

Topic Contributed Paper Session: The Supplemental Poverty Measure: New Research Findings  
Section on Government Statistics

Organizer and Chair: Kathleen S. Short, U.S. Census Bureau

Discussant: Constance Citro, Committee on National Statistics

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**Supplemental Poverty Measure Thresholds:  
Imputing Noncash Benefits to the Consumer Expenditure Survey Using  
Current Population Survey-Parts I and II**

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## Abstract

In March 2010 an Interagency Technical Working Group (ITWG) released guidelines on thresholds and resources for a Supplemental Poverty Measure (SPM). The ITWG recommended that thresholds include in-kind benefits that are accounted for in resources; however, only limited in-kind benefit information is available in the Consumer Expenditure Survey (CE), the data source upon which the thresholds are based. For example, the CE collects information on rental housing that is subsidized and market rents so that rent subsidies can be imputed. Also, the CE collects information on food expenditures that implicitly include the cash value of benefits from the Supplemental Nutrition Assistance Program (SNAP) but no information on other food programs. In earlier work, Garner (2010a,c,d) imputed in-kind rates and benefits for the National School Lunch Program (NSLP) and Women, Infants, and Children Program (WIC) using eligibility guidelines (CE Eligibility Method) and consumer unit characteristics data from the CE. To better reflect reported rates of participation, data from the Current Population Survey (CPS), the basis of the SPM resource measure, are used to model imputations to the CE for participation in NSLP and WIC (CPS Program Participation Method) in this study. Data for five years, referring to 2005 to 2009, are used for the imputations. CPS-based imputed participation rates for NSLP and WIC are used along with U.S. Department of Agriculture information to assign benefit levels to the CE. Thresholds based on the CPS Program Participation Method are produced for 2009 and compared to thresholds based on the CE Eligibility Method. Preliminary results reveal that the two sets of thresholds -- based on the CPS Program Participation method and the CE Eligibility method and defined for owners with mortgages, owners without mortgages and renters -- are not statistically significantly different from each other. In contrast, when housing tenure thresholds are compared to each other within each method group, statistically significant differences arise. No poverty rates using these thresholds are produced.

## I. Introduction

In March 2010 an Interagency Technical Working Group (ITWG) published guidelines for the development and production of thresholds and resources for a Supplemental Poverty Measure (SPM). Consistent with the findings of the National Academy of Sciences (NAS) panel (Citro and Michael 1995), these guidelines recommended that thresholds be based on U.S. Consumer Expenditure Survey (CE) data and that resource calculations be based on data from the Current Population Survey Annual Social and Economic Supplement (CPS ASEC). Although the thresholds are based on a set of commodities that families must purchase: food, clothing, shelter, and utilities (FCSU), the ITWG further recommended that efforts should be made to also include the value of in-kind benefits in the thresholds in order to ensure the consistency of the threshold and resource definitions. Specifically, the ITWG stated “so far as possible with available data, the calculation of FCSU should include any in-kind benefits that are counted on the resource side for food, shelter, clothing and utilities. This is necessary for consistency of the threshold and resource definitions.” Johnson presented an overview of the ITWG guidelines in a recent *FOCUS* article (2010). The ITWG guidelines are similar to those presented in the *Measuring of American Poverty Act of 2009*.

In several recent studies, researchers have added the value of in-kind benefits in Supplemental Poverty Measurement (SPM) defined resources and thresholds. Included in resources are benefits that include Supplemental Nutrition and Assistance Program (SNAP), National School Lunch Program (NSLP), Women, Infants, and Children Program (WIC), rent subsidies, and energy assistance (Short 2011a, b; Short and Renwick 2010). However, including such benefits in thresholds poses a particular challenge since only limited in-kind benefit information is available in the CE. For example, the CE collects information on rental housing that is subsidized and market rents so that rent subsidies can be imputed. Also, the CE collects information on food expenditures that implicitly include the cash value of benefits from the SNAP (previously known as food stamps). However, no information is collected regarding participation in the NSLP and WIC. To estimate NSLP and WIC subsidies, Garner (2010a, c, d; 2011) used program eligibility guidelines and consumer unit characteristics; she assumed that all consumer units eligible for benefits under these two programs participated in the programs (CE Eligibility Method).<sup>1</sup> Yet, eligibility rates do not equal participation rates, since not all eligible individuals or households participate in these programs. For an example of this, see Jackowitz and Tiehen (2010) who report that 79.1 percent of eligible households participated in WIC during the postnatal period.

A different method to impute the value of NSLP and WIC program benefits (CPS Program Participation Method) was first introduced by Hokayem in June of this year at the annual Conference of the Western Economics Association (Garner and Hokayem 2011). Data from the CPS ASEC for 2006-2010 were used to estimate a multinomial probit model for NSLP

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<sup>1</sup> In each of the Garner studies cited on SPM thresholds, rental subsidies were estimated and counted in shelter expenditures for renters when renters noted that they lived in subsidized rental units. See <http://www.census.gov/hhes/povmeas/methodology/supplemental/index.html> and <http://www.bls.gov/pir/spmhome.htm> for ongoing SPM research.

participation and a binomial probit for WIC participation.<sup>2</sup> In the current study, to estimate participation rates in the NSLP and WIC in the CE, CPS-based probit coefficients are applied to the CE Interview<sup>3</sup> sample. The U.S. Department of Agriculture is the source of the NSLP and WIC benefit levels assigned to consumer units in the CE. CPS data that refer to 2005 through 2009 are used for participation rate modeling. Rates are imputed for consumer units participating in the CE any time between 2005 quarter two through 2010 quarter one. Imputations are produced using pooled data over these years, with year serving as a control variable in the models.

The remainder of this paper is divided into several sections. The next three draw heavily on the Western Economics Association conference paper (Garner and Hokayem 2011), while the remainder represent new research. Section II reviews the literature on NSLP and WIC participation to identify factors associated with program participation and to develop the explanatory variables used in the imputation models. Section III describes the two methods, the CE Eligibility Method and the CPS Program Participation Method, used to impute participation rates in the NSLP and WIC. Section IV describes the CPS ASEC estimation sample and presents probit model estimation results. Section V describes how the model is applied to the CE sample to impute program participation and assign program benefits. Average predicted probabilities from applying the CPS method to the CPS and to the CE are presented. Section VI focuses on the production of SPM thresholds for 2009 with imputed benefits. Section VII includes thresholds based on each of the two program participation and benefits imputation methods. For both sets of thresholds, as in the Garner (2010a,c,d; 2011), food stamps are implicitly included in food expenditures and rental subsidies are imputed. The paper closes with a discussion of research issues and future research on SPM thresholds at the BLS. Poverty statistics, based on the SPM, are not presented in this paper.

Our preliminary conclusions from this study are three:

1. The CPS Program Participation Method is a viable option for imputing NSLP and WIC benefits to the CE. Kernel density plots and predicted probabilities of the CPS and CE program participation rates suggest that the CPS Method translates to comparable rates in the CE.
2. The two sets of SPM thresholds for 2009 -- based on the CPS Program Participation Method and the CE Eligibility Method as defined for owners with mortgages, owners

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<sup>2</sup> See Garner and Hokayem (2011) for a presentation of reported and predicted participation rates using the CPS data and models.

<sup>3</sup> The CE is composed of two parts: the Interview and the Diary. The Interview is used to collect information over a longer period of time than is the Diary. Also, detailed clothing, shelter and utilities expenditures data are available in the Interview. Food expenditures are most extensive in the Diary; however, since it is necessary to produce the SPM thresholds using consumer unit specific data, global food expenditures collected in the Interview were used. In the future, the Division of Consumer Expenditure Surveys will be conducting research on how to combine data from the Diary and Interview to produce a better estimate of food expenditures. See <http://www.bls.gov/cex/> for a detailed description of the CE Diary and Interview survey instruments.

without mortgages, and renters -- are not statistically significantly different from each other.

3. A major finding is that thresholds for owners with mortgages are statistically different from thresholds for renters for both methods at the 0.05 level. Differences for all other pairs of housing status are statistically different at the 0.001 level.

## **II. Literature Review**

### **a. Factors Associated with National Lunch Program (NSLP) Participation**

Prior research identifies several factors associated with participation in the NSLP, including socioeconomic characteristics, participation in other food assistance programs, program features, alternative food choices, region and degree of urbanization. Most studies rely on either student or parent reports of participation or on administrative data. The definition of participation also varies. Some studies define participation by eating a lunch at school while other studies define participation by whether a child qualifies for a free or reduced price. Dunifon and Kowaleski-Jones (2003) define participation by whether a child receives a free or reduced price meal. Using data from the 1997 Panel Study of Income Dynamics, Dunifon and Kowaleski-Jones (2003) find that black children or those having more siblings in the household were more likely to participate in the NSLP than white children or those with fewer siblings, respectively. In contrast, family income and paternal education were negatively associated with participation. Dunifon and Kowaleski-Jones also found a positive association between the percentage of time the child received food stamps and NSLP participation. Using data from the 2001 Survey of Income and Program Participation (SIPP) and the 1999-2002 National Health and Nutrition Examination Survey (NHANES), Newman and Ralston (2006) report NSLP participation is highest for children ages 8 to 13 for free, reduced price, and paid meals. Nearly two-thirds of participants for free meals come from female-headed households.

Similarly, Gordon et al. (2007), who examine eating lunch at school as well as receiving a free or reduced price meal, also find differential effects by race, income and the age composition of the children in the family, as well as by gender. Specifically, Hispanic and black children participate in the NSLP at higher rates than non-Hispanic white children and children of other races. Low income children are more likely to participate in the program than their more affluent counterparts. NSLP participation is also higher among boys than girls.

A few studies address the effects of maternal labor supply on NSLP participation, defined as eating a school lunch, with mixed results. Akin et al (1983) find mother's work hours increase NSLP participation, but only for older children in the age group 12-18 years. Although Gleason (1995) suggests children of mothers who work are less likely to participate in the NSLP, this effect is statistically insignificant. Using data from the Early Childhood Longitudinal Study – Kindergarten Class (ECLS-K) and employing an instrumental variable approach to address the endogeneity of the maternal labor supply decision, Datar and Nicosia (2009) conclude that maternal employment significantly increased participation with larger effects for mothers working full-time than for those working part-time.

Program features also influence program participation, although the results of these studies are mixed. For example, Akin et al (1983), Maurer (1984), and Gleason (1995) find negative price effects on participation rates while Barnes' (1988) analysis of all meal price types finds students are fairly nonresponsive to the price of meals. In their analysis of data from the NSLP Access, Participation, Eligibility and Certification Study, Moore et al. (2009) report that school type (i.e., elementary, middle, and high school) is the factor most strongly associated with participation among students certified for free and reduced price meals. Moore et al. (2009) analyze participation by number of school lunches served and by free or reduced price category.

#### **b. Factors Associated with Women, Infants, and Children (WIC) Participation**

Prior research reveals that factors influencing participation in the USDA's Special Supplemental Nutritional Program for Women, Infants and Children (WIC) are similar to those associated with NSLP participation. For example, socioeconomic characteristics, participation in other public assistance programs, and program features are also associated with WIC participation.

Using data from the 1996 SIPP panel and the 1998-2001 CPS ASEC, Bitler, Currie and Scholz (2003) examine the determinants of postnatal WIC participation. Overall, their findings suggest that individual characteristics play a larger role in participation than state-level factors. For example, black and Hispanic mothers are more likely to participate than their non-Hispanic white counterparts; however, Asian mothers are less likely to participate. Having low-income and being married are positively associated with postnatal WIC participation, whereas having attended college and suburban residences are negatively associated with postnatal WIC participation. Other studies find similar factors are associated with prenatal WIC participation (Tiehen and Jacknowitz 2008; Swann 2007). Again, non-Hispanic black and Hispanic mothers are more likely to access WIC prenatally than their non-Hispanic white counterparts (Swann 2007). Prenatal WIC participation is negatively associated with education attainment and age (Tiehen and Jacknowitz 2008; Swann 2007). Swann (2007) also finds that not having health insurance and being a single mother increases the likelihood of prenatal WIC participation. In addition, state policies also affect prenatal WIC participation. Studies including WIC program characteristics find prenatal participation is lower in states requiring income documentation to establish eligibility and is higher in states that allow TANF receipt or Medicaid eligibility to confer automatic WIC eligibility (Oliveira and Frazao 2009; Swann 2010).

A few studies examine the timing and dynamics of WIC participation. For example, Swann (2007) uses the 1988 National Maternal and Infant Health Survey (NMHS) and finds a strong association between previous WIC participation and prenatal WIC participation. Using data from the Early Childhood Longitudinal Study, Birth Cohort (ECLS-B), Jacknowitz and Tiehen (2009) examine transitions into and out of the WIC program from pregnancy until the child is age one. They conclude that prenatal WIC coverage is strongly correlated with postnatal receipt of WIC and that economic advantage plays an important role in determining exit from WIC. In a similar study, Jacknowitz and Tiehen (2010) find that mothers with a college degree and employed mothers tend to delay WIC participation. Using data from the 2001 SIPP panel, Castner et al. (2009) find that mothers in households participating in other public assistance programs, in combination with declining earnings, have an increased likelihood of entering WIC.

Bitler and Currie (2004) also use SIPP data to demonstrate that state Medicaid policies that influence infant take-up rates had long-term effects on WIC participation.

### **III. Methods to Impute NSLP and WIC Participation to CE Data**

This section describes two methods currently developed to impute NSLP and WIC participation rates to consumer units in the CE:

1. The CPS Program Participation Method (first introduced in Garner and Hokayem 2011).
2. The CE Eligibility Method first introduced by Garner (2010c, and most recently in Garner 2011).

The key difference in the two methods rests on the assumption of participation rates among eligible households. The first method estimates the probability of program take-up and assigns benefits based on this probability (CPS Program Participation Method). In contrast, the second method assumes full take-up of program benefits by all consumer units who are eligible based on program guidelines and consumer unit characteristics. See Garner (2011) for a description of the CE Eligibility Method, i.e., how the program eligibility guidelines are applied. The CPS Program Participation Method estimates a model predicting program participation using data from the CPS ASEC. Results from this model are used to impute participation rates for consumer units in the CE before assigning program benefits. The CPS model specifications draw on the findings from the previous literature on NSLP and WIC participation, mainly that program participation is a function of demographic characteristics, socioeconomic characteristics, and participation in other public assistance programs. A multinomial probit model is used to estimate NSLP participation, and a probit model is used to predict WIC participation.

The motivation for a multinomial probit model for the NSLP comes from the method of adding this benefit to measures of resources. All children who eat a lunch at school participate in the NSLP, and all lunches in the NSLP are subsidized. Children qualifying for a free or reduced price school lunch receive a large subsidy, while those buying a school lunch that is not free or reduced price receive a small subsidy. An estimated cash value is added to resources for children reported as receiving a free or reduced price meal and for children reported as receiving a subsidized meal. In the CPS, the reference person identifies the number of children who “usually” ate a hot lunch.<sup>4</sup> In a separate question, the reference person identifies the number of children who received a free or reduced price lunch.<sup>5</sup> The CPS instrument does not distinguish between children receiving a free lunch and children receiving a reduced price

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<sup>4</sup> The CPS question asks, “During 20XX, how many of the children in this household usually ate a complete hot lunch offered at school?”

<sup>5</sup> The CPS question asks, “During 20XX, how many of the children in this household received free or reduced price lunches because they qualified for the federal school lunch program?”

lunch. The answers to these questions are used to identify the three mutually exclusive alternatives for the multinomial probit model:

1. At least one child in the household eats a subsidized school lunch **and** the child ate that lunch because he/she qualified for a free or reduced price (referred to “Subsidized Lunch with a Free or Reduced Price”).
2. At least one child in the household eats a subsidized school lunch but no child or children in the household qualified for a free or reduced price (referred to “Subsidized Lunch”).
3. No child in the household eats a subsidized school lunch or qualified for a free or reduced price (referred to “No Subsidized Lunch”). This means that the child does not eat a school-provided meal of any type.

The multinomial probit model is specified in the following way:

$$y_{ij} = \mathbf{x}'_i \boldsymbol{\beta} + \tau + \alpha_s + \varepsilon_{ij} \quad (1)$$

where  $i$  indexes household  $i$ , and  $s$  indexes the state in the U.S. in which the household lives.  $y_{ij}$  represents household  $i$  's choice of alternative  $j$  from the set of three alternatives outlined above. The three random error terms,  $\varepsilon_{ij}$ , are independently and identically distributed with a joint normal distribution. The model produces coefficient estimates for each alternative and does not depend on the independence of irrelevant alternatives (IIA) assumption (Cameron and Trivedi 2005).

The motivation for the WIC binomial probit model for WIC participation also comes from the method of adding WIC benefits to measures of resources. This method adds the value of WIC benefits based on program information from the U.S. Department of Agriculture. It relies on a CPS question asking about anyone in the household who was on WIC.<sup>6</sup> This question is used to determine the outcome of the probit model.

The binomial probit model is specified in the following way:

$$y_i = \mathbf{x}'_i \boldsymbol{\beta} + \tau + \alpha_s + \varepsilon_i \quad (2)$$

where  $y_i$  is a dichotomous variable equal to 1 for WIC program participation and zero otherwise. The random error,  $\varepsilon_i$ , follows a normal distribution. The other variables are the same as those for the multinomial probit model with the exception of  $\mathbf{x}'_i$ .

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<sup>6</sup> The CPS question asks, “At any time last year, (were you/was anyone in this household) on WIC, The Women, Infants, and Children Nutrition Program?”



$x'_i$  differs for NSLP and model WIC specifications only in the age composition of children variables. Since the NSLP program is focused on school-age children, the NSLP specification only includes a count of the number of children in the household for the age groups corresponding to elementary school (ages 5-10), middle school (ages 11-13), and high school (ages 14-18). Similarly, the WIC program is focused on infants and young children below the age of 5; the WIC specification only includes a count of the number of children in the household between ages 0 and 5.

In both models,  $x'_i$  is a vector of demographic characteristics for the head of household, household characteristics, and variables representing public assistance and geography of residence.  $\tau$  is a vector of annual dummy variables for 2005-2009, omitting the year 2005.  $\alpha_s$  is a vector of state fixed effects, omitting the state of Oklahoma. Both model specifications are estimated via maximum likelihood.

Table 1 lists the CPS explanatory variables and their definitions used in both the multinomial and binomial probit model specifications.

#### **IV. Estimation Samples and Results for the CPS and CE**

The analysis, using the CPS ASEC data, are for a pooled sample of households whose data refer to calendar years 2005-2009 but are collected in 2006 through 2010. The CE sample and characteristic variables, to which the CPS estimated multinomial and binomial probit coefficients are applied, are defined following the CPS definitions presented in Table 1. CE quarterly Interview data from 2005 quarter two through 2010 quarter one are used to produce the NSLP and WIC participation rates. The CE data are collected quarterly, so the CE sample is pooled, assuming data from each quarter are independent of data from other quarters. Pooling the data allow for larger sample sizes by state (examples of states would be Florida and Georgia) for estimating state fixed effects. To create a consistent sample between the CPS ASEC and the CE, the CPS estimation sample covers all states excluding Iowa, New Mexico, North Dakota, Vermont, and Wyoming.<sup>7</sup> To be in the CPS NSLP universe a household must have a child between the ages of 5 and 18, inclusive. To be in the CPS WIC universe a household must meet one of two conditions: (1) have at least one female member age 15 or above and a child less than age 6; or (2) have at least one female member between the ages of 15 and 45.<sup>8</sup> Both samples omit any household reporting negative income or income greater than \$200,000.<sup>9</sup> The CPS sample also omits households headed by an individual whose work status is the Armed Forces. The comparable CE sample omits consumer units with a reference person or spouse whose work status is the armed forces; the reason for restricting the CE sample in this way is due to the fact that reference person identification is not the same as head of household in the CPS; either the “head” or another adult could be the reference person.

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<sup>7</sup> The Consumer Expenditure Survey, during the periods upon which this study is based, did not sample consumer units in these states. The concern for the CE is to produce population estimates by region, not states.

<sup>8</sup> Defining the universe in this way also includes potentially pregnant women eligible for WIC.

<sup>9</sup> Any household reporting zero income is changed to \$1 to facilitate taking the natural log for model estimation.

Tables 2 and 3, respectively, present sample summary statistics for the NSLP and WIC estimation samples for the CPS and CE samples to which the NSLP and WIC coefficients are applied. Also included are summary statistics for the CPS ASEC using and CE samples for the pooled samples. In each case, means and standard errors are based on replicate weights (using Fay's method in the case of the CPS and balanced repeated replication (BRR) in the case of the CE.<sup>10</sup>

Tables 4 and 5 present the results of the multinomial and probit estimations, respectively. Column 1 in Table 4 contains the estimates for the choice "Subsidized Lunch with a Free or Reduced Price," and column 2 in Table 4 contains the estimates for the "Subsidized Lunch" choice. The choice "No Subsidized Lunch" is the reference outcome. The estimated coefficients do not represent marginal effects. The reference state for both tables is Oklahoma. The reference year in both tables is 2005.

The results of applying the CPS estimated coefficients in Tables 4 and 5 to the CE and also to the CPS, for validation, samples are presented first as kernel density plots and second as average participation rates. To produce the predicted probabilities, the CPS estimated model coefficients are applied to household characteristics in the CPS and CE samples. The cumulative normal distribution function is used to produce the WIC probabilities of participation and the bivariate normal distribution is used to produce the NSLP probabilities of participation.

Figures presented after Table 5 are kernel density plots of the CPS and CE predicted probabilities, based on the CPS Program Participation Method, for the NSLP weighted samples (Figures 1 through 6) and the WIC samples next (Figures 7 and 8). The figures are based on the pooled weighted samples.

The average predicted probabilities in Tables 6 and 7 are first produced by year and then for the pooled samples. Along with the predicted probabilities are the sample sizes upon which the rates are based. For the CPS, the probabilities are based on models estimated with household weights. For the CE, the predicted probabilities are estimated using the CPS coefficients (from the models estimated with weights) applied to the NSLP and WIC samples. Average CE probabilities are weighted using CU replicate weights. Please note that the change in WIC sample sizes from 2007 to 2008 for the CPS ASEC is due to a change in the way the survey has identified the WIC universe. Beginning with 2008, the CPS ASEC began indentifying whether they considered the households as not being in the WIC universe. Prior to 2008, the CPS ASEC grouped households not in the WIC universe together with households reporting "No" to the question regarding whether anyone in the household was on WIC in the last year.

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<sup>10</sup> See <http://www.bls.gov/cex/anthology/csxanth5.pdf> for a description of BRR applied to the CE (Blaha 2003) and to [http://smpbff2.dsd.census.gov/pub/cps/march/Use\\_of\\_the\\_Public\\_Use\\_Replicate\\_Weight\\_File\\_final\\_PR\\_2010.doc](http://smpbff2.dsd.census.gov/pub/cps/march/Use_of_the_Public_Use_Replicate_Weight_File_final_PR_2010.doc) for a description of the Fay's method applied to the CPS (Judkins 1990). Also see Garner (2010b) for an application of the method to NAS thresholds.

Table 7 includes these probabilities for households and consumer units that have exactly two children. The focus on two children is because the SPM threshold sample includes only two children; however, other restrictions apply to the CE sample before the SPM thresholds are produced. In the last row of Table 7, probabilities for the SPM sample, upon which the 2009 SPM thresholds are based, are presented. For threshold production, the pooled sample is used.

The household participation rates in Table 6 and Table 7 are not comparable to individual participation rates published by the Department of Agriculture since these are for specific estimation samples and not the total NSLP and WIC population.

To provide an indication of the distribution of school lunches, data from the USDA (USDA 2007, 2008, 2010, 2011) are used. In FY 2006, free meals represented half of all school meals served, reduced-price meals represented 10 percent and other school meals (paid) represented about 40 percent. By FY 2009, the percentage of schools meals that were free increased to 52 percent, reduced priced meals were level at 10 percent, and other paid school meals represented 38 percent of all school lunches served.

The impact of the National School Lunch Program and the Special Supplemental Nutrition Program for Woman, Infants, and Children (WIC) has increased on the last several years. For example, in FY 2006, 30.1 million children per month participated in the school lunch program compared to 31.3 million children in FY 2009. Increases in WIC participation also resulted over this time period. In FY 2006, 8.1 million people participated in WIC per month but by FY 2009, 9.1 million people per month participated.

#### **V. Procedures to Impute In-Kind Benefits to CE Data Based on the CPS Program Participation Method**

School lunch and WIC benefits are produced for each quarter of the CE data. Then they are added to expenditures for food, clothing, shelter and expenditures and annualized to form the basis of the SPM thresholds. For food stamps, we assign the average (over the 48 contiguous states) school lunch values reported by the USDA for schools in which less than 60 percent of the lunches served during the second preceding school year were served free or at a reduced price. Also included in the imputation of school meal values are commodity school lunch program values. We obtained these data from the Census Bureau though the data are available on link from the U.S. Department of Agriculture. For WIC, USDA produces average monthly WIC benefits per person. CE characteristics data are used in combination with average monthly WIC benefits to produce quarterly values for the CE sample.<sup>11</sup>

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<sup>11</sup> In some states, WIC benefits are transferred to participants via debit cards while other states give participants checks to be used for WIC-approved food. In this study, we assume that participants use checks and thus their WIC benefits are not be automatically included in reported food expenditures for the CE. Here's a map from the USDA website that shows which states currently use EBT for WIC. The only states currently, as of January 2011, that use debit cards for WIC are Michigan, New Mexico, Nevada, Texas, and Wyoming. See: <http://www.fns.usda.gov/wic/EBT/EBTActivityMap.pdf>

For the NSLP universe sample, we assume that children receive free and reduced-priced meals 167 days per year, as do researchers at the Census Bureau who have imputed these benefits and added them to resources for poverty measurement (e.g., Short 2011 and Short and Renwick 2011). To impute a value for school lunches, we multiply the number of eligible school aged children within a consumer unit times the number of days receiving meals times the dollar amount per lunch (available from the Census Bureau). This number is then multiplied by the CE probabilities that are derived from the CPS multinomial probit model.

An additional assumption is needed to estimate the value of free and reduced meal subsidies because the estimated probability is for free and reduced meal participation together (choice 1 in section III), and the subsidy amounts differ for free and reduced meals. School lunch program participation guidelines are used to assign the relevant subsidy values.

In a similar manner, WIC predicted probabilities are used to assign benefits to consumer units. A consumer unit is predicted to participate in WIC if the predicted probability exceeds 50 percent. For those predicted to participate in WIC, benefits are computed as the number of eligible members in the WIC universe sample times the average national food cost by monthly WIC benefits. Monthly benefits are converted to quarterly benefits simply by multiplying by 3.

The NSLP and WIC average benefit amounts from the Census Bureau or the USDA are also applied when imputing NSLP and WIC benefit levels using the CE Eligibility Method. However the NSLP and WIC universes differed somewhat for the two methods. Rental housing subsidies are estimated just as they were for the Garner (2010a,c,d) paper. Food stamps are implicitly included in reported CE food expenditures. Information on energy assistance is not asked in the CE and thus benefits from this assistance are not valued for this paper.

## **VI. Production of SPM Thresholds**

### **1. The Estimation Sample and Equivalence Scale**

The estimation sample is composed of consumer units with exactly two children. Since the number of people in a consumer unit can differ from one case to the next (i.e., the number of adults can vary although the number of children is fixed at two), an equivalence scale is needed to equalize expenditures across all consumer units. The number of equivalent adults is determined by the number of adults and children in the household. For each consumer unit, FCSU expenditures are divided by the number of adult equivalent units. Each person in the consumer unit is assigned the adult equivalent value of FCSU expenditures for his or her consumer unit. Adult equivalent expenditures are then converted to those for two-adult two-child consumer units by applying the equivalence scale factor for this CU type to the single adult equivalent value.

As recommended in the ITWG guidelines, the three-parameter equivalence scale is used to adjust FCSU expenditures. The three-parameter scale allows for a different adjustment for single parents (Betson, 1996). This scale has been used in several BLS and Census Bureau studies (for example, see: Garner and Short 2010; Johnson et al., 1997; Short et al., 1999; Short

2001). The three-parameter scale is shown below.

$$\text{One and two adults: } scale = (adults)^{0.5} \quad (3a)$$

$$\text{Single parents: } scale = (adults + 0.8 * firstchild + 0.5 * otherchildren)^{0.7} \quad (3b)$$

$$\text{All other families: } scale = (adults + 0.5 * children)^{0.7} . \quad (3c)$$

The equivalence scale for two adults is set to 1.41. The economy of scales factor is set at 0.70 for other family types. The NAS Panel recommended a range of 0.65 to 0.75. Bishop (2010) commented that the equivalence scale factor is too large and should be reduced given the shares of the threshold for shelter and utilities, commodity groups with large economies of scale.

## 2. Threshold Estimation

The SPM thresholds are based on a range of expenditures around the 33<sup>rd</sup> percentile of FCSU expenditures for two-adult two-child consumer units (but based on expenditures for all consumer units with exactly two children as described above). To identify the range, FCSU expenditures are ranked from lowest to highest, weighting the data by the number of consumer units in the U.S. The range is defined as within the 30<sup>th</sup> and 36<sup>th</sup> percentile points in the FCSU distribution. Restricting the estimation sample to this range of expenditures results in thresholds that are based on the expenditures of a subsample of the original estimation sample composed of two-child consumer units.

The ITWG notes that separate SPM thresholds be produced for owners with mortgages, owners without mortgages, and renters. The reasoning behind this guideline is that thresholds should reflect differing spending needs and housing represents the largest share of the FCSU based thresholds (see Garner and Short 2010). The approach used in this study to produce housing status specific thresholds is the same used by Garner (2010a,c,d). However, another method to account for differences in spending need based on housing status has been proposed by Betson (2009). Garner and Betson (2010) incorporated this alternative method in their research on NAS-based thresholds. Rather than use spending to account for housing needs in the thresholds, Garner and Short (2001) produced NAS thresholds using rental equivalence for owner-occupants and rents for others.<sup>12</sup>

The ITWG method to account for spending needs by housing status uses the within range means of FCSU and shelter plus utilities overall and, in addition, the means of shelter plus utilities for groups of consumer units distinguished by housing status. To produce housing-based FCSU thresholds, first a SPM threshold that is not distinguished by housing status is produced. The overall threshold equals the mean of the range of FCSU expenditures times 1.2 to represent a multiplier, accounting for other basic goods and services. Second, expenditures

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<sup>12</sup> See Johnson et al. (2011) for a study of housing subsidies in SPM resources.

for overall shelter and utility expenditures are substituted by the shelter plus utility expenditures for each housing status subgroup. Below is the equation used to produce the FCSU thresholds for two-adult, two child consumer units and for each  $i$  housing status group.

$$Threshold_j = \left[ (1.2 * FCSU) - (shelter \& utilities) + (shelter \& utilities)_j \right]_{\text{within 30th to 36th percentile range}} \quad (4)$$

Variables  $FCSU$  and  $shelter\&utilities$  are the means for all consumer units within the range without distinction by housing status, while  $j$  refers to the housing status group.

## VII. Thresholds

SPM thresholds, based on the CPS Program Participation Method and the CE Eligibility Method, are presented in Table 8. Standard errors too are presented. All thresholds and standard errors are based on replicate weights. Thresholds that only include food stamps are presented for comparison to those with imputed benefits for NSLP, WIC, and rental subsidies using the two methods described in this study. Thresholds are for two adults with two children but the estimation sample is based on a sample composed of all consumer units with two children, as noted before. Figure 9 is shows the relative magnitude of the SPM thresholds. As expected, it appears that thresholds based on the CPS Program Participation Method are lower than those based on the CE Eligibility Method. Thresholds based on these two methods are higher than those with only food stamps included as an in-kind benefit.

Statistical tests are conducted to determine if thresholds based on the CPS and CE Methods are statistically different, and whether there are differences between thresholds based on housing status. Statistical differences in the thresholds are determined using the standard formula for differences between means (Downie and Heath 1974).

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{s_{\bar{X}_1}^2 + s_{\bar{X}_2}^2}} \quad (5)$$

This formula was selected to test if the thresholds are statistically different since they are based on means; however, it is for uncorrelated data. Since overlapping years of quarterly CE data are being used and the thresholds based on the CPS and CE Methods are based on similar consumer units, the data are clearly correlated. As noted in Downie and Heath (1974), when data are correlated, the size of the standard error of the difference in the means is reduced, depending on the size of the correlation coefficient (not produced for this study). When the standard error of the difference decreases, the size of the computed  $t$  is larger, with the same numerator value. Thus, by using the formula for uncorrelated data, a very stringent test is being applied to test differences in the thresholds. In other words, when the computed  $t$  is 2.19 with a sample size of 1000, for example, with correlated data, the actual  $t$  would be much larger. Thus any statistical result that is reported in this study would be even greater if the correlation had been incorporated in the test.

The tests of statistical differences suggest the following:

1. The two sets of SPM thresholds for 2009 -- based on the CPS Program Participation Method and the CE Participation Method and defined for owners with mortgages, owners without mortgages, and renters -- are not statistically significantly different from each other at the 0.001 level.
2. However, within imputation method group, housing-specific thresholds are statistically significantly different from each other. For example, thresholds for the pairs noted below are statistically significantly different:
  - Owners with mortgages vs. renters (at 0.05 level)
  - Owners with mortgages vs. owners without mortgages (at 0.001 level)
  - Owners without mortgages vs. renters (at 0.001 level)

### **VIII. Discussion and Summary**

There were two aims for this study: 1) to impute in-kind benefits for NSLP and WIC to the CE Interview based on a newly developed CPS Program Participation Method, and 2) to produce housing specific SPM thresholds using the imputed NSLP and WIC benefits based on this method. This exercise was successful. To evaluate the new method, SPM thresholds were also produced using an earlier CE Eligibility Method. Statistical tests of differences in the two sets of housing-specific SPM thresholds reveal that the thresholds are not statistically different from each other, at least for 2009.

Another issue examined in this study was whether thresholds for owners with mortgages, owners without mortgages, and renters are different or whether only two thresholds are needed: one for owners without mortgages and everyone else (combining the owners with mortgages and renter groups). Statistical tests of differences in housing-specific SPM thresholds, within imputation method type group, reveal that housing tenure thresholds are different. This result provides support for continuing to produce separate thresholds for owners with mortgages, owners without mortgages, and renters.

While the CPS Program Participation Method offers one way to impute in-kind benefits in the CE and the CE Eligibility Method another, additional methods should be explored. An alternative method is a statistical matching model. The model developed in this paper can be used as a basis for a predictive mean matching model where CE consumer units are matched to CPS households based on the predicted probabilities. The matched CPS household would serve as the “donor” observation for the NSLP or WIC benefit of the CE consumer unit. This method would need to rely on the public use CPS data (rather than the internal data) since, under current federal government regulations it is not possible to share internal household survey data across agencies. To test how well such a matching model might perform, the model created for this study could be applied to the CPS public use data with results compared to those from the current study.

Once there is agreement on the method to impute in-kind benefits for school lunches and WIC, SPM thresholds with these benefits can be produced at the BLS. These then would be sent to the Census Bureau for geographic price adjustment.<sup>13</sup> The price-adjusted thresholds would then be used by Census Bureau staff to produce poverty statistics based on the ITWG guidelines.

## I. References

(Many of the unpublished working papers and presentations listed here are available the BLS or Census Bureau web site: <http://stats.bls.gov/pir/spmhome.htm> , <http://www.census.gov/hhes/povmeas/data/nas/index.html> , and <http://www.census.gov/hhes/povmeas/data/supplemental/index.html> .

Akin, John S., David K. Guilkey, Barry M. Popkin, and James H. Wyckoff. "The Demand for School Lunches: An Analysis of Individual Participation in the School Lunch Program." *Journal of Human Resources*, vol. 18, no. 2, spring 1983, pp. 213-230.

Barnes, Roberta "Modeling Student Participation in School Nutrition Programs." Washington, DC: The Urban Institute, 1988.

Betson, David, "Homeownership and Poverty Measurement," paper prepared for presentation at the Brookings Institution/ Census Bureau Conference on Improved Poverty Measurement, Washington, DC, (October) 2009.

Betson, David, "Is Everything Relative? The Role of Equivalence Scales in Poverty Measurement," University of Notre Dame, Poverty Measurement Working Paper, Census Bureau, 1996.

Bishop, John, Discussant of "Supplemental Poverty Measure Thresholds: Estimates for 2008," presentation by Thesia I. Garner at the Society of Government Economists Annual Meeting, Washington, DC, November 15, 2010.

Bitler, Marianne, and Janet Currie. "Medicaid at Birth, WIC Take Up, and Children's Outcomes." RAND Labor and Population Working Paper WR-172, May 2004.

Bitler, Marianne, Janet Currie, and John Karl Scholz. "WIC Eligibility and Participation." *Journal of Human Resources*, vol. 38, 1139-79, 2003.

Blaha, Jeffrey L. "Standard Errors in the Consumer Expenditure Survey," *Consumer Expenditure Survey Anthology*, 2003.

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<sup>13</sup> For a discussion of geographic adjustment methods and research, see Renwick (2009a,b, 2010, 2011). Also see Ziliak (2010).



Cameron, A. Colin. and Pravin Trivedi. *Microeconometrics: Methods and Applications*. Cambridge University Press, 2005.

Castner, Laura, James Mabli, and Julie Sykes. "Dynamics of WIC Program Participation by Infants and Children, 2001 to 2003." Final report. Princeton, NJ: Mathematica Policy Research, Inc., April 2009.

Citro, Constance F., and Robert T. Michael (eds.), *Measuring Poverty: A New Approach*, Washington, D.C.: National Academy Press, 1995.

Datar, Ashlesha, and Nancy Nicosia. "The Impact of Maternal Labor Supply on Children's School Mean Participation." RAND Health Working Paper WR-670, March 2009.

Downie, N. M., and R. W. Heath. *Basic Statistical Methods*, Fourth Edition, New York: Harper and Row Publishers, 1974.

Dunifon, Rachel, and Lori Kowaleski-Jones. "The Influences of Participation in the National School Lunch Program and Food Insecurity on Child Well-Being." *The Social Service Review*, vol. 77, no. 1, March 2003, pp. 72-92.

Garner, Thesia I., "Moving to a Supplemental Poverty Measure (SPM): Research on Thresholds for 2008," presentation at the Southern Economic Association Annual Meeting, Atlanta, GA, November 20, 2010, 2010a (presentation available from the author).

Garner, Thesia I., "Note on Standard Errors and Other Relevant Statistics of Experimental Poverty Thresholds Produced at the Bureau of Labor Statistics: 2006 to 2008," Bureau of Labor Statistics (BLS) Working Paper 436, March, 2010b.

Garner, Thesia I., "Supplemental Poverty Measure Thresholds: Estimates for 2008," presentation at the Society of Government Economists Annual Meeting, Washington, DC, November 15, 2010, 2010c (presentation available from the author).

Garner, Thesia I., "Supplemental Poverty Measure Thresholds and the Estimation Sample," paper prepared for presentations at the 32nd Annual Research Conference of the Association for Public Policy Analysis and Management, Boston, MA, November 4-6, 2010, 2010d (paper under revision).

Garner, Thesia I., "Supplemental Poverty Measure Thresholds: Laying the Foundation" paper for Allied Social Science Association (ASSA) Annual Meetings, Denver, CO, January 2011 (presentation available from the author; paper under revision).

Garner, Thesia I. and David Betson, "Housing and Poverty Thresholds: Different Potions for Different Notions," paper prepared for presentations at the Midwestern Economics Association Meetings, Chicago, IL, March 20, 2010. (An earlier version of this paper is available as BLS

Working Paper 435: "Setting and Updating Modern Poverty Thresholds," <http://stats.bls.gov/osmr/abstract/ec/ec100030.htm>, and was also presented at the Annual Meeting of the Allied Social Science Associations (ASSA) in Atlanta, Georgia, January 3, 2010 during the Society of Government Economists Session (SGE).

Garner, Thesia I. and Charles Hokayem, "Supplemental Poverty Measure Thresholds: Imputing Noncash Benefits to the Consumer Expenditure Survey Using Current Population Survey," presented at the 86<sup>th</sup> Annual Conference of the Western Economic Association, San Diego, CA, June 30, 2011. Available at: [http://www.census.gov/hhes/povmeas/methodology/supplemental/research/Garner\\_Hokayem\\_WEA.pdf](http://www.census.gov/hhes/povmeas/methodology/supplemental/research/Garner_Hokayem_WEA.pdf)

Garner, Thesia I. and Kathleen S. Short, "Creating a Consistent Poverty Measure Over Time Using NAS Procedures: 1996-2005," *Review of Income and Wealth*, Series 56, Number 2, June 2010.

Garner, Thesia I. and Kathleen S. Short, "Owner-Occupied Shelter in Experimental Poverty Measures," paper presented at the Annual Meeting of the Southern Economic Association, Tampa, Florida, November 1, 2001.

Gleason, Philip. "Participation in the National School Lunch Program and the School Breakfast Program." *American Journal of Clinical Nutrition*, vol. 61, no. 1 (S), January 1995, pp. 213s-220s.

Gordon, Anne, Mary Kay Fox, Melissa Clark, Renée Nogales, Elizabeth Condon, Philip Gleason, and Ankur Sarin. "School Nutrition Dietary Assessment Study-III: Volume II: Student Participation and Dietary Intakes." Final report. Princeton, NJ: Mathematica Policy Research, Inc., November 2007.

Jacknowitz, Alison, and Laura Tiehen. "Transitions Into and Out of the WIC Program: A Cause for Concern." *The Social Service Review*, vol. 83, no. 2, pp. 151-83, 2009.

Jacknowitz, Alison, and Laura Tiehen. *WIC Participation Patterns: An Investigation of Delayed Entry and Early Exit*, Economic Research Report 109, U.S. Department of Agriculture, Economic Research Service, December 2010.

Johnson, David, "Progress toward improving the U.S. poverty measure: Developing the new Supplemental Poverty Measure," *Focus*, Vol. 27, No. 2, Winter 2010.

Johnson, David, Stephanie Shipp, and Thesia I. Garner, "Developing Poverty Thresholds Using Expenditure Data," in *Proceedings of the Government and Social Statistics Section*. Alexandria, VA: American Statistical Association, August 1997, pp. 28-37.

Johnson, Paul D., Trudi Renwick, and Kathleen Short, "Estimating the Value of Federal Housing Assistance for the Supplemental Poverty Measure," U.S. Census Bureau, 2011.

Judkins, D., "Fay's Method for Variance Estimation," *Journal of Official Statistics*, Vol. 6, No. 3, 1990, pp.223-239.

Maurer, Kenneth. "The National Evaluation of School Nutrition Programs: Factors Affecting Student Participation." *American Journal of Clinical Nutrition*, vol. 40, no. 2 (S), August 1984, pp. 425-447.

*The Measuring of American Poverty Act of 2009*, MAP Act, H.R. 2909, bill introduced in the 111<sup>th</sup> U.S. Congress by Representative McDermott and a companion bill introduced by Senator Dodd (S. 1625).

Moore, Quinn, Lara Hulse, Michael Ponza. "Factors Associated with School Meal Participation and the Relationship Between Different Participation Measures." Final Report, Princeton, NJ: Mathematica Policy Research, Inc. May 2009.

Newman, Constance, and Katherine Ralston. "Profiles of Participants in the National School Lunch Program: Data from Two National Surveys." *Economic Information Bulletin Number 17*. Alexandria, VA: USDA, ERS, August 2006.

*Observations from the Interagency Technical Working Group on Developing a Supplemental Poverty Measure* (Interagency), March 2010, available at [http://www.census.gov/hhes/www/poverty/SPM\\_TWGObservations.pdf](http://www.census.gov/hhes/www/poverty/SPM_TWGObservations.pdf) .

Oliveira, Victor, and Elizabeth Frazao. *The WIC Program: Background, Trends, and Economic Issues, 2009 Edition*, Economic Research Report No. 73, U.S. Department of Agriculture, Economic Research Service, April 2009.

Renwick, Trudi, "Alternative Geographic Adjustments of U.S. Poverty Thresholds: Impact on State Poverty Rates," presented during the American Statistical Association Annual Meetings, Washington, DC. August 2009a , <http://www.census.gov/hhes/www/povmeas/papers.html>

Renwick, Trudi, "Experimental Poverty Measures: Geographic Adjustments from the American Community Survey and BEA Price Parities," *2009 Proceedings of the American Statistical Association, Social Statistics Section* [CD-ROM], Alexandria, VA: American Statistical Association: Presented at the conference in Washington, DC, August 2009b.

Renwick, Trudi, "Geographic Adjustments of Supplemental Poverty Measure Thresholds: Using the American Community Survey Five-Year Data on Housing Costs," paper prepared for the ASSA Annual Meetings, Denver, CO, January 2011 (updated June 2011).

Renwick, Trudi, "Improving the Measurement of Family Resources in a Modernized Poverty Measure," paper prepared for presentations at the Allied Social Sciences Associations (ASSA) meetings, Society of Government Economists (SGE) session, Atlanta, GA, January 3, 2010, <http://www.census.gov/hhes/www/povmeas/papers.html>

Short, Kathleen, "Experimental Poverty Measures: 1999", U.S. Census Bureau, Current Population Reports, Consumer Income, P60-216, U.S. Government Printing Office, Washington, DC, 2001.

Short, Kathleen, "The Supplemental Poverty Measure: Examining the Incidence and Depth of Poverty in the U.S. Taking Account of Taxes and Transfers," paper prepared for the 86<sup>th</sup> Annual Conference of the Western Economic Association, San Diego, CA, June 30, 2011a.

Short, Kathleen, "Supplemental Poverty Measure: Preliminary Estimates for 2009," paper prepared for the ASSA Annual Meetings, Denver, CO, 2011b.

Short, Kathleen, Thesia Garner, David Johnson, and Patricia Doyle, *Experimental Poverty Measures: 1990 to 1997*, U.S. Census Bureau, Current Population Reports, Consumer Income, P60-205, U.S. Government Printing Office, Washington, DC, 1999.

Short, Kathleen and Trudi J. Renwick, "Supplemental Poverty Measure: Preliminary Estimation for 2008," paper prepared for the 32<sup>nd</sup> Annual Research Conference of the Association for Public Policy Analysis and Management, Boston, MA, November 4-6, 2010, 2010.

Swann, Christopher "WIC Eligibility and Participation: The Roles of Changing Policies, Economic Conditions, and Demographics," *The B.E. Journal of Economic Analysis & Policy*, vol. 10, iss. 1 (Contributions), Article 21, 2010.

Swann, Christopher "The Timing of Prenatal WIC Participation." *The B.E. Journal of Economic Analysis & Policy*, vol. 7, iss. 1 (Topics), Article 5, 2007.

Tiehen, Laura, and Alison Jacknowitz. "Why Wait?: Examining Delayed WIC Participation Among Pregnant Women." *Contemporary Economic Policy*, vol. 26, no. 4, pp. 518-538, 2008.

U.S. Department of Agriculture, *The Food Assistance Landscape: FY 2006 Annual Report*, USDA Economic Research Service, Economic Information Bulletin No. 6-4, 2007.

U.S. Department of Agriculture, *The Food Assistance Landscape: FY 2007 Annual Report*, USDA Economic Research Service, Economic Information Bulletin No. 6-5, May 2008.

U.S. Department of Agriculture, *The Food Assistance Landscape: FY 2009 Annual Report*, USDA Economic Research Service, Economic Information Bulletin No. 6-7, March 2010.

U.S. Department of Agriculture, *The Food Assistance Landscape: FY 2010 Annual Report*, USDA Economic Research Service, Economic Information Bulletin No. 6-8, March 2011.

Ziliak, James P., *Alternative Poverty Measures and the Geographic Distribution of Poverty in the United States*, a draft report prepared for the Office of the Assistant Secretary for Planning and Evaluation, U.S. Department of Health and Human Services, available from the author at [iziliak@uky.edu](mailto:iziliak@uky.edu), 2010.

**Table 1: Explanatory Variables in Multinomial Probit and Probit Models**

Variable Name	Description
<b>Head of Household Variables</b>	
Age	Age in years
<b>Race</b>	
White, non-Hispanic	Dummy variable for white, non-Hispanic
Black, non-Hispanic	Dummy variable for black, non-Hispanic
Hispanic	Dummy variable for Hispanic
Other race (excl. category)	Dummy variable for other race
<b>Gender</b>	
Male (excl. category)	Dummy variable for male
Female	Dummy variable for female
<b>Education</b>	
Low education (excl. category)	Dummy variable for low education (less than 12 years)
Medium education	Dummy variable for medium education (between 12 and 14 years, inclusive)
High education	Dummy variable for high education (greater than or equal to 15 years)
<b>Marital Status</b>	
Married (excl. category)	Dummy variable for married
Widowed	Dummy variable for widowed
Past marriage	Dummy variable for past marriage
Never married	Dummy variable for never married
<b>Employment</b>	
Not in labor force (excl. category)	Dummy variable for not in the labor force
Unemployed	Dummy variable for 0 hours worked
Part-time	Dummy variable for hours worked between 0 and 35
Full-time	Dummy variable for greater than or equal to 35 hours worked
<b>Household Variables</b>	
Household income	Household income
Household size	Household size
<b>Age composition of children</b>	
Number of children 0-5	Number of children between ages 0 and 5, inclusive
Number of children 5-10	Number of children between ages 5 and 10, inclusive
Number of children 11-13	Number of children between ages 11 and 13, inclusive
Number of children 14-18	Number of children between ages 14 and up to 18
<b>Public Assistance</b>	
Foodstamp	Dummy variable for anyone in household receiving food stamps
Welfare	Dummy variable for anyone in household receiving welfare
Medicaid	Dummy variable for anyone in household covered by Medicaid
<b>Residence</b>	
Urban	Dummy variable for residing in a metropolitan area
Rural (excl. category)	Dummy variable for residing in a nonmetropolitan area

**Table 2: Weighted Sample Summary Statistics for NSLP Model: CPS and CE Interview**

Variable Name	CPS ASEC 2006-2010 (n=123,241) <sup>a</sup>		CE Interview 2005Q2-2010Q1 (n=39,211) <sup>b</sup>	
	Mean	Standard Error	Mean	Standard Error
<b>Head of Household/Reference Person Variables</b>				
Age	41.62	0.04	41.53	0.096
<b>Race</b>				
White, non-Hispanic	0.60	0.002	0.60	0.011
Black, non-Hispanic	0.15	0.001	0.16	0.003
Hispanic	0.19	0.001	0.19	0.011
Other race (excl. category)	0.06	0.001	0.05	0.002
<b>Gender</b>				
Male (excl. category)	0.46	0.002	0.40	0.005
Female	0.54	0.002	0.60	0.005
<b>Education</b>				
Low education (excl. category)	0.15	0.002	0.17	0.006
Medium education	0.77	0.002	0.59	0.006
High education	0.08	0.001	0.24	0.005
<b>Marital Status</b>				
Married (excl. category)	0.66	0.002	0.69	0.005
Widowed	0.03	0.001	0.03	0.001
Past marriage	0.18	0.001	0.17	0.003
Never married	0.13	0.001	0.11	0.003
<b>Employment</b>				
Not in labor force (excl. category)	0.19	0.002	0.18	0.004
Unemployed	0.05	0.001	0.01	0.001
Part-time	0.12	0.001	0.13	0.003
Full-time	0.64	0.002	0.68	0.004
<b>Household Variables</b>				
Household income	\$65,501	\$215	\$64,559	\$626
Household/Consumer Unit size	4.06	0.006	4.08	0.014
<b>Age composition of children</b>				
Number of children 0-5	0.74	0.003	0.72	0.007
Number of children 11-13	0.37	0.002	0.36	0.005
Number of children 14-18	0.50	0.002	0.52	0.005
<b>Public Assistance</b>				
Foodstamp	0.13	0.002	0.11	0.005
Welfare	0.03	0.001	0.02	0.001
Medicaid	0.30	0.002	0.16	0.004
<b>Residence</b>				
Urban	0.84	0.005	0.86	0.014
Rural (excl. category)	0.16	0.005	0.14	0.014
<b>School Lunch Participation</b>				
Subsidized Lunch, FR	0.26	0.002		
Subsidized Lunch	0.43	0.002		
No Subsidized Lunch	0.32	0.002		

<sup>a</sup> U.S. Census Bureau, Current Population Survey, 2006-2010 Annual Social and Economic Supplement. For outcomes, “Subsidized, FR” refers to receiving a subsidized lunch with a free or reduced Price, “Subsidized Lunch” refers to receiving a subsidized lunch, and “No Subsidized Lunch” refers to not receiving a subsidized lunch. Standard errors are estimated using replicate weights (Fay’s method). For information on sampling and nonsampling error, see <[www.census.gov/apsd/techdoc/cps/cpsmar10.pdf](http://www.census.gov/apsd/techdoc/cps/cpsmar10.pdf)>.

<sup>b</sup> Bureau of Labor Statistics, U.S. Department of Labor, Consumer Expenditure Interview Survey, 2005Q2-2010Q1. Sample statistics are weighted using the quarterly consumer unit weights. For information on sampling and nonsampling error, see <<http://www.bls.gov/cex/anthology/csxnth5.pdf>>.

**Table 3: Weighted Sample Summary Statistics for WIC Model: CPS and CE Interview**

Variable Name	CPS ASEC 2006-2010 (n=190,633) <sup>a</sup>		CE Interview 2005Q2-2010Q1 (n=61,589) <sup>b</sup>	
	Mean	Standard Error	Mean	Standard Error
<b>Head of Household/Reference Person Variables</b>				
Age	46.22	0.042	38.00	0.125
<b>Race</b>				
White, non-Hispanic	0.66	0.001	0.63	0.009
Black, non-Hispanic	0.14	0.001	0.14	0.005
Hispanic	0.14	0.001	0.17	0.009
Other race (excl. category)	0.06	0.001	0.06	0.002
<b>Gender</b>				
Male (excl. category)	0.47	0.002	0.38	0.005
Female	0.53	0.002	0.62	0.005
<b>Education</b>				
Low education (excl. category)	0.16	0.001	0.14	0.005
Medium education	0.76	0.002	0.57	0.004
High education	0.08	0.001	0.29	0.005
<b>Marital Status</b>				
Married (excl. category)	0.51	0.002	0.62	0.004
Widowed	0.09	0.001	0.02	0.001
Past marriage	0.18	0.001	0.13	0.003
Never married	0.22	0.002	0.23	0.004
<b>Employment</b>				
Not in labor force (excl. category)	0.32	0.001	0.16	0.004
Unemployed	0.04	0.001	0.01	0.001
Part-time	0.11	0.001	0.14	0.003
Full-time	0.53	0.002	0.69	0.005
<b>Household Variables</b>				
Household income	\$52,730	\$165	\$61,538	\$454
Household/Consumer Unit size	2.79	0.006	3.36	0.023
<b>Age composition of children</b>				
Number of children 0-5	0.29	0.002	0.43	0.006
<b>Public Assistance</b>				
Foodstamp	0.11	0.001	0.10	0.004
Welfare	0.02	0.001	0.02	0.001
Medicaid	0.23	0.002	0.13	0.004
<b>Residence</b>				
Urban	0.83	0.006	0.86	0.014
Rural (excl. category)	0.17	0.006	0.14	0.014
<b>WIC Participation (%)</b>	0.06	0.001	0.14	0.014

<sup>a</sup> U.S. Census Bureau, Current Population Survey, 2006-2010 Annual Social and Economic Supplement. Standard errors are estimated using replicate weights (Fay's method). For information on sampling and nonsampling error, see <[www.census.gov/apsd/techdoc/cps/cpsmar10.pdf](http://www.census.gov/apsd/techdoc/cps/cpsmar10.pdf)>.

<sup>b</sup> Bureau of Labor Statistics, U.S. Department of Labor, Consumer Expenditure Interview Survey, 2005Q2-2010Q1. Sample statistics are weighted using the quarterly consumer unit weights. For information on sampling and nonsampling error, see <<http://www.bls.gov/cex/anthology/csxanth5.pdf>>.



**Table 4: Multinomial Probit Model for NSLP Using CPS ASEC 2006-2010**

VARIABLES	(1)	(2)
	Subsidized Lunch With A Free or Reduced Price	Subsidized Lunch
Age	-0.00458*** (0.000944)	-0.000815 (0.000793)
White, non-Hispanic	-0.362*** (0.0383)	0.0112 (0.0311)
Black, non-Hispanic	0.346*** (0.0465)	0.147*** (0.0392)
Hispanic	0.608*** (0.0405)	0.155*** (0.0372)
Female	0.143*** (0.0186)	0.000249 (0.0165)
Medium education	-0.414*** (0.0267)	0.0718*** (0.0256)
High education	-1.357*** (0.0541)	-0.180*** (0.0340)
Widowed	0.479*** (0.0541)	0.178*** (0.0431)
Past married	0.464*** (0.0254)	0.115*** (0.0207)
Never married	0.315*** (0.0298)	-0.0107 (0.0263)
ln(household income)	-0.133*** (0.00914)	0.182*** (0.0142)
Household size	-0.0905*** (0.00978)	-0.0157** (0.00773)
Number of children 5-10	0.467*** (0.0158)	0.240*** (0.0135)
Number of children 11-13	0.541*** (0.0172)	0.336*** (0.0146)
Number of children 14-18	0.335*** (0.0158)	0.212*** (0.0122)
Foodstamp	0.908*** (0.0332)	-0.706*** (0.0422)
Welfare	0.000737 (0.0531)	-0.0565 (0.0632)
Medicaid	1.030*** (0.0198)	0.0922*** (0.0193)
Unemployed	0.269*** (0.0468)	0.159*** (0.0371)
Part-time	0.0671** (0.0296)	0.0756*** (0.0255)
Full-time	-0.0458* (0.0248)	0.220*** (0.0208)
Urban	-0.441*** (0.0405)	-0.252*** (0.0333)
Constant	1.622*** (0.127)	-1.803*** (0.166)
Pseudo log-likelihood	-129,489.37	
Pseudo R <sup>2</sup>	Not available	
Observations	123,241	

Table reports multinomial probit model estimates with “No Subsidized Lunch” as the reference outcome. State and year fixed effects are included. Standard errors are estimated using replicate weights (Fay’s method). \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Source: U.S. Census Bureau, Current Population Survey, 2006-2010 Annual Social and Economic Supplement. For information on sampling and nonsampling error, see <[www.census.gov/apsd/techdoc/cps/cpsmar10.pdf](http://www.census.gov/apsd/techdoc/cps/cpsmar10.pdf)>.

**Table 5: Probit Model for WIC Using CPS ASEC 2006-2010**

VARIABLES	WIC
Age	-0.0177*** (0.000795)
White, non-Hispanic	-0.0629* (0.0342)
Black, non-Hispanic	0.0418 (0.0392)
Hispanic	0.294*** (0.0363)
Female	0.0455*** (0.0159)
Medium education	-0.0840*** (0.0185)
High education	-0.566*** (0.0723)
Widowed	0.112*** (0.0390)
Past married	-0.0275 (0.0232)
Never married	-0.000703 (0.0207)
ln(household income)	-0.0273*** (0.00441)
Household size	0.00659 (0.00578)
Number of children 0-5	0.715*** (0.00961)
Foodstamp	0.446*** (0.0210)
Welfare	0.153*** (0.0273)
Medicaid	0.820*** (0.0179)
Unemployed	0.0754** (0.0299)
Part-time	0.0468* (0.0250)
Full-time	-0.0211 (0.0197)
Urban	-0.149*** (0.0227)
Constant	-1.452*** (0.0972)
Pseudo log-likelihood	-34982.49
Pseudo R <sup>2</sup>	0.45
Observations	190,633

Table reports probit model estimates. State and year fixed effects are included. Standard errors are estimated using replicate weights (Fay's method). \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Source: U.S. Census Bureau, Current Population Survey, 2006-2010 Annual Social and Economic Supplement. For information on sampling and nonsampling error, see <[www.census.gov/aprd/techdoc/cps/cpsmar10.pdf](http://www.census.gov/aprd/techdoc/cps/cpsmar10.pdf)>.

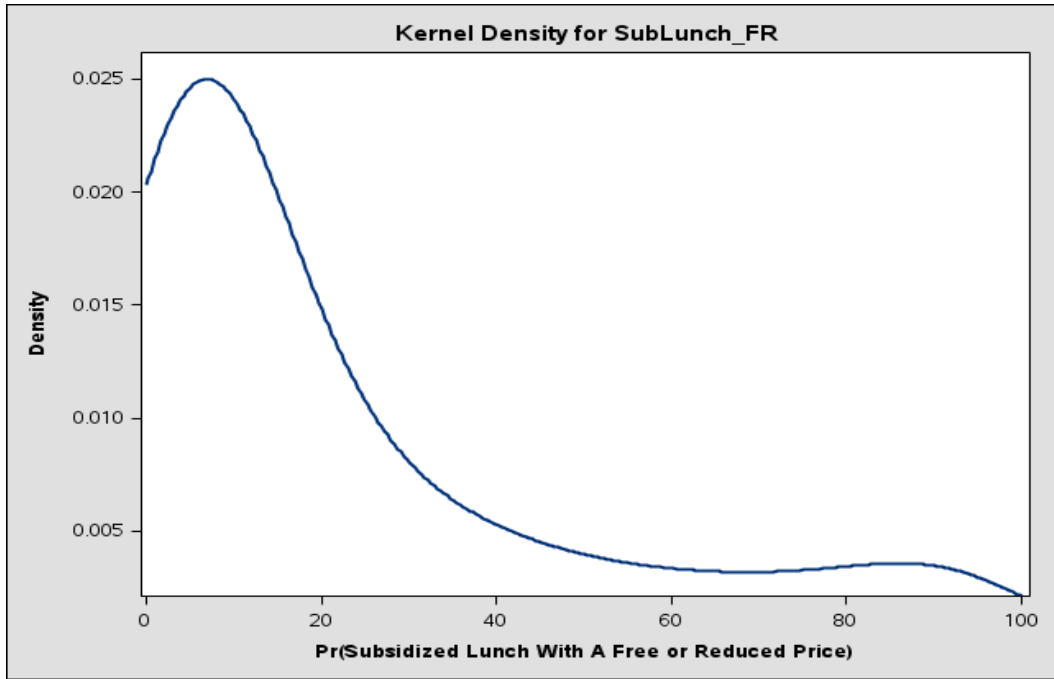


Figure 1. CPS ASEC 2006-2010: Predicted Free or Reduced Lunch Participation

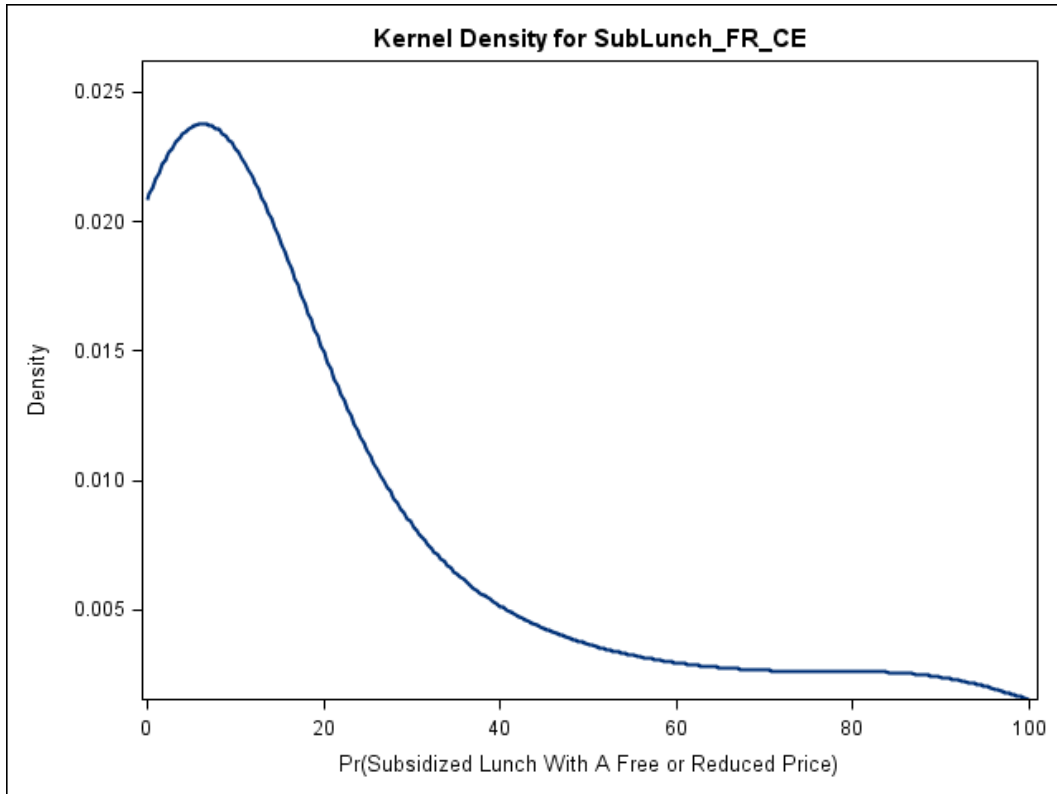


Figure 2. CE 2005Q2-2010Q1: Predicted Free or Reduced Lunch Participation

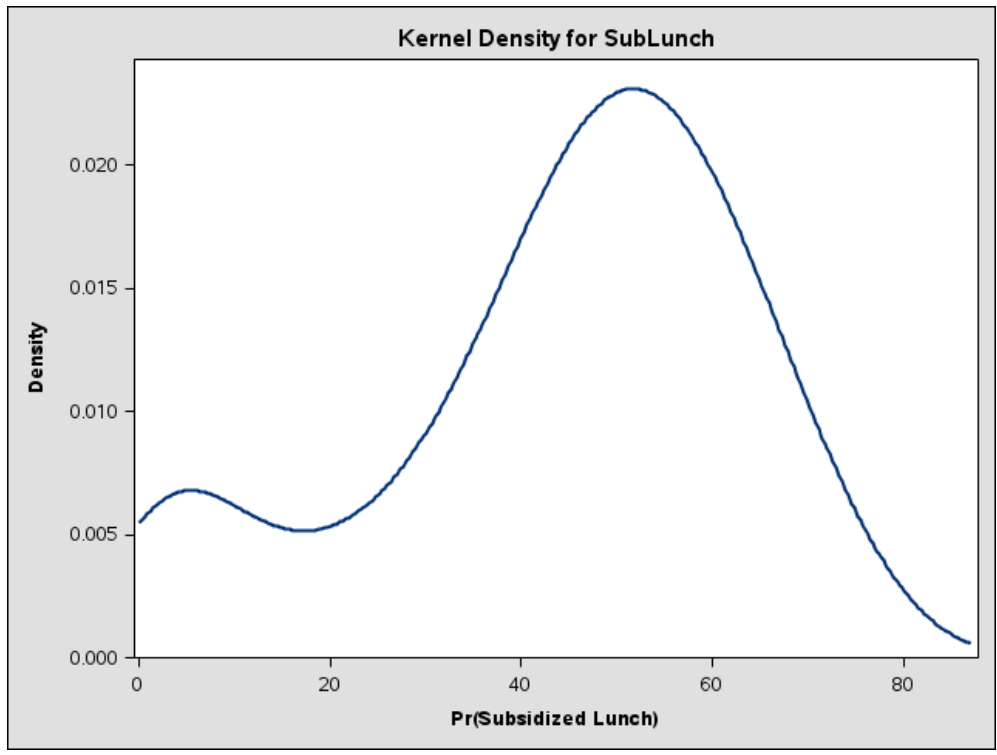


Figure 3. CPS ASEC 2006-2010: Predicted Paid Lunch Participation

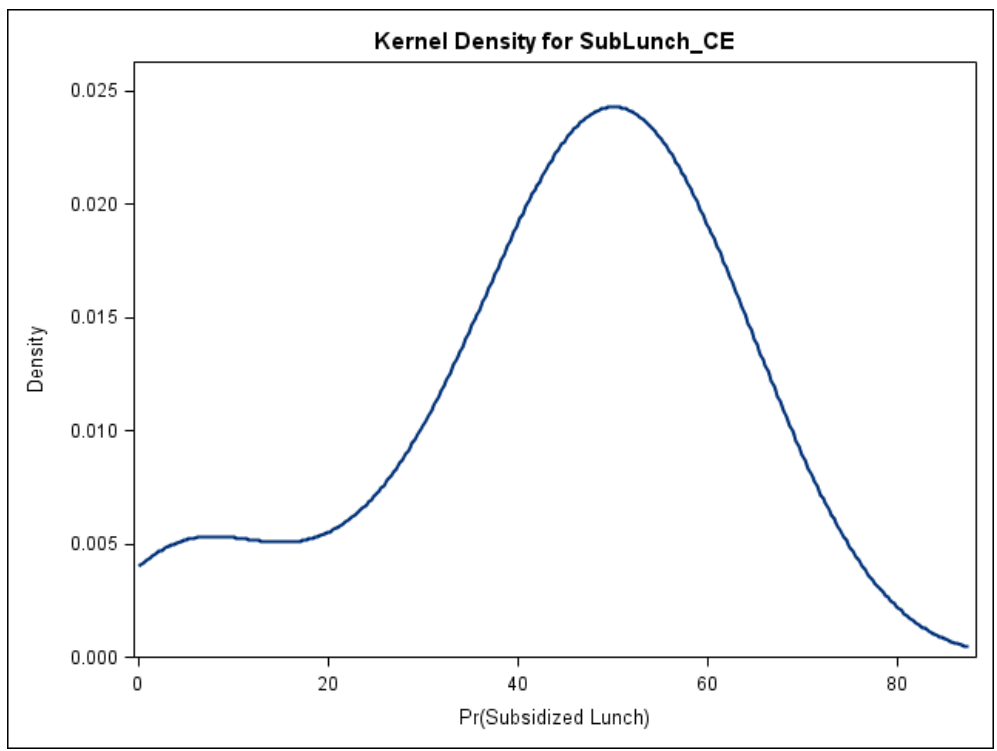


Figure 4. CE 2005Q2-2010Q1: Predicted Paid Lunch Participation

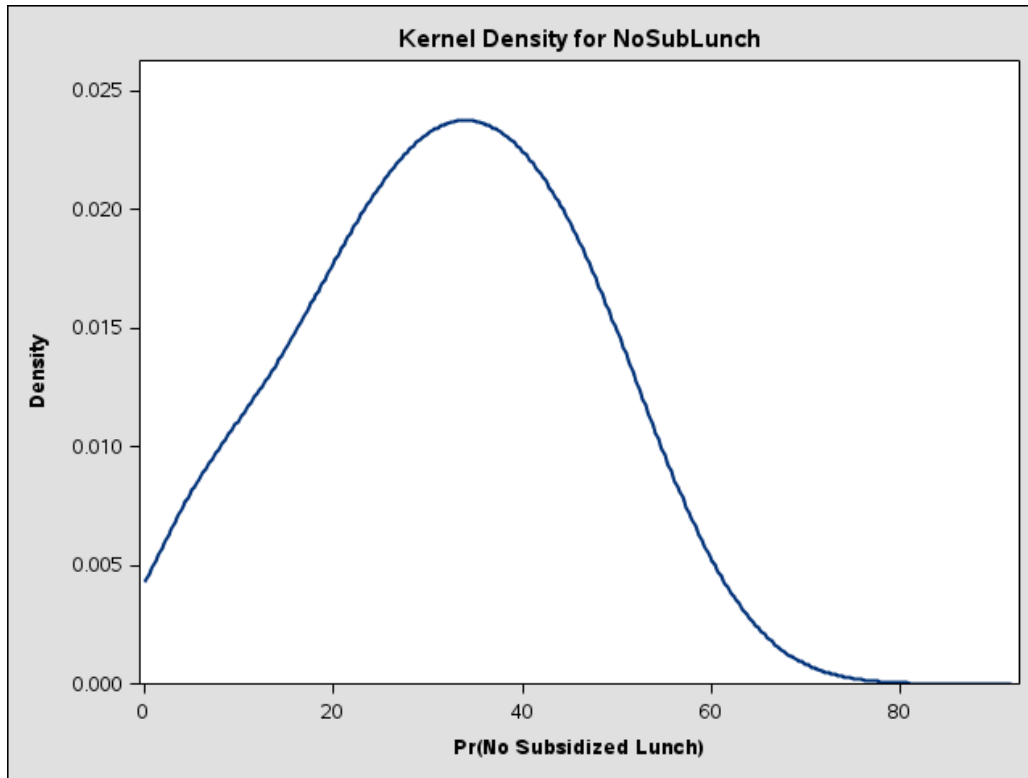


Figure 5. CPS ASEC 2006-2010: Predicted No School Lunch Participation

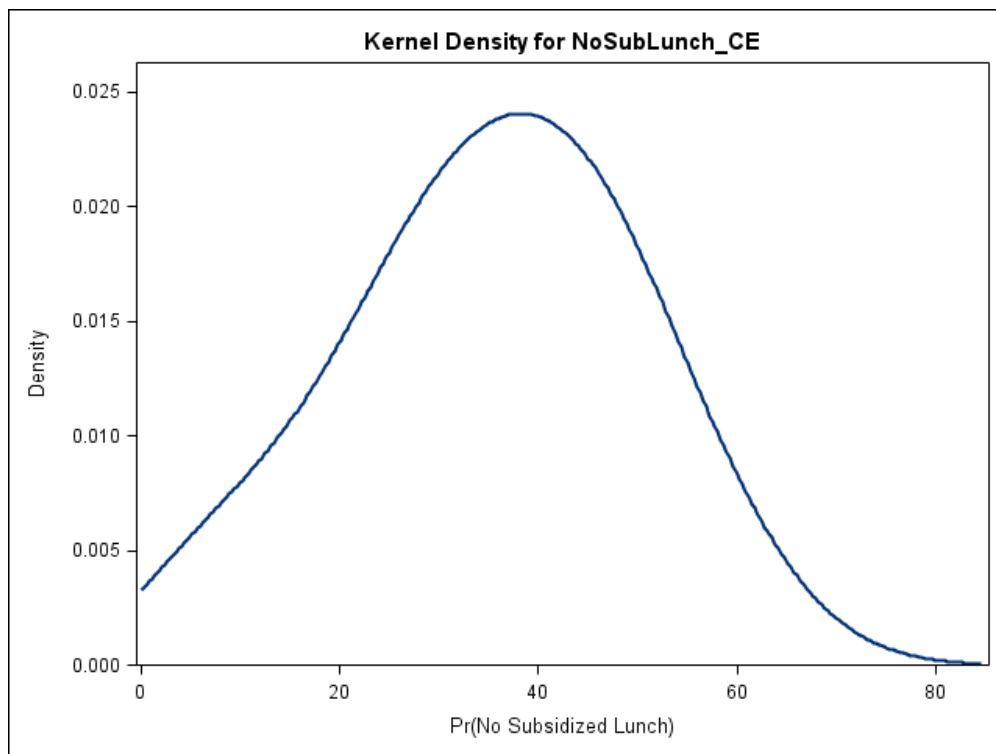


Figure 6. CE 2005Q2-2010Q1: Predicted No School Lunch Participation

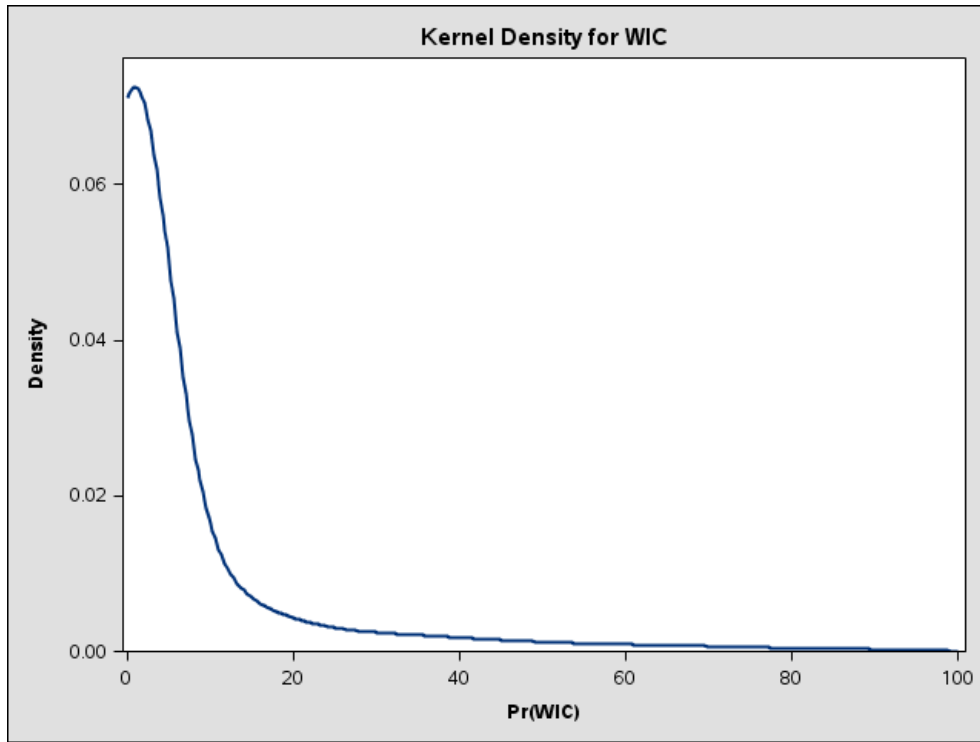


Figure 7. CPS ASEC 2006-2010: Predicted WIC Participation

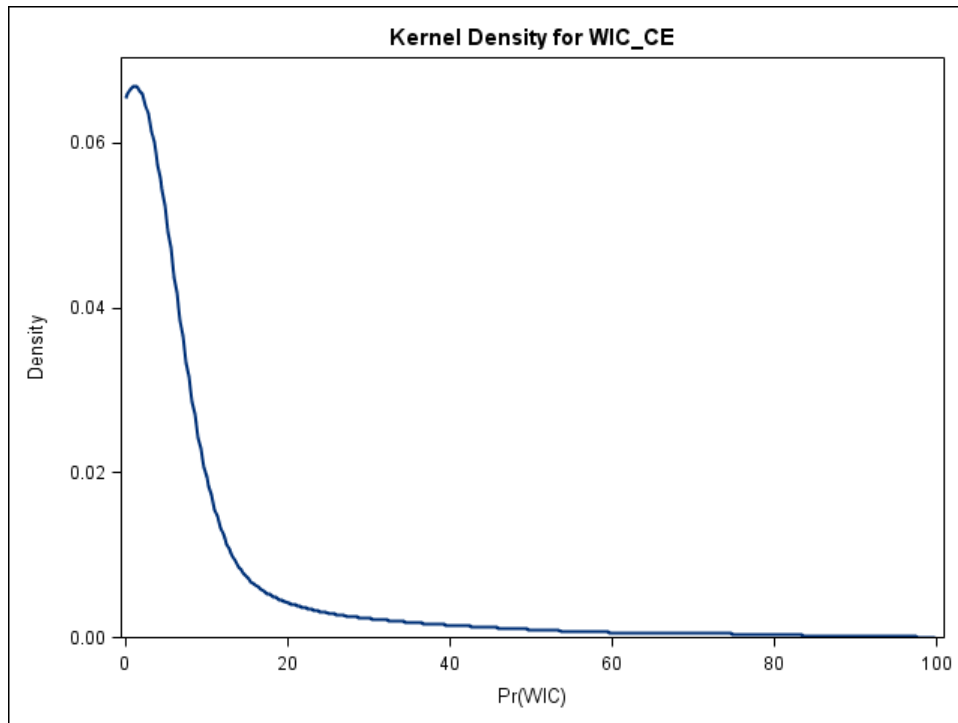


Figure 8. CE 2005Q2-2010Q1: Predicted WIC Participation

**Table 6: Weighted Predicted Probabilities of School Lunch and WIC Program Participation Using Model Estimation: CPS ASEC and CE Interview**

Data Collected	Source	Sample Size	School Lunch Model			WIC Model	
			Subsidized, FR	Subsidized Lunch	No subsidized Lunch	Sample Size	WIC
2006	CPS ASEC	25,000	23.7%	45.3%	30.9%	68,121	3.4%
2005Q2-2006Q1	CE Interview	8,857	20.8%	45.2%	34.1%	13,661	4.3%
2007	CPS ASEC	24,546	23.5%	44.7%	31.8%	67,443	3.3%
2006Q2-2007Q1	CE Interview	7,924	20.7%	44.3%	35.0%	12,496	4.1%
2008	CPS ASEC	24,721	22.8%	44.2%	33.0%	18,045	12.5%
2007Q2-2008Q1	CE Interview	7,579	18.7%	44.9%	36.4%	11,931	5.3%
2009	CPS ASEC	24,533	24.0%	43.7%	32.3%	18,198	13.0%
2008Q2-2009Q1	CE Interview	7,405	19.5%	44.8%	35.7%	11,618	5.6%
2010	CPS ASEC	24,441	26.4%	42.6%	31.0%	18,826	13.6%
2009Q2-2010Q1	CE Interview	7,446	22.3%	43.2%	34.5%	11,883	6.2%
2006-2010	CPS ASEC	123,241	24.1%	44.1%	31.8%	190,633	6.2%
2005Q2-2010Q1	CE Interview	39,211	20.4%	44.4%	35.1%	61,589	5.1%

<sup>a</sup> U.S. Census Bureau, Current Population Survey, 2006-2010 Annual Social and Economic Supplement. Sample probabilities are based on a model that uses household weights. For outcomes, “Subsidized, FR” refers to receiving a subsidized lunch with a free or reduced Price, “Subsidized Lunch” refers to receiving a subsidized lunch, and “No Subsidized Lunch” refers to not receiving a subsidized lunch. For information on sampling and nonsampling error, see <[www.census.gov/apsd/techdoc/cps/cpsmar10.pdf](http://www.census.gov/apsd/techdoc/cps/cpsmar10.pdf)>.

<sup>b</sup> Bureau of Labor Statistics, U.S. Department of Labor, Consumer Expenditure Interview Survey, 2005Q2-2010Q1. Sample statistics are weighted using the quarterly consumer unit weights. For information on sampling and nonsampling error, see <<http://www.bls.gov/cex/anthology/csxanth5.pdf>>.

**Table 7: Weighted CE Interview Predicted Probabilities of School Lunch and WIC Program Participation Using Model Estimation for Consumer Units with Two Children**

Data Collected	Source	Sample Size	School Lunch Model			WIC Model	
			Subsidized, FR	Subsidized Lunch	No subsidized Lunch	Sample Size	WIC
2006	CPS ASEC	9,330	22.5%	47.1%	30.4%	10,868	7.1%
2005Q2-2006Q1	CE Interview	3,195	19.0%	47.1%	33.9%	3,398	6.2%
2007	CPS ASEC	9,141	22.3%	46.3%	31.3%	10,649	6.9%
2006Q2-2007Q1	CE Interview	2,977	18.4%	46.6%	35.0%	3,195	6.2%
2008	CPS ASEC	8,933	21.1%	46.4%	32.5%	5,245	14.5%
2007Q2-2008Q1	CE Interview	2,794	16.5%	47.1%	36.3%	2,954	7.2%
2009	CPS ASEC	8,869	22.7%	45.8%	31.5%	5,317	15.4%
2008Q2-2009Q1	CE Interview	2,825	18.5%	45.9%	35.6%	2,079	7.9%
2010	CPS ASEC	8,796	25.0%	44.8%	30.2%	5,410	16.2%
2009Q2-2010Q1	CE Interview	2,747	21.3%	44.7%	34.0%	2,922	9.1%
2006-2010	CPS ASEC	45,069	22.7%	46.1%	31.2%	37,489	10.6%
2005Q2-2010Q1	CE Interview	14,538	18.7%	46.3%	35.0%	15,448	7.3%
2005Q2-2010Q1	CE Interview: in 30-35th FCSU range (threshold estimation sample) <sup>c</sup>	1,054	21.2%	46.0%	32.8%	1,054	7.0%

<sup>a</sup> U.S. Census Bureau, Current Population Survey, 2006-2010 Annual Social and Economic Supplement. Sample probabilities are based on a model that uses household weights. For outcomes, “Subsidized, FR” refers to receiving a subsidized lunch with a free or reduced Price, “Subsidized Lunch” refers to receiving a subsidized lunch, and “No Subsidized Lunch” refers to not receiving a subsidized lunch. For information on sampling and nonsampling error, see <[www.census.gov/apsd/techdoc/cps/cpsmar10.pdf](http://www.census.gov/apsd/techdoc/cps/cpsmar10.pdf)>.

<sup>b</sup> Bureau of Labor Statistics, U.S. Department of Labor, Consumer Expenditure Interview Survey, 2005Q2-2010Q1. Sample statistics are weighted using the quarterly consumer unit weights. For information on sampling and nonsampling error, see <<http://www.bls.gov/cex/anthology/csxanth5.pdf>>.

<sup>c</sup> For the SPM estimation sample, the NSLP percentages have been rebased to equal 100 percent. The non-rebased probabilities for the three NSLP groups are 17.9 percent, 38.8 percent, and 27.7 percent respectively. Since the NSLP original probabilities were estimated for the NSLP sample as a whole, there is no guarantee that the sum of the probabilities for the estimation sample will equal 100 percent.



**Table 8. FCSU (with In-Kind Benefits) Expenditures and Thresholds Based on 30th to 36th Percentile FCSU Expenditure Range: 2009**

	2A+2C Consumer Units																									
	With Only Food Stamps (n=1,063)						Eligibility Guidelines + CE Characteristics (n=1,048)						CPS Probit Estimation+CE Characteristics (n=1,054)													
	30-36th percentile range of FCSU		Shelter + Utilities within FCSU 30-36 range		Std. Error		30-36th percentile range of FCSU		Shelter + Utilities within FCSU 30-36 range		Std. Error		FCSU Thresholds		Std. Error		30-36th percentile range of FCSU		Shelter + Utilities within FCSU 30-36 range		Std. Error		FCSU Thresholds		Std. Error	
Cus with Two Children, FCSU																										
With Subsidies (adding values for CE-Based Rental Subsidies and CE- and CPS-Based NSLP and WIC Subsidies)																										
FCSU	\$19,879	(15.99)					\$21,093	(15.82)					\$20,966	(12.65)												
Food	\$6,931	(96.62)					\$7,442	(91.02)					\$7,344	(102.39)												
Clothing	\$1,163	(39.40)					\$1,173	(44.22)					\$1,155	(50.72)												
Shelter	\$8,102	(117.64)					\$8,702	(136.81)					\$8,762	(160.40)												
Utilities	\$3,683	(52.11)					\$3,776	(62.12)					\$3,705	(57.75)												
Other	\$3,976	(3.20)					\$4,219	(3.16)					\$4,193	(2.53)												
Treatment of shelter+utilities																										
Not accounting for housing status			\$11,785	(99.16)	\$23,854	(19.19)			\$12,477	(103.54)	\$25,311	(18.99)			\$12,467	(129.04)	\$25,159	(15.18)								
Accounting for housing status																										
Owners with mortgages			\$12,381	(107.27)	\$24,450	(94.45)			\$13,087	(132.78)	\$25,921	(118.06)			\$13,024	(147.20)	\$25,716	(128.23)								
Owners without mortgages			\$8,229	(294.87)	\$20,298	(303.29)			\$8,533	(396.31)	\$21,367	(388.08)			\$8,368	(333.67)	\$21,060	(313.04)								
Renters			\$11,804	(141.63)	\$23,874	(97.49)			\$12,420	(176.26)	\$25,255	(149.80)			\$12,593	(193.13)	\$25,286	(148.93)								

CE sample restricted to owners with and without mortgages, and renters with and without government rental subsidies. Annual CPI-U All Items were used to adjust quarterly expenditures to 2009 year dollars. Five years of CE Interview data were used to produce these estimate; quarterly Interview reports were considered to be independent, as in official BLS publications of CE data.

\*Threshold=(1.2\*FCSU)-(shelter+utilities share for all) + (shelter+utilities for subgroup)

Thresholds produced by Thesia I. Garner, BLS, July 14, 2011 using CPS probit coefficients produced by Charles Hokayem June 2010. Marisa Gudrais produced the standard errors, using replicate weights, on July 15, 2011.

**Figure 9. 2009 SPM FCSU Thresholds with and without Imputed Subsidies**

