps for families with girls are smaller, but can be as high as 2.5 percentage points. The gender difference is greatest for older children, where those families with older boys have over 4 percentage point greater rates of VLFS than those for girls. The gap for very young children is about half that, about 2 percentage points.[11]

Exploring Explanations for the Age and Gender Differences. We will explore possible reasons for these age and gender gaps in the remainder of the statistical analysis. The data allow us to examine three different general areas of possible explanation: (i) differences in nutritional needs and hence food costs for children of different ages and genders; (ii) differences in financial strain, family routines, and availability of help from others, all of which were uniquely collected in the TCS data; and (iii) differences in age and gender gaps by different strata of the population, strata measured mainly by financial situation but also for a few related variables.

Nutritional Needs. The U.S. Department of Agriculture has for many years estimated the cost of purchasing a minimally adequate diet for individuals of different ages and genders. The methodology uses dietary guidelines established for different ages and genders and determines

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insignificant.

[11] Our results are not sensitive to the use of our VLFS indicator rather than a measure of food security based on the TCS child questions alone. We constructed a dependent variable equal to the sum of the four child TCS questions and estimated an ordered probit model with that dependent variable, with the same specification of independent variables as in our VLFS model.

the market basket of different food groups needed to meet the Recommended Daily Allowances (RDAs) for 15 essential nutrients (U.S. Department of Agriculture, 1999). Specific low-cost options for weekly meals which attain these RDAs are then calculated by obtaining prices for different foods which together will yield this outcome. The minimal-cost of that bundle of meals is called the Thrifty Food Plan (TFP) and is widely used to assess the adequacy of family incomes to achieve minimally nutritious diets and, in fact, the TFP is used by USDA to set SNAP allotments.

Table 4 shows the 1999 USDA TFP weekly food costs for individuals of different ages and genders in a family of 4. Food costs for children less than 12 are not different by gender but rise significantly with age. Gender differences in food costs appear for older children and adults but those are also modest in size, but some of the age differences (e.g., between adolescents and those under 12) are larger. Given these differences, a family with limited financial resources may choose to forgo expenditures for adolescents with their high food costs in favor of protecting younger children and maintaining their food input at nutritionally adequate levels.

Our exercise to test this hypothesis shows that it is quite important for explaining age differences. We first estimate the TFP separately for each focal child in the sample, using that focal child's age and gender.[12] We then estimate the VLFS random effects probit model shown in Column (2) of Table 2 but substituting the TFP variable for the focal child for the five age-gender indicators in that equation. The resulting probit coefficient on TFP is a highly significant 0.0106 (s.e.=.00033), showing that a higher TFP for the focal child leads to a significantly

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The results showed relative age and gender differences very similar to those shown in Table 2.

[12] As noted in the footnote to Table 4, those figures differ by family size, so this must be taken into account.

greater probability that the family exhibits Very Low Food Security. We then calculate the mean TFP values for the six age-gender categories and plug those into our estimated VLFS probit and predict the probability that VLFS=1 for each of the six categories and compute the differences, which are the marginal effects. By this procedure, we can determine how much TFP alone can explain age-gender differences in the probability of having Very Low Food Security.

Table 5 shows the predicted differences, which should be compared to those in Table 3. For boys 0-5, for example, the differential TFP amounts for boys of that age compared to boys 12-18 leads to a predicted difference of a 3.7 lower percentage point probability for the younger boys. This is almost half of the actual difference of 7.7 percentage points shown in Table 3, demonstrating that food needs, as measured by the TFP, can explain almost 50 percent of the difference in Very Low Food Security between those two age groups of boys. Interpreting the rest of the results similarly shows that TFP can explain only about one-fifth of the VLFS difference between 6-11 boys and 12-18 boys, but can explain all of (in fact, more than) the difference in VLFS between 0-5 girls and 12-18 girls; and it can explain about half the difference between 6-11 girls and 12-18 girls.

However, essentially none of the gender differences in VLFS are explained by TFP. In retrospect, this is not too surprising given the relative unimportance of gender in TFP food costs shown in Table 4.

Influence of Other Important Variables Measured in the TCS. Several unique variables were collected in the TCS which are rarely found in other surveys of food security. One constituted a set of six questions regarding whether the family was under financial strain, querying the respondent how often they had to borrow to pay bills, how often they had to put off

buying something they needed, how often they could not afford to do things for fun, whether they had had difficulty paying bills in the last 12 months, whether they could afford the housing, food, and clothing they needed, and whether they generally end up with enough money (see footnotes to Appendix Table 2C). These questions were aimed at determining more accurately the family's financial situation than just their family income; in fact, one of the puzzles in the food security literature is how little of the variation in food security is explained by income. An index constructed from the six variables has considerable variance across families and, particularly important for present purposes, the families with an older focal child reported being under more financial strain than those with younger focal children (although there was little gender difference). Whether it was the presence of the older child with his or her greater expense requirements or something else cannot be determined, but this could explain some of the age gaps in VLFS.

A second set of questions which were also aimed at indirectly measuring the family's ability to cope with financial crises asked the household caregiver whether she had access to people "who will listen," who will help with child care, with small favors, or will loan money (again, see footnotes to Appendix Table 2C). While 70 percent of the sample reported positively to at least one of these, 30 percent reported negatively to all four, representing a very low and precarious financial condition. Once again, those with negative reports to the questions were disproportionately drawn from those with older focal children.

A third set of questions aimed at a different characteristic of the family, namely, whether the family had established routines--whether they had a time when everyone talks or plays quietly, whether the children go to bed the same time every night, whether they all eat dinner

together every evening, and at least some of them eat breakfast together (Appendix Table 2C). Developmental psychologists have found that such family routines are correlated with positive developmental outcomes. In our case, the last two questions are also directly related to whether the children are eating with the rest of the family. Perhaps predictably, those families with an older focal child were less likely to follow these family routines than families with a younger focal child.

When variables for these three family indicators are added to the random effects probit model in Table 2, they are highly significant. The coefficients on variables for being above the median of the financial strain index, for having any of the help variables answered positively, and for being above the median of a family routines index were 1.29 (s.e.=.132), -.386 (s.e.=.094), and -.212 (s.e.=.102), respectively, and hence all highly significant and going in the expected direction. More important for present purposes, the inclusion of these three variables in the regression markedly reduces the estimated age gaps in VLFS implied by the regression, as demonstrated in Table 6. The gap between 0-5 boys and 12-18 boys falls from 7.7 percentage points to 5.2 percentage points and that between 6-11 and 12-18 boys falls from 6.5 percentage points to 3.5. For girls, the gap between the youngest 0-5 and the oldest 12-18 is virtually eliminated and that between 6-11 girls and 12-18 girls is about halved. The gender differences, however, are little affected by the inclusion of these variables (with the possible exception of that between older boys and girls), for the variables are not highly correlated with gender.

Complete Stratification by Financial Variables and Family Routines. The clear importance of financial variables and family routines revealed by the previous analysis suggests that even more of the age gaps in VLFS, if not those across gender, could be explained by

completely stratifying the sample by these variables and treating them as entirely different subpopulations. Table 7 does that and shows that this is indeed the case. For example, stratifying the sample by whether families are above or below the poverty line and reestimating the random effects probit model in column (2) of Table 2 yields the marginal effects reported in Table 7A. Age gaps for boys are drastically higher for those with lower incomes than for those with higher incomes. For families with higher income, indeed, the small 1.4 percentage point difference between 6-11 boys and 12-18 boys is based on a probit coefficient that is not statistically distinguishable from zero, implying that that age gap, at least, essentially disappears for those with higher incomes (recall that all families in the TCS began with incomes less than 200 percent of the poverty line, so these families with greatly diminished age gaps are not "high income" in absolute terms). For girls, however, the relative 0-5 gap is greater for those above the poverty line but the standard error on the underlying probit coefficient is quite large and the coefficient has a t-statistic below 1. The gender gaps are also essentially eliminated for those with incomes above the poverty line.

Table 7B shows analogous results when stratifying by a second economic variable, the financial strain index discussed above which was already shown to be important for age gaps in food security. Now, in almost every age and gender category, VLFS differences are drastically reduced and often near zero for those with lower levels of financial strain. This further demonstrates the importance of economic well-being in affecting the food security gaps under investigation in this study.

Table 7C shows similar age and gender gaps when stratifying by the level of family routines. In this case, about half of the gaps in the table are reduced to low levels for those with

routines above the median in the sample (e.g., those for 0-5 and 6-11 girls relative to their 12-18 counterparts, and those for 0-5 and 6-11 girls vs. boys). However, the age gaps for boys, while smaller for those with higher levels of family routines than for those with lower levels, still remain at magnitudes of concern (3.5 percentage points, 4.2 percentage points) and the gap between older boys and girls is slightly larger for those families practicing higher levels of family routines.[13]

Discussion and Conclusions

The data from the Three-City Study reveal that past work finding insignificant gender gaps in food security has masked different effects by age, with families with young boys (0-5) exhibiting lower levels of Very Low Food Security than young girls, very little difference for boys and girls 6-11, and higher levels of VLFS for families with 12-18 boys than for girls of the same age. The age gaps in food security have been suggested before in the literature but the ability to focus on an individual child made possible by the TCS data provides much stronger evidence for higher levels of VLFS for older children than younger ones, and that the age gradient is much steeper for boys than for girls.

Within each gender, the age gradient in VLFS is consistent with a modified version of the well-known protection hypothesis. According to this hypothesis, adults protect their children from food hardship by sacrificing their own food intake before reducing that of their children

[13] Stratifying by whether families had anyone to help, another variable discussed previously, did not reveal much reduction in VLFS gaps for those with and without any such help and hence is not shown.

(Radimer et al., 1999; Hamelin et al., 1999, 2002).[14] While this does not address age differentials among children, a reasonable modification of the hypothesis would suggest that parents protect younger children more than older children. Reduced food intake among infants, toddlers, and very young children is known from research to have major negative lifetime consequences on health, and parents are no doubt aware of this general relationship, knowing that children at young ages are developing basic mental, physical, and motor skills and are more vulnerable to deficiencies in nutrition.

However, the alternative hypothesis that differential caloric needs of children of different ages is also mentioned but can only be examined with the individual child data available in this data set, and we have shown that those differential nutritional needs can, in some sense, explain a large fraction of the age gaps in VLFS. Depending on the age comparisons being made, differential nutritional needs can "explain" from one-third to all of the differences in VLFS.[15] However, while this is an important finding, it does not really explain parental behavior and why parents do not choose to allocate more expenditure to older children in order to equalize the nutritional gaps, let us say--e.g., equalizing the nutritional deficiencies across all children--which they could do if they wished to. The reason they do not probably relates to the same protective behavior for younger children already discussed and that nutritional deficiencies for them would be more harmful than for older children.

Nutritional needs have no power in explaining gender differences, however. There are no significant difference in USDA-estimated caloric needs for younger boys and girls and only

[14] A qualitative study by Fram et al. (2011), however, provides evidence against this hypothesis.

[15] In a qualitative study of 90 households, Edin et al. (2013) find that "teenage boys in

small differences for adolescents, and the latter are too small to explain the much larger VLFS levels in families with older boys than those with older girls. The protective hypothesis, in general, also is not easy to square with the observed gender differences. It is not clear why parents would prefer to protect older girls more than older boys and, further, why younger boys should be protected more than younger girls. Some of the other mechanisms to be discussed next may explain these differences.

The results here also show that economic resources and financial situation are considerably more important than has been shown in past work. While virtually all studies of the determinants of food security show that low levels of food security are correlated with lower levels of income, much of the emphasis in past discussions has been on how little income can explain, given that so many families with low incomes do not exhibit low levels of food security and so many families with high incomes do exhibit low levels (e.g., Gunderson, 2013, p.5). Once again, the focus of attention here is different, where age and gender differentials rather than the overall level of food security are being examined. But for age and gender differentials, money income appears to be extremely important. Families with incomes just above the poverty line, but still low, have male age differentials that are drastically smaller than those for lower income families, and the gender differences virtually disappear. An additional result appears when financial strain and stress are used to measure the importance of financial resources. Even when holding money income fixed, adding financial strain measures to the regression equation lowers age and gender gaps considerably; and when examining just those with lower levels of financial strain, male age gaps are drastically reduced in magnitude and female age gaps and

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particular can eat their way through a household's food reserve quickly."

gender gaps are virtually eliminated.

The clear implication of these results is that families start to impose significantly differential food intake across children, whether by age or by gender, only when resources get very low and/or financial strain reach high levels. In some sense, parents feel forced to start rationing food across different types of children and to make those difficult decisions by force of extreme circumstances.

A somewhat different interpretation, at least of the financial strain effect, is that some families are better at managing their scarce resources than others. In a qualitative study, Edin et al. (2013) finds that parents spend an enormous amount of time in deciding where to shop for food, where the best prices are, looking for sales, planning meals around inexpensive foods, and in managing their budget in general. Further, because this is a skill, some parents are more skilled at that activity than others. In addition, in a quantitative analysis, Gunderson and Garasky (2013), using a measure of financial management skills, show that such skills are negatively related to low levels of food security. It is possible that the financial strain measures obtained in the TCS data may be partly reflecting this type of skill rather than the force of external pressures and needs. This would be a good topic for further exploration.

Yet another factor uncovered here, and much less studied in work to date, concerns the extent to which parents organize their children's activities into routine and well-defined schedules and whether meals like dinner and breakfast are generally eaten at home and with other family members. Families which organize family activities to a greater degree have much lower rates of low food security and much lower average age and gender differentials, although they are not entirely eliminated. These activities may be most salient for older children, who

often do not eat dinner at home or who do not participate in stable family routines and activities, and this could be another explanation for the higher rates of low food security among families with an older child which has been found so markedly here.

Finally, our findings on networks--that whether a family has others to call on for various kinds of help, should they need it, has some (although somewhat limited) effects in reducing age and gender differentials--is consistent with the importance of social networks, more broadly speaking, for food security. Martin et al. (2004), in a small sample of families in Connecticut, found that an index of social capital--which includes trust, reciprocity, and social networks--was positively associated with household food security, and that neighbor reciprocity was particularly strongly so associated. Edin et al. (2013) found that the availability of kin networks was extremely important in combating food crises by invitations from those kin to eat at their house, but that many families have no networks at all and have a much more difficult time in coping. In the quantitative analysis here, we find that having others who can help with various exchanges reduces age and gender effects to some extent but even those who have others to help still have significant gaps in VLFS across different types of children.

The age and gender gaps in food security uncovered for the first time in this study are dramatic and should be a source of social concern. While many factors have been found to be heavily associated with the existence and magnitude of these gaps, it remains the case that many households with the lowest levels of economic well-being appear to be forced to allocate food intake across children by age and gender in ways that are clearly harmful to some children. More research into both the causes and possible policy solutions to this problem would be warranted.

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Table 1. Means Values of Very Low Food Security (VLFS) Indicator

	All Children	Male	Female
All	.083	.080	.076
By Age:			
0-5	.056	.045	.067
6-11	.061	.062	.060
12-18	.115*+	.138*+	.096*

Notes:
N=4,229
*: Significantly different from the 6-11 category at the 10 percent level
+: Significantly different from the 0-5 category at the 10 percent level

Table 2. Coefficients from Probit Random Effects Estimation of VLFS Models

Variable	(1)	(2)
Age and gender variables		
Female	-.066	--
	(.105)	
Age 0-5	-.465*	--
	(.130)	
Age 6-11	-.470*	--
	(.121)	
Age 0-5 female[1]	--	-.498*^
		(.168)
Age 6-11 female	--	.-664*+
		(.173)
Age 12-18 female	--	-.353*
		(.157)
Age 0-5 male	--	-.802*
		(.173)
Age 6-11 male	--	-.621*
		(.161)
Control variables		
Hispanic	.010	.034
	(.218)	(.232)
Non-Hispanic Black	.102	.152
	(.232)	(.220)
Log real monthly income	-.016	-.017
	(.058)	(.052)
Income below poverty line	.568*	.566*
	(.123)	(.128)
Own home	-.422*	-.418*
	(.168)	(.169)
Own car	-.178*	-.170
	(.106)	(.107)
No. adults	.094*	.084
	(.057)	(.057)
No. children = 2	-.437*	-.452*
	(.153)	(.155)
No. children > 2	-.292*	-.316*
	(.130)	(.132)
Not employed	.038	.033
	(.102)	(.102)

Table 2, Continued. Coefficients from Probit Random Effects Estimation of VLFS Models

Variable	(1)	(2)
High school	-.066	-.082
	(.126)	(.127)
College	.075	.039
	(.148)	(.149)
Married	-.295*	-.294*
	(.135)	(.135)
Disabled	.516*	.522*
	(.113)	(.113)
Fair or poor health	.163	.164
	(.103)	(.103)
TANF recipient	-.082	-.084
	(.1180	(.118)
SNAP recipient	-.313*	-.313*
	(.116)	(.117)
SBP recipient	-.095	-.906
	(.149)	(.152)
NLSP recipient	.342*	.336*
	(.167)	(.169)
WIC recipient	.077	.078
	(.104)	(.105)
Boston	-.325*	-.318*
	(.160)	(.169)
Chicago	-.507*	-.508*
	(.168)	(.169)
Constant term	-1.80*	-1.63*
	(.342)	(.334)
Sigma[2]	1.04*	1.03*
	(.109)	(.109)
Log likelihood	-1012.9	-1008.3

Notes:
Standard errors in parentheses
*Significant at the 10% level
[+]Significantly different from Age 12-18 female
[^]Significantly different from Age 0-5 male
Survey weights used in the estimation
[1]Indicator for 12-18 male omitted
[2]Standard error of the composite error term.

Table 3. Age and Gender Marginal Effects.

Age Differences (Relative to 12-18)	
Male	
0-5	-.077
6-11	-.065
Female	
0-5	-.013
6-11	-.026
Gender Differences (Male Minus Female)	
0-5	-.022
6-11	.003
12-18	.041

Notes:
Marginal effects calculated from Table 2, column (2) by setting all Control variables to their means, all age-gender variables to zero, and calculating the predicted Prob(VLFS=1), which is the baseline probability; then, for each age-gender group, the predicted Prob(VLFS=1) is recalculated, and the difference from the baseline probability is the marginal effect.

Table 4. Weekly Cost of Food Under Thrifty Plan, June 1999

Child	
1-2 years	$15.50
3-5 years	16.70
6-8 years	20.70
9-11 years	24.50
Male	
12-14 years	25.30
15-19 years	26.10
20-50 years	28.00
51 years and over	25.30
Female	
12-19 years	25.30
20-50 years	25.20
51 years and over	24.80

Notes:
For a family of four only. Costs for other families are scaled up and down to account for economies of scale.
Source: http://cnpp.usda.gov/Publications/FoodPlans/1999/CostofFoodJun1999.pdf, accessed September 9, 2014.

Table 5. Age and Gender Marginal Effects
Arising from Differences in Nutritional Needs

Age Differences (Relative to 12-18)	
Male	
0-5	-.037
6-11	-.013
Female	
0-5	-.036
6-11	-.012
Gender Differences (Male Minus Female)	
0-5	-.0002
6-11	-.0005
12-18	-.0008

Notes:
See Table 3.

Table 6. Age and Gender Marginal Effects
Arising from Differences in Financial Strain,
Help from Others, and Family Routines

Age Differences (Relative to 12-18)	
Male	
0-5	-.052
6-11	-.035
Female	
0-5	-.005
6-11	-.013
Gender Differences (Male Minus Female)	
0-5	-.019
6-11	.010
12-18	.033

Notes:
See Table 3.

Table 7A. Age and Gender Marginal Effects for Families with Income Below and Above the Poverty Line

	Below the Poverty Line	Above the Poverty Line
Age Differences (Relative to 12-18)		
Male		
0-5	-.113	-.031
6-11	-.098	-.014
Female		
0-5	.001	-.024
6-11	-.021	-.015
Gender Differences (Males Minus Female)		
0-5	-.041	-.003
6-11	-.004	-.004
12-18	.076	.003

Notes: See Table 3.

Table 7B. Age and Gender Marginal Effects for Families with High and Low Financial Strain

	Above Median Financial Strain	Below Median Financial Strain
Age Differences (Relative to 12-18)		
Male		
0-5	-.090	-.021
6-11	-.089	-.013
Female		
0-5	.010	-.001
6-11	-.027	-.003
Gender Differences (Males Minus Female)		
0-5	-.051	-.001
6-11	-.011	.008
12-18	.049	-.019

Notes: See Table 3.

Table 7C. Age and Gender Marginal Effects for Families with Low and High Levels of Family Routines

	Below Median Family Routines	Above Median Family Routines
Age Differences (Relative to 12-18)		
Male		
0-5	-.085	-.042
6-11	-.048	-.035
Female		
0-5	-.016	-.009
6-11	-.026	.006
Gender Differences (Males Minus Female)		
0-5	-.040	.005
6-11	.008	-.003
12-18	.029	.038

Notes: See Table 3.

Appendix Table 1

Food Hardship Questions in the Three-City Study

Adult Caregiver

ST8 – At any time in the past 12 months, did you or other adults in your household cut the size of your meals or skip meals because there wasn't enough money for food?

ST9 – At any time in the past 12 months, did you or any other adults in your household not eat for a whole day because there wasn't enough money for food?

ST10 – In the past 12 months, were you ever hungry but didn't eat because you couldn't afford enough food?

ST11 – Sometimes people lose weight because they don't have enough to eat. In the past 12 months, did you lose weight because there wasn't enough food?

Focal Child

ST12 – At any time in the past 12 months, did you cut the size of any of [CHILD]'s meals because there wasn't enough money for food?

ST13 – At any time in the past 12 months, did [CHILD] skip a meal because there wasn't enough money for food?

ST14 – Did this happen...(frequency)?

ST15 – At any time in the past 12 months, was [CHILD] hungry but you just couldn't afford more food?

Appendix Table 2A. Means Values of Child Characteristics

Characteristic	Percent Distribution
Age	
0-5	54.7
6-11	19.3
12-18	26.0
Gender	
Male	51.0
Female	49.0
Race-Ethnicity	
Hispanic	51.0
Non-Hispanic Black	44.4
Non-Hispanic White	4.6
Child Care Arrangement	
Always with caregiver	37.2
Daycare center	24.3
Other	38.5
Foreign born	18.9

Notes:
Wave 1 only, N=1,463.
Survey weights used in this and all other tables in the study.

Table 2B. Means Values of Caregiver Characteristics

Characteristic	Percent Distribution
Education	
Less than high school	39.6
High school	39.5
College	20.8
Employment	
Working	36.7
Not working	63.3
Married	30.1
Health Status	
Good, very good, or Excellent	74.5
Fair or poor	25.5
Disabled	16.7
Religion	
Catholic	46.5
Protestant	20.3
Other	22.0
None	11.2

Notes:
Wave 1 only, N=1,463.

Appendix Table 2C. Means Values of Household Characteristics

Characteristic	Mean Value or Percent Distribution
Log real monthly income	$971[1]
Income below poverty line (%)	76.0
Own car (%)	48.2
Own home (%)	17.4
Has a financial asset (%)	38.6
Number of adults	1.8
Number of children	3.0
City of residence (%)	
Boston	32.2
Chicago	36.1
San Antonio	31.7
Financial strain index[2]	-0.1
Above median of index(%)	43.5
Family routines index[3]	2.8
Above median of index (%)	48.3
Have anyone to help (%)[4]	70.1
Whether others ask for help (%)	97.6
Welfare program receipt (%)	
TANF	34.4
SNAP	46.1
SBP	70.8
NLSP	73.1
WIC	43.1

Notes:
Wave 1 only, N=1,463.
[1] In 1999 CPI-U-RS dollars.
[2] Composite score measuring level of financial strain from six questions (how often has to borrow to pay bills; how often has to put off buying something you need; how often can afford to do things for fun; have had difficulty paying bills in last 12 months; can afford the housing, food, and clothing you need; have generally ended up with enough money in the last 12 months)
[3] Mean of answers to four family routine questions (have a time when everyone talks or plays quietly; children go to bed at the same time each night; family eats dinner at the same time each night; at least some of the family eats breakfast together)
[4] Whether have access to people who will listen, help with child care, help with small favors, or will loan money