A Tobit Analysis of WIC Children's Consumption of Pyramid Group Foods

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Selected Paper prepared for presentation at the American Agricultural Economics Association Annual Meeting, Denver, Colorado, August 1-4, 2004

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Short Summary

This paper develops and estimates an econometric model for children's consumption of the *Pyramid Group* foods using the Continuing Survey of Food Intake by Individuals (CSFII) for the years 1994-96, 1998. This analysis is accomplished using a Tobit model (censored dependent variable) and by appropriately incorporating the survey design characteristics.

Summary

The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) provides supplemental food packages which are designed to provide nutrients identified to be lacking in the diets of low-income women, infants and children. Consumption of food items that meet the Pyramid recommendations is expected to improve participants' diet and nutritional status, which in turn, is expected to improve the health of program participants. However, the relationship between WIC and consumption of food items recommended by USDA has not been thoroughly examined. This paper develops and estimates an econometric model for children's consumption of the *Pyramid Group* foods using the Continuing Survey of Food Intake by Individuals (CSFII) for the years 1994-96, 1998. This analysis is accomplished using a Tobit model (censored dependent variable) and by appropriately incorporating the survey design characteristics. Results of the regression analysis indicate that participation in the WIC program significantly affects the consumption patterns of children, for certain types of *Pyramid Group* foods. After controlling for other factors, WIC children consumed more milk, fruit and whole grain and less of added sugar than the group of eligible nonparticipating children.

A Tobit Analysis of WIC Children's Consumption of Pyramid Group Foods[1]

Introduction

Survey data are used in most empirical work in economic. Nevertheless, economists typically have not considered survey sampling methods to be relevant to their analyses [Carrington, Eltinge and McCue (2000)]. The availability of general purpose statistical packages with added features to account for complex samples did not seem to change the practice of economists, perhaps due to lack of familiarity with sample design issues and design-based inference methods. Survey data on consumption of goods (for example, food) often have values clustered at zero. Similarly, data on hours of work often have clustering of observations at zero. Greene (2000) cites the following examples from the literature with a significant fraction of observations for the dependent variable with zero values: household purchases of durable goods [Tobin (1958)]; the number of extramarital affairs [Fair (1977, 1978)]; the number of hours worked by a woman in the labor force [Quester and Greene (1982)]; the number of arrests after release from prison [Witte (1980)]; household expenditures on various commodity groups [Jarque (1987)]; and vacation expenditures [Melenberg and van Soest (1996)]. Greene also points out that in all the above stated examples, the conventional Ordinary Least Squares (OLS) methods fail to use all the available information and consequently the OLS estimators are biased and inconsistent.

The computational procedure Tobit, developed by Tobin (1958) for censored dependent variables, uses all observations, both those at the limit and those above it, to estimate a regression line. Tobit is preferable over the conventional OLS procedure where a significant proportion of observations for the dependent variables clustered at zero. This paper considers estimating an econometric model using censored regression models on sample survey data while incorporating auxiliary information on survey design characteristics. The data for the analysis comes from the Continuing Survey of Food Intake by Individuals (CSFII) for the years 1994-96, 1998. This investigation considers the children's consumption of

[1] Thanks to Mark Prell, Elizabeth Frazão, Victor Oliveira and David Smallwood for reviewing earlier manuscripts and for helpful comments and suggestions.

Pyramid Group foods. This paper examines the extent to which eating patterns differ between WIC participants and nonparticipants using food categories classified under the Food Guide Pyramid dietary recommendations. Consumption of the *Pyramid Group* foods is expected to improve children's diet and nutritional status, which, in turn, is expected to improve the health of program participants.

Importance of Survey Design Instruments in Econometric Analysis[2]

Most publicly available data come from structured surveys with specific goals. For example, the primary goal of the CSFII/ 1994-98 was to obtain nationally representative samples of non-institutionalized persons residing in households in the United States for each of 40 analytic domains defined by sex, age, and income level. An important goal of most of the surveys is to project the population averages for subgroups based on specific socioeconomic and geographic characteristics. For example, the Current Population Survey (CPS) measures the unemployment rate separately for each state, the Consumer Expenditure Survey (CES) measures average spending pattern and the National Longitudinal Survey of Youth (NLSY) measures the labor market activity of black and white youth. These goals mostly involve estimating averages for a desired population (for example, the current U.S. population). Economists and others using these surveys should pay attention to the survey design features and incorporate them appropriately while estimating multivariate behavioral relationships[3].

Though the details may vary, most designs combine three basic features: stratification, and varying probabilities of selection and clustering[4]. Stratification entails choosing independent subsamples of predetermined size from each stratum, thereby reducing sampling variation. The basic idea is that sampling variability of a sample mean can be divided into a) sampling variation within strata and b) sampling

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[2] Chandran (2004) discusses the importance of accounting for survey design components while estimating econometric models. He also provides empirical estimates comparing four alternate estimating procedures: (1) Regression estimation using conventional OLS not accounting for survey design. (2) Regression estimation using conventional MLE (Tobit) not accounting for survey design. (3) Regression estimation using survey regression methods accounting for survey design.. (4) Regression estimation using MLE (Tobit) accounting for survey design.

[3] Deaton (1997) provides an excellent review with emphasis on design issues and techniques relevant to work using data collected in developing countries.

[4] The sample design is constructed to keep clusters and strata with the following distinct features: Stratification is to ensure that each stratum is represented in the survey are quite different from one another, and at the same time within the stratum the elements are relatively homogeneous. In contrast, clustering done to make certain that clusters are internally heterogeneous, and at the same time different clusters within a stratum are somewhat similar to each other.

variation in each stratum's sample share. By fixing each stratum's sample share, stratification eliminates sampling variation due to this latter between-stratum component. If the strata have very different means for Y because the auxiliary variables used to define strata are highly correlated with Y, then stratification can increase precision substantially. If the strata are very similar to one another, however, then this procedure reduces sampling variance only slightly. Thus, the ideal stratification scheme creates strata that are internally homogeneous and externally heterogeneous.

The *varying probability of selection* procedure (also known as *probability proportional to size selection*) allows a survey to better achieve its goals. An important reason for varying probabilities of selection is that a survey may need separate estimates for subpopulations of unequal size. For example, one of the goals of CSFII survey was to collect data on rates of participation of low income families in federal programs such as the WIC and Food Stamp Program (FSP). By varying the selection probabilities CSFII was able to get higher percent of families from low income and lower percent of families from high income. Using estimators based on the assumption of Simple Random Sampling (SRS) may not yield robust results with desirable statistical properties. For example, the estimates of population parameters using survey sample selected with varying probability are likely to be biased and/or statistically inefficient.

Collecting data from population units that are geographically close together is often considerably less costly than collecting data from elements chosen independently. Selecting groups of close elements (clusters) reduces per-element collection costs, and thereby allows for a larger sample size. Cost alone is not the sole motive for using clusters. For example, one of the goals of CSFII was to collect health and diet information on the entire family living in the same household.

The CSFII survey is a stratified, multistage area probability sample. The sampling frame was organized using estimates of the U.S. population in 1990. The stratification plan took into account geographic location, degree of urbanization, and socioeconomic characteristics. At the first stage of sampling, the entire United States was divided into primary sampling units (PSU's) consisting of Metropolitan Statistical Areas (MSA's). The second stage was the selection from each PSU of 36 area segments consisting of blocks or groups of blocks. Area segments were chosen with probability proportional to size. In the third stage, listed dwelling units in the selected area segments were drawn into the sample from the listings. For all the four years of the CSFII 1994-98, the calculation of the number of dwelling units to be screened took into account the sample sizes needed to achieve the desired levels of precision specified by USDA. Estimation of econometric models using the CSFII data is strengthened by taking into account the sampling scheme, rather than treating the observations as though they come from a simple random sample[5].

Differences in Approach to Regressions by Survey Statisticians and Econometricians[6]

Survey statisticians and economists employ may employ two distinct approaches for estimating the parameters of a regression model. The survey statisticians correctly take account of the survey design instruments by employing the finite population approach whereas economists typically, consider the sample coming from an infinite population using SRS. Consider a simple multiple regression model represented by

$$Y = X\beta + \varepsilon \qquad (1)$$

where X represents a column rank *k,* $E(\varepsilon|X)=0$, and $V(\varepsilon|X) = \sigma^2$.

The economists would apply classical ordinary least squares (OLS) to obtain the estimate, b_{OLS} of the β parameter of the model (1):

$$b_{OLS} = (X'X)^{-1}(X'Y) \qquad (2)$$

For samples with varying probabilities of selection, the survey statisticians would typically recommend use of the weighted least squares (WLS) estimator and obtain b_{WLS}, an alternate estimate of the β parameter of the model (1):

$$b_{WLS} = (X'WX)^{-1}(X'WY) \qquad (3)$$

where *W* is a diagonal matrix of survey weights. From the econometric modeling point of view, WLS is

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[5] The general estimating procedures outlined in econometric textbooks assume the data come from a simple random sample (SRS). SRS is conceptually the most straightforward method of selecting a sample. It consists of selecting a sample of size n from a population of size N where each observation gets equal selection probability.

[6] Complete details on the differences between these two approached are beyond the scope of this paper. Those interested should refer to Arrington , Eltinge and McCue (2000) for an in-depth analysis and comparison of the two approaches..

usually based on heteroscedasticity which is assumed while estimating model (1) if data come from a varying probability sample. The estimates of coefficients using (2) are biased and OLS underestimates the standard errors [7]. In other words, econometric estimates using OLS procedure are likely to reject hypotheses on population parameters more frequently than the estimates accounting for design characteristics.

Estimation of Censored Variables

The textbook presentation of a Tobit regression model for a censored dependent variable is usually stated by:

$$Y_i = X_i \beta + \varepsilon \qquad \text{if } X_i \beta + \varepsilon > 0 \qquad (4)$$
$$Y_i = 0 \qquad \text{if } X_i \beta + \varepsilon <= 0$$

This formulation of the model implies that the conditional expectation of Y_i given that $X_i \beta + \varepsilon > 0$ is equal to $X_i \beta$ and the conditional expectation of Y_i given that $X_i \beta + \varepsilon <= 0$ is equal to zero. In other words, $E[Y_i / X_i \beta + \varepsilon > 0] = X_i \beta$ and $E[Y_i / X_i \beta + \varepsilon <= 0] = 0$. For a random observation (which may or may not be censored) the expected value of Y_i for any X_i will become :

$$E[Y_i / X_i] = \phi[X_i \beta/\sigma] [X_i \beta + \sigma \lambda_i] \text{ where } \lambda_i = \{\phi[X_i \beta/\sigma] / [\Phi[X_i \beta/\sigma]\} \qquad (5)$$

Some textbooks provide an alternative formulation of equation (4) using an index (latent) variable $Y_i^* = X_i \beta + \varepsilon$ with the following modifications:

$$Y_i = Y_i^* \qquad \text{if } Y_i^* > 0 \qquad (6)$$
$$Y_i = 0 \qquad \text{if } Y_i^* <= 0$$

Using the latent variable, Greene (2000) provides an estimate of the marginal effects of any independent variable (X_i):

$$\delta E[Y_i / X_i] / \delta X = \beta \text{ multiplied by } Prob[a < Y_i^* < b] \qquad (7)$$

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[7] The presence of heteroscedasticiy in general econometric modeling situations yield unbiased estimates of parameters but the standard errors of the estimates are underestimated. In reality, with complex sample designs, the estimates of standard error can potentially be biased and the magnitude and directions of the bias, if any, depends on factors such as sample size and design characteristics.

This general result establishes the fact that the parameter estimate of β needs to take account of the censored information provided by the model defined above. McDonald and Moffitt (1979) provide an elegant decomposition of the marginal effects into two parts: The first part accounts for the change in y of those above the limit weighted by the probability of being above the limit. The second part measures the change in probability of being above the limit, weighted by the expected value of y. The OLS estimator of the above Tobit model is likely biased and inconsistent. The estimation of the Tobit model stated in equation (4) is accomplished using the *survey Tobit module*[8] of STATA version 8.

Previous Studies

Several national-level studies conducted either during or after the dramatic expansion of the child component of the WIC program during the 1990's have examined the effect of participation in WIC on the nutrient or dietary intake of children. A 1999 study conducted by Kramer-LeBlanc, et al., analyzed the nutrient intake of WIC participants to determine how well they meet nutritional standards, including the 1989 Recommended Dietary Allowances (RDA), the 1995 Dietary Guidelines for Americans, and the Food Guide Pyramid. The study, based on data from the Third National Health and Nutrition Examination Survey (NHANES) conducted from 1988 to 1994, examined the median intakes of WIC participants, focusing on the five target nutrients—protein, iron, calcium, vitamins A and C, and four other nutrients of potential concern— folic acid, zinc, vitamin B6, and magnesium—as well as energy. Results of the study indicated that WIC children generally achieved good nutrient intake, meeting all nutrients recommendations[9].

Oliveira and Gundersen (2000), using data from the 1994-96 CSFII, found that after controlling for selection bias, participation in WIC increased children's intakes of iron, foliate, and vitamin B6. Using the same CSFII data set, Wilde, McNamara, and Ranney (2000) found that WIC participants consumed significantly fewer amounts of added sugars. Chandran (2003) used the 1994-96, 1998 CSFII data set to

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[8] The StatNews #35: Software for Analyzing Complex Surveys (published by the office of Statistical consulting) dated October 22, 2003 briefly reviews the issues that must be addressed when analyzing data from a complex survey and provides an update on the available software. Those interested should also refer to two previous newsletters (StatNews #11 and #12, October 1996) to get details on how to analyze data from complex surveys. More details also available at "Survey Data – Reference Manual Release 8 " 2003 published by STATA corporation, College Station, Texas

[9] The study reported that shortfalls in the intake of zinc were seen among WIC children. However, in 2001 the National Academy of Sciences published new recommendations for zinc intake. Children met the recommendations for zinc when applying the new standards.

examine the effect of WIC participation on food consumption and diet quality of children 2-4 years of age. Diet quality was assessed using USDA's Healthy Eating Index (HEI), which incorporates 10 recommended components of dietary guidelines. The study found that participation in WIC was positively associated with improvements in diet quality as measured by HEI and several of its components. The analysis also found that WIC participation was associated with reduced sugar consumption by children. Using data from the 1994-96, 1998 CSFII, Oliveira and Chandran (2004) found that participation in the WIC program significantly increases the WIC-approved cereal and juice[10]. No previous national-level studies have examined the consumption of Pyramid group foods by children's WIC status.[11]

The Data

The source of data for this study was the Continuing Survey of Food Intake by Individuals (CSFII) 1994-96, 1998 conducted by USDA's Agricultural Research Service (ARS, 2000). The CSFII 1994-96 included the collection of information from persons of all ages. The 1998 survey—the Supplemental Children's Survey (or CSFII 1998)—which only collected data from children less than 10 years of age, was designed so that the data could be combined with those from the 1994-96 survey. Data were collected from nationally representative samples each year. The CSFII 1994-96, 1998 collected information on food intake from individuals—specifically the kinds and amounts of food consumed on each of 2 nonconsecutive days—through in-person interviews using 24-hour recalls. Adult proxies, preferably the person responsible for preparing the child's meals, provided the food intake data for children. Specifically, the analysis uses 29 food groups belonging to the Food Guide Pyramid Data Set. The analysis variables consist of 5 main *Pyramid* food groups (grains, vegetables, fruits, dairy and meats), 22 *Pyramid* food sub-groups (whole grains, non-whole grains, dark-green leafy vegetables, deep yellow vegetables, cooked dry beans and peas, white potatoes, other starchy vegetables, tomatoes and other vegetables, main fruits (citrus, melon and berries), other fruits, milk, yogurt, cheese, meat (beef, pork, veal, lamb and game), organ meats, frankfurters, poultry, fish, eggs, soybean, and nuts, and two Pyramid Tip food categories (discretionary fat and added sugars).

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[10] "Children's Consumption of WIC-Approved Foods," by Victor Oliveira and Ram Chandran, Draft report, Economic Research Service, USDA October 30, 2003.

[11] Few studies have examined the food consumption patterns of any group of WIC participants. One exception is a 1981 study of pregnant women that found that WIC clients consumed milk, juice, and fortified cereals more frequently than non-WIC recipients while the two groups consumed eggs and cheese with equal frequency (Endres, Etal, 1981).

The Food Guide Pyramid was first introduced in 1992 to illustrate a food guide developed by USDA (Welsh et al. 1993). The Pyramid is an educational tool to help explain and interpret the Dietary Guidelines for Americans– seven basic principles for healthful eating that form the basis of Federal nutrition policy (USDA/DHHS 1995, Federal Register 1990). The methodology to convert the food intakes in terms of food-guidance based servings was developed by the researchers at the Agricultural Research Service (ARS) and at the National Cancer Institute (Cleveland et al. 1997; Krebs-Smith et al. 1995, 1996). This methodology was applied to develop the Food Guide Pyramid Data Set using the food intakes reported by the CSFII survey respondents.

Classifying Children by WIC Status

To be eligible for WIC, family income must fall at or below 185 percent of the Federal poverty guidelines or the child must participate in the Food Stamp, Medicaid, or TANF programs (or have certain family members who participate in the Medicaid or TANF programs). In addition, the child must also be individually determined to be at "nutritional risk" by a health professional. Because the CSFII data do not allow for the determination of nutritional risk, WIC eligibility for this study was proxied solely by income eligibility, as determined by the annual income of the household.[12] Past research suggests that WIC income eligibility estimates based on annual income may underestimate income eligibility for WIC (Gordon, et al., 1997).[13] In order to include all children who were likely to have met the WIC income-eligibility criteria at some point during the year, this report considered children in households with annual income at or below 200 percent of the poverty guidelines to be income-eligible for WIC. Children who were authorized to receive food stamps, or who lived in a household that received income from the Aid to Families with Dependent Children (AFDC) or the Temporary Assistance for Needy Families (TANF) programs, were considered to be WIC eligible regardless of income.[14] Although participation in Medicaid also makes a child income-eligible for WIC, the CSFII did not collect information on Medicaid participation. Children who resided in a household in which someone was participating in WIC were considered to be eligible for WIC regardless of income.

[12] The inability of using the CSFII to determine whether an individual meets the nutritional risk criteria has no practical affect in determining their WIC eligibility status for this study. WIC applicants are required to meet only one of a number of nutritional risk criteria to be eligible for WIC. Research has determined that "nearly all U.S. women and children" do not meet the criteria based on failure to meet Dietary Guidelines and thus are at nutritional risk (Institute of Medicine, 2002).

[13] WIC regulations state that local WIC agencies in determining the income eligibility of an applicant, may consider either the income of the family during the past 12 months or the families current income to determine which one more accurately reflects the family's status (7CFR 246.7). More individuals may be eligible based on monthly or biweekly income rather than annual income (for example, during a recent period of unemployment).

[14] The Personal Responsibility and Work Opportunity Reconciliation Act of 1996 replaced the AFDC program with the TANF program.

Of the 6748 children age 1-4 included in the CSFII data set, 1,229 were excluded from the analysis because they were breastfeeding, did not have 2 days of consumption data, or did not report their WIC status.[15] Also CSFII data do not contain food servings data for the 978 children of age 1. The remaining 4,451 children were assigned to one of four mutually exclusive groups determined by WIC status (table 1). These four groups included WIC participants—children who were participating in the WIC program at the time of survey - as well as three groups of nonparticipants: those who were nonparticipants but were treated as eligible for WIC because they were residing in a household with a member participating in WIC, those eligible for WIC based on income or participation in Food Stamp or AFDC/TANF, and those not eligible for WIC as determined by household income.[16] The fourth group of children included in the analysis were ineligible nonparticipants - children not eligible for WIC due to household income exceeding 200 percent of the poverty guidelines and nonparticipation in the Food Stamp and AFDC/TANF programs. There are fundamental differences in factors such as household resources, education levels and nutrition knowledge of parents between WIC-eligible and WIC-ineligible children. Because these factors may affect food consumption patterns, the most relevant comparison of the effects of WIC will be between WIC participants and other low-income children.[17] However, for the purpose of completeness, the group of children ineligible to participate in WIC was included in this analysis.

Descriptive Analysis

Table 2 presents the socioeconomic and demographic characteristics of the children belonging to the age group between 2 to 4[18]. The table presents statistical information for the aggregate sample along with four distinct groups classified by WIC status (WIC participant, nonparticipants living in WIC household, eligible nonparticipants living in non-WIC household and ineligible nonparticipants.

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[15] Breastfeeding children were excluded from this analysis since the CFSII does not contain data on the amount of breast-milk consumed.

[16] In addition to household income, the eligibility for WIC participation also accounts for participation in other governmental programs such as the Food Stamp, Medicaid, or TANF Program. The Personal Responsibility and Work Opportunity Reconciliation Act of 1996 replaced the AFDC program with the TANF program.

[17] Some of the unobservable differences between WIC participants and ineligible children can not be controlled for by statistical procedures.

[18] Statistical procedures, SURVEYMEANS and SURVEYREG of SAS Version 9 were used to compile the table.

All statistical data presented in the body of the table represent population values and were computed using appropriate sample weights while taking account of the sample design characteristics. According to the table, 18.4 percent of U.S. children in the age group between 2 to 4 are WIC recipients. WIC recipients are generally younger than the other 3 groups reflecting the decline in children's participation in WIC as they get older. WIC recipients as well as eligible nonparticipants in WIC households are more likely than the other 2 groups to receive food stamps and to be black or Hispanic. As expected, ineligible nonparticipants appear to be better off relative to the other 3 groups, as measured by socioeconomic characteristics such as annual household income, home ownership, assets, and head of household's years of schooling. They are also less likely to live in a single-headed household, and in central cities and rural areas. Within the two groups of eligible nonparticipating children, those who resided in a WIC household were less likely to be white, more likely to be black or Hispanic, to receive food stamps, live in larger size households, and to reside in the West, and in central cities.

Table 3 presents the average consumption (measured in *Food Pyramid* serving units or Oz.) of the *Pyramid* food intakes of the children by WIC status, over the 2 days in which intake data were collected. Statistical estimates of the population averages for children in the group of 2 to 4 are presented in the body of the table along with their standard errors. According to the Food Guide Pyramid (USDA, 1992) the recommended number of servings for children between the ages 2 and 4 is –grains 6, vegetables 3, fruits 2, milk 2, and meat 2. The estimate of grains servings for all children in sample 4.87 and the consumption by WIC status varied between 4.76 (eligible nonparticipating children in the WIC household) and 4.95 (eligible nonparticipants living in non-WIC household). For all children, the average consumption of vegetables, fruits, milk and meat servings are respectively 1.63, 1.92, 1.56, and 1.95. The estimate of the average number of spoons of added sugar consumption (12.85 tea spoons) by children participating in WIC are lower than for the average for all children (14.4) and also lower than for the rest of the other groups. Examination of whether WIC participation was responsible for the reduction in consumption of added sugar in the daily diet requires analytical procedures that account for socioeconomic and geographic characteristics of the children. The study addresses the answers to such questions in the next section.

Table 3 shows negligible levels of consumption of yogurt (0.04 servings), dark green vegetables (0.07), yellow vegetables (0.10), organ meats (0.01 Oz), fish (0.13Oz) and meat equivalent from soy product (0.02 Oz) by children between 2 and 4 years of age. Consequently, the regression models of consumptions were not developed on these variables.

Empirical Model

The econometric model is derived from the basic economic assumption that the meal planner of the households makes the decision.

The conceptual economic model of demand for a specific WIC-approved food may be stated by

$Q = f(X, G, \varepsilon)$

where Q = Quantity of *Pyramid Group* Foods

X = Household characteristics

G = WIC participation status

ε = stochastic error term

The dependent variables of the model consists of 22 variables that include: (1) five major Pyramid Group Foods - Dairy, Fruits, Vegetables, Grains and Meat; (2) fifteen the *Pyramid* subgroups items - Milk, Cheese, Citrus, Non-citrus fruits, Whole grain, Nonwhole grain, Darkgreen vegetables, White potato, Starchy vegetables, Tomato, Meats, Frankfurters, Poultry, Eggs, and Nuts were investigated; and (3) two Pyramid Tip Foods – Discretionary fat and Added-sugar.

The independent variables of the model consist of WIC-Status dummy variables, food stamp recipient dummy, household income represented as percent of poverty, household size, household assets of value equal to or greater than $5,000, homeownership, sex dummy, race dummies (Black, Hispanic, Other racial/ethnic), regional dummies, location dummies (urban, rural or inner city), age dummies, education level of the head of the household, family status dummy (single or dual headed) and year dummies. This analysis has the benefit of simultaneously controlling for multiple factors that may influence the consumption of *Food Pyramid Group* foods, such as child's age, receipt of food stamps, etc.

Household characteristics: Since income influences the kinds and amount of foods that can be purchased, a variable representing the annual income of the household expressed as a percentage of the poverty threshold was included. Because a household's assets may affect its ability to withstand unexpected decreases in income, two measures of household wealth were included—homeownership and whether the household had cash assets of more than $5,000. Size of household and whether the household was single-headed may influence the amount of time available for meal planning and preparation. Number of other children 1-9 years of age was included in the model to account for the influence of other children on the eating patterns of the child of interest. Number of years of schooling completed by the household head was included as a proxy for nutritional knowledge.[19]

Empirical Results and Discussion

The results of the analysis are presented in tables 4A to 4D. Regression coefficients were considered to be significantly different from zero at 10 percent level of statistical significance to accommodate the increased fluctuations in daily food intakes of children based on two-day data[20].

Table 4A provides the regression results for Dairy Group and Pyramid Tip. Table 4B presents the results for the Grain and Fruit Groups. Table 4C and 4D respectively provide the regression results for the Meat and Vegetable Groups. Separate regressions were run for each of the major food groups of interest.

WIC Status variables

Compared to both eligible nonparticipants and ineligible nonparticipants, WIC participants consumed significantly more Dairy (total and milk), Fruits (total and other), Wholegrain and significantly smaller

[19] In households reporting both a male and female head of house, the years of schooling of the female head was used to represent the head's education.

[20] Due to day-to-day fluctuations in the dietary intake of individuals, estimates of intake based on only 2 days of data will be distributed less tightly around the mean than estimates based on more days of data. This will increase the width of the confidence intervals around the estimate of the mean, thus making it more difficult to obtain differences between estimates that are statistically significant. In other words, the presence of large intraindividual variation (day-to-day flucuations in sample member's reported intake) makes it more difficult to determine interindividual variation (variation in usual intake among sample members) which is the variation of interest (Fraker, 1990).

amount of added sugar than eligible nonparticipants. The consumption of *Pyramid Group* Fruits (total and other) for the WIC participants was also significantly greater than the consumption by the ineligible nonparticipants. For all the other *Food Pyramid Group* foods, the results on consumption did not show significant statistical differences between children by WIC status. The CSFII survey using the two-day food intake does not capture all the foods consumed by children between 2 and 4 years of age.

Many of the other independent variables included in the regression model were statistically significant. For example, male children consumed significantly more for most of the *Pyramid Group* foods than female children. Relative to four-year olds, two-year olds consumed significantly greater amount of Dairy (total and milk), added sugar, discretionary fat, fruits, grains, meats and vegetables.

Participation in the Food Stamp Program had little effect on the consumption of the various foods included in the analysis—it increased the consumption of meats (meat, poultry and poultry and frankfurters) but decreased fruits and fish consumption. The lack of significant findings may be explained by the fact that food stamps can be used to purchase most foods and beverages while WIC benefits are much more targeted to specific types of foods (Chandran, 2003).[21]

Weekend days were associated with less consumption of Dairy (total and milk), added sugar, fruits (total and others), wholegrain, and greater consumption of meat (MPF, BPVL, and frankfurters), eggs and potatoes. Among the more notable findings: there were numerous differences in consumption of the food groups by race/ethnicity and geographic regions, suggesting strong cultural and regional dietary patterns. For example, blacks consumed significantly less dairy products (total, milk and cheese) while Hispanics consumed significantly less sugar and discretionary fat.

Discussion

An experimental evaluation of the effects of WIC on children would use random selection from a group of eligible children, with only some children receive the benefits. On average, the characteristics (both observable and unobservable) of the two groups of children would not differ other than whether or not they participated in the WIC program (assuming that all children selected to receive WIC benefits did so).

[21] Food stamps can not be used to purchase alcohol, tobacco, hot foods, and foods eaten in the store.

Differences in consumption levels between the two groups could they be attributed solely to the effects of WIC, and not the result of a bias due to self-selection. However, because of the ethical concerns associated with withholding benefits from needy children, a random assignment design is not possible. Although there are statistical techniques that control for selection bias, they require the model to include one or more explanatory variables that explain program participation but do not directly influence food consumption. Because of the lack of such variables in the CSFII, a statistical model that corrects for self-selection bias was not used.

WIC recipients differ in unobservable ways from income-eligible nonparticipants and these unobservable differences influence foods intake. These unobservable differences may bias the regression estimates of WIC's effect on food consumption because the differences can not fully be attributable to program participation. Biases due to self-selection may be upward, that is, in favor of WIC's effects on the consumption of WIC foods. For example, self-selection bias may occur when eligible children do not participate in WIC because their parents are unaware that their child is eligible to receive WIC benefits. These parents may be less knowledgeable about the importance of nutrition for a child's health than are parents of children who actively seek out sources of nutrition assistance. This could happen when the parents of a child who is eligible for WIC chooses not to enroll the child in the program because they perceive that the stigma, cost, and/or time involved in applying for the program, picking up the food vouchers, and attending nutrition education sessions exceed the program's benefits. This may be an indication that these parents, relative to parents who apply for WIC, are not very concerned about their child's nutritional status or motivated to improve the child's nutritional status[22].

This analysis attempts to account for the selection bias by comparing the consumption of *Pyramid Group* foods by WIC participants with three groups of nonparticipants—those eligible to participate based on income, those living in the WIC household and those ineligible to participate. The comparison between the WIC participants and nonparticipants living in the WIC household was included to control the self-selection bias. Results of this comparison showed that WIC participation was associated with increased

[22] Self-selection bias can also be downward, against WIC's effects on nutrient intake. This could happen if the parents of an eligible child choose not to participate because their child has a low nutritional risk and they perceive that there is little to be gained from participating in WIC. That is, WIC participants may be more likely to be at greater nutritional risk than nonparticipants. If this is the case, then comparisons with WIC children would result in a downward bias of WIC.

consumption of *Pyramid Group* Dairy, Grain and Fruit and decreased consumption of added sugar.

Conclusions

Results from a multivariate regression analysis indicate that participation in the WIC program significantly affects the consumption patterns of children, for certain types of *Pyramid* group foods. Compared to both eligible nonparticipants and ineligible nonparticipants, WIC participants consumed significantly more Dairy (total and milk), Fruits (total and other), Wholegrain and significantly smaller amount of added sugar than eligible nonparticipants. The consumption of *Pyramid Group* Fruits (total and other) for the WIC participants was also significantly greater than the consumption by the ineligible nonparticipants. For all the other *Food Pyramid Group* foods, the results on consumption did not show significant statistical differences between children by WIC status. The CSFII survey using the two-day food intake does not capture all the foods consumed by children between 2 and 4 years of age.

Many of the socioeconomic variables included in the regression model were statistically significant. For example, male children consumed significantly more for most of the *Pyramid Group* foods than female children. Relative to four-year olds, two-year olds consumed significantly greater amount of Dairy (total and milk), added sugar, discretionary fat, fruits, grains, meats and vegetables. The results show that participation in the Food Stamp Program had little effect on the consumption of the various foods included in the analysis—it increased the consumption of meats (meat, poultry and poultry and frankfurters) but decreased fruits and fish consumption.

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Table 1 Number of children 1-4 years of age by WIC status

WIC status	Number of Children
WIC participant--children participating in WIC at time of interview	836
Eligible nonparticipant (non-WIC household)--nonparticipating child who is eligible for WIC based on income and resides in a nonWIC household	1,374
Eligible nonparticipant (WIC household)--nonparticipating child who is eligible for WIC based on income and resides in a WIC household	178
Ineligible nonparticipant--nonparticipating child who is ineligible for WIC based on income	2,163
Total children included in the analysis	4,551

Table 2: Socioeconomic and demographic characteristics of the children by WIC Status.

Variables	Estimates of Mean Values*				
	All	WIC Household		Non-WIC Household	
	Children	WIC Child	Non-WIC Child	income eligible	income ineligible
	4,551	836 (18.4%)	178 (3.9%)	1374 (30.2%)	2163 (47.5%)
Child characteristics					
Foodstamp recipient	18.57%	50.53%	42.09%	27.36%	0.00%
Male	50.88%	51.73%	50.93%	51.41%	50.27%
White	60.50%	38.28%	28.12%	48.15%	78.23%
Black	17.33%	27.86%	31.69%	24.29%	8.38%
Hispanic	16.05%	27.23%	35.89%	20.89%	7.65%
Other racial/ethnic	6.11%	6.63%	4.30%	6.67%	5.74%
Age-2 year	33.06%	38.89%	27.11%	30.54%	32.82%
Age-3 year	33.78%	32.26%	32.94%	32.47%	35.16%
Age-4 year	33.16%	28.86%	39.95%	36.99%	32.02%
Household Characteristics					
Size of household	4.47	4.83	5.51	4.64	4.16
Homeowner	54.91%	28.35%	29.35%	35.75%	77.61%
Household has assets of $5,000	32.82%	5.04%	3.97%	10.54%	58.00%
Single-headed household	20.50%	38.43%	39.30%	31.73%	6.08%
Other children	62.87%	63.45%	70.00%	70.30%	58.02%
Percent of poverty	194.67	98.90	104.59	115.09	282.34
Household Income	$40,019	$17,919	$20,270	$20,140	$61,037
Head's schooling years	12.82	11.15	10.97	11.64	14.24
Geographic Characteristics					
Region					
Midwest	23.91%	25.05%	13.37%	24.06%	24.21%
South	32.78%	31.56%	36.65%	33.09%	32.76%
West	23.48%	24.51%	37.94%	25.74%	20.71%
Northeast	19.83%	18.89%	12.03%	17.11%	22.32%
Urbanization					
Central city	32.91%	44.86%	45.38%	36.44%	25.55%
Metropolitan	48.27%	31.92%	40.58%	40.94%	59.06%
Nonmetropolitan	18.82%	23.23%	14.03%	22.62%	15.39%

* Estimates of the mean and standard errors were computed using Statistical Analysis System (SAS) Procedure, SurveyMeans that accounts for Sample Design features and appropriate sampling weights.

Table 3 - *Pyramid Group* Food Intakes of the Children Using CSFII 1994-96 and 98 Survey Data by WIC Status

Variables	Estimates of Mean Values					Estimates of the Standard Errors				
	All Children	WIC Household		Non-WIC Household		All Children	WIC Household		Non-WIC Household	
		WIC Child	Non-WIC Child	income eligible	income ineligible		WIC Child	Non-WIC Child	income eligible	income ineligible
	4,551	836	178	1,374	2,163	4,551	836	178	1,374	2,163
Dairy total servings	1.94	1.91	1.65	1.85	2.03	0.02	0.05	0.09	0.03	0.03
Milk servings	1.56	1.57	1.36	1.50	1.61	0.02	0.05	0.08	0.03	0.03
Yogurt servings	0.04	0.02	0.02	0.02	0.06	0.00	0.00	0.00	0.00	0.00
Cheese servings	0.33	0.31	0.27	0.32	0.36	0.01	0.02	0.02	0.02	0.01
Fruit total servings	1.92	1.93	1.65	1.59	2.13	0.04	0.07	0.12	0.06	0.05
Citrus fruit servings	0.64	0.64	0.60	0.59	0.67	0.02	0.04	0.06	0.03	0.03
Other fruit servicings	1.29	1.29	1.05	1.00	1.46	0.03	0.06	0.10	0.04	0.04
Vegetable total servings	1.63	1.83	1.78	1.71	1.50	0.02	0.06	0.10	0.04	0.03
Dark green veg. Servings	0.07	0.06	0.08	0.06	0.08	0.00	0.01	0.02	0.01	0.01
Deep yellow veg. servings	0.10	0.09	0.08	0.08	0.11	0.00	0.01	0.02	0.01	0.01
White potato servings	0.73	0.87	0.74	0.81	0.63	0.01	0.05	0.07	0.03	0.02
Starchy veg. Servings	0.16	0.18	0.23	0.16	0.14	0.01	0.01	0.04	0.01	0.01
Tomato servings	0.25	0.29	0.30	0.28	0.22	0.01	0.02	0.03	0.01	0.01
Other vegetable servings	0.33	0.35	0.35	0.32	0.32	0.01	0.02	0.04	0.01	0.01
Grains total servings	4.87	4.83	4.76	4.95	4.84	0.04	0.14	0.14	0.10	0.06
Whole grain servings	0.76	0.74	0.59	0.71	0.80	0.02	0.03	0.08	0.03	0.03
Nonwhole grain servings	4.11	4.09	4.17	4.23	4.05	0.04	0.12	0.12	0.08	0.06
Meat, poultry, fish (Oz.)	2.22	2.55	2.75	2.41	1.94	0.03	0.06	0.15	0.05	0.04
Meat (beef, pork, veal, lamb, game) (Oz)	0.82	0.97	0.99	0.95	0.67	0.02	0.04	0.10	0.03	0.02
Organ meats (Oz)	0.01	0.01	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00
Frankfurters/luncheon meats (Oz)	0.61	0.67	0.64	0.68	0.54	0.02	0.04	0.05	0.03	0.03
Poultry (chicken, turkey, etc.) (Oz)	0.65	0.75	0.87	0.64	0.60	0.01	0.04	0.10	0.02	0.02
Fish including seafoods (Oz)	0.13	0.14	0.24	0.13	0.13	0.01	0.02	0.05	0.01	0.01
Meat equivalent from eggs (Oz)	0.28	0.35	0.38	0.33	0.22	0.01	0.02	0.04	0.02	0.01
Meat equivalent from soy product (Oz)	0.02	0.00	0.06	0.01	0.02	0.00	0.00	0.06	0.00	0.01
Meat equivalent from nuts (Oz)	0.14	0.12	0.12	0.14	0.15	0.01	0.01	0.02	0.01	0.01
Discretionary fat (gms)	42.64	43.91	43.47	44.74	40.91	0.38	0.97	1.61	0.70	0.39
Added sugar (tea spoons)	14.41	12.85	15.29	15.14	14.49	0.22	0.31	0.88	0.34	0.28

* computed by summing all the meat categories and using the conversion factor of 1serving equal to 2.5 Oz of lean meat

Note: 1 Estimates of the Mean and standard errors were computed using the Statistical Analysis System (SAS) Procedure, SurveyMeans that accounts for Sample Design features and appropriate sampling weights.

Table 4A Pyramid Food Groups : Regression Results for Dairy Foods and Pyramid Tip Foods

Variables	Dairy Group						Pyramid Tip			
	Total dairy		Milk		Cheese		Discrete Fat		Added Sugar	
	Censored= 30		Censored= 80		Censored= 729		Censored= 4		Censored= 0	
	Est.	t-value	Est.	t-value	Est.	t-value	Est.	t-value	Est.	t-value
Eligible nonparticipant	-0.081	-1.35	-0.08	-1.41	0.00	0.15	1.16	1.03	1.87	4.55
Nonparticipant in WIC household	-0.242	-2.28	-0.22	-2.10	-0.06	-1.31	-0.78	-0.47	2.31	2.33
Nonparticipant and ineligible	-0.085	-0.92	-0.08	-0.94	-0.03	-0.81	-0.85	-0.50	0.73	1.14
Percent of Poverty	0.000	-0.02	0.00	-0.19	0.00	0.78	0.00	-0.11	0.01	1.65
Male	0.067	1.75	0.07	1.93	-0.01	-0.36	2.74	4.99	0.70	2.29
Age-2 year	-0.070	-1.43	-0.01	-0.29	-0.08	-4.27	-6.09	-7.29	-3.69	-9.10
Age-3 year	-0.067	-1.87	-0.02	-0.48	-0.06	-3.16	-3.24	-4.71	-1.20	-3.73
Black	-0.455	-8.31	-0.35	-6.20	-0.10	-4.75	0.24	0.22	-0.39	-0.60
Hisponic	0.011	0.12	0.09	1.06	-0.09	-3.08	-1.17	-1.02	-0.62	-1.33
Other racial/ethinic	-0.213	-2.47	-0.05	-0.63	-0.24	-5.39	-4.00	-2.76	-2.91	-4.37
Foodstamp recipient	-0.038	-0.61	-0.08	-1.21	0.06	2.44	1.42	1.29	-0.43	-0.81
Household Size	0.009	0.69	0.02	1.60	-0.01	-2.60	0.19	0.65	-0.10	-0.87
Single headed household	0.043	0.63	0.06	0.79	0.00	-0.02	0.02	0.01	0.07	0.14
Homeowner	0.032	0.62	0.03	0.60	0.01	0.55	-0.24	-0.32	0.32	0.87
Asets of $5000 or greater	0.083	1.90	0.05	1.43	0.03	1.52	-0.97	-1.18	-1.06	-2.87
Schooling years	0.011	1.58	0.00	0.35	0.01	2.81	-0.32	-3.07	-0.09	-1.19
Other children	-0.111	-2.29	-0.13	-2.92	0.01	0.52	-0.82	-1.26	0.90	2.82
Midwest	-0.006	-0.10	0.04	0.83	-0.02	-0.49	-0.10	-0.09	1.45	2.30
South	-0.148	-2.96	-0.08	-2.02	-0.04	-1.09	-1.29	-1.15	0.61	0.88
West	-0.007	-0.14	-0.02	-0.41	0.01	0.36	-3.16	-2.41	-0.89	-1.18
Central city	-0.059	-1.23	-0.03	-0.78	-0.03	-1.49	-0.59	-0.85	0.28	0.98
Nonmetropolitan	0.004	0.05	-0.02	-0.24	0.04	1.41	1.99	2.03	0.73	1.25
year94	-0.195	-3.47	-0.13	-2.55	-0.06	-2.07	-2.23	-2.03	-1.01	-2.11
year95	-0.175	-2.45	-0.11	-1.51	-0.06	-2.97	-2.39	-2.54	-0.02	-0.05
year96	-0.096	-1.55	-0.07	-1.14	-0.02	-0.77	-2.87	-3.54	-1.10	-2.76
Weekend	-0.127	-4.14	-0.10	-3.24	-0.02	-1.39	0.21	0.35	0.59	1.84
Summer	0.055	1.20	0.06	1.24	0.00	-0.13	1.32	1.58	0.27	0.74
Fall	0.151	2.69	0.16	3.29	-0.02	-0.71	-0.51	-0.61	-0.89	-2.11
Winter	-0.064	-1.16	-0.04	-0.83	-0.03	-1.79	-1.18	-1.42	-0.83	-1.80
Constant	2.132	14.75	1.69	11.09	0.36	5.07	51.08	19.41	14.86	10.51

Note 1: Cells marked with torquoise color (lighter gray) represent the parameter values that are statistically significant at 5% or lower.

'Note 2 : Cells marked with yellow tan color (darker gray) represent the parameter values that are statistically significant between 5% and 10%

Table 4B Pyramid Food Groups : Regression Results for Fruit Group and Grain Group Foods

Variables	Fruit Group						Grain Group					
	Total		Citrus		Other		Total grain		Whole		Nonwhole	
	Censored= 169		Censored= 908		Censored= 447		Censored= 2		Censored= 602		Censored= 2	
	Est.	t-value	Est.	t-value	Est.	t-value	Est.	t-value	Est.	t-value	Est.	t-value
Eligible nonparticipant	-0.398	-4.06	-0.06	-0.98	-0.39	-4.76	0.02	0.12	-0.10	-1.94	0.10	0.66
Nonparticipant in WIC household	-0.300	-2.07	-0.05	-0.48	-0.24	-1.95	-0.18	-1.10	-0.18	-1.86	-0.03	-0.19
Nonparticipant and ineligible	-0.229	-1.58	0.04	0.37	-0.33	-3.17	-0.23	-1.13	-0.25	-3.19	-0.02	-0.10
Percent of Poverty	0.000	0.65	0.00	0.22	0.00	1.12	0.00	1.06	0.00	2.64	0.00	0.26
Male	0.232	5.37	0.03	1.08	0.21	5.48	0.38	5.02	0.11	3.47	0.28	4.23
Age-2 year	0.185	2.62	-0.06	-1.06	0.23	5.41	-1.05	-13.06	-0.11	-2.75	-0.94	-12.31
Age-3 year	0.027	0.45	-0.07	-1.92	0.09	1.74	-0.55	-8.28	-0.04	-1.15	-0.51	-8.44
Black	-0.019	-0.15	0.08	0.90	-0.08	-0.75	-0.06	-0.56	-0.06	-0.85	-0.04	-0.29
Hisponic	0.367	3.26	0.37	5.87	0.02	0.19	-0.28	-2.17	-0.31	-5.83	-0.03	-0.22
Other racial/ethinic	-0.013	-0.09	0.24	2.05	-0.28	-3.02	-0.33	-2.26	-0.36	-6.84	-0.05	-0.33
Foodstamp recipient	-0.158	-1.40	0.05	0.75	-0.22	-2.23	-0.03	-0.19	-0.01	-0.15	0.00	0.01
Household Size	-0.054	-2.45	-0.03	-1.89	-0.04	-2.25	0.05	1.32	0.00	-0.07	0.05	1.57
Single headed household	-0.016	-0.17	-0.08	-1.47	0.06	0.71	0.15	1.49	-0.05	-0.73	0.21	2.17
Homeowner	0.034	0.46	-0.03	-0.50	0.06	0.88	-0.09	-0.90	-0.03	-0.72	-0.07	-0.89
Asets of $5000 or greater	0.152	1.70	0.03	0.47	0.12	1.59	0.03	0.29	0.05	1.18	-0.02	-0.21
Schooling years	0.062	6.24	0.02	3.20	0.05	5.35	0.02	2.01	0.02	1.77	0.01	0.83
Other children	0.010	0.16	0.06	1.17	0.00	-0.05	0.19	2.38	0.05	1.58	0.13	1.66
Midwest	-0.200	-1.61	-0.06	-0.86	-0.16	-1.70	-0.19	-1.35	0.02	0.41	-0.22	-1.60
South	-0.304	-2.71	-0.11	-2.02	-0.25	-2.64	-0.31	-2.33	-0.06	-1.08	-0.26	-2.04
West	-0.108	-1.08	-0.06	-0.91	-0.07	-0.85	-0.34	-2.33	0.11	2.01	-0.43	-3.06
Central city	-0.044	-0.54	0.00	-0.01	-0.02	-0.40	0.08	0.69	0.10	2.05	-0.01	-0.09
Nonmetropolitan	-0.279	-2.60	-0.03	-0.59	-0.30	-3.54	0.04	0.27	-0.02	-0.41	0.05	0.39
year94	-0.196	-1.66	-0.17	-2.50	-0.09	-0.85	-0.25	-2.58	-0.04	-1.02	-0.20	-2.22
year95	-0.261	-3.14	-0.10	-1.85	-0.18	-2.56	-0.27	-2.54	-0.04	-0.88	-0.22	-2.15
year96	-0.253	-2.76	-0.12	-1.68	-0.20	-2.35	-0.12	-1.01	-0.08	-1.42	-0.06	-0.62
Weekend	-0.168	-3.02	-0.01	-0.23	-0.18	-3.77	0.02	0.24	-0.08	-2.57	0.08	1.16
Summer	0.066	0.64	0.04	0.66	0.03	0.39	-0.04	-0.39	-0.05	-0.99	0.01	0.14
Fall	-0.153	-1.66	-0.21	-3.61	0.05	0.65	-0.05	-0.45	-0.08	-1.36	0.02	0.24
Winter	-0.080	-0.91	-0.08	-1.55	0.01	0.15	-0.07	-0.61	-0.02	-0.46	-0.04	-0.37
Constant	1.686	7.24	0.45	2.36	0.99	5.12	4.95	15.60	0.57	3.70	4.21	13.36

Note 1: Cells marked with torquoise color (darker gray) represent the parameter values that are statistically significant at 5% or lower.

'Note 2 : Cells marked with yellow color (lighter gray) represent the parameter values that are statistically significant between 5% and 10%

Table 4C Pyramid Food Groups : Regression Results for Meat Group Foods

Variables	Meat Group											
	MPF		BPVLG		Frankfurters		Poultry		Eggs		Nuts	
	Censored= 86		Censored= 941		Censored= 1674		Censored= 1831		Censored=1831		Censored= 2343	
	Est.	t-value	Est.	t-value	Est.	t-value	Est.	t-value	Est.	t-value	Est.	t-value
Eligible nonparticipant	-0.083	-1.13	-0.01	-0.17	0.07	1.07	-0.13	-1.77	0.02	0.51	0.01	0.55
Nonparticipant in WIC household	0.138	0.76	0.04	0.26	-0.05	-0.54	0.13	0.88	0.02	0.36	0.00	0.04
Nonparticipant and ineligible	-0.065	-0.50	-0.05	-0.61	0.02	0.20	-0.05	-0.41	0.01	0.18	-0.07	-1.43
Percent of Poverty	-0.001	-1.69	0.00	-1.63	0.00	-0.16	0.00	-0.17	0.00	-1.69	0.00	2.18
Male	0.159	3.03	0.02	0.33	0.09	2.12	0.08	2.21	0.04	1.78	0.03	1.73
Age-2 year	-0.468	-8.37	-0.24	-5.46	-0.17	-2.86	-0.09	-1.53	0.09	3.02	-0.08	-3.45
Age-3 year	-0.270	-5.16	-0.11	-2.84	-0.05	-1.01	-0.13	-2.57	-0.01	-0.38	-0.01	-0.75
Black	0.605	7.26	0.04	0.63	0.22	3.65	0.53	7.39	0.13	4.15	-0.11	-3.38
Hisponic	0.149	1.96	-0.01	-0.09	-0.12	-1.90	0.33	4.12	0.21	5.65	-0.25	-8.70
Other racial/ethinic	0.149	1.30	0.01	0.12	-0.25	-2.14	0.28	3.04	0.12	2.68	-0.17	-4.49
Foodstamp recipient	0.084	1.23	0.03	0.42	0.24	3.07	-0.02	-0.17	0.03	0.97	0.00	-0.08
Household Size	0.022	1.05	0.02	1.24	0.01	0.58	0.00	0.00	0.01	1.37	0.00	-0.07
Single headed household	0.024	0.31	0.09	1.19	-0.02	-0.35	-0.01	-0.08	-0.10	-2.48	0.03	1.03
Homeowner	-0.035	-0.43	-0.10	-1.59	0.09	1.49	0.03	0.41	0.01	0.37	-0.02	-0.92
Asets of $5000 or greater	-0.099	-1.56	-0.12	-2.04	-0.03	-0.53	0.06	0.92	-0.05	-1.36	0.00	0.15
Schooling years	-0.023	-2.15	-0.01	-1.59	-0.01	-1.80	-0.01	-1.33	-0.02	-4.27	0.01	1.75
Other children	-0.059	-0.97	-0.04	-0.97	0.00	0.04	0.00	-0.10	0.00	-0.16	0.03	1.49
Midwest	0.091	1.36	0.30	4.86	0.22	2.27	-0.29	-5.27	-0.03	-0.64	-0.01	-0.24
South	-0.033	-0.53	0.19	3.20	0.06	0.74	-0.13	-2.21	0.03	0.55	-0.03	-0.87
West	-0.216	-2.66	0.18	2.97	-0.07	-0.81	-0.34	-5.23	0.00	0.10	0.00	0.04
Central city	-0.010	-0.15	-0.09	-1.93	0.07	1.22	-0.02	-0.32	-0.01	-0.46	0.00	-0.07
Nonmetropolitan	0.192	2.58	0.27	5.20	0.15	3.31	-0.19	-3.56	0.01	0.32	-0.01	-0.23
year94	0.041	0.65	0.08	1.42	-0.02	-0.32	0.01	0.14	-0.07	-1.92	-0.03	-1.10
year95	-0.008	-0.11	-0.02	-0.26	0.08	1.21	-0.06	-0.94	-0.06	-1.52	0.06	1.83
year96	-0.096	-1.16	-0.07	-1.20	-0.01	-0.16	-0.07	-0.90	-0.06	-1.52	-0.01	-0.22
Weekend	0.070	1.83	0.07	2.02	0.05	1.35	0.01	0.28	0.06	3.06	0.01	0.51
Summer	0.028	0.51	0.01	0.37	0.07	0.91	-0.03	-0.46	0.01	0.46	0.01	0.53
Fall	-0.150	-2.43	0.01	0.15	-0.17	-2.22	0.02	0.31	0.00	0.05	0.00	-0.06
Winter	-0.120	-1.72	0.00	0.01	-0.15	-2.29	0.00	0.06	-0.01	-0.18	0.03	1.27
Constant	2.797	16.04	0.88	5.27	0.27	1.21	0.59	2.67	0.23	2.14	-0.16	-2.43

Note 1: Cells marked with torquoise color (lighter gray) represent the parameter values that are statistically significant at 5% or lower.

'Note 2 : Cells marked with yellow tan color (darker gray) represent the parameter values that are statistically significant between 5% and 10%

Table 4D Pyramid Food Groups : Regression Results for Vegetable Group Foods

Variables	Vegetable Group									
	Total		Dark Green		White Potato		Starchy		Tomato	
	Censored= 0		Censored= 3515		Censored=1233		Censored= 2673		Censored= 736	
	Est.	t-value	Est.	t-value	Est.	t-value	Est.	t-value	Est.	t-value
Eligible nonparticipant	-0.113	-1.42	-0.02	-0.36	-0.04	-0.46	-0.03	-0.85	-0.01	-0.47
Nonparticipant in WIC household	-0.007	-0.06	-0.03	-0.33	-0.09	-0.78	0.11	1.26	0.01	0.15
Nonparticipant and ineligible	-0.145	-1.67	0.02	0.32	-0.08	-0.86	-0.06	-0.80	-0.05	-1.41
Percent of Poverty	-0.001	-1.03	0.00	0.05	0.00	-0.39	0.00	-0.86	0.00	-0.44
Male	0.051	1.32	-0.04	-1.26	0.06	1.67	0.02	0.77	0.02	1.41
Age-2 year	-0.190	-3.41	0.03	0.83	-0.09	-1.86	-0.02	-0.51	-0.04	-2.70
Age-3 year	-0.145	-3.39	-0.04	-1.16	-0.05	-1.38	-0.03	-1.00	-0.02	-2.12
Black	0.210	3.85	0.25	5.70	0.18	2.93	0.02	0.46	0.02	0.77
Hisponic	-0.020	-0.27	-0.03	-0.68	-0.05	-0.62	-0.08	-1.95	0.07	4.05
Other racial/ethinic	0.055	0.54	0.24	3.08	-0.02	-0.27	-0.02	-0.43	-0.05	-1.91
Foodstamp recipient	0.020	0.26	-0.07	-1.17	0.07	0.95	0.01	0.26	-0.01	-0.36
Household Size	-0.034	-1.52	0.03	2.09	-0.04	-2.08	-0.01	-1.23	-0.01	-2.71
Single headed household	-0.010	-0.13	0.11	1.91	0.01	0.14	0.00	-0.02	-0.04	-2.35
Homeowner	0.010	0.20	0.08	2.37	0.02	0.37	0.02	0.45	-0.01	-0.98
Asets of $5000 or greater	-0.062	-0.95	0.04	1.08	-0.14	-2.56	-0.01	-0.29	0.01	0.37
Schooling years	-0.016	-1.84	0.01	2.08	-0.02	-2.71	0.01	1.76	-0.01	-3.04
Other children	0.037	0.64	-0.04	-1.10	0.05	0.93	-0.02	-0.75	0.03	2.13
Midwest	0.173	1.72	-0.04	-0.77	0.18	2.86	0.02	0.55	0.02	0.74
South	0.079	0.91	0.03	0.82	0.13	2.29	0.00	-0.04	-0.01	-0.58
West	-0.086	-1.01	0.00	-0.07	-0.02	-0.26	-0.06	-1.47	-0.02	-0.63
Central city	-0.045	-0.84	-0.01	-0.31	-0.06	-1.26	0.00	-0.10	0.02	1.45
Nonmetropolitan	0.014	0.18	-0.06	-1.81	0.04	0.62	0.02	0.27	0.03	1.21
year94	-0.165	-2.56	-0.08	-2.03	-0.16	-2.46	-0.03	-0.62	0.00	0.17
year95	-0.135	-2.69	0.01	0.14	-0.07	-1.39	-0.04	-0.79	-0.02	-1.17
year96	-0.165	-2.17	-0.07	-1.25	-0.12	-1.80	-0.08	-2.34	0.01	0.66
Weekend	0.026	0.56	0.01	0.56	0.05	1.11	-0.03	-2.15	0.00	0.13
Summer	-0.061	-1.04	-0.04	-1.00	-0.07	-1.21	-0.04	-1.44	0.03	1.59
Fall	-0.153	-2.93	-0.01	-0.29	-0.13	-2.22	-0.03	-0.75	0.02	1.10
Winter	0.011	0.20	0.01	0.31	-0.01	-0.25	-0.03	-0.73	0.05	2.64
Constant	2.296	13.75	-0.83	-6.31	1.11	7.81	-0.01	-0.09	0.39	7.03

Note 1: Cells marked with torquoise color (lighter gray) represent the parameter values that are statistically significant at 5% or lower.

'Note 2 : Cells marked with yellow tan color (darker gray) represent the parameter values that are statistically significant between 5% and 10%