

**Supplemental Poverty Measure Thresholds:  
Imputing School Lunch and WIC Benefits to the Consumer Expenditure Survey  
Using the Current Population Survey**

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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) Interview component, the data source upon which the thresholds are based. For example, 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. This study introduces a new method, the CPS Program Participation Method, of imputing benefits for the National School Lunch Program (NSLP) and the Women, Infants, and Children program (WIC). In this study, data from the Current Population Survey (CPS), the data source upon which the SPM resource measure is based, are used to model the participation of CE households in the NSLP and WIC using the CPS Program Participation Method. These CPS-based participation rates for NSLP and WIC are then used along with U.S. Department of Agriculture information to assign benefit levels to the CE households. Thresholds based on the CPS Program Participation Method are produced for 2009 and compared to thresholds based on a method based on program eligibility guidelines, the CE Eligibility Method. SPM thresholds are produced by housing types as well as overall. No poverty rates using these thresholds are produced.

Results reveal that the CE Eligibility Method overall threshold is higher than the CPS Program Participation Method overall threshold. This is not surprising since the CE threshold is based on eligibility while the CPS threshold is based on program participation. The paired CE and CPS based thresholds are also statistically significantly different from each other for owners with mortgages and for owners without mortgages. When housing tenure thresholds are compared to each other within each method group, statistically significant differences arise for two of the three pairs of thresholds. In particular, the thresholds for owners without a mortgage were found to be different from the thresholds of both owners with a mortgage and renters, while the thresholds for owners with a mortgage and renters did not differ from each other at the significance levels used for testing.

## 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 *FOCUS* article (2010). The ITWG guidelines are similar to those presented in the *Measuring of American Poverty Act of 2009* introduced by Rep. Jim McDermott.

Researchers previously added the value of in-kind benefits in SPM defined resources and thresholds.<sup>1</sup> Included in resources are benefits such as 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). Including these benefits in thresholds has posed a particular challenge since only limited in-kind benefit information is available in the CE. For example, the BLS assumes that cash value of benefits from SNAP (previously known as food stamps) are included in reported food expenditure. However, no information is collected regarding NSLP or WIC. Limited information is collected for the imputation of rent subsidies. The CE collects information on whether rental housing is subsidized and the rent paid for the unit. This is used in combination with Fair Market Rents from the U.S. Department of Housing and Urban Development to impute rent subsidies. In earlier research, Garner (2010a, c, d; 2011) used program eligibility guidelines and consumer unit characteristics to impute NSLP and WIC benefits (CE Eligibility Method).<sup>2</sup> But

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<sup>1</sup> See <http://www.census.gov/hhes/povmeas/methodology/supplemental/index.html> and <http://www.bls.gov/pir/spmhome.htm> for ongoing SPM research.

<sup>2</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. Only subsidies for consumer units living in rental housing are considered. The rent subsidy is defined as the difference in the actual rent paid by the CU and the “market rent” of a unit with similar characteristics (i.e., number of bedrooms in this case). CE data used in the imputation are the responses to general housing questions and the rent actually paid. When a consumer unit begins participating in the CE Interview Survey, respondents are asked whether they live in public housing or have received government assistance to help with shelter expenses. This information is carried forward in subsequent interviews. General questions are asked about the housing unit. Those referring to subsidized housing are provided below (see <http://stats.bls.gov/cex/capi/2010/cecapihome.htm>).

Is this house in a public housing project, that is, is it owned by a local housing authority or other local public agency?

eligibility rates do not equal participation rates, since not all eligible individuals or households participate in these programs. For an example, Jackowitz and Tiehen (2010) report that 79.1 percent of eligible households participated in WIC during the postnatal period.

Garner and Hokayem (2011a, b) introduced an alternative method, the CPS Program Participation Method, to impute the value of NSLP and WIC program benefits that is based on program participation. The CPS Program Participation Method estimates a model predicting program participation using data from the CPS ASEC and imputes a probability of program participation for consumer units in the CE before assigning program benefits. This study builds on Garner and Hokayem (2011a, b) by using a similar estimation method and more specifically incorporating features of the CPS universe definitions for NSLP and WIC. In this study, data from the CPS ASEC for 2006-2010 were used to estimate a multinomial logit model for NSLP participation and a logit model for WIC participation.<sup>3</sup> The CPS-based logit coefficients are applied to the CE Interview sample.<sup>4</sup> The U.S. Department of Agriculture serves as the source of the NSLP and WIC benefit levels assigned to consumer units in the CE. 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 the variable year serving as a control in the models.

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1. Yes
  2. No

Are your housing costs lower because the Federal, State, or local government is paying part of the cost?

1. Yes
2. No

As proxies for the market rents, Garner used data from HUD on Fair Market Rents (FMRs) for 2004 through 2009 (See <http://www.huduser.org/portal/datasets/fmr.html>). FMRs are assigned to consumer units who report in the CE that their housing costs are lower because a government is paying part of the costs. Public housing units are assigned market rents that are adjusted to reflect the average gross rent paid plus the average subsidy value as reported by HUD (The adjustment factor is 767/971 for 2008 and is assumed to be the same for 2004 quarter one through 2009 quarter one for this study; see: [http://www.huduser.org/portal/picture2008/form\\_7totH4.odt](http://www.huduser.org/portal/picture2008/form_7totH4.odt). Garner followed the same procedure used by Short and Renwick 2010, footnote 4.) FMRs data were matched with CE data by the number of bedrooms in the rental unit, county, and state. FMR data are available for zero to four bedrooms. When there were more than four bedrooms in a CE rental unit, the CU was assigned the FMR for four bedroom rental units in the county. When there was more than one FMR for a county, the average FMR for the county was used and then assigned to the subsidized rental units in the CE. CUs living in rent-controlled units also receive implicit housing subsidies. However, no attempt was made to impute housing subsidies for these CUs. The reason is that data on rent-control are not available over the full five years that underlie the 2008 SPM thresholds. The CE began asking about rent-control in 2007 quarter two.

<sup>3</sup> See Garner and Hokayem (2011a) for a presentation of reported and predicted participation rates using the CPS data and probit models.

<sup>4</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.

School lunches and WIC are important for poverty measurement as their use has increased over the past several years (USDA 2007, 2008, 2010, 2011b). For example, in FY 2006, on average 30.1 million children per day received subsidized, reduced price, or free lunches compared to 31.3 million children per day in FY 2009 (USDA 2008, 2011). WIC participation also increased 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 (USDA 2007, 2010).

The remainder of this paper is as follows. 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 CPS Program Participation Method and the previously developed CE Eligibility Method; both are used to impute in-kind benefits to consumer units in the CE. Section IV describes the CPS ASEC estimation sample and presents logit 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-based model 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 Garner (2010a, c, d; 2011), food stamps are assumed to be included in reported 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.

It is assumed that in-kind benefits reflect consumption needs and are time-specific. Thus, when in-kind benefits are imputed, they reflect the value of benefits that were in effect around the interview period. For example, for consumer units who participated in a CE Interview anytime within the 2004 quarter two to 2005 quarter one time period, in-kind benefits reflect 2004 program participation or eligibility, and benefits. Interviews that took place anytime within the 2008 quarter two to 2009 quarter one period reflect 2008 eligibility and benefit levels.

Conclusions from this study are:

1. On average, the CPS Program Participation Method yields lower 2009 threshold values than the CE Eligibility Method for these tenure groups – overall, owners with mortgages, owners without mortgages. The differences are statistically significant for the overall sample at the 0.001 level, for owners with mortgages at the 0.01 level, and for owners without mortgages at the 0.10 level. The differences between the CE and CPS based thresholds are not statistically different for renters at these levels. CE based thresholds were expected to be higher since the imputed NSLP and WIC in-kind benefits were based on models of eligibility rather than participation.
2. Comparison of housing status thresholds

- a. SPM thresholds for owners without mortgages are statistically different from SPM thresholds for renters within both imputation methods at the 0.001 level.
- b. SPM thresholds for owners without mortgages are also statistically different from SPM thresholds for owners with mortgages within both imputation methods at the 0.001 level.
- c. SPM thresholds for owners with mortgages are not statistically different from SPM thresholds for renters within both imputation methods at the 0.10 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. All children who eat a lunch at school participate in the NSLP, and all lunches in NSLP are subsidized. Children qualifying for a free or reduced price lunch receive a larger subsidy. Children from families with income below 130 percent of the federal poverty guidelines are eligible for a free lunch, and children from families with income between 130 percent and 185 percent of the poverty guidelines are eligible for reduced price lunch. Children from families with income over 185 percent of the poverty guidelines pay full price, although their lunches are still subsidized to a small extent (USDA 2011).

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 as eating a lunch at school while other studies, unlike the USDA, 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. 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

racers. 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, or 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 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 Jackowitz 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 Jackowitz 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 to impute NSLP and WIC participation rates to consumer units in the CE: (1) The CPS Program Participation Method (Garner and Hokayem 2011a, b); and (2) The CE Eligibility Method (Garner 2010c, 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. The CPS Program Participation Method is described first, followed by the CE Eligibility Method.

#### **a. CPS Program Participation Method**

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 logit model is used to estimate NSLP participation, and a logit model is used to predict WIC participation.

The motivation for a multinomial logit 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 larger subsidy than those buying a school lunch that is not free or reduced price. An estimated cash value is added to resources for children reported as usually eating lunch at school. In the CPS, the reference person identifies the number of children who “usually” ate a hot lunch.<sup>5</sup> In a separate question, the reference person identifies the number of children who received a free or reduced price lunch.<sup>6</sup> The CPS instrument does not distinguish between children receiving a free lunch and children receiving a reduced price lunch. The answers to these questions are used to identify the three mutually exclusive alternatives for the multinomial logit model:

1. At least one child in the household ate a subsidized school lunch **and** the child 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 ate 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 lunch of any type.

Underlying the multinomial logit model is an additive random utility model where a household chooses the option yielding the highest utility. We do not observe the utility of each alternative, just the alternative chosen. The multinomial logit model is specified in the following way with a normalization for estimation:

$$\Pr(y = 1) = \frac{e^{X_i\beta^1}}{1+e^{X_i\beta^1}+e^{X_i\beta^2}} \quad (\text{Subsidized Lunch with a Free or Reduced Price})$$

$$\Pr(y = 2) = \frac{e^{X_i\beta^2}}{1+e^{X_i\beta^1}+e^{X_i\beta^2}} \quad (\text{Subsidized Lunch})$$

$$\Pr(y = 3) = \frac{1}{1+e^{X_i\beta^1}+e^{X_i\beta^2}} \quad (\text{No Subsidized Lunch}) \quad (1)$$

where  $y$  represents the three outcomes regarding school lunches. A probability for each outcome is estimated for each household  $i$ . The errors underlying the model are assumed to be independently and identically distributed with a Type-I extreme value distribution. The model produces coefficient estimates for each alternative ( $\beta^1, \beta^2, \beta^3$ ) that represent the attractiveness

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<sup>5</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>6</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?”

of that alternative relative to a base alternative (Cameron and Trivedi 2005). Alternative 3, “No Subsidized Lunch,” is the base alternative.

The motivation for the WIC logit 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 participated in WIC.<sup>7</sup> This question is used to determine the outcome of the logit model.

The logit model is specified in the following way:

$$\Pr(y = 1) = \frac{1}{1+e^{X_i\beta}} \quad (2)$$

where  $y$  is a dichotomous variable equal to 1 for WIC program participation and zero otherwise. The error for this model follows a Type-I extreme value distribution.<sup>8</sup>

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. Also included are annual dummy variables for 2005-2009, omitting the year 2005, and state fixed effects, omitting the state of Oklahoma. Both model specifications are estimated via maximum likelihood.  $X_i$  differs for each specification 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.

Table 1 lists the CPS explanatory variables and their definitions used in both the multinomial and logit model specifications. Beginning with 2008, the CPS ASEC began indentifying households in and not in the WIC universe. Prior to 2008, the CPS ASEC grouped households not in the WIC universe together with households reporting “No” in the responses to the question regarding whether anyone in the household participated in WIC in the last year. To create a consistent “No” response prior to 2008, households not in the universe were filtered from households reporting “No.” The reported participation rates for 2006 and 2007 CPS ASEC reflect this filtering in the summary statistics and the analysis in this paper.

#### b. CE Eligibility Method

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<sup>7</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?”

<sup>8</sup> See Cameron and Trivedi (2005) and Greene (1993) for a further discussion of multinomial logit and logit models.

The CE Eligibility Method is described in this section. This description is drawn from Garner (2011). A description of the program eligibility NSLP imputation is presented first, followed by the one for WIC. For the CE Eligibility Method, all consumer units identified to be eligible to receive benefits are assumed to participate in the programs.

The CE Eligibility Method is based on consumer demographics and information available about school meals in the CE Interview Survey data base, and U.S. Department of Agriculture (USDA 2011a) Nutrition Program eligibility guidelines and school meal values. The CE includes questions about expenses for school meals purchased for children ages 4 to 18. The CE information about school meals is used in the imputation of NSLP benefits for consumer unit children identified as eligible for reduced price meals or full price meals but not for free meals. According to USDA school lunch guidelines, students are automatically eligible to receive free meals if their family receives welfare or SNAP. A consumer unit is defined as program-eligible if the consumer unit reported receiving welfare benefits and/or participated in the food stamp program. For consumer units not program-eligible, school lunch income eligibility is imputed using the consumer unit's net income and the Federal poverty guidelines. Net income is computed as before-tax-money-income minus the value of food stamps, pension and retirement income, Supplemental Security Income (SSI), income losses from farm and non-farm rents, interest income, and other select income, for example, income from the care of foster children, and the cash values of fellowships and scholarships or stipends not based on working. If the consumer unit net income is below 130 percent of Federal poverty guidelines, school children in the CU qualify for free meals. If net CU income is between 130 and 185 percent of the federal poverty guidelines, the children qualify for reduced priced meals.

Like subsidized school meals, the CE does not collect information on WIC. To include a value for WIC benefits in the SPM thresholds, program eligibility is imputed and benefit values assigned to consumer units using USDA guideline for WIC eligibility (USDA 2011c). It is assumed that consumer units with children less than five years of age and mothers with children in this age group are automatically program eligible if the consumer unit receives welfare or SNAP benefits, or participates in Medicaid. If the consumer unit is not automatically program eligible, before tax money income, net of the value of SNAP benefits, is compared to the Federal poverty guidelines to determine income eligibility. Mothers and young children are considered income eligible for WIC if net incomes are at or below 185 percent of the poverty guidelines.

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

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. CE data to which the CPS program participation model coefficients are applied are collected in 2005 quarter two through 2010 quarter one; these data to refer to expenditures made in the previous three months of the interviews and essentially refer to the same time period as the CPS data, 2005 through 2009.

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 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>9</sup>

The universes for the CPS regression models for the NSLP and WIC rely on different income and demographic qualifications. The universe for the NSLP model comes from combining the universes of the two CPS questions used to generate the model alternatives outlined in the previous section. These questions cover a child eating hot lunch and the number of children who receive a free or reduced price lunch. To be in the universe for a child eating a hot lunch, a household must have a child between the ages of 5 and 18, inclusive. To be in the universe for children who receive a free or reduced price lunch, a household must have a child between the ages of 5 and 18, inclusive **and** a household income less than \$50,000. The CE NSLP universe sample includes all consumer units with a child between the ages of 5 and 18, inclusive **and** a consumer unit income less than \$50,000; income in this case is CE defined before tax money income minus the value of SNAP benefits.

The universe for the WIC model comes from the one CPS WIC question about whether anyone in the household participated in WIC. To be in this universe a household must meet an income requirement **and** a demographic requirement. The income requirement consists of household income less than \$25,000 for 1 person, less than \$35,000 for 2-3 persons, and less than \$50,000 for four or more persons. The demographic requirement consists of (1) a household having at least one female member age 15 or above and a child less than age 6 **or** (2) a household having at least one female member between the ages of 15 and 45.<sup>10</sup> The CE WIC universe sample is defined according to the same demographic requirements for the CPS.

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. In each case, means and standard errors are based on replicate weights using balanced repeated replication (BRR) with Fay's method in the case of the CPS and balanced repeated replication in the case of the CE.<sup>11</sup>

Tables 4 and 5 present the results of the multinomial logit and logit estimations, respectively.<sup>12</sup> Column 1 in Table 4 contains the estimates for the choice "Subsidized Lunch with a Free or

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<sup>9</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>10</sup> Defining the universe in this way also includes potentially pregnant women eligible for WIC.

<sup>11</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.

<sup>12</sup> Any household reporting negative income or zero income is changed to \$1 to facilitate taking the natural log for both model estimations.

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. Plots 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 (Figure 1) and the WIC samples next (Last Panel, Figure 1).<sup>13</sup> 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. 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.

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. 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.

## **V. Procedures to Impute In-Kind Benefits to CE Data**

School lunch and WIC benefits are imputed for each quarter of the CE data. Then they are added to expenditures for food, clothing, shelter and expenditures and annualized before the CPS thresholds are produced. The per person dollar value of benefits are the same for the CPS Program Participation and CE Eligibility Methods. However, the total values assigned to each CU differ based on the imputed participation rates for the CPS Method and to the imputed eligibility for the CE Method.

### **a. Benefit Levels**

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<sup>13</sup> The kernel density plots are generated using the proc KDE procedure in SAS with bandwidth multiplier of 3 and the over smoothed option for the smoothing parameter. The predicted probabilities are multiplied by 100 before generating the kernel density plots.

Included in the imputation of school meal values are payment rates per meal and commodity school lunch program values. Payment rates and commodity values are available online via the U.S. Department of Agriculture (USDA) web site (<http://www.fns.usda.gov/cnd/lunch/>).

Payment rates are set by the USDA per meal and differ based on the percentage of lunches that are free or reduced. For this study, average (over the 48 contiguous states) school lunch payment rates, 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, were assigned to each student. Payment rates are reflective of those that were in effect at the time of the CE interview. For example, for both the CE Method school lunch eligible and CPS Method school lunch participants, CUs participating in the CE survey from July 1, 2008 through June 30, 2009 were assigned a payment rate of \$0.26 for a “paid” (but not free or reduced) meal, \$2.19 for a reduced school lunch, and \$2.59 for a free lunch. The USDA refers to school meals as “paid” under the NSLP since all school-provided meals are subsidized at some level. Throughout the remainder of this paper, we refer to this group as “paid subsidized” or subsidized as opposed to free or reduced.

The commodity school meal program was created as part of the National School Lunch Act. The Act establishes the national average minimum value of donated foods for the school year to be given to states for each lunch served in the NSLP. As for the NSLP payment rates, the national average rate is assigned based on quarter in which the CU participated in the CE survey. For example, for the period July 1, 2008 to June 30, 2009, the commodity value was 20.75 cents for NSLP schools (*Federal Register*, 2008).

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>14</sup> Each person identified as being WIC eligible or as a WIC participant is assigned the average national food cost value for monthly WIC benefits; this value was multiplied by three to reflect the same time period as the quarterly expenditures reported in the CE data files. The average national monthly food cost for 2009, for example, was \$42.40 per person. WIC data are available on the USDA web site: <http://www.fns.usda.gov/wic/>.

## b. Assignment of Benefits to CUs

### 1. CPS Program Participation Method

For school lunch benefits, we use the NSLP and WIC model universe definitions outlined in Section IV to differentiate the free or reduced universe from the paid subsidized lunch universe when applying the CPS Program Participation Method. The procedure for imputing the school lunch benefit, described below for the CPS Program Participation Method, adds an

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<sup>14</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 assumed to be automatically included in reported food expenditures for the CE. 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>

expected paid subsidized lunch benefit and an expected free or reduced lunch benefit to each consumer unit with children of school age . These children are referred to as “eligible” for the NSLP. We impute the paid subsidized or reduced price lunch benefit to consumer units with school aged children (age between 5 and 18, inclusive). For the CPS Program Participation Method, we do not use the CE information on CU reported spending on school meals, but rely solely on the probabilities produced using the CPS estimated regression coefficients applied to the CE sample. We assume children receive NSLP meals 167 days per year, as do researchers at the Census Bureau who have imputed these benefits to resources for poverty measurement (e.g., Short 2011b and Short and Renwick 2010). We multiply the number of school aged children in the consumer unit (*#EligChild*) times the number of days receiving meals times the dollar amount per lunch (*Lunch Cost*). This value is then multiplied by the imputed probability for the CE sample using the regression coefficients from the CPS multinomial logit model (*Pr(SubLunch)*, choice 2 in Section III) to create a quarterly value. These quarterly values are added to quarterly expenditures for food, clothing, shelter and utilities and then annualized to produce the SPM thresholds, described later in this paper. So, for all consumer units with school aged children,

$$Paid\ Subsidized\ Lunch\ Benefit = Pr(SubLunch) \left[ \frac{\#EligChild * 167 * Lunch\ Cost}{4} \right] \quad (3)$$

We impute the free or reduced lunch benefits in a similar manner as the NSLP benefits using the CPS Program Participation Method, with two differences. First, the universe for the free or reduced lunch benefit consists of consumer units with school aged children who have household income less than \$50,000. Second, since the probability from the multinomial model represents free and reduced lunch together (*Pr(Free or Reduced)*, choice 1 in Section III), we use annual school lunch free and reduced lunch participation rates from the USDA to adjust the benefit amount. The free participation rate (*P(Free)*) and reduced participation rate (*P(Reduced)*) are obtained from the U.S. Department of Agriculture.<sup>15</sup>

Combining this information with the cost of reduced and free lunch (*Reduced Lunch Cost* and *Free Lunch Cost*) and assuming children receive a meal 167 days per year gives the free or reduced lunch benefit as

$$Free\ or\ Reduced\ Lunch\ Benefit = Pr(Free\ or\ Reduced) \times$$

$$\left[ \frac{(P(Reduced) * \#EligChild * Reduced\ Lunch\ Cost + P(Free) * \#EligChild * Free\ Lunch\ Cost) * 167}{4} \right] \quad (4)$$

<sup>15</sup> 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 (USDA 2007). 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 (USDA 2010).

For the CPS Program Participation Method, WIC predicted probabilities for consumer units in the CE are based on the CPS estimated binomial logit coefficients. Consumer units in the WIC defined universe, using the CPS questions as much as possible (described in Section IV) are assigned WIC benefits. For each consumer unit in the WIC universe, the predicted probability is multiplied by the number of members in the WIC universe sample (*#EligMemb*) times the average national food cost value for monthly WIC benefits (*WIC Monthly Benefit*). Monthly benefits are converted to quarterly benefits simply by multiplying by three. WIC benefits for the WIC universe sample are computed as follows,

$$WIC\ Benefit = Pr(WIC) \times \#EligMemb * WIC\ Monthly\ Benefit * 3 \quad (5)$$

## 2. CE Eligibility Method

The NSLP per meal and WIC average per person benefit amounts from the USDA (*Lunch Cost, Reduced Lunch Cost, Free Lunch Cost, and WIC Monthly Benefit*, used in equations 3-5) are also applied when imputing NSLP and WIC benefit levels for the CE Eligibility Method. As noted earlier, in the CE data file is a variable that identifies whether the consumer unit incurred expenditures for school meals.<sup>16</sup> This information is used to assign benefit levels to those defined as program eligible, based on program guidelines, to receive paid subsidized (but not free or reduced) meals and those identified as program eligible to receive reduced priced meals. Those identified as receiving free meals are based on program eligibility guidelines only. Benefits are only given to consumer units identified as program eligible using the CE Eligibility Method.

## 3. Other In-Kind Benefits

In addition to NSLP and WIC, other benefits are also included for each consumer unit before the SPM thresholds are produced. 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

## a. 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

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<sup>16</sup> The number of children for whom the CU paid for school meals was not used in earlier imputations of reduced-price meals for the production of the SPM thresholds (Garner and Hokayem 2011b).



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.

$$\text{One and two adults: } scale = (adults)^{0.5} \quad (6a)$$

$$\text{Single parents: } scale = (adults + 0.8 * firstchild + 0.5 * otherchildren)^{0.7} \quad (6b)$$

$$\text{All other families: } scale = (adults + 0.5 * children)^{0.7} . \quad (6c)$$

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.

#### b. 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). In this study, the imputed in-kind NSLP and WIC benefits are included in FCSU expenditures. As in earlier studies, SNAP benefits are assumed to be implicitly included in food expenditures and rent subsidies are also imputed and included. Thus, whenever “FCSU” is used in this paper, FCSU expenditures are assumed to include imputed subsidies for NSLP, WIC, SNAP, and rent subsidies, unless otherwise noted.

To identify the range around the 33<sup>rd</sup> percentile, 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 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 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  $j$  housing status group.

$Threshold_j =$

$$[(1.2 * FCSU) - (Shelter\&Utilities) + (Shelter\&Utilities)_j]_{\text{Within 30th to 36th percentile range}} \quad (7)$$

Variables  $FCSU$  and  $Shelter\&Utilities$  are the means for all consumer units within the range without distinction by housing status, while  $(Shelter\&Utilities)_j$  refers to the mean of shelter and utilities within the range by housing status group.

## VII. Thresholds

SPM thresholds and standard errors, based on the CPS Program Participation Method and the CE Eligibility Method, are presented in Table 8. All thresholds and standard errors are based on replicate weights; the BLS provides 44 replicates for the production of statistics for the CE data. Thresholds that include food stamps and rent subsidies are presented for comparison to those with imputed benefits for NSLP and WIC using the two methods. 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 2 shows the relative magnitude of the SPM thresholds.

Statistical tests are conducted to determine if thresholds based on the CPS and CE Methods are statistically different from each other, and whether there are differences between thresholds based on housing status within the imputation sets. The null hypothesis is that the difference is equal to zero. When comparing the CE and CPS based thresholds, a statistical test of differences in means for correlated data is used; see equation (8). The specification of the variance in the denominator accounts for the correlation of the CE and CPS subsamples. The test is applied, for example, by comparing the renter threshold based on the CPS Program Participation Method to the renter threshold based on the CE eligibility Method.

$$z_{\text{correlated}} = \frac{\bar{X}_j - \bar{X}_k}{\sqrt{\hat{V}(\bar{X}_j - \bar{X}_k)}} \quad (8)$$

where

$rep$  = replicate number

$j$  = CPS eligibility method

$k$  = CE program participation method

$$\hat{V}(\bar{X}_j - \bar{X}_k) = \frac{1}{44} \sum_{1,rep}^{44} [(\bar{X}_{j,rep} - \bar{X}_{k,rep}) - (\bar{X}_{j,Full\ sample} - \bar{X}_{k,Full\ sample})]^2 = \text{pooled variance}$$

When the samples are uncorrelated, as in the case of renters and owners with mortgages within the CE imputation set, for example, the z test statistic for uncorrelated data is used. See equation (9) below.

$$z_{un-correlated} = \frac{\bar{X}_j - \bar{X}_k}{\sqrt{\hat{V}(\bar{X}_j) + \hat{V}(\bar{X}_k)}} \quad (9)$$

where

*rep* = replicate number

*j* ≠ *k* housing type = renter, owners with mortgages, owners without mortgages

$$\hat{V}(\bar{X}_j) + \hat{V}(\bar{X}_k) = \frac{1}{44} \sum_{rep=1}^{44} (\bar{X}_{j,rep} - \bar{X}_{j,Full\ sample})^2 + \frac{1}{44} \sum_{rep=1}^{44} (\bar{X}_{k,rep} - \bar{X}_{k,Full\ sample})^2$$

The tests of statistical differences suggest the following:

1. On average, the CPS Program Participation Method yields lower 2009 threshold values than the CE Eligibility Method for these tenure groups – overall, owners with mortgages, and owners without mortgages. The differences are statistically significant for the overall sample at the 0.001 level, for owners with mortgages at the 0.01 level, and for owners without mortgages at the 0.10 level. The differences between the CE and CPS based thresholds are not statistically different for renters at these levels. CE based thresholds were expected to be higher since the imputed NSLP and WIC in-kind benefits were based on models of eligibility rather than participation.
2. Comparison of housing status thresholds
  - a. SPM thresholds for owners without mortgages are statistically different from SPM thresholds for renters within both imputation methods at the 0.001 level.
  - b. SPM thresholds for owners without mortgages are also statistically different from SPM thresholds for owners with mortgages within both imputation methods at the 0.001 level.
  - c. SPM thresholds for owners with mortgages are not statistically different from SPM thresholds for renters within both imputation methods at the 0.10 level.

The z scores for the statistical tests are shown in Appendix Table A.

### 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. To evaluate the new method, SPM thresholds were also produced using an earlier CE

Eligibility Method. In some cases, for 2009 thresholds, applying the CPS Program Participation Method to the CE sample resulted in lower thresholds than when the CE Eligibility Method was used. This was expected since it is well known that fewer people and families participate in in-kind benefit programs than are eligible. Statistical tests of differences in the CE and CPS paired thresholds suggest that SPM thresholds are statistically significantly different overall, for owners with mortgages, and for owners without mortgages. The matched pair of renter CE and CPS Method thresholds are not statistically significantly different from each other at the significance level applied in this study.

Another issue examined in this study was whether thresholds for owners with mortgages, owners without mortgages, and renters differ within imputation method. Statistical tests of differences in housing-specific SPM thresholds, within imputation method type group, reveal that housing tenure thresholds are statistically different for owners without mortgages compared to renters and for owners without mortgages compared to owners with mortgages.

While the CPS Program Participation Method and CE Eligibility Method offer ways to impute in-kind benefits in the CE, 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>17</sup> The price-adjusted thresholds would then be used by Census Bureau staff to produce poverty statistics based on the ITWG guidelines.

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<sup>17</sup> For a discussion of geographic adjustment methods and research, see Renwick (2009a,b, 2010, 2011). Also see Ziliak (2010).

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**Table 1: Explanatory Variables in Multinomial Logit and Logit 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 18, inclusive
<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=111,702) <sup>a</sup>		CE Interview 2005Q2-2010Q1 (n=41,767) <sup>b</sup>	
	Mean	Standard Error	Mean	Standard Error
<b>Head of Household/Reference Person Variables</b>				
Age	41.59	0.038	41.65	0.108
<b>Race</b>				
White, non-Hispanic	0.62	0.002	0.61	0.011
Black, non-Hispanic	0.14	0.001	0.15	0.006
Hispanic	0.18	0.001	0.19	0.011
Other race (excl. category)	0.06	0.001	0.06	0.002
<b>Gender</b>				
Male (excl. category)	0.47	0.002	0.41	0.005
Female	0.53	0.002	0.59	0.005
<b>Education</b>				
Low education (excl. category)	0.14	0.002	0.16	0.006
Medium education	0.76	0.002	0.58	0.006
High education	0.10	0.001	0.27	0.005
<b>Marital Status</b>				
Married (excl. category)	0.68	0.002	0.70	0.004
Widowed	0.03	0.001	0.02	0.001
Past marriage	0.17	0.002	0.16	0.003
Never married	0.12	0.001	0.11	0.003
<b>Employment</b>				
Not in labor force (excl. category)	0.18	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	0.65	0.002	0.68	0.004
<b>Household Variables</b>				
Household income	\$53,577	\$154	\$76,425	\$987
Household/Consumer Unit size	4.08	0.006	4.09	0.019
<b>Age composition of children</b>				
Number of children 5-10	0.75	0.003	0.72	0.006
Number of children 11-13	0.37	0.002	0.36	0.005
Number of children 14-18	0.61	0.003	0.63	0.006
<b>Public Assistance</b>				
Foodstamp	0.12	0.002	0.11	0.004
Welfare	0.03	0.001	0.02	0.001
Medicaid	0.29	0.002	0.15	0.005
<b>Residence</b>				
Urban	0.85	0.005	0.86	0.014
Rural (excl. category)	0.15	0.005	0.14	0.014
<b>School Lunch Participation (%)</b>				
Subsidized Lunch, FR	25.0%	0.002	19.4%	0.005
Subsidized Lunch	43.0%	0.002	46.7%	0.004
No Subsidized Lunch	32.0%	0.002	33.9%	0.004

<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/apds/techdoc/cps/cpsmar10.pdf](http://www.census.gov/apds/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=70,430) <sup>a</sup>		CE Interview 2005Q2-2010Q1 (n=22,051) <sup>b</sup>	
	Mean	Standard Error	Mean	Standard Error
<b>Head of Household/Reference Person Variables</b>				
Age	36.54	0.064	36.07	0.171
<b>Race</b>				
White, non-Hispanic	0.51	0.003	0.48	0.013
Black, non-Hispanic	0.19	0.002	0.21	0.009
Hispanic	0.24	0.002	0.25	0.015
Other race (excl. category)	0.06	0.001	0.05	0.003
<b>Gender</b>				
Male (excl. category)	0.37	0.003	0.28	0.006
Female	0.63	0.003	0.72	0.006
<b>Education</b>				
Low education (excl. category)	0.22	0.002	0.27	0.007
Medium education	0.75	0.002	0.62	0.007
High education	0.02	0.001	0.12	0.004
<b>Marital Status</b>				
Married (excl. category)	0.49	0.003	0.46	0.006
Widowed	0.03	0.001	0.03	0.002
Past marriage	0.18	0.002	0.18	0.004
Never married	0.29	0.003	0.32	0.007
<b>Employment</b>				
Not in labor force (excl. category)	0.26	0.002	0.28	0.006
Unemployed	0.08	0.001	0.02	0.001
Part-time	0.15	0.002	0.19	0.005
Full-time	0.51	0.003	0.52	0.006
<b>Household Variables</b>				
Household income	\$26,085	\$91	\$22,716	\$172
Household/Consumer Unit size	3.61	0.011	3.42	0.035
<b>Age composition of children</b>				
Number of children 0-5	0.57	0.004	0.55	0.01
<b>Public Assistance</b>				
Foodstamp	0.23	0.003	0.24	0.007
Welfare	0.06	0.001	0.05	
Medicaid	0.44	0.003	0.27	0.007
<b>Residence</b>				
Urban	0.82	0.007	0.83	0.021
Rural (excl. category)	0.18	0.007	0.17	0.021
<b>WIC Participation (%)</b>				
	14.6%	0.002	11.5%	0.003

<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/csxnth5.pdf>>.

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

VARIABLES	(1)	(2)
	Subsidized Lunch With A Free or Reduced Price	Subsidized Lunch
Age	-0.00427*** (0.00145)	-0.00100 (0.00108)
White, non-Hispanic	-0.401*** (0.0607)	-0.0553 (0.0388)
Black, non-Hispanic	0.527*** (0.0709)	0.211*** (0.0511)
Hispanic	0.824*** (0.0622)	0.210*** (0.0461)
Female	0.188*** (0.0285)	0.0246 (0.0208)
Medium education	-0.399*** (0.0403)	0.00950 (0.0367)
High education	-1.854*** (0.0914)	-0.364*** (0.0465)
Widowed	0.446*** (0.0862)	0.305*** (0.0607)
Past married	0.457*** (0.0393)	0.281*** (0.0294)
Never married	0.155*** (0.0481)	0.0566 (0.0354)
ln(household income)	-0.999*** (0.0273)	0.565*** (0.0278)
Household size	-0.0306* (0.0157)	-0.000230 (0.0107)
Number of children 5-10	0.601*** (0.0233)	0.244*** (0.0180)
Number of children 11-13	0.724*** (0.0232)	0.400*** (0.0197)
Number of children 14-18	0.247*** (0.0242)	0.0961*** (0.0167)
Foodstamp	0.782*** (0.0497)	-0.886*** (0.0652)
Welfare	-0.194** (0.0823)	-0.144 (0.105)
Medicaid	1.263*** (0.0317)	0.227*** (0.0278)
Unemployed	0.294*** (0.0706)	0.328*** (0.0489)
Part-time	0.0651 (0.0447)	0.159*** (0.0323)
Full-time	0.126*** (0.0379)	0.326*** (0.0287)
Urban	-0.538*** (0.0615)	-0.380*** (0.0468)
Constant	10.03*** (0.301)	-5.801*** (0.298)
Pseudo log-likelihood		-111,008.42
Pseudo R <sup>2</sup>		0.26
Observations		111,702

Table reports multinomial logit 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)>.

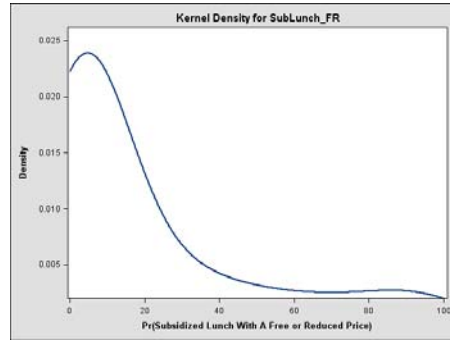
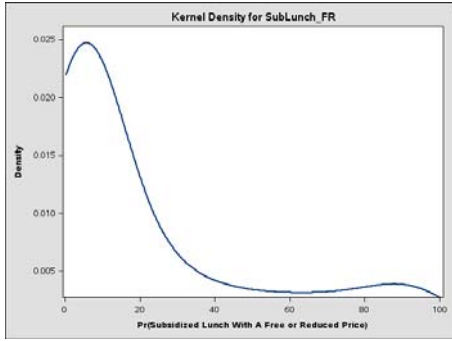
**Table 5: Logit Model for WIC Using CPS ASEC 2006-2010**

VARIABLES	WIC
Age	-0.0224*** (0.00182)
White, non-Hispanic	-0.100 (0.0699)
Black, non-Hispanic	0.0215 (0.0789)
Hispanic	0.481*** (0.0752)
Female	-0.114*** (0.0371)
Medium education	-0.0736** (0.0371)
High education	-0.871*** (0.188)
Widowed	0.205** (0.103)
Past married	-0.102* (0.0545)
Never married	-0.0591 (0.0456)
ln(household income)	-0.116*** (0.0231)
Household size	-0.0723*** (0.0137)
Number of children 0-5	1.333*** (0.0204)
Foodstamp	0.690*** (0.0438)
Welfare	0.168*** (0.0506)
Medicaid	1.502*** (0.0412)
Unemployed	0.0112 (0.0572)
Part-time	0.00716 (0.0481)
Full-time	-0.0926** (0.0412)
Urban	-0.240*** (0.0433)
Constant	-1.361*** (0.276)
Pseudo log-likelihood	-27,563.49
Pseudo R <sup>2</sup>	0.33
Observations	70,430

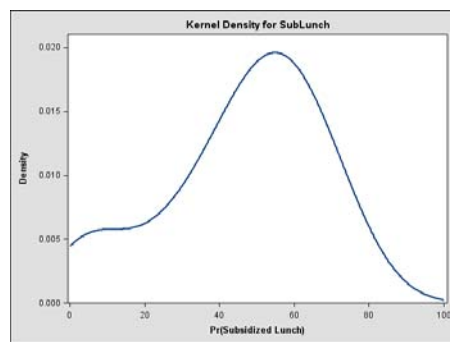
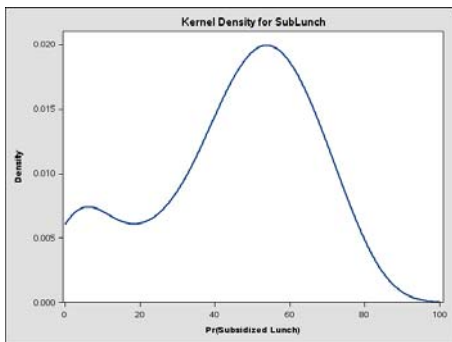
Table reports logit model estimates. State and year fixed effects are included. Standard errors are estimated using replicate weights (Fay's method). \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

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)>.

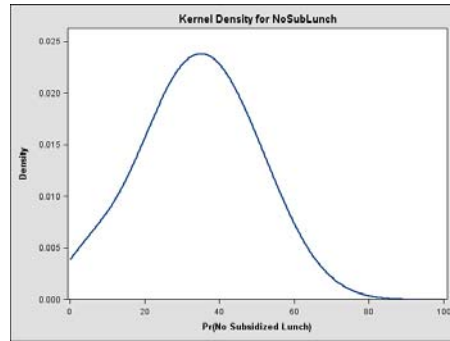
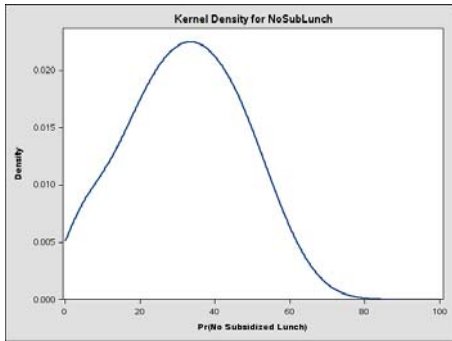
**Figure 1: Predicted Participation in NSLP and WIC Programs**



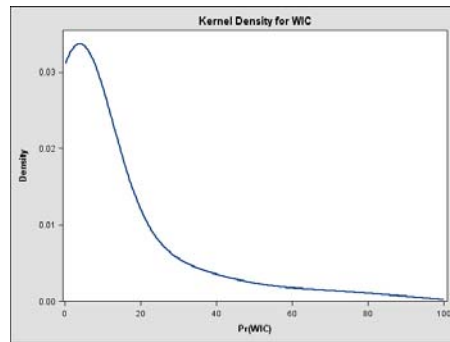
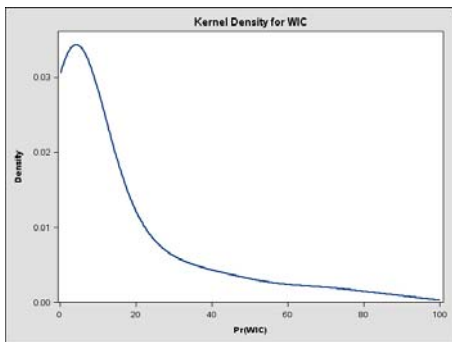
**Predicted Free or Reduced Lunch Participation: CPS ASEC 2006-2010 (left) and CE 2005Q2-2010Q1 (right)**



**Predicted Paid Lunch Participation: CPS ASEC 2006-2010 (left) and CE 2005Q2-2010Q1 (right)**



**Predicted No School Lunch Participation: CPS ASEC 2006-2010 (left) and CE 2005Q2-2010Q1 (right)**



**Predicted WIC Participation: CPS ASEC 2006-2010 (left) and CE 2005Q2-2010Q1 (right)**

**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	22,699	23.4%	45.6%	31.1%	15,594	13.4%
2005Q2-2006Q1	CE Interview	9,367	19.9%	47.3%	32.8%	5,157	10.9%
2007	CPS ASEC	22,393	22.9%	44.8%	32.3%	14,717	14.1%
2006Q2-2007Q1	CE Interview	8,436	19.6%	46.4%	34.1%	4,342	11.4%
2008	CPS ASEC	22,306	22.3%	44.8%	33.0%	13,040	15.1%
2007Q2-2008Q1	CE Interview	8,050	17.8%	47.3%	34.9%	4,172	10.6%
2009	CPS ASEC	22,173	23.7%	43.8%	32.5%	13,145	16.2%
2008Q2-2009Q1	CE Interview	7,940	18.7%	46.8%	34.5%	4,008	11.6%
2010	CPS ASEC	22,131	25.9%	42.9%	31.2%	13,934	16.4%
2009Q2-2010Q1	CE Interview	7,974	21.0%	45.6%	33.4%	4,372	12.8%
2006-2010	CPS ASEC	111,702	23.6%	44.4%	32.0%	70,430	14.9%
2005Q2-2010Q1	CE Interview	41,767	19.4%	46.7%	33.9%	22,051	11.5%

<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	8,532	21.7%	47.5%	30.8%	4,762	15.4%
2005Q2-2006Q1	CE Interview	3,547	17.8%	48.9%	33.4%	1,459	13.8%
2007	CPS ASEC	8,451	21.3%	46.6%	32.1%	4,550	16.1%
2006Q2-2007Q1	CE Interview	3,298	16.4%	48.7%	34.9%	1,236	14.8%
2008	CPS ASEC	8,145	20.2%	47.0%	32.8%	4,035	16.9%
2007Q2-2008Q1	CE Interview	3,163	14.7%	50.0%	35.3%	1,155	12.5%
2009	CPS ASEC	8,142	21.5%	46.1%	32.3%	4,056	18.4%
2008Q2-2009Q1	CE Interview	3,163	14.7%	50.0%	35.3%	1,155	12.5%
2010	CPS ASEC	8,117	23.9%	45.1%	30.9%	4,256	18.8%
2009Q2-2010Q1	CE Interview	3,133	18.7%	47.8%	33.4%	1,235	16.6%
2006-2010	CPS ASEC	41,387	21.7%	46.5%	31.8%	21,659	17.0%
2005Q2-2010Q1	CE Interview	16,312	16.9%	48.6%	34.4%	35,167	14.6%
2005Q2-2010Q1	CE Interview: in 30-35th FCSU range (threshold estimation sample) <sup>c</sup>	1,055	21.1%	46.4%	32.5%	1,055	5.9%

<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 18.1 percent, 39.8 percent, and 27.9 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**

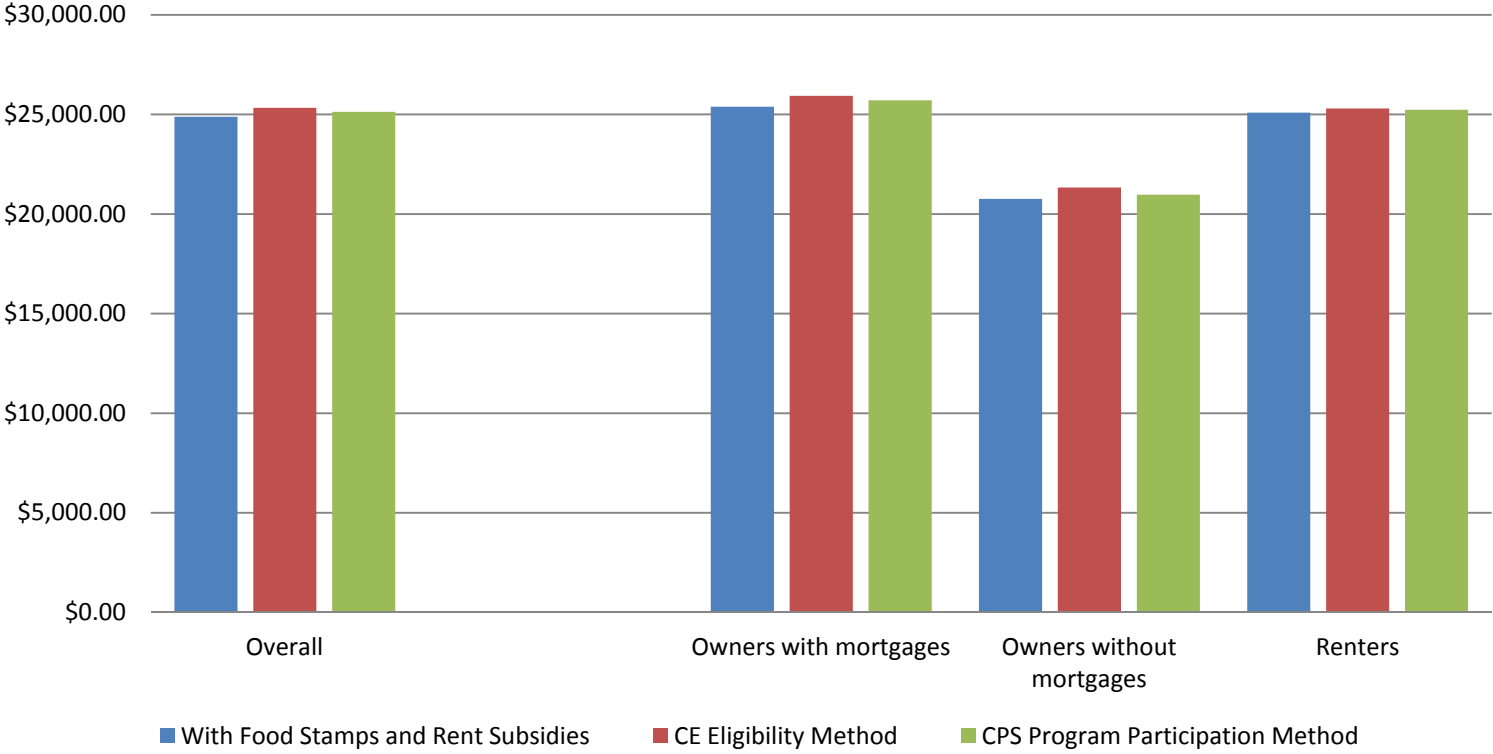
	2A+2C Consumer Units																	
	With Food Stamps and Rent Subsidies (n=1,063)						CE Eligibility Method Program Eligibility Guidelines + CE Characteristics (n=1,048)						CPS Program Participation Method CPS Logit Estimation+CE Characteristics (n=1,054)					
	30-36th percentile range of FCSU		Shelter + Utilities within FCSU 30- 36 range		FCSU Thresholds Std. Error		30-36th percentile range of FCSU		Shelter + Utilities within FCSU 30- 36 range		FCSU Thresholds Std. Error		30-36th percentile range of FCSU		Shelter + Utilities within FCSU 30-36 range		FCSU Thresholds Std. Error	
CU's with Two Children, FCSU																		
With Subsidies (adding values for CE- Based Rental Subsidies and CE- and CPS- Based NSLP and WIC Subsidies)																		
FCSU	\$20,734	\$210					\$21,107	\$206					\$20,942	\$206				
Food	\$7,132	\$130					\$7,459	\$103					\$7,311	\$116				
Clothing	\$1,149	\$48					\$1,162	\$44					\$1,155	\$55				
Shelter	\$8,715	\$197					\$8,706	\$189					\$8,751	\$189				
Utilities	\$3,738	\$83					\$3,780	\$78					\$3,725	\$79				
Other	\$4,147	\$42					\$4,221	\$41					\$4,188	\$41				
Treatment of shelter+utilities																		
Not accounting for housing status			\$12,453	\$211	\$24,881	\$252			\$12,486	\$203	\$25,329	\$247			\$12,476	\$199	\$25,131	\$247
Accounting for housing status																		
Owners with mortgages			\$12,962	\$202	\$25,389	\$257			\$13,090	\$165	\$25,933	\$222			\$13,055	\$184	\$25,709	\$253
Owners without mortgages			\$8,335	\$406	\$20,763	\$428			\$8,487	\$447	\$21,329	\$485			\$8,317	\$451	\$20,972	\$488
Renters			\$12,662	\$234	\$25,089	\$263			\$12,453	\$263	\$25,295	\$302			\$12,578	\$236	\$25,233	\$267

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 using CPS logit coefficients produced by Charles Hokayem in November 2011. Marisa Gudrais produced the standard errors, using replicate weights in November 2011.

**Figure 2: 2009 SPM FCSU Thresholds with and without Imputed Subsidies**



<b>Appendix Table A. Statistical Tests for Differences in Means: CE vs. CPS Subsidy Imputations for 2009 Year Thresholds</b>					
			<b>Difference in Means</b>	<b>Standard Error of Differences in Means</b>	<b>z-score</b>
<b>Correlated Data</b>					
<b><i>Between Paired CPS Program Participation and CE Eligibility Methods Thresholds</i></b>					
	Overall		-\$198	\$18	-11.14 ****
	Owners with mortgages		-\$223	\$83	-2.68 ***
	Owners without mortgages		-\$357	\$185	-1.93 *
	Renters		-\$62	\$95	-0.66
<b>Uncorrelated Data</b>					
<b><i>Between Housing Type Thresholds within CPS Program Participation Method</i></b>					
	Owners with mortgages & Renters		\$476	\$368	1.30
	Owners with mortgages & Owners without mortgages		\$4,738	\$550	8.62 ****
	Renters & Owners without mortgages		\$4,261	\$556	7.66 ****
<b><i>Between Housing Type Thresholds Within CE Eligibility Method</i></b>					
	Owners with mortgages & Renters		\$637	\$375	1.70
	Owners with mortgages & Owners without mortgages		\$4,603	\$533	8.63 ****
	Renters & Owners without mortgages		\$3,966	\$571	6.95 ****
Standard errors are estimated using replicate weights. **** $p < 0.001$ , *** $p < .01$ , * $p < 0.1$					