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# NSLP/SBP Access, Participation, Eligibility, and Certification Study

# Erroneous Payments in the NSLP and SBP

# Volume II: Sampling and Data Analysis Appendices

United States Department of Agriculture
Food and Nutrition Service

November 2007

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# Volume II: Sampling and Data Analysis Appendices

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**Appendix**

# APPENDIX A

# SAMPLE DESIGN AND SELECTION

The APEC study used a multistage sample design, which first sampled SFAs, then schools served by the SFAs, and then children who attend the sampled schools. Substantive data for the study were obtained from the entities at each of these levels of sampling.

The primary sampling unit (PSU) in the multi-stage design was the SFA. In the first step of sampling, 191 PSU equivalents (some PSUs selected with certainty were large enough to count as two PSU equivalents so there were 189 unique SFAs) were subselected from a sample of 2,500 SFAs that had been selected as part of another project.[1] The SFAs in the larger sample had been screened to determine eligibility and to obtain information about their participation in the National School Lunch Program and School Breakfast Program.

The 191 sampled PSU equivalents were divided randomly into 99 main selections and 92 replacement selections. The process for dividing the PSUs into main and replacement selections is described below in Section A.1. The replacement selections were to be contacted when main selections chose not to participate in the study. The original design called for a final sample of 100 PSU equivalents. Because of budget constraints, the final sample had to be reduced to 80 PSU equivalents. So after the initial sample was selected and divided into main and replacement selections, we selected a subsample so that the main sample comprised 87 PSU equivalents (85 unique SFAs) with the expectation that with non-response the responding sample would comprise 80 PSU equivalents. We refer to this process below as "sampling down."

[1]As part of a separate contract (the National School Lunch Program Sample Frame Construction Project), a sample of approximately 2,500 districts was selected with probabilities proportional to size (PPS) with the measure of size (MOS) being the square root of enrollment; those districts were screened for their SFA status in order to compile a sample frame of SFAs. Because no complete sample frame of SFAs is available, the sampling work began by drawing a sample of *school districts* using the Common Core of Data (CCD), a comprehensive database on school districts and schools maintained by the U.S. Department of Education. In more than 90 percent of instances, the school district and the SFA are the same. However, in a nontrivial number of instances they are not, either because the same SFA serves several districts, because the district does not participate in the NSLP, or for other reasons. The set of SFAs resulting from this project will be referred to as the "NSLP sample" in this memo.

Within each SFA that was sampled and agreed to participate in the study, a sample of schools was selected, the number of schools depending on whether the SFA represented more than one PSU equivalent, and whether any schools in the district participated in Provision 2 or Provision 3. If there were enough schools in the district, the sampled schools were designated as main or replacement selections with the replacements being used if main selections did not participate.

Students attending sampled schools were sampled from records provided by SFA offices or schools participating in the study. Independent samples were selected from two sets of records: (1) lists of applicants for free or reduced-price meal benefits or students directly certified for free or reduced-price meals and (2) benefit issuance lists. The applicant sample included both certified and denied applicants. The sample from the application lists was used to collect application data. The benefits issuance sample was used to collect data for validating the accuracy of school's benefit issuance lists. In addition, samples were selected of cashier meal transactions at schools.

The sample for the household interview was a subsample of the applicant sample. Samples of applications certified for free or reduced-price meals were selected throughout the year, but denied applicants were selected for the household survey only during the initial months of the school year. Some student households were selected to be interviewed a second time as part of a panel survey, but the panel only included those certified for free or reduced-price meal benefits.

The remainder of the appendix provides additional detail on how the APEC sample was selected.

## 1. Selecting SFAs

The SFA sample was selected in three steps: first, an initial sample of SFAs was selected; second, the sample was divided into main and replacement selections; third, we sampled down to 80 main selections, by selecting a subsample of SFAs from the initial sample. In the sampling down process, SFAs retained their status as main or replacement selections.

The NSLP sample constructed under another project served as the frame for selecting the required sample of SFAs under the APEC contract. In other words, the APEC sample of SFAs is a subsample of the NSLP sample. The NSLP sample had been selected with probability proportional to the square root of SFA enrollment. However, it was decided that the use of this MOS was not optimal for APEC. Thus, in selecting the APEC SFAs, we set the probabilities of selection so that when schools were selected within SFAs using PPS selection (with the MOS being total school enrollment), and students were selected with equal probability within schools, the overall probabilities of selection of students would be approximately equal across SFAs. One way of thinking of this subsampling procedure is that it had the effect of making the resulting sample of SFAs a PPS sample with the MOS being the number of students enrolled in schools served by the SFA (rather than the square root).[2] In selecting the SFAs, the sample was explicitly stratified by whether SFAs were large enough to be selected with certainty. The noncertainty stratum was stratified on whether or not they were expected to have schools in Provision 2 or 3, and implicitly stratified on region, poverty, and SBP participation. The sample

[2]In the sampling procedure we employed, we essentially made the resulting sample have the property of probabilities of selection proportional to total enrollment. The reason for switching back and forth on the issue of whether to use the square root of enrollment or actual enrollment as the measure of size is that we were attempting to optimize the tradeoff between variances in the *SFA* analysis, variance in the *school* analysis and variances in the *student* analysis. We originally thought that the square root measure of size might yield the best results, but tabulations based on the screening sample suggested that a measure based on total enrollment would better meet the study's needs.

was selected with SAS PROC SURVEYSELECT, using the probability minimum replacement (PMR), also known as the Chromy, procedure.

The distribution of the APEC sample of SFAs is presented in Table A.1. Eleven SFAs were large enough to be selected with certainty into the initial sample and eight of these were large enough to be certainty selections for the main sample[3]. Two of the certainty selections, New York City and Los Angeles, were large enough to be assigned "double" numbers of schools and students. Because these two received double allocations they are counted as the equivalent of 2 SFAs each. Because of the "double hits," the sample of 191 PSU equivalents, before division into main and replacement subsamples contained 189 unique SFAs; after division, the main sample included 97 unique SFAs, but 99 PSU-equivalents. For the initial noncertainty

TABLE A.1

DISTRIBUTION OF SFA SAMPLE
(PSU Equivalents In Parentheses)

| | Main Sample | | | Replacement Sample | | | |
|---|---|---|---|---|---|---|---|
| SFAs | P23 | Other | **Total** | P23 | Other | Total | **Total** |
| A. Initial Sample | | | | | | | |
| 1. Certainty | 4 (6) | 4 (4) | **8 (10)** | 1 (1) | 2 (2) | 3 (3) | **11 (13)** |
| 2. Other | 14 (14) | 75 (75) | **89 (89)** | 14 (14) | 75 (75) | 89 (89) | **178 (178)** |
| **Total** | 18 (20) | 79 (79) | **97 (99)** | 15 (15) | 77 (77) | 92 (92) | **189 (191)** |
| B. After "Sampling Down" | | | | | | | |
| 1. Certainty | 3 (5) | 2 (2) | **5 (7)** | 0 (0) | 0 (0) | 0 (0) | **5 (7)** |
| 2. Other retained | 12 (12) | 65 (65) | **77 (77)** | 12 (12) | 65 (65) | 77 (77) | **154 (154)** |
| 3. Other reserve | 1 (1) | 2 (2) | **3 (3)** | 0 (0) | 3 (3) | 3 (3) | **6 (6)** |
| **Total** | **16 (18)** | **69 (69)** | **85 (87)** | **12 (12)** | **68 (68)** | **80 (80)** | **165 (167)** |

[3]Designation as a certainty selection in a PPS sample is based on the expectation that a PSU is "certain" to be selected. A threshold for certainty selection is (usually set at 80 or 90 percent of) the sampling interval *(I)*, $I = \sum_{All\ PSUs} MOS_{PSU} / n_{PSU}$ where $n_{PSU}$ is the number of PSUs to be selected. Because the main sample is approximately half as large as the initial sample, the sampling interval and, hence the threshold MOS for certainty selection is larger; hence, only 8 of the 11 were retained with certainty for the main sample.

selections, and for the SFAs selected with certainty for the initial sample but not large enough to be designated as main selections with certainty, pairs were formed and one of each pair was randomly (that is, with equal probability) assigned to be part of the main sample and one the replacement sample.

For the SFAs initially selected with certainty but not retained with certainty for the main sample, pairs were formed based on geography. For the noncertainty selections, pairs were formed of SFAs selected from adjacent sampling zones, because the zones were based on stratification criteria. Thus, SFAs in adjacent zones should have similar characteristics.[4]

After the selection of the initial sample of SFAs and division into main and replacement samples, budget constraints required reduction of the sample. In the sampling down step, we selected a subsample that comprised the certainty selections (5 certainty selections, all main selections, accounting for 7 SFA-equivalents), and 77 pairs of noncertainty selections. In addition, 3 pairs of noncertainty SFAs were randomly selected to be part of a reserve sample in case nonresponse among the other retained SFAs led to fewer than 80 participating.

## 2. Selecting Schools

The APEC school sample includes both public and private schools. The sampling frames used for public schools were either the Common Core Data (CCD) frame of public schools or lists provided by the SFAs themselves. The frame for private schools was a commercial list obtained from a private source, Quality Education Data (QED). Private schools were sampled

[4]SFAs in a pair are predominantly found in the same region, and tend to be similar with regard to presence of a school breakfast program, use of Provisions 2 and 3, and poverty level.

from among those located within the boundaries of a sampled SFA, based on the ZIP code of the private school's location.

Schools are the unit of analysis for the counting and claiming data collection and serve as an intermediate sampling stage or unit for the selection of students for the household survey and application data abstraction. We oversampled schools participating in Provisions 2 or 3 (P23 schools) to support comparative analysis of P23 and non-P23 schools on erroneous payments outcomes.

The selection of private schools also led to the collection of additional SFA data. Some private schools served as their own SFA. Other private schools were part of larger nonpublic SFAs, who were asked to provide SFA data.

The number of public schools selected in an SFA depended on whether the SFA was large enough to represent multiple PSUs (New York City and Los Angeles) and for other SFAs, whether or not there were P23 schools in the SFA. In Los Angeles and New York City (each representing 2 PSU equivalents) public schools were selected in multiple stages. In Los Angeles we selected two areas of the city with PPS; within each area we sampled 12 schools and randomly picked half to be main selections and half to be replacements for a total of 12 main selections. In New York, we first sampled two of the five boroughs with PPS; next we selected two areas in each of the two sampled boroughs. In each area we sampled six schools and randomly assigned two to be main.[5] After data collection began, we randomly selected two of the main schools to be dropped from the sample. Thus the final total of main selections was six in New York. In New York, we also selected four private schools, two of which had NSLP/SBP

[5]We only retained six public schools in New York because it was the last district we selected schools from; we could not find any P23 base-year schools, and had already hit our targets on NP23 and P23 non-base schools; we thus limited the selections because of cost pressures and scheduling factors.

and agreed to participate so we collected data from eight schools in the New York district. In other SFAs, for non-P23 districts, we sampled six public schools (three main, three replacements) if the district had six or more schools. In districts with fewer than six schools, we sampled all of them and if there were more than three, designated three as main selections and one or two as replacements.

In P23 districts our target number of schools depended on whether all schools were P23. In all, there were 17 districts that had P23 schools (19 district-equivalents). We sent the P23 districts lists of schools and asked them to annotate which were P23, and if P23 which were in their base year and non-base year. In districts where we had already sampled, we asked the district whether any schools were added or closed in the past two years, and made reselections if there were new schools. Our target was to select more P23 schools than non-P23 schools from the P23 districts, and select more P23 base-year schools than non-base year schools.

Schools were selected within SFAs with PPS (size was measured by the estimated number of free or reduced-price certified students); after the schools were selected, the target number of schools (unless there were fewer than that selected) were randomly assigned to be main schools and the remainder as replacements; the replacement schools were used in case the main selection would not participate or had closed or become ineligible.

We selected two private schools in each of our sampled districts where there were at least two private schools; if a district had only one private school we sampled it. The exceptions were New York and Los Angeles, where we selected four each (because each of these counts as the equivalent of two districts).[6] We selected the private schools PPS using the Chromy method; the

[6]In both New York and Los Angeles, we selected private schools in the areas selected within the SFAs.

MOS was total students. The public school SFAs were the explicit strata. Implicit strata within SFAs were based on whether the school is Catholic, and by level (elementary or secondary).

Private schools were sampled in all SFAs in the sample (including alternate SFAs). We formed three random replicates of SFAs. The initial set of private schools to be contacted were those in "main" SFAs that had been assigned to the first replicate. We worked the first replicate and were finding few schools that participated in NSLP or SBP, so we released the full sample and made screening calls to each to see if it had the NSLP or SBP. Our target was to recruit approximately 10 to 15 private schools. From an initial sample of 200 private schools selected that were located within the areas of public school SFAs that agreed to participate[7], we identified 32 schools or dioceses that told us they operated the SBP or NSLP. We were able to obtain cooperation from 10 private schools. Seven of the 32 schools only had a few certified students or did not participate in the SBP or NSLP at all and so were given "ineligible" status. One other district was dropped because of Hurricane Katrina. A total of eight schools were ineligible. The remainder of the schools (14) refused our invitation to participate. The most common reasons given for refusing were because the study was not mandatory or confidentiality statutes.

### 3. Selecting Students and Meal Transactions

We selected samples of three groups of applicants from study schools, samples of students from the school's Benefit Issuance Lists, and samples of cashier meal transactions. The applicant samples were:

- Certified Applicants for Household Survey and Application Data Abstraction, selected mostly in the early part of the school year (September through November); but also throughout the school year ("newly certified applicants"); these samples were selected from non-P23 schools and P23 schools in their base year.

[7]In two public SFAs that ultimately did not participate, we selected one private school.

- Denied Applicants for Household Survey and Application Data Abstraction were sampled from the same schools as approved applicants; these were sampled only in the early part of the school year (September through November).
- Denied and Certified Applications for P23 Application Data Abstraction Only, sampled in all P23 schools; in base year P23 schools, this sample was selected independently of the samples for household surveys.

In selecting samples of students from School's Benefits Issuance Lists, some P23 schools not in their base year (that is, both SBP and NSLP were P23 non-base year programs) did not have such lists. The samples of cashier meal transactions were selected during breakfasts and lunches on a randomly selected day of the week at each study school.

For each study school that had a meal program that was either non-P23 or P23 base year, we selected for the household survey, (1) 20 certified students (10 main, 10 replacements) and 4 denied applicants (2 main, 2 replacements), and (2) 6 newly certified students (2 main, 4 replacements). Regarding the certified initial sample, our target was to complete 9 - 10 certified household surveys. Field staff were told to release the 10 main selections for the approved applicants, and if they encountered nonresponse, release up to 2 replacements, and then contact MPR field coordinators before going any deeper into the replacement sample. Similar procedures were followed for the denied applicants.

There was no replacement sample for the P23 application abstraction-only samples. At P23 schools that were base-year, we selected an additional sample of 16 certified and 4 denied applicants (independently from the 20 certified and 4 denied applicants sampled for the household survey component.) At P23 schools that were non-base year, we selected 16 certified and 4 denied applicants from the base year (not current school year).

Because we were also interested in examining change in eligibility during the school year, we selected a sample of certified students for a second household survey as part of the certified panel sample. The certified panel sample consists of all certified households that were sampled

and completed the initial CAPI household survey. This included newly certified households. There were two exceptions. We did not include: (1) Hurricane Katrina or Hurricane Rita households, since we did not ask about income sources or amounts in the first interview, because of the sensitivity of their situation; and (2) households in which the target child transfers out of the school district (if they change schools but remain in the same district, then we include them, however).

Our target was to sample 1,000 certified student-households and complete 800 certified panel interviews during the remainder of the school year (November 2005 – June 2006). Before selecting the first panel sample, all certified student households from the initial sample (September and October) were randomly assigned to one of eight months (December 2005 to July 2006). Newly certified students were given a chance of selection by first assigning them to one of the months remaining in the panel period. For example, a newly certified student whose family was interviewed in November could be assigned to panel months January through July. Each month's panel sample was selected from student-households that had been randomly assigned to that month. We sampled and released approximately 125 cases each month, and completed telephone interviews with 100 certified households per release on average. (Because we were approximately one month late implementing the panel data collection, we initially released two samples, the November 2005 and December 2005 samples and began interviewing them in January 2006).

# APPENDIX B

# CONSTRUCTING ANALYTIC WEIGHTS FOR APEC DATA

Weights were constructed at three levels: school food authorities (SFAs), schools, and students. The weights at the three levels are not independent. In general, the final weight for the SFA served as the initial weight at the school level and the final school weight served as the initial weight for the student-level data. At the SFA level, we constructed two weights. One weight that included only public SFAs served as the base weight for the school weights; and the other that also included private SFAs was used to make national estimates regarding SFAs. For schools, a basic weight was constructed that was used for national estimates and as the basis for student level weights. In addition, five sets of weights were constructed at the school level for analysis of noncertification error: benefit issuance error, cashier error, point-of-sale aggregation error, school-to-SFA report aggregation error, and SFA-to-state-agency meal claim aggregation error. At the student level, weights were constructed for application data, the baseline household survey and the panel survey, and these weights were post-stratified in order that our sample-based sums of the number of certified students and dollar amounts of SBP and NSLP meal reimbursements in error would equal national totals.

These weights are described in the remainder of this appendix. The discussion of weighting frequently refers to the sample selection process, which is described in Appendix A.

## A. SFA LEVEL WEIGHTS

There are two sets of SFA-level weights. The first, for public SFAs, served as the basis for computing school-level weights, and private SFA weights. The second included private SFAs, which are either private schools that operate independently or larger nonpublic SFAs (such as a Catholic diocese) that serve private schools under their jurisdiction. The second set of weights was used for making SFA-level estimates.

We first discuss the weights of the public SFAs, and then the weights for private SFAs, which use the public SFA weights as their initial weighting factor.

## 1. Public SFA Weights

The initial weight at the (public) SFA level is the selection weight from the NSLP sample, adjusted for eligibility in the NSLP survey. (The NSLP sample was used as the frame for APEC.) We used the sampling weight from NSLP, rather than the NSLP final weight, because the final weight was adjusted for non-response to NSLP, but we had sampled (NSLP) non-responders for APEC. The SFA weight also incorporates:

- The inverse of each SFA's probability of selection into the initial APEC sample
- The inverse of each SFA's probability of being retained (or kept as a reserve) in the sampling down process
- Adjustments to reflect the release of reserve SFAs
- Adjustments for selection into the main sample, including adjustments for replacements that were used in the final sample of SFAs
- Adjustments for non-response not accounted for by the above adjustments for release of replacements
- Post-stratification to externally estimated totals of all SFAs

The initial weight for the *kth* SFA participating in the study was:

*(1)* $W0SFA_k = Wgtsel(NSLP)_k * Erate(NSLP)$

where $Wgtsel(NSLP)_k$ is the SFA's sampling weight for the NSLP sample and *Erate(NSLP)* the eligibility rate for the NSLP survey as determined when that study was done.[1]

The next weighting factor adjusts for differing probabilities of selection into the initial APEC sample.

[1] Some school districts in the NSLP sample did not have SBP or NSLP programs.

*(2)* $W1SFA_k = 1/P1_k$

where:

$P1_k$ is the probability of selection from the NSLP frame to the initial sample

$P1_k = 1.0$ for (initial) certainty selections

$P1_k = \frac{a(non)_h MOS_{kh}}{\sum_{all\ in\ h} MOS_{kh}}$ for (initial) non-certainty selections

where:

$MOS_{kh}$ is the measure of size for the SFA, described in Appendix A.

$a(non)_h$ is the number of SFAs selected in stratum *h*.

The next step adjusted for the sampling-down process. As described in Appendix A, five initial certainty selections were retained with certainty. From the 92 pairs formed of other initial certainty selections and the noncertainty SFAs, we selected a random subsample of 80 pairs of SFAs; 77 pairs were retained for the reduced sample, and 3 pairs designated as reserves.

(3) $W2SFA_k$ = 1 for the SFAs retained with certainty

= $W2aSFA_k$ * $W2bSFA_k$ for others

$W2aSFA_k = 1/PRETAIN$

where:

$PRETAIN = 80/92$ is the probability of a pair being retained or designated a reserve SFA

$W2bSFA_k = (77 + n\_res\_used)/80)$ = 1 (reflecting the release of all 3 pairs reserve SFAs)

*n_res_used* is the number of reserve pairs where one or more SFAs was released

Among the pairs of SFAs, one was randomly selected as the "main" SFA and the other as a "replacement" to be contacted if the main selection did not participate. The next adjustment will

account for this subselection and for nonresponse if any within the pair. For the initial five certainty selections retained with certainty after sampling down, the adjustment factor is:

(4) $W3SFA_{kj} = 1$

The values of this factor, $W3SFA_{kj}$ for (noncertainty) pairs of SFAs are shown in Table B.1. The subscript *j* refers to the pair.

TABLE B.1

VALUES OF $W3SFA_{kj}$ FOR PAIRS OF SFAs

| Within A Pair | | |
|---|---|---|
| Released | Completed | *W3SFA* |
| 1 | 1 | 2 for the released SFA (based on *1/p ; p = 1/2*); 0 for the other |
| 2 | 0 | 1 for each of the SFA |
| 2 | 1 | 2 for the completed SFA *(1/p x 1/rr* where *p = 1 and rr = 1/2);* 0 for the other |
| 2 | 2 | 1 for each of the SFAs |

Includes initial non-certainty and initial certainty SFAs that were not retained with certainty.

(The sum of $W3SFA_{kj}$ for a pair will always = 2; when only one district in a pair was released, $W3SFA_{kj}$ reflects subsampling within the pair; if both were released the weight reflects no subsampling within the pair, but if one of the pair was not completed, $W3SFA_{kj}$ reflects non-response within the pair.)

Only two pairs of SFAs fell into the category of 2 released, 2 completed. In two pairs of SFAs an unusual situation occurred. The "main" SFA refused to participate but a private school already had been sampled and participated in the study. So for weighting public SFAs, schools, and students, $W3FSA_{kj}$ was assigned as if 2 SFAs were released and 1 completed. However, for weighting private SFA schools and students, they were treated as having 2 released and 2 completed.

The next step was to form cells to adjust for nonresponse (not already accounted for). Variables used for forming nonresponse cells are those used in stratifying the sample (size, presence of Provision 2 or Provision 3, poverty, and so on).

To compute this nonresponse factor we first defined a preliminary weight:

(5) $PREWT_k = W0SFA_k * W1SFA_k * W2SFA_k * W3SFA_k$

Four cells were defined for the response rate adjustment based on whether the SFA was sampled as P23 and two regions.[2]

(6) $$RRADJ_c = \frac{\sum_{releasedSFAs \in c} PREWT_k}{\sum_{compSFAs \in c} PREWT_k}$$

The SFA weight adjusted for nonresponse is:

(7) $PREWT_k * RRADJ_p$.

Finally, the public SFA weights was post-stratified:

(8) $WGTSFAPS_k = WGTSFANR_k * PSF_{PUB}$

where:

(9) $PSF_{PUB}$ (post-stratification factor) = 14478/ $\sum_{\substack{Public\ SFAs \\ responding}} WGTSFANR_k$ for public SFAs

## 2. Private SFA Weights

In addition to SFAs that are public school districts, there are two types of SFAs for which SFA data were collected and hence, weights were needed:

- Private schools that operate independently are treated as their own SFAs
- Nonpublic districts (for example, Catholic dioceses) that serve as SFAs for some private schools in the sample

[2]The "West" region comprised the FNS Mountain, Southwest and Western regions; all other FNS regions were defined as "East" for this adjustment.

The weights for private schools that operate independently as SFAs are the same as their basic school weights, discussed below. The weights for the nonpublic districts were based on the nonresponse adjusted weight for the public SFA in which they are located. The private SFA weight before post-stratification is:

(10) $WGTPRE_j$ = $WGTSFANR_k$ for the public SFA where $j$ is located if $j$ is a nonpublic district

= School weight if $j$ is a private school acting as its own SFA

The ratio adjustment factor and final weight for private SFAs were the preliminary weight multiplied by a post-stratification factor:

(11) $$PSF_p = 5118 / \sum_{\substack{\text{Private SFA} \\ \text{responding}}} WGTPRE_j$$

(12) $WGTSFAPS_k = WGTPRE_k \; PSF_{pri}$

## B. BASIC SCHOOL-LEVEL WEIGHTS AND NONCERTIFICATION ERROR WEIGHTS

School-level weights were calculated somewhat differently for public and private schools. In this section, we first describe the basic weighting for public schools and then for private schools. We then describe the weights for school-level noncertification error estimates.

### 1. Basic School-Level Weights for Public Schools

The initial weight ($WOSCH_{ijk}$) for any public school $i$ in stratum $j$[3] and $SFA_k$ is the variable $WGTSFAPS_k$ for the public SFA of which the school is part. The first adjustment factor,

[3]The notation is general, not all samples were explicitly stratified within SFA: where there was no stratification $j$ is a constant and the weights are calculated as if there was one stratum.

$W1SCH_{ijk}$ is the inverse of the probability of the first phase of selection of the school within its SFA. Schools were selected with PPS and some were large enough to be selected with certainty. Thus:

(13) $W1SCH_{ijk} = W1a_{ijk} * W1b_{ijk} * W1c_{ijk}$

(14) $W1a_{ijk} = 1/P_{boro}$ for schools in New York City

$= 1.0$ otherwise,

(15) $P_{boro} = 2 \sum_{\text{schools in boro}} MOS_{ijk} / \sum_{\text{schools in city}} MOS_{ijk}$

where:

$MOS_{ijk}$ is the measure of size for the school (see Appendix A)

(16) $W1b = 1/P_{area}$ for schools in Los Angles, Chicago and the sampled boroughs of New York

$= 1.0$ otherwise

(17) $P_{area} = n_{area} \sum_{\text{schools in area}} MOS_{ijk} / \sum_{\text{schools in city}} MOS_{ijk}$ for Los Angeles and Chicago

(18) $P_{area} = 2 \sum_{\text{schools in area}} MOS_{sch} / \sum_{\text{schools in boro}} MOS_{sch}$ for New York

where:

$n_{area}$ is the number of schools selected in the area.

The final factor of $W1SCH_{ijk}$ is:

(19) $W1c_{ijk} = 1/PSCH_{ijk}$

where:

$PSCH_{ijk} = 1$ if school is selected with certainty

$$PSCH_{ijk} = \frac{n'_{jk} MOS_{ijk}}{\sum_{ijk=1}^{N'_{ijk}} MOS_{ijk}}, \text{ otherwise}$$

$n'_{jk}$ is the number of noncertainty selections made in stratum $j$, $SFA_k$

$N'_{jk}$ is the number of schools available for noncertainty selection with PPS in $j$ and $k$

$MOS_{ijk}$ is the measure of size for the *ith* school in stratum $j$ in $SFA_k$
(and in area for New York, Los Angeles, and Chicago)

The next factor, $W2SCH_{ijk}$ accounts for subselection of public schools into the main and replacement samples and for release of schools.

In all SFAs we computed:

(20) $W2SCH_{ijk} = 1/Prel_{jk}$

$Prel_{jk} = nrel_{jk}/ninit_{jk}$

$nrel_{jk}$ is the number of schools released in stratum $j$, $SFA_k$

$ninit_{jk}$ is the number of schools initially selected in $j$, $k$

(In New York City we treated those dropped as not part of $nrel_{jk}$ —see Appendix A.)

Among public schools, all released schools participated in the study, so there was no adjustment for nonresponse.

The school level weight, before post-stratification is:

(21) $WPRELIM_{ijk} = WOSCH_{ijk} * W1SCH_{ijk} * W2SCH_{ijk}$.

We then post-stratified the public school weights so that the sum of weights for completed schools is consistent with our best estimate of the number of study-eligible schools in SFAs having NSLP or SBP.[4] Thus:

(22) $$PSF_{public} = \frac{88,996}{\sum_{ijk \in complete} WPRELIM_{ijk}}$$

(23) $$WSCHPS_{ijk} = WPRELIM_{ijk} * PSF_{public}$$

## 2. Weights for Private Schools

For private schools $W0SCH_{ijk}$ is the same as for public schools. $W1SCH_{ijk}$ was also computed the same as for public schools. However, the next stage reflected the different subselection processes employed in Chicago, Los Angeles, New York, and other SFAs. For all SFAs other than Chicago, Los Angeles, or New York:

(24) $W2SCH_{ijk} = 1/P_{sub}$

$P_{sub} = n_{sub}/n_{init}$

$n_{sub}$ = the number of private schools subsampled from these SFAs

$n_{init}$ = the number of private schools initially selected across all SFAs where private schools were selected

For Chicago, Los Angeles, and New York:

(25) $W2SCH_{ijk} = 1/P_{sub\_city}$

$P_{sub\_city} = P_{boro} * P_{reg} * (n_{sub\_reg}/n_{int\_reg})$

$P\_{boro}$ is the probability of selection for a borough in New York; it is 1.0 for other cities

[4]The estimate provided by FNS was 88,996.

$P\_{reg}$ is the probability of the region being selected

$n_{\_sub\_reg}$ is the number of private schools subselected

$n_{\_int\_reg}$ is the number of private schools initially selected in the region

The weights for private schools were then post-stratified so that the sum of weight for schools providing data is consistent with our best estimate of private schools with SBP/NSLP:

(26) $WPRELIM_{ijk}$ is the same as in equation (21) above.

(27) $$PSF_{private} = \frac{N^*_{private}}{\sum_{ijkecomplete,private} WPRELIM_{ijk}} \text{ (Need to get value for N*)}$$

(28) $WSCHPS_{ijk} = WPRELIM_{ijk}\, PSF_{private}$ for private schools

## 3. Weights for Estimating Non-Certification Errors

In addition to the basic school weight, four additional school-level weights were constructed. These weights, used for the analyses of non-certification error, are weights for analysis of:

- Cashier error
- Point-of-sale error
- School-to-SFA reporting errors
- SFA-to-state-agency reporting error

In each case the weight for error type *e* is the poststratified school weight adjusted for non-response. Thus:

(29) $ERRWT_{ijke} = WSCHPS_{ijk} * RRADJ_{ce}$

where:

(30) $RRADJce = 1/RRce$

(31) $$RR_{ce} = \sum_{\substack{ijk \text{ complete} \\ \text{for } e \in c}} WSCHPS_{ijk} \Big/ \sum_{\substack{ijk \text{ basic} \\ \text{complete} \in c}} WSCHPS_{ijk}$$

where the cells defined geographically, were:

- East, comprising the Mid-Atlantic, Northeast, and Midwest FNS regions
- South, comprising the Southeast and Southwest FNS regions
- West, comprising the Western and Mountain FNS regions

## C. STUDENT-LEVEL WEIGHTS

Student-level weights were constructed for application data abstraction, the initial household survey, and the panel household survey. For the application data abstraction, weights were constructed for three groups, because sample selection procedures differed among them. These three groups were:

- Certified applicants selected during the early part of the school year
- Denied applicants (selected during the early part of the school year only)
- Newly certified applicants selected throughout the school year

The samples of certified and denied applicants selected at the beginning of the school year included samples in schools using P23 schools that were selected only for application data abstraction.

For the initial household survey, the sample comprised the three groups defined for application data abstraction, but there were no household survey samples selected at P23 non-base year schools. In addition, the household survey samples in P23 base year schools were selected at a different rate than the applications for data abstraction.

The initial weighting factor for all the student-level weights was the post-stratified weights for the students school. So for student *h* in school *i,j,k:*

(32) $W0STU_{hijk} = WSCHPS_{ijk}$

The first adjustment for these groups is the inverse of within school probability of selection. For the six groups: (A) approved (other than newly certified) applicants for data abstraction; (B) denied applicants for data abstraction; (C) newly certified applicants for data abstraction; groups were selected for the household survey (D) the approved, (E) denied and, (F) newly certified applicants. For each group:

(33) $WISTU_{hijk} = 1/P(Z)_{nijk}$ (Z = A,B,C,D,E,F)

(34) $P(Z)_{hijk} = n(Z)_{ijk} / M(Z)_{ijk}$

where:

$n(Z)_{ijk}$ is the number of applications sampled for *Z* in school *i,j,k*

$M(Z)_{ijk}$ is the estimated total number of applications for *Z* in *i,j,k*

The probability of selection was computed in one step, $n(Z)_{ijk}$ representing the total number for which data collection was attempted. We then defined a preliminary weight adjusted for non-response, and post-stratified to population totals.

The non-response adjustment:

(35) $PRWTSTU_{hijk} = WOSTU_{hijk} * W1STU_{hijk}$

(36) $RRADJSTU_c = 1/RRSTU_c$

(37) $$RRSTU_c = \sum_{\substack{\text{students} \\ \text{observed} \in c}} PRWSTU_{hijk} \Big/ \sum_{n_{ijk}=1 \in c}^{n(Z)_{ijk}} PRWSTU_{hijk}$$

(38) $RRADJWT_{hijk} = PREWTSTU_{hijk} * RRADJSTU_c$

The response rate cells were:

- All private schools were in one cell
- For public schools, six cells were defined based on level (elementary or secondary) and region (East, South, and West)

For the household survey, post-stratification was based on dollar totals of reimbursement, separately for breakfast and lunch. If for each student:

$RBK_{hijk}$ is the total amount reimbursed for breakfasts

$RLU_{hijk}$ is the total amount reimbursed for lunches

then:

(39) $WRBK_{hijk} = RBK_{hijk} * RRADJWJ_{hijk}$

(40) $WRLU_{hijk} = RLU_{hijk} * RRADJWT_{hijk}$

A single post-stratification factor was applied for each meal for the approved applicants (including newly certified).

(41) $$PSFBK = \$1,385,177,894 / \sum_{\substack{hijk \text{ completes} \\ \text{approved}}} WRBK_{hijk}$$

(42) $$PSFLU = \$5,591,125,585 / \sum_{\substack{hijk \text{ completes} \\ \text{approved}}} WRLU_{hijk}$$

(43) $WSTBKPS_{hijk} = PSFBK * WRBK_{hijk}$

(44) $WSTLUPS_{hijk} = PSFLU * WRLU_{hijk}$

The lunch post-stratification factor was applied to the denied applicant household survey.

The weights for the application data were not post-stratified.

For the panel survey weights we adjusted for selection into the panel and non-response. There were eight monthly panel surveys; a household could be eligible for one to eight of those panels depending on when their baseline interview was completed.

The probability of selection for any student into the panel was:

(45) $Ppanel_{hijk} = \sum P_m I(M)_{hijk}$

(46) $P_m = n_m/N_m$

(47) $I(M)_{hijk}$ = 1 if the student could have been selected for month *M* and 0 otherwise[5]

$n_m$ = 125 (the number selected each month for the panel survey)

$N_m$ is the number available for selection in month *M*

The initial weighting factor was the post-stratified lunch weight, and the second factor the inverse of the probability of selection into the panel. Thus:

(48) $W0PANEL_{hijk} = WSTULUPS_{hijk}$

(49) $W1PANEL_{hijk} = 1/PPanel_{hijk}$

(50) $WPREPANEL_{hijk} = W0PANEL_{hijk} * W1PANEL_{hijk}$

Because response to the panel survey was relatively high and constant from month to month, the panel weights were adjusted for non-response within month.

(51) $RR_m = ncomp_m/n_m$

(52) $RRADJPANEL_{hijk} = 1/RR_m$ for the panel month when the student was completed

(53) $FWTPANEL_{hijk} = WPREPANEL_{hijk} * RRADJPANEL_{hijk}$ for completes, and 0 otherwise

[5]If a student's household had completed the initial household interview before month one, they could have been selected for the panel in months one through eight; students whose baseline interview was in month one, could have been selected for months two through eight; and so on.

## D. POST-STRATIFYING STUDENT-LEVEL WEIGHTS

We post-stratified the student-level weights in order that our sample-based sums of the number of certified students and dollar amounts of SBP and NSLP meal reimbursements in error would equal national totals. By post-stratifying, we were able to remove sampling error from these measures.

In order to calculate post-stratified weights, we needed an external source of information on total reimbursements (here total reimbursements are defined as the total additional subsidy for free and reduced-price meals for our household survey population: certified students and denied applicant students attending non-P23 and P23 base-year schools in the 48 contiguous states and District of Columbia). For the NSLP, the extra subsidy for free and reduced-price lunches refer to the Section 11 payments. We obtained accurate measures of total Section 11 reimbursements based on administrative data maintained by FNS. However, the post-stratification process was complicated somewhat by the fact that this administrative data includes reimbursements from some districts and programs that are not included in the population covered by the APEC study sample. Most importantly, the administrative data includes reimbursements for schools that are using P23 and are in a non-base year, but our main population for calculating the largest components of erroneous payments excludes these schools.[6] Thus, we adjusted FNS administrative data using other external data sources to come up with a target NSLP

[6]Our approach to estimating erroneous payments consists of three steps: (1) derive estimates of erroneous payments for non-P23 and P23 base-year schools using our national sample of certified students and denied applicants attending these schools; (2) impute estimates of erroneous payments in P23 non-base year schools; and (3) combine the two sets of estimates to yield estimates of erroneous payments for all schools. Our basic approach allows direct estimation of erroneous payments for certified and denied applicant students in schools that do not use P23 or that are P23 schools in their base year, because these schools certified students for free or reduced-price meals during SY 2005–2006. By contrast, P23 schools not in their base year did not certify students during the 2005–2006 school year, so we could not use our basic estimation methods for these schools. The post-stratification adjustments therefore apply to certified and denied applicant students and reimbursement amounts in NP23 and P23 BY schools.

reimbursement amount (that is, the amount we wanted our weighted sum of NSLP reimbursements to equal). This target served as the basis of our post-stratification of the student-level sample weights.

We constructed a separate set of post-stratified weights for the analysis of SBP erroneous payments, using an analogous procedure. However, there was one additional complication involving schools that are non-base year P23 schools in the SBP program but do not use Provision 2 or 3 (NP23) in the NSLP program. In particular, the procedure we used to derive the target SBP reimbursement amount from FNS administrative data included reimbursements at these schools. However, our main sample for calculating erroneous payments in the SBP excluded these schools. We therefore developed an approach to ensure consistency between the population of interest represented by our sample and the population included in the target reimbursement amount.

The remainder of this appendix describes the procedures for obtaining post-stratified weights for certified students and for reimbursements for free and reduced-price meals in the NSLP and SBP.

## 1. Total Section 11 NSLP Reimbursements

According to FNS administrative data, total Section 11 reimbursements for free and reduced-price lunches in Fiscal Year (FY) 2006 equaled $6,219,472,229.[7] However, this total

[7]We used FNS administrative data for FY 2006 to calculate total reimbursements, whereas our estimates of erroneous payments refer to SY 2005–2006. Thus, FNS data on dollar reimbursements in FY 2006 would include August 2006 and September 2006, whereas our sample of students represents the population of meals consumed in SY 2005–06, so that it includes August 2005 and September 2005. The dollar amounts could differ for two reasons: (1) if there was any trend up or down in the number of meals consumed in August and September between 2005 and 2006, or even just random variation between the two years; and (2) the meals are reimbursed at slightly different rates in the two years (higher rate in 2006). Given that our post-stratification target is based on FY 2006 data, we will be slightly off for both of these reasons. However, some of our post-stratification numbers were based on the number of meals times the SY 2005–06 reimbursement rates, so that our numbers will be off only because of the

included reimbursements from the following sources not included in our primary household survey study population:

- Alaska, Hawaii, U.S. territories, and Department of Defense
- Residential child care institutions (RCCIs)
- Provision 2 and 3 non-base year schools

To determine the relevant target reimbursement amount for our study population, we needed to subtract reimbursements from these sources from the total Section 11 reimbursement amount shown above. Determining reimbursements from the first source is relatively straightforward, because FNS administrative data include direct information on it. Determining reimbursements at RCCIs and non-base year P23 schools is more challenging. Our approach for each is described below.

**Removing Reimbursements in Non-Contiguous States and Territories.** FNS administrative data includes separate totals by state and U.S. territory. For FY 2006, total Section 11 NSLP reimbursements in Alaska, Hawaii, U.S. territories, and DOD equaled $146,985,518 or approximately 2.4 percent of Section 11 NSLP reimbursements overall. After removing reimbursements in Alaska, Hawaii, U.S. territories, and the DOD, Section 11 reimbursements in the 48 contiguous states and District of Columbia equaled $6,072,486,711.

**Removing Reimbursements in RCCIs.** FNS no longer collects administrative data about Section 11 reimbursements separately for RCCIs. It does report information about the number of free and reduced-price meals served in RCCIs most recently for October 2005 only, as opposed to the full year. We used this information to calculate the proportion of free meals in RCCIs and

*(continued)*
first reason. In either case, we deemed this to be a minor discrepancy. We could have used monthly FNS administrative data to get slightly more accurate numbers, but did not have the resources to do so.

proportion of reduced-price meals in RCCIs and assumed that these proportions held for the entire school year.[8] We then used these factors as proxy measures of the proportion of Section 11 reimbursements for free and reduced-price meals in RCCIs. This allowed us to estimate that annual reimbursements at RCCIs equaled $220,222,977. Removing this from the total resulted in Section 11 NSLP reimbursements in the 48 contiguous states and District of Columbia (excluding RCCIs) equaling $5,852,263,734.

**Removing Reimbursements in P23 Nonbase Year Schools.** Unfortunately, FNS data does not disaggregate total reimbursements by P23 status either. Thus, we relied on other data sources to determine the proportion of total reimbursements at non-base year P23 schools. We used data from the APEC study school sample and FNS-742 Verification Summary data to make a series of adjustments to the total free and reduced-price Section 11 NSLP reimbursements in FY 2006 reported in the FNS National Database to derive our target NSLP reimbursement amount for our study population of certified students in NP23 and P23 base year schools. The specific steps we followed were:

1. Using data on the number of school lunches and the number of certified students in our sample of 266 study schools for October 2005 obtained from the *APEC study SFA survey/faxback form,* we derived estimates of average daily participation rates in the NSLP for students certified for free and reduced-price meals, separately for students in all schools and for students in P23 NBY schools (schools with both NSLP and SBP P23 NBY).[9]

[8]These proportions equaled 0.016767 and 0.000931, respectively for free and reduced-price meals in RCCIs in October 2005.

[9]For example, the average daily NSLP participation rate of students certified for free meal benefits equals the total number of lunches provided to students certified for free meal benefits in October 2005 divided by the total number of certified person-days (that is, the total number of students certified for free meals multiplied by the number of serving days for lunch in October 2005). The average daily NSLP participation rates for all schools overall were estimated to be 0.775 for students certified for free meal benefits and 0.655 for students certified for reduced-price meal benefits; for P23 NBY schools the average daily participation rates equaled 0.721 for students certified for free meal benefits and 0.668 for students certified for reduced-price meal benefits.

2. We applied the average daily participation rates derived in Step 1 to the numbers of free and reduced-price certified students reported in FNS-742 Verification Summary data to calculate meal reimbursements on an average October 2005 day at all schools and at P23 NBY schools.[10]

3. We divided total Section 11 NSLP reimbursements in October 2005 at P23 non-base year schools by the total Section 11 NSLP reimbursements in October 2005 at all schools to determine the proportion of Section 11 NSLP reimbursements at P23 NBY schools.[11]

4. We then multiplied the total Section 11 reimbursements at schools nationally (excluding RCCIs and the non-contiguous states and territories) from the FNS National Database by (1 minus the proportion of Section 11 reimbursements at P23NBY schools), calculated in Step 3, to derive our "administratively-based" target dollar amount of Section 11 reimbursements in FY 2006 in NP23 and P23 base-year schools in the 48 contiguous states and District of Columbia.[12]

After these adjustments, we estimated the amount of Section 11 NSLP reimbursements for certified students in NP23 and P23 base-year schools in the 48 contiguous states to equal $5,591,125,585 in FY 2006.

**2. SBP Reimbursement**

According to FNS administrative data, total reimbursements for free and reduced-price breakfasts in FY 2006 equaled $1,971,869,612. However, this total is the full reimbursement amount—not the amount above the paid rate. In addition, it includes reimbursements from the following sources not included in our primary study population:

- Alaska, Hawaii, U.S. territories, and DOD
- Residential child care institutions (RCCIs)

[10]The total Section 11 reimbursements for free and reduced-price certified students in P23 NBY schools on an average day in October 2005 equaled $1,271,401 and equaled $28,493,052 in all schools.

[11]We estimated the proportion of Section 11 NSLP reimbursements at P23 NBY schools to equal 0.044290 of total Section 11 NSLP reimbursements.

[12]This proportion equaled (1 - .044290), or 0.95571.

- Provision 2 and 3 non-base year schools
- Provision 2 and 3 non-base year schools in SBP but NP23 in NSLP

To determine the relevant target reimbursement amount for our study population, we needed to first express free and reduced-price price reimbursements in terms of the marginal amount above the paid rate (that is, the additional Child Nutrition Act (CNA) Section 4 subsidies paid for free and reduced-price breakfasts above the paid rate). Then we needed to subtract reimbursements from these sources from the total SBP reimbursement amount shown above. Our approach for each is described below.

**Removing Reimbursements in Non-Contiguous States and Territories and Expressing Them in Terms of the Additional Subsidy Above the Paid Rate.** Using the FNS National Database, we determined separately the total number of free breakfasts and reduced-priced breakfasts provided to students in the 48 contiguous states and District of Columbia and distinguished free and reduced-price breakfasts by whether they were severe needs or not. We then multiplied the number of meals in each of these four cells by the respective marginal reimbursement rate above the paid rate.[13] For FY 2006, total SBP reimbursements (expressed in terms of amounts above the paid rate) in the 48 contiguous states and District of Columbia (that is, excluding Alaska, Hawaii, U.S. territories, and the Department of Defense) equaled $1,658,395,183.

**Removing Reimbursements in RCCIs.** As mentioned earlier, FNS does not collect administrative data about reimbursements separately for RCCIs. It does include information about the number of free and reduced-price breakfasts provided by RCCIs most recently for

[13]The marginal reimbursement rates for free and reduced-price breakfasts above the paid rate in severe needs schools equals $1.28 and $0.98, respectively. The comparable rates in non-severe needs schools equal $1.04 and $0.74.

October 2005 only, distinguishing between severe and non-severe needs. We used this information to calculate the proportion of free breakfasts in RCCIs that were severe needs, the proportion of free breakfasts in RCCIs that were non-severe needs, the proportion of reduced-price breakfasts in RCCIs that were severe needs, and the proportion of reduced-price breakfasts in RCCIs that were non-severe needs and assumed that these proportions held for the entire school year.[14] We then used these factors as proxy measures of the proportion of marginal SBP reimbursements for free and reduced-price meals in RCCIs. This allowed us to estimate that annual reimbursements (additional subsidies above the paid rate) at RCCIs equaled $97,519,070 in the SBP. Removing this from the total resulted in reimbursements in the 48 contiguous states and District of Columbia (excluding RCCIs) equal to $1,560,876,113.

**Removing Reimbursements in P23 Non-base Year Schools.** As we did for the NSLP estimate, we relied on other data sources to determine the proportion of total reimbursements at non-base year P23 schools. We used data from the APEC study school sample and FNS-742 Verification Summary data to make a series of adjustments to the total free and reduced-price SBP reimbursements in FY 2006 reported in the FNS National Database. An additional consideration needed to be taken into account: whether the school was severe needs or not (reimbursement rates are higher in severe-needs schools).

The specific steps we followed were:

1. Using data on the number of school lunches and certified students in our sample of study schools offering the SBP from the *APEC study SFA survey/faxback form,* we derived estimates of average daily participation rates in the SBP for students certified for free and reduced-price meals in October 2005, separately for students in all

[14]These proportions in RCCIs in October 2005 were as follows: free severe needs 0.0378; free non-severe needs 0.031; reduced-price severe needs 0.0013; and reduced-price non-severe needs 0.0023.

schools and for students in P23 NBY schools (schools with both NSLP and SBP P23 NBY).[15]

2. Then using FNS-742 data, we applied the participation rates derived in Step 1 to the numbers of free and approved students to calculate meal reimbursements on an average October 2005 day at all schools and for P23 NBY schools, taking into account whether the schools was severe needs or not.[16]

3. We divided total SBP reimbursements (above the paid rate) in October 2005 at P23NBY schools by the total SBP reimbursements (above the paid rate) in October 2005 at all schools to determine the proportion of SBP reimbursements at P23 NBY schools.[17]

4. We then multiplied the SBP reimbursements at schools nationally from the FNS National Database by (1 minus the proportion of SBP reimbursements at P23 NBY schools), calculated in Step 3, to derive an estimate of the target number of free and reduced-price reimbursements in FY 2006 in all schools except those with both NSLP and SBP P23 NBY.[18]

After these adjustments, we estimated the amount of SBP reimbursements for certified students in NP23 and P23 BY schools (but including P23 NBY SBP but NP23 in NSLP) in the 48 contiguous states and District of Columbia to equal $1,497,533,428.

**Removing Reimbursements from P23 NBY SBP and NP23 NSLP Schools.** The final adjustment is to remove reimbursements from schools that are P23 NBY in the SBP but NP23 in the NSLP because these schools are included in FNS National Database, but were not included when we estimated SBP erroneous payments in NP23 and P23 BY schools. The steps we followed were:

[15]The SBP participation rates for all schools overall were estimated to be 0.380 for students certified for free meals and 0.224 for students certified for free and reduced-price meals; for P23 NBY schools in both the SBP and NSLP the participation rates equaled 0.309 for students certified for free meals and 0.276 for students certified for reduced-price meals.

[16]The SBP reimbursements (above the paid rate) for students certified for free and reduced-price meals in P23 NBY schools in both the SBP and NSLP on an average day in October 2005 equaled $322,378 and equaled $7,943,973 in all schools.

[17]We estimated the proportion of SBP reimbursements at P23 NBY schools in both programs to equal 0.040581 of total SBP reimbursements.

[18]This proportion equaled (1 - .040581), or 0.959419.

1. We adjusted the target reimbursement estimate derived in Step 4 above to exclude the amount of SBP reimbursements in schools with P23 NBY SBP and NP23 NSLP programs in October 2005. To do this, we needed the following estimate: Among SBP reimbursements at any school that is not P23 NBY in both programs, what proportion come from schools that are P23 NBY in neither program? That estimate was derived as follows:

   - (a) Using data from the APEC study SFA survey/faxback forms—school-level data, we derived estimates of reimbursements for several groups for the month of October 2005: those certified for free breakfasts in schools not P23 NBY in both programs; those certified for reduced-price breakfasts in schools not P23 NBY in both programs; those certified for free breakfasts in schools that are P23 NBY in neither program; and those certified for reduced-price breakfasts in schools that are P23 NBY in neither program. The reimbursements for students certified for free and reduced-price meals were summed for each group of schools.
   - (b) We calculated the adjustment factor, by dividing the weighted sums of SBP reimbursements in each group of schools.[19]
   - (c) We multiplied the target SBP reimbursement amount derived in Step 4 above by the adjustment factor derived in Step 1(b) to obtain an estimate of the target total amount of SBP reimbursements (above the paid rate) in NP23 and P23 BY schools in the 48 contiguous states and District of Columbia in FY 2006.

After these adjustments, we estimated the amount of SBP reimbursements for certified students in NP23 and P23 BY schools in the 48 contiguous states and District of Columbia to equal $1,385,177,894 in FY 2006.

### 3. Total Number of Certified Students

We used the total free and reduced-price Section 11 reimbursement amount in non-Provision 2/3 (NP23) and Provision 2/3 Base Year (P23BY) schools nationally (48 contiguous states and District of Columbia, excluding RCCIs) as the main target in the post-stratification of our household interview student sample (see Section D.1). Once we constructed this post-

[19]In October 2005, the total SBP reimbursements (above the paid rate) in schools with P23 NBY SBP and NP23 NSLP programs equaled $16,233,976 and the total SBP reimbursements (above the paid rate) in schools with neither P23 NBY in their meal programs equaled $200,140,960. This implies an adjustment factor equal to 0.92497.

stratification weight, we compared the weighted number of certified students from the APEC study sample with our best measure of that number from FNS administrative data (FNS National Database). The two numbers were essentially the same so we did not further post-stratify on students.

Specifically, we performed the following steps to derive the target measure of the number of students certified for free and reduced-price meals attending NP23 and P23BY schools in the 48 contiguous states and District of Columbia in FY 2006 (excluding RCCIs):

1. Using the FNS National Database, we determined the number of students in the 48 contiguous states and District of Columbia during FY 2006 not in RCCIs who are (a) certified for free meals, (b) certified for reduced-price meals, and (c) certified for free or reduced-price meals.
2. Using FNS-742 data, we determined the number of students (a) certified for free meals, (b) certified for reduced-price meals, and (c) certified for free or reduced-price meals in all schools in the 48 contiguous states and District of Columbia during FY 2006. We then used information from the FNS National Database on the number of free and reduced-price meals provided in RCCIs to adjust the total number of students certified for free and reduced-price meals in FNS-742 data to remove students attending RCCI from the total.[20]
3. Similarly, using FNS-742 data, we derived the total number of students certified for free and reduced-price meals in P23 NBY schools, again adjusting out of the totals students attending RCCIs.
4. Using the results from Step 2 and Step 3, we derived adjustment factors for the proportion of students certified for free and reduced-price meals who are in NP23 and P23 BY schools.[21]
5. We then applied the adjustment factors derived in Step 4 to data on the number of students certified for free and reduced-price meals in the FNS National Database. We calculated the number of students certified for free and reduced-price meals in non-P23 and P23 base-year schools (that is, we adjusted out the number of students certified for free and reduced-price meals in P23 NBY schools from the previous derived totals).

[20]Using data from the FNS National Database we estimated that the proportion of free approved students in RCCIs equals 0.017; and the proportion of reduced-price students equals 0.001.

[21]Using data from FNS-742, we estimated that the proportion of free approved students in P23 NBY schools equals .050595 and the proportion of reduced-price approved students equals .028996.

This yielded our best estimate of the number of students certified for free and reduced-price meals in the 48 contiguous states and District of Columbia (and not in RCCIs) attending non-P23 and P23 non-base year schools in SY 2005–06—which is the definition of our study sample (shown in Table B.2).

TABLE B.2

NUMBER OF CERTIFIED STUDENTS, SY 2005–06

| | 48 contiguous states and District of Columbia (Excludes P23 NBY Schools and RCCIs) |
|---|---|
| Students Certified for Free Meals: | 16,925,436 |
| Students Certified for Reduced-Price Meals: | 3,941,158 |
| Total Certified Students: | 20,866,594 |

## E. DERIVING NATIONAL ESTIMATES OF TOTAL REIMBURSEMENTS FOR ALL MEALS PROVIDED IN THE SBP AND NSLP

The key measure in the APEC study is the erroneous payments rate. For erroneous payments due to certification error, this rate equals the ratio of two sums: (1) the total dollar amount of the additional subsidy for free or reduced-price meals paid in error due to certification errors, and (2) the total amount of reimbursements paid out to districts for all meals (free, reduced-price, and paid) they provide to participating students. Total reimbursements (the denominator) includes cash payments to districts for all meals served to participating students—certified as well as those paying full price, and, in the case of the NSLP, includes commodities valued on a per meal basis. In order to derive estimates of erroneous payments rates for the NSLP and SBP, we needed to construct measures of total reimbursements for the NSLP and SBP for our study population: students in schools in the 48 contiguous states and District of

Columbia in SY 2005–06 (that is, excluding Alaska, Hawaii, the U.S. territories and DOD, and excluding students attending RCCIs).

### 1. NSLP Total Reimbursements

**Cash Reimbursements.** In FY 2006, cash reimbursements for all lunches provided in the United States equaled $7,387,910,623 (FNS National Datafile). This figure includes reimbursements from Section 4, Section 4 additional (2 cents), and Section 11. Cash reimbursements for noncontiguous states, U.S. territories and DOD equaled $171,133,691. Removing these reimbursements from the total cash reimbursements results in $7,216,776,932 for the 48 contiguous states and District of Columbia. This figure includes cash reimbursements for RCCIs. The general approach for eliminating the RCCI share is to multiply the total reimbursements by the proportion of meals served at non-RCCI schools. However, because different types of meals receive different levels of reimbursements, we needed to disaggregate this proportion of meals measure so that there are separate measures for each group of meals that receives a different reimbursement level. For Section 11 payments, this amounts to distinguishing between free and reduced-price meals. For Section 4, all meals served receive the same reimbursement level, so we did not need to distinguish them.

Adjusting out the cash reimbursements for RCCI's:

| | Total NSLP Reimbursement (Dollars) | | Percentage of Non-RCCI Meals | Total Non-RCCI Reimbursement |
|---|---|---|---|---|
| Section 11 Free: | 5,255,141,146 | x | .983233 | 5,167,028,194 |
| Section 11 Reduced-Price | 817,345,565 | x | .999069 | 816,584,616 |
| Section 4: | 1,144,290,221 | x | .991213 | 1,134,235,586 |
| **Total** | | | | **7,117,848,396** |

Total cash reimbursement for all lunches provided to our study population in FY 2006 therefore equaled $7,117,848,396.

**Value of Commodities.** The NSLP receives commodities, called entitlement foods, valued on a per-meal basis. In FY 2006, entitlement per meal equaled $0.1927. Districts provided 5,027,514,387 NSLP lunches that year for the entire United States. Removing lunches provided in noncontiguous states, territories and DOD and those provided to students in RCCIs yields 4,891,164,525 lunches for our study population. Therefore, the value of commodities in the NSLP equaled $942,527,404.

**Total Reimbursement for All NSLP Meals.** Total cash and commodity reimbursement for all lunches provided to our study population in FY 2006 therefore equaled $8,060,375,800.

### 2. SBP Total Reimbursements

The SBP does not participate in the commodity program. In FY 2006, cash reimbursements for all breakfasts provided in the United States equaled $2,044,440,010 (FNS National Datafile). This figure includes all Section 4 subsidies, including the extra subsidies for free or reduced-price breakfasts, and takes into account severe-needs reimbursements. Cash reimbursements for noncontiguous states, territories, and DOD equaled $41,251,294. Removing these reimbursements from the total cash reimbursements results in $2,003,188,716 for the 48 contiguous states and District of Columbia This figure includes cash reimbursements for RCCIs. Our approach for eliminating the RCCI share is to multiply the total reimbursements by the proportion of meals served at non-RCCI schools. However, because different types of meals receive different levels of reimbursements, we needed to disaggregate this proportion of meals measure so that there are separate measures for each group of meals that receives a different reimbursement level, taking into account severe versus non-severe need schools.

Adjusting out the cash reimbursements for RCCIs:

| | Total SBP Reimbursement ($) | | % Non-RCCI Meals | Total Non-RCCI Reimbursement |
|---|---|---|---|---|
| Free-Severe Needs | 1,580,536,873 | x | .952254 | 1,520,877,928 |
| Free-Non-SN | 173,629,256 | x | .969062 | 168,257,514 |
| Reduced-Price SN | 152,724,407 | x | .998795 | 152,540,374 |
| Reduced-Price Non-SN | 25,153,006 | x | .997721 | 25,095,682 |
| Paid | 71,145,173 | x | .997518 | 70,968,591 |
| **Total** | **2,003,188,716** | | | **1,937,740,089** |

Total cash reimbursement for all breakfasts provided to our study population in FY 2006 therefore equaled $1,937,740,089.

## F. METHOD OF ESTIMATING STANDARD ERRORS FOR CERTIFICATION ERROR AMOUNTS AND RATES

To estimate the standard errors associated with our overall estimates of erroneous payments rates due to certification error, we used the fact that the overall estimates are calculated as weighted averages of the erroneous payments rate estimates among two sets of schools (with the weights set to the proportion of total reimbursements at each set of schools). The first set of schools includes non-P23 schools and P23 base year schools, from which our main student sample was selected and used to estimate erroneous payments rates. The second set of schools includes P23 non-base year schools, for which we imputed the erroneous payments rate based on data collected from students at P23 base year schools.

Our overall standard error estimates can thus be calculated as the standard error of this weighted average, so long as we can estimate the variance of each of the component parts of the weighted average. We estimated the variance of the erroneous payments rate estimates for non-P23 and P23 base year schools based on our student sample, at the same time that we estimated

the rate itself. This variance estimate takes into account the complex sample design of the student sample using the Taylor series expansion approach with the SUDAAN statistical software package. Since the second component of the weighted average—the P23 non-base year component--is based on an imputed erroneous payments rate, we could not directly calculate the variance estimate. Instead, we imputed the standard error of the erroneous payments rate estimate at the P23 non-base year schools. In particular, we assumed that the variance of erroneous payments at P23 non-base year schools would be the same as the variance at P23 base year schools. Based on that assumption, we could use the estimated standard error at P23 base year schools to proxy for the P23 non-base year standard error.

# APPENDIX C

# SFA, SCHOOL, AND STUDENT CHARACTERISTICS

The APEC Study collected information on the administrative and operational structure of SFAs and schools sampled for the study that when weighted can be tabulated to provide descriptive summaries that are representative of SFAs and schools participating in the school meal programs nationally. Tables C1–C11 provide summary statistics on the characteristics of SFAs, schools, and students (certified students and denied applicants). These data are weighted to be nationally representative. Characteristics of SFAs and schools are presented two ways: (1) weighted by the SFA or school, and (2) the SFA or school weight adjusted for the number of enrolled students with access to the school meal programs. The latter show findings in terms of the percentages of students in the SFA (or attending schools) with characteristics indicated in the tables.

Because the primary objective of the APEC study was to generate precise national estimates of the dollar amounts and rates of erroneous payments in the NSLP and SBP due to certification error, and not to estimate characteristics of SFAs and schools precisely, some caution should be used when using the data to examine SFA and school characteristics. In particular, the samples of SFAs and schools are smaller than what would be considered ideal for that purpose, meaning the estimates of characteristics are subject to greater sampling variability.

Readers wanting more reliable information on SFA and school characteristics nationally are urged to obtain other recent sources, such as "Descriptive Analysis Memorandum and Tables from the School Food Authority Characteristics Survey" (Logan and Kling 2005), "The School Nutrition Dietary Assessment Study (SNDA-III), Volume I, School Food Service, School Food Environment, and Meals Offered and Served (Gordon et al. 2007). Summaries of FNS-742 verification summary data prepared by FNS staff and available at the USDA website provide national data on some SFA characteristics as well as characteristics and outcomes of the verification process.

TABLE C.1

CHARACTERISTICS OF SCHOOL FOOD AUTHORITIES, BY PROVISION 2/3 STATUS
(Percentages of SFAs)

| Characteristic | Non-Provision 2/3 SFAs[a] | Provision 2/3 SFAs[b] | All SFAs |
|---|---|---|---|
| Public vs. Private SFA | | | |
| Administers public schools only | 86.5 | 92.2 | 86.8 |
| Administers private schools only | 5.7 | 0.5 | 5.4 |
| Administers both public and private schools | 7.8 | 7.3 | 7.8 |
| Single vs. Multiple District SFA | | | |
| Administers single district | 88.6 | 99.5 | 89.2 |
| Administers multiple districts or entities | 11.4 | 0.5 | 10.8 |
| Urbanicity | | | |
| District covers urban area | 15.9 | 75.6 | 18.9 |
| District covers suburban area | 34.2 | 24.4 | 33.7 |
| District serves a town | 15.5 | 0.0 | 14.8 |
| District covers rural area | 34.4 | 0.0 | 32.7 |
| Region | | | |
| Northeast | 11.5 | 22.1[c] | NA |
| Mid-Atlantic | 10.6 | 4.5[c] | NA |
| Southeast | 10.9 | 5.4[c] | NA |
| Midwest | 25.6 | 4.7[c] | NA |
| Southwest | 7.8 | 23.6[c] | NA |
| Mountain Plains | 20.6 | 12.9[c] | NA |
| Western | 13.0 | 26.8[c] | NA |
| District Size (Mean) | | | |
| Total Number of Schools | 9.0 | 41.8 | 10.7 |
| Number of Public Schools | 8.8 | 39.5 | 10.3 |
| Number of Private Schools | 0.3 | 2.2 | 0.3 |
| Total Number of Students | 5,438.7 | 29,814.7 | 6,659.4 |
| Percentage of Schools by Type of School | | | |
| Elementary schools | 60.7 | 67.3 | 61.0 |
| Middle schools | 14.8 | 15.6 | 14.8 |
| High schools | 21.3 | 11.7 | 20.8 |
| Other programs | 3.3 | 5.4 | 3.4 |
| Student Enrollments | | | |
| Less than 1,000 | 20.2 | 0.0 | 19.2 |
| 1,000 to 4,999 | 50.4 | 0.0 | 47.9 |
| 5,000 to 9,999 | 18.7 | 39.0 | 19.7 |
| 10,000 to 19,999 | 6.4 | 42.2 | 8.2 |
| 20,000 to 49,999 | 3.5 | 10.6 | 3.9 |
| 50,000 or more | 0.8 | 8.1 | 1.1 |
| Median | 2,362.0 | 12,306.0 | 2,414.0 |
| Mean | 5,438.7 | 29,814.7 | 6,659.4 |
| **Sample Size** | **69** | **18** | **87** |

Table C.1 *(continued)*

Source: APEC Study, SFA survey data
Note: Data are weighted by SFA weight.

Table reads: "86.8 percent of SFAs administers the NSLP and/or SBP in public schools only."

[a]None of the schools in the district uses Provisions 2 or 3 in the NSLP or SBP.

[b]Some schools in the district use Provisions 2 or 3 in the NSLP or SBP.

[c]Estimates based on FNS-742 data. The APEC sample design with 87 SFAs is not the best source of information on the prevalence of Provision 2 or Provision 3 districts or schools in the United States because its primary objective is obtaining national estimates of erroneous payments built up from the student level and not providing precise estimates of SFA characteristics nationally. We therefore show distribution of P23 districts based on FNS-742 data (n = 17,282 SFAs). Note that FNS-742 data collects data only on P23 schools that are in a non-base year. FNS-742 does not distinguish P23 base-year schools from other schools in the data. For example, a district may have only P23 base-year schools (and no P23 non-base year schools) if it is just introducing P23 in SY 2005–06. FNS-742 data indicates that the West has the highest percentage (26.8 percent of districts with P23NBY schools are located in the West), followed by the Southwest (23.6 percent), and Northeast (22.1 percent).

TABLE C.2

CHARACTERISTICS OF SCHOOL FOOD AUTHORITIES, BY PROVISION 2/3 STATUS
(Percentages of Students in SFAs with Characteristics Indicated in Row Headings)

| Characteristic | Non-Provision 2/3 SFAs[a] | Provision 2/3 SFAs[b] | All SFAs |
|---|---|---|---|
| Public vs. Private SFA | | | |
| Administers public schools only | 93.7 | 65.0 | 87.2 |
| Administers private schools only | 0.5 | 0.4 | 0.5 |
| Administers both public and private schools | 5.9 | 34.6 | 12.3 |
| Single vs. Multiple District SFA | | | |
| Administers single district | 94.5 | 88.5 | 93.1 |
| Administers multiple districts or entities | 5.5 | 11.5 | 6.9 |
| Urbanicity | | | |
| District covers urban area | 26.1 | 70.5 | 36.1 |
| District covers suburban area | 49.8 | 29.5 | 45.3 |
| District serves a town | 7.3 | 0.0 | 5.7 |
| District covers rural area | 16.8 | 0.0 | 13.0 |
| Region | | | |
| Northeast | 6.7 | 24.2 | 10.7 |
| Mid-Atlantic | 15.1 | 2.6 | 12.3 |
| Southeast | 19.2 | 20.2 | 19.5 |
| Midwest | 19.6 | 8.9 | 17.2 |
| Southwest | 16.8 | 2.3 | 13.6 |
| Mountain Plains | 9.4 | 0.0 | 7.3 |
| Western | 13.1 | 41.7 | 19.5 |
| District Size (Mean) | | | |
| Total number of schools | 45.3 | 454.1 | 137.0 |
| Number of public schools | 44.7 | 406.3 | 125.8 |
| Number of private schools | 0.6 | 47.8 | 11.2 |
| Percentage of Schools by Type of School | | | |
| Elementary schools | 62.3 | 61.6 | 62.1 |
| Middle schools | 17.1 | 14.8 | 16.6 |
| High schools | 15.6 | 14.3 | 15.3 |
| Other programs | 5.1 | 9.3 | 6.0 |
| Student Enrollments | | | |
| Less than 1,000 students | 1.7 | 0.0 | 1.3 |
| 1,000 to 4,999 students | 22.4 | 0.0 | 17.3 |
| 5,000 to 9,999 students | 23.2 | 8.9 | 20.0 |
| 10,000 to 19,999 students | 16.1 | 22.3 | 17.5 |
| 20,000 to 49,999 students | 22.1 | 11.9 | 19.8 |
| 50,000 or more students | 14.6 | 56.9 | 24.1 |
| **Sample Size** | **69** | **18** | **87** |

Source: APEC Study, SFA Survey Data.

Table C.2 *(continued)*

Note: Data are weighted by SFA weight adjusted for number of students.
Table reads: "87.2 percent of students are in SFAs which administer the NSLP and/or SBP in public schools only."

[a]None of the schools in the district use Provisions 2 or 3 in the NSLP or SBP.

[b]Some schools in the district use Provisions 2 or 3 in the NSLP or SBP.

TABLE C.3

NSLP AND SBP MEAL PROGRAM CHARACTERISTICS, BY PROVISION 2/3 STATUS
(Percentages of SFAs)

| Characteristic | Non-Provision 2/3 SFAs[a] | Provision 2/3 SFAs[b] | All SFAs |
|---|---|---|---|
| Percentage of Schools by Type of Meal Program Offered | | | |
| NSLP only | 23.9 | 4.5 | 23.0 |
| SBP only | 0.0 | 0.1 | 0.0 |
| Both NSLP and SBP | 76.1 | 95.4 | 77.0 |
| Percentage of Enrolled Students by Type of Meal Program Offered | | | |
| In schools offering NSLP only | 24.8 | 4.2 | 23.7 |
| In schools offering SBP only | 0.0 | 0.0 | 0.0 |
| In schools offering both NSLP and SBP | 75.2 | 95.8 | 76.2 |
| Student Certification Status (Percentages) | | | |
| Certified for free meals | 30.4 | 39.1 | 30.8 |
| Certified for reduced-price meals | 8.4 | 9.0 | 8.4 |
| Certified for free or reduced-price meals | 38.8 | 46.1 | 39.1 |
| Percentage of NSLP Lunches by Type | | | |
| Free | 37.8 | 47.3 | 38.3 |
| Reduced-price | 10.1 | 10.0 | 10.1 |
| Paid | 52.1 | 42.6 | 51.6 |
| NSLP Participation (Percentages) | | | |
| Average Daily Participation Rate | | | |
| Among all students | 58.7 | 67.1 | 59.1 |
| Among students certified for free meals | 75.7 | 81.9 | 76.0 |
| Among students certified for reduced-price meals | 71.9 | 73.1 | 72.0 |
| Among students not certified (paid) | 50.4 | 53.2 | 50.6 |
| Percentage of Breakfasts by Type | | | |
| Free | 61.2 | 72.2 | 61.8 |
| Reduced-price | 11.2 | 10.7 | 11.2 |
| Paid | 27.6 | 17.1 | 27.0 |
| SBP Participation (Percentages) | | | |
| Average Daily Participation Rate | | | |
| Among all students | 25.0 | 25.0 | 25.0 |
| Among students certified for free meals | 40.3 | 37.4 | 40.1 |
| Among students certified for reduced-price meals | 25.6 | 21.0 | 25.4 |
| Among students not certified (paid) | 17.5 | 8.0 | 16.9 |
| **Sample Size** | **69** | **18** | **87** |

Source: APEC Study, SFA Survey Data.

Note: Data are weighted by the SFA weight.

Table reads: "23.0 percent of SFAs operate the NSLP only."

[a]None of the schools in the district use Provisions 2 or 3 in the NSLP or SBP.

[b]Some schools in the district use Provisions 2 or 3 in the NSLP or SBP.

TABLE C.4

NSLP AND SBP MEAL PROGRAM CHARACTERISTICS, BY PROVISION 2/3 STATUS
(Percentages of Students in SFAs with Characteristics Indicated in Row Headings)

| Characteristic | Non-Provision 2/3 SFAs[a] | Provision 2/3 SFAs[b] | All SFAs |
|---|---|---|---|
| Percentage of Schools by Type of Meal Program Offered | | | |
| NSLP only | 17.9 | 3.5 | 14.7 |
| SBP only | 0.1 | 0.1 | 0.1 |
| Both NSLP and SBP | 82.0 | 96.4 | 85.2 |
| Percentage of Enrolled Students by Type of Meal Program Offered | | | |
| In schools offering NSLP only | 18.3 | 3.3 | 15.0 |
| In schools offering SBP only | 0.3 | 0.0 | 0.2 |
| In schools offering both NSLP and SBP | 81.4 | 96.7 | 84.8 |
| Percentage of Students Certified | | | |
| Certified for free meals | 32.6 | 51.3 | 36.8 |
| Certified for reduced-price meals | 7.4 | 9.3 | 7.8 |
| Certified for free or reduced-price meals | 40.0 | 59.9 | 44.4 |
| Percentage of NSLP Lunches by Type | | | |
| Free | 43.5 | 64.4 | 48.2 |
| Reduced-price | 9.4 | 9.6 | 9.4 |
| Paid | 47.1 | 26.0 | 42.4 |
| NSLP Participation | | | |
| Average Daily Participation Rate | | | |
| Among all students | 54.8 | 57.8 | 55.5 |
| Among students certified for free meals | 75.9 | 72.8 | 75.2 |
| Among students certified for reduced-price meals | 68.9 | 59.1 | 66.7 |
| Among students not certified (paid) | 42.4 | 36.7 | 41.1 |
| Percentage of Breakfasts by Type | | | |
| Free | 66.9 | 77.5 | 69.5 |
| Reduced-price | 9.8 | 8.4 | 9.5 |
| Paid | 23.3 | 14.1 | 21.1 |
| SBP Participation | | | |
| Average Daily Participation Rate | | | |
| Among all students | 20.0 | 22.1 | 20.5 |
| Among students certified for free meals | 35.8 | 31.8 | 34.8 |
| Among students certified for reduced-price meals | 21.8 | 17.5 | 20.8 |
| Among students not certified (paid) | 10.1 | 7.3 | 9.5 |
| **Sample Size** | **69** | **18** | **87** |

Source: APEC Study, SFA Survey Data.

Note: Data are weighted by SFA weight adjusted for number of students.

Table reads: "14.7 percent of students are in SFAs that offer the NSLP only."

[a]None of the schools in the district use Provisions 2 or 3 in the NSLP or SBP.

[b]Some schools in the district use Provisions 2 or 3 in the NSLP or SBP.

TABLE C.5

CHARACTERISTICS OF SFA SCHOOL MEAL PROGRAM OPERATIONS, BY PROVISION 2/3 STATUS
(Percentages of SFAs)

| Characteristic | Non-Provision 2/3 SFAs[a] | Provision 2/3 SFAs[b] | All SFAs |
|---|---|---|---|
| Uses Food Service Management Company | | | |
| Yes | 18.0 | 19.5 | 18.1 |
| No | 82.0 | 80.5 | 81.9 |
| Uses Direct Certification | | | |
| Yes | 65.8 | 56.2 | 65.3 |
| No | 34.2 | 43.8 | 34.7 |
| Direct Certification Method | | | |
| Does not use direct certification | 40.7 | 43.8 | 40.9 |
| Non-matching, active response | 17.7 | 0.9 | 16.7 |
| District-level matching, passive response | 16.9 | 51.2 | 18.9 |
| State-level matching, passive response | 12.4 | 3.0 | 11.8 |
| Other | 12.4 | 1.0 | 11.7 |
| Number of Years Using Direct Certification | | | |
| Does not use direct certification | 34.2 | 43.8 | 34.7 |
| 1 to 2 years | 9.9 | 0.0 | 9.4 |
| 3 to 5 years | 9.4 | 3.6 | 9.1 |
| 6 to 8 years | 32.5 | 41.8 | 33.0 |
| More than 8 years | 14.1 | 10.7 | 13.9 |
| Percentage of Students Certified for Free Meals by Certification Method | | | |
| Direct certification | 26.1 | 16.6 | 25.6 |
| Other certification not by application | 1.9 | 1.0 | 1.9 |
| Application—categorically certified | 24.9 | 30.9 | 25.2 |
| Application—income certified | 47.1 | 51.9 | 47.3 |
| Percentage of Approved Applications by Type of Approval | | | |
| Free, categorically certified | 40.4 | 25.6 | 39.6 |
| Free, income certified | 28.7 | 52.0 | 29.9 |
| Reduced-price, income certified | 31.0 | 22.4 | 30.5 |
| District tracks and maintains data on students participation in NSLP and/or SBP at individual level | | | |
| Yes | 94.2 | 51.7 | 92.1 |
| No | 5.8 | 48.3 | 8.0 |
| **Sample Size** | **69** | **18** | **87** |

Source: APEC Study, SFA Survey Data.

Note: Data are weighted by SFA weight.

Table reads: "18.1 percent of SFAs use a food management company."

[a]None of the schools in the district use Provisions 2 or 3 in the NSLP or SBP.

[b]Some schools in the district use Provisions 2 or 3 in the NSLP or SBP.

TABLE C.6

CHARACTERISTICS OF SFA SCHOOL MEAL PROGRAM OPERATIONS,
BY PROVISION 2/3 STATUS
(Percentages of Students in SFAs with Characteristics Indicated in Row Headings)

| Characteristic | Non-Provision 2/3 SFAs[a] | Provision 2/3 SFAs[b] | All SFAs |
|---|---|---|---|
| Uses Food Service Management Company | | | |
| Yes | 20.7 | 11.6 | 18.6 |
| No | 79.4 | 88.5 | 81.4 |
| Uses Direct Certification | | | |
| Yes | 77.8 | 88.8 | 80.3 |
| No | 22.2 | 11.2 | 19.7 |
| Direct Certification Method | | | |
| Does not use direct certification | 22.8 | 11.2 | 20.2 |
| Non-matching, active response | 14.0 | 18.1 | 14.9 |
| District-level matching, passive response | 23.9 | 49.2 | 29.7 |
| State-level matching, passive response | 33.4 | 5.5 | 27.0 |
| Other | 5.9 | 15.9 | 8.2 |
| Number of Years Using Direct Certification | | | |
| Does not use direct certification | 22.2 | 11.2 | 19.7 |
| 1 to 2 years | 8.6 | 0.0 | 6.7 |
| 3 to 5 years | 9.3 | 6.5 | 8.7 |
| 6 to 8 years | 26.4 | 42.4 | 30.0 |
| More than 8 years | 33.4 | 39.9 | 34.9 |
| Percentage of Students Certified for Free Meals by Certification Method | | | |
| Direct certification | 26.2 | 31.1 | 27.4 |
| Other certification not by application | 1.9 | 1.0 | 1.6 |
| Application—categorically certified | 20.5 | 20.0 | 20.4 |
| Application—income certified | 51.4 | 47.6 | 50.6 |
| Percentage of Approved Applications by Type of Approval | | | |
| Free, categorically certified | 43.4 | 18.5 | 37.7 |
| Free, income certified | 28.3 | 62.1 | 36.0 |
| Reduced-price, income certified | 28.3 | 19.5 | 26.3 |
| District tracks and maintains data on students participation in NSLP and/or SBP at individual level | | | |
| Yes | 89.9 | 56.6 | 82.4 |
| No | 10.1 | 43.4 | 17.6 |
| **Sample Size** | **69** | **18** | **87** |

Source: APEC Study, SFA Survey Data.

Note: Data are weighted by SFA weight adjusted for number of students.

Table reads: "18.6 percent of students are in SFAs which use a food management company."

[a]None of the schools in the district use Provisions 2 or 3 in the NSLP or SBP.

[b]Some schools in the district use Provisions 2 or 3 in the NSLP or SBP.

TABLE C.7

CHARACTERISTICS OF SCHOOLS, BY PROVISION 2/3 STATUS
(Percentages of Schools)

| Characteristic | Non-Provision 2/3 Schools | Provision 2/3 Schools | All Schools |
|---|---|---|---|
| Type of Community | | | |
| Urban | 39.4 | 83.1 | 44.6 |
| Suburban | 36.0 | 16.9 | 33.8 |
| Town | 8.7 | . | 7.6 |
| Rural | 15.9 | . | 14.0 |
| Region | | | |
| Northeast | 7.7 | 24.7[a] | NA |
| Mid-Atlantic | 11.2 | 9.3[a] | NA |
| Southeast | 14.9 | 24.0[a] | NA |
| Midwest | 24.6 | 4.0[a] | NA |
| Southwest | 18.2 | 15.4[a] | NA |
| Mountain Plains | 10.5 | 6.6[a] | NA |
| Western | 12.7 | 26.6[a] | NA |
| School Level | | | |
| Elementary | 73.8 | 85.3 | 75.2 |
| Middle | 14.7 | 12.8 | 14.4 |
| High | 11.5 | 1.9 | 10.4 |
| School Enrollment | | | |
| Less than 400 students | 34.0 | 21.7 | 32.6 |
| 400 to 799 students | 44.7 | 55.7 | 46.0 |
| 800 to 1200 students | 14.1 | 14.7 | 14.2 |
| More than 1200 students | 7.2 | 7.9 | 7.2 |
| Median | 507 | 667 | 534 |
| Mean | 616 | 692 | 625 |
| **Sample Size** | **211** | **55** | **266** |

Source: APEC Study, data on study schools from SFA Survey.

Note: Data are weighted by school weight.

Table reads: "44.6 percent of all schools offering the NSLP and/or SBP are located in urban areas."

[a]Estimates based on FNS-742 data. The APEC sample design with 87 SFAs and 262 schools is not the best source of information on the prevalence of Provision 2 or Provision 3 districts or schools in the United States because its primary objective is obtaining national estimates of erroneous payments built from the student level and not providing precise estimates of SFA characteristics nationally. We therefore show distribution of P23 schools based on FNS-742 data (n = 17,282 SFAs). Note that FNS-742 data collects data only on P23 schools that are in a non-base year. FNS-742 does not distinguish P23 base-year schools from other schools in the data. For example, a district may only have P23 base-year schools (and no P23 non-base year schools) if it is just introducing P23 in SY 2005 - 06. The distribution of schools in terms of Provision 2/3NBY schools indicates that 26.6 percent of Provision 2/3 non-base year schools are located in the Western region, the Northeast has 24.7 percent, the Southwest has 14.4 percent, and the Midwest has 13.3 percent of these schools.

TABLE C.8

CHARACTERISTICS OF SCHOOLS, BY PROVISION 2/3 STATUS
(Percentages of Students in Schools with Characteristics Indicated in Row Headings)

| Characteristic | Non-Provision 2/3 Schools | Provision 2/3 Schools | All Schools |
|---|---|---|---|
| Type of Community | | | |
| Urban | 34.3 | 80.2 | 40.3 |
| Suburban | 45.8 | 19.8 | 42.4 |
| Town | 6.9 | . | 6.0 |
| Rural | 13.0 | . | 11.3 |
| Region | | | |
| Northeast | 6.7 | 31.2 | 9.9 |
| Mid-Atlantic | 12.6 | 0.3 | 11.1 |
| Southeast | 16.3 | 24.2 | 17.3 |
| Midwest | 18.0 | 2.4 | 16.0 |
| Southwest | 20.8 | 6.0 | 18.9 |
| Mountain Plains | 9.1 | . | 8.0 |
| Western | 16.5 | 35.9 | 19.1 |
| School Level | | | |
| Elementary | 60.5 | 82.3 | 63.3 |
| Middle | 19.4 | 14.5 | 18.7 |
| High | 20.1 | 3.2 | 18.0 |
| School Enrollment | | | |
| Less than 400 students | 14.1 | 10.2 | 13.6 |
| 400 to 799 students | 41.8 | 50.3 | 42.9 |
| 800 to 1,200 students | 21.4 | 22.0 | 21.4 |
| More than 1,200 students | 22.7 | 17.5 | 22.0 |
| **Sample Size** | **211** | **55** | **266** |

Source: APEC Study, data on study schools from SFA Survey.

Note: Data are weighted by school weight adjusted for number of enrolled students with access to the school meal programs.

Table reads: "40.3 percent of students with access to the school meal programs are in schools located in urban areas."

TABLE C.9

NSLP AND SBP MEAL PROGRAM CHARACTERISTICS, BY PROVISION 2/3 STATUS
(Percentages of Schools)

| Characteristic | Non-Provision 2/3 Schools | Provision 2/3 Schools | All Schools |
|---|---|---|---|
| Types of Meal Programs Offered | | | |
| NSLP only | 14.4 | . | 12.7 |
| Both NSLP and SBP | 85.6 | 100.0 | 87.3 |
| Provision 2/3 Status | | | |
| NSLP only, NP 2/3 | 14.3 | . | 12.7 |
| SBP only, NP 2/3 | 0.3 | . | 0.3 |
| SBP NP 2/3, NSLP NP 2/3 | 85.4 | . | 75.3 |
| SBP P2/3 BY, NSLP NP 2/3 | . | 16.7 | 2.0 |
| SBP P2/3 NBY, NSLP NP 2/3 | . | 30.1 | 3.5 |
| SBP P2/3 BY, NSLP P2/3 BY | . | 14.8 | 1.7 |
| SBP P2/3 NBY, NSLP P2/3 NBY | . | 38.4 | 4.5 |
| Uses Offer-Versus-Serve (OVS)[a] | | | |
| Uses OVS | 94.1 | 93.5 | 94.0 |
| Does not use OVS | 5.9 | 6.5 | 6.0 |
| Student Certification (Percentages) | | | |
| Certified for free meals | 40.5 | 65.1 | 43.4 |
| Certified for reduced-price meals | 9.4 | 18.3 | 10.5 |
| Certified for free or reduced-price meals | 49.9 | 83.4 | 53.8 |
| Percentage of NSLP Lunches by Type | | | |
| Free | 49.0 | 73.4 | 51.9 |
| Reduced-price | 10.0 | 7.9 | 9.8 |
| Paid | 41.0 | 18.7 | 38.3 |
| Receives NSLP 60 Percent Subsidy[b] | | | |
| Yes | 34.5 | 80.9 | 39.9 |
| No | 65.5 | 19.1 | 60.1 |
| NSLP Participation (Percentages) | | | |
| Average Daily Participation Rate | | | |
| Among all students | 64.6 | 77.0 | 66.1 |
| Among students certified for free meals | 77.0 | 81.6 | 77.5 |
| Among students certified for reduced-price meals | 72.3 | 60.7 | 71.0 |
| Among students not certified (paid) | 51.9 | 55.1 | 52.2 |
| Percentage of SBP Breakfasts by Type | | | |
| Free | 69.6 | 80.7 | 71.2 |
| Reduced-price | 9.8 | 6.6 | 9.3 |
| Paid | 20.6 | 12.7 | 19.5 |
| Receives Severe Needs SBP Subsidy[c] | | | |
| Yes | 52.1 | 93.7 | 57.0 |
| No | 47.9 | 6.3 | 43.0 |

Table C.9 *(continued)*

| Characteristic | Non-Provision 2/3 Schools | Provision 2/3 Schools | All Schools |
|---|---|---|---|
| SBP Participation (Percentages) | | | |
| Average Daily Participation Rate | | | |
| Among all students | 26.6 | 35.5 | 27.8 |
| Among students certified for free meals | 40.1 | 49.8 | 41.4 |
| Among students certified for reduced-price meals | 25.0 | 26.4 | 25.1 |
| Among students not certified (paid) | 14.1 | 31.0 | 16.1 |
| **Sample Size** | **211** | **55** | **266** |

Source: APEC Study, data on study schools from SFA Survey.

Note: Data are weighted by school weight.

Table reads: "12.7 percent of schools participating in the school meal programs offer the NSLP only."

[a]School uses offer-versus-serve option in one or both school meal programs.

[b]School receives extra two cents for each lunch served because 60 percent or more of total lunches served are to students certified for free or reduced-price meals.

[c]School receives extra 24 cents for each free or reduced-price breakfast served.

NP = Non-provision 2/3 program
P2/3 = Provision 2/3 program
BY = Provision 2/3 program in base year
NBY = Provision 2/3 program in non-base year

TABLE C.10

NSLP AND SBP MEAL PROGRAM CHARACTERISTICS, BY PROVISION 2/3 STATUS
(Percentages of Students in Schools with Characteristics Indicated in Row Heading)

| Characteristic | Non-Provision 2/3 Schools | Provision 2/3 Schools | All Schools |
|---|---|---|---|
| Types of Meal Programs Offered | | | |
| NSLP only | 11.1 | . | 9.6 |
| Both NSLP and SBP | 88.9 | 100.0 | 90.4 |
| Provision 2/3 Status | | | |
| NSLP only, NP 2/3 | 11.0 | . | 9.6 |
| SBP only, NP 2/3 | 1.0 | . | 0.9 |
| SBP NP 2/3, NSLP NP 2/3 | 88.0 | . | 76.6 |
| SBP P2/3 BY, NSLP NP 2/3 | . | 14.4 | 1.9 |
| SBP P2/3 NBY, NSLP NP 2/3 | . | 24.4 | 3.2 |
| SBP P2/3 BY, NSLP P2/3 BY | . | 15.0 | 2.0 |
| SBP P2/3 NBY, NSLP P2/3 NBY | . | 46.2 | 6.0 |
| Uses Offer-Versus-Serve (OVS)[a] | | | |
| Uses OVS | 95.8 | 90.5 | 95.1 |
| Does not use OVS | 4.2 | 9.5 | 4.9 |
| Student Certification (Percentages) | | | |
| Certified for free meals | 38.9 | 61.8 | 41.9 |
| Certified for reduced-price meals | 9.0 | 21.5 | 10.6 |
| Certified for free or reduced-price meals | 48.1 | 83.2 | 52.5 |
| Percentage of NSLP Lunches by Type | | | |
| Free | 49.7 | 73.1 | 52.9 |
| Reduced-price | 10.0 | 8.6 | 9.8 |
| Paid | 40.3 | 18.3 | 37.3 |
| Receives NSLP 60 Percent Subsidy[b] | | | |
| Yes | 35.5 | 84.5 | 41.9 |
| No | 64.5 | 15.5 | 58.1 |
| NSLP Participation (Percentages) | | | |
| Average Daily Participation Rate | | | |
| Among all students | 59.4 | 74.7 | 61.4 |
| Among students certified for free meals | 72.9 | 81.8 | 74.1 |
| Among students certified for reduced-price meals | 67.5 | 59.0 | 66.4 |
| Among students not certified (paid) | 46.7 | 54.0 | 47.6 |
| Percentage of SBP Breakfasts by Type | | | |
| Free | 69.5 | 79.4 | 71.0 |
| Reduced-price | 9.5 | 7.4 | 9.1 |
| Paid | 21.0 | 13.2 | 19.8 |
| Receives Severe Needs SBP Subsidy[c] | | | |
| Yes | 51.5 | 96.7 | 57.4 |
| No | 48.5 | 3.3 | 42.6 |

Table C.10 *(continued)*

| Characteristic | Non-Provision 2/3 Schools | Provision 2/3 Schools | All Schools |
|---|---|---|---|
| SBP Participation (Percentages) | | | |
| Average Daily Participation Rate | | | |
| Among all students | 21.8 | 33.2 | 23.4 |
| Among students certified for free meals | 35.0 | 49.0 | 37.0 |
| Among students certified for reduced-price meals | 21.3 | 25.7 | 22.0 |
| Among students not certified (paid) | 11.9 | 33.0 | 14.7 |
| **Sample Size** | **211** | **55** | **266** |

Source: APEC Study, data on study schools from SFA Survey.

Note: Data are weighted by school weight adjusted for number of enrolled students with access to the school meal programs.

Table reads: "9.6 percent of students with access to the school meal programs attend schools that offer the NSLP only."

[a]School uses offer-versus-serve option in one or both school meal programs.

[b]School receives extra two cents for each lunch served because 60 percent or more of total lunches served are to students certified for free or reduced-price meals.

[c]School receives extra 24 cents for each free or reduced-price breakfast served.

NP = Non-provision 2/3 program
P2/3 = Provision 2/3 program
BY = Provision 2/3 program in base year
NBY = Provision 2/3 program in non-base year

TABLE C.11

CHARACTERISTICS OF STUDENTS, BY CERTIFICATION STATUS
(Percentages of Students)

| | Certified Students and Denied Applicants | | |
|---|---|---|---|
| | All | Free and Reduced-Price Certified | Denied |
| Child's Grade | | | |
| PreK to K | 10.6 | 10.6 | 10.6 |
| 1 to 3 | 33.2 | 33.5 | 27.3 |
| 4 to 5 | 18.5 | 18.3 | 23.1 |
| 6 to 8 | 21.4 | 21.4 | 21.3 |
| 9 to 12 | 16.3 | 16.2 | 17.6 |
| Gender | | | |
| Male | 52.5 | 52.2 | 58.5 |
| Female | 47.5 | 47.8 | 41.5 |
| Race/Ethnicity | | | |
| White, non-Hispanic | 29.3 | 28.9 | 36.5 |
| Black, non-Hispanic | 29.0 | 29.4 | 21.9 |
| Hispanic | 35.7 | 36.0 | 29.5 |
| Other | 6.1 | 5.8 | 12.0 |
| Location | | | |
| Urban | 45.9 | 46.2 | 39.2 |
| Suburban | 34.0 | 34.0 | 34.3 |
| Town | 6.6 | 6.6 | 6.1 |
| Rural | 13.5 | 13.1 | 20.3 |
| Household Headed by | | | |
| Two parents | 49.9 | 48.8 | 68.8 |
| Single parent | 45.1 | 46.0 | 28.9 |
| Other relative | 4.9 | 5.1 | 2.3 |
| Nonrelative | 0.1 | 0.1 | 0.0 |
| Parent's Education | | | |
| Less than high school | 31.9 | 32.9 | 13.8 |
| High school or GED | 43.1 | 42.9 | 45.8 |
| Some college | 19.6 | 19.2 | 27.1 |
| College graduate | 5.4 | 5.0 | 13.3 |
| Program Participation | | | |
| TANF | 7.9 | 8.3 | 0.8 |
| Food stamps | 32.6 | 34.2 | 4.4 |
| SFSP | 12.8 | 12.9 | 10.1 |
| Number of Children < 18 Years | | | |
| 1 | 13.7 | 13.4 | 19.5 |
| 2 | 32.1 | 31.2 | 47.1 |
| 3 | 29.0 | 29.3 | 24.5 |
| 4 or more | 25.2 | 26.1 | 9.0 |

TABLE C.11 (*continued*)

| | Certified Students and Denied Applicants | | |
|---|---|---|---|
| | All | Free and Reduced-Price Certified | Denied |
| Age of Youngest Child | | | |
| Less than 5 | 34.1 | 34.6 | 25.5 |
| 5 to 8 | 35.3 | 35.4 | 34.2 |
| 9 to 13 | 23.0 | 22.4 | 34.5 |
| 14 to 18 | 7.5 | 7.6 | 5.8 |
| Household Size | | | |
| 1 to 3 | 23.9 | 23.6 | 29.4 |
| 4 to 6 | 64.8 | 64.7 | 66.2 |
| 7 to 9 | 9.7 | 10.0 | 4.2 |
| 10 or more | 1.6 | 1.7 | 0.2 |
| Income Relative to Poverty (Percentage) | | | |
| Less than 50 | 21.8 | 22.9 | 2.3 |
| 50 to 99 | 31.4 | 32.8 | 6.6 |
| 100 to 129 | 15.8 | 16.2 | 8.5 |
| 130 to 184 | 17.8 | 17.8 | 17.8 |
| 185 to 249 | 8.4 | 7.3 | 27.8 |
| 250 to 399 | 3.7 | 2.4 | 26.3 |
| 400 or more | 1.1 | 0.6 | 10.6 |
| **Sample Size** | **3,402** | **2,949** | **453** |

Source: APEC Study, Household Survey, weighted data.

# APPENDIX D

# NSLP AND SBP STUDENT PARTICIPATION IMPUTATIONS

In the estimation of erroneous payments due to certification errors in the study of Access, Participation, Eligibility, and Certification (APEC), we have determined the amount of erroneous payments for meals consumed by each sample member in each month of the 2005–2006 school year. For students whose certification status was correct, there were no erroneous payments. For those whose certification status was not correct, however, there were erroneous payments of a given size for each reimbursable school meal provided to that individual. If the student was certified for free meals but should have been certified for reduced-price meals, for example, there was an erroneous payment of $0.40 for each program lunch consumed during the month. Therefore, to determine overall erroneous payments during the school year, we need to know the number of school meals (lunches and breakfasts) each sample member consumed during each month of the school year.

For a portion of the sample in a given month, we have high-quality administrative data on the number of meals consumed by the individual in the month. These meal counts were tracked electronically by schools as students consumed their school meals. For other sample members, however, we were unable to obtain administrative data because the district does not track participation at the individual student level (either electronically or manually). For these students we only have survey data on their participation status.[1] This survey data shows the students' reported participation status during the school day and school week just prior to the administration of the household survey (which was typically a month or two into the school year). Students' participation was reported by their parent or guardian. When possible, the respondent asked the student to confirm the amounts reported. For these students, we have no other information on the number of school meals they obtained during other portions of the

[1]There is also an intermediate group of students for whom we have administrative SBP and NSLP meal counts during a portion of the school year but no information during the rest of the school year.

school year. Thus, we needed to impute the actual number of meals consumed by these students in each month for which we had no administrative data.

This appendix describes the basic approach we used to impute students' monthly school lunch and school breakfast participation (that is, the number of meals consumed during the month) in cases in which we have no administrative data for a given student in a given month. First, we describe the overall approach to imputing these missing values. Next, we describe the details of the imputation model we estimated to determine the relationship between actual participation in a given month (as determined by the administrative data) and the response to the participation questions on the household survey (and other individual characteristics) among those with both administrative and survey data. We also describe the results of the estimation of this model. The final section describes the process we used for imputing monthly participation among sample members for whom we have survey data but no administrative data on participation.

## A. OVERALL APPROACH

We attempted to obtain participation data from schools' administrative records for all students in the household survey sample (in other words, all those whose parent or guardian completed a household survey). As shown in Table D.1, we successfully obtained the data for all months of the school year for more than half of this sample (52 percent in the case of NSLP participation). Students with incomplete participation data fall into two groups. In the first group, for 23 percent of all students in the sample, we obtained participation data for some but not all months of the school year. The most common reason for this was if a district was able to provide full participation data for a single semester only. Thus, for most of the students in this group, we have administrative data on participation for at least half of the school year. In the second group of students are those for whom we have no administrative data on NSLP or SBP

TABLE D.1

AVAILABILITY OF ADMINISTRATIVE DATA ON NSLP PARTICIPATION

| | Percentage of Students | Percentage of Student-Month Observations |
|---|---|---|
| Available for All Months | 51.5 | 64.8 |
| Available for More Than Half of All Months | 19.0 | n.a. |
| Available for Fewer Than Half of All Months | 3.8 | n.a. |
| Data Not Available | 25.7 | 35.2 |

Source: APEC Study, student-level participation records data.

n.a. = not applicable.

meals consumed during the year. This group makes up 26 percent of the sample in the case of the NSLP. Overall, among all student-month observations when school was in session, we have administrative data on NSLP participation in 65 percent of observations. The numbers for SBP participation are similar.

The process for imputing participation status for those with missing data for a given month consisted of three steps. The first step involved estimating the imputation model using sample members with both administrative and survey data on participation. In particular, we estimated the relationship between the number of meals the student consumed in the month and a set of variables we believe can predict the number of meals consumed. The key predictor variable is the student's participation level as reported on the household survey.

The second step involved calculating a predicted number of meals consumed in the month among students for whom we have no administrative data on participation in that month. We calculated predicted participation by multiplying the estimated coefficients from the model estimated in the first step by the values of the model's independent variables for a given individual.

The third step in the imputation process involved accounting for the fact that the imputation model did not perfectly explain variation in individuals' monthly school meal participation. In other words, there was some variation in the number of meals consumed among students who had the same predicted participation levels. Therefore, after calculating each student's predicted number of meals consumed (among those missing administrative data on participation in a given month), we calculated their imputed number of meals consumed. This imputed number of meals was set equal to the predicted number of meals plus an imputed value of the stochastic error term (which included one part that varied only across individuals and a second part that varied across

both individuals and months). The inclusion of this error term ensures that our imputation process does not artificially reduce the overall variation of monthly participation.

## B. ESTIMATING THE IMPUTATION MODEL

### 1. The Basic Model

We estimated separate imputation models for the number of school breakfasts consumed in a given month and the number of school lunches consumed in a given month. Each of these imputation models was estimated using data from sample members for whom we have both administrative data on meals consumed in a given month and survey data that could be used to define the key explanatory variables included in the model. This imputation model is shown below:

(1) $$M_{it} = \alpha_0 + X_i\beta + Z_{it}\delta + MP_t\theta + \alpha_1 P_i + \alpha_2 P_i^2 + \alpha_3 P_i * MS_{it} + \alpha_4 P_i * H_i + u_i + e_{it}$$

where: $M_{it}$ = number of meals (breakfast or lunch) consumed by student i in month t
$X_i$ = time invariant student characteristics related to participation in month t
$Z_{it}$ = time-varying student characteristics related to participation in month t
$P_i$ = survey-based indicator of student i's meal program participation
$MP_t$ = set of binary variables indicating current month (t)
$MS_{it}$ = number of months between survey and month t
$u_i$ = student-level error term
$e_{it}$ = student/month error term

In the model, the outcome (or dependent variable) is the number of school meals consumed during a given month by a given student. This outcome was regressed on a set of factors that vary by student but not by month ($X_i$), a set of factors that vary by student and month ($Z_{it}$), the month in which participation is being measured ($MP_t$), and a set of terms representing a function of the student's participation as reported on the household survey (P). This set of terms is described in greater detail below.

The error structure in the model consists of two components—an individual-specific error term and a random error term. The individual-specific term ($u_i$) represents unobserved factors that explain why a given individual consumed more or fewer meals in a month than would be expected given his or her survey-reported characteristics and other observed factors. This term is constant for a given individual across months of the school year. The random term ($e_{it}$) represents factors that are specific to both the individual student and month that cause the student to consume more or fewer meals in a month than would be expected given his or her survey-reported characteristics and other observed factors. One of the model's assumptions is that $e_{it}$ is independent and identically distributed across sample members and months, while $u_i$ is independent and identically distributed across sample members.

Household survey-reported school meal participation is a key predictor of a student's actual monthly participation (based on administrative data) so considerable care was taken in determining the appropriate specification for including it in the imputation model. The measure is based on a survey question about whether the student ate a school lunch (breakfast) on the previous school day, as well as questions about their participation on each day of the most recent completed full school week prior to the survey. Thus, we have information on whether students consumed school breakfasts and lunches on as many as six school days during the month in which the survey was conducted.[2] However, we do not have six data points for each student in the sample for three reasons. First, for some students, the previous school day was part of the most recent full school week, so there is participation data for only five days for these students. Second, due to an error in the CAPI survey, some students were not asked about their participation on Friday of the most recent full school week. Finally, students may not have

[2]An exception to the survey-reported participation variable covering the survey month occurs in cases in which the survey was administered early in the month and the "previous school week" was during the previous month.

attended school during every day of the most recent school week (or previous school day). These students could not possibly have eaten a school meal on those days that they did not attend school.

To account for these various situations, the key survey-reported participation variable measured the proportion of days that the student ate a school lunch (breakfast) among days on which he or she could possibly have done so. If, for example, a student with complete data ate a school lunch on the previous day and on three of the five days of the most recent full school week, the value of this variable would be 4/6, or 0.67. If, on the other hand, the previous school day was the Friday of the most recent school week (for this same student), the value of the variable would be 3/5, or 0.60.

The distribution of the survey-reported NSLP and SBP participation variables is shown in Table D.2. Because a student's parent or guardian was the household survey respondent, we had some concerns about the accuracy of the information they reported on their children's school meal participation. Parents may not be truly aware of how frequently their child eats a school meal. In some cases, sample members (students) sat in on that part of the household survey interview and helped their parents answer those questions; in that case, we expect that information to be more accurate than if they did not help their parents answer the questions on school meal participation. Thus, the imputation model includes an interaction term that allows the estimated relationship between the survey-based participation variable and the number of meals consumed during the month (the dependent variable) to vary according to whether the sample member helped his or her parent answer those questions.

Another issue with using survey-based participation as a predictor of the actual number of meals consumed during a given month is that the survey-based variable represents participation during a single week just before the survey was conducted—typically very early in the school

TABLE D.2

PROPORTION OF DAYS STUDENT WAS REPORTED TO HAVE RECEIVED A REIMBURSABLE SCHOOL MEAL DURING SURVEY REFERENCE PERIOD
(Percentage of Students)

| | NSLP | SBP |
|---|---|---|
| 0 Days During Reference Period | 4.0 | 40.7 |
| 1 to 20 Percent of Days | 1.1 | 3.7 |
| 21 to 40 Percent of Days | 0.9 | 3.0 |
| 41 to 60 Percent of Days | 1.1 | 3.0 |
| 61 to 80 Percent of Days | 2.9 | 4.3 |
| 81 to 99 Percent of Days | 3.5 | 3.5 |
| All Days During Reference Period | 86.4 | 41.8 |

Source: APEC Study, Household Survey.

year. By contrast, the dependent variable represents meals consumed during any given month during the school year. It seems reasonable to expect that the survey-based participation variable would be a more accurate predictor of meals consumed early in the school year than it is of meals consumed later in the school year. Thus, the model also includes an interaction term that allows the estimated relationship between survey-based participation and the number of meals consumed to vary according to the number of elapsed months between the month in which the survey was conducted and the current month (the month in which the dependent variable was being measured).

Survey-based participation enters the imputation model in two additional ways. First, to allow for the possibility that the relationship is non-linear, the model includes a squared value of survey-based participation. Second, the model also includes a survey-based variable representing the student's participation in the other meal program. In other words, the NSLP lunch participation model includes the proportion of days during the reference period the student was reported to eat a school breakfast (in addition to all of the survey-based lunch participation variables). Similarly, the SBP breakfast participation model includes a survey-based lunch participation variable.

The model includes various other explanatory variables in the vectors $X_i$ and $Z_{it}$. Each of these variables is potentially related to the number of meals a student consumed during a give month and is available for those students for whom we need to impute participation (that is, those students missing administrative information on participation). In addition to the survey-based participation variables described above and a set of binary variables indicating the current month, the model includes the following variables:

- Age (and age squared)
- Gender

- Race/ethnicity
- Household structure
- Parents' employment
- Household size
- Free/reduced-price income eligibility
- Free/reduced-price certification status
- Whether directly certified/categorically eligible
- Whether respondent reported that the student did not eat a school lunch (breakfast) on every day of the previous week because he or she ate at home or does not always like the food served[3]
- Whether respondent reported that the student did not eat a school lunch (breakfast) on *any* day of the previous week because he or she regularly eats at home or never likes the food served
- Index of the student's overall level of satisfaction with school meals
- Index of the parent's overall level of satisfaction with school meals
- Proportion of days absent from school

The model also includes two or three missing value indicators (though none of the explanatory variables is missing in more than 2 or 3 percent of observations).

## 2. Estimation Method

To determine the appropriate technique to estimate the model, we first had to assess the extent to which the value of the dependent variable in this model is limited or censored, in the sense that it could not exceed the total number of days the student attended school in the month or be less than zero. Without censoring, ordinary least squares (OLS) estimation of the imputation model would be appropriate. However, if a large enough proportion of observations

[3]This variable was designed to get at differences between students who skip a day or two of school lunch (breakfast) because of persistent issues (such as not liking the food or making it a habit to eat at home) versus transitory issues (such as having a one-time conflict with another school event).

are censored at either of these limits, then OLS estimates may be biased. For example, while an increase in survey-reported participation presumably is associated with an increase in the number of meals consumed during the month, changes in survey-reported participation cannot have this effect among students who are already consuming a school meal on each school day during the month (that is, who already have the maximum value of the dependent variable).

We have incomplete data on the extent to which the administrative data on meals consumed during a month is censored. We know the proportion of students who consume zero meals during the month—it is reasonably small (14 percent) for lunch participation but much larger (48 percent) for breakfast participation—but we cannot determine the exact extent of censoring at the upper limit on meals consumed. This upper limit varies across students, both because students attend different schools with different numbers of school days during a given month, and also because students are absent from school for different (and unobserved) numbers of days during a month. Thus, while we have an estimate of the number of school days in each month of the school year, this information is not specific to particular students or particular schools.

Based on the extent of censoring at zero, we estimated equation (1) using OLS in the case of NSLP participation. In the case of SBP participation, however, we estimated a two-stage model to account for the substantial censoring at zero. The first stage is a probit model predicting whether students eat any SBP breakfasts at all during a given month. The second stage is an OLS model of the number of breakfasts consumed during the month, conditional on consuming some positive number. In other words, while the full sample of students is used to estimate the

probit model of "any participation," only the portion (slightly more than half) of the sample with some participation is used to estimate the OLS model of the number of meals consumed.[4]

### 3. Lunch Imputation Model Results

Table D.3 shows the results of the model used to impute NSLP participation. The estimation of this model is based on 23,201 student-month observations from 2,529 students who have both household survey data and administrative data on NSLP participation. Overall, the explanatory variables in the model explain about one-third of the variation in the monthly number of NSLP lunches consumed. Of the unexplained variation, about one-third comes from student-level error term and the remaining two-thirds comes from the student-month error term.

The variable representing NSLP participation as reported on the household survey has a positive and highly significant relationship with the monthly number of meals consumed, as expected. There is no evidence that this relationship is nonlinear, as the squared participation term is not statistically significant. However, the relationship does depend on the timing of the survey month relative to the current month. The relationship is strongest for months immediately surrounding the survey month, and weakens as the length of time between the survey month and current month lengthens. The negative coefficient on this interaction term is statistically significant. On the other hand, the interaction between survey-based participation and an indicator of whether the student assisted his or her parent in responding to the participation questions on the survey is not statistically significant (though it is positive, as expected). None of the other variables related to school meal participation, including SBP breakfast participation, is significantly related to the number of meals consumed during the month.

[4]In the case of the lunch participation model, we tested the sensitivity of the model to the estimation method by estimating the model using the two-stage method in addition to the OLS method. The results of the two methods were similar.

TABLE D.3

ESTIMATION RESULTS: IMPUTATION MODEL OF NSLP PARTICIPATION
(Dependent Variable = Number of NSLP Reimbursable Lunches Received During Month)

| | Results | |
|---|---|---|
| | Coefficient Estimate | Standard Error |
| Intercept | -10.486** | 1.169 |
| Survey-Based Participation Terms | | |
| Percentage of days ate school lunch | 8.483** | 2.129 |
| Percentage of days ate school lunch (squared) | -1.059 | 1.782 |
| Lunch participation*# of months since survey | -0.600** | 0.023 |
| Lunch participation*Whether student helped parent respond | 0.283 | 0.190 |
| Percentage of days ate school breakfast | 0.199 | 0.180 |
| Never eat school lunch: eat at home or do not like food | 0.416 | 0.660 |
| Do not always eat school lunch: eat at home or do not like food | -0.714 | 0.626 |
| Satisfaction with school meal program: Student | 0.037 | 0.129 |
| Satisfaction with school meal program: Parent | 0.083 | 0.128 |
| Current Month (July/August is omitted month) | | |
| September | 1.785** | 0.183 |
| October | 1.061** | 0.187 |
| November | 1.243** | 0.169 |
| December | -0.837** | 0.154 |
| January | 1.578** | 0.180 |
| February | 2.908** | 0.174 |
| March | 2.913** | 0.213 |
| April | 4.324** | 0.158 |
| May | 3.755** | 0.204 |
| June | 2.459** | 0.204 |
| Number of school days in month | 0.470** | 0.013 |
| Demographic/Socioeconomic Variables | | |
| Age | 0.837** | 0.139 |
| Age squared | -0.054** | 0.007 |
| Gender = female | -0.383** | 0.158 |
| Household size | 0.033 | 0.051 |
| Race/ethnicity (“other” category is omitted) | | |
| White | -0.016 | 0.347 |
| Black | 0.475 | 0.358 |
| Hispanic | 0.130 | 0.348 |
| Family structure/parents employment (2 parents, 1 employed is omitted) | | |
| 2 parents, both employed | 0.261 | 0.247 |
| 1 parent, employed | 0.204 | 0.222 |
| 1 parent, not employed | -0.952** | 0.253 |
| No parents in household | -0.550 | 0.265 |

Table D.3 *(continued)*

| | Results | |
|---|---|---|
| | Coefficient Estimate | Standard Error |
| Certification Status (paid category is omitted) | | |
| Certified for free meals | 3.642** | 0.182 |
| Certified for reduced-price meals | 2.667** | 0.225 |
| Directly certified (binary) | 0.871** | 0.217 |
| Categorically eligible (binary) | 0.168 | 0.241 |
| Income Eligibility Status (eligible only for free meals category is omitted) | | |
| Income eligible for free meals | -1.340** | 0.253 |
| Income eligible for reduced-price meals | -0.620* | 0.280 |
| Other Variables | | |
| % of days student attended school during reference week | 1.972** | 0.631 |
| Student no longer attends target school | -5.440** | 1.010 |
| Missing value indicator for survey-based lunch participation | -3.257** | 0.539 |
| **Sample Size (student-month observations)** | **23,201** | |
| **Sample Size (number of students)** | **2,529** | |
| **Mean of Dependent Variable (days)** | **11.6** | |
| **Variance of $u_i$** | **13.1** | |
| **Variance of $e_{it}$** | **20.0** | |

Source: APEC Study, student-level NSLP participation records data and Household Survey.

*Significantly different from zero at the .05 level, two-tailed test.
**Significantly different from zero at the .01 level, two-tailed test.

Beyond survey-based participation, several other explanatory variables are significantly related to monthly NSLP participation. In particular, the percentage of days the student attended school during the survey reference week is positively related to monthly participation. Relative to students paying the full price for school meals, those certified for free or reduced-price meals consume significantly more meals during the month.[5] Being directly certified has an additional positive and significant effect on monthly participation. Once certification status is controlled, however, a student's income eligibility for free or reduced-price meals is negatively related to participation.

Several demographic factors are related to participation. Students' age has a nonlinear relationship—positive among younger students but eventually flattening out and becoming negative as they become older. Household structure/parents' employment is also somewhat related to participation. Relative to households in which there are two parents or one working parent, students in households with a single parent who does not work consume significantly fewer NSLP meals in a given month. Finally, males receive significantly more NSLP meals in a given month than females.

We also looked at the relationship between the current month and NSLP participation. Not surprisingly, the number of meals students consume in a given month is positively and significantly related to the number of school days in that month. Even after controlling for the number of school days, participation varies by month of the school year. Participation is highest in the spring months, particularly April and May.

[5]In the sample used for this study, the only students not certified for free or reduced-price meals are those who applied for benefits but whose applications were denied.

## 4. Breakfast Imputation Model Results

Table D.4 shows the results of the two-stage model used to impute SBP participation. The estimation of the first stage probit model of whether or not students consume any SBP breakfasts in a month is based on 22,153 student-month observations from 2,528 students who have both household survey data and administrative data on SBP participation. The second stage OLS model of the number of breakfasts consumed (among those who consume some positive number) is based on 11,522 student-month observations from 1,771 students. The explanatory variables in the second stage model explain about 26 percent of the total variance in the monthly number of breakfasts consumed.

The results of the first stage probit model of whether the student participated in the SBP during the month and the second stage OLS model of the number of meals consumed during the month are generally consistent, but the strength of the variables' relationship with the dependent variable seems a bit stronger in the case of the probit model of any participation. In other words, more of the variables are statistically significantly related to whether the student had any school breakfasts than with the number of breakfasts consumed (and levels of statistical significance are typically higher). As with the lunch model, the survey-based SBP participation variable (the proportion of days during the reference period the student is reported to have eaten a school breakfast) is positively related to the likelihood that they participate at some point during the month in the SBP. This relationship is nonlinear, getting significantly smaller as the value of the survey-based participation variable increases. Survey-based participation also has a significant negative interaction with the number of months between the survey and current month. Finally, even after controlling for the survey-based SBP participation variable (and its interactions), students' school lunch participation as reported on the survey is positively and significantly related to the number of school breakfasts students consume during a month.

TABLE D.4

ESTIMATION RESULTS: IMPUTATION MODEL OF SBP PARTICIPATION
(Dependent Variable = Number of SBP Reimbursable Breakfasts Received During Month)

| | Results (Standard Errors in Parentheses) | |
|---|---|---|
| | Probit Model of Any Participation | OLS Model of Number of Meals Conditional on Participating |
| Intercept | -1.789** | -3.543* |
| | (0.139) | (1.490) |
| Survey-Based Participation Terms | | |
| Percentage of days ate school breakfast | 2.797** | 3.041 |
| | (0.159) | (1.796) |
| Percentage of days ate school breakfast (squared) | -1.687** | 2.448 |
| | (0.142) | (1.561) |
| Breakfast participation * # of months since survey | -0.049** | -0.274** |
| | (0.007) | (0.032) |
| Breakfast participation * Whether student helped parent respond | 0.031 | 0.415 |
| | (0.029) | (0.303) |
| Percentage of days ate school lunch | 0.125** | -0.510 |
| | (0.044) | (0.534) |
| Never eat school breakfast: eat at home or do not like food | -0.101** | -1.078* |
| | (0.035) | (0.448) |
| Do not always eat school breakfast: eat at home or do not like food | -0.240 | 0.446 |
| | (0.155) | (1.691) |
| Satisfaction with school meal program: Student | 0.027 | -0.078 |
| | (0.015) | (0.168) |
| Satisfaction with school meal program: Parent | 0.008 | 0.250 |
| | (0.015) | (0.167) |
| Current Month (July/August is omitted month) | | |
| September | 0.203** | 1.004** |
| | (0.055) | (0.233) |
| October | 0.197** | 0.603* |
| | (0.055) | (0.237) |
| November | 0.264** | 0.994** |
| | (0.051) | (0.212) |
| December | 0.225** | -0.809** |
| | (0.046) | (0.194) |
| January | 0.284** | 0.534* |
| | (0.054) | (0.228) |
| February | 0.323** | 1.621** |
| | (0.052) | (0.221) |
| March | 0.347** | 1.060** |
| | (0.062) | (0.274) |
| April | 0.409** | 2.839** |
| | (0.045) | (0.201) |
| May | 0.346** | 1.490** |
| | (0.057) | (0.257) |
| June | 0.100 | 2.018** |
| | (0.059) | (0.305) |
| Number of school days in month | 0.014** | 0.487** |
| | (0.004) | (0.019) |

Table D.4 *(continued)*

| | Results (Standard Errors in Parentheses) | |
|---|---|---|
| | Probit Model of Any Participation | OLS Model of Number of Meals Conditional on Participating |
| Demographic / Socioeconomic Variables | | |
| Age | -0.022 | 0.007 |
| | (0.016) | (0.177) |
| Age squared | 0.000 | -0.011 |
| | (0.001) | (0.008) |
| Gender = female | -0.107** | -0.424* |
| | (0.018) | (0.205) |
| Household size | 0.046** | 0.061 |
| | (0.006) | (0.064) |
| Race/ethnicity ("other" category is omitted) | | |
| White | 0.377** | -0.549 |
| | (0.040) | (0.479) |
| Black | 0.399** | 0.232 |
| | (0.041) | (0.486) |
| Hispanic | 0.066 | -0.851 |
| | (0.040) | (0.481) |
| Family structure / parents employment (2 parents, 1 employed is omitted) | | |
| 2 parents, both employed | 0.136** | 0.323 |
| | (0.029) | (0.326) |
| 1 parent, employed | 0.041 | -0.533 |
| | (0.026) | (0.292) |
| 1 parent, not employed | -0.035 | -0.886** |
| | (0.029) | (0.321) |
| No parents in household | 0.002 | -0.516 |
| | (0.042) | (0.461) |
| Certification Status (paid category is omitted) | | |
| Certified for free meals | 0.479** | 0.821** |
| | (0.031) | (0.300) |
| Certified for reduced-price meals | 0.227** | 0.089 |
| | (0.035) | (0.340) |
| Directly certified (binary) | 0.036 | -0.511 |
| | (0.027) | (0.279) |
| Categorically eligible (binary) | 0.094** | -0.790* |
| | (0.032) | (0.311) |
| Income Eligibility Status (eligible only for free meals category is omitted) | | |
| Income eligible for free meals | -0.093** | 0.192 |
| | (0.031) | (0.349) |
| Income eligible for reduced-price meals | -0.090** | -0.130 |
| | (0.033) | (0.387) |

Table D.4 *(continued)*

| | Results (Standard Errors in Parentheses) | |
|---|---|---|
| | Probit Model of Any Participation | OLS Model of Number of Meals Conditional on Participating |
| Other Variables | | |
| % of days student attended school during reference week | 0.084 | 0.929 |
| | (0.072) | (0.813) |
| Student no longer attends target school | -0.757** | -2.319 |
| | (0.117) | (1.404) |
| Missing value indicator for survey-based lunch participation | -0.502** | -3.437** |
| | (0.057) | (0.734) |
| **Sample Size (student-month observations)** | **22,153** | **11,522** |
| **Sample Size (number of students)** | **2,528** | **1,771** |
| **Mean of Dependent Variable (days)** | **0.520** | **0.262** |
| **Variance of $u_i$** | **---** | **15.1** |
| **Variance of $e_{it}$** | **---** | **14.4** |

Source: APEC Study, student-level SBP participation records data, and Household Survey data.

*Significantly different from zero at the .05 level, two-tailed test.
**Significantly different from zero at the .01 level, two-tailed test.

Survey-based participation is also positively related to the number of breakfasts consumed during the month among participants. Although the estimated coefficient on this variable as well as its squared term are not statistically significant individually, because they are both positive they do have a positive and significant relationship with monthly SBP participation when considered jointly. There is a negative interaction between survey-based participation and the number of months between the survey and current month as well.

As with the NSLP model, certification status is a significant predictor of monthly SBP participation. Relative to students paying the full price for school meals, those certified for free or reduced-price meals consume significantly more meals during the month. While being directly certified has no additional effect on monthly participation, being categorically eligible (that is, certified for free meals by application on the basis of food stamp or TANF receipt) is positively and significantly related to participating at all, but negatively and significantly related to the number of meals consumed among participants. Once certification status is controlled, a student's income eligibility for free or reduced-price meals is again negatively related to participation.

Students' age is not significantly related to monthly SBP participation, but females are less likely to participate in the SBP and have fewer school breakfasts per month than males. In addition, Hispanic students (along with those in the "other race" category) are less likely than white or black students to participate in the SBP, though among participants, race/ethnicity is not related to the number of meals consumed during the month.

There is a strong relationship between the number of school days in a given month and SBP participation. In addition, monthly SBP participation tends to be higher in the winter/spring semester than in the fall.

## C. IMPUTING THE NUMBER OF MEALS CONSUMED

### 1. Approach

To impute the number of NSLP lunches consumed in a given month among students for whom that information is missing, we first used the coefficient estimates from the imputation model to calculate predicted meals consumed. This calculation involved multiplying the values of the independent variables included in the imputation model by the appropriate coefficient estimates from the model for each individual for whom we wish to make an imputation. To calculate predicted school lunches consumed in September for a given student, for example, we used:

(2) $$\hat{M}_{i,Sept} = \hat{\alpha}_0 + X_i\hat{\beta} + Z_{i,Sept}\hat{\delta} + MP_{Sept}\hat{\theta} + \hat{\alpha}_1 P_i + \hat{\alpha}_2 P_i^2 + \hat{\alpha}_3 P_i * MS_{i,Sept} + \hat{\alpha}_4 P_i * H_i$$

The next step involved simulating the error terms of the imputation model ($u_i$ and $e_{it}$) for individual students. Relying on the predicted values calculated in equation (2) alone would provide a reasonable set of estimates of the number of meals consumed by students *on average*, but would not accurately reflect the variability in this outcome across the population. By adding the two error terms to the predicted values, we generated a set of imputed values that both accurately estimate actual meals consumed on average and also accurately represent the true variability of meals consumed among this population.

To simulate the error terms, we needed to make some assumptions about their behavior in the population. In addition to assuming that each is independent and identically distributed and that the error terms are independent of each other and of the explanatory variables included in the imputation model, we also assumed that both $u_i$ and $e_{it}$ are normally distributed.

Thus, we drew a single value of $u_i$ for each individual student for whom we needed to impute meals. This value was drawn at random from a normal distribution with mean 0 and standard deviation $\hat{\sigma}_u^2$. In the case of the NSLP imputation model, for example, the value of this

variance was 13.1 (see Table D.3). This single draw of $u_i$ for a given individual was used for each of that individual's monthly observations. We then drew a value of $e_{it}$ at random from a normal distribution with mean 0 and standard deviation $\hat{\sigma}_e^2$ (20.0 in the case of the NSLP). We drew separate values of this error term for each individual and for each month we wished to make an imputation for that individual. Finally, for a given month *t* and a given individual *i*, the imputed number of meals consumed was set equal to the predicted number of meals plus the sum of the two error terms:

(3) $M_{it}^{*} = \hat{M}_{it} + u_i^{*} + e_{it}^{*}$

One final adjustment was made to this imputation. We bottom-coded the imputed value at 0 and top-coded the value at our estimate of the number of school days in the month. In other words, if the value resulting from equation (3) was less than 0, we set the imputed number of lunches to 0 since a student could not consume a negative number of meals during the month. Similarly, we assumed that the student could not consume more lunches during the month than the number of days school was in session, and so if the value resulting from equation (3) was greater than the number of school days we set the imputed number of lunches equal to the number of school days. These adjustments affected a small proportion of cases.

Because we used a two-stage model to impute for the SBP, the process for imputing the number of breakfasts consumed was a bit different. The first step involved imputing whether or not a particular student had consumed any breakfasts. We did this by calculating the predicted probability that a given student had consumed any breakfasts using the coefficient estimates from the probit model along with values of the independent variables. If this predicted probability was less than 50 percent, we assumed that the student did not participate in the SBP and imputed 0 breakfasts consumed during the month. If the predicted probability was greater

than or equal to 50 percent, we moved to the second stage OLS equation. In particular, we used the same process for imputing the specific number of breakfasts consumed for this group as we used for imputing the number of lunches described above.

## 2. Lunch Imputation Results

To assess the accuracy of our imputation process, we imputed values of the monthly lunch and breakfast totals not only for students lacking administrative data on participation but also for students for whom we had the data. For students with administrative data, as a result, we have both an actual value and an imputed value of the number of meals consumed. Table D.5 shows the distributions of the actual and imputed monthly number of NSLP lunches (and SBP breakfasts) consumed among students for whom we have both administrative and survey data.

The imputation process generates a distribution of meals consumed that differs somewhat from the actual distribution at the extremes of the distribution, but does capture the typical number of meals consumed fairly accurately. For example, the proportion of students who consume no NSLP lunches during the month (15 percent) is more than twice as large as the proportion with an imputed value of 0 (6 percent). Similarly, the proportion who actually consume 16 or more lunches per month (38 percent) is greater than the proportion with imputed values this high (27 percent). On the other hand, the mean imputed number of lunches consumed (11.3) is very close to the mean actual number consumed (11.6) for this group of students.

An alternative way of examining the accuracy of the imputation process is to compare the actual and imputed values for individual students. Table D.6 shows the distribution across students of the imputation error, defined as the absolute value of the difference between a student's actual number of meals consumed and his or her imputed value. While the imputed value is an exact match of the actual value in relatively few cases, the imputed number of

TABLE D.5

DISTRIBUTION OF ACTUAL VERSUS IMPUTED MEALS RECEIVED,
NSLP LUNCHES & SBP BREAKFASTS
(Sample Includes Students with Both Administrative and Survey Data)

| | Lunch | | Breakfast | |
|---|---|---|---|---|
| | Actual | Imputed | Actual | Imputed |
| Number of Meals (Percentages) | | | | |
| 0 | 14.6 | 6.4 | 48.7 | 48.1 |
| 1 to 5 | 9.9 | 13.0 | 16.0 | 9.2 |
| 6 to 10 | 12.3 | 23.0 | 11.0 | 16.2 |
| 11 to 15 | 25.3 | 30.7 | 12.5 | 17.2 |
| 16 or more | 37.8 | 26.9 | 11.8 | 9.3 |
| Median number | 13.0 | 12.0 | 1.0 | 2.0 |
| Mean number | 11.6 | 11.3 | 5.1 | 5.5 |

Source: APEC Study, student-level participation records data, and household survey data.

TABLE D.6

DISTRIBUTION OF IMPUTATION ERROR IN THE MONTHLY NUMBER OF REIMBURSABLE MEALS RECEIVED, NSLP LUNCHES & SBP BREAKFASTS
(Sample Includes Students with Both Administrative and Survey Data)

| Imputation Error (Absolute Difference Between Actual Versus Imputed Number of Meals) | Lunch (Percentages) | Breakfast (Percentages) |
|---|---|---|
| Less than 1 | 8.9 | 35.4 |
| 1 to 2 | 22.2 | 13.3 |
| 3 to 4 | 17.9 | 11.0 |
| 5 to 6 | 14.8 | 9.4 |
| 7 to 8 | 10.7 | 7.7 |
| 9 to 10 | 8.4 | 7.0 |
| More than 10 | 17.1 | 16.3 |

Source: APEC Study, student participation records data, and household survey data.

lunches is within four meals of the actual value in about half of all cases and within eight meals in three-fourths of all cases.

Because the purpose of the imputation process is to allow us to more accurately estimate the dollar amount and rate that free or reduced-price meal reimbursements that are erroneous, its most important attribute is that it be relatively accurate for both students certified in error and those whose certification status is accurate. In particular, we would like the mean number of imputed meals to equal the mean number of actual meals for both groups of students. If, by contrast, the imputation process overestimated meals consumed among those certified in error and underestimated meals consumed among those certified accurately, the resulting estimate of the rate of erroneous payments would be biased.

By this measure, the imputation process is successful. Among students who have been certified accurately, the mean number of lunches actually consumed was 12.0 and the imputed mean was 11.6. Among those certified in error, the mean number actually consumed was 10.4 and the imputed mean was 10.3.

### 3. Breakfast Imputation Results

The imputation process is somewhat more accurate in the case of SBP breakfasts than in the case of NSLP lunches, primarily because a large proportion of students never consume school breakfasts and the model is fairly successful in identifying those students. For example, the administrative data suggests that 48.7 percent of students in a typical month do not receive school breakfasts, while the imputation process resulted in 0 meals consumed for 48.1 percent of students (Table D.5). Among students with positive numbers of meals consumed, the model again somewhat underestimates the proportion of students at either end of the distribution, but the mean number of imputed breakfasts consumed (5.5) is close to the actual mean (5.1). Again,

we found that the mean number of meals consumed was close to the actual number both for students who were certified in error and those certified accurately.

For more than one-third of cases, the imputed number of breakfasts consumed was exactly equal to the actual number of breakfasts consumed. Overall, the imputed number is within two meals of the actual number in nearly half of all cases and within eight meals in more than three-fourths of all cases.

# APPENDIX E

# INCOME SOURCE AND AMOUNT IMPUTATIONS

This appendix describes the methods we used to impute missing income sources and amounts in the household survey. The survey contained a comprehensive set of questions about who was in the sampled student's household and how much income each person in the household had during the reference month (month covered by the household's meal benefit application). For persons older than age 16, we asked the respondent whether they received income—and, if so, the dollar amount received—from each of 21 possible sources. For children age 16 or younger, we asked the respondent whether they received income from four different sources, and the amount from each source. We also asked about income from TANF on a household basis. Survey responses were converted into a single monthly amount variable for each person/source pair.

**Methods for Imputing Non-TANF Income Sources.** Table E.1 shows the number (and percentage) of missing cases for each income source excluding TANF income. These missing item responses were replaced with imputed values, while all complete, consistent answers provided for these sample members were left unchanged.[1] We processed two separate files, one for adults (and some minors 16 or older) and one for children, and imputations were conducted separately from these two files. We used sequential hot-decking to impute missing income amounts for all of the income sources. The procedures are similar to those used in an earlier study, The Evaluation of the National School Lunch Program (NSLP) Application/Verification Pilot Projects,[2] although no median imputations were used in APEC.

[1]Responses to the source and amount questions for a particular source are considered to be consistent if income from the source was reported as being received and the amount was either non-zero or missing. A set of source and amount responses are inconsistent if the source was reported as being received but the amount was zero. In that case we edited the response to indicate that the person did not receive income from the source.

[2]The imputation procedures are documented in the final report for that study, in Chapter VIII of Volume II: Data Collection, Study Methods and Supplementary Tables on Certification Impacts.

TABLE E.1

PREVALENCE OF MISSING DATA, BY INCOME SOURCE

| | | Number of Missing Responses (Percentage of Persons with Missing Responses) | | |
|---|---|---|---|---|
| Number | Income Source Type | Source Indicator and Amount Both Missing | Source Reported but Amount Missing | Total Missing Applicable Responses |
| **Adult Income Sources:** | | | | |
| 1 | Job | 33 (0.48) | 331 (4.79) | 361 (5.27) |
| 2 | Unemployment compensation | 30 (0.44) | 8 (0.12) | 35 (0.55) |
| 3 | Worker's compensation | 27 (0.39) | 1 (0.01) | 25 (0.41) |
| 4 | Social Security or railroad retirement | 31 (0.45) | 34 (0.49) | 62 (0.94) |
| 5 | Private pensions | 29 (0.42) | 6 (0.09) | 35 (0.55) |
| 6 | Veteran's benefits | 30 (0.43) | 1 (0.01) | 31 (0.45) |
| 7 | Supplemental security income | 34 (0.49) | 13 (0.19) | 47 (0.68) |
| 8 | Alimony | 25 (0.36) | 0 | 25 (0.36) |
| 9 | Child support | 26 (0.38) | 12 (0.17) | 38 (0.55) |
| 10 | Interest and dividends | 30 (0.43) | 2 (0.03) | 32 (0.46) |
| 11 | Rental income | 28 (0.41) | 4 (0.06) | 33 (0.47) |
| 12 | Nonfarm business, partnership, or professional practice[a] | 30 (0.43) | 9 (0.13) | 39 (0.56) |
| 13 | Farm[a] | 28 (0.41) | 1 (0.01) | 29 (0.42) |
| 14 | Financial aid for college | 25 (0.36) | 21 (0.30) | 46 (0.67) |
| 15 | Savings withdrawals | 38 (0.55) | 8 (0.12) | 46 (0.67) |
| 16 | Regular contributions from persons outside the household | 32 (0.46) | 3 (0.04) | 35 (0.50) |
| 17 | Other cash income, such as net royalties, income from trusts, prize winnings, or bonuses | 31 (0.45) | 3 (0.04) | 34 (0.49) |
| 18 | General assistance | 26 (0.38) | 12 (0.17) | 38 (0.55) |
| 19 | Non-military housing subsidies | 22 (0.32) | 9 (0.13) | 31 (0.45) |
| 20 | Black lung benefits | 24 (0.35) | 0 | 24 (0.35) |
| 21 | Other income | 24 (0.35) | 24 (0.35) | 48 (0.69) |
| **Child Income Sources:** | | | | |
| 1 | Child support | 63[b] (0.71) | 26 (0.29) | 89 (1.00) |
| 2 | Social Security | 63[b] (0.71) | 9 (0.10) | 72 (0.81) |
| 3 | Persons outside the household | 63[b] (0.71) | 0 (0) | 63 (0.69) |
| 4 | Other | 63[b] (0.71) | 6 (0.07) | 69 (0.78) |

Source: APEC Study, Household Survey.

[a]Income from businesses or farms could be either a profit (positive amount) or loss (negative amount).

[b]For 2 of these 63 cases, the respondent reported that the child received income, but the source of income was not given. The imputations accommodated this.

In the hot-deck imputation method, missing values are replaced one at a time with an available value from a similar respondent in the same study. The procedures starts with a set of imputation classes and the cases within each class are processed and compared. This procedure preserves the distribution of the estimates, and increases the variance relative to the mean imputation method. Thus, the underestimation of the variance of the estimate is decreased. In the case of the sequential hot-deck imputation, each class starts with a single value for the item subject to imputation; each record is compared to that item, if the record has a value for that item it replaces the starter value; on the other hand, if the record is missing that item the starter value or the value that has replaced it is "filled-in" on the case with the missing value.

The pool of covariates used as classing and sorting variables in the sequential hot deck are given below:

1. Age of household member
2. Age of respondent
3. Education level of respondent
4. Household member's gender
5. Whether household member is Hispanic
6. Household member's race
7. Household size
8. Household structure (two-parent, single-parent, other)
9. Relationship of household member to respondent (adult data file only)
10. School district quartile
11. Certification status in school lunch program (free, reduced-price, denied)

We used the relationship of household member to respondent to impute income for the adult file only; it has four levels (respondent, spouse, other adult, teen). The school district identifier was used to provide information about the socioeconomic status of the household in which the

person resides, which was not captured by other variables. However, using individual school districts as classing variables precluded us from using any other covariates, because the number of sampled households in each school district is relatively small. Using it as a sorting variable would mean often (in effect) not using it because consecutive districts have nothing in common. To accommodate this, we grouped school districts into four (or fewer) groups depending upon the variable being imputed. The four (or fewer) category variable was used (where applicable) as a classing variable. For example, for the jobs income variable, the proportion of sampled respondents who had a job was calculated for each school district. These proportions were then ranked from lowest to highest, where each quartile of school districts represents a school district category. A person requiring imputation to determine whether he has a job may not get a donor from his own school district, but he does get a donor from a school district with a similar percentage of persons having jobs. For imputing the amount of income received from jobs, the quartile was based on the mean income in the school district among those with jobs.

For the continuous variables with many levels (age of household member, age of respondent, and education level of respondent), levels were collapsed when used as classing variables, but remained unchanged when used as sorting variables. When the age of household member variable was used as a classing variable in the children file, the levels are 0 to 2 years, 3 to 5 years, 6 to 9 years, 10 to 12 years, 13 to 15 years, and 16 to 20 years. When this variable was used as a classing variable in the adult file, the levels are under 18 years, 18 to 29 years, 30 to 39 years, 40 to 49 years, 50 to 64 years, and 65 years of age or older. In both files, when the age of respondent variable was used as a classing variable, the levels are the same as those used for the age of household member variable in the adult file, without the under-18 category. When the education level variable was used as a classing variable in both files, the levels are “did not

finish high school" (0-11), "finished high school only" (12), and "attended training/school beyond high school" (13-18).

If the covariates used as classing/sorting variables have missing values, and the variable requiring imputation also is missing, then three alternative strategies were employed, depending upon the available data. (1) When considerable data are available, the missing value was treated as a separate level, where donors and recipients were both missing the covariate in question. However, if this results in imputation classes without donors, two separate strategies were attempted. (2) If only one other level of the covariate in question has most of the observations, then the missing value in the covariate was set to that value. (3) However, if multiple levels of the covariate in question have a nontrivial number of observations, then separate hot decks were used, one for cases where the response variable was missing but the covariate was not, and one for cases where both the response variable and the covariate in question were missing. In the latter case, the covariate in question was excluded as a sorting/classing variable.

All of the variables in question have missing values, but the information that is available differs. In the child data file, there are three types of missing data: (1) no information is available, so that the "missing" indicator is given as .Y; (2) it is known that at least one of the four sources of income is not missing, indicated by .I; and (3) it is known that the respondent has positive income for the variable in question, but the amount is unknown, indicated by .F. In the adult file, there are only two types of missing data: (1) no information is available, so that the "missing" indicator is given by .I; and (2) it is known that the respondent has positive income (or nonzero income, for farm and business income) for the variable in question, but the amount is unknown, indicated by .F. For each of these situations, the imputation accommodated the information that is known.

For many of the income sources included in the study, the process that informs whether a person received income from a particular source differs from the process determining the amount received from that source. (In fact, it is not uncommon that it is known that the income is nonzero, but the amount is not known.) There is sufficient data for all of the income sources to describe the relationship between a set of covariates and whether a person received income from a given source. However, given that a person received income from that source, there is often insufficient data to describe the relationship between a set of covariates and the amount received. If the percent of persons who received income from a given source is less than 0.50 percent, then the source and dollar amount was imputed jointly. (The percent of persons who received income from a given source is given in Table E.2.)

The imputations for the remainder of cases to determine whether a person received income from a particular source were done separately from the imputations determining the amount of income from that source. In particular, an imputation was processed to determine whether a respondent received income from a given income source. Once that was determined, a second imputation, with different covariates used in the hot-deck imputation procedure, determined the amount of income received. The second imputation for each variable included respondents who were known to have received income and the amount was unknown, plus respondents who were imputed to have received income from that source. This makes it straightforward to accommodate the information available if it is known that a specific variable has nonzero income. For both sets of imputations, if insufficient donors were available within the class defined by the given classing variables, levels were collapsed in the last variable in the list of classing variables. The number of classing variables was small enough to ensure that the amount of collapsing required was minimal.

TABLE E.2

NUMBER AND PERCENT RECEIVING INCOME FROM EACH INCOME SOURCE

| Number | Source | Number Who Received Income from Source | Percent Who Received Income from Source |
|---|---|---|---|
| **Adult Income Sources:** | | | |
| 1 | Job | 3,271 | 50.71 |
| 2 | Unemployment compensation | 118 | 1.74 |
| 3 | Worker's compensation | 22 | 0.32 |
| 4 | Social Security or railroad retirement | 230 | 3.41 |
| 5 | Private pensions | 27 | 0.40 |
| 6 | Veteran's benefits | 27 | 0.40 |
| 7 | Supplemental security income | 231 | 3.41 |
| 8 | Alimony | 4 | 0.06 |
| 9 | Child support | 287 | 4.24 |
| 10 | Interest and dividends | 11 | 0.16 |
| 11 | Rental income | 33 | 0.49 |
| 12 | Nonfarm business, partnership, or professional practice[a] | 35 | 0.51 |
| 13 | Farm[a] | 2 | 0.03 |
| 14 | Financial aid for college | 31 | 0.46 |
| 15 | Savings withdrawal | 39 | 0.58 |
| 16 | Regular contributions from persons outside the household | 72 | 1.06 |
| 17 | Other cash income, such as net royalties, income from trusts, prize winnings, or bonuses | 9 | 0.13 |
| 18 | General assistance | 84 | 1.24 |
| 19 | Non-military housing subsidies | 61 | 0.90 |
| 20 | Black lung benefits | 0 | 0.00 |
| 21 | Other | 56 | 0.83 |
| **Child Income Sources:** | | | |
| 1 | Child support | 587 | 6.59 |
| 2 | Social Security | 414 | 4.65 |
| 3 | Persons outside the household | 13 | 0.15 |
| 4 | Other | 73 | 0.82 |

[a]Income from businesses or farms could be either a profit (positive amount) or loss (negative).

For the child data set, if it was known that at least one of the four sources of income was nonzero, but it was unknown which ones, donors were limited to cases where the total income from the four sources of income was positive. The four variables were imputed sequentially, starting with the least prevalent and imputing in order of prevalence. For the income source with the highest prevalence (child support), if none of the other imputation produced a nonzero income, then the child support variable was imputed to a nonzero income. Otherwise, if an income source from a source of income with lower prevalence produced an imputed nonzero income, then the imputation for child support was allowed to be zero or nonzero.

The classing and sorting variables for each variable are given in Table E.3. In this table, the "C" which precedes the number represents classing variables; the "S" represents sorting variables. These variables and the order in which they were placed were determined by looking at correlation tables, cross-tabulations, and rough stepwise regressions.

**Methods for Imputing TANF Income.** This part of the appendix describes our methods for imputing two household TANF income variables: (1) TANF payments to the respondent, the respondent's spouse, or the respondent's children, and (2) TANF payments to other members of the household unit. Unlike the data for the variables discussed for imputing non-TANF sources and amounts, TANF is imputed at the household level rather than the individual level. The prevalence of missing data for these two variables is given in Table E.4.

Missing item responses about receipt of TANF income were replaced with imputed values, while leaving unchanged all complete, consistent answers provided for these sample members.[3] Sequential hot-decking was used to impute missing income amounts for the most commonly

[3]Responses to the source and amount questions for a particular source are considered to be consistent if income from the source was reported as being received and the amount was either non-zero or missing. A set of source and amount responses are inconsistent if the source was reported as being received but the amount was zero. In that case we edited the response to indicate that the person did not receive income from the source.

TABLE E.3

NUMBER AND PERCENT RECEIVING INCOME FROM EACH INCOME SOURCE, AND CLASSING AND SORTING VARIABLES USED IN HOT DECK, BY INCOME SOURCE

| # | Source | Received Income from Source | Amount Received from Source |
|---|---|---|---|
| **Adult Data Set** | | | |
| 1 | Job | C1. Relationship to respondent<br>C2. Gender of household member<br>C3. School district quartile<br>C4. Status-lunch program<br>C5. Household structure<br>C6. Hispanicity of household member<br>S1. Age of household member<br>S2. Education of respondent | C1. School district quartile<br>C2. Household structure<br>C3. Education category of respondent<br>C4. Gender of household member<br>C5. Household member is white or not<br>C6. Status-lunch program<br>S1. Education of respondent<br>S2. Household size |
| 2 | Unemployment compensation | C1. School district quartile<br>C2. Relationship to respondent<br>C3. Status-lunch program<br>C4. Education category of respondent<br>C5. Gender of household member<br>C6. Hispanicity of household member<br>S1. Education of respondent<br>S2. Age of household member | C1. School district quartile[a]<br>C2. Household structure<br>C3. Education category of respondent<br>C4. Gender of household member<br>C5. Household member is white<br>S1. Education of respondent<br>S2. Age of respondent<br>S3. Status-lunch program |
| 3 | Worker's compensation | C1. Gender of household member<br>C2. Education category of respondent<br>C3. Household size<br>C4. Age category of household member[b]<br>C5. School district quartile[b]<br>C6. Relationship to respondent[b]<br>S1. Education of respondent<br>S2. Age of household member | |
| 4 | Social Security or railroad retirement | C1. Age category of household member<br>C2. School district quartile<br>C3. Household structure<br>C4. Age category of respondent<br>C5. Relationship to respondent<br>C6. Respondent is white or not<br>S1. Hispanicity of household member<br>S2. Education of respondent<br>S3. Age of household member<br>S4. Age of respondent | C1. School district quartile[a]<br>C2. Education category of respondent<br>C3. Relationship to respondent<br>C4. Gender of household member<br>C5. Household structure<br>S1. Age of respondent<br>S2. Education of respondent<br>S3. Age of household member |
| 5 | Private pensions | C1. School district quartile<br>C2. Age category of household member<br>C3. Household structure<br>C4. Age category of respondent<br>C5. Relationship to respondent<br>S1. Education of respondent<br>S2. Age of household member<br>S3. Age of respondent | |

Table E.3 *(continued)*

| # | Source | Received Income from Source | Amount Received from Source |
|---|---|---|---|
| 6 | Veteran's benefits | C1. Gender of household member<br>C2. Age category of household member<br>C3. Education category of respondent<br>C4. School district quartile<br>C5. Age category of respondent[a]<br>S1. Age of household member<br>S2. Education of respondent | |
| 7 | Supplemental security income | C1. Household structure<br>C2. Age category of household member<br>C3. Status-lunch program<br>C4. Education of respondent<br>C5. Hispanicity of household member<br>C6. School district quartile<br>S1. Gender of household member<br>S2. Age of household member<br>S3. Education level of respondent | C1. School district quartile<br>C2. Education of respondent<br>C3. Gender of household member<br>S1. Age category of respondent<br>S2. Education of respondent |
| 8 | Alimony | C1. School district quartile<br>C2. Household structure<br>C3. Race (white, black, other)<br>C4. Education category of respondent<br>C5. Age category of household member<br>S1. Education of respondent<br>S2. Age of household member | |
| 9 | Child support | C1. School district quartile<br>C2. Household structure<br>C3. Gender of household member<br>C4. Relationship to respondent<br>C5. Hispanicity of household member<br>C6. Race (white, black other)<br>S1. Age of household member<br>S2. Status-lunch program<br>S3. Education of respondent | C1. School district quartile<br>C2. Education category of respondent<br>C3. Age category of household member<br>C4. Household structure<br>C5. Hispanicity of household member<br>C6. Status-lunch program<br>S1. Education of respondent<br>S2. Age of household member |
| 10 | Interest and dividends | C1. Status-lunch program<br>C2. Age category of household member<br>C3. School district quartile[b]<br>C4. Hispanicity of household member[b]<br>C5. Education category of respondent<br>C6. Household structure<br>S1. Age of household member<br>S2. Education of respondent | |
| 11 | Rental income | C1. Status-lunch program<br>C2. Education category of respondent<br>C3. Age category of household member<br>C4. Relationship to respondent<br>C5. Race (white, black, other)<br>C6. School district quartile<br>S1. Household size<br>S2. Age of household member<br>S3. Age of respondent | |

Table E.3 *(continued)*

| # | Source | Received Income from Source | Amount Received from Source |
|---|---|---|---|
| 12 | Nonfarm business, partnership, or professional practice[c] | C1. Gender of household member<br>C2. Relationship to respondent<br>C3. School district quartile<br>C4. Household structure<br>C5. Education category of respondent<br>C6. Age category of household member[b]<br>S1. Education of respondent<br>S2. Age of household member | |
| 13 | Farm[c] | C1. School district quartile<br>C2. Status-lunch program<br>C3. Education category of respondent<br>C4. Age category of household member<br>C5. Household structure<br>C6. Gender of household member[b]<br>S1. Education of respondent<br>S2. Age of household member<br>S3. Age of respondent | |
| 14 | Financial aid for college | C1. Age category of household member<br>C2. Age category of respondent<br>C3. Education category of respondent<br>C4. Relationship to respondent<br>C5. School district quartile<br>S1. Age of household member<br>S2. Education of respondent | C1. School district quartile<br>C2. Age category of household member<br>C3. Age category of respondent<br>C4. Relationship to respondent<br>C5. Status-lunch program<br>C6. Household structure<br>S1. Age of household member |
| 15 | Savings withdrawal | C1. Hispanicity of household member<br>C2. Relationship to respondent<br>C3. Age category of household member<br>C4. Education category of respondent<br>C5. School district quartile<br>C6. Race (white, black, other)<br>S1. Age of household member<br>S2. Education of respondent<br>S3. Age of respondent | C1. School district quartile<br>C2. Age category of household member<br>C3. Hispanicity of household member<br>C4. Household structure<br>C5. Race (white, black, other)<br>S1. Age of household member<br>S2. Education of respondent |
| 16 | Regular contributions from persons outside the household | C1. Household structure<br>C2. School district quartile<br>C3. Gender of household member<br>C4. Race (white, black, other)<br>C5. Household size<br>C6. Status-lunch program<br>S1. Age of respondent<br>S2. Age of household member | C1. School district quartile<br>C2. Education category of respondent<br>C3. Status-lunch program<br>C4. Household structure<br>S1. Age of household member |
| 17 | Other cash income, such as net royalties, income from trusts, prize winnings, or bonuses | C1. Status-lunch program<br>C2. Age category of household member<br>C3. Age category of respondent<br>C4. Gender of household member<br>C5. School district quartile<br>S1. Education of respondent<br>S2. Age of household member | |

Table E.3 *(continued)*

| # | Source | Received Income from Source | Amount Received from Source |
|---|---|---|---|
| 18 | General assistance | C1. School district quartile<br>C2. Status-lunch program<br>C3. Household structure<br>C4. Relationship to respondent<br>C5. Age category of household member<br>C6. Gender of household member<br>S1. Age of household member<br>S2. Age of respondent | C1. School district quartile<br>C2. Education category of respondent<br>C3. Age category of household member<br>C4. Age category of respondent<br>C5. Relationship to respondent<br>S1. Age of household member<br>S2. Age of respondent |
| 19 | Non-military housing subsidies | C1. Race (black, white, other)<br>C2. Household structure<br>C3. Status-lunch program<br>C4. Gender of household member<br>C5. Relationship to respondent<br>C6. School district quartile<br>S1. Age of household member<br>S2. Education of respondent | C1. School district quartile<br>C2. Status-lunch program<br>C3. Education category of respondent<br>C4. Age category of household member<br>C5. Gender of household member<br>S1. Age of household member |
| 20 | Black lung benefits | All imputed to zero | |
| 21 | Other | C1. Gender of household member<br>C2. Household structure<br>C3. School district quartile<br>C4. Age category of household mbr<br>C5. Hispanicity of household mbr<br>C6. Status-lunch program<br>S1. Age of household member<br>S2. Age of respondent | C1. School district quartile<br>C2. Household structure<br>C3. Age category of household member<br>S1. Relationship to respondent<br>S2. Household size<br>S3. Education of respondent |
| **Child Data Set** | | | |
| 1 | Child support | C1. School district quartile<br>C2. Household structure<br>C3. Household size<br>C4. Age category of child<br>C5. Respondent finished hs or not<br>C6. Race (white, black, other)<br>S1. Age of child<br>S2. Education of respondent | C1. School district quartile<br>C2. Age category of child<br>C3. Age category of respondent<br>S1. Age of child<br>S2. Education level of respondent<br>S3. Age of respondent |
| 2 | Social Security | C1. School district quartile<br>C2. Age category of respondent<br>C3. Household structure<br>C4. Age category of child<br>C5. Education category of respondent<br>C6. Gender of child<br>S1. Age of respondent<br>S2. Age of child | C1. School district quartile<br>C2. Household structure<br>C3. Education category of respondent<br>C4. Status-lunch program<br>S1. Education of respondent<br>S2. Age of respondent<br>S3. Household size |
| 3 | Persons outside the household | C1. School district quartile<br>C2. Race (white, black, other)<br>C3. Household structure<br>C4. Education category of respondent<br>C5. Age category for child<br>S1. Education of respondent<br>S2. Age of child<br>S3. Gender of child | |

Table E.3 *(continued)*

| # | Source | Received Income from Source | Amount Received from Source |
|---|---|---|---|
| 4 | Other | C1. Age category of respondent<br>C2. Race (black, white, other)<br>C3. Status-lunch program<br>C4. Household structure<br>C5. Household size<br>C6. School district quartile<br>S1. Education category of respondent<br>S2. Age of respondent | C1. School district quartile[b]<br>C2. Age category of respondent<br>C3. Race (white, black, other)<br>C4. Household structure<br>C5. Status-lunch program (if C1 excluded)<br>S1. Age of respondent<br>S2. Education of respondent |

[a]This variable was excluded if there was no nonmissing data in the school district with the person's income being imputed.

[b]These covariates were not included in the imputation where the amount was known to be positive.

[c]Income from businesses or farms could be either a profit (positive amount) or loss (negative amount).

TABLE E.4

PREVALENCE OF MISSING DATA, BY INCOME SOURCE

| | | Number of Missing Responses | | |
|---|---|---|---|---|
| Number | Income Source Type | Source Indicator and Amount Both Missing | Source Reported but Amount Missing | Total Missing Applicable Responses |
| **Adult Income Sources:** | | | | |
| 1 | TANF payments to respondent, respondent's spouse, or respondent's children | 10 (0.29%) | 4 (0.12%) | 14 (0.41%) |
| 2 | TANF payments to other members of household | 10 (0.29%) | 6 (0.18%) | 16 (0.47%) |

missing sources. The pool of covariates used as classing and sorting variables in the sequential hot deck are given below:

1. Age of household member
2. Age of respondent
3. Education level of respondent
4. Household member's gender
5. Household member's Hispanicity
6. Household member's race
7. Household size
8. Household structure (two parent, single parent, other)
9. School district quartile
10. Status in lunch program (free, reduced-price, denied)

School districts were grouped in the same way as described for non-TANF income sources, with separately calculated quartiles for the proportion of households in the school district receiving TANF, and among cases where TANF was positive, quartiles for the mean TANF amount in the school district. For the variables with many levels (age of household member, age of respondent, and education level of respondent), levels were collapsed when used as classing variables, but remained unchanged when used as sorting variables. When the age of the target child variable was used as a classing variable, the levels are 0 to 2 years, 3 to 5 years, 6 to 9 years, 10 to 12 years, 13 to 15 years, and 16 to 20 years. When the education level variable was used as a classing variable in both files, the levels are "did not finish high school" (0-11), "finished high school only" (12), and "attended training/school beyond high school" (13-18).

If the covariates used as classing/sorting variables have missing values, and the variable requiring imputation also is missing, then three alternative strategies were employed, depending upon the available data. (1) When considerable data are available, the missing value was treated

as a separate level, where donors and recipients were both missing the covariate in question. However, if this results in imputation classes without donors, two separate strategies were attempted. (2) If only one other level of the covariate in question has most of the observations, then the missing value in the covariate was set to that value. (3) However, if multiple levels of the covariate in question have a nontrivial number of observations, then separate hot decks were used, one for cases where the response variable was missing but the covariate was not, and one for cases where both the response variable and the covariate in question were missing. In the latter case, the covariate in question was excluded as a sorting/classing variable.

In the TANF file, there are only two types of missing data: (1) no information is available, so that the "missing" indicator is given by .I; and (2) it is known that the respondent has positive income (or nonzero income, for farm and business income) for the variable in question, but the amount is unknown, indicated by .F. For each of these situations, the imputation accommodated the information that is known. If the percent of persons who received income from a given source is less than 0.50%, then the source and dollar amount was imputed jointly. (The percent of persons who received income from a given source is given in Table E.5.)

The imputations for the remainder of cases to determine whether a person received income from a particular source was done separately from the imputations determining the amount of income from that source. In particular, an imputation was processed to determine whether a respondent received income from a given income source. Once that was determined, a second imputation, with different covariates used in the hot-deck imputation procedure, determined the amount of income received. The second imputation for each variable included respondents who were known to have received income and the amount was unknown, plus respondents who were imputed to have received income from that source. This makes it straightforward to accommodate the information available if it is known that a specific variable has nonzero

TABLE E.5

NUMBER AND PERCENT RECEIVING INCOME FROM EACH INCOME SOURCE

| Number | Source | Number Who Received Income from Source | Percent Who Received Income from Source |
|---|---|---|---|
| 1 | TANF payments to respondent, respondent's spouse, or respondent's children | 239 | 7.03% |
| 2 | TANF payments to other members of household | 11 | 0.32% |

income. For both sets of imputations, if insufficient donors were available within the class defined by the given classing variables, levels were collapsed in the last variable in the list of classing variables. The number of classing variables was small enough to ensure that the amount of collapsing required was minimal.

The classing and sorting variables for each variable are given in Table E.6. In this table, the "C" which precedes the number represents classing variables; the "S" represents sorting variables. These variables and the order in which they were placed were determined by looking at correlation tables, cross-tabulations, and rough stepwise regressions.

**Methods for Imputing Missing Income Information in the Panel Follow-up Survey.** We completed a follow-up (panel) survey with 799 households certified for free or reduced-price meals who completed the initial household survey to obtain data on school meal program participation and eligibility later in the school year. We used the same methods for imputing missing income source and amount information described for the main household survey. In some cases, not enough information was available for hot-deck imputation in cases where the source was known to be positive (that is, the donor pool was insufficient for imputation). In those cases, additional donors were borrowed from the household survey for the same variable (known as "cold deck"). For example, for the imputation of adult income from other cash sources, one case had a value of .F indicating positive unknown income from that source. Only two donors were available for positive income, which was insufficient for one recipient. So an additional six donors were used from the household survey values. The donor was selected from the eight total donors available.

**Other Imputations.** The hot-decking imputations described elsewhere in this appendix were implemented on monthly income amount variables for each person/source combination. Each of these monthly amount variables was constructed from three separate household survey

TABLE E.6

NUMBER AND PERCENT RECEIVING INCOME FROM EACH INCOME SOURCE, AND CLASSING AND SORTING VARIABLES USED IN HOT DECK, BY INCOME SOURCE

| # | Source | Received Income from Source | Amount Received from Source |
|---|---|---|---|
| 1 | TANF payments to respondent, respondent's spouse, or respondent's children | C1. School district quartile<br>C2. Status-lunch program<br>C3. Education category of respondent<br>C4. Household structure<br>C5. Household size<br>C6. Race<br>S1. Education level of respondent | C1. School district quartile<br>C2. Household size<br>C3. Education category of respondent<br>S1. Education level of respondent |
| 2 | TANF payments to other members of household | C1. Household structure<br>C2. Age category of respondent<br>C3. Education category of respondent<br>C4. Status-lunch program<br>C5. Race<br>C6. School district quartile[a]<br>S1. Age of respondent<br>S2. Education of respondent | |

[a]These covariates were not included in the imputation where the amount was known to be positive.

variables, indicating the amount, period (such as week, month, or year), and number of periods in which income for that person/source was received. Before creating the monthly income amount variables, we imputed missing data in the income period and number of periods variables. Specifically, we implemented the following imputations:

- If an amount variable was nonmissing, but the corresponding period variable was missing, then we assigned the most common period reported for other persons with similar income amounts for the same source.
- If both the amount and period variables were nonmissing, but the number of periods was missing, then we typically assumed the person worked consistently throughout the month, and used the period alone to convert the amount to monthly. We made an exception in cases where the period was hourly, to avoid assuming a full-time work schedule. For these cases, we imputed the median number of hours worked among people who reported an hourly period and then used that imputed number of hours along with the hourly rate information to compute a monthly amount.
- The number of periods variable for *documented* income was often zero, probably because the document did not clearly indicate this information. In such cases, we ignored the zero. If the documented period was the same as the reported period, then we used the reported number of periods to compute the documented monthly amount. Otherwise, we assumed the person worked consistently throughout the month and used the standard conversion to monthly.
- If a respondent said they did not know whether a person had any income from a particular source, we imputed the amount to zero, on the assumption that income the respondent did not know about was likely to be a small amount. Any other missing data in the variables that indicated whether the person had any income at all from the source was imputed using the same hot-decking procedure used to impute missing data in the amount variables.

# APPENDIX F

# IMPUTATION OF CERTIFICATION ERROR FOR NON-BASE YEAR PROVISION 2 OR 3 SCHOOLS

This appendix describes the methodology used in imputing erroneous payments for schools operating a meal program under Provisions 2 or 3 that are not in their base year. Certification error for Provision 2/3 school meal programs depends on what took place in the schools' respective base years. However, for non-base year Provision 2/3 programs, we do not observe the income and categorical certification eligibility of students in the school's base year, which occurred in a school year prior to SY 2005–2006. As a result, we must impute erroneous payments for the 31 non-base year Provision 2/3 SBP programs and the 18 non-base year Provision 2/3 NSLP programs in our sample.

Our approach to imputing certification error for non-base year Provision 2/3 school meal programs is two-pronged. If a school is not non-base year Provision 2/3 in both of its meal programs, we impute the school's certification error rate in the non-base year Provision 2/3 program based on the directly estimated certification error rate in its other program. If this is not possible, then we impute the certification error rate based on the directly estimated certification error rates of similar school meal programs that are using Provision 2/3 and that are in their base year. The remainder of this appendix describes these two approaches in more detail.

## A. IMPUTATION BASED ON SCHOOL'S OTHER MEAL PROGRAM

It is not necessarily the case that schools are operating under Provision 2/3 in a non-base year in both of its meal programs. Of the 31 schools with non-base year Provision 2/3 SBP programs, 13 have NSLP programs that are not using Provision 2/3.[1] For these schools, our imputation technique is straightforward. We simply assign the directly estimated certification error rate from the NSLP to the SBP. The implicit assumptions of this approach are (1) that

[1]There are no schools in our sample that are non-base year Provision 2/3 in NSLP but that are not in SBP.

schools have similar certification error rates in their NSLP and SBP programs, and (2) that schools certification error rates in their base year were similar to those in SY 2005–2006.[2]

## B. IMPUTATION BASED ON PROVISION 2/3 BASE YEAR SCHOOLS

For the 18 schools that are using Provision 2/3 and not in their base year in both SBP and NSLP, we must impute certification error in both programs based on estimated models of certification error. These models are estimated using ordinary least squares on the sample of schools that use Provision 2/3 and are in their base years. The implicit assumption of this approach is that schools operating in their base year in SY 2005–2006 have similar certification error rates to schools that were operating in their base years in previous years. We estimated separate models for overpayment and underpayment rates in the NSLP. Gross and net certification error rates were generated by adding our imputed overpayment and underpayment estimates. Analogous procedures were conducted for the SBP.

A limitation of this approach is the small number of schools in our sample that are Provision 2/3 and operating in their base year. Although this type of school was oversampled, our data include only 24 schools that are Provision 2/3 base year in SBP and 19 schools that are Provision 2/3 base year in NSLP. As a result, our imputation models must remain streamlined and contain only the variables most associated with certification error in Provision 2/3 schools. Even with a small number of variables, coefficients tend to be imprecisely estimated.

One variable that we expected to be important in our models is administrative error. Although overall certification error and certification error due to misreporting are not directly

[2]The first assumption is justified based on the high correlation between certification error rates in schools' lunch and breakfast programs (.735). The latter assumption will be violated if schools act on their incentive to inflate error rates in their base years. This incentive results from the fact that future reimbursements are based on reimbursements in the base year. Thus, the higher the reimbursement rates are in the base year, the more reimbursements schools will receive in non-base years. However, verification procedures limit the strength of these incentives.

available for non-base year Provision 2/3 schools, we can estimate administrative error directly using the same techniques used for non-Provision 2/3 and base year Provision 2/3 schools. This is because we were able to collect administrative application data from the (pre-SY 2005–2006) base year for non-base year Provision 2/3 schools.

In addition to administrative error, we experimented with a variety of specifications that included independent variables such as type of school (elementary, middle, or high school), school enrollment, percentage of students certified for free or reduced-price meals, region, and urbanicity. Our final models include administrative certification error, percentage of students certified for reduced-price meals, and an indicator variable for whether the school was located in an urban area. Coefficient estimates and adjusted R-squared statistics for these models are presented in Table F.1.

After estimating these models, we imputed overpayments and underpayments for Provision 2/3 non-base year schools by evaluating the models with the schools' values for the included characteristics. We then added overpayments and underpayments to generate school-level estimates for gross certification error and subtracted underpayments from overpayments to generate estimates of net certification error. We generated national estimates for Provision 2/3 non-base year schools by constructing a weighted average of these school-level estimates using the statistical analysis weights that make sample schools nationally representative of the population of reimbursable meals.

TABLE F.1

COEFFICIENT ESTIMATES AND ADJUSTED R-SQUARED STATISTICS FOR MODELS USED IN IMPUTING CERTIFICATION ERROR FOR NON-BASE YEAR PROVISION 2 OR 3 SCHOOLS

| | NSLP | | SBP | |
|---|---|---|---|---|
| | Overpayments | Underpayments | Overpayments | Underpayments |
| Administrative error | 0.12<br>(0.16) | -0.01<br>(0.03) | 0.15<br>(0.32) | -0.03<br>(0.03) |
| Percentage of students certified for reduced price meals | 2.21<br>(1.26) | 0.02<br>(0.11) | 2.31<br>(1.15) | -0.03<br>(0.04) |
| Urban | -1.98<br>(6.57) | -4.08**<br>(0.65) | -10.01<br>(9.68) | -0.20<br>(0.18) |
| R-squared | 0.56 | 0.81 | 0.74 | 0.06 |
| **Sample Size** | **19** | **19** | **21** | **21** |

Source: APEC data, weighted.

Note: Estimation samples include schools operating using Provision 2/3 in the indicated program and in their base years.

Standard errors in parentheses.

*Significantly different from zero at the **.05** level, two-tailed test.
**Significantly different from zero at the **.01** level, two-tailed test.

# APPENDIX G

# ALTERNATIVE DEFINITIONS OF CERTIFICATION ERROR

The computation of erroneous payments due to certification error is complex and required applying program rules to data from different sources to determine the eligibility, certification error, and amounts of erroneous payments for each sampled student. The base measure of erroneous payments used in the analysis of certification error for this study implements, to the extent possible, the policy and procedures specified by USDA Food and Nutrition Service for determining student eligibility for free or reduced-price meals for students who applied for meal benefits.

We conducted a series of sensitivity tests to determine the extent to which alternative definitions and assumptions affect our estimates of the rates of erroneous payments. We tested the influence on key measures of different (1) definitions of who was in the economic unit, and (2) assumptions about the eligibility of students who had missing or incomplete applications or direct-certification documentation or who reapplied later in the school year. To reduce complexity, our sensitivity analyses exclude Provision 2 or 3 schools in a non-base year.

**Definitions of Economic Unit.** To determine if a student meets income eligibility requirements for school meal benefits, school officials compare household size and total household income to income eligibility guidelines. An issue for the household is who to include as a household member when students apply for benefits. According to the Eligibility Guidance for School Meals Manual issued by USDA, the household or economic unit is defined as:

"A group of related or unrelated individuals who are not residents of an institution or boarding house but who are living as one economic unit and who share housing and/or significant income and expenses of its members. Generally, individuals residing in the same house are an economic unit. However, more than one economic unit may reside together in the same house. Separate economic units in the same house are characterized by prorating expenses and economic independence from one another."

In estimating erroneous payments, we use information provided in the household survey to determine the eligibility status of a student's household. This requires determining which of the persons reported by the respondent as residing in the household at the time of application was actually part of the economic unit. The base measure of erroneous payments considers all relatives—including relatives by marriage or adoption—of the target child (sampled student) living in the same household to be in the same economic unit, but considers any non-relatives living in the household to be outside that economic unit. Excluding these unrelated persons from the economic unit affect the measure of a student's eligibility in two ways: (1) it reduces household size, and (2) it reduces household income by the amount of any income these non-relatives have. Since household size and household income affect eligibility status in opposite directions, omitting non-relatives could theoretically result in either increasing or decreasing the student's eligibility. To test the sensitivity of eligibility—and therefore our estimate of amounts and rates of erroneous payments—to our assumption about non-relatives, we computed an alternative version of eligibility using a definition of economic unit that includes all household members reported in the survey.

Table G.1 shows how the different assumptions about who is in the economic unit affect measures of household size, income, and students' eligibility for free or reduced-price meals. Including unrelated persons in the economic unit resulted in a mean household size of 4.7 people and mean monthly household income of $1,987, compared to a mean household size of 4.6 people and mean monthly household income of $1,968 when non-relatives were excluded. These household size and income differences resulted in very small changes in the level of benefits for which a student was eligible. Only 0.01 percent fewer students who applied for meal benefits would be eligible for free meals under the alternative definition, and 0.05 percent more students would be eligible for reduced-price meals. Because the differences in eligibility

resulting from the alternative definition were so small, we did not compute certification error rates and erroneous payments for the alternative version.

TABLE G.1

HOUSEHOLD SIZE AND ELIGIBILITY FOR FREE OR REDUCED-PRICE MEALS, UNDER ALTERNATIVE SPECIFICATIONS OF ECONOMIC UNIT

| | Definition of Economic Unit | |
|---|---|---|
| | Main Definition: Excludes Unrelated Household Members | Alternative Definition: Includes Unrelated Household Members |
| Household Size (Mean) | 4.61 | 4.66 |
| Household Income (Mean) | $1,967.63 | $1,986.53 |
| Percentage of Students Eligible for: | | |
| Free meals | 74.05 | 74.06 |
| Reduced-price meals | 14.44 | 14.49 |
| Ineligible | 11.51 | 11.45 |

**Assumptions about Students' Eligibility.** Creating our measures of certification error and erroneous payments required making assumptions about the eligibility of students in certain circumstances. We tested different assumptions about (1) the eligibility of students in which the applicant failed to properly complete meal benefit applications, (2) applications and direct certification documents missing from SFA files, and (3) the circumstances of students who reapplied for NSLP or SBP benefits later in the school year.

We created four different versions of the eligibility variables. The first version is the base measure of eligibility. It was used to compute the certification error and erroneous payments measures presented in this report. The *base measure* assumes the following:

- Students are considered to be eligible for benefits based on the information on household circumstances provided in the household survey, even if the applicant did not properly complete necessary NSLP/SBP paperwork—specifically, if the applicant

either (1) submitted an incomplete application,[1] or (2) failed to respond if selected for verification.[2] If, for a particular student, an application is found that does not include all required information, it is considered an administrative error. However, if the certification status is correct based on the household's circumstances reported on the application and household survey, then it is not considered a certification error and thus is not included in the calculations of erroneous payments. (Therefore administrative errors do not always equate to certification errors and thus erroneous payments.)

- Students are considered to be ineligible for free or reduced-price meals if the application for free or reduced-price meals (or direct certification information) could not be found in the SFA's files. This definition corresponds to FNS rules, which require SFAs to keep all applications on file, and conforms to how the state's Coordinated Review Effort (CRE) reviewers handle these situations. When CRE reviewers encounter a student receiving meal benefits without an application on file, or a student on the directly certified list, the state agency is required to recover the free or reduced-price portion of the reimbursement paid for the meals served to that student. In the APEC study, we consider this an administrative error and a certification error, and it is included in the estimate of erroneous payments.

- Students who reapplied for benefits later in the year, after their initial application, still are assumed to be eligible for the same level of benefits reflected in the data reported in their initial household survey. It is possible that the reapplication was prompted by a change in household circumstances, but we did not collect survey data on the households at the later date, so information from the initial survey is the best estimate.

Each of the three alternative versions we implemented reverses one of these assumptions:

- **Alternative 1: Ineligible If Application Is Incomplete.** Under this version, we consider students to be ineligible for benefits they are receiving if the applicant submitted an incomplete application or did not respond to a verification request, regardless of whether the certification decision is consistent with the information on household circumstances reported on the application or in the study's household survey. This alternative would result in a higher rate of overcertification, and a lower rate of undercertification, than the base definition. Of the 2,947 certified students in our main sample, 59 submitted incomplete applications and thus may be affected by this assumption.

[1]To be considered complete, applications must contain all the information necessary to assess eligibility, plus an adult's signature, and, in the case of income-based applications, the adult's SSN (or indication that the adult does not have one).

[2]We did not directly collect data on which households in our sample were selected for verification. Instead, we used administrative records data on changes in certified students' certification status over the school year, and assumed that two-thirds of students whose status changed from free or reduced-price to paid during the months of November or December had their benefits terminated for failure to provide requested income documentation.

- **Alternative 2: Missing Application or Direct Certification Documentation Does Not Automatically Mean Ineligible.** Under this alternative, households are considered to be eligible for benefits based on the information on their household circumstances provided in the household survey, even if their application could not be found in the SFA's files. Although FNS rules (reflected in our base measure) require SFAs to keep all applications on file, we have some concern that MPR field staff may not have been given the complete access to applications that FNS regional or state staff would have in all cases. Thus, it is possible that an application or direct certification documentation did exist at the SFA, but our field staff were simply unable to retrieve it. This alternative also is consistent with how the FSP defines erroneous payments, where information obtained in interviews with households or persons knowledgeable about the household's circumstances may be used to assess eligibility determination when the FSP conduct their quality control reviews and documentation is missing. This alternative would result in a lower rate of overcertification error and a higher rate of undercertification error than the base definition. Applications could not be found for 40 certified students in our sample, which would thus be affected by this assumption.

- **Alternative 3: Reapplicants Certified Without Error.** The final alternative version assumes the information reported by reapplicants on their new application was accurate and the SFA assessed it correctly. Because this alternative assumes away the occurrence of reporting and administrative error after a reapplication, it would result in a lower rate of certification error than the base definition. Our sample includes 106 students who reapplied later in the year and thus would be affected by this assumption.

Table G.2 provides estimates of erroneous payments under these four different specifications for students who applied for meal benefits in schools that do not use Provision 2 or 3 or that are Provision 2 or 3 schools in their base year. None of the alternatives resulted in erroneous payments estimates that differed by as much as one percentage point from the base measure, which was 8.8 percent for the NSLP and 8.1 percent for the SBP. The alternative that differed the most (Alternative 1) also resulted in the highest rates of erroneous payments. Considering students for whom incomplete applications were submitted to be ineligible for benefits (Alternative 1) resulted in erroneous payment rates of 9.7 percent for the NSLP and 9.1 percent for the SBP. The underpayment rate was slightly lower under this alternative, but that was more than offset by the higher overpayment rate.

TABLE G.2

ERRONEOUS PAYMENTS DUE TO CERTIFICATION ERROR IN THE NSLP AND SBP, UNDER ALTERNATIVE SPECIFICATIONS OF ELIGIBILITY
(Standard Errors in Parentheses)

| | NSLP | SBP |
|---|---|---|
| **Base Measure** | | |
| Erroneous Payments as Percentage of Free or Reduced-Price Reimbursements | | |
| Overpayments | 6.82 | 6.41 |
| Underpayments | 2.02 | 1.70 |
| Total erroneous payments | 8.83 | 8.10 |
| **Alternative 1: Ineligible If Application Incomplete** | | |
| Erroneous Payments as Percentage of Free or Reduced-Price Reimbursements | | |
| Overpayments | 7.86 | 7.57 |
| Underpayments | 1.85 | 1.51 |
| Total erroneous payments | 9.71 | 9.08 |
| **Alternative 2: Missing Application or Direct Certification Documentation Does Not Automatically Mean Ineligible** | | |
| Erroneous Payments as Percentage of Free or Reduced-Price Reimbursements | | |
| Overpayments | 6.23 | 6.28 |
| Underpayments | 2.09 | 1.76 |
| Total erroneous payments | 8.32 | 8.03 |
| **Alternative 3: Reapplicants Certified Without Error** | | |
| Erroneous Payments as Percentage of Free or Reduced-Price Reimbursements | | |
| Overpayments | 6.58 | 6.11 |
| Underpayments | 2.03 | 1.71 |
| Total erroneous payments | 8.61 | 7.82 |

Note: These estimates exclude schools that are Provision 2 or 3 schools in their non-base year.

The other two alternatives resulted in lower erroneous payment rates than the base measure. The lowest erroneous payment rates for the NSLP resulted from relaxing the assumption that students whose applications were not found in the SFA's files were ineligible for benefits (Alternative 2). This alternative resulted in erroneous payment rates of 8.3 percent for the NSLP (0.5 percentage points lower than under the base measure). Assuming that students reapplying later in the school year were certified without error (Alternative 3) yielded a rate of 7.8 percent for the SBP, which is 0.3 percentage points lower than under the base definition.

# APPENDIX H

# PROGRAM ACCESS AND PARTICIPATION FINDINGS

The APEC study also enabled us to examine a limited set of issues related to access to, and participation in, the school meal programs. In this appendix, we will explore: (1) the extent to which application procedures are barriers, (2) NSLP and SBP participation, and (3) participation in the Summer Food Service Program (SFSP).

## A. METHODS

We conducted descriptive tabulations of data from several sources. The household survey in-person interviews with a parent or guardian of sampled students collected information on all of these issues and thus is the source of most of the data used in the analyses in this appendix. For issues related to program participation, in addition to parent reports in the household survey, we also collected administrative records data on individual participation of each sampled student in the NSLP and SBP, and we collected school-level participation data through the SFA survey and fax-back form.

## B. FINDINGS

### 1. NSLP and SBP Program Knowledge and Experiences

Table H.1 presents findings on households' knowledge of NSLP/SBP application procedures. Not surprisingly, almost all parents of both certified students and denied applicants reported that they were aware of the availability of free and reduced-price meals (98 percent) and had received an application or letter about the programs from their child's school (95 percent). The vast majority (93 percent) found the materials easy to understand, and more than three-fourths of parents (77 percent) were familiar with most of the eligibility criteria. About 64 percent understood that they could apply at any time during the year, and 72 percent knew that they might be asked to provide verification of the information reported on their application.

TABLE H.1

HOUSEHOLDS' KNOWLEDGE OF PROCEDURES FOR APPLYING FOR FREE/REDUCED-PRICE MEALS
(Percentages)

| | Applicants | | |
|---|---|---|---|
| | All | Certified | Denied |
| Aware of Free/Reduced-Price Meal Program Benefits | 98.4 | 98.5 | 97.1 |
| Received Letter and/or Application From School | 95.2 | 95.1 | 97.6 |
| Found application materials clear and easy to understand[a] | 93.4 | 93.4 | 92.8 |
| Found application materials difficult to understand[a] | 5.0 | 4.9 | 6.7 |
| Does not know[a] | 1.6 | 1.6 | 0.5 |
| Number of Eligibility Criteria Familiar with:[b] | | | |
| 0 | 1.0 | 0.9 | 1.8 |
| 1 to 2 | 22.6 | 22.5 | 24.0 |
| 3 to 4 | 76.5 | 76.5 | 74.2 |
| Understands Can Apply for Benefits at Any Time During the Year | 64.3 | 64.2 | 65.9 |
| Understands That Applications May be Subject to Verification | 71.6 | 71.9 | 67.5 |
| **Sample Size** | **3,399** | **2,947** | **453** |

Source: APEC Study, Household Survey, weighted data

[a]Calculated for those households who reported receiving application materials.

[b]The survey asked about four eligibility criteria: (1) whether household income needs to be at or below certain levels; (2) whether the student may receive free meals if household receives TANF or food stamps; (3) whether the household can apply at any time during the school year; and (4) whether the school district may ask families to show proof of income sources and amounts received (verification).

## 2. NSLP and SBP Program Participation

Tables H.2 through H.7 present findings on students' participation in the NSLP and SBP. According to aggregate school-level information reported by SFAs on participation rates of all students in their schools (not just those sampled for the APEC study),[1] 77 percent of students certified for free meals, 70 percent of students certified for reduced-price meals, and 52 percent of students paying full-price participate in the NSLP on an average day in October 2005 (Table H.2).[2] Participation in the SBP is considerably lower: 40 percent of students certified for free meals, 26 percent of students certified for reduced-price meals, and 18 percent of students paying full-price (Table H.3). Participation in both programs is more common in elementary schools and middle schools than in high schools. Students attending rural schools have higher participation rates than those in more urbanized settings.

Parents of sampled students reported higher levels of participation than the SFAs did. According to the household survey data, 91 percent of students certified for free meals, 87 percent of students certified for reduced-price meals, and 74 percent of students paying full-price had a school lunch on the day before the survey; and 52 percent of students certified for free meals, 41 percent of students certified for reduced-price meals, and 23 percent of students paying full-price had a school breakfast (Table H.4). In each certification status category, most parents reporting that their child had a school meal the previous day also reported that the child had that school meal every day during the previous week.

[1]Based on administrative records data, these rates are not subject to the reporting error that would likely occur in parent reports on their child's participation, although they could be subject to bias due to counting and claiming errors.

[2] Each participation rate was computed as the computed as (number of meals served for that certification status) / (number of serving days * number of students in that certification status).

TABLE H.2

AVERAGE SCHOOL-LEVEL NSLP PARTICIPATION,
BY CERTIFICATION STATUS
(Percentages)

| | Certification Status | | |
|---|---|---|---|
| | Free | Reduced-Price | Paid[a] |
| **Participation Rates for** | | | |
| All Schools | 76.5 | 70.4 | 52.0 |
| Elementary Schools | 79.7 | 73.2 | 55.9 |
| Middle Schools | 77.1 | 74.1 | 52.5 |
| High Schools | 54.5 | 46.7 | 27.0 |
| Urban Schools | 78.2 | 66.9 | 49.3 |
| Suburban Schools | 73.6 | 71.7 | 51.7 |
| Rural Schools | 79.3 | 80.1 | 65.2 |
| **Number of Schools** | **256** | **248** | **248** |

Source: APEC Study, SFA Survey—school data, weighted data.

Note: Aggregate participation rates were for each school. These rates were computed, for each category, as follows:

$$Rate(i) = \frac{Total\ Meals\ to\ Group(i)}{(Number\ of\ Serving\ Days)\ x\ (Number\ of\ Children\ in\ Group(i)}$$

where $i$ = free, reduced-price, or paid status.

[a]Refers to students paying full price for school lunches. Paid students include those who applied for meal benefits and were denied, or who did not apply.

TABLE H.3

AVERAGE SCHOOL-LEVEL SBP PARTICIPATION,
BY CERTIFICATION STATUS
(Percentages)

| | Certification Status | | |
|---|---|---|---|
| | Free | Reduced-Price | Paid[a] |
| **Participation Rates for** | | | |
| All Schools | 39.7 | 25.9 | 18.1 |
| Elementary Schools | 43.1 | 27.8 | 20.0 |
| Middle Schools | 35.1 | 25.5 | 16.6 |
| High Schools | 24.2 | 14.3 | 8.2 |
| Urban Schools | 39.1 | 24.5 | 17.9 |
| Suburban Schools | 36.2 | 22.6 | 14.7 |
| Rural Schools | 53.4 | 42.2 | 30.6 |
| **Number of Schools** | **242** | **235** | **234** |

Source: APEC Study, SFA Survey—school data, weighted data.

Note: Aggregate participation rates were computed for each school. These rates were computed, for each category, as follows:

$$Rate(i) = \frac{Total\ Meals\ to\ Group(i)}{(Number\ of\ Serving\ Days) \times (Number\ of\ Children\ in\ Group(i)}$$

where $i$ = free, reduced-price, or paid status.

[a]Refers to students paying full price for school breakfasts. Paid students include those who applied for meal benefits and were denied, or who did not apply.

TABLE H.4

PARTICIPATION AS REPORTED BY PARENTS,
BY CERTIFICATION STATUS
(Percentages)

| | Certification Status | | |
|---|---|---|---|
| | Free | Reduced-Price | Denied |
| **School Lunch** | | | |
| Participated on Day Prior to Interview | 91.2 | 86.9 | 74.1 |
| Number of Days in Past Week That Child Participated[a] | | | |
| None | 4.4 | 7.0 | 21.5 |
| 1 | 0.8 | 2.2 | 3.3 |
| 2 | 1.4 | 1.7 | 4.2 |
| 3 | 1.7 | 2.5 | 1.6 |
| 4 | 3.4 | 5.8 | 3.7 |
| 5 (every day) | 88.3 | 80.9 | 65.7 |
| (Mean no. days) | 4.6 | 4.4 | 3.6 |
| **Sample Size** | **2,303** | **513** | **435** |
| **School Breakfast** | | | |
| Participated on Day Prior to Interview | 52.2 | 40.7 | 22.9 |
| Number of Days in Past Week That Child Participated[a] | | | |
| None | 36.4 | 50.6 | 66.5 |
| 1 | 2.9 | 3.1 | 6.0 |
| 2 | 3.8 | 4.8 | 3.1 |
| 3 | 3.4 | 3.6 | 2.3 |
| 4 | 3.5 | 5.2 | 2.3 |
| 5 (every day) | 49.9 | 32.7 | 19.9 |
| (Mean no. days) | 2.8 | 2.1 | 1.3 |
| **Sample Size** | **2,162** | **453** | **411** |

Source: APEC Study, Household Survey, weighted data

[a]For the most recent completed week prior to the interview

TABLE H.5

REASONS FOR NOT PARTICIPATING IN NSLP,
BY CERTIFICATION STATUS
(Percentages)

| | Certification Status | | | |
|---|---|---|---|---|
| | Total | Free | Reduced-Price | Denied |
| **Reasons Not Participating** | | | | |
| Child Does Not Eat Lunch | 0.9 | 1.5 | 0.0 | 0.0 |
| Child Eats Lunch at Home/Not at School for Lunch | 17.8 | 19.9 | 15.0 | 14.1 |
| Child Prefers to Bring Lunch From Home | 19.3 | 11.4 | 27.5 | 36.6 |
| Child Does Not Like the School Meals | 43.4 | 44.5 | 51.8 | 30.3 |
| Child Does Not Have Enough Time to Eat Lunch | 16.6 | 16.6 | 26.8 | 5.0 |
| Child's Friends Do Not Participate/Child Embarrased | 3.5 | 3.1 | 5.9 | 2.1 |
| Child on Special Diet | 2.5 | 1.3 | 3.9 | 5.0 |
| Child Does Not Like Waiting in Line | 7.8 | 10.5 | 5.3 | 1.5 |
| Cost of Meals | 6.7 | 2.8 | 3.2 | 23.7 |
| Other Reason/Parent Does Not Know if Child Eats Lunch | 14.1 | 18.5 | 5.5 | 9.0 |
| **Most Important Reason** | | | | |
| Child Does Not Eat Lunch | 0.3 | 0.4 | 0.0 | 0.0 |
| Child Eats Lunch at Home/Not at School for Lunch | 14.8 | 17.0 | 10.9 | 12.1 |
| Child Prefers to Bring Lunch From Home | 13.9 | 6.6 | 21.0 | 30.6 |
| Child Does Not Like the School Meals | 38.5 | 40.4 | 46.4 | 23.0 |
| Child Does Not Have Enough Time to Eat Lunch | 6.3 | 7.9 | 6.9 | 0.0 |
| Child's Friends Do Not Participate/Child Embarrased | 1.5 | 2.1 | 0.0 | 1.1 |
| Child on Special Diet | 2.4 | 1.3 | 3.9 | 4.3 |
| Child Does Not Like Waiting in Line | 3.6 | 4.9 | 2.1 | 0.7 |
| Cost of Meals | 6.0 | 2.8 | 3.2 | 20.0 |
| Other Reason/Parent Does Not Know if Child Eats Lunch | 12.7 | 16.5 | 5.5 | 8.2 |
| **Sample Size** | **223** | **104** | **34** | **85** |

Source: APEC Study, Household Survey, weighted data

TABLE H.6

REASONS FOR NOT PARTICIPATING IN SBP,
BY CERTIFICATION STATUS
(Percentages)

| | Certification Status | | | |
|---|---|---|---|---|
| | Total | Free | Reduced-Price | Denied |
| **Reasons Not Participating[a]** | | | | |
| Child Does Not Eat Breakfast | 6.8 | 7.1 | 5.9 | 6.2 |
| Child Eats Breakfast at Home/Not at School for Breakfast | 64.6 | 59.4 | 76.2 | 80.3 |
| Child Prefers to Bring Breakfast From Home | 3.2 | 3.1 | 3.8 | 2.4 |
| Child Does Not Like the School Meals | 12.5 | 14.1 | 8.5 | 9.4 |
| Child Does Not Have Enough Time to Eat Breakfast | 22.7 | 25.0 | 18.4 | 13.0 |
| Child's Friends Do Not Participate/Child Embarrassed | 2.2 | 2.6 | 1.4 | 0.6 |
| Child on Special Diet | 0.8 | 0.9 | 0.7 | 0.8 |
| Child Does Not Like Waiting in Line | 2.8 | 3.4 | 1.0 | 1.7 |
| Cost of Meals | 1.0 | 0.6 | 0.0 | 6.6 |
| Other Reason/Parent Does Not Know if Child Eats Breakfast | 7.7 | 9.3 | 4.7 | 1.1 |
| **Most Important Reason** | | | | |
| Child Does Not Eat Breakfast | 6.0 | 6.2 | 5.5 | 5.6 |
| Child Eats Breakfast at Home/Not at School for Breakfast | 55.4 | 49.7 | 69.9 | 68.5 |
| Child Prefers to Bring Breakfast From Home | 0.9 | 0.7 | 1.2 | 1.2 |
| Child Does Not Like the School Meals | 9.8 | 10.7 | 8.1 | 6.6 |
| Child Does Not Have Enough Time to Eat Breakfast | 16.4 | 19.2 | 9.6 | 8.8 |
| Child's Friends Do Not Participate/Child Embarrassed | 1.2 | 1.5 | 0.8 | 0.3 |
| Child on Special Diet | 0.8 | 0.8 | 0.7 | 0.8 |
| Child Does Not Like Waiting in Line | 1.9 | 2.6 | 0.0 | 0.5 |
| Cost of Meals | 1.0 | 0.6 | 0.0 | 6.5 |
| Other Reason/Parent Does Not Know if Child Eats Breakfast | 6.6 | 7.9 | 4.2 | 1.1 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 |
| **Sample Size** | **1,318** | **823** | **224** | **271** |

Source: APEC Study, Household Survey, weighted data

[a]Total exceeds 100 percent because respondents can give more than one reason for not participating

TABLE H.7

SATISFACTION WITH SCHOOL MEALS
(Percentages)

| | Certification Status | | | |
|---|---|---|---|---|
| | Total | Free | Reduced-Price | Denied |
| Child's Satisfaction with Taste[a] | | | | |
| Very satisfied | 38.7 | 38.5 | 39.8 | 37.5 |
| Somewhat satisfied | 42.5 | 42.7 | 42.7 | 39.1 |
| Somewhat dissatisfied | 13.6 | 14.0 | 11.2 | 15.0 |
| Very dissatisfied | 5.2 | 4.7 | 6.4 | 8.4 |
| Child Satisfaction with Amounts[a] | | | | |
| Very satisfied | 46.3 | 46.7 | 48.4 | 33.8 |
| Somewhat satisfied | 30.9 | 30.6 | 30.5 | 35.2 |
| Somewhat dissatisfied | 16.0 | 16.0 | 14.6 | 19.7 |
| Very dissatisfied | 6.8 | 6.6 | 6.4 | 11.3 |
| Child's Overall Satisfaction[a] | | | | |
| Very satisfied | 43.5 | 43.8 | 44.1 | 37.2 |
| Somewhat satisfied | 41.0 | 41.4 | 38.7 | 43.4 |
| Somewhat dissatisfied | 11.0 | 11.0 | 10.8 | 11.5 |
| Very dissatisfied | 4.5 | 3.9 | 6.4 | 7.9 |
| Respondent's Satisfaction with Healthfulness | | | | |
| Very satisfied | 53.1 | 53.9 | 51.9 | 44.1 |
| Somewhat satisfied | 32.7 | 32.8 | 32.1 | 34.1 |
| Somewhat dissatisfied | 9.4 | 9.0 | 10.1 | 12.4 |
| Very dissatisfied | 4.8 | 4.3 | 5.9 | 9.4 |
| Respondent's Overall Satisfaction | | | | |
| Very satisfied | 58.5 | 60.4 | 55.6 | 40.3 |
| Somewhat satisfied | 30.0 | 29.2 | 31.8 | 36.0 |
| Somewhat dissatisfied | 7.8 | 7.3 | 8.2 | 15.1 |
| Very dissatisfied | 3.7 | 3.2 | 4.4 | 8.6 |
| **Sample Size** | **3,335** | **2,379** | **530** | **426** |

Source: APEC Study, Household Survey, weighted data

[a]Parents are being asked to report child's satisfaction.

Parents who reported that their child did not participate in the NSLP and SBP every day that school meals were available were asked their reasons for not participating or for not participating more often. The most commonly reported reason for not eating a school lunch—reported by 43 percent of households that do not participate in the NSLP every day—was that the child does not like the food (Table H.5). This was also the reason most often cited as the most important reason for not participating in the NSLP. Other common reasons for not participating in the NSLP were that the child prefers to bring lunch from home (19 percent), the child is not at school at lunchtime (17 percent), and the child does not have enough time to eat lunch (17 percent). Almost two-thirds (65 percent) of households that did not participate in the SBP every day gave the fact that the child is not at school at breakfast time as a reason for not eating a school breakfast—this was both the most frequent reason given and the reason most frequently reported as most important (Table H.6). Other common reasons for not participating in the SBP were that the child does not have enough time to eat breakfast at school (23 percent) and that the child does not like the food (13 percent). Table H.7 provides additional detail on household's satisfaction with the quality of school meals along several dimensions: for children—taste, amount of food, and overall satisfaction; for parents—healthfulness and overall satisfaction

### 3. SFSP Participation

SFSP participation is relevant to the main objectives of the study as a background characteristic of the students sampled. Perhaps more important, this study provides an opportunity to gather information on this issue, which is of independent policy interest, at a low marginal cost. Of the APEC household survey sample, 15 percent reported participating in a program that offered free meals to children in the community during the summer before the survey (Table H.8). These are not all necessarily the SFSP, however, because respondents may

TABLE H.8

SUMMER FOOD SERVICE PROGRAM PARTICIPATION
(Percentages)

| | Certification Status | | | |
|---|---|---|---|---|
| | Total | Free | Reduced-Price | Denied |
| Participated in a Summer Food Program | 14.9 | 15.8 | 11.6 | 12.0 |
| Frequency of Participation[a] | | | | |
| Number of days per week | 4.3 | 4.3 | 4.2 | 4.4 |
| Total number of days participated | 27.9 | 27.8 | 26.9 | 32.4 |
| Types of Meals Received[a] | | | | |
| Breakfast | 43.3 | 44.1 | 39.6 | 37.4 |
| Lunch | 89.1 | 89.5 | 92.9 | 68.5 |
| Dinner | 2.5 | 2.3 | 4.0 | 0.5 |
| Other | 37.5 | 37.6 | 37.6 | 36.6 |
| Location of Summer Food Program[a] | | | | |
| School | 54.1 | 53.6 | 59.2 | 48.4 |
| Park | 7.5 | 7.5 | 7.1 | 8.7 |
| Community center | 21.5 | 21.3 | 21.3 | 26.7 |
| Camp | 5.4 | 5.8 | 1.2 | 9.7 |
| Church | 5.7 | 5.9 | 6.1 | 1.7 |
| Day care center | 3.4 | 2.8 | 6.1 | 7.3 |
| Other | 4.1 | 4.4 | 3.5 | 0.0 |
| Distance to Summer Food Program[a] | | | | |
| Less than 1 mile | 44.2 | 46.7 | 33.1 | 28.9 |
| 1 to 5 miles | 41.0 | 39.1 | 55.6 | 34.0 |
| More than 5 miles | 14.8 | 14.1 | 11.2 | 37.1 |
| Types of Activities At Summer Program[a] | | | | |
| Academics | 45.2 | 49.0 | 23.8 | 40.0 |
| Arts and Crafts | 24.6 | 24.9 | 20.2 | 31.6 |
| Recreation program | 31.6 | 33.1 | 20.4 | 36.7 |
| Child Liked the Food[a] | | | | |
| No | 6.5 | 5.2 | 12.7 | 11.7 |
| Sometimes | 14.7 | 14.9 | 6.9 | 33.7 |
| Yes | 78.8 | 79.8 | 80.5 | 54.6 |
| **Sample Size** | **3,388** | **2,398** | **540** | **450** |

Source: APEC Study, Household Survey, weighted data

[a]Calculated for students who were reported to have participated in SFSP.

not be able to differentiate between the SFSP and other programs that provide food to children during the summer. For example, lunches provided as part of summer school are typically part of the NSLP, and some of the programs located at schools—which comprise more than half (54 percent) of the summer food programs reported—could fall into this category. Similarly, food provided at day care centers (3 percent of programs reported) might be under the Child and Adult Care Food Program rather than the SFSP.

Table H.9 presents information on students who did not participate in a summer food program. Less than one-third (28 percent) of nonparticipant households were aware of the availability of summer food programs, and more than half (56 percent) said they would send their child to a summer program if one opened close to their home. Among those aware of summer food programs, the most frequently reported reason for not participating was that the child did not like the food served by the program (30 percent). Other common reasons for not participating were that the student had other activities or was out of town (24 percent), the program was too far away (20 percent), or the parent had not been aware of the program at the time (11 percent).

TABLE H.9

NON-PARTICIPANTS IN THE SUMMER FOOD SERVICE PROGRAM PARTICIPATION
(Percentages)

| | Certification Status | | | |
|---|---|---|---|---|
| | Total | Free | Reduced-Price | Denied |
| Did Not Participate in Summer Food Program | 85.1 | 84.2 | 76.7 | 88.0 |
| Aware of Summer Food Program[a] | 27.5 | 28.6 | 23.3 | 25.5 |
| Distance to Summer Food Program[b] | | | | |
| Less than 1 mile | 40.9 | 42.6 | 35.8 | 26.8 |
| 1 to 5 miles | 45.7 | 46.9 | 40.7 | 40.1 |
| More than 5 miles | 13.4 | 10.5 | 23.4 | 33.1 |
| Reasons for Not Participating[b] | | | | |
| Not aware of program | 10.6 | 12.3 | 3.0 | 6.1 |
| Program too far away | 19.8 | 19.8 | 21.5 | 15.8 |
| Child does not like food at program | 30.4 | 28.7 | 38.1 | 35.5 |
| Concerned about safety of the child | 8.4 | 9.4 | 5.1 | 2.4 |
| Other activities/out of town | 24.1 | 24.5 | 20.7 | 28.0 |
| Wanted to avoid stigma | 1.4 | 1.7 | 0.0 | 2.1 |
| Could not afford to participate | 1.1 | 1.3 | 0.0 | 0.7 |
| Other | 15.1 | 15.0 | 16.1 | 13.8 |
| Would Use SFSP If Available[a] | 56.4 | 58.0 | 53.0 | 46.4 |
| Other Strategies Used to Feed Children During the Summer | | | | |
| Asked relatives for help | 12.5 | 13.0 | 11.2 | 9.7 |
| Used a food pantry | 10.3 | 11.0 | 9.2 | 4.4 |
| Bought less expensive types of food | 44.1 | 46.2 | 38.1 | 33.7 |
| **Sample Size** | **2,908** | **2,024** | **484** | **400** |

Source: APEC Study, Household Survey, weighted data

[a]Calculated for students who were reported to have not participated in SFSP.

[b]Calculated for students who were reported to have not participated in SFSP but aware of its existence.

# APPENDIX I

# OUTCOMES OF DISTRICT'S VERIFICATION PROCEDURES

School districts are required each year to select a small sample of applications approved for free or reduced-price meals and verify that the students covered by the application are eligible for the meal benefits they receive. In most cases, households whose applications are selected for verification must present documentation that establishes that the household is eligible for FSP/TANF/FDPIR benefits or that the household income is below 130 percent or between 130 and 185 percent of the federal poverty level in order to continue receiving free or reduced-price meal benefits.[1] Students who are certified for free meals through direct certification are not subject to verification.[2] On the basis of documentation received, the district will determine whether it should leave benefits unchanged, increase benefits from reduced-price to free, reduce them from free to reduced-price, or reduce them from free or reduced-price to paid. If the district does not receive any documentation from a sampled household and cannot directly verify a nonresponding household's certification status, it must terminate the student's benefits (change them to paid). In this section we summarize the characteristics and results of district's verification activities for SY 2005–2006.

## A. METHODOLOGY

Our analysis of verification characteristics and results is based on data from all SFAs and private schools submitting FNS-742 verification summary data to FNS for SY 2005–2006.[3] FNS received data from 17,282 SFAs within 54 child nutrition state and territorial agencies and from

[1]In conducting eligibility verification of the sample of approved applications, districts may first use direct verification (obtain and use income and program participation information about the applicant family from certain public agencies) before contacting the family.

[2]Students certified for free meals from the homeless liaison list, income-eligible Head Start, pre-K Even Start, residential students in Residential Child Care Institutions (RCCIs), and non-applicants approved by local officials are also not subject to verification.

[3]The APEC study's SFA survey collected information on the process districts use to conduct verification and on the results they obtained for our sample of 87 public and private SFAs. The findings from the APEC study sample of SFAs are similar to those based on the full FNS-742 datafile, differing because of sampling error.

3 states in which FNS regional offices administer the NSLP in private schools and/or Residential Child Care Institutions (RCCIs). The number of students enrolled in these SFAs was 46,015,996 and represents approximately 90 percent of the total students enrolled in schools operating the NSLP and/or SBP nationwide.

Verification results are presented in terms of all verified applications and for subgroups organized by type of certified application verified, by the method used by the school district to select its verification sample, and by district size. We calculated the percentage of verified applications in which the school district:

- Did not change the certification status of the students covered by the application
- Changed the certification status from reduced-price to free
- Changed the certification status from free to reduced-price
- Changed the certification status from free or reduced-price to paid
- Terminated benefits (changed to paid) because the household did not respond to the verification request

The verification findings summarized here are based on the district's reviews of documentation provided by the household or through direct verification by the school district. FNS does not directly collect data to independently assess the accuracy of the school district's verification decisions about the applications verified and reported in FNS-742 data. Past studies have shown, however, that verification decisions also may be determined with error just as initial certification decisions are. For example, Burghardt et al. (2004a) found that approximately 20 percent of certified applications selected for verification whose benefits were unchanged were ineligible for the benefit they were receiving at the time of verification, based on eligibility information obtained through the study's household survey. Therefore the findings about verification results should be interpreted purely as a descriptive summary of districts'

verification procedures and outcomes for the current school year and of changes in characteristics and outcomes since the previous year.[4] *These results should not be interpreted as another measure of the certification error rate.*

## B. FINDINGS

School districts nationwide approved approximately 8,669,895 applications for free or reduced-price benefits in SY 2005–2006. About eighty percent of approved applications were certified on the basis of income reported on an application, with about twenty percent of approved applications certified for free meal benefits based on household receipt of FSP/TANF/FDPIR benefits.

Districts reported selecting 363,187 approved applications for verification in SY 2005–2006 (Table I.1). This represented 4.2 percent of total certified applications for the school year. Slightly more than half (54.5 percent) of applications selected for verification were certified for free meals on the basis of reported income and household size, 16.9 percent were certified as categorically eligible for free meals, and 28.5 percent were certified for reduced price meals. Nearly half (48 percent) of verified applications were selected using a focused/error-prone method. This is more than twice the rate from just one year earlier when 17 percent of verified applications were selected using a focused-sampling method. (The change observed between the

[4]Past studies have used verification results to derive estimates of certification error rates and provide information on erroneous payments (USDA 1990a; Burghardt et al. 2004a). We do not use FNS-742 verification summary data to derive certification-related error rates because of limitations in the data for that purpose (such as non-random sampling of verified applications, districts' use of direct certification, and district officials' errors when verifying applications). In the component of the APEC study that develops models to update annual estimates of erroneous payments, we are examining the relationship between verification results and certification error rates. We expect district verification results to be an important predictor of the model of district error rates in that, although these verification results may not be precise, they are a direct estimate of erroneous certification rates in each district.

TABLE I.1

CHARACTERISTICS OF THE VERIFICATION PROCESS

| | All Districts SY 2004–2005 | All Districts SY 2005–2006 |
|---|---|---|
| Number of Certified Applications Selected for Verification | 395,137 | 363,187 |
| Percentage of Certified Applications Selected for Verification | 3.8 | 4.2 |
| Percentage of Verified Applications by Type | | |
| Free, categorically certified | 22.8 | 16.9 |
| Free, income certified | 54.6 | 54.5 |
| Reduced-price, income certified | 22.7 | 28.5 |
| Percentage of Verified Applications by Verification Sampling Method | | |
| Random sampling | 71.3 | 36.5 |
| Focused sampling | 17.3 | 48.1 |
| All applications verified | 11.4 | 11.2 |
| **Sample Size (SFAs)** | **16,648** | **17,282** |

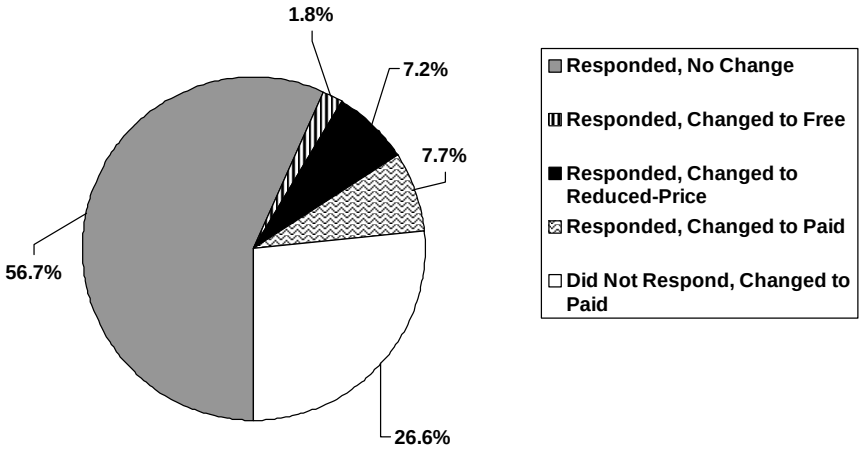
Sources: FNS-742 Verification Summary Data, SY 2005–2006; OANE (2005).

two years is largely due to a change in the relevant regulations, as discussed below.) Only 11 percent of the verified applications were from districts that verified all applications.[5]

### 1. Verification Results Based on All Verified Applications

For the majority (56.7 percent) of applications selected for verification, the verification determinations of school districts resulted in no change in the certification status of the application (see Figure I.1). Districts changed the certification status of 43.3 percent of applications selected for verification. The majority of these certification changes occurred because the household did not respond to the verification request (26.6 percent of applications selected for verification). Approximately one-seventh (14.9 percent) of applications selected for verification were determined to be eligible for a lower level of benefits or ineligible for any benefits on the basis of documentation provided by the household.

**Figure I.1**
**Verification Outcomes**
**All Applications**



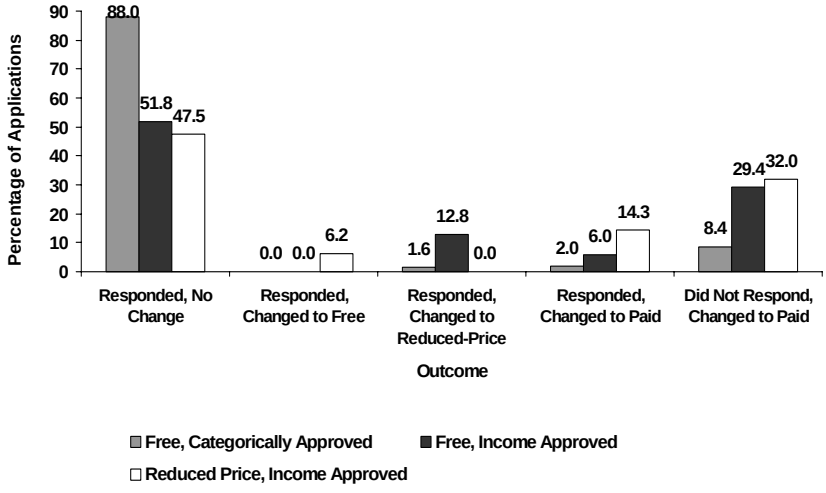

[5]Under the Child Nutrition and WIC Reauthorization Act of 2004, districts must limit their verification sample to the size allowed by statute (1½ or 3 percent, depending on verification procedures used), and are no longer allowed to choose to verify all certified applications. However, a district may verify applications which are not in the verification sample if they have reason to believe the information on the application is not correct, and State agencies can verify applications beyond the verification sample as part of their oversight activities.

## 2. Verification Results by Type of Certification

Applications may be certified based on income or be certified as categorically eligible for free meals base on reported household receipt of FSP/TANF/FDPIR benefits. Categorically eligible applications were most likely to have their certification status remain unchanged when verified. For 88 percent of categorically eligible applications selected for verification, the school district did not change certification status on the basis of documentation it reviewed (Figure I.2). In contrast, the certification status remained unchanged for 52 percent of income-eligible free meal applications and 48 percent of reduced-price eligible applications selected for verification. Reduced-price applications had the highest percentage of verified applications changed to paid at 46 percent. Out of every 100 reduced-price applications selected for verification, 14 were cases in which the household responded to the verification request but provided information which led the school district to change its status to paid, and 32 were terminated because the household did not respond to the verification request.

**Figure I.2**

**Verification Outcomes by Certification Status**

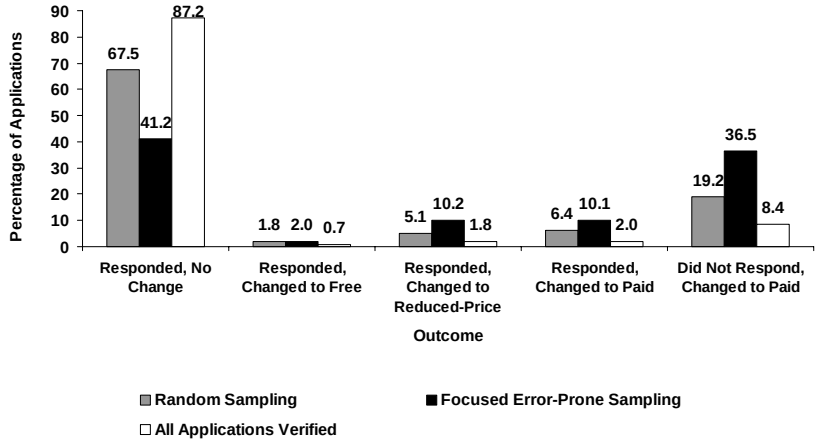


### 3. Verification Results by Method of Selecting Verification Sample

Verification sampling requirements changed under the Child Nutrition and WIC Reauthorization Act of 2004 and became effective in SY 2005–2006. The intent of the changes was to increase the focus on cases which had a high probability of being in error. The second of two years of data available for this analysis reflects the new rules.[6]

Districts that verified all applications had the smallest percentage of certification changes as a result of verification—13 percent (see Figure I.3). However, this method of verification is least likely to be used (just 11 percent of applications selected for verification were verified by school districts that verified all certified applications). As of SY 2006-2007, SFAs were no longer allowed to choose to verify all applications. In districts using focused sampling, approximately 60 percent of applications selected for verification had a change in certification status; in districts

**Figure I.3**
**Verification Outcomes by Sampling Method**



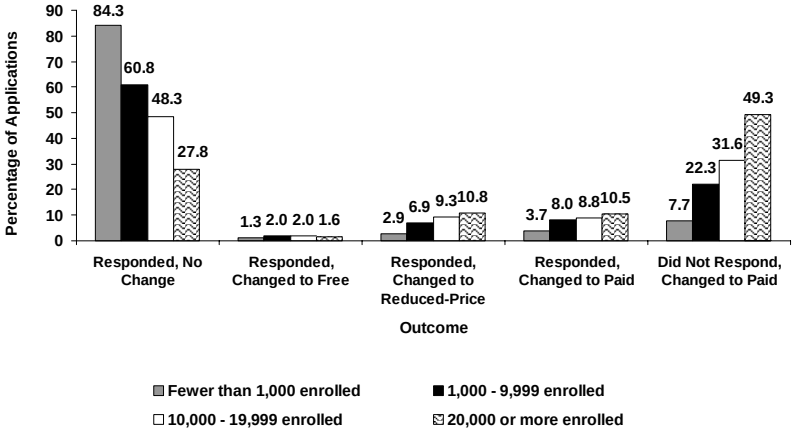

[6]Under the new law, most districts that had a nonresponse rate of 20 percent or higher for the previous year's verification sample now must verify the lesser of 3 percent of all applications or 3,000 applications, drawn first from focused/error-prone applications. If the number of error-prone applications on file is less than the required sample size, the remaining applications to be verified are selected at random. Districts that had a nonresponse rate below 20 percent for the prior year's verification or that have at least 20,000 students certified for free or reduced-price meal benefits based on applications and show at least a 10 percent improvement in their nonresponse rate between the second prior year and the prior year are allowed to use alternate sampling procedures (either 3 percent of applications selected at random or 1.5 percent of applications using focused selection).

using random sampling, about one-third of verified applications had a change in the certification status. In both cases, the majority of certification changes were due to the household not responding to the verification request (approximately 37 percent of verified applications in focused sampling districts and 19 percent of verified applications in random sampling districts).

### 4. Verification Results by District Size

The majority of districts or private schools participating in the NSLP and/or SBP are very small (enrollments of fewer than 1,000 students). Most districts with 20,000 or more enrolled students used focused sampling and none of them verified all applications. Districts with fewer than 1,000 enrolled students primarily used random sampling to select applications for verification but also were the most likely to verify all applications. Small districts had the lowest percentage of verified applications that changed certification status. Districts with fewer than 1,000 enrolled students changed certification status of 16 percent of verified applications, compared with 72 percent of verified applications in districts with 20,000 or more enrolled students (Figure I.4). Very large districts had the greatest percentage of applications changed to

**Figure I.4**
**Verification Outcomes by District Size**



paid due to nonresponse. Forty-nine percent of verified applications in districts with 20,000 or more enrolled students were changed to paid due to the household not responding to the verification request, compared with 8 percent in districts with fewer than 1,000 enrolled students.

### 5. Comparisons with Earlier FNS Study of Verification Summary Data

As expected, changes in verification sampling requirements and other legislative changes affected the characteristics and outcomes of verification in SY 2005–2006 relative to SY 2004–2005, the first year FNS collected data from SFAs on verification outcomes (OANE 2005). First, districts selected fewer categorically eligible applications for verification in SY 2005–2006 (17 percent versus 23 percent). Second, there was a dramatic shift in the number of districts using focused/error-prone sampling to select the verification sample. In SY 2005–2006, 48 percent of applications selected for verification were from districts using error-prone sampling, compared to just 17 percent of verified applications one year earlier. This increased usage of focused/error-prone sampling resulted in an increase in verified applications that changed certification status (Table I.2). In SY 2005–2006, 43 percent of all applications selected for verification changed certification status, compared with 35 percent in SY 2004–2005. The percentage of verified applications in which the household failed to respond to the verification request and therefore changed to paid increased by 3 percentage points (26.5 percent versus 23.4 percent).

TABLE I.2

VERIFICATION OUTCOMES

| Verification Outcome | All Applications SY 2004–2005 | All Applications SY 2005–2006 |
|---|---|---|
| Responded, No Change | 64.5 | 56.8 |
| Responded, Changed to Free | 1.6 | 1.8 |
| Responded, Changed to Reduced-Price | 4.8 | 7.2 |
| Responded, Changed to Paid | 5.7 | 7.7 |
| Did Not Respond, Changed to Paid | 23.4 | 26.5 |
| **Sample Size** | **395,137** | **363,187** |

Source: FNS-742 Verification Summary Data, SY 2005–2006; OANE (2005).

# APPENDIX J

# INCOME DYNAMICS OVER THE SCHOOL YEAR FINDINGS

Beginning in SY 2004-2005, households certified for free or reduced-price meals at any point during a school year remain eligible for that level of benefits for the rest of the school year, even if their circumstances change in a way that would make them ineligible or eligible for a lower level of benefits.[1] In the past, households were required to report any changes in household size and income changes greater than $50 per month, and their certification status would be adjusted accordingly. The analysis in this appendix measures the extent to which the household circumstances of students certified for free or reduced-price meals changed over the course of the school year, the extent to which these changing circumstances would have resulted in changes in free or reduced-price eligibility under previous program regulations, and the resulting consequences of the recent statutory change to a year-long certification period on our estimates of erroneous payments.

## A. METHODS

Among households certified for free and reduced-price meals that responded to the initial APEC household survey, we selected a representative subsample of households to include in our panel-survey sample. For each household in this subsample, we administered a second survey later in the school year. Questions on this panel survey were similar to those in the initial household survey, covering topics related to student's participation in the NSLP and SBP and including detailed questions on household composition and income. Administration of the panel

[1]This change was part of the Child Nutrition and WIC Reauthorization Act of 2004. If a household's circumstances change in a way that would make it eligible for a higher level of benefits, however, it is allowed to reapply and become certified for that level of benefits. The household may also voluntarily request a change to a lower benefit level.

survey was staggered across the second semester of the school year, taking place between January and July 2006.[2] The panel survey was ultimately completed by 799 households.

To examine changes in eligibility status over the course of the school year, we used panel survey questions about household circumstances to construct a measure of eligibility at a second point in time during the year. This construction followed the same process that we used to create our initial measure of eligibility (based on information collected through the initial household survey about household circumstances at the time the student was certified for meal benefits). We computed household size, household income, and categorical eligibility based on the information reported on the survey, then applied FNS guidelines to independently assess the level of benefits to which the household would have been eligible if it had applied for benefits at that time.

Our analysis compares the measure of eligibility based on the initial household survey data to that based on the panel-survey data. To determine the causes of any changes in eligibility status, we also compared our measures of household size, total monthly income, and categorical eligibility from the two surveys. After examining changes in household circumstances, we used similar methods to test the consequences of the recent policy change on a certified student's eligibility status over the course of the school year. We computed a measure of what the certification error rate would have been at the time of the panel survey if the rule specifying a year-long certification period had not been implemented by comparing the student's certification status on the district's master eligibility list at the beginning of the year to our independent

[2]The vast majority of the initial household survey interviews were conducted between September and December 2005, but some newly certified households completed their initial interview later in the year. In the initial household survey, questions about household circumstances focused on the month in which the application for free or reduced-price meals was submitted; in the panel survey, those questions focused on the month immediately prior to the interview. The amount of time between the reference month for the two surveys was less than three months for 6 percent of the panel sample, between three and six months for half of the sample, between six and nine months for 41 percent, and more than nine months for the remaining 3 percent.

assessment of the student's eligibility status based on information provided on the panel survey by his or her parent or guardian. In addition to conducting analyses for the entire panel sample, we examined some issues for subsamples defined by the number of months elapsed between the initial and panel surveys.

## B. FINDINGS

### 1. Changes in Household Circumstances and Student Eligibility Status

Table J.1 shows how certified students' eligibility status changed between the time of the initial household survey, administered at the beginning of the school year for most students, and the panel survey administered later in the school year. Between the time the student initially was certified for meal benefits and the time of the panel survey, 23 percent of certified students were estimated to have had a change in household circumstances that would have resulted in a different level of eligibility.

Increases in students' eligibility for benefits were more common than decreases. About 14 percent of certified students in the panel survey sample became eligible for a higher level of benefits—that is, the parent reported changes in household circumstances such as a decrease in income, an increase in household size, or becoming categorically eligible (by beginning to receive TANF, FSP, or FDPIR). Nine percent reported changes in household circumstances that would have made the student eligible for a lower level of benefits or no benefits at all.[3]

[3]Any of these changes in the level of eligibility could have occurred for a student who was initially accurately certified, overcertified, or undercertified. For example, a student initially certified for reduced-price meals and not eligible for benefits (that is, overcertified) could have experienced a change in circumstances that increased his or her eligibility level to reduced-price, resulting in an accurate certification status at this later point during the year. Alternatively, the increase in eligibility could have been to the free level, causing the student's new status to be undercertified. Various other possibilities would arise through different combinations of initial certification status, initial eligibility status, and change in eligibility status. These various possibilities and their net effect on students' certification accuracy are explored later in this appendix.

TABLE J.1

CHANGES IN ELIGIBILITY STATUS BETWEEN TIME OF HOUSEHOLD SURVEY AND TIME OF PANEL SURVEY

| | Eligibility Status at Time of Household Survey | | | |
|---|---|---|---|---|
| | Free | Reduced-Price | Paid | Total |
| Eligibility Status at Time of Panel Survey | | | | |
| Free | 89.61 | 51.38 | 28.13 | 77.83 |
| | (1.87) | (7.81) | (8.11) | (2.17) |
| Reduced-price | 6.76 | 39.61 | 30.21 | 14.35 |
| | (1.51) | (6.60) | (6.49) | (1.65) |
| Paid | 3.63 | 9.00 | 41.66 | 7.82 |
| | (1.09) | (3.08) | (7.47) | (1.27) |
| Change in Eligibility Status, Among All Households Completing Panel Survey | | | | |
| Increase[a] | NA | 51.38 | 58.34 | 13.74 |
| | | (7.81) | (7.47) | (2.40) |
| Decrease[b] | 10.39 | 9.00 | NA | 9.26 |
| | (1.87) | (3.08) | | (1.53) |
| No change | 89.61 | 39.61 | 41.66 | 77.00 |
| | (1.87) | (6.60) | (7.47) | (2.70) |
| **Sample Size** | **598** | **129** | **72** | **799** |

Source: APEC study, weighted data.

Note: Standard errors in parentheses.

[a]An increase in eligibility status is a change in circumstances resulting in eligibility for a higher level of benefits—for example, a change from reduced-price to free.

[b]A decrease in eligibility status is a change in circumstances resulting in eligibility for a lower level of benefits—for example, a change from reduced-price to paid.

NA = not applicable.

Eligibility status changes were considerably more common for students initially eligible to receive reduced-price meals than those initially eligible for free meals. Only 10 percent of initially free-eligible students would have been eligible for a different level of benefits based on the panel survey, compared to 60 percent of students certified for reduced-price meals (Table J.1). This difference is not surprising, because the income range for reduced-price eligibility is relatively narrow (between 130 and 185 percent of the federal poverty level) compared to that for free meals (below 130 percent of poverty). The changes among free-eligible students were always to a lower level of eligibility, of course, while changes from reduced-price were far more often increases to free eligibility (51 percent) than decreases to ineligibility (9 percent).

Table J.2 presents changes in the eligibility status of certified students by subgroups, based on the amount of time elapsed between the household's application for free or reduced-price meals and the month before the panel survey. The results show considerable month-to-month volatility but no clear association between the percentage of cases with eligibility status changes and the amount of time elapsed between the measurements of eligibility. The percentage of certified students with an increase in eligibility ranged from 7 percent to 18 percent across the subgroups, and the percentage with a decrease in eligibility ranged from 5 percent to 14 percent. Certified students in households that were administered a panel survey less than six months after their initial survey had somewhat higher rates of change in eligibility status than those surveyed six months or more after their initial survey, but these differences were not statistically significant. Still, this result may seem counterintuitive, as it might be expected that household circumstances would change more given a longer period of time. However, research has found a high degree of income volatility among low-income populations such as the sample of students certified for free and reduced-price meals used for this analysis. One study found that households frequently cross back and forth over the NSLP/SBP eligibility thresholds several

TABLE J.2

CHANGES IN ELIGIBILITY STATUS, BY TIME ELAPSED BETWEEN REFERENCE MONTHS FOR HOUSEHOLD AND PANEL SURVEYS

| | Change in Eligibility Status | | |
|---|---|---|---|
| | Increase [a] | Decrease [b] | No Change |
| Among households completing panel survey within three months of household survey (n = 75) | 17.30<br>(5.15) | 13.86<br>(4.44) | 68.84<br>(6.81) |
| Among households completing panel survey four months after household survey (n = 137) | 18.16<br>(7.07) | 5.58<br>(2.42) | 76.26<br>(6.82) |
| Among households completing panel survey five months after household survey (n = 130) | 16.03<br>(4.89) | 14.37<br>(4.26) | 69.60<br>(5.39) |
| Among households completing panel survey six months after household survey (n = 122) | 12.67<br>(3.78) | 7.11<br>(2.70) | 80.22<br>(4.47) |
| Among households completing panel survey seven months after household survey (n = 126) | 14.70<br>(4.88) | 6.37<br>(2.32) | 78.93<br>(5.51) |
| Among households completing panel survey eight months after household survey (n = 124) | 7.47<br>(2.21) | 14.44<br>(3.90) | 78.10<br>(3.99) |
| Among households completing panel survey nine or more months after household survey (n = 85) | 9.03<br>(4.06) | 5.74<br>(2.49) | 85.23<br>(4.97) |

Source: APEC study, weighted data.

Note: Standard errors in parentheses.

[a]An increase in eligibility status is a change in circumstances resulting in eligibility for a higher level of benefits—for example, a change from reduced-price to free.

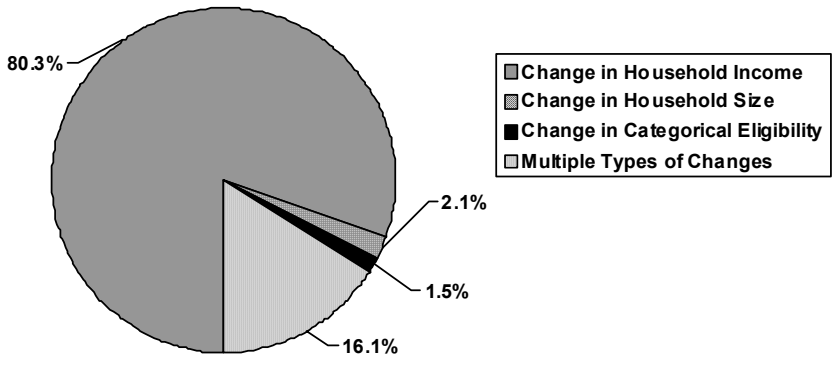
[b]A decrease in eligibility status is a change in circumstances resulting in eligibility for a lower level of benefits—for example, a change from reduced-price to paid.

times during a school year: of the 30 percent of households whose eligibility changed during the course of the school year, two-thirds had more than one change in eligibility (Newman 2006). This suggests that even students whose eligibility status based on the panel survey matches that based on the initial household survey (and thus are considered to have had no change in eligibility status in Table J.2) may have actually had multiple, but offsetting, changes in eligibility status between the surveys.[4]

The most common reason for a change in eligibility status was a change in household income. About 80 percent of all eligibility status changes—including both increases and decreases in eligibility—were caused by changes in income alone (Figure J.1). Changes in household size and categorical eligibility were less common. Only 2 percent of changes in eligibility status were due to changes in household size alone, and just one percent resulted from

**Figure J.1**

**Changes in Household Circumstances, Among Those with Changes in Eligibility Status Between Household Survey and Panel Survey**




[4]It is possible that households with longer amounts of elapsed time between the two surveys experienced more changes in circumstances, which simply cannot be measured by the APEC data. As the APEC surveys each asked only about household circumstances at a point in time and did not ask retrospective questions about offsetting changes that may have occurred in between the surveys, we have no way of measuring the number of changes that may have occurred.

a change in the household's receipt of TANF, FSP, or FDPIR alone. About 16 percent of certified students had a change in eligibility status due to multiple factors.[5]

Table J.3 shows the reasons for eligibility changes in more detail. As shown in the second panel, among certified students that would have been eligible for a higher level of benefits at the time of the panel survey, 96 percent (14 percent of all certified students in the panel sample) had a decrease in household income between the two surveys. Similarly, 96 percent of certified students whose eligibility status declined (10 percent of all certified students in the panel sample) had an increase in household income. Household size increased in 11 percent of cases with an eligibility status increase (one percent of the sample overall) and decreased in 7 percent of cases with an eligibility status decrease (one percent of the sample overall). About 13 percent of increases in eligibility status for free or reduced-price meals (2 percent of all certified students in the panel sample) were due to the household becoming categorically eligible, and 10 percent of decreases in eligibility status for free or reduced-price meals (one percent of the panel sample) were due to the household losing its categorical eligibility. There is some overlap in these percentages, as some households had changes in more than one type of circumstance.

Volatility in household circumstances does not always result in changes in student's eligibility status. For the vast majority of certified students whose eligibility status was the same according to both surveys, the respondent still reported some change in income, and many reported changes in household size or categorical eligibility. Among certified students whose eligibility status was the same at the time of the household and panel surveys, in 95 percent of the cases the parent reported different income amounts at each time, and one-fifth

[5]For example, a person with income might have left the household, thus decreasing both household size and income simultaneously. Or household income might have decreased, prompting the family to apply for TANF, FSP, or FDPIR that would change the household's categorical eligibility.

TABLE J.3

CHANGES IN HOUSEHOLD CIRCUMSTANCES BETWEEN HOUSEHOLD SURVEY AND PANEL SURVEY

| | Change in Eligibility Status Between Household Survey and Panel Survey | | | |
|---|---|---|---|---|
| | Increase[a] | Decrease[b] | No Change | Total |
| Change in Household Size | | | | |
| Increase | 10.78 | 10.15 | 10.84 | 10.77 |
| | (4.23) | (3.80) | (1.31) | (1.32) |
| Decrease | 4.06 | 7.12 | 9.54 | 8.56 |
| | (1.93) | (2.91) | (1.37) | (1.16) |
| No change | 85.16 | 82.73 | 79.62 | 80.67 |
| | (4.54) | (4.06) | (1.94) | (1.89) |
| Change in Household Income | | | | |
| Any increase | 4.06 | 96.40 | 54.50 | 51.44 |
| | (2.41) | (2.22) | (2.67) | (2.47) |
| Any decrease | 95.94 | 3.60 | 40.31 | 44.56 |
| | (2.41) | (2.22) | (2.51) | (2.33) |
| No change | 0.00 | 0.00 | 5.19 | 3.99 |
| | (0.00) | (0.00) | (1.14) | (0.86) |
| Increase of $50 or more | 4.06 | 96.40 | 47.26 | 45.88 |
| | (2.41) | (2.22) | (2.43) | (2.39) |
| Decrease of $50 or more | 95.23 | 2.15 | 36.77 | 41.61 |
| | (2.46) | (1.89) | (2.26) | (2.18) |
| No change of $50 or more | 0.70 | 1.45 | 15.96 | 12.51 |
| | (0.71) | (1.14) | (2.01) | (1.51) |
| Increase of 5 percent or more | 4.06 | 95.62 | 45.28 | 44.27 |
| | (2.41) | (2.35) | (2.30) | (2.27) |
| Decrease of 5 percent or more | 93.97 | 2.15 | 32.90 | 38.46 |
| | (2.56) | (1.89) | (2.08) | (2.17) |
| No change of 5 percent or more | 1.96 | 2.23 | 21.82 | 17.26 |
| | (1.19) | (1.38) | (2.31) | (1.70) |
| Change in Categorical Eligibility | | | | |
| Increase[c] | 13.38 | NA | 9.43 | 9.10 |
| | (3.96) | | (1.77) | (1.46) |
| Decrease[d] | NA | 9.82 | 9.36 | 8.11 |
| | | (3.52) | (1.42) | (1.13) |
| No change | 86.62 | 90.18 | 81.21 | 82.78 |
| | (3.96) | (3.52) | (2.07) | (1.80) |
| **Sample Size** | **98** | **93** | **608** | **799** |

Source: APEC study, weighted data.

Note: Standard errors in parentheses.

[a]An increase in eligibility status is a change in circumstances resulting in eligibility for a higher level of benefits—for example, a change from reduced-price to free.

[b]A decrease in eligibility status is a change in circumstances resulting in eligibility for a lower level of benefits—for example, a change from reduced-price to paid.

[c]An increase in categorical eligibility occurs when a household begins to receive TANF/FSP/FDPIR benefits.

[d]A decrease in categorical eligibility occurs when a household stops receiving TANF/FSP/FDPIR benefits.

NA = not applicable.

reported a different number of household members (Table J.3). Apparently, these changes in household circumstances were offsetting or were simply not large enough to move the household across the meal benefit eligibility thresholds. Categorical eligibility changed for nineteen percent of households whose free eligibility status did not change had a change in categorical eligibility; in other words, the were eligible for free meals based on reported income and household at the time when they reported that they not receiving TANF, FSP, or FDPIR benefits.

The main measure of a change in household income counts an increase or decrease of even $1 as a change, which may overestimate volatility because very small differences could be due to imprecise reporting rather than an actual change in income—for example, a respondent may have simply rounded an income amount on one survey but not the other. To address this issue, we created two alternative measures of income volatility: one that considers only changes greater than 5 percent of income, and one that considers only changes greater than $50 to be actual changes in income.[6]

As expected, overall changes in income are reduced somewhat using these measures, as can be seen in the "Total" column of Table J.3. The percentage of all certified students with no change in income rises from 4 percent for the "any change" measure to 13 percent under the "less than $50 change" measure and to 17 percent under the "less than 5 percent change" measure. Even under the strictest alternative measure, a large proportion of certified students (more than 80 percent) experienced a change in household income during the time between the two surveys. Among only those certified students whose eligibility status changed (the first two columns of the table), the three alternative measures of income change yield relatively consistent results, as changes in eligibility status are more likely to result from larger changes in income.

[6]Alternative measures of household size or categorical eligibility were not constructed, as these circumstances are less likely to be reported imprecisely.

## 2. Certification Error—If Eligibility Were Determined at the Time of the Panel Survey

Under NSLP/SBP rules prior to the recently enacted Child Nutrition and WIC Reauthorization Act of 2004, households were required to report any changes in circumstances that could shift the household toward a lower level of school meal benefits. Specifically, any change in income of $50 or more or any change in household size had to be reported. If the reported change resulted in a lower benefit eligibility status, districts were required to make the appropriate change in the student's certification status. Although the statutory change eliminated that requirement, the panel data allow us to examine how certification error among the panel sample would have changed under the former policy.

If eligibility were measured based on household circumstances reported at the time of the panel survey, rather than earlier in the year—closer to the time the initial application was submitted—the certification error rate would be 24 percent (see Table J.4). This is slightly higher than the actual certification error rate of 22 percent for certified students, based on the initial household survey data, presented in Chapter III of the APEC Study Final Report.[7] This difference in the overall certification rate is driven by a difference in the rate of undercertification, which is 9 percent based on the panel survey, compared to just 6 percent in the initial household survey.[8] The overcertification rate computed based on the panel-survey data is almost identical to that computed based on the initial household survey (15 percent). The finding that the overcertification rate would not have changed should not be interpreted to suggest that the new program rule has not influenced student's receipt of meal benefits as their

[7]The certification rate based on the initial household survey data remains 23 percent when the sample is restricted to households that also completed the panel survey.

[8]Undercertification was not affected by the change in program rules, because households still have the right to reapply at any time during the year if their circumstances change in a way that makes them eligible for a higher level of benefits.

TABLE J.4

CERTIFICATION ERROR RATES, BASED ON ELIGIBILITY AT TIME OF PANEL SURVEY

| | Certification Status[a] | | |
|---|---|---|---|
| | Free | Reduced-Price | Total |
| Eligibility Status at Time of Panel Survey (percent of certified students) | | | |
| Free | 84.94 | 46.34 | 77.83 |
| | (1.96) | (7.09) | (2.17) |
| Reduced-Price | 9.18 | 37.26 | 14.35 |
| | (1.43) | (5.47) | (1.65) |
| Paid | 5.88 | 16.39 | 7.82 |
| | (1.34) | (4.27) | (1.27) |
| Error Rate (Percent of Certified Students), Among All Households Completing Panel Survey | | | |
| Overcertification rate | NA | NA | 15.31 |
| | | | (1.79) |
| Undercertification rate | NA | NA | 8.53 |
| | | | (2.11) |
| Total certification error rate[c] | NA | NA | 23.84 |
| | | | (2.34) |
| Broad certification error rate[d] | NA | NA | 7.82 |
| | | | (1.27) |
| **Sample Size** | **653** | **146** | **799** |

Source: APEC study, weighted data.

Note: Standard errors in parentheses. Certification error rates are for the sample of free and reduced-price certified students for whom we have both a completed household survey and a completed panel survey.

[a]Certification status recorded on district's master eligibility roster at time student was sampled.

[b]The total certification error rate is the percentage of all certified students who are receiving a level of benefits that differs from their eligibility level.

[c]The broad certification error rate is the percentage of all certified students who are eligible for neither free nor reduced-price meal benefits.

NA = not applicable.

circumstances change later in the school year. Simply comparing the overcertification rates for the sample based on the two surveys ignores the fact that some students are overcertified based on one survey but not the other. In particular, 11 percent of students that were certified without error based on the initial household survey (8 percent of the panel sample overall) had changes in household circumstances that would have led to overcertification based on the panel survey. In the calculation of the overall overcertification error rate, these cases were offset by other students (comprising a similar proportion of the sample) whose certification error based on the initial household survey would have been "corrected" by changes in household circumstances by the time of the panel survey.

Table J.5 shows what the certification error rates based on eligibility status from the panel survey would be for subgroups based on the amount of time between the months covered by the two surveys. As with changes in eligibility status between the initial and panel surveys, the status measured at the time of the panel survey follows no clear pattern over time. The overcertification rate would have ranged from 8 percent to 21 percent, whereas the undercertification rate would have ranged from 5 percent to 15 percent. The overall certification error rate would have ranged from 14 percent to 30 percent. None of the error rates showed a steady increase or decrease over time. As with eligibility status changes, one might have expected to see a pattern of greater certification error among households that completed the panel survey a longer time after the initial household survey, if the old eligibility policy had been in effect. This trend did not emerge in the APEC data, possibly due to the high degree of income volatility among students from low-income households, whose eligibility status—and thus certification error—might change more than once between surveys.

TABLE J.5

CERTIFICATION ERROR RATES, BASED ON ELIGIBILITY STATUS AT TIME OF PANEL SURVEY, BY TIME BETWEEN REFERENCE MONTHS FOR HOUSEHOLD AND PANEL SURVEYS

| | Error Rate (% of Certified Students) | | | |
|---|---|---|---|---|
| | Overcertification Rate | Undercertification Rate | Total Certification Error Rate[a] | Broad Certification Error Rate[b] |
| Among households completing panel survey within three months of household survey (n = 75) | 22.64 (6.66) | 7.80 (3.72) | 30.44 (6.86) | 12.79 (4.65) |
| Among households completing panel survey four months after household survey (n = 137) | 11.10 (3.45) | 15.39 (7.67) | 26.49 (7.40) | 7.75 (2.59) |
| Among households completing panel survey five months after household survey (n = 130) | 20.53 (4.31) | 7.24 (3.79) | 27.77 (5.01) | 10.43 (3.73) |
| Among households completing panel survey six months after household survey (n = 122) | 9.96 (3.10) | 6.89 (3.10) | 16.84 (4.19) | 5.18 (1.90) |
| Among households completing panel survey seven months after household survey (n = 126) | 15.55 (3.18) | 8.41 (3.62) | 23.95 (4.43) | 6.96 (2.49) |
| Among households completing panel survey eight months after household survey (n = 124) | 21.39 (4.22) | 5.85 (2.24) | 27.24 (4.26) | 9.58 (3.20) |
| Among households completing panel survey nine or more months after household survey (n = 85) | 8.51 (3.21) | 5.08 (2.35) | 13.60 (4.87) | 3.55 (2.48) |

Source: APEC study, weighted data.

Note: Standard errors in parentheses. Certification error rates are for the sample of free and reduced-price certified students for whom we have both a completed household survey and a completed panel survey.

[a]The total certification error rate is the percentage of all certified students who are receiving a level of benefits that differs from their eligibility level.

[b]The broad certification error rate is the percentage of all certified students who are eligible for neither free nor reduced-price meal benefits.