Factors Associated With School Meal Participation and the Relationship Between Different Participation Measures

Contractor and
Cooperator
Report No. 53

June 2009

Quinn Moore
Lara Hulsey
Michael Ponza

MATHEMATICA
Policy Research, Inc.

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By Quinn Moore, Lara Hulsey, and Michael Ponza, Mathematica Policy Research, Inc.

Abstract

This study investigated factors that influence students' participation in the National School Lunch Program (NSLP) and School Breakfast Program (SBP). The analysis used recently collected data on a large, nationally representative sample of students certified for free and reduced-price meals during the 2005–06 school year. Results show that, although eligible students are very likely to participate in the programs (i.e. pick up the meal offered that day), eligible elementary school students are more likely to participate than are middle or high school students. Likewise, students who like the taste of the meals are more likely to participate than are students who do not like the taste. In addition, if students now eligible for reduced-price lunches were instead given free lunches, they would participate more than they do now. The same was not strictly the case, however, for breakfast. Finally, the study suggests that analysts should use caution in relying on parents' reports of a student's participation to estimate yearly school meal participation. Parental reports of the previous day's or previous week's participation tend to overstate participation, which results in higher reported annual participation rates than is true according to administrative data.

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EXECUTIVE SUMMARY

This report investigates three important aspects of student participation in the National School Lunch Program (NSLP) and School Breakfast Program (SBP) using recently collected data on a large, nationally representative sample of students certified for free and reduced-price meals during the 2005–2006 school year. First, we examine the factors that influence students' participation decisions (here and throughout the report we use "participation" to refer to the number of school meals that students receive and "certification" to refer to whether or not students are certified for free or reduced-price meals). Second, we examine the relationship between school meal certification status and participation using meal certification error as a natural experiment. Finally, we explore the extent to which parent reports of their children' participation accurately represent actual school meal participation as determined from school administrative records. Our methodology and the findings related to these three sets of analyses are summarized in the sections that follow.

A. FACTORS ASSOCIATED WITH SCHOOL MEAL PARTICIPATION

A key objective of the NSLP and the SBP is to ensure that children have access to nutritious meals. However, many students who are certified for school meal benefits do not participate consistently in the school meal programs. Learning more about the factors related to participation in the NSLP and SBP is a step toward increasing the number of students who receive needed nourishment through the school meal programs.

Our primary analysis focuses on a school meal participation measure based on student-level administrative records data. The strength of this measure is that it is more likely to reflect students' actual school meal consumption during the school year than are self-reports or parent reports of participation, which are subject to reporting error and typically have a short time reference.

Using these data, we estimate a multivariate regression model of the relationship between school meal participation and student demographics, family characteristics, attitudes toward school meals, school characteristics, and school meal program characteristics. Our key findings from this analysis are:

- School type is the factor most strongly associated with both school lunch and school breakfast participation among students certified for free and reduced-price meals. For example, compared to otherwise similar elementary school students, middle school students are 5 percentage points less likely to obtain a school lunch at a given eating occasion, while high school students are 28 percentage points less likely.

- Students who are satisfied with the taste of school meals are much more likely to obtain a school lunch or a school breakfast than students who are not. The relationship between satisfaction with taste and school lunch participation is particularly strong for high school students.

- School use of electronic point-of-sale (POS) technology is strongly associated with student's school lunch participation. This may be because electronic POS technology increases the convenience or decreases the stigma of receiving school lunch. This relationship is strongest for high school students.

- Students from households with an employed adult obtain school lunches more often than otherwise similar children who do not have employed adults in their household. One reason for this relationship may be that low-income employed parents have less time to prepare meals for their children at home than parents who are not employed. This relationship is strongest for elementary school students.

B. CERTIFICATION STATUS AND SCHOOL MEAL PARTICIPATION

The extent to which school meal programs can affect student nutrition depends directly on the extent to which these programs increase school meal consumption. We take advantage of a natural experiment to make inferences about the causal effect of student's school meal certification status on school meal receipt by exploiting the fact that students who are eligible for a certain certification status (for example, free meals) are sometimes misclassified into another certification status (for example, reduced-price meals). The results of this analysis have several important policy implications. Most fundamentally, they enable us to assess how successful school meal programs are at increasing low-income student's receipt of school meals, which is necessary for the programs' success in improving nutrition among disadvantaged school-aged children. Additionally, our findings have implications for the debate on the effects of eliminating the reduced-price certification category because we can assess the increase in school meal receipt that would result from providing free meals to students eligible for reduced-price benefits under current program rules.

There are two reasons a student may receive the wrong school meal certification status: reporting error (parents did not report correct information on their application) and administrative error (school or district administrators did not correctly process the application). Because administrative error is not likely to have occurred systematically, we can consider the application process as a natural experiment in which some students who would otherwise be eligible for a particular certification status are assigned to a different certification status. In other words, the reason that a student who was eligible for a particular certification status was not certified for that status is fairly random from the student's perspective. As a result, any differences in participation between, say, free-eligible students who were correctly certified and free-eligible students who were

certified for reduced-price meals can be attributed directly to differences in certification status.

This experiment allows us to answer the following research questions:

- *What is the effect of certification for free meals relative to certification for reduced-price meals?*
  - From the perspective of free-eligible students
  - From the perspective of reduced-price-eligible students
- *What is the effect of certification for free meals relative to no certification for free or reduced-price meals?*
  - From the perspective of free-eligible students
  - From the perspective of students not eligible for free or reduced-price meals
- *What is the effect of certification for reduced-price meals relative to no certification for free or reduced-price meals?*
  - From the perspective of reduced-price-eligible students
  - From the perspective of students not eligible for free or reduced-price meals

Our key findings related to these questions are:

- Reduced-price-eligible students who are certified for free meals because of administrative error obtain significantly more school lunches than otherwise similar reduced-price-eligible students who are properly certified, but they do not obtain more school breakfasts.

- These findings suggest that eliminating the reduced-price certification category would increase lunch participation among students eligible for reduced-price meals under the current program rules, but that it would not increase breakfast participation.

- Among free-eligible students, there is strong evidence that free certification increases breakfast participation compared to not being certified for free or reduced-price meals, and no strong evidence of an increase in lunch participation.

C. COMPARISONS OF PARENT-REPORTED PARTICIPATION AND ADMINISTRATIVE RECORDS

A reliable measure of participation is critical for any study examining student participation in the NSLP or SBP. Because collecting detailed student-level

administrative data on actual daily participation can be prohibitively expensive,[1] researchers have often relied on parent- or student-reported data to measure student participation, though these types of measures are likely subject to greater error than are measures based on administrative data. This study uses data from a nationally representative sample of students that included parent surveys and administrative records to examine how closely estimates of NSLP and SBP participation developed from parent-reported data for a day or week match actual participation among students certified to receive free and reduced-price meals over a longer period of time. Because the administrative data are not sufficiently detailed to determine whether the report of participation on the previous day (or week) for a given child is accurate for that day (or week), these comparisons of parent-reported measures to administrative records measures confound two possible sources of differences: (1) reporting error and (2) actual participation differences between time periods. Thus, discussions of how closely estimates of participation for the month or year based on parent reports for a day or week match actual participation for the month or year should not be misinterpreted as the accuracy of parent reports for the specific time period for which they were reporting.

We conducted three types of comparisons of estimates of participation based on parent reports to actual participation based on administrative records data: (1) comparisons of different measures of aggregate participation rates, (2) comparisons of different measures for individual students, and (3) comparisons of factors associated with different measures of participation. Our key findings related to these comparisons are:

- Measures of NSLP and SBP participation based on parent reports for a short time period overstate actual monthly and annual participation over longer periods among students certified to receive free or reduced-price meals. These differences might be due to differences in the data source or the time period of the measures.

- Parent reports are better estimates of longer-term participation in the NSLP than in the SBP.

- Parent reports on school meal program participation for a day or week provide better estimates of participation during the relevant month than of annual participation.

- Compared to parents of middle and high school students, parents of elementary school students report NSLP participation rates for a week that are closer to their children's actual annual participation.

[1] Other reasons researchers do not collect administrative data on participation are that some schools or districts do not collect and store data on participation at the individual level, or some schools or districts that do so might not release the data because of student confidentiality.

I. STUDY OVERVIEW

The National School Lunch Program (NSLP) and School Breakfast Program (SBP) play a critical role in America's strategy to ensure that all of the nation's children, especially those who are from low-income families, have access to adequate and nutritious food. Research has shown that participation in the NSLP and SBP is associated with children's diets that were higher in intakes of fiber, selected vitamins, and minerals, and lower in intakes of "added sugars" at breakfast, at lunch, and over 24 hours. Improving the healthfulness of food children eat at school is also a component of strategies to address growing concerns about rising levels of obesity among children. However, many children who could eat school meals do not do so. Identifying factors that influence students' NSLP and SBP meal participation decisions will help us better understand the possible implications of policies designed to positively affect children's diets.

This report investigates three important aspects of school meal participation using recently collected data on a large, nationally representative sample of students certified for free and reduced-price meals during the 2005–2006 school year. First, we examine the factors that influence the participation decisions of children from low-income households. Second, we examine the role of school meal certification status on participation. Third, we explore the extent to which parent reports of student NSLP and SBP meal participation accurately represent actual school meal participation as determined from school administrative records.

A. BACKGROUND

1. Overview of the NSLP and SBP

The NSLP and SBP provide federal financial assistance and commodities to schools to enable them to serve nutritious lunches and breakfasts to school children. In fiscal year (FY) 2007, the NSLP provided lunches to 30.5 million students each school day; overall, the program

provided subsidies for more than 5 billion lunches served to school children nationally at a cost of almost $11 billion (Food and Nutrition Service 2008). Slightly more than 10 million students obtain an SBP breakfast each school day; the SBP subsidized nearly 1.7 billion breakfasts at a cost of more than $2 billion in FY 2007. More than half of these school lunches and breakfasts receive an extra subsidy because they are served to children from low-income households who are approved to receive free or reduced-price meals.

Students must become certified in order to receive meals free or at a reduced price. Most students become certified by submitting an application to the Local Education Authority (LEA). The LEA uses information in the application on household size; income; and participation in the Supplemental Nutrition Assistance Program (SNAP, formerly the Food Stamp Program), Temporary Assistance for Needy Families (TANF), or Food Distribution Program on Indian Reservations (FDPIR) to determine whether the household qualifies for free or reduced-price meals. Students may also become certified for free meals through "direct certification," which allows LEAs to use information provided by the SNAP/TANF/FDPIR administering agency to establish that a student is a member of a household that is eligible for one of these programs and is thus automatically eligible to receive free meals.[1]

Although the primary goal of the NSLP and SBP is to provide nutritious meals to school children, many students—even those from low-income families who would be eligible to receive free or reduced-price meals—do not participate in the programs. To explore this issue, studies have examined factors influencing participation, using (1) indirect methods, such as inferring

[1] There are some schools in which all students can receive free meals without applying or being directly certified in a current school year. Under Provision 2 or Provision 3, schools can operate in a "base year" in which they serve all meals at no charge but use normal program procedures to take applications and count meals by eligibility category. Provision 2 and 3 schools then may continue to serve all meals at no charge and take only a daily aggregate count of meals served for up to four additional years, during which they claim reimbursement based on the base year.

reasons for participation or nonparticipation from the associations with school, student, or household characteristics; and (2) direct methods, such as asking school staff, parents, or students in surveys or focus groups about the reasons children participate or do not participate.

Throughout this report, we use the term participation to refer to a student's receipt of a reimbursable school meal on a given day or over a given period of time and certification to refer to whether students are certified to receive free or reduced-price meals. This point is important because some studies instead define participants as those students who are certified to receive free or reduced-price meals, regardless of whether, or how often, they actually obtain NSLP and SBP meals.

2. Literature on Participation

A review of the literature on school meal participation found several studies on factors associated with participation in the NSLP and SBP and characteristics of participants. Most relied on student or parent reports of the number of days of participation in a specific target week or whether participated on a given day as their measure of participation. A recent study examined student-/parent-reported participation using two nationally representative surveys—the 2001 Panel Survey of Income and Program Participation (SIPP) and the 1999–2002 National Health and Nutrition Examination Survey (NHANES)—to examine characteristics of NSLP participants (Newman and Ralston 2006). The SIPP data measure participation based on whether a student had a school meal in the past month, while NHANES includes data on the number of times in a week the student had a school meal. The study examined participants' ethnicity, household composition, age, income to poverty level, and participation in other public assistance programs by participants' certification category. Findings included that NSLP participation was highest for children ages 8 to 13 and that whites and Asian students were less likely to participate in the NSLP than other racial/ethnic groups.

Several multivariate studies found negative price effects on participation and significant relationships between participation and demographic characteristics, parental attitudes, and alternatives to school meals (Gordon et al. 2007a; Gleason 1995, Barnes 1988, Maurer 1984, and Akin et al. 1983). For example, the third School Nutrition Dietary Assessment Study (SNDA-III) found that Hispanic and black students participated in the NSLP and SBP at much higher rates than students of other ethnicities/races, boys participated at a higher rate than girls, students from low-income households participated at a higher rate than students from higher-income households, and elementary school students participated at a higher rate than middle and high school students (Gordon et al. 2007a). The SNDA-III study also computed estimates of student participation rates, based on foods students consumed, their sources, and comparison to the menu offered. The SNDA-III data indicate that about 62 percent of all students and 79 percent of certified students participated in the NSLP and about 18 percent of all and 32 percent of certified students participated in the SBP on a typical day in school year (SY) 2004-2005. Participation rates based on national administrative program data from the U.S. Department of Agriculture (USDA) Food and Nutrition Service (FNS) presented in an appendix of the SNDA-III report were 60 percent of all students and 78 percent of certified students for the NSLP meals and 23 percent and 34 percent for the SBP.

Other studies have examined whether administrative features of the NSLP and SBP can affect participation. A random assignment evaluation of a universal free breakfast pilot project found that SBP participation increased when universal free breakfast was implemented, even among students certified for free and reduced-price meals (Bernstein et al. 2004). A study of direct certification in the school meal programs found that direct certification had a very small positive effect on NSLP participation (Gleason et al. 2008). However, districts that did not use direct certification or include any Provision 2 or 3 schools had higher participation rates than

those that did. In addition, using a district-level model, that study also found that the estimated effect of using an electronic point-of-sale (POS) system was not statistically significant.

B. RESEARCH QUESTIONS

The goal of this project is to explore issues related to participation in the school meal programs. We begin investigating the factors associated with school meal participation by addressing three broad, largely descriptive sets of questions related to school meal participation:

- What are the school meal participation rates for students certified for free or reduced-price meals? Do these rates vary for key subgroups? Do school meal program implementation characteristics play an important role in participation?
- Which child, family, and school characteristics are associated most strongly with school meal participation when controlling for a variety of factors?
- Do the factors associated with school meal participation differ for elementary, middle, and high school students?

In addition to these three questions, we make use of a natural experiment to try to investigate one specific factor that may be related to school meal participation:

- What is the effect of school meal certification status on school meal participation based on evidence using erroneous certification as a natural experiment?

Finally, we explore three related sets of questions concerning the comparison of administrative data to parent reports on participation.

- How do parent reports of student participation in the NSLP and SBP compare with administrative records data on the student's actual participation for the month? Do participation rates based on parent reports for a target week more accurately estimate monthly or annual participation than those based on parent reports for a single day? Does the relationship between parent reports and administrative records data vary by student, family, or school characteristics?
- Are parent reports generalizable to annual participation rates? How do parent reports based on a day and week compare with administrative records of the student's

participation for the year? How do parent reports and actual participation vary over the school year?

- What are the implications of using parent reports versus administrative data? How do the factors found to be associated with participation differ for participation based on parent reports rather than administrative records?

C. DATA SOURCES, ANALYSIS SAMPLES, AND KEY MEASURES

1. Data Sources

This report relies on a unique data set constructed for the NSLP/SBP Access, Participation, Eligibility, and Certification (APEC) study, which was conducted by Mathematica Policy Research, Inc. (MPR) for FNS. These data provide a nationally representative sample of public and private schools participating in the USDA school meal programs in SY 2005–2006 and of free certified, reduced-price certified, and denied applicant students attending those schools. For this study, MPR conducted telephone interviews with 87 public and private school food authorities (SFAs); conducted in-person interviews with 2,950 households certified to receive free and reduced-price school meals (and interviewed 800 of these households a second time by telephone later in the school year as part of a panel sample) and 453 denied-applicant households; abstracted administrative records data on nearly 8,000 sampled applications; assessed the school's benefit issuance lists, observed meal transactions, and collected data on meal-counting and claiming processes from the 266 study schools and 87 SFAs; and collected detailed administrative records data from SFAs on the daily participation of sample members in the NSLP and SBP (Ponza et al. 2007a and Ponza et al. 2007b). The main goal of the APEC study was to compute estimates of erroneous payments in the NSLP and SBP. However, the wealth of data collected provides a rich opportunity for secondary analyses. This report makes use of three key APEC data sources: (1) interviews of parents of sampled children (the

household survey), (2) surveys of SFA directors, and (3) administrative records on student-level meal program participation.

2. Analysis Samples

The sample for our school-level analyses includes 266 schools in 87 SFAs. The main school-level analysis focuses on meals obtained by all students certified to receive free and reduced-price meals. This sample includes both students who applied for school meal benefits and those who were directly certified using administrative records to determine categorical eligibility. In addition to the primary analysis sample of students certified for free and reduced-price meals, we also analyze a sample that includes students not certified for school meal benefits (students who applied but were denied benefits).

The sample for our student-level analyses includes 200 schools in 73 SFAs, because student-level data was not collected in Provision 2 and 3 schools that were not in their base year, and some schools did not provide administrative records data on participation.[2] Restricting the analysis to those with administrative records data reduces the size of our primary sample from the 2,947 students certified to receive free and reduced-price meals in the APEC study to 2,186 students for our analyses of NSLP participation, of whom 1,987 also have administrative records data on SBP participation. Thus, although the full APEC sample is nationally representative of SFAs, schools, and students, the sample used in this report is not. Table I.1 summarizes the characteristics of students in the primary sample used for most of our student-level analyses and of students in the APEC sample for whom administrative records are not available. These two groups of students are similar in terms of gender, race/ethnicity, poverty status, school type, and

[2] Reimbursements to students in Provision 2 or 3 nonbase year schools account for 4.5 percent of all NSLP free or reduced-price reimbursements and for 11.3 percent of all free or reduced-price SBP reimbursements.

TABLE I.1

CHARACTERISTICS OF STUDENTS CERTIFIED FOR FREE AND REDUCED PRICE MEALS IN THE APEC SAMPLE, BY WHETHER SCHOOL MEAL ADMINISTRATIVE RECORDS ARE AVAILABLE
(Percentages Unless Noted Otherwise)

	Administrative Records Are Available	Administrative Records Are Not Available
Student Characteristics		
Certified for Free Meals	82.0	83.1
Female	52.5	51.0
African American or Hispanic	69.7	65.9
Family Characteristics		
Parental Educational Attainment		
Less than high school degree	32.1	35.8
High school degree	44.5	37.2
More than high school degree	23.4	27.1
In Poverty	54.1	56.4
Monthly Household Income (dollars)	1,824	1,814
Employed Household Member	74.5	74.5
Number of Children (number)	2.83	2.68
Experienced Food Insecurity Outcome	70.5	72.3
Attitudes Toward School Meals		
Student's Satisfaction with School Meal Taste		
Very satisfied	39.2	34.2
Somewhat satisfied	42.7	39.4
Somewhat or very dissatisfied	18.1	26.4
School Characteristics		
School Type		
Elementary school	67.4	70.2
Middle school	19.0	18.5
High school	13.6	11.3
Percentage of Student Body Certified Free/Reduced- Price	62.5	64.6
Enrollment (number of students)	893	862
Located in an Urban Area	41.0	68.3**
School Meal Program Implementation Characteristics		
Uses Direct Certification	91.6	84.0
Uses Electronic Point-of-Sale Technology	94.2	45.2***
Sample Size	**2,186**	**763**

Source: APEC study data.

Note: All figures are weighted. Standard errors account for clustering in the survey design. Differences between the samples in means of continuous variables were tested for using two-tailed *t*-tests; differences between the samples in the distributions of categorical variables were tested for using chi-squared tests.

Differences in means of continuous variables is:
*Significantly different from zero at the .10 level, two-tailed test.
**Significantly different from zero at the .05 level, two-tailed test.
***Significantly different from zero at the .01 level, two-tailed test.

most other variables with two exceptions. Students with administrative records available are significantly less likely to be located in urban areas and are much more likely to attend a school that uses electronic point-of-sale technology than students without administrative records data on participation. The latter difference likely is directly related to the difficulty a school faces in supplying student-level administrative records since electronic systems are more likely to store student-level meal counts. The sample without administrative records data also has somewhat lower parent-reported participation rates than does the sample with data from both sources (for example, parent data for a week yields NSLP average participation rates of 89 percent for those with administrative records data and 83 percent for those without) (figures not shown).

A further limitation of the student-level data used in this analysis is that the APEC student sample includes only students who were certified for free meals, certified for reduced-price meals, or who applied for and were denied school meal benefits. Thus, we can not look at school meal participation for all students who were not certified for school meal benefits using this measure. While we do conduct supplementary analyses for students who applied for and were denied school meal benefits, *it is important to note that the sample of denied applicants is not generalizable to the population of all students not certified for school meal benefits.*

When comparing parent reports on participation to administrative records (Chapter IV), the sample is restricted to cases for which we have both administrative records and parent-reported data. This restriction reduces the sample sizes to 2,139 for analyses of NSLP participation and 1,840 for SBP analyses. For analyses related to changes in parent-reported participation over the school year, the sample sizes are further reduced to those households surveyed twice.

The APEC study oversampled larger districts and schools, elementary schools, and districts containing Provision 2 or 3 schools. Because oversampling and nonresponse can result in unequal selection probabilities, the data sets include sample weights. We use these weights in our

analyses to ensure that the results are not biased. We also account for the multistage, clustered sample design in the APEC study when estimating standard errors in this model.

3. Key Measures

The key measures used in this study consist of participation measures and the student, family, and school characteristics used as explanatory measures in our analyses. The NSLP and SBP participation measures come from student-level administrative records, school-level SFA reports, and parent reports collected in the household survey.

- *Student-level administrative records*. The administrative records data provide the number of SBP breakfasts and NSLP lunches that sample students obtained during each month of SY 2005–2006. These data enable us to construct accurate annual measures of a student's typical number of meals obtained per eating opportunity during the school year. In addition, we construct a measure of a student's typical number of meals obtained per eating opportunity during the month of the household survey that allows for closer comparisons to information collected in the survey.
- *School-level SFA reports.* Data from the SFA survey provides school-level data on the number of SBP and NSLP meals served in October 2005 at the school, by free/reduced-price category. We use these data to construct school-level measures of NSLP/SBP meal participation that represent the number of meals obtained per eating opportunity, so that they are in the same units as our student-level measures of participation.
- *Parent reports.* The household survey collects information on whether the student ate NSLP/SBP meals on the prior day and on each day during the prior week, as reported by the parent. Our analysis relies on both the binary measure of participation for the prior day and a constructed measure indicating the proportion of days during the previous week that the student ate a school meal. Similar information also was collected later in the year in a follow-up telephone survey of a subset of respondents for free and reduced-price certified students to the initial in-person household survey.

Data on student and family characteristics come primarily from the household survey. The reference period for most of these variables is at the time of or during the month before the household survey, which was conducted during the first semester of SY 2005-2006. Data on

school characteristics come primarily from the survey of SFA directors. More information on the construction of key explanatory variables is provided in Table I.2.

D. ORGANIZATION OF REPORT

The remainder of this report provides additional details on the measures and methodology used for each analysis and presents findings on each topic. Chapter II examines the factors that are associated with participation in the NSLP and SBP, including whether they vary by school type. Chapter III explores the effect of school meal certification status on NSLP and SBP meal participation. Chapter IV compares participation measures based on parent reports to actual participation as measured by administrative records data. Appendices provide supplemental tables related to each chapter.

TABLE I.2

SOURCE AND VARIABLE CONSTRUCTION FOR KEY EXPLANATORY MEASURES

	Source	Construction
Family Characteristics		
Parental educational attainment	HH Survey	Parent's reported educational level. The measure's three categories consist of no high school degree or equivalent, high school degree or equivalent only, or more than high school degree.
Monthly household income	HH Survey	Total household income in the month prior to the survey. Includes income from all household members and all income sources.
Employed household member	HH Survey	Whether any household member had earnings income from a job in the month before the survey.
Number of children	HH Survey	Number of children younger than 18 in the household.
Experienced food insecurity outcome	HH Survey	Based on whether, during the summer before SY 2005-2006, the household used a food pantry, asked relatives for help with food, bought less-expensive types of food because of money problems, or used public food assistance programs.
Attitudes Toward School Meals		
Student's satisfaction with school meal taste	HH Survey	Whether student was very satisfied, somewhat satisfied, or dissatisfied with school meal taste. Survey responses related to student attitudes toward portion size and overall meal quality were also recorded.
School Characteristics		
School type	SFA Survey	Whether the school is an elementary, middle, or high school.
Enrollment	SFA Survey	Total number of students enrolled.
Percentage of student body certified free/reduced-price	SFA Survey	Number of students certified for free or reduced-price meals divided by number of students enrolled.
School Meal Program Implementation Characteristics		
Uses direct certification	SFA Survey	Whether schools certify students for school meal benefits directly (without an application) based on their categorical eligibility.
Uses electronic POS technology	SFA Survey	Whether schools use electronic meal intake systems at their points of sale.

HH Survey = Household Survey; POS = point of sale; SFA Survey = Survey of SFA Directors; SY = school year.

II. FACTORS ASSOCIATED WITH SCHOOL MEAL PARTICIPATION

This chapter summarizes the results from analyses designed to identify factors associated with school lunch and school breakfast participation. As described in the introductory chapter, the analysis is based on data from the Access, Participation, Eligibility, and Certification (APEC) study. Because of the diverse set of variables available in the APEC data set, this analysis offers interesting insight into a number of policy-relevant topics. In particular, it enables us to use actual (rather than parent-reported) school lunch and school breakfast participation data to look at the relationship between participation and key factors, such as attitudes toward school meals, school meal program implementation attributes, and other important characteristics.

Key Findings:

- School type is the factor most strongly associated with both school lunch and school breakfast participation among students certified for free and reduced-price meals. For example, compared to otherwise similar elementary school students, middle school students are 5 percentage points less likely to obtain a school lunch at a given eating occasion, while high school students are 28 percentage points less likely.
- Students who are satisfied with the taste of school meals are much more likely to obtain a school lunch or a school breakfast than students who are not. The relationship between satisfaction with taste and school lunch participation is particularly strong for high school students.
- School use of electronic point-of-sale (POS) technology is strongly associated with school lunch participation. This may be because electronic POS technology increases the convenience or decreases the stigma of receiving school lunch. This relationship is strongest for high school students.
- Students from low-income households with an employed adult obtain school lunches more often than otherwise similar children who do not have employed adults in their household. One reason for this relationship may be that low-income employed parents have less time to prepare meals for their children at home than parents who are not employed. This relationship is strongest for elementary school students.

The chapter is in four sections. We begin by describing the measures and methodology used in this analysis. Second, we provide an overview of the participation rates derived from the APEC data. Third, we identify the factors associated with school meal participation that emerged from our multivariate analysis. Finally, we explore whether there are important differences in the factors associated with school meal participation by school type.

A. METHODS

1. Measures

Our primary analysis focuses on a school meal participation measure based on student-level administrative records data. These data provide the number of SBP breakfasts and NSLP lunches that students in the analysis sample received during each month of school year (SY) 2005–2006. Because collecting school meal administrative records is very burdensome and expensive, these data are not typically available in studies of school meal participation. The administrative records data enable us to construct an annual measure of a student's typical number of meals consumed per eating opportunity during the school year.

The strength of this measure is that it is more likely to reflect students' actual school meal consumption during the school year than are self-reports or parent reports of participation, which are subject to reporting error and typically have a short time reference. One limitation of this measure is that the APEC student sample used in this analysis includes only students who were certified for free meals, certified for reduced-price meals, or who applied for and were denied school meal benefits. Thus, we cannot look at school meal participation for all students who were not certified for school meal benefits using this measure. A further limitation is that these data are not nationally representative. Although the full APEC sample is nationally representative of school food authorities (SFAs), schools, and students, about one-fifth of sample schools did not provide administrative records.

In addition to the measure of school meal participation based on student administrative records, we examined participation using data based on SFA reports. These data provide the number of SBP and NSLP meals served in sample schools during October 2005, by meal certification category (free, reduced-price, and not certified). We use these data to construct school-level measures of NSLP/SBP meal participation that represent the number of meals received per eating opportunity, so that they are in the same units as our student-level measures of participation. Unlike the measure based on student administrative records, we are able to construct the measure based on SFA reports for all students, including those not certified for meal benefits. However, because the SFA report data are collected at the school level, they do not allow us to investigate the relationship between school meal participation and student-level characteristics, such as attitudes toward school meals.

2. Analysis

We use a multivariate regression approach to estimate the relationship between school meal participation and student demographics, family characteristics, attitudes toward school meals, school characteristics, and school meal program characteristics.[1] The models for NSLP participation can be represented as

(1) $$Participation_{is} = Student_{is}\beta_1 + Family_{is}\beta_2 + Attitude_{is}\beta_3 + School_s\beta_4 + Meal_s\beta_5 + \varepsilon_{is}$$

where

- $Participation_{is}$ is a measure of NSLP participation for student *i* in school *s*

[1] As discussed in Chapter I, we use sample weights in our analyses to ensure that the results are not biased. We account for the multistaged, clustered sample design in the APEC study when estimating standard errors in this model. The OLS regression specification does not account for the fact that participation rates cannot be less than 0. Results from Tobit regression analysis, which do account for the censored dependent variable, are qualitatively similar to those presented here.

- $Student_{is}$ is a vector of demographic characteristics for student *i*, including gender and race/ethnicity
- $Family_{is}$ is a vector describing the characteristics of the student's family, including parental educational attainment, household income, whether anyone in the household is employed, number of children, and whether the household experienced any food insecurity outcomes during the summer prior to the school year[2]
- $Attitude_{is}$ is a vector describing the student's satisfaction with school meal taste
- $School_s$ is a vector of characteristics for school *s*, including the percentage of the student body certified for free or reduced-price meals, enrollment, and whether the school is located in an urban area
- $Meal_s$ is a vector of school meal program implementation characteristics, including whether the school uses direct certification and whether it uses electronic POS technology

Models of SBP participation are of analogous form. We also estimate models for students certified for free and reduced-price meals and separately by certification category (free certified or reduced-price certified). However, we find few substantive differences between the factors associated with participation among students certified for free meals and the factors associated with participation among students certified for reduced-price meals. Accordingly, we focus our discussion on models estimated for the sample of students certified for free and reduced-price meals.

In addition to estimating student-level models of participation, we estimate models using the school-level measures of participation as dependent variables. However, our school-level models cannot control for any student- or family-level factors. The school-level models can be represented as

$$(2)\quad Participation_s = School_s\lambda_1 + Meal_s\lambda_2 + \eta_s$$

[2] These food insecurity outcomes include whether the family used a food pantry or food bank, asked relatives for help with food, bought less-expensive types of food, used summer food service programs, or used public food assistance programs during the summer prior to the school year.

where $Participation_s$ is a measure of the school meal participation rate for students in school s, $School_s$ is a vector of school characteristics, and $Meal_s$ is a vector of school meal program implementation characteristics. These school-level models provide a robustness check on our student-level results, and enable us to examine factors related to participation rates for all students, including those not certified for free or reduced-price meals. In addition, the school-level analysis is based on nationally representative data whereas the student-level analysis is not.

B. SCHOOL MEAL PARTICIPATION RATES

According to student-level school administrative records, students certified to receive free and reduced-price meals eat school lunch at about 7 in 10 eating occasions and eat school breakfasts at about one in 3 eating occasions during the school year (Table II.1).[3] Participation is somewhat higher for students certified for free meals than for those certified for reduced-price meals (70 versus 67 percent in the NSLP and 33 versus 26 percent in the SBP). Participation rates for students who applied for and were denied school meal benefits were lower than for those certified for meal benefits, at 57 percent in the NSLP and 18 percent in the SBP.

The participation rates based on student-level administrative records are slightly lower than participation rates based on school-level meal counts as reported by SFA directors. School-level participation rates for students certified free and reduced-price meals are 77 percent for the NSLP and 37 percent for the SBP (Table II.1). This difference may be because student-level participation rates are based on the full school year whereas school-level participation rates are based on a single month early in the school year (October) when participation may be higher.

[3] SBP participation rates apply only to students in schools that offer the SBP.

TABLE II.1

NSLP AND SBP PARTICIPATION RATES BY CERTIFICATION STATUS, BASED ON STUDENT-LEVEL ADMINISTRATIVE DATA AND SCHOOL-LEVEL DISTRICT REPORTS
(Percentage of Meals Consumed[a])

	NSLP	SBP
Student-Level Administrative Data[b]		
Students certified for free and reduced-price meals	69.37	32.12
	(1.70)	(1.83)
Students certified for free meals	69.91	33.43
	(1.75)	(1.94)
Students certified for reduced-price meals	66.95	26.05
	(2.04)	(2.32)
Students not certified for free or reduced-price meals but who applied for school meal benefits	56.56	18.25
	(4.02)	(3.52)
School-Level District Reports		
All students	65.71	27.48
	(1.54)	(1.34)
Students certified for free and reduced-price meals	76.65	37.26
	(1.43)	(1.41)
Students certified for free meals	77.16	40.28
	(1.43)	(1.58)
Students certified for reduced-price meals	72.16	25.09
	(1.67)	(1.40)
Students not certified for free or reduced-price meals	52.73	15.15
	(1.68)	(1.41)

Source: APEC study data.

Note: All figures are weighted. Standard errors, presented in parentheses, account for clustering in the survey design.

[a]Student-level participation rates are the percentage of meals consumed for the full school year. School-level participation rates are the percentage of meals consumed during the month of October.

[b]Does not include students not certified for free or reduced-price meals who did not apply for school meal benefits.

APEC = Access, Participation, Eligibility, and Certification; NSLP = National School Lunch Program; SBP = School Breakfast Program.

Student-level participation rates are also slightly lower than those reported in the third School Nutrition Dietary Assessment (SNDA-III) study based on Food and Nutrition Service (FNS) national data (78 percent of NSLP meals and 34 percent of SBP meals) (Gordon et al. 2007a). These differences may be because the APEC administrative records data is not nationally representative, whereas these other participation rates are.[4] Another possibility is that administrative records systematically undercount participation for some reason, for example if meal transactions are not consistently linked to individual students.

C. FACTORS RELATED TO SCHOOL MEAL PARTICIPATION

This section describes findings from the multivariate analysis. For both school lunch and school breakfast participation, school type and student attitudes toward school meals emerged as factors with particularly strong relationships among students certified for free or reduced-price meals. Other factors also emerged as important but differed for lunch and breakfast participation.

1. School Lunch Participation Results Based on Student-Level Analyses

School Type. The factor most strongly associated with school lunch participation for students certified for school meal benefits is school type. Controlling for other factors, middle school students are 5 percentage points less likely to get a school lunch than elementary school students, while high school students are 28 percentage points less likely (Table II.2). These differences are quite large given the overall mean lunch participation rate of 69 percent. Potential explanations for this relationship include increased autonomy for older students, differences in

[4] As will be discussed in the next chapter, parent reports of student participation are higher in schools that provided administrative records compared to those that did not. Thus, parent reports are not consistent with SFA reports of meals served, which indicates that participation is lower at schools that provided administrative records than at those that did not.

TABLE II.2

DIFFERENCES IN STUDENT-LEVEL NSLP AND SBP SCHOOL MEAL PARTICIPATION RATES ASSOCIATED WITH VARIOUS FACTORS, FOR FREE AND REDUCED-PRICE STUDENTS
(Percentages of Eating Occasions)

	NSLP	SBP
Student Characteristics		
Male	0.51	3.64**
	(1.09)	(1.57)
African American or Hispanic	3.94**	0.95
	(1.90)	(2.32)
Family Characteristics		
Parental Educational Attainment		
High school degree	1.02	-2.98
	(1.54)	(2.02)
More than high school degree	1.42	-2.69
	(2.04)	(2.76)
Monthly Household Income	0.44	-0.35
	(0.52)	(0.68)
Employed Household Member	5.56***	-1.50
	(1.84)	(2.24)
Number of Children	0.31	1.83***
	(0.30)	(0.61)
Experienced Food Insecurity Outcome	2.60*	1.79
	(1.56)	(1.68)
Attitudes Toward School Meals		
Student's Satisfaction with School Meal Taste		
Very satisfied	8.05***	5.27*
	(2.45)	(2.89)
Somewhat satisfied	5.59**	4.73*
	(2.18)	(2.63)
School Characteristics		
School Type		
Middle school	-5.11*	-6.81**
	(2.76)	(2.99)
High school	-28.22***	-11.41***
	(4.88)	(3.30)
Percentage of Student Body Certified Free/Reduced-Price	-0.05	0.19
	(0.07)	(0.11)
Enrollment		
801 to 1,200	-2.97	-4.09
	(3.22)	(4.04)
Greater than 1,200	-5.45	-5.37
	(4.71)	(4.46)
Located in Urban Area	-2.68	-10.56**
	(3.21)	(5.08)

TABLE II.2 (*Continued)*

	NSLP	SBP
School Meal Program Implementation Characteristics		
Uses Direct Certification	-0.03	6.21
	(2.73)	(6.07)
Uses Electronic POS Technology	9.55***	4.32
	(3.48)	(3.42)
Constant	54.46***	10.32
	(6.81)	(10.06)
Sample Size	**2,107**	**1,934**

Source: APEC study data.

Notes: Figures are coefficient estimates from OLS regressions in which the relevant participation rate is the dependent variable. Participation rates represent the percentage of meals received per eating opportunity during the full school year, based on administrative records. All figures are weighted. Standard errors, presented in parentheses, account for clustering in the survey design.

*Significantly different from zero at the .10 level, two-tailed test.
**Significantly different from zero at the .05 level, two-tailed test.
***Significantly different from zero at the .01 level, two-tailed test.

APEC = Access, Participation, Eligibility, and Certification; NSLP = National School Lunch Program; OLS = ordinary least squares; POS = point of sale; SBP = School Breakfast Program.

food options other than school meals, and increased stigma associated with school meal participation in higher grade levels.

Attitudes Toward School Meals. Another factor very strongly associated with school lunch participation among low-income students is student satisfaction with the taste of school meals.[5] Students certified for free and reduced-price meals who report being very satisfied with the taste of school meals are eight percentage points more likely to obtain school lunch than otherwise similar students who are not satisfied with school meal taste, while students who are somewhat satisfied are five percentage points more likely to obtain school lunch.[6] These findings highlight the importance of food quality in students' lunch participation decision.

Electronic POS Technology. Controlling for other factors, low-income students in schools that use electronic POS technology are 10 percentage points more likely to eat school lunches than those in schools that do not use such systems. There are several potential explanations for this relationship. First, electronic POS technology may increase meal processing speed. The faster-moving lines that result may make school meals seem more convenient and appealing to students. Second, electronic POS technology may decrease the stigma associated with school meal participation by making it less obvious that a student is getting a free or reduced-price meal. For example, some schools may have electronic scanning systems in which no cash changes hands at the register and the price charged to the student is indicated electronically.

[5] It is possible that meal attitudes are a mediating variable that alters the estimated relationship between participation and covariates other than meal attitudes. We investigated this possibility by estimating models that exclude the meal attitudes variables. Compared to models that control for meal attitudes, models that exclude meal attitudes have coefficients that are highly similar in magnitude and identical in levels of significance.

[6] Bivariate analysis shows some other positive attitudes toward school meals are also significantly associated with higher participation rates, including a student's overall satisfaction with meal quality and a parent's satisfaction with meal healthfulness (Appendix A, Table A.1). However, the strongest relationship is that with a student's satisfaction with school meal taste. A student's satisfaction with portion size and parent's satisfaction with meal quality are not significantly associated with participation.

Other systems might involve color-coded punch cards or additional methods for identifying students certified for free or reduced-price meals that are obvious to anyone who observes the transaction or sees a student's card. Third, electronic POS technology may limit students' control over the participation decision if the technology allows parents to deposit money directly to a school meal account rather than giving cash (which can be spent elsewhere) to the student. Finally, it is also possible that whether a school has electronic POS technology is correlated with other unobserved school characteristics that are associated with participation.

Employed Household Member. Students certified for free and reduced-price meals from households with an employed adult obtain school lunches 5.6 percentage points more frequently than otherwise similar children who do not have employed adults in their household. One reason for this relationship may be that low-income employed parents have less time to prepare meals for their children at home than parents who are not employed. If this is the case, supporting the employment of low-income parents may be an unintended benefit of the NSLP.

Food Insecurity. Low-income students who experienced a food insecurity outcome (such as using a food pantry or a public food assistance program) in the summer before the school year were 2.6 percentage points more likely to participate than otherwise similar students who did not experience food insecurity. This suggests that participation is related to the need for nutrition assistance.

Race/Ethnicity. Students who are African American or Hispanic are nearly four percentage points more likely to get school lunches than otherwise similar students from other racial and ethnic backgrounds.

Other Factors. The relationships between school lunch participation rates and all other included factors were not statistically significant. Some of these factors, such as gender and

school enrollment, are significantly associated with participation in bivariate analysis, but are no longer statistically significant after controlling for other factors (Appendix A, Table A.1).[7]

2. School Breakfast Participation Results Based on Student-Level Analyses

School Type. As with lunch participation, the factor most strongly associated with school breakfast participation for students certified for free and reduced-price meals is school type. Middle school students obtain meals 7 percentage points less often than otherwise similar elementary school students, while high school students obtain meals 11 percentage points less often (Table II.2). These differences are quite large given the overall mean school breakfast participation rate of 33 percent.

Attitudes Toward School Meals. A student's satisfaction with the taste of school meals is also significantly associated with school breakfast participation, controlling for other factors. Low-income students who report being very satisfied with the taste of school meals and those who report being somewhat satisfied are five percentage points more likely to eat school breakfast than otherwise similar students who are not satisfied with school meal taste.

Number of Children in Household. Students certified for free and reduced-price meals who come from households with more children are more likely to eat school breakfasts than those from families with fewer children. Controlling for other factors, each additional child in the household increases breakfast participation by 1.8 percentage points (so a student from a family with three children would obtain meals 3.7 percentage points more frequently than a student

[7] Another notable result from the bivariate analysis is that participation rates in Provision 2 or 3 base year schools are substantially lower than those in non-Provision 2 or 3 schools. A potential explanation of this finding may be that Provision 2 or 3 base year schools have an incentive to encourage all low-income students to become certified for school meal benefits, regardless of whether they are interested in participating. Non-Provision 2 or 3 schools do not have this incentive. This set of incentives could lead to lower participation rates among students certified for free and reduced-price meals in Provision 2 or 3 base year schools compared to their counterparts in non-Provision 2 or 3 schools (and higher participation rates among all students).

from a one-child household). This relationship may result from the fact that larger families often have a greater need for nutrition assistance or that making breakfast at home for a larger number of children may be more difficult than for a smaller number of children.

Urbanicity. Low-income students from schools in urban areas are 11 percentage points less likely to get school breakfasts than otherwise similar students in nonurban areas.

Gender. Male students certified for free or reduced-price meals are nearly four percentage points more likely to obtain school breakfasts than otherwise similar female students certified for free or reduced-price meals.

Other Factors. The relationships between school breakfast participation rates and all other included factors were not statistically significant. Thus, some of the factors that are important for school lunch participation are not important for school breakfast participation, including electronic POS technology, having an employed household member, food insecurity, and race/ethnicity. These differences underscore the fact that the breakfast participation decision is quite different from the lunch participation decision—although all students have the opportunity to eat school lunch during the school day, students must make the effort to arrive to school early in order to obtain a school breakfast. Accordingly, there are plausible hypotheses for the differences in factors associated with breakfast and lunch participation.

For example, electronic POS technology may not be related to breakfast participation (as it is for lunch participation) because the gains to convenience are less pronounced due to the relatively smaller number of students who participate in school breakfast and their staggered arrival times, both of which would lead to shorter lines even without electronic POS technology. It is also possible that the stigma-reducing effects of electronic POS technology are less pronounced for school breakfast because most students obtaining school breakfast are certified for school meal benefits, leading to stigmatization of any SBP participation regardless of use of

electronic POS technology. The same factors that lead to a positive association between having an employed household member and lunch participation may mute the relationship with breakfast participation. In particular, low-income employed parents may have less time to prepare meals for their children at home than parents who are not employed, but they may also have less time to bring their children to school early.

As with school lunch participation, some factors that are significantly associated with breakfast participation in bivariate analysis are no longer significant after controlling for other factors (Appendix Table A.2). These factors include school enrollment, household income, food insecurity, and a school's percentage of students certified for free or reduced-price meals.

3. Results Based on School-Level Analyses

As in the analysis with student-level participation measures, regressions based on school-level participation indicate that school type is the factor most strongly associated with school meal participation. For example, high school students who are certified for free and reduced-price meals obtain school lunches on 21 percentage points fewer occasions than their elementary school counterparts, and they obtain school breakfasts on 10 percentage points fewer occasions (Table II.3). However, the relationship between participation and other factors differs for the student-level and school-level analyses. For example, the percentage of the student body certified for free or reduced-price meals, enrollment, and urbanicity are all significantly related to lunch participation in the school-level analysis whereas they are not in the student-level analysis. These differences are likely related to the fact that the student-level analysis also controls for a wide variety of other factors that may be correlated with school characteristics, and to the fact that the school-level analysis includes schools that both did and did not provide administrative meal participation records data.

TABLE II.3

DIFFERENCES IN SCHOOL-LEVEL NSLP AND SBP SCHOOL MEAL PARTICIPATION RATES ASSOCIATED WITH VARIOUS FACTORS, BY CERTIFICATION STATUS
(Percentages of Eating Occasions)

	NSLP		SBP	
	All Students	Free and Reduced-Price Students	All Students	Free and Reduced-Price Students
School Characteristics				
School Type				
Middle school	-2.12	-0.47	-8.33***	-10.78***
	(2.28)	(2.09)	(2.35)	(2.91)
High school	-20.18***	-20.68***	-5.63*	-9.76***
	(6.25)	(5.56)	(2.93)	(3.63)
Percentage of Student Body Certified Free/Reduced-Price	0.28***	-0.05***	0.36***	0.10
	(0.05)	(0.06)	(0.08)	(0.09)
Enrollment				
801 to 1,200	1.05	3.83	-5.77**	-6.42*
	(2.75)	(2.48)	(2.86)	(3.82)
Greater than 1,200	-16.60***	-14.56***	-8.96***	-14.02***
	(4.95)	(3.45)	(2.60)	(3.40)
Located in Urban Area	1.14	5.38**	-3.63	-1.27
	(2.61)	(2.63)	(3.24)	(3.76)
School Meal Program Implementation Characteristics				
Uses Direct Certification	1.60	5.62	4.77	9.19*
	(3.71)	(3.77)	(4.38)	(5.36)
Uses Electronic POS Technology	5.23*	1.62	7.16**	7.00*
	(3.01)	(2.64)	(3.05)	(3.72)
Constant	49.62***	74.77***	2.11***	23.83***
	(2.99)	(4.67)	(5.27)	(6.51)
Sample Size	**237**	**237**	**211**	**211**

Source: APEC study data.

Notes: Figures are coefficient estimates from OLS regressions in which the relevant participation rate is the dependent variable. Participation rates represent the percentage of meals received per eating opportunity during the full school year, based on administrative records. All figures are weighted. Standard errors, presented in parentheses, account for clustering in the survey design.

*Significantly different from zero at the .10 level, two-tailed test.
**Significantly different from zero at the .05 level, two-tailed test.
***Significantly different from zero at the .01 level, two-tailed test.

APEC = Access, Participation, Eligibility, and Certification; NSLP = National School Lunch Program; POS = Point of Sale; SBP = School Breakfast Program.

The school-level measures enable us to examine differences in the factors associated with the participation rate of all students compared to those associated with the participation of students certified for free and reduced-price meals. For the most part, the relationship between various factors and participation is similar in these two analyses. One notable exception is the percentage of the student body that is certified for free or reduced-price meals. When looking at the school lunch participation rate for all students, there is a large positive relationship with this variable, although there is a negative significant relationship when looking at lunch participation only among students certified for free or reduced-price meals. Similarly, there is a large positive relationship with breakfast participation for all students, while there is no significant relationship for students certified for free or reduced-price meals. This discrepancy is consistent with expectations. Because the participation rate of students certified for free and reduced-price meals is much higher than that of students not certified for school meal benefits, it is reasonable that a larger percentage of students certified for free or reduced-price meals would drive up the participation rate among *all students*. However, the expected direction of the relationship between the percentage of students certified for free or reduced-price meals and the participation rate *of students certified for free and reduced-price meals* is not clear.

D. SCHOOL MEAL PARTICIPATION AT DIFFERENT TYPES OF SCHOOLS

Given the large difference in participation rates by school type, it seems likely that the factors that are associated with meal participation vary by school type. We explored this possibility by estimating separate regressions by school type (that is, separately for students at elementary, middle, and high schools). We find that the relevant factors often differ substantially by school type, and that these differences across school type provide important insight into the factors driving lunch participation, but less insight into breakfast participation.

1. School Lunch Participation

In the analysis conducted separately by school type, important differences emerged in the relationship between school lunch participation and student attitudes toward school meal taste, electronic POS technology, and employment by a household member.[8]

Student attitudes toward the taste of school meals are one of the factors most strongly associated with school lunch participation overall. We find that this relationship is driven almost entirely by high school students; satisfaction with meal taste is much more strongly associated with lunch participation for high school students than for elementary and middle school students.[9] For example, high school students who are very satisfied with school meal taste obtain meals at 22 percentage points more eating occasions than high school students who are not satisfied with meal taste, compared to 5 percentage points more among elementary school students and 6 percentage points more among middle school students (Table II.4). An explanation for this finding could be that high school students have more autonomy in their school meal participation decisions and more options outside of school meals, so their attitude toward school meals is more important than for younger students. This finding may indicate that focusing on meal quality may be a way to increase the relatively low lunch participation rates of high school students. A similar story can be told for electronic POS technology. High school students in schools that use electronic POS technology obtain school meals at 25 percentage points more eating occasions than students in schools that do not use electronic processing, compared to 16 percentage points more for middle school students and 3 percentage points more for elementary school students.

[8] Chow tests confirm that differences in the coefficients among these regressions are statistically significant.

[9] The differences in these coefficients, as well as those on electronic POS technology, are statistically significant, as confirmed by Wald tests.

TABLE II.4

CHANGES IN STUDENT-LEVEL NSLP MEAL PARTICIPATION RATES
ASSOCIATED WITH VARIOUS FACTORS, BY SCHOOL TYPE
(Percentages of Eating Occasions)

	Elementary School	Middle School	High School
Student Characteristics			
Male	-0.43	1.65	5.33*
	(1.27)	(2.40)	(2.87)
African American or Hispanic	4.07**	6.02	-0.25
	(1.87)	(3.95)	(4.50)
Family Characteristics			
Parental Educational Attainment			
High school degree	0.25	1.31	-1.47
	(1.83)	(2.58)	(3.91)
More than high school degree	1.60	-2.31	-4.28
	(2.00)	(3.78)	(5.55)
Monthly Household Income	-0.49	2.64***	0.29
	(0.61)	(0.73)	(1.39)
Employed Household Member	6.59***	0.76	6.85
	(2.33)	(3.01)	(4.20)
Number of Children	0.18	0.22	0.72
	(0.29)	(0.86)	(1.27)
Experienced Food Insecurity Outcome	2.81	0.85	3.67
	(1.84)	(3.09)	(3.57)
Attitudes Toward School Meals			
Student's Satisfaction with School Meal Taste			
Very satisfied	5.23*	6.04	21.68***
	(2.70)	(3.88)	(4.40)
Somewhat satisfied	3.70	2.16	14.81***
	(2.56)	(4.02)	(3.80)
School Characteristics			
Percentage of Student Body Certified Free/Reduced-Price	-0.12*	0.02	0.37***
	(0.07)	(0.15)	(0.13)
Enrollment			
801 to 1,200	-3.96	0.69	4.44
	(3.32)	(7.15)	(15.62)
Greater than 1,200	1.15	-7.90	-4.57
	(5.69)	(7.36)	(10.23)
Located in Urban Area	-0.14	-5.15	-20.55***
	(3.31)	(6.21)	(6.11)

TABLE II.4 (*continued*)

	Elementary School	Middle School	High School
School Meal Program Implementation Characteristics			
Uses Direct Certification	-0.08	-15.85*	13.99
	(2.58)	(8.54)	(15.39)
Uses Electronic POS Technology	2.81	15.94	25.35***
	(3.04)	(10.63)	(8.21)
Constant	68.28***	56.63***	-23.41
	(7.25)	(11.51)	(15.58)
Sample Size	**1,456**	**388**	**263**

Source: APEC study data.

Notes: Figures are coefficient estimates from OLS regressions in which the relevant participation rate is the dependent variable. Participation rates represent the percentage of meals received per eating opportunity during the full school year, based on administrative records. All figures are weighted. Standard errors, presented in parentheses, account for clustering in the survey design.

*Significantly different from zero at the .10 level, two-tailed test.
**Significantly different from zero at the .05 level, two-tailed test.
***Significantly different from zero at the .01 level, two-tailed test.

APEC = Access, Participation, Eligibility, and Certification; NSLP = National School Lunch Program; POS = Point of Sale.

The association of lunch participation and electronic POS technology is extremely large, particularly given the low average participation rate among high school students. As with student satisfaction with meal taste, the convenience offered by electronic POS technology may be more important for high school students because they have more autonomy in their food choices. This relationship would also be expected if stigma effects are stronger among older students and electronic POS technology is related to reduced stigma.

Another factor that offers interesting results when examined separately by school type is whether the student has an employed household member. In particular, the positive relationship between lunch participation and having an employed household member is largest for elementary school students, smaller (but still large) for middle school students, and not significant for high school students. This is consistent with the use of the NSLP as a work support, because parents of young children face the strongest time and resource constraints and younger children have few alternatives to school lunch other than lunch brought from home.

2. School Breakfast Participation

The patterns that emerge from conducting analysis separately by school type are not as informative for breakfast participation as they are for lunch participation. For example, student attitudes toward the taste of school meals are also important factors for overall SBP meal participation, but the patterns by school type are not clear. In particular, there is a strong positive relationship between attitudes toward taste and breakfast participation for elementary school students, a negative relationship for middle school students, and no significant relationship for high school students (Table II.5).

TABLE II.5

CHANGES IN STUDENT-LEVEL SBP MEAL PARTICIPATION RATES
ASSOCIATED WITH VARIOUS FACTORS, BY SCHOOL TYPE
(Percentages of Eating Occasions)

	Elementary School	Middle School	High School
Student Characteristics			
Male	2.84	5.26	4.90*
	(2.01)	(3.19)	(2.81)
African American or Hispanic	3.22	0.40	-4.00
	(2.76)	(5.46)	(4.22)
Family Characteristics			
Parental Educational Attainment			
High school degree	-4.12*	-0.43	2.60
	(2.31)	(4.07)	(3.29)
More than high school degree	-2.06	-5.77	3.02
	(3.58)	(3.47)	(5.11)
Monthly Household Income	-0.98	0.42	1.24
	(0.80)	(1.86)	(1.17)
Employed Household Member	-2.01	-2.13	3.34
	(2.89)	(3.82)	(4.54)
Number of Children	1.67*	2.74**	1.09
	(0.86)	(1.02)	(1.15)
Experienced Food Insecurity Outcome	2.75	-1.46	4.06
	(2.36)	(4.02)	(2.45)
Attitudes Toward School Meals			
Student's Satisfaction with School Meal Taste			
Very satisfied	9.75**	-9.37**	7.00
	(4.07)	(4.36)	(4.37)
Somewhat satisfied	7.60*	-2.01	2.41
	(3.82)	(4.86)	(1.82)
School Characteristics			
Percentage of Student Body Certified Free/Reduced-Price	0.15	0.51**	0.06
	(0.13)	(0.22)	(0.09)
Enrollment			
801 to 1,200	-6.42	1.86	11.45*
	(4.25)	(9.69)	(6.01)
Greater than 1,200	-6.76	0.04	-4.44
	(6.36)	(8.57)	(6.80)
Located in Urban Area	-11.00*	-16.33**	0.83
	(6.20)	(6.26)	(4.05)

TABLE II.5 (*continued*)

	Elementary School	Middle School	High School
School Meal Program Implementation Characteristics			
Uses Direct Certification	5.52	12.73	10.13***
	(5.76)	(9.41)	(2.67)
Uses Electronic POS Technology	0.26	7.05	5.95
	(3.84)	(6.03)	(8.05)
Constant	15.21	-17.91*	-12.97
	(11.91)	(8.95)	(9.95)
Sample Size	**1,347**	**347**	**240**

Source: APEC study data.

Notes: Figures are coefficient estimates from OLS regressions in which the relevant participation rate is the dependent variable. Participation rates represent the percentage of meals received per eating opportunity during the full school year, based on administrative records. All figures are weighted. Standard errors, presented in parentheses, account for clustering in the survey design.

*Significantly different from zero at the .10 level, two-tailed test.
**Significantly different from zero at the .05 level, two-tailed test.
***Significantly different from zero at the .01 level, two-tailed test.

APEC = Access, Participation, Eligibility, and Certification; POS = Point of Sale; SBP = School Breakfast Program.

III. ASSESSING THE RELATIONSHIP BETWEEN CERTIFICATION STATUS AND SCHOOL MEAL PARTICIPATION BASED ON CERTIFICATION ERROR

The primary objective of the National School Lunch Program (NSLP) and the School Breakfast Program (SBP) is to ensure that children have access to nutritious meals. In assessing the success of school meal programs in achieving this goal, it is important to determine whether certification for school meal benefits induces students to consume more school meals. The extent to which school meal programs can affect student nutrition depends directly on the extent to which these programs increase school meal consumption.

This chapter describes a natural experiment that provides insight into this important relationship. In particular, we make inferences about the causal effect of school meal certification status on school meal receipt by exploiting the fact that students who are eligible for a certain certification status (for example, free meals) are sometimes misclassified into another certification status (for example, reduced-price meals). The results of this analysis have several important policy implications. Most fundamentally, they enable us to assess how successful school meal programs are at increasing receipt of school meals, which is necessary for the programs' success in improving nutrition among disadvantaged school-aged children. Additionally, our findings have implications for the debate on the effects of eliminating the reduced-price certification category because we can assess the increase in school meal receipt that would result from providing free meals to students eligible for reduced-price benefits under current program rules.

Key Findings:

- For students eligible for free meals, those who were erroneously denied benefits were much less likely to obtain school meals than those who were properly certified. This finding, combined with similar findings for students certified for reduced-price meals and for those not eligible for school meal benefits, suggests that the school meal programs are successful at increasing receipt of school meals.
- Reduced-price-eligible students who are certified for free meals because of administrative error receive significantly more school lunches than otherwise similar reduced-price-eligible students who are properly certified, but they do not obtain more school breakfasts.
- These findings suggest that eliminating the reduced-price certification category would increase lunch participation among students eligible for reduced-price meals under the current program rules, but that it would not increase breakfast participation.

A. BACKGROUND

Evaluating the effect of school meal certification status on school meal consumption is difficult. The descriptive analysis presented in the previous chapter shows that students certified for free meals obtain meals at higher rates than those certified for reduced-price meals, and that both of these groups obtain school meals at much higher rates than do students who applied and were not certified for school meal benefits (Table II.1). However, this pattern does not imply that school meal benefit certification *causes* students to consume more school meals. Because school meal benefits are means tested, students' eligibility status is directly related to their economic circumstances. This is important because economically disadvantaged students might be more likely to consume school meals than other students regardless of certification category. For example, it might be that students eligible for free meals have less access to nutritious food at home than do those eligible for reduced-price meals, leading them to obtain more school meals.

Multivariate analyses can control for some of the characteristics that vary for different certification status groups, such as household income, parental education level, and food

insecurity. However, it would not be possible to control for all factors that are associated with both school meal certification status and school meal participation rates. These unobserved factors (that is, those that are not possible to include in the analysis) interfere with our ability to make causal inferences about the relationship between school meal certification status and school meal participation rates without an experimental research design. We implement this type of research design based on the natural experiment provided by misclassification error in the school meal certification process.

There are two reasons a student may receive the wrong school meal certification status: reporting error and administrative error.[1] Reporting error occurs when parents do not report correct information about their household circumstances on their application. This might be intentional, for example, when they knowingly misreport their income or household composition in order to become certified for a higher level of benefits than they are eligible, or it can be unintentional, if they do not understand they should report income for all members of the household unit or make mistakes on the amount or frequency of receipt. Administrative error can occur for a number of reasons, including: (1) local education authority (LEA) staff assessing eligibility do not sum the number of household members from the application correctly, (2) they fail to sum household income correctly, (3) they do not correctly convert income from the units in which it is reported (such as dollars per week) into the units used in the guidelines (such as dollars per month), (4) they make an error in translating the household size and monthly income into an eligibility status, or (5) they make an error in determining categorical eligibility.[2]

[1] Reporting and administrative error do not always result in the student receiving the incorrect certification status. For the purposes of this study, we consider only cases in which the error affected certification status.

[2] We do not include administrative error related to certification of applications that are not complete (usually because they are missing either a signature or a Social Security number), because in these cases certification status matches eligibility status as determined by household size, income, and benefit receipt. This approach is consistent

In the case of administrative error, we can consider the application process as a natural experiment in which some students who would otherwise be eligible for a particular certification status are assigned to a different certification status. In other words, the reason that a student who was eligible for a particular certification status was not certified for that status is fairly random from the student's perspective. As a result, the certification status is not related to the student's likelihood of participating through any indirect means. Any differences in participation between, say, free-eligible students who were correctly certified and free-eligible students who were certified for reduced-price meals can be attributed directly to differences in certification status.

B. METHODOLOGY

The Access, Participation, Eligibility, and Certification (APEC) study was designed to measure erroneous payments in the NSLP and SBP. As a result, we have information on which students in our sample are erroneously certified and the reason for the misclassification error.

Making use of misclassification error is fairly straightforward. For example, when evaluating the effect of certification status on students eligible for free meals, we first construct a sample of students who were *eligible* for free meals (based on their household circumstances according to APEC household survey and meal benefits application), regardless of their *actual* certification status. This sample includes free-eligible students who were certified for free meals, as well as those free-eligible students who were certified for reduced-price meals and those who were denied benefits. We exclude from this sample students who were misclassified because of reporting error. We make this exclusion because reporting error is not likely to be random. That

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(continued)
with treatment of this type of administrative error in the calculation of administrative error rates in Ponza et al. (2008).

is, it is likely to be associated with factors that are also correlated with school meal participation. Thus, including students with reporting error could bias the results.

Using this sample, we estimate the following OLS regression equation:

$$(3) \qquad Participation_i = RP_i\gamma_1 + NC_i\gamma_2 + Control_i\beta + \varepsilon_i$$

where $Participation_i$ is the school meal participation rate of student *i, RP* indicates that the student was eligible for free meals but certified for reduced-price meals, *NC* indicates that the student was eligible for free meals but not certified for free or reduced-price meals despite applying for benefits, and the omitted category would indicate that the student is both eligible and certified for free meals.[3] The vector $Control_i$ includes the set of student, family, and school characteristics that were specified in the multivariate analysis described in Chapter II. Among the variables included as covariates in this specification are the number of children in the household and monthly household income. These variables are directly related to the information that would be entered on a school meal benefit application.[4] Thus, the estimated effects from this natural experiment are conditional on comparing students whose applications (and other observed characteristics) are similar.

The coefficients of interest are those associated with RP_i and NC_i; γ_1 represents the change in school meal participation that results from a free-eligible student being certified for reduced-price meals rather than free meals, while γ_2 represents the change in school meal participation

[3] We also estimated this relationship using Tobit regressions, which account for the fact that the participation rates cannot be less than zero. Results from this analysis are qualitatively similar to those presented here.

[4] In addition to the specification described in equation (3), we also estimated a model for the free-eligible sample that controlled for whether the student was categorically eligible for free meals. Results from this specification were similar to those described below. Because categorical eligibility only applies to free-eligible students, there are no categorically eligible students in the samples of reduced-price eligible students and students not eligible for free or reduced-price meals.

that results from a free-eligible student not being certified for free or reduced-price meal benefits rather than being certified for free meals. Similar analysis is conducted using a sample of reduced-price-eligible students and a sample of students not eligible for free or reduced-price meals.

Each of these samples enables us to address different aspects of three main research questions:

- *What is the effect of certification for free meals relative to certification for reduced-price meals?*
  - From the perspective of free-eligible students
  - From the perspective of reduced-price-eligible students
- *What is the effect of certification for free meals relative to no certification for free or reduced-price meals?*
  - From the perspective of free-eligible students
  - From the perspective of students not eligible for free or reduced-price meals
- *What is the effect of certification for reduced-price meals relative to no certification for free or reduced-price meals?*
  - From the perspective of reduced-price-eligible students
  - From the perspective of students not eligible for free or reduced-price meals

We do not expect effects measured from the perspective of students in different eligibility categories (i.e. for different analysis samples) necessarily to be the same. For example, the effect of certification for free-meals relative to certification for reduced-price meals is unlikely to be the same for free-eligible students and reduced-price eligible students. This is because having different eligibility statuses implies that the groups have different economic circumstances and may have different participation responses to receiving free meals rather than reduced-price meals.

In considering the analyses from the perspective of students not eligible for school meal benefits, it is important to remember that these students all applied for school meal benefits. Students who are not eligible and not certified are denied applicants, that is, students *who applied for and were denied school meal benefits*. Ineligible students who are certified for free or reduced-price meals had to have applied for meals in order to have become certified. Thus, analysis of the sample of ineligible students does not generalize to all students who were not eligible for free or reduced-price meals.[5] Accordingly, the coefficients from this analysis do not represent the increase in meal participation rates that would result from universal certification. Rather, they reflect changes in behavior among ineligible students with sufficient interest in receiving school meal benefits to submit an application.

Although analysis of this natural experiment provides evidence on the effect of meal certification status on NSLP/SBP meal participation, it does have limitations. First, if administrative error is related to participation in a systematic way, the appealing properties of the natural experiment are not preserved. For example, if free-eligible students who are near the income threshold (that is, those who are less disadvantaged) are more likely to be subject to administrative error, then differences in meal participation may be the result of differences in student characteristics rather than of differences in meal certification category. Including a comprehensive set of controls may partially address this concern; however, there may be unobserved differences in those students subject to administrative error and those who are not. An additional limitation lies in the small sample size of students who were erroneously classified; erroneously classified students comprise 2 percent of the free-eligible sample, 16

[5] Students in the free-eligible and reduced-price-eligible samples who are not certified also must have applied for benefits. Thus, the free-eligible sample represents all free-eligible students who applied for benefits, while the reduced-price-eligible sample represents all reduced-price-eligible students who applied for benefits.

percent of the reduced-price-eligible sample, and 18 percent of the ineligible sample. This limits our power to detect statistically significant differences in meal participation between the groups. Indeed, standard errors on the coefficients of interest tend to be quite large, so we find statistical significance only for very large effects.

C. SAMPLE CHARACTERISTICS

In this section, we examine whether students with a given eligibility status who were misclassified due to administrative error have similar characteristics to students with the same eligibility status who were correctly certified. For example, we compare the characteristics of students who were eligible for free meals but certified for reduced-price meals due to administrative error to the characteristics of students who were eligible for free meals and correctly certified for free meals. The more similar these groups are, the more comfortable we can be that any differences in participation that we observe are the result of differences in certification status, rather than the result of other differences between the two groups.

Table III.1 presents student characteristics for the three analysis samples by certification status. We find some evidence of differences by certification status for free-eligible and ineligible students. In particular, student characteristics suggest that correctly certified free-eligible students may be more disadvantaged than other free-eligible students, while ineligible students correctly denied benefits may be less disadvantaged than other ineligible students not correctly certified. However, we find less evidence of systematic differences by certification status among students eligible for reduced-price meals.

TABLE III.1

CHARACTERISTICS OF STUDENTS IN THE FREE-ELIGIBLE, REDUCED-PRICE-ELIGIBLE, AND NOT ELIGIBLE SAMPLES, BY CERTIFICATION STATUS
(Percentage Unless Noted Otherwise)

	Free-Eligible Students			Reduced-Price-Eligible Students			Ineligible Students		
	Free-Certified	Reduced-Price-Certified	Not Certified	Free-Certified	*Reduced-Price-Certified*	Not Certified	Free-Certified	Reduced-Price-Certified	*Not Certified*
Student Characteristics									
Male	51.2	53.0	58.1	37.9	56.6	73.2	52.1	61.1	58.4
African American or Hispanic	72.2	69.3	46.6	92.7***	52.1	67.0	67.9	61.6	53.6
Family Characteristics									
Parental Educational Attainment							++	+	
Less than a high school degree	34.5	46.5	21.5	41.6	20.8	34.6	27.8	29.8	8.9
High school degree	44.6	34.7	38.4	33.4	46.8	24.0	50.3	50.9	48.8
More than high school degree	21.0	18.8	40.1	25.0	23.4	41.5	21.9	19.4	42.4
Household Income (dollars)	1,335	1,866	1,616	2,795	2,685	2,502	3,624**	3,309***	5,351
Employed Household Member	65.8	94.1***	90.9***	88.7	96.3	96.1	93.4	99.8	99.3
Number of Children (number)	2.98	2.55	2.43	2.68	2.57	2.08***	2.52***	2.30	2.00
Experienced Food Insecurity Outcome	79.4	41.4***	82.5	40.7	37.0	65.3**	54.5	65.9**	37.8
Attitudes Toward School Meals									
Student's Satisfaction with School Meal Taste							+	++	
Very satisfied	39.5	38.0	33.3	52.4	42.1	34.9	19.0	20.2	42.2
Somewhat satisfied	42.8	24.6	52.2	26.2	46.6	40.5	61.2	75.2	33.2
Somewhat or very dissatisfied	17.7	37.4	14.4	21.4	11.3	24.6	19.8	4.6	24.6
School Characteristics									
School Type		++							
Elementary school	69.1	40.2	80.2	77.7	62.3	60.0	63.3	45.9	64.4
Middle School	18.0	50.7	15.2	9.9	23.5	30.8	19.8	27.5	17.2
High School	13.0	9.1	4.6	12.4	14.2	9.2	16.9	26.7	18.4
Percentage of Student Body Certified Free/Reduced-Price	64.2	62.8	70.2	75.3***	51.2	80.6***	62.4	52.6	60.4
Enrollment (number of students)	862	581**	751	833	959	726	831	1,081	802
Located in Urban Area	44.4	59.6	58.7	55.9	30.5	82.0***	28.7	24.6	27.7
School Meal Program Implementation Characteristics									
Uses Direct Certification	91.5	89.0	90.2	100.0**	89.4	100.0**	99.8**	84.4	91.4
Uses Electronic POS Technology	94.6	95.8	100.0***	95.9	92.5	90.8	84.3	94.1	92.2
Sample Size	**1,514**	**18**	**28**	**20**	**189**	**15**	**33**	**15**	**215**

Source: APEC study data.

TABLE III.1 *(continued)*

Notes: All figures are weighted. Standard errors account for clustering in the survey design Students whose certification status was misclassified due to reporting error are excluded.

*Significantly different from zero at the .10 level, two-tailed t-test.
**Significantly different from zero at the .05 level, two-tailed t-test.
***Significantly different from zero at the .01 level, two-tailed t-test.

+Significantly different from zero at the .10 level, chi-squared test.
++Significantly different from zero at the .05 level, chi-squared test.
+++Significantly different from zero at the .01 level, chi-squared test.

APEC = Access, Participation, Eligibility, and Certification; POS = Point of Sale.

Although differences by certification status provide valuable context for the analysis, our estimates control for a variety of factors, including the number of children in the household and household income, which are key pieces of information that are used to determine eligibility by SFA administrators. Any non-random variation in the assignment of certification status should be related to these variables because this is the information that LEA administrators are using to determine eligibility. Since we explicitly control for the factors that are most likely to influence the certification category to which a student is assigned, our estimates should reflect the relationship between participation and certification status.

Free-Eligible Sample. There is some evidence that free-eligible students who were correctly certified are more disadvantaged than free-eligible students who were incorrectly certified due to administrative error. Among free-eligible students, students certified for free meals are significantly less likely than either students certified for reduced-price meals or those not certified for meal benefits to have an employed household member. Students certified for free meals are also significantly more likely than students certified for reduced-price meals to have experienced a food insecurity outcome in the summer prior to the school year. Correctly certified students also have lower household incomes on average than incorrectly certified students, although these differences are not statistically significant.

There is likely more error surrounding income eligibility for free benefits than categorical eligibility, which is eligibility based on receipt of welfare benefits, Supplemental Nutrition Assistance Program (SNAP, formerly the food stamp program) benefits, or other benefits. This is partly because income is much more difficult to measure than benefit receipt. In addition, to determine income eligibility, LEAs have to make mathematical calculations based on income and numbers of household members in the former situation. In contrast, categorical eligibility is determined based on a benefit program case number—in the case of direct certification SFAs do

not have to review an application at all to determine categorical eligibility. Accordingly, incorrectly certified free-eligible students may be more likely to be income eligible and less likely to be categorically eligible compared to correctly certified free-eligible students. Categorically eligible students are likely more disadvantaged than those eligible based on income, which could result in free-eligible students certified for free meals being more disadvantaged as a group than free-eligible students not certified for free meals.

Reduced-Price Eligible Sample. Overall, there is less evidence of systematic differences by certification status in the reduced-price eligible sample than in the free-eligible sample. Compared to correctly certified reduced-price eligible students, students certified for free meals but eligible for reduced-price meals are significantly more likely to be African American or Hispanic. They also come from schools that have higher percentages of students certified for free or reduced-price meals and that are more likely to use electronic point of sale (POS) technology. Differences in other characteristics, such as monthly household income and experiencing a food insecurity outcome in the summer before the school year, are small and not statistically significant.

Reduced-price eligible students who were incorrectly denied school benefits, compared to correctly certified reduced-price eligible students, come from households that had significantly fewer children, that were more likely to have experienced a food insecurity outcome, and that were more likely to located in an urban area.

Ineligible Sample. There is evidence that ineligible applicants for school meal benefits who were correctly certified are less disadvantaged those who were certified for free and reduced-price meal benefits. In particular, compared to students who were incorrectly granted benefits, students who were correctly denied benefits have parents with higher education levels and have substantially higher household income levels.

D. OBSERVED ASSOCIATION BETWEEN CERTIFICATION AND PARTICIPATION

The association between certification status and school meal participation estimated using a simple, nonexperimental multivariate framework provides useful context for the analysis based on the miscertification natural experiment. We estimated the relationship between school meal participation rates and certification status using an OLS regression model that controls for a set of student, family, and school characteristics. The results from this analysis, presented in Table III.2, show a pattern similar to that of the unadjusted mean participation rates. Compared to students certified for free meals, students certified for reduced-price lunches receive meals at approximately 4 percentage points fewer eating occasions controlling for other factors, while those who applied for and were denied certification for free or reduced-price meals receive meals at 15 percentage points fewer eating occasions. Both of these differences are statistically significant at the 5 percent level. Differences in SBP participation between students who were free certified, reduced-price certified, or not certified were of similar magnitude and were also statistically significant.

Although these figures control for a wide range of student, family, and school characteristics, there might be unobserved factors that are associated with both school meal certification status and school meal participation rates. If this is the case, we would expect for there to be important differences between the findings presented here and the experimental findings.

E. EFFECTS OF CERTIFICATION STATUS ON SCHOOL MEAL PARTICIPATION

1. School Lunch Participation

Results from analyses related to lunch participation, presented in Table III.3, indicate that there is a large effect on participation when students are given a more generous certification status than the one for which they are eligible, that is when they are overcertified. For example,

TABLE III.2

DIFFERENCES IN SCHOOL LUNCH PARTICIPATION RATES ASSOCIATED WITH CERTIFICATION STATUS, BY MEAL PROGRAM
(Percentages of Eating Occasions)

	NSLP	SBP
Certification Status		
Reduced-Price	-3.81**	-4.86**
	(1.66)	(2.12)
Not Certified	-15.10***	-13.32***
	(3.11)	(2.71)
Sample Size	**2,440**	**2,240**

Source: APEC study data.

Notes: Figures are coefficient estimates from OLS regressions in which the lunch participation rate is the dependent variable. Independent variables include sex, race/ethnicity, parental educational attainment, monthly household income, household employment, number of children in the household, food insecurity, satisfaction with school meal taste, school type, school percentage certified for free or reduced-price meals, school enrollment, school location in an urban area, school use of direct certification, and school use of electronic POS technology. Participation rates represent percentage of meals received per eating occasion during the full school year, determined based on administrative records. All figures are weighted. Standard errors, presented in parentheses, account for clustering in the survey design.

*Significantly different from zero at the .10 level, two-tailed test.
**Significantly different from zero at the .05 level, two-tailed test.
***Significantly different from zero at the .01 level, two-tailed test.

APEC = Access, Participation, Eligibility, and Certification; POS = Point of Sale.

TABLE III.3

EFFECT OF CERTIFICATION STATUS ON SCHOOL LUNCH PARTICIPATION RATES, BY ELIGIBILITY STATUS
(Percentages of Eating Occasions)

	Free-Eligible Students	Reduced-Price-Eligible Students	Ineligible Students
Certification Status			
Free	--	12.84**	24.08***
		(5.14)	(5.74)
Reduced-Price	-1.45	--	16.22**
	(7.62)		(7.43)
Not Certified	-10.16	-3.18	--
	(12.25)	(7.68)	
Student Characteristics			
Male	0.51	-3.71	6.43*
	(1.47)	(3.11)	(3.45)
African American or Hispanic	3.13	11.46***	-5.26
	(2.06)	(3.60)	(5.22)
Family Characteristics			
Parental Educational Attainment			
High school degree	1.89	6.35	-5.32
	(1.86)	(3.93)	(6.33)
More than high school degree	2.70	4.30	-0.90
	(2.29)	(4.74)	(6.32)
Household Income	0.22	1.77	0.53
	(0.94)	(3.75)	(0.51)
Employed Household Member	6.53***	-4.28	11.37*
	(1.85)	(4.53)	(5.72)
Number of Children	0.17	0.15	2.44
	(0.39)	(2.08)	(2.57)
Experienced Food Insecurity Outcome	3.44	4.44	3.44
	(2.12)	(3.12)	(3.90)
Attitudes Toward School Meals			
Student's Satisfaction with School Meal Taste			
Very satisfied	4.62*	13.51*	16.26**
	(2.59)	(6.95)	(7.13)
Somewhat satisfied	1.35	15.15**	18.87***
	(2.24)	(6.73)	(5.76)
School Characteristics			
School Type			
Middle school	-5.39**	-12.70***	-6.93
	(2.50)	(4.07)	(5.55)
High school	-31.03***	-24.47***	-24.03***
	(4.20)	(9.02)	(8.46)
Percentage of Student Body Certified for Free/Reduced-Price Meals	-0.06	-0.10	0.11
	(0.08)	(0.09)	(0.13)

TABLE III.3 *(continued)*

	Free-Eligible Students	Reduced-Price-Eligible Students	Ineligible Students
Enrollment			
801 to 1,200	-2.23	-9.93*	7.36
	(2.85)	(5.37)	(6.20)
Greater than 1,200	-4.82	-6.50	-1.91
	(4.26)	(7.50)	(8.77)
Located in Urban Area	-2.50	-5.43	-3.92
	(3.47)	(4.45)	(6.55)
School Meal Program Implementation Characteristics			
Uses Direct Certification	-2.17	-0.08	-0.09
	(2.99)	(6.30)	(8.32)
Uses Electronic POS Technology	9.74**	2.09	20.77***
	(3.97)	(5.69)	(6.55)
Constant	59.71***	57.55***	3.74
	(7.43)	(15.19)	(12.33)
Sample Size	**1,498**	**220**	**259**

Source: APEC study data.

Notes: Figures are coefficient estimates from OLS regressions in which the lunch participation rate is the dependent variable. Participation rates represent percentage of meals received per eating occasion during the full school year, determined based on administrative records. All figures are weighted. Standard errors, presented in parentheses, account for clustering in the survey design.

*Significantly different from zero at the .10 level, two-tailed test.
**Significantly different from zero at the .05 level, two-tailed test.
***Significantly different from zero at the .01 level, two-tailed test.

APEC = Access, Participation, Eligibility, and Certification; POS = Point of Sale.

reduced-price-eligible students who were erroneously certified for free meals due to administrative error obtained meals 13 percentage points more frequently than reduced-price-eligible students who were properly certified. Effects are even larger for ineligible students who applied for school meal benefits. Ineligible students who were certified for free meals obtained lunches 24 percentage points more frequently than properly certified ineligible students, while ineligible students who were certified for reduced-price meals obtained school lunches 16 percentage points more frequently.

Evidence of impacts on lunch participation from undercertification is not as strong. Free-eligible students who were erroneously denied benefits (that is, were not certified for free or reduced-price meals) had a much lower lunch participation rate than otherwise similar free-eligible students who were correctly certified (Table III.3). However, this difference was not precisely estimated and is not statistically significant. The other two undercertification effects also have the expected sign; however, they are not large nor are they statistically significant.

2. School Breakfast Participation

In contrast to results from the lunch participation analysis, we do not find evidence of increased school breakfast participation for reduced-price-eligible students who are certified for free meals; the coefficient on free certification for the sample of reduced-price-eligible students is positive, but it is small and not statistically significant (Table III.4). We do find large increases in school breakfast participation for overcertified students who were not eligible for school meal benefits. Ineligible students who were certified for free meals were 20 percentage points more likely to obtain school breakfasts than properly certified ineligible students, while ineligible students who were certified for reduced-price meal obtained school breakfasts 17 percentage points more frequently than properly certified ineligible students.

TABLE III.4

EFFECT OF CERTIFICATION STATUS ON SCHOOL BREAKFAST PARTICIPATION RATES, BY ELIGIBILITY STATUS
(Percentages of Eating Occasions)

	Free-Eligible Students	Reduced-Price-Eligible Students	Ineligible Students
Certification Status			
Free	--	1.38	20.37**
		(12.16)	(8.08)
Reduced-Price	4.52	--	17.37*
	(5.85)		(10.33)
Not certified	-12.76**	-2.11	--
	(5.76)	(8.56)	
Student Characteristics			
Male	4.59***	-6.29	3.06
	(1.63)	(5.24)	(5.07)
African American or Hispanic	2.02	3.14	2.88
	(2.44)	(5.36)	(5.43)
Family Characteristics			
Parental Educational Attainment			
High school degree	-3.77*	-2.93	-6.38
	(1.98)	(6.33)	(8.48)
More than high school degree	-1.78	-9.24	-4.46
	(3.45)	(7.11)	(8.37)
Household Income	1.34	-9.82**	0.34
	(1.13)	(3.91)	(0.64)
Employed Household Member	-1.80	-4.35	-3.91
	(2.54)	(11.18)	(15.89)
Number of Children	0.96	7.58**	-4.03
	(0.80)	(3.16)	(3.06)
Experienced Food Insecurity Outcome	0.42	9.78**	8.83**
	(2.48)	(4.27)	(4.34)
Attitudes Toward School Meals			
Student's Satisfaction with School Meal Taste	6.12	-5.94	10.44*
Very satisfied	(3.57)*	(7.84)	(5.59)
	4.05	3.29	10.20*
Somewhat satisfied	(3.18)	(8.38)	(5.32)
School Characteristics			
School Type			
Middle school	-7.32**	-4.66	-14.05***
	(3.40)	(6.34)	(4.60)
High school	-14.26***	-11.07	-24.93**
	(3.95)	(8.36)	(10.18)
Percentage of Student Body Certified for Free/Reduced-Price Meals	0.17	0.43***	-0.02
	(0.12)	(0.15)	(0.15)

TABLE III.4 *(continued)*

	Free-Eligible Students	Reduced-Price-Eligible Students	Ineligible Students
Enrollment			
801 to 1,200	-3.71	-9.20	0.31
	(3.97)	(7.51)	(7.70)
Greater than 1,200	-6.73	1.35	-0.77
	(5.95)	(7.04)	(10.48)
Located in Urban Area	-8.11	-18.80***	-9.05
	(5.12)	(5.96)	(6.87)
School Meal Program Implementation Characteristics			
Uses Direct Certification	5.25	-15.06*	-1.02
	(6.14)	(8.73)	(8.13)
Uses Electronic POS Technology	5.58	-4.11	-3.25
	(3.50)	(7.40)	(8.41)
Constant	11.82	46.10**	31.71
	(10.91)	(21.16)	(25.27)
Sample Size	**1,382**	**199**	**238**

Source: APEC study data.

Notes: Figures are coefficient estimates from OLS regressions in which the breakfast participation rate is the dependent variable. Participation rates represent percentage of meals received per eating occasion during the full school year, determined based on administrative records. All figures are weighted. Standard errors, presented in parentheses, account for clustering in the survey design.

*Significantly different from zero at the .10 level, two-tailed test.
**Significantly different from zero at the .05 level, two-tailed test.
***Significantly different from zero at the .01 level, two-tailed test.

APEC = Access, Participation, Eligibility, and Certification; POS = Point of Sale.

We find some evidence of undercertification effects for school breakfast participation. Among free-eligible students, those who were improperly denied benefits were 13 percentage points less likely to obtain school breakfast on a given eating occasion than properly certified students. The other two undercertification effects also have the expected sign; however, they are not large nor are they statistically significant.

F. IMPLICATIONS OF FINDINGS

Findings from this natural experiment provide evidence that certification for school meal benefits does increase school meal consumption. Among students eligible for free meals, those who were erroneously denied benefits were much less likely to obtain school meals than those who were properly certified (though this effect is not precisely estimated for school lunches). Furthermore, students eligible for reduced-price meals and erroneously certified for free meals were more likely to obtain school lunches than those who were properly certified. Students who were not eligible for school meal benefits and who were overcertified were also more likely to obtain school meals than their properly certified counterparts. Each of these findings suggests that the school meal programs are successful at increasing receipt of school meals. The fact that students respond in the intended way to the incentives of the school meal programs is consistent with the programs improving nutrition among disadvantaged school-aged children.

The results of this analysis also have important implications for the debate over eliminating the reduced-price certification category. In addition to increasing access to nutritious meals for children from low-income families, some policymakers and observers have argued that eliminating the reduced-price category would simplify the program, leading to reduced administrative costs and reduced erroneous payments. However, opponents of this change are concerned with increased cost.

Our impact estimates related to students who were eligible for reduced-price meals but who were erroneously certified for free meals speak directly to this debate. The difference between the school meal participation of this group and those who were correctly certified for reduced-price meals is likely to approximate the change in participation that would result from providing free meals to students who are certified for reduced-price meals under the current program.[6] We find that students who are eligible for reduced-price meals but certified for free meals obtain school lunches 13 percentage points more often than students correctly certified for reduced-price meals. However, we do not find significant differences in the school breakfast participation rates of these two groups.[7] These findings suggest that eliminating the reduced-price category would increase school lunch participation, but would not change school breakfast participation.

The conclusions drawn from the natural experiment analysis are quite different from those drawn from nonexperimental analysis of participation rates. As discussed in an earlier section, the regression-adjusted differences in the school lunch and school breakfast participation rates of students certified for free and reduced-price meals are approximately 4 percentage points. If these differences were interpreted as causal effects, the conclusion would be that eliminating the reduced-price category would lead to 4 percentage point increases in school lunch and school breakfast participation. The differing conclusions of the observational and natural experiment approaches confirm the value of the natural experiment approach.

Impact estimates from the natural experiment can be translated into the expected change in the number of meals served that would result from providing free meals to all students certified

[6] Eliminating the reduced-price category might also increase applications for school meal benefits. Estimates from this analysis cannot account for potential changes in application behavior.

[7] The lack of significant differences for the school breakfast program could be related to the increased complexity of the school breakfast participation decision relative to the school lunch participation decision. School breakfast participation is more difficult than lunch participation because it requires arriving at school early. Breakfast participation is also often considered more stigmatized because participants tend to be disadvantaged.

for reduced-price meals under the current system keeping free meal reimbursement rates at their current levels. Given the national total of 488.2 million reduced-price lunches served during SY 2005-2006, our estimates imply an estimated increase of 89.7 million lunches from this policy change.[8] The 95 percent confidence interval around this estimate, which reflects the statistical variability in the estimate, is 17.8 million to 161.5 million lunches. This increase in participation can be considered a benefit of eliminating the reduced-price category, because it reflects students' increased access to nutritious meals. With 154.2 million reduced-price breakfasts served during SY 2005-2006, the point estimate for the change in meals served for the SBP is 6.4 million breakfasts, with a confidence interval of -106.1 million to 118.8 million breakfasts.

There are two ways that costs would increase as a result of eliminating the reduced price category. First, all meals served to students certified for reduced price meals under the current program rules would be reimbursed at a higher rate. Second, reimbursements would increase because students certified for reduced price meals under current program rules would elect to receive more meals if they were instead certified for free meals. Estimates of the cost of eliminating the reduced-price category can also be derived from our estimated changes in meals served.

Under the current program rules, reduced-price lunches are reimbursed at $0.40 less than free lunches. Applying this amount to the 488.2 million lunches received by students certified for reduced price meal under current program rules would cost $195.3 million. The average free school lunch is reimbursed at $2.33, plus a $0.1927 per meal reimbursement for the value of

[8] Estimates of the number of reduced-price meals served come from the FNS national data file (Version 8.2 Public Use).

commodities.[9] Applying these amounts to the estimated 89.7 million increase in the number of lunches served associated with eliminating the reduced price category yields an increase in reimbursements of $226.2 million, with a 95 percent confidence interval of $44.9 million to $407.3 million. Thus, the total cost of eliminating the reduced price category for the NSLP would be $421.5 million, with a 95 percent confidence interval of $240.2 million to $602.6 million.

Reduced-price breakfasts are reimbursed at $0.30 less than free breakfasts. Applying this amount to the 154.3 million breakfasts served to students certified for reduced price meals under the current program rules would cost $46.3 million. The average free breakfast is reimbursed at $1.42.[10] Applying this amount to the estimated 6.4 million breakfast increase associated with eliminating the reduced price category leads to a cost increase of $9.1 million, with a 95 percent confidence interval of -$150.9 to $169.0 million. The total cost of eliminating the reduced price category for the SBP is then $55.3 million, with a 95 percent confidence interval of -$104.67 million to $215.3 million. Based on these figures, the overall estimated cost of this policy change across the NSLP and SBP is $476.8 million. When deciding whether to eliminate the reduced-price meal category, policymakers should weigh these cost estimates against the benefits of increased access discussed above, along with other benefits that are beyond the scope of this study, such as reduced administrative costs.

[9] The regular NSLP reimbursement rate is $2.32, while the rate is $2.34 in schools with more than 60 percent of students certified for free or reduced price meals. The average reimbursement rate is based on 51 percent of reimbursed meals receiving the additional two cent reimbursement (FNS national data file).

[10] The regular SBP reimbursement is $1.27, while the rate is $1.51 in severe needs schools. The average reimbursement rate is based on 64 percent of reimbursed meals being served in severe needs schools (FNS national data file).

IV. COMPARISONS OF PARENT-REPORTED PARTICIPATION AND ADMINISTRATIVE RECORDS

A reliable measure of school meal program participation is critical for any study examining student participation in the National School Lunch Program (NSLP) or School Breakfast Program (SBP). However, the data available to researchers on school meal program participation is often limited or incomplete. Researchers have often relied on parent- or student-reported data to measure student participation in the NSLP and SBP, but these measures are typically based on data collected at a single point in time, either referring to a single day or summarizing usual participation for a longer period, and are subject to recall error.

This chapter examines how well parent reports of NSLP and SBP participation during a short time period among students certified to receive free and reduced-price meals represent actual school meal consumption by certified students over a longer period, as determined from school administrative records. Section A provides background on measures of participation used by researchers; Section B describes the measures and methodologies used in this chapter. Section C presents findings related to comparisons of aggregate participation rates; Section D presents findings related to individual-level comparisons, including whether there is variation by student and household characteristics in how well parent reports for a day or week capture usual annual or monthly participation. Section E discusses how the factors found to be associated with participation differ depending on which measure of participation is used. Supplemental tables related to comparisons of parent-reported and administrative records data are included in the appendixes.

Key Findings:

- Measures of NSLP and SBP participation based on parent reports for a short time period overstate actual participation over longer periods among students certified to receive free or reduced-price meals. These differences might be due to differences in the data source or the time period of the measures.
- Parent reports are better estimates of longer-term participation in the NSLP than in the SBP.
- Parent reports on school meal program participation for a day or week provide better estimates of participation during the relevant month than of annual participation.
- Compared to parents of middle and high school students, parents of elementary school students report NSLP participation rates for a week that are closer to their children's actual annual participation.

A. BACKGROUND

A reliable measure of participation is necessary for any study examining rates of student participation in school meal programs, factors associated with participation, or other related issues. Some studies use certification to receive free or reduced-price meals as a proxy for participation in the NSLP or SBP, but such measures do not capture any information on whether, and how often, students actually obtain school meals. In addition, such measures entirely ignore participation by students who pay full price for NSLP and SBP meals. As explained in Chapter I, this report focuses on actual participation, defined as receipt of a reimbursable school meal.

Having detailed student-level data on actual daily participation over the course of the school year would be ideal, but collecting such data can be prohibitively expensive. Although districts are required by the Food and Nutrition Service (FNS) to track student participation in the NSLP and SBP, they do not necessarily do so at the student level.[1] Among those that do keep such student-level data, each district uses its own formats and storage procedures, making collecting and combining such data across districts extremely burdensome. Although many school districts

[1] Although most districts keep student-level data on daily participation, maintaining counts of participants by certification status is sufficient to meet FNS requirements.

use electronic systems for tracking school meal counts, these systems cannot always produce data files that are useful to researchers. The recent Access, Participation, Eligibility, and Certification (APEC) study found that only about a third of the 87 school food authorities (SFAs) in a nationally representative sample were able to provide student-level participation data electronically, although many of the remaining districts submitted printouts from electronic systems. Even the data submitted electronically required considerable processing to convert the data to a useful format and render it comparable across districts.

Thus, researchers have often relied on parent- or student-reported data to measure student participation in the NSLP and SBP. This information can be collected with relative ease, particularly in studies that require interviews of parents or students to collect data on related issues. However, as noted by Gleason et al. (2004), these types of measures of participation are likely subject to greater error than are measures based on administrative data. Both parent and student reports are subject to recall error when reporting on participation on a certain day, and asking them to report "usual" participation requires them to summarize behavior over the entire school year, which could lead to inaccuracies. Also, parents might simply not know whether their children actually participated or not—for example, they might not clearly distinguish à la carte purchases from purchases counted as reimbursable school meals, or children might actively mislead their parents about getting school lunches.[2] However, collecting data from students themselves can be more difficult, because parent consent is often required before interviewing minors and very young children are not likely to be reliable survey respondents.

In addition, student- or parent-reported measures typically focus either on "usual" program participation or on participation during a single school day or week, because collecting data on

[2] Parent reports on the participation of older students might be particularly prone to error, as older students typically have more autonomy in their school meal participation decisions.

longer periods would be overly burdensome to the respondents. For example, the 2004 Panel Survey of Income and Program Participation (SIPP) asked students ages 15 and older and parents of younger children if the students usually get NSLP and SBP meals (http://www.census.gov/sipp/). The 2007-2008 National Health and Nutrition Examination Survey (NHANES) (http://www.cdc.gov/nchs/nhanes.htm) and the Evaluation of the NSLP Application/Verification Pilot Projects (Gleason et al. 2004) both collected data from parents on the number of times in a week their children usually had school meals. The Early Childhood Longitudinal Study Kindergarten Cohort (ECLS-K) asked parents both whether their children usually received school meals and how many school meals the student received during a particular week (http://nces.ed.gov/ecls/kindergarten.asp). The 1994-1996/1998 Continuing Survey of Food Intakes by Individuals (CSFII) (http://www.ars.usda.gov/Services/docs.htm?docid=14392) and the School Nutrition Dietary Assessment Study (SNDA-III) (Gordon et al. 2007b) asked how many times per week children usually received school breakfasts/lunches; it also collected dietary intake data that could be used to construct a measure of participation on a target day. As described earlier in this report, the APEC study asked parents whether their children participated on a target day and on each day during a target week (in addition to collecting administrative records data). The series of questions on participation in the APEC household survey was more detailed than the questions asked in many other surveys. It asked first whether the child attended school each day, then whether the child ate breakfast or lunch on each day he or she attended, and whether it was a school meal or something else.[3]

[3] The instrument provided a definition of what a school meal is, such as "By school lunch we mean the meal received from the School Lunch Program which consists of a set of food items from the menu that were either free or, if paid for, was purchased for a single price, as opposed to individual foods that are priced and bought separately."

Given the prevalence of parent reports as the basis for research on school meal participation, it is important to understand how closely estimates of participation developed from parent-reported data collected at one point in time match actual participation over a longer period. Past studies have acknowledged the limitations of parent-reported measures of participation, and some have examined their reliability by comparing them to other measures. This previous research indicates that parents typically overestimate their children's true levels of participation. For example, the Evaluation of the NSLP Application/Verification Pilot Projects compared district-level participation rates based on administrative data on the number of reimbursable meals claimed by SFAs to aggregated rates of NSLP participation based on parents' reports and found that the parent-reported measures indicated higher levels of participation than did measures based on administrative records (Gleason et al. 2004). Two other studies found substantially higher rates of participation when estimates were based on parental reports of usual participation than when based on foods consumed from the school cafeteria on a given day (Burghardt et al. 1993; Gleason and Suitor 2001). The SNDA-III study asked both children and their parents about participation in the NSLP and SBP and found that parents' reports were consistently higher than their children's (Gordon et al. 2007b).

However, none of these studies have been able to compare individual-level data from both administrative records and parent reports. Some compared parental reports to student reports (sometimes derived from food intake diaries, potentially introducing another type of measurement error), rather than to administrative records. Although Gleason et al. (2004) used administrative records data on participation, those data were aggregated to the district level. Thus, that study could not explore how parent-reported measures compared to administrative records at the individual level, nor could it examine which student-level characteristics were related to how well measures based on parent reports captured usual participation.

The current report does both, using nationally representative data collected in the APEC study, which includes detailed administrative data on the participation of most sample members in the NSLP and SBP for the entire school year, along with information from parent surveys. This data set provides a unique opportunity to test the reliability of parent-reported participation data at the individual level. In addition, it enables us to assess how closely measures based on parent reports correspond to usual participation over a longer time period varies according to student or family attributes.

Unfortunately, the administrative data measures of participation used in the APEC study cover different lengths of time than the parent reports, so differences between the two types of measures could be due to either the data source or the time period.[4] However, if researchers are using parent reports for short time periods as a proxy for actual participation over the school year, it is important to understand how closely those measures match, regardless of the cause of the differences. The analyses in this chapter should not be considered simple comparisons of parent reports to administrative records, but comparisons of one estimate of participation—based on parent-reported data on a short time period—to actual participation over a longer period.

B. METHODOLOGY

1. Measures

To address the set of research questions (described in Chapter I) related to the comparison of administrative data to parent reports, we created (1) estimates of student-level participation rates

[4] The raw administrative records data collected for the APEC study were disaggregated by day as well as by student, but the data were aggregated across days during the processing. As mentioned previously, individual-level data from districts were burdensome to process, and aggregated monthly measures were adequate to meet the goals of the APEC study. With additional resources and effort, it would be possible to go back to the disaggregated raw data and compute measures of participation based on administrative data for the day and week of parent reports. However, that effort is beyond the scope of the current project.

from the APEC household survey data and (2) actual student-level participation rates from the administrative records data.

Participation Based on Parent Reports. The APEC household survey asked parents a series of questions, as described above, about whether their children obtained a school breakfast and/or lunch on the most recent school day, and on each day during the most recently completed week.[5] From their responses to these questions, we created two different estimates of student-level participation rates from the APEC household survey data—one based on parent reports for the most-recent school day and one based on parent reports for each day of the most recent full week of school.

- ***Parent Reports for a Target Day.*** The estimated participation rate based on a single school day is a binary measure, indicating that the student either participated (that is, a participation rate of 100 percent) or did not (that is, a participation rate of zero percent). Thus, participation rate estimates for a day are necessarily concentrated in the tails of the distribution. As shown in Table IV.1, 78 percent of students certified to receive free and reduced-price meals ate a school lunch that day, according to their parents, and the remaining 22 percent did not; 43 percent of students ate a school breakfast, while 57 percent did not.
- ***Parent Reports for a Target Week.*** The participation rate based on parent reports for a week captures somewhat more variation.[6] However, estimates based on a week still exhibit clustering in the tails, because many students have a usual plan for a given meal—either they have the school meal almost every day (75 percent do this for lunch and 41 percent for breakfast), or they almost never have a school meal (5 percent do this for lunch and 41 percent for breakfast).[7] Because the week measure requires parents to report on participation several days in the past, it might be more susceptible to recall error than the day measure.

[5] For days parents reported that their children did not attend school, the students were counted as not participating in the NSLP and SBP. Treating absences this way is consistent with the administrative records, which do not distinguish between nonparticipation due to absence and nonparticipation for other reasons.

[6] For most students, the week measure is based on five days, and thus indicates participation rates of 0, 20, 40, 60, 80, or 100 percent. In cases in which parent-reported data were missing for one or more days during the week, this measure was computed based on the number of days of nonmissing data.

[7] Throughout this chapter, "almost every day" is used to mean more than 80 percent of the school days during the reporting period; "almost never" is used to mean fewer than 20 percent of school days.

TABLE IV.1

COMPARISON OF AGGREGATE NSLP AND SBP PARTICIPATION AMONG FREE AND REDUCED-PRICE CERTIFIED STUDENTS, BASED ON PARENT REPORTS AND ADMINISTRATIVE RECORDS

	Parent-Reported Data		Administrative Records Data	
	Based on Previous Day	Based on Previous Week	For the Month Covered by Parent Reports	For the Year
Percentage of School Days Participated in the NSLP (n = 2,139)				
0	22.18	4.45	7.86	1.81
	(2.17)	(0.93)	(2.65)	(0.56)
1 to 20	--	0.91	3.47	4.90
		(0.26)	(0.77)	(0.85)
21 to 40	--	2.91	3.32	7.22
		(0.48)	(0.70)	(0.94)
41 to 60	--	4.12	5.64	15.08
		(0.49)	(0.58)	(2.52)
61 to 80	--	12.89	16.15	24.66
		(1.98)	(1.68)	(2.08)
81 to 100	77.82	74.73	63.56	46.33
	(2.17)	(2.04)	(2.69)	(3.44)
Mean Percentage of School Days Participated in the NSLP	77.82	88.79	74.65	69.81
	(2.17)	(1.00)	(2.53)	(1.68)
Percentage of School Days Participated in the SBP (n = 1,840)				
0	57.11	37.80	35.88	18.46
	(2.42)	(2.02)	(0.03)	(2.07)
1 to 20	--	3.45	13.12	26.50
		(0.53)	(1.71)	(1.60)
21 to 40	--	4.00	10.08	15.32
		(0.55)	(1.27)	(0.96)
41 to 60	--	4.50	8.76	14.91
		(0.61)	(0.86)	(1.46)
61 to 80	--	8.90	12.77	14.25
		(1.36)	(1.69)	(1.37)
81 to 100	42.89	41.35	19.38	10.56
	(2.42)	(1.99)	(2.15)	(1.85)
Mean Percentage of School Days Participated in the SBP	42.89	53.38	35.60	33.25
	(2.42)	(2.01)	(2.15)	(1.88)

Source: APEC study data.

Note: All figures are weighted. Standard errors, presented in parentheses, account for clustering in the survey design.

APEC = Access, Participation, Eligibility, and Certification; NSLP = National School Lunch Program; SBP = School Breakfast Program.

Most students who are reported to have obtained a school meal on the previous day are also reported to have obtained a meal almost every day during the most-recently completed week. However, many of those reported to have *not* had the school meal on the previous day are still reported to have obtained school meals on multiple days during the previous week. Thus, parent reports for a day yield lower estimated participation rates on average (78 percent for lunch and 43 percent for breakfast) than do those for a week (89 percent for lunch and 53 percent for breakfast).

Participation Based on Administrative Records. The student-level administrative records data discussed in earlier chapters provide our measures of actual NSLP and SBP participation. The APEC study collected detailed administrative records data from SFAs on the number of school breakfasts and lunches obtained by each student during each month of the 2005–2006 school year. From this data, we constructed measures of each student's typical number of meals obtained per eating opportunity, both for the entire school year and for a target month.[8]

- ***Administrative Records for a Target Month.*** This measure relies on information from administrative records on the student's participation during the month that includes the day and week about which the parent reported in the household survey. It was constructed by dividing the number of reimbursable meals recorded for the student during the month by the number of serving days in the month.
- ***Administrative Records for the Year.*** This measure of actual school meal program participation relies on administrative records data for the entire school year. It was created by dividing the number of reimbursable meals recorded for the student over the school year by the number of serving days in the year.

Researchers using parent-reported data on NSLP and SBP participation are often attempting to estimate usual participation over the entire school year, rather than for a shorter period.

[8] For students who were enrolled in the district for only part of the year, participation rates are computed based on the time during which they were enrolled.

However, as parent-reported data are most often collected at a single point in time, comparisons to annual participation rates might suffer due to variation in participation over the course of the school year. Data from the APEC study show that parent reports on their children's participation are fairly consistent over the year, as are aggregate actual participation rates, but that actual monthly participation for individuals, as captured by administrative records data, can vary widely. (Additional detail on how our measures of participation vary over the year can be found in Appendix C.)

Despite the consistency of aggregate monthly participation rates over the course of the school year, the administrative records data indicate higher aggregate rates of participation during the target month, on average, compared to annual participation rates (Table IV.1). This coincidence that participation tended to be higher in the month in which the parent was surveyed should be kept in mind when comparing the two administrative records measures to the parent-reported measures (see Section C).

As noted above, because both administrative records measures cover a longer time period than either of the parent-reported measures, comparing parent reports to administrative records confounds two possible sources of differences: (1) reporting error and (2) actual participation differences between time periods.[9] The administrative data measures from the APEC study are not sufficiently detailed to enable comparisons of parent reports to administrative data for the same time period, which would be necessary to determine whether the report of participation on the previous day (or week) for a given child is accurate for that day (or week). Thus, discussions of how closely estimates of participation based on parent reports for a day or week match actual

[9] One might expect the latter type of difference to be greater for the measure based on a single day, because the day measure is binary and thus cannot capture any variation in a student's participation over time.

participation for the month or year should not be misinterpreted as the accuracy of parent reports for the specific time period for which they were reporting.

2. Analysis Methods

To address the set of questions related to how closely parent-reported participation for a short period matches actual participation over a longer period, we compare estimates of participation based on parent reports for a day and week to actual participation for a month and year based on administrative records data. In particular, we conduct three types of comparisons, each of which is the focus of one of the subsections in this chapter: (1) comparisons of different measures of aggregate participation rates, (2) comparisons of different measures for individual students, (3) comparisons of factors associated with different measures of participation.

As in the earlier chapters of this report, all analyses presented here are restricted to students certified to receive free and reduced-price meals. In addition, as all analyses in this chapter involve comparisons of household survey to administrative records data, the sample is further restricted to only those students for whom data is available from both sources. This reduces the sample size to 2,139 for analyses related to the NSLP and to 1,840 for analyses related to the SBP. As in the preceding chapters, all analyses presented here are weighted to account for oversampling and nonresponse, and the estimation of standard errors accounts for the multistage, clustered sample design in the APEC study.

Aggregate Participation Rates. To explore the effect that using parent-reported data for a short time period has on estimates of aggregate participation rates for a longer period, we compute the aggregate participation rates using each of the four measures of participation described above (parent reports for a day, parent reports for a week, administrative records for a month, and administrative records for a year), then compare those based on parent reports to those based on administrative records data. We examine both the distribution (to see, for

example, what proportion of students never participated in the NSLP and SBP and what proportion almost always did) and the mean percentage of school days a student participated during the relevant time period for each data source.

Participation of Individual Students. In comparisons of aggregate rates, under-reports by some parents might offset over-reports by others. To determine how well individual parents' reports for a given day or week match their children's participation for the month or year, we compare the parent-reported and actual participation rates for each individual student, then create a variable indicating how much the parent-reported measure overestimated or underestimated participation.

In addition, comparisons of the participation rate measures for individual students enable us to explore whether the parent-reported short-term measures are closer to the longer-term administrative records measures for some subgroups than for others. To do this, we first conduct univariate analyses, examining how well the different participation measures match for individuals within particular subgroups, defined by student or school characteristics. We then run ordinary least squares (OLS) regressions in which the dependent variable is the number of percentage points difference between the measures. Independent variables include student demographic and socioeconomic characteristics and characteristics of the schools and meal programs.

Factors Associated with Participation. To examine the effect that using different participation measures would have on which school and student characteristics are found to be associated with participation in the NSLP and SBP, we run versions of the main regression model presented in Chapter II using each of our parent-reported participation measures as the dependent variable. We then compare those results to the results from similar regressions that used measures of participation based on administrative records data as the dependent variable.

C. COMPARISONS OF ESTIMATES BASED ON PARENT REPORTS TO AGGREGATE ACTUAL PARTICIPATION RATES

This section presents findings related to comparisons of aggregate participation rates. We first compare estimated NSLP and SBP participation rates based on parent reports for a day and for a week to monthly rates based on administrative records, then we compare those same estimates to annual participation rates.

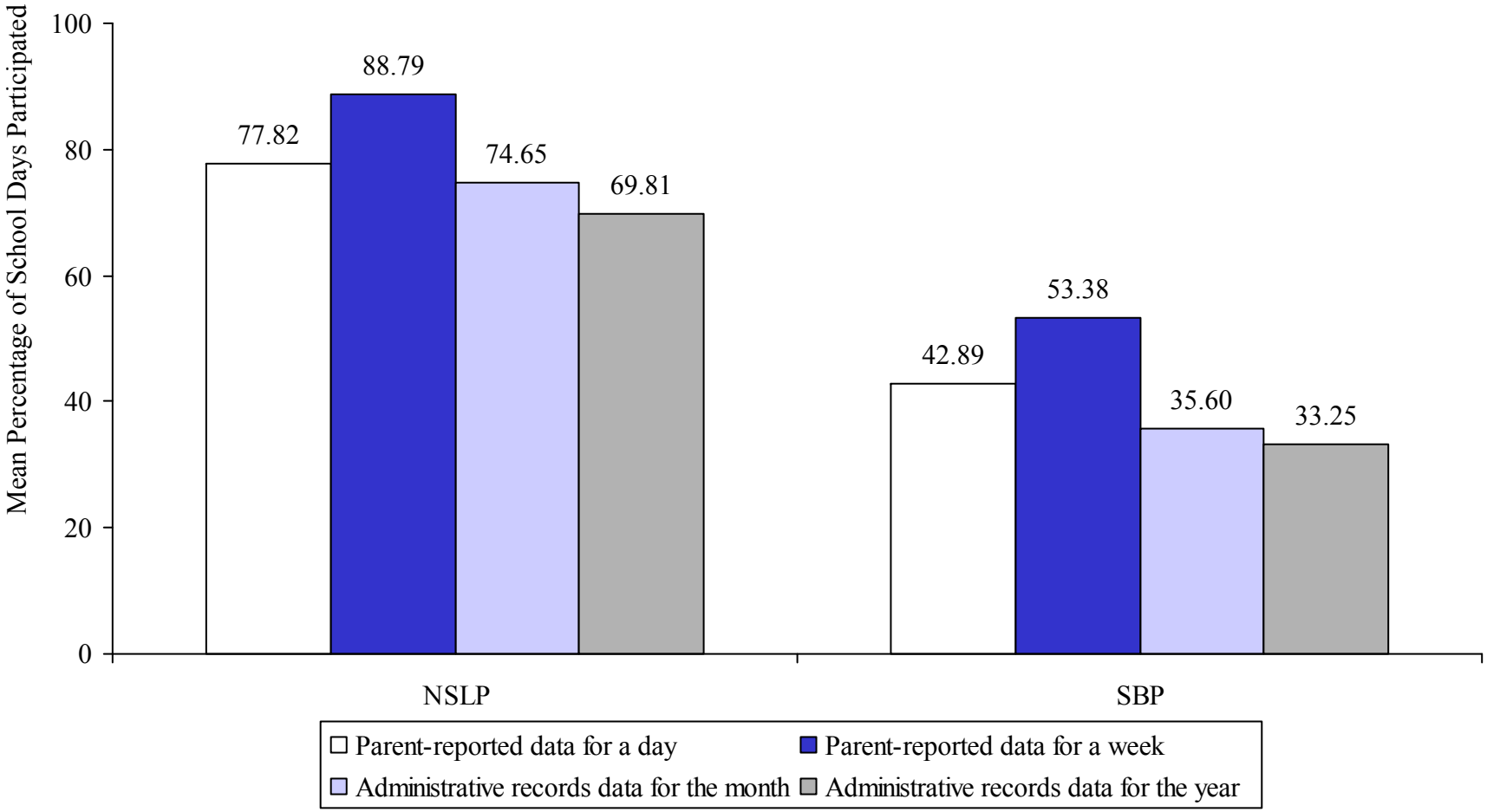
1. Monthly Rates

Parent reports for a day or week yield higher estimates of the number of usual participants in the NSLP and SBP than do the administrative records for the month. For example, administrative records data indicate that 64 percent of students certified to receive free and reduced-price meals ate a school lunch almost every day (that is, more than 80 percent of school days) during the month for which parents reported on their children's participation, while parents reported that 75 percent ate a school lunch almost every day during a week and 78 percent ate a school lunch on the prior day (Table IV.1). The difference is even greater for the SBP—parent reports indicate that 43 percent of certified students had a school breakfast on the prior school day and 41 percent had a school breakfast almost every day during the prior week, while administrative records indicate that slightly fewer than 20 percent ate school breakfast almost every day during the month. It is possible that the higher parent-reported rates are due to parents mistakenly assuming that their children's usual behavior happens every day of the week, and not remembering—or perhaps being unaware of—exceptions to the general pattern.

At the aggregate level, as shown in Figure IV.1, although parent-reported measures consistently yield at least somewhat higher estimates of mean participation rates than

FIGURE IV.1

COMPARISON OF AGGREGATE NSLP AND SBP PARTICIPATION RATES AMONG CERTIFIED STUDENTS BASED ON PARENT REPORTS AND ADMINISTRATIVE RECORDS



Source: APEC study data.
Note: All figures are weighted.

administrative records indicate, reports for a single day are closer to the actual monthly rates than are parent reports for an entire week. According to administrative records data, the average NSLP participation rate among certified student is 75 percent during the month covered by parent reports. At 78 percent, the estimated participation rate based on parent reports for a day is only slightly higher, while the estimated rate based on parent reports for a week is considerably higher, at 89 percent. The average SBP participation rate based on administrative records data for the month is 36 percent, while the estimate based on parent reports for a week is 53 percent and the estimate based on a day is 43 percent.

2. Annual Rates

Aggregate annual NSLP and SBP participation rates are somewhat lower than those rates for the month covered by the parent survey.[10] Thus, because parent reports tend to overestimate monthly participation rates, they overestimate participation rates for the year by a larger amount. For example, the annual NSLP participation rate based on administrative records for students certified to receive free and reduced-price meals is 70 percent overall, compared to 75 percent for the month based on administrative records, 89 percent based on parent reports for a week, and 78 percent based on parent reports for a day (Figure IV.1). Administrative records data indicate an average annual SBP participation rate of 33 percent, compared to a monthly rate of 36 percent, and parent-reported estimates of 53 percent based on a week and 43 percent based on a single day.

The differences are even greater when examining usual participation rather than mean participation rates (Table IV.1). Administrative records data indicate that 46 percent of certified

[10] As noted in Section A, the difference between the month and year measures is merely an artifact of the APEC data, because participation coincidentally tended to be higher during the month in which a parent was surveyed.

students had a school lunch almost every day over the course of the year, while 64 percent did so during the target month. Parent reports suggest that 75 percent had a school lunch almost every day during the target week, and 78 percent had a school lunch on the prior day. For breakfast, the annual data indicate 11 percent of students participated in the SBP almost every day, while the monthly data show 19 percent did, and estimates from parent reports suggest 41 percent participated almost every day during the target week and 43 percent did on the prior day. This progression is not surprising, because longer time periods allow more opportunity for variation in participation.

D. COMPARISONS OF ESTIMATES BASED ON PARENT REPORTS TO ACTUAL PARTICIPATION FOR INDIVIDUAL STUDENTS

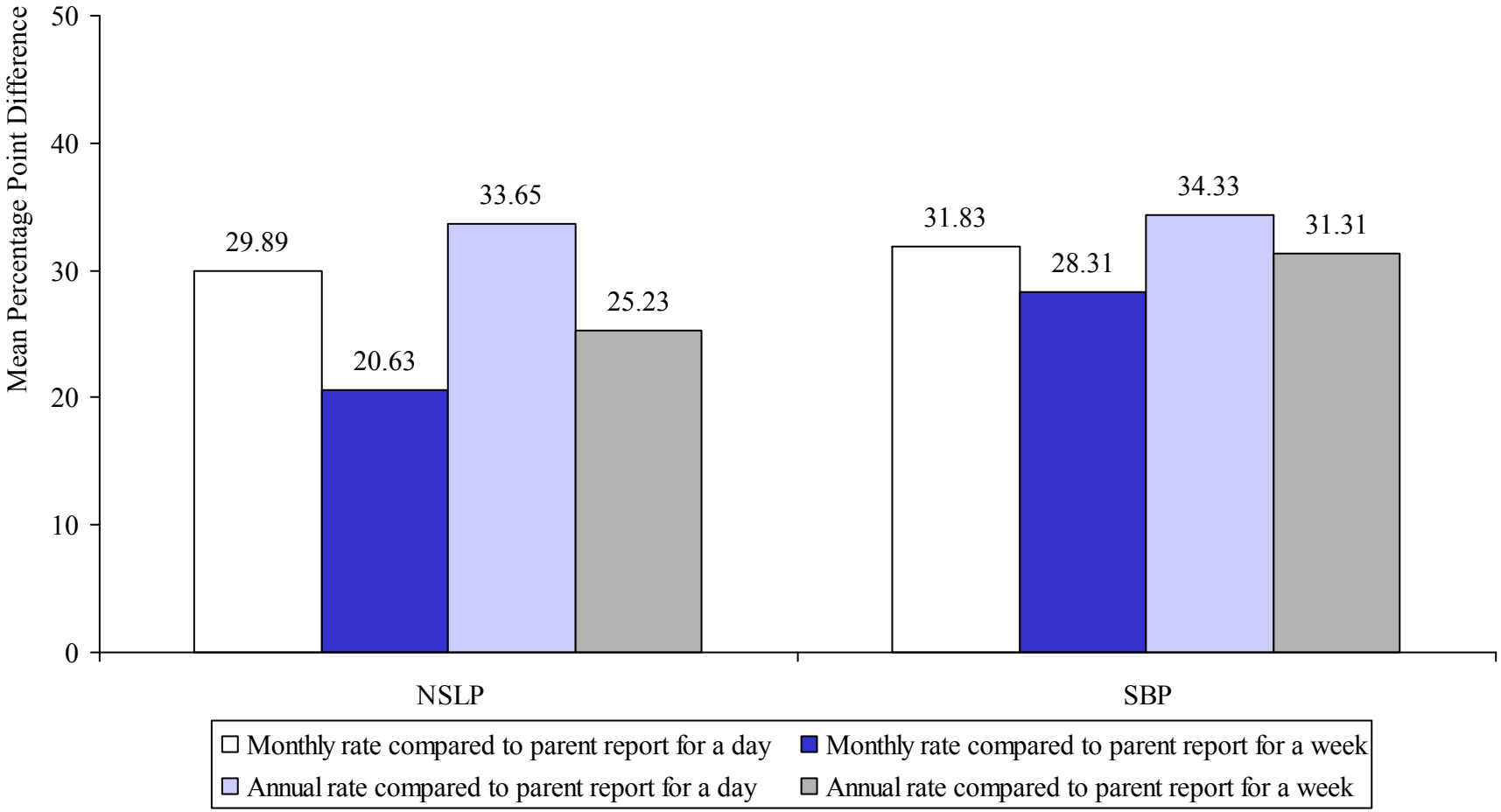
The previous section focused on aggregated participation data; this section presents findings related to how well measures based on parent reports for a day or week capture usual annual or monthly participation at the individual level, including how the similarity of the measures varies by student and household characteristics. Understanding this issue is important for researchers conducting individual-level analyses that involve participation, such as exploring child or family characteristics associated with participation. As noted above, because each of the comparisons we make involves differences in both data source (parent report or administrative records) and time period (day, week, month, or year), we are assessing the strength of a particular parent-reported participation measure as a proxy for actual participation over a longer time period, not simply the ability of parents to report without error.

1. Key Overall Findings

Individual-level comparisons, like those of aggregate participation rates, show sizeable differences between parent-reported measures for short periods and actual participation over longer periods. As shown in Figure IV.2, measures that cover more similar time periods are

FIGURE IV.2

INDIVIDUAL-LEVEL DIFFERENCES BETWEEN MONTHLY AND ANNUAL NSLP AND SBP PARTICIPATION RATES FOR CERTIFIED STUDENTS, AND ESTIMATES BASED ON PARENTS' REPORTS OF THEIR CHILDREN'S PARTICIPATION FOR A TARGET DAY AND WEEK



Source: APEC study data.
Note: All figures are weighted.

found to be closer to each other: individual-level estimates based on parent-reported data for a week are closer to administrative records measures for the month or year than are estimates based on parent reports for a single day, and administrative records for the month are closer to parent-reported data for a day or week than are the entire year's data. For example, comparisons of parent reports to administrative records for individuals found that, on average, rates based on parent reports for a week differ from their certified child's NSLP participation rate during the month by 21 percentage points, while parent reports for a day differ from their child's annual participation rate by an average of 34 percentage points. Individual comparisons of parent reports for a day to actual monthly participation and of parent reports for a week to actual annual participation yielded mean differences in between these two extremes.

It might seem intuitive that comparisons of measures based on more-similar time periods would show more-similar results. However, this intuition did not always hold true when examining measures of aggregate participation rates. For example, although Figure IV.2 shows that parent reports for a week provide a better estimate (compared to reports for a single day) of their child's usual participation during the month, Section C noted that parent reports for a day are a better indicator of *aggregate* participation rates for the month. This apparent inconsistency is due to the fact that the measure based on a single day includes a much larger proportion of extreme underestimates—that is, cases in which the student participated almost every day during the month, but is not reported by his or her parent to have participated on the specific day asked about in the survey and thus has an estimated participation rate of zero percent by that measure. Because the prevalence of extreme *over*estimates is similar in the day and week measures, these extreme underestimates outweigh the overestimates in the day measure to result in a lower overall estimate of the participation rate, which is thus closer to the actual participation rate.

However, the fact that the weekly measure comes closer than the daily measure to matching the monthly measure of individual participation does not necessarily imply that weekly reports are better measures of participation for the relevant week than the daily reports are for the relevant day. As explained previously, the finding might reflect differences in actual participation during the time periods used for each measure, rather than reporting error by parents. It is perhaps not surprising that a measure based on data for a week comes closer to a monthly measure than a measure based on a single day does, because the one-day measure cannot capture any variation in participation over time.

Each type of comparison indicates that parent reports for a day or week yield estimates that are closer to actual participation over longer time periods for the SBP than for the NSLP. However, the patterns of relative similarity across measures are similar for both school meal programs. Parent reports for a week provide estimates of their certified child's SBP participation rate that differ from the child's actual participation rate for the month by an average of 28 percentage points, and parent reports for a day differ from actual monthly participation by 32 percentage points (Figure IV.2). Parents reported SBP participation rates for a week that differ by 31 percentage points from their child's actual participation rate for the year, and reports for a day differ from the annual rate by 34 percentage points, on average.

Overestimates are considerably more common than underestimates in both the NSLP and the SBP (Table IV.2). For example, 40 percent of parent reports for a week overestimate their certified child's annual NSLP participation by more than 20 percentage points, while only 6 percent underestimate it by that margin. Parent reports for a day overestimate annual NSLP participation for 36 percent of children and underestimate it for 19 percent. For the SBP, parent reports for a week overestimate their child's participation for the year in 43 percent of cases and

TABLE IV.2

INDIVIDUAL-LEVEL DIFFERENCES BETWEEN MONTHLY AND ANNUAL NSLP AND SBP PARTICIPATION RATES FOR FREE AND REDUCED-PRICE CERTIFIED STUDENTS, AND ESTIMATES BASED ON PARENTS' REPORTS OF THEIR CHILDREN'S PARTICIPATION FOR A TARGET DAY AND WEEK

	Estimate of Monthly Participation Rate		Estimate of Annual Participation Rate	
	Based on Parent Report for Target Day	Based on Parent Report for Target Week	Based on Parent Report for Target Day	Based on Parent Report for Target Week
NSLP				
Mean absolute value of percentage point difference between estimate and actual participation rate	29.89	20.63	33.65	25.23
	(2.05)	(2.16)	(1.37)	(1.10)
Overestimates	25.76	25.23	26.77	25.81
	(2.76)	(2.88)	(1.48)	(1.34)
Underestimates	71.87	21.69	60.76	23.09
	(2.41)	(2.17)	(2.30)	(1.64)
Percentage of parent reports that:				
Overestimate monthly participation rate:				
By more than 60 percentage points	7.92	8.55	7.72	7.02
	(2.17)	(2.61)	(1.02)	(1.04)
By 21 to 60 percentage points	15.13	15.85	28.57	33.04
	(1.36)	(1.09)	(2.49)	(3.27)
Within 20 percentage points	59.86	70.62	44.75	54.16
	(2.56)	(2.46)	(3.13)	(3.15)
Underestimate monthly participation rate:				
By 21 to 60 percentage points	3.25	4.04	6.08	4.57
	(0.54)	(0.57)	(1.03)	(0.72)
By more than 60 percentage points	13.84	0.94	12.89	1.22
	(2.13)	(0.36)	(1.58)	(0.29)
SBP				
Mean absolute value of percentage point difference between estimate and actual participation rate	31.83	28.31	34.33	31.31
	(1.17)	(1.33)	(0.99)	(1.18)
Overestimates	48.23	43.59	51.06	45.65
	(2.60)	(2.19)	(2.43)	(1.86)
Underestimates	42.86	27.31	29.80	18.48
	(2.15)	(1.80)	(1.78)	(1.32)
Percentage of parent reports that:				
Overestimate annual participation rate:				
By more than 60 percentage points	15.13	16.24	16.80	17.12
	(1.37)	(1.61)	(1.29)	(1.48)
By 21 to 60 percentage points	12.68	19.52	17.89	25.48
	(1.33)	(1.70)	(1.61)	(1.75)
Within 20 percentage points	53.32	56.14	42.72	46.71
	(1.61)	(1.96)	(1.75)	(2.18)

TABLE IV.2 *(continued)*

	Estimate of Monthly Participation Rate		Estimate of Annual Participation Rate	
	Based on Parent Report for Target Day	Based on Parent Report for Target Week	Based on Parent Report for Target Day	Based on Parent Report for Target Week
Underestimate annual participation rate:				
By 21 to 60 percentage points	9.19	5.44	15.46	9.11
	(1.12)	(0.79)	(2.18)	(1.38)
By more than 60 percentage points	9.69	2.67	7.13	1.58
	(1.83)	(0.61)	(1.03)	(0.43)

Source: APEC study data.

Note: All figures are weighted. Standard errors, presented in parentheses, account for clustering in the survey design.

APEC = Access, Participation, Eligibility, and Certification; NSLP = National School Lunch Program; SBP = School Breakfast Program.

underestimate their participation in 11 percent of cases, and parent reports for a day are overestimates for 35 percent of cases and underestimates for 23 percent.

2. Key Subgroup Findings

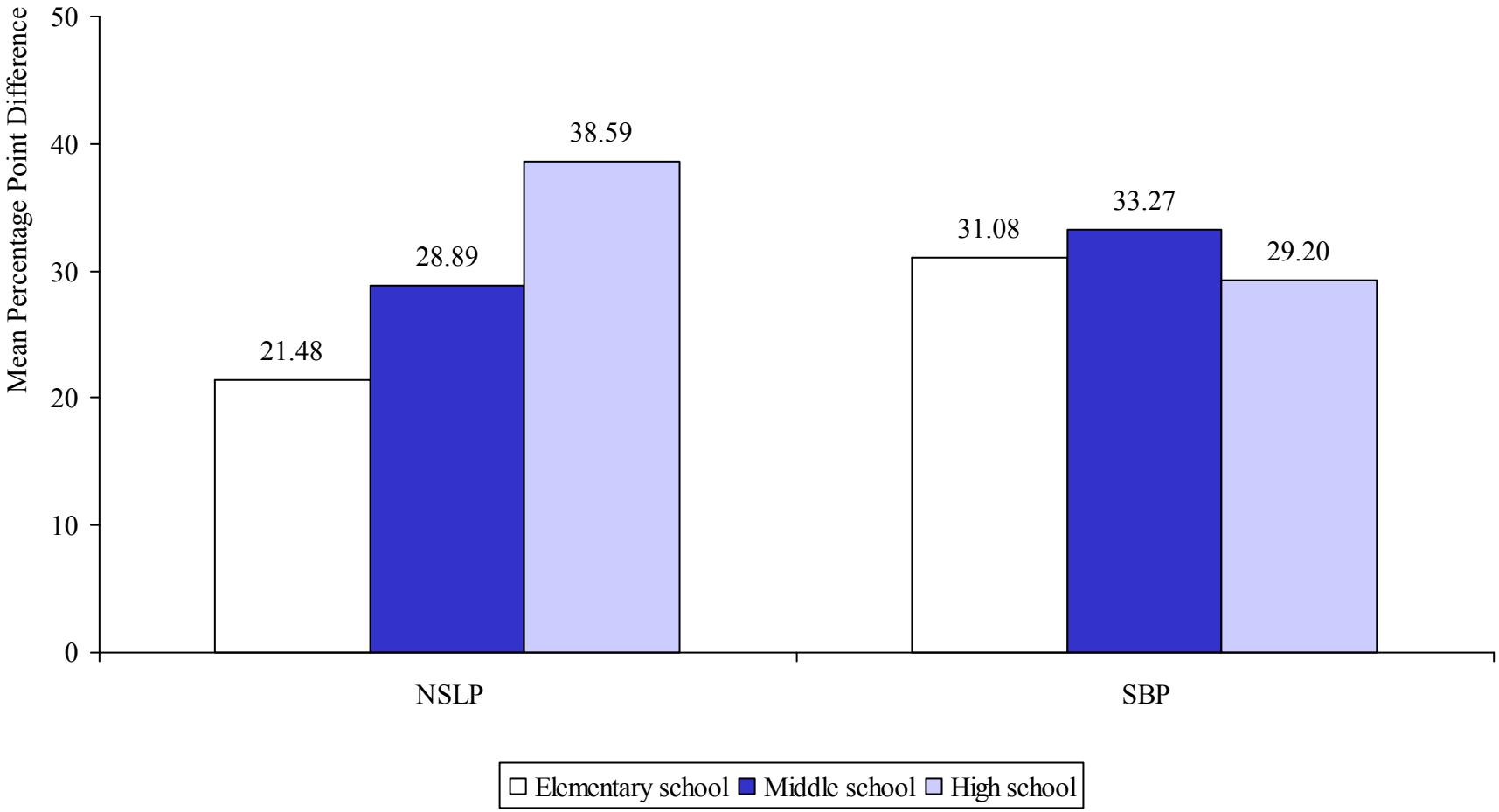
How well parent-reported measures of participation for a day or week capture usual annual or monthly participation can vary for different subgroups of students. In this subsection, we present findings from both univariate and multivariate analyses. Appendix D includes additional results of univariate analyses of individual-level data for subgroups.

Because our measures combine differences between data sources and differences in time periods, our parent-reported measures might be found to be better estimates of participation for subgroups that participate more consistently. This should not be interpreted to imply that parents in those subgroups are necessarily more often correct about their child's participation during the specific time period about which they are reporting; rather, it implies that the measure as a whole comes closer to actual participation over a longer period for those subgroups.

Univariate analyses suggest that measures based on parent reports for a day or week provide better estimates of NSLP participation over a longer time period for some subgroups while providing better estimates of SBP participation for different subgroups. For example, parent reports on NSLP participation for a week are closer to their certified child's actual participation for the year for schools serving younger students (Figure IV.3). In particular, parents of high school students reported information for a week that differed from their child's annual NSLP participation rate by 39 percentage points, on average. In comparison, parent reports for a week differed from actual annual participation rates by an average of 29 percentage points for middle

FIGURE IV.3

INDIVIDUAL-LEVEL DIFFERENCES BETWEEN ANNUAL NSLP AND SBP PARTICIPATION RATES FOR CERTIFIED STUDENTS, AND ESTIMATES BASED ON PARENTS' REPORTS OF THEIR CHILDREN'S PARTICIPATION FOR A TARGET WEEK, BY SCHOOL TYPE



Source: APEC study data.
Note: All figures are weighted.

school students and 21 percentage points for elementary school students.[11] Besides schools serving younger children, parent reports of their child's NSLP participation for a week are also better estimates of annual participation for students in smaller schools (see Table D.4 in Appendix D).

For the SBP, univariate analyses indicate that parent reports for a week provide better estimates of their child's annual participation for those certified to receive reduced-price meals (compared to free meals) and for those in schools in which fewer than half of all students are certified to receive either free or reduced-price meals (see Table D.4). Participation in the SBP tends to be lowest among these groups, and parent reports on a week's SBP participation are closest to actual annual participation for those who never have a school breakfast.

Multivariate analyses also indicate that measures of certified children's NSLP participation based on parent reports for a week provide estimates closer to actual annual participation in schools serving younger students. In particular, parent reports for middle school students differ from annual participation rates by 7 percentage points more (controlling for other differences) than do parent reports for elementary school students, and parent reports for high school students differ by 10 percentage points more (Table IV.3). In schools that use electronic point-of-sale (POS) technology, parents report weekly participation rates that are 13 percentage points closer to annual participation than in other schools. One possible explanation for this finding is that parents in schools with POS technology pay in advance for meals and might be able to view POS data for their child online or receive other updates of participation; thus, they might have more information about how often their child participates than do parents in other schools. In addition,

[11] One possible explanation for this finding is that school cafeterias serving students in higher grades often offer more choices at lunch, including à la carte items, and parents might not be able to differentiate between those foods obtained at school and reimbursable NSLP meals. Older students might also have more autonomy in their school meal participation decision, so their parents do not know what they have for lunch.

TABLE IV.3

FACTORS ASSOCIATED WITH THE DIFFERENCE BETWEEN MEASURES OF STUDENT-LEVEL NSLP AND SBP PARTICIPATION RATES BASED ON PARENT-REPORTS FOR A WEEK AND ACTUAL ANNUAL PARTICIPATION
(Percentages of Eating Occasions)

	NSLP	SBP
Student Characteristics		
Male	0.63	1.02
	(1.71)	(3.27)
African American or Hispanic	2.80	2.41
	(2.66)	(2.71)
Family Characteristics		
Parental Educational Attainment		
High school degree	-1.25	-0.73
	(1.69)	(2.55)
More than high school degree	-1.07	1.11
	(1.83)	(2.86)
Household Income	-0.21	0.51
	(0.50)	(0.78)
Employed Household Member	-0.01	-2.57
	(1.74)	(4.39)
Number of Children	0.17	-1.82**
	(0.55)	(0.81)
Experienced Food Insecurity Outcome	1.22	2.40
	(1.55)	(1.87)
Attitudes Toward School Meals		
Student's Satisfaction with School Meal Taste		
Very satisfied	-0.51	3.53
	(2.48)	(3.50)
Somewhat satisfied	-1.70	-2.50
	(2.41)	(2.91)
School Characteristics		
School Type		
Middle school	6.58**	-0.25
	(2.81)	(3.01)
High school	10.48*	3.27
	(5.79)	(3.88)
Percentage of Student Body Certified for Free/Reduced-Price Meals	0.06	0.07
	(0.06)	0.11
Enrollment		
801 to 1,200	0.45	-9.50***
	(3.07)	(2.81)
Greater than 1,200	2.32	-10.37**
	(6.00)	(4.30)
Located in Urban Area	1.52	4.39
	(2.80)	(4.09)
School Meal Program Implementation Characteristics		
Uses Direct Certification	-0.19	0.55
	(2.88)	(4.97)

TABLE IV.3 *(continued)*

	NSLP	SBP
Uses Electronic Point-of-Sale Technology	-13.01**	1.02
	(5.36)	(4.44)
Constant	22.98***	17.84*
	(7.39)	(9.33)
Sample Size	**2,029**	**1,773**

Source: APEC study data.

Notes: Figures are coefficient estimates from OLS regressions in which the dependent variable is the difference between measures of participation based on parent reports and on actual annual participation based on administrative records. Both participation rates are expressed as the percentage of meals received per eating occasion. All figures are weighted. Standard errors, presented in parentheses, account for clustering in the survey design.

*Significantly different from zero at the .10 level, two-tailed test.
**Significantly different from zero at the .05 level, two-tailed test.
***Significantly different from zero at the .01 level, two-tailed test.

APEC = Access, Participation, Eligibility, and Certification; NSLP = National School Lunch Program; OLS = ordinary least squares; SBP = School Breakfast Program.

when a parent puts money into a POS account directly, children cannot spend the money elsewhere.[12] Of course, these factors would not affect those certified to receive free meals.

Multivariate analyses of SBP participation found that parents who have more children in their household tend to provide reports for a week that more closely match annual rates of SBP participation than do parents with fewer children, controlling for other differences. In addition, parents whose children attend larger schools report a week's SBP participation that is closer to their children's actual annual participation than those at smaller schools.

E. FACTORS ASSOCIATED WITH PARTICIPATION

Given the concerns about how well parent-reported NSLP and SBP participation data for a day or week estimate actual participation for a longer time period, relying on measures based on parent reports on a short time period to explore factors associated with participation over a longer period could potentially lead researchers to miss some interesting relationships, or to find spurious ones. This section summarizes key findings about how the student and institutional characteristics found to be associated with participation differ depending on which measure of participation is used. Additional details regarding factors associated with parent-reported and actual participation can be found in Appendix E. Because the measures of participation differ both in terms of data source and time period, differences in the factors associated with each measure could be due to either the time period or the data source.

Comparing the results of multivariate analyses using different measures of participation yields somewhat mixed results. Students' satisfaction with school meals is found to be positively associated with actual participation in the NSLP and SBP and with both measures of participation based on parent reports. For example, according to parent reports for a week,

[12] In some schools, children might be able to spend these funds on à la carte foods sold in the school cafeteria.

certified students who are very satisfied with the taste of school meals are 16 percentage points more likely to obtain an NSLP lunch than those who are not satisfied; according to administrative records for the year, they are 8 percentage points more likely to obtain a school lunch. School level also is associated with the administrative records and both parent-reported measures of participation in the NSLP, and with the administrative records and the parent-reported measure of participation based on a day—but not parent reports for a week—for the SBP.

However, several other factors found to be associated with actual participation are not associated with parent reports, and vice versa. For example, food insecurity outcomes (such as using a food pantry or a public food assistance program) are found to be positively associated with one measure of parent-reported participation in the NSLP and SBP, but not associated with the other parent-reported measure or with participation measures based on administrative data. Parent reports for a week indicate that students in households that have experienced food insecurity outcomes are 9 percentage points more likely to obtain an SBP breakfast than other students, but neither parent reports for a day nor administrative records for the year show a statistically significant association between food insecurity and SBP participation.

Appendix E includes tables presenting the complete results of these regressions, along with additional discussion of which factors were found to be associated with both actual participation over the school year and parent-reported participation for shorter time periods, and which relationships were inconsistent across measures.

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APPENDIX A

SUPPLEMENTAL TABLES FOR THE ANALYSIS OF FACTORS RELATED TO SCHOOL MEAL PARTICIPATION

This appendix presents supplemental tables for the analyses presented in Chapter II that assess factors related to school meal participation. Table A.1 provides mean student-level NSLP participation rates for different subgroups, by certification category. Table A.2 provides analogous information for student-level SBP participation rates. Tables A.3 and A.4 present school-level NSLP and SBP participation rates for different subgroups, by certification category. Relevant findings from these tables are discussed in Chapter II.

TABLE A.1

STUDENT-LEVEL NSLP PARTICIPATION RATES BASED ON ADMINISTRATIVE RECORDS, BY STUDENT MEAL PROGRAM CERTIFICATION CATEGORY
(Meals Per Eating Occasion For Full School Year)

	All Free and Reduced-Price Certified	Free Certified	Reduced-Price Certified	Denied Applicant
Overall	69.37	69.91	66.95	56.56
	(1.70)	(1.75)	(2.04)	(4.02)
Student Characteristics				
Gender				
Female	67.83	68.62	63.89	53.42
	(2.14)	(2.22)	(2.91)	(4.63)
Male	70.77*	71.10	69.38	58.39
	(1.60)	(1.68)	(2.30)	(4.61)
African American or Hispanic				
No	67.26	68.51	63.45	55.29
	(1.94)	(2.10)	(2.60)	(5.73)
Yes	70.28	70.44	69.38*	57.51
	(1.98)	(2.00)	(2.68)	(4.51)
Grade				
Pre-K or kindergarten	70.82	70.98	70.23	54.08
	(3.41)	(3.64)	(4.55)	(7.98)
Grades 1 through 3	75.93	76.65*	72.15	68.15*
	(1.42)	(1.46)	(2.39)	(4.29)
Grades 4 through 5	75.01	75.30	73.84	69.56**
	(2.67)	(2.93)	(3.09)	(4.67)
Grades 6 through 8	70.50	70.75	69.12	52.98
	(2.03)	(1.99)	(3.63)	(4.41)
Grades 9 through 12	47.69***	47.75***	47.47***	27.79**
	(4.70)	(4.57)	(6.04)	(8.69)
Family Characteristics				
Parental Educational Attainment				
No high school degree	67.92	68.48	63.36	54.24
	(2.07)	(2.14)	(4.21)	(7.48)
High school degree	70.85*	71.81*	67.04	54.60
	(1.62)	(1.70)	(2.36)	(4.78)
More than high school degree	68.60	68.45	69.08	59.37
	(3.21)	(3.66)	(2.77)	(5.04)
In Poverty				
No	68.37	69.02	67.05	56.93
	(2.04)	(2.33)	(2.05)	(3.86)
Yes	70.22	70.44	66.42	52.14
	(1.78)	(1.74)	(5.73)	(13.18)
Monthly Household Income				
Less than $1,000	68.76	68.94	59.85	29.13
	(1.85)	(1.82)	(11.11)	(16.99)
At least $1,000, less than $2,000	71.65**	72.00**	69.23	70.54**
	(1.91)	(1.97)	(4.13)	(6.27)
At least $2,000, less than $3,000	66.92	68.31	63.56	64.21*
	(2.44)	(2.61)	(3.01)	(4.94)
At least $3,000	72.07	73.67*	69.98	52.50

TABLE A.1 *(continued)*

	All Free and Reduced-Price Certified	Free Certified	Reduced-Price Certified	Denied Applicant
	(2.67)	(3.00)	(3.29)	(4.13)
Employed Household Member				
No	64.23	64.63	53.05	48.52
	(2.02)	(1.94)	(8.43)	(5.39)
Yes	71.12***	72.17***	67.62*	56.81
	(1.76)	(1.91)	(2.01)	(4.15)
Receipt of TANF				
No	69.78	70.50	66.84	56.50
	(1.66)	(1.70)	(2.06)	(4.04)
Yes	64.70	64.54*	87.61**	77.78***
	(3.58)	(3.59)	(7.34)	(0.00)
Receipt of Food Stamps				
No	69.19	70.03	66.96	56.65
	(1.80)	(1.90)	(2.03)	(4.16)
Yes	69.64	69.69	63.69	53.52
	(1.95)	(1.95)	(16.96)	(6.40)
Number of Children				
1	66.54	67.54	62.69	50.93
	(2.60)	(2.59)	(3.54)	(6.56)
2	67.62	68.00	66.17	56.29
	(1.87)	(2.22)	(2.52)	(4.54)
3	70.94**	71.68*	67.70	64.87*
	(1.91)	(1.94)	(2.90)	(4.34)
4 or more	71.35**	71.31*	71.59**	46.13
	(1.96)	(2.03)	(3.61)	(11.28)
Single Parent Household				
No	69.76	70.21	68.16	54.80
	(1.91)	(2.02)	(2.12)	(4.24)
Yes	68.99	69.67	64.51	60.94
	(1.82)	(1.91)	(3.07)	(5.53)
English Is Primary Language				
No	68.15	70.37	56.66	60.90
	(2.46)	(2.55)	(3.18)	(6.04)
Yes	69.89	69.70	70.71***	55.18
	(1.72)	(1.83)	(2.12)	(4.37)
U.S. Citizen				
No	70.02	71.28	62.67	59.69
	(2.70)	(2.63)	(4.23)	(6.92)
Yes	69.15	69.43	67.94	56.06
	(1.66)	(1.76)	(2.14)	(4.23)
Attitudes Toward School Meals				
Student's Satisfaction with School Meal Taste				
Very satisfied	72.90	73.37	70.78	64.59
	(1.74)	(1.87)	(2.61)	(4.58)
Somewhat satisfied	69.84**	70.02**	69.03	61.76
	(1.61)	(1.67)	(2.51)	(5.16)
Somewhat or very dissatisfied	60.64***	62.20***	52.90***	37.45***
	(3.32)	(3.43)	(3.80)	(5.58)
Student's Satisfaction with School Meal Portions				

TABLE A.1 *(continued)*

	All Free and Reduced-Price Certified	Free Certified	Reduced-Price Certified	Denied Applicant
Very satisfied	70.72	71.40	67.76	62.50
	(1.75)	(1.95)	(2.55)	(4.39)
Somewhat satisfied	70.13	70.73	67.41	60.11
	(1.80)	(1.93)	(3.39)	(6.00)
Somewhat or very dissatisfied	68.06	67.68	70.14	53.91
	(2.50)	(2.81)	(3.57)	(4.92)
Student's Overall Satisfaction with School Meal Quality				
Very satisfied	72.00	72.50	69.69	60.41
	(1.69)	(1.79)	(2.76)	(4.46)
Somewhat satisfied	69.59	69.83	68.37	64.32
	(1.96)	(2.11)	(2.30)	(4.98)
Somewhat or very dissatisfied	64.12***	64.83***	61.12	43.11**
	(2.81)	(2.90)	(5.37)	(7.06)
Parent's Satisfaction with School Meal Healthfulness				
Very satisfied	71.53	71.79	70.31	66.98
	(1.50)	(1.60)	(2.27)	(4.05)
Somewhat satisfied	68.14**	68.52*	66.42	57.07*
	(1.94)	(2.19)	(2.86)	(5.43)
Somewhat or very dissatisfied	68.90	69.95	64.51	42.36***
	(2.95)	(3.24)	(5.18)	(5.30)
Parent's Overall Satisfaction with School Meal Quality				
Very satisfied	70.87	70.78	71.33	64.57
	(1.65)	(1.73)	(2.32)	(4.29)
Somewhat satisfied	67.93	69.59	61.17***	58.65
	(2.20)	(2.34)	(2.85)	(6.02)
Somewhat or very dissatisfied	68.96	69.30	67.40	48.39**
	(2.58)	(2.89)	(5.44)	(5.75)
Food Insecurity				
Used a Food Pantry or Food Bank Last Summer				
No	69.69	70.31	66.97	57.13
	(1.75)	(1.81)	(1.97)	(4.06)
Yes	66.47	66.44*	66.67	46.02
	(2.19)	(2.28)	(7.39)	(9.09)
Asked Relatives for Help with Food Last Summer				
No	69.40	70.07	66.36	56.95
	(1.76)	(1.83)	(2.09)	(4.17)
Yes	69.16	68.71	71.24	53.34
	(1.93)	(2.08)	(3.68)	(11.54)
Bought Less-Expensive Types of Food Last Summer				
No	69.92	70.49	67.63	56.75
	(1.92)	(2.00)	(2.30)	(4.76)
Yes	68.63	69.18	65.64	56.26
	(1.81)	(1.85)	(3.23)	(5.19)
Used Summer Food Service Program Last Summer				

TABLE A.1 *(continued)*

	All Free and Reduced-Price Certified	Free Certified	Reduced-Price Certified	Denied Applicant
No	68.95	69.32	67.34	55.90
	(1.79)	(1.87)	(2.07)	(4.14)
Yes	71.85	73.04*	63.77	60.54
	(2.11)	(2.16)	(4.66)	(8.68)
Used Public Food Assistance Programs Last Summer				
No	67.52	67.62	67.29	56.35
	(2.34)	(2.54)	(2.58)	(4.87)
Yes	70.15	70.69	66.54	56.76
	(1.63)	(1.68)	(2.82)	(4.85)
Any Food Insecurity Outcome				
No	69.21	69.98	67.10	56.70
	(1.88)	(2.01)	(2.02)	(4.17)
Yes	69.80	69.91	57.84	52.57
	(1.73)	(1.73)	(15.85)	(5.02)
School Characteristics				
School Type				
Elementary school	74.75	75.09	73.08	66.50
	(1.54)	(1.60)	(2.02)	(3.59)
Middle school	68.49**	69.09**	65.94*	43.22***
	(2.66)	(2.71)	(3.69)	(5.33)
High school	44.04***	44.13***	43.71***	31.87***
	(4.50)	(4.31)	(6.82)	(9.09)
Private School				
No	69.24	69.79	66.71	56.77
	(1.72)	(1.77)	(2.09)	(4.07)
Yes	79.12***	83.72***	74.55**	50.85
	(1.74)	(2.08)	(2.68)	(10.44)
Enrollment				
400 or fewer	72.78	72.80	72.70	54.69
	(3.43)	(3.63)	(4.21)	(7.91)
401 to 800	73.15	73.44	71.47	62.52
	(1.67)	(1.77)	(2.21)	(4.62)
801 to 1,200	69.52	71.14	62.51	64.11
	(3.14)	(2.90)	(5.35)	(4.97)
Greater than 1,200	54.89***	53.81***	58.30*	31.22**
	(6.03)	(5.87)	(6.54)	(7.34)
Percentage of Student Body Certified Free/Reduced-Price				
0 to 25 percent	61.41	65.12	49.82	40.85
	(8.23)	(8.25)	(9.88)	(10.51)
26 to 50 percent	66.53	66.06	68.30*	53.40
	(3.54)	(3.63)	(4.11)	(7.14)
51 to 75 percent	68.99	69.64	66.44	57.79
	(2.08)	(2.29)	(2.35)	(4.99)
76 to 100 percent	72.93	73.27	70.68*	60.65
	(2.73)	(2.77)	(4.10)	(7.48)

TABLE A.1 *(continued)*

	All Free and Reduced-Price Certified	Free Certified	Reduced-Price Certified	Denied Applicant
Percentage of Student Body Certified Free				
0 to 25 percent	70.10	70.85	67.69	57.20
	(3.13)	(3.18)	(4.52)	(6.67)
26 to 50 percent	63.81	64.17	62.44	49.16
	(3.18)	(3.32)	(3.48)	(5.86)
51 to 75 percent	73.66	74.11	71.36	67.07
	(2.33)	(2.65)	(3.37)	(4.66)
76 to 100 percent	72.24	72.47	70.66	58.35
	(3.24)	(3.20)	(4.96)	(9.37)
Percentage of Student Body Certified Reduced-Price				
0 to 25 percent	69.25	69.81	66.67	55.53
	(1.70)	(1.75)	(2.04)	(3.93)
26 to 50 percent	93.70***	95.21***	91.44***	96.58***
	(0.00)	(0.00)	(0.00)	(0.00)
Region				
Northeast	69.36	70.51	64.46	49.40
	(3.09)	(3.29)	(4.07)	(8.59)
Southeast	75.41	76.06	72.48	60.11
	(3.10)	(3.19)	(3.72)	(7.01)
Central	68.57	68.61	68.34	65.02
	(2.51)	(2.44)	(3.51)	(5.23)
West	62.21	62.73	59.94	50.22
	(4.10)	(4.34)	(4.80)	(11.68)
Urban				
No	69.69	70.23	67.60	57.18
	(2.04)	(2.22)	(2.23)	(4.55)
Yes	68.91	69.47	65.65	55.19
	(2.95)	(2.88)	(4.24)	(7.22)
Uses Food Management Company				
No	70.11	70.75	67.27	58.27
	(1.94)	(1.99)	(2.32)	(4.63)
Yes	65.75	65.86	65.21	47.62*
	(2.91)	(3.05)	(3.79)	(3.87)
School Meal Program Implementation Characteristics				
Uses Direct Certification				
No	73.25	75.96	62.97	64.60
	(2.89)	(2.23)	(6.36)	(3.02)
Yes	69.02	69.37**	67.38	55.81
	(1.82)	(1.87)	(2.12)	(4.38)
Direct Certification Method				
None	73.25	75.96	62.97	64.60
	(2.89)	(2.23)	(6.36)	(3.02)
Nonmatching, active	65.88*	66.27**	63.83	56.70
	(3.20)	(3.32)	(5.23)	(8.31)
District-level matching, passive	70.71	71.40	66.59	52.68*
	(2.79)	(2.72)	(3.99)	(6.22)

TABLE A.1 *(continued)*

	All Free and Reduced-Price Certified	Free Certified	Reduced-Price Certified	Denied Applicant
State-level matching, passive	66.34	66.30**	66.46	50.79
	(3.50)	(3.65)	(3.65)	(8.37)
Other methods	70.86	70.99	70.36	68.91
	(4.48)	(4.92)	(3.23)	(6.01)
Provision 2 or 3 Base Year				
No	69.63	70.23	66.88	55.65
	(1.75)	(1.80)	(2.12)	(4.01)
Yes	64.13	61.67	73.09***	72.81***
	(4.00)	(5.72)	(0.56)	(3.37)
Uses Electronic POS Technology				
No	59.97	58.87	64.60	28.26
	(5.63)	(6.32)	(5.45)	(11.85)
Yes	69.90*	70.51*	67.10	58.65**
	(1.70)	(1.73)	(2.14)	(3.76)
Sample Size	**1,966**	**1,632**	**334**	**218**

Source: APEC study data.

Notes: All figures are weighted. Standard errors, presented in parentheses, account for clustering in the survey design. Denied applicants are students who applied for and were denied school meal benefits; this sample is not generalizable to all students not certified for school meal benefits.

*Significantly different from zero at the .10 level, two-tailed test. Italics indicate the reference group for significance tests.
**Significantly different from zero at the .05 level, two-tailed test.
***Significantly different from zero at the .01 level, two-tailed test.

APEC = Access, Participation, Eligibility, and Certification; NSLP = National School Lunch Program; POS = Point of Sale; TANF = Temporary Assistance for Needy Families.

TABLE A.2

STUDENT-LEVEL SBP PARTICIPATION RATES BASED ON ADMINISTRATIVE RECORDS, BY STUDENT MEAL PROGRAM CERTIFICATION CATEGORY
(Meals Per Eating Occasion For Full School Year)

	All Free and Reduced-Price Certified	Free Certified	Reduced-Price Certified	Denied Applicant
Overall	32.12	33.43	26.05	18.25
	(1.83)	(1.94)	(2.32)	(3.52)
Student Characteristics				
Gender				
Female	29.87	30.78	25.22	16.92
	(2.15)	(2.17)	(3.55)	(3.14)
Male	34.11***	35.87***	26.68	19.01
	(1.88)	(2.05)	(2.45)	(4.75)
African American or Hispanic				
No	30.63	31.60	27.56	12.85
	(2.35)	(2.57)	(3.57)	(2.29)
Yes	32.77	34.19	24.71	22.41
	(2.28)	(2.27)	(3.42)	(5.77)
Grade				
Pre-K or kindergarten	32.72	33.93	28.17	17.12
	(3.29)	(3.23)	(6.32)	(6.30)
Grades 1 through 3	38.71**	40.83**	27.61	28.24*
	(2.51)	(2.63)	(3.16)	(5.75)
Grades 4 through 5	36.47	38.37	28.26	23.98
	(3.07)	(3.25)	(5.14)	(6.69)
Grades 6 through 8	27.10	27.78	23.45	9.52
	(3.35)	(3.36)	(4.39)	(2.47)
Grades 9 through 12	19.01***	18.47***	21.01	6.12
	(1.93)	(1.64)	(5.80)	(3.19)
Family Characteristics				
Parental Educational Attainment				
No high school degree	34.53	35.59	25.76	19.04
	(2.46)	(2.52)	(5.01)	(6.16)
High school degree	31.54	32.18	29.00	19.45
	(1.88)	(1.97)	(2.88)	(6.02)
More than high school degree	29.93*	32.54	21.30	16.70
	(2.54)	(2.90)	(3.41)	(3.25)
In Poverty				
No	30.14	32.03	26.21	19.07
	(1.73)	(1.91)	(2.29)	(3.65)
Yes	33.82**	34.29	25.22	7.52***
	(2.26)	(2.20)	(6.15)	(1.99)
Monthly Household Income				
Less than $1,000	34.52	34.77	20.79	2.74
	(2.40)	(2.35)	(10.46)	(0.49)
At least $1,000, less than $2,000	31.93	33.45	21.56	20.84*
	(2.60)	(2.49)	(4.87)	(10.36)

TABLE A.2 *(continued)*

	All Free and Reduced-Price Certified	Free Certified	Reduced-Price Certified	Denied Applicant
At least $2,000, less than $3,000	29.41**	30.17*	27.54	23.55***
	(1.92)	(1.99)	(3.39)	(5.85)
At least $3,000	33.88	37.91	28.47	16.07***
	(2.64)	(3.59)	(2.96)	(2.84)
Employed Household Member				
No	32.97	33.41	20.31	10.33
	(2.24)	(2.21)	(5.94)	(5.24)
Yes	31.84	33.45	26.31	18.52
	(2.02)	(2.19)	(2.33)	(3.61)
Receipt of TANF				
No	32.22	33.75	25.80	18.30
	(1.88)	(1.99)	(2.24)	(3.53)
Yes	30.92	30.43	89.33***	0.00***
	(3.48)	(3.33)	(9.57)	(0.00)
Receipt of Food Stamps				
No	29.89	31.48	25.58	18.28
	(2.06)	(2.35)	(2.19)	(3.64)
Yes	36.43***	36.25**	69.74***	17.19
	(1.99)	(1.97)	(16.68)	(4.37)
Number of Children				
1	25.58	27.19	19.42	19.91
	(2.43)	(2.46)	(5.07)	(5.33)
2	28.53	31.22	18.24	16.38
	(2.29)	(2.49)	(3.17)	(4.55)
3	35.47***	34.76***	38.60***	21.36
	(2.09)	(2.36)	(3.49)	(4.91)
4 or more	36.12***	37.53***	25.76	13.98
	(2.51)	(2.52)	(5.74)	(5.13)
Single Parent Household				
No	31.38	32.84	26.10	16.08
	(2.16)	(2.30)	(2.75)	(2.62)
Yes	33.18	34.28	25.95	23.44
	(2.02)	(2.07)	(3.62)	(8.05)
English Is Primary Language				
No	28.30	29.89	19.90	12.44
	(3.25)	(3.25)	(4.86)	(4.64)
Yes	33.65	34.91	28.15	19.96
	(1.87)	(1.97)	(2.47)	(4.05)
U.S. Citizen				
No	28.52	30.21	18.77	9.38
	(2.86)	(3.08)	(4.23)	(4.86)
Yes	33.10*	34.35	27.69*	19.59*
	(1.89)	(1.96)	(2.55)	(3.68)

TABLE A.2 *(continued)*

	All Free and Reduced-Price Certified	Free Certified	Reduced-Price Certified	Denied Applicant
Attitudes Toward School Meals				
Student's Satisfaction with School Meal Taste				
Very satisfied	34.23	36.60	23.35	23.52
	(2.35)	(2.65)	(3.30)	(4.96)
Somewhat satisfied	32.90	33.56	29.88	17.66
	(1.82)	(1.81)	(3.70)	(5.34)
Somewhat or very dissatisfied	25.53***	26.03***	23.20	11.23**
	(2.87)	(3.01)	(5.12)	(2.59)
Student's Satisfaction with School Meal Portions				
Very satisfied	33.54	35.45	24.82	22.52
	(2.37)	(2.62)	(3.05)	(4.14)
Somewhat satisfied	30.66	31.97	24.77	19.64
	(2.04)	(2.03)	(4.32)	(5.27)
Somewhat or very dissatisfied	32.47	32.10	34.41	14.90
	(2.51)	(2.52)	(5.69)	(5.39)
Student's Overall Satisfaction with School Meal Quality				
Very satisfied	33.97	35.90	24.64	22.84
	(2.20)	(2.47)	(3.62)	(4.11)
Somewhat satisfied	32.45	33.69	26.17	18.45
	(2.13)	(2.09)	(4.27)	(6.97)
Somewhat or very dissatisfied	26.87***	26.29***	29.14	12.15**
	(2.33)	(2.32)	(6.31)	(2.97)
Parent's Satisfaction with School Meal Healthfulness				
Very satisfied	34.71	36.38	26.28	23.43
	(2.03)	(2.16)	(3.10)	(4.92)
Somewhat satisfied	30.77*	31.49**	27.35	19.42
	(2.19)	(2.16)	(4.17)	(5.99)
Somewhat or very dissatisfied	26.49***	27.63***	22.10	9.00**
	(2.59)	(3.46)	(5.78)	(2.71)
Parent's Overall Satisfaction with School Meal Quality				
Very satisfied	32.45	33.75	25.79	22.86
	(2.11)	(2.27)	(3.05)	(3.99)
Somewhat satisfied	32.77	34.61	25.37	18.57
	(1.87)	(1.75)	(3.90)	(5.98)
Somewhat or very dissatisfied	30.53	30.27	31.65	12.41
	(2.81)	(3.41)	(7.38)	(5.18)
Food Insecurity				
Used a Food Pantry or Food Bank Last Summer				
No	31.85	33.45	24.73	18.25
	(1.91)	(1.98)	(2.32)	(3.69)
Yes	33.96	32.73	41.60**	18.17
	(3.04)	(2.97)	(7.33)	(7.23)

TABLE A.2 *(continued)*

	All Free and Reduced-Price Certified	Free Certified	Reduced-Price Certified	Denied Applicant
Asked Relatives for Help with Food Last Summer				
No	31.98	33.71	23.90	18.53
	(1.99)	(2.09)	(2.50)	(3.84)
Yes	33.30	31.69	40.07**	15.49
	(2.91)	(2.84)	(6.54)	(4.68)
Bought Less-Expensive Types of Food Last Summer				
No	32.46	33.86	26.85	19.02
	(2.03)	(2.16)	(2.75)	(5.02)
Yes	31.79	33.01	25.00	17.01
	(2.08)	(2.11)	(3.43)	(3.39)
Used Summer Food Service Program Last Summer				
No	31.70	32.78	27.00	18.59
	(1.90)	(2.01)	(2.46)	(3.68)
Yes	34.46	36.94	18.88	16.64
	(3.33)	(3.16)	(4.98)	(5.19)
Used Public Food Assistance Programs Last Summer				
No	29.76	31.15	25.88	18.35
	(2.11)	(2.41)	(2.22)	(3.68)
Yes	36.92***	36.91**	38.23	15.77
	(1.97)	(1.96)	(18.18)	(4.89)
Any Food Insecurity Outcome				
No	29.40	30.78	26.10	19.10
	(2.38)	(2.77)	(2.81)	(5.19)
Yes	33.24**	34.31	26.11	17.25
	(1.87)	(1.92)	(2.57)	(3.06)
School Characteristics				
School Type				
Elementary school	36.52	38.15	28.56	24.34
	(2.29)	(2.26)	(3.25)	(4.81)
Middle school	26.09***	26.71***	23.62	5.92***
	(3.15)	(3.56)	(5.18)	(2.11)
High school	17.73***	17.57***	18.41*	4.55***
	(1.98)	(2.01)	(4.96)	(2.61)
Private School				
No	32.14	33.46	26.05	18.48
	(1.88)	(1.96)	(2.35)	(3.57)
Yes	20.53***	12.28***	31.49*	0.00***
	(1.12)	(0.65)	(1.79)	(0.00)
Enrollment				
400 or fewer	40.25	40.97	37.47	27.40
	(2.90)	(3.25)	(3.63)	(5.98)
401 to 800	34.35*	35.86	25.36**	20.83
	(2.66)	(2.65)	(4.14)	(5.72)
801 to 1,200	30.15**	31.98*	22.10**	16.89
	(3.31)	(3.59)	(4.43)	(3.42)

TABLE A.2 *(continued)*

	All Free and Reduced-Price Certified	Free Certified	Reduced-Price Certified	Denied Applicant
Greater than 1,200	21.50***	21.26***	22.26**	4.35***
	(3.55)	(3.97)	(4.63)	(2.04)
Percentage of Student Body Certified Free/Reduced-Price				
0 to 25 percent	18.21	20.93	6.59	2.77
	(6.70)	(7.54)	(2.39)	(2.57)
26 to 50 percent	24.97	25.15	24.29***	10.41**
	(2.21)	(2.51)	(3.83)	(2.98)
51 to 75 percent	35.03**	37.35**	25.90***	20.31***
	(2.73)	(2.75)	(3.56)	(4.20)
76 to 100 percent	37.80**	38.41**	33.48***	27.64**
	(3.40)	(3.27)	(5.64)	(9.50)
Percentage of Student Body Certified Free				
0 to 25 percent	24.13	23.56	26.11	9.09
	(3.49)	(3.61)	(4.90)	(3.93)
26 to 50 percent	28.15	30.06	20.90	15.14
	(2.48)	(2.83)	(3.07)	(3.40)
51 to 75 percent	42.79***	43.85***	36.82	20.67*
	(3.27)	(3.14)	(5.53)	(4.28)
76 to 100 percent	34.47**	35.48**	27.50	31.18
	(3.45)	(3.39)	(5.10)	(12.75)
Percentage of Student Body Certified Reduced-Price				
0 to 25 percent	31.84	33.20	25.56	16.07
	(1.83)	(1.92)	(2.24)	(2.31)
26 to 50 percent	82.33***	93.61***	65.41***	93.84***
	(0.00)	(0.00)	(0.00)	(0.00)
Region				
Northeast	32.24	33.23	27.78	28.18
	(5.28)	(5.21)	(6.81)	(11.92)
Southeast	35.87	37.65	27.94	19.94
	(3.76)	(4.20)	(2.62)	(3.58)
Central	30.55	31.87	23.98	14.79
	(2.01)	(2.29)	(3.90)	(3.51)
West	29.98	31.04	25.46	12.59
	(4.80)	(4.70)	(5.69)	(4.83)
Urban				
No	33.83	34.73	30.24	19.79
	(2.69)	(2.85)	(2.68)	(4.78)
Yes	29.54	31.62	17.56***	14.10
	(2.22)	(2.42)	(3.47)	(1.35)
Uses Food Management Company				
No	33.47	34.92	26.94	20.39
	(2.14)	(2.20)	(2.70)	(4.05)

TABLE A.2 *(continued)*

	All Free and Reduced-Price Certified	Free Certified	Reduced-Price Certified	Denied Applicant
Yes	25.44**	26.27**	21.15	7.52***
	(2.82)	(3.02)	(3.86)	(1.99)
School Meal Program Implementation Characteristics				
Uses Direct Certification				
No	28.96	30.14	23.65	15.36
	(6.78)	(7.19)	(5.97)	(5.03)
Yes	32.41	33.74	26.28	18.53
	(1.94)	(2.02)	(2.47)	(3.84)
Direct Certification Method				
None	28.96	30.14	23.65	15.36
	(6.78)	(7.19)	(5.97)	(5.04)
Nonmatching, active	31.55	33.75	19.50	15.29
	(3.20)	(3.28)	(4.07)	(3.71)
District-level matching, passive	32.63	33.63	26.72	18.61
	(3.06)	(3.05)	(3.44)	(2.90)
State-level matching, passive	30.48	31.76	25.50	19.45
	(2.62)	(3.01)	(3.84)	(9.39)
Other methods	35.09	37.36	26.71	16.12
	(10.74)	(10.43)	(11.44)	(8.85)
Provision 2 or 3 Base Year				
No	33.89	35.25	27.56	19.83
	(1.83)	(1.93)	(2.39)	(3.81)
Yes	18.61**	18.60***	18.68	7.51**
	(5.57)	(5.82)	(4.91)	(2.88)
Uses Electronic POS Technology				
No	29.27	29.40	28.59	7.89
	(4.16)	(4.19)	(6.22)	(4.08)
Yes	32.30	33.70	25.90	19.13**
	(1.98)	(2.06)	(2.47)	(3.75)
Sample Size	**1,789**	**1,491**	**298**	**197**

Source: APEC study data.

Notes: All figures are weighted. Standard errors, presented in parentheses, account for clustering in the survey design. Denied applicants are students who applied for and were denied school meal benefits; this sample is not generalizable to all students not certified for school meal benefits.

*Significantly different from zero at the .10 level, two-tailed test. Italics indicate the reference group for significance tests.
**Significantly different from zero at the .05 level, two-tailed test.
***Significantly different from zero at the .01 level, two-tailed test.

APEC = Access, Participation, Eligibility, and Certification; POS = Point of Sale; SBP = School Breakfast Program; TANF = Temporary Assistance for Needy Families.

TABLE A.3

SCHOOL-LEVEL NSLP PARTICIPATION RATES BASED ON SFA SURVEY DATA, BY STUDY MEAL PROGRAM CERTIFICATION CATEGORY

	All Students	Free Certified	Reduced-Price Certified	Not Certified
Overall	65.71	77.16	72.16	52.73
	(1.54)	(1.43)	(1.67)	(1.68)
School Characteristics				
School Type				
Elementary school	69.65	79.91	74.69	55.86
	(2.07)	(1.67)	(2.59)	(2.41)
Middle school	66.14	78.56	77.65	53.82
	(2.36)	(2.21)	(2.29)	(3.18)
High school	38.62***	56.78***	48.29***	30.82***
	(6.27)	(4.93)	(6.14)	(7.11)
Private School				
No	66.68	76.50	72.71	53.34
	(1.83)	(1.66)	(2.01)	(2.17)
Yes	57.33	84.81*	70.55	52.27
	(6.17)	(4.22)	(4.24)	(4.01)
Enrollment				
400 or fewer	67.11	79.70	73.28	53.00
	(2.85)	(2.49)	(2.96)	(3.70)
401 to 800	68.40	77.07	74.46	56.07
	(2.41)	(2.44)	(2.36)	(2.48)
801 to 1,200	67.38	81.71	73.46	55.19
	(3.47)	(3.32)	(4.18)	(3.51)
Greater than 1,200	37.37***	56.57***	49.00***	25.06***
	(4.27)	(3.15)	(3.88)	(3.95)
Percentage of Student Body Certified Free/Reduced-Price				
0 to 25 percent	49.51	72.52	65.35	45.98
	(3.67)	(5.06)	(3.90)	(4.08)
26 to 50 percent	61.58***	77.13	75.04**	52.62
	(2.70)	(2.05)	(2.66)	(3.38)
51 to 75 percent	67.74***	77.24	71.27	52.27
	(3.42)	(2.85)	(5.04)	(4.10)
76 to 100 percent	80.47***	80.30	73.61*	58.53**
	(1.44)	(2.23)	(3.15)	(3.93)
Percentage of Student Body Certified Free				
0 to 25 percent	56.92	76.33	69.80	50.89
	(2.94)	(3.63)	(3.57)	(3.39)
26 to 50 percent	60.97	74.90	71.66	49.03
	(3.17)	(2.96)	(3.24)	(3.58)
51 to 75 percent	75.84***	81.91	77.28	57.31
	(2.22)	(2.48)	(2.93)	(4.17)
76 to 100 percent	80.41***	77.90	71.80	59.17
	(1.60)	(2.43)	(3.61)	(4.08)

TABLE A.3 *(continued)*

	All Students	Free Certified	Reduced-Price Certified	Not Certified
Percentage of Student Body Certified Reduced-Price				
0 to 25 percent	66.24	77.49	73.91	53.74
	(1.71)	(1.59)	(1.53)	(2.02)
26 to 50 percent	47.22	65.84	13.28***	18.61***
	(11.38)	(10.25)	(6.43)	(4.83)
Region				
Northeast	60.76	76.04	69.62	48.26
	(2.24)	(3.05)	(3.92)	(3.26)
Southeast	79.73***	84.23**	83.11***	67.24***
	(2.38)	(2.23)	(1.78)	(3.63)
Central	69.23**	78.91	73.29	57.39**
	(3.05)	(2.08)	(3.23)	(3.14)
West	57.03	68.51	65.28	39.63
	(4.71)	(3.44)	(5.02)	(4.26)
Urban				
No	63.73	74.99	74.26	54.33
	(2.19)	(2.09)	(2.04)	(2.56)
Yes	68.30	80.00	69.29	50.65
	(2.99)	(2.23)	(4.07)	(3.44)
Uses Food Management Company				
No	65.97	77.23	72.11	53.36
	(2.09)	(1.74)	(2.42)	(2.49)
Yes	64.34	76.80	72.43	49.47
	(1.82)	(2.94)	(4.32)	(2.17)
School Meal Program Implementation Characteristics				
Uses Direct Certification				
No	58.90	71.71	69.57	53.09
	(2.18)	(2.28)	(2.43)	(2.87)
Yes	67.43***	78.54**	72.80	52.64
	(2.08)	(1.77)	(2.53)	(2.55)
Direct Certification Method				
None	58.90	71.71	69.57	53.09
	(2.18)	(2.28)	(2.43)	(2.88)
Nonmatching, active	58.53	77.58	66.14	45.45
	(3.85)	(4.27)	(8.03)	(4.44)
District-level matching, passive	76.66***	82.96***	79.26**	61.17*
	(2.44)	(2.60)	(2.79)	(3.42)
State-level matching, passive	63.70	77.14	70.23	46.93
	(3.50)	(2.95)	(4.09)	(4.34)
Other methods	60.34	69.11	70.65	45.30
	(3.99)	(2.64)	(3.08)	(5.90)

TABLE A.3 *(continued)*

	All Students	Free Certified	Reduced-Price Certified	Not Certified
Provision 2 or 3 Base Year				
No	65.81	77.58	72.51	52.89
	(1.81)	(1.64)	(2.15)	(2.13)
Yes	72.18	68.78*	67.28	55.35
	(3.53)	(4.90)	(4.95)	(13.31)
Uses Electronic POS Technology				
No	60.14	79.73	67.29	46.05
	(3.52)	(3.69)	(4.69)	(4.05)
Yes	68.08**	77.36	74.56	55.40**
	(1.77)	(1.56)	(1.44)	(2.16)
Sample Size	**240**	**240**	**240**	**240**

Source: APEC study data.

Notes: All figures are weighted. Standard errors, presented in parentheses, account for clustering in the survey design.

*Significantly different from zero at the .10 level, two-tailed test. Italics indicate the reference group for significance tests.
**Significantly different from zero at the .05 level, two-tailed test.
***Significantly different from zero at the .01 level, two-tailed test.

APEC = Access, Participation, Eligibility, and Certification; NSLP = National School Lunch Program; POS = Point of Sale; SFA = School Food Authority.

TABLE A.4

SCHOOL-LEVEL SBP PARTICIPATION RATES BASED ON SFA SURVEY DATA,
BY STUDY MEAL PROGRAM CERTIFICATION CATEGORY
(Meals Per Eating Occasion For Full School Year)

	All Students	Free Certified	Reduced-Price Certified	Not Certified
Overall	27.48	40.28	25.09	15.15
	(1.34)	(1.58)	(1.40)	(1.41)
School Characteristics				
School Type				
Elementary school	30.75	44.08	27.31	16.84
	(2.15)	(2.21)	(2.20)	(2.12)
Middle school	21.89***	32.33***	22.97	13.44
	(2.50)	(2.62)	(2.46)	(3.36)
High school	13.22***	25.56***	13.44***	6.51***
	(2.93)	(2.87)	(3.85)	(3.04)
Private School				
No	27.52	39.85	25.44	15.53
	(1.88)	(1.78)	(1.87)	(1.91)
Yes	27.95	39.98	16.35**	8.61***
	(5.09)	(7.28)	(2.98)	(1.57)
Enrollment				
400 or fewer	32.59	45.17	28.00	15.58
	(3.19)	(3.59)	(3.08)	(2.67)
401 to 800	28.29	40.65	26.24	17.83
	(2.14)	(2.18)	(2.22)	(2.85)
801 to 1,200	22.61***	38.80	22.46	12.28
	(2.36)	(4.39)	(3.53)	(2.24)
Greater than 1,200	9.19***	19.49***	10.32***	3.62***
	(2.32)	(2.99)	(2.46)	(1.13)
Percentage of Student Body Certified Free/Reduced-Price				
0 to 25 percent	12.24	33.52	17.98	8.84
	(3.15)	(7.72)	(4.84)	(2.59)
26 to 50 percent	17.42	33.46	23.47	9.03
	(1.90)	(2.14)	(2.49)	(1.99)
51 to 75 percent	31.89***	45.47	26.28	14.83
	(2.54)	(2.64)	(3.31)	(2.62)
76 to 100 percent	40.66***	45.70	28.18*	26.56***
	(2.67)	(3.24)	(3.03)	(4.40)
Percentage of Student Body Certified Free				
0 to 25 percent	16.89	37.64	20.55	10.44
	(3.08)	(5.41)	(4.17)	(2.88)
26 to 50 percent	20.67	34.68	24.39	10.14
	(1.84)	(2.17)	(2.15)	(1.70)
51 to 75 percent	40.28***	51.27**	28.51	17.93
	(2.53)	(3.02)	(4.46)	(3.61)
76 to 100 percent	40.44***	43.08	28.59	29.53***
	(3.26)	(3.65)	(3.06)	(5.36)

TABLE A.4 *(continued)*

	All Students	Free Certified	Reduced-Price Certified	Not Certified
Percentage of Student Body Certified Reduced-Price				
0 to 25 percent	27.53	39.69	25.78	15.31
	(1.82)	(1.76)	(1.82)	(1.82)
26 to 50 percent	25.97	57.75***	5.11***	10.66
	(7.94)	(3.77)	(2.88)	(9.86)
Region				
Northeast	26.10	40.47	21.50	16.13
	(3.38)	(3.77)	(3.45)	(4.16)
Southeast	36.42**	47.16	35.50***	18.26
	(3.19)	(3.04)	(3.53)	(2.95)
Central	25.78	39.57	23.15	13.09
	(2.79)	(2.11)	(2.77)	(2.27)
West	22.68	32.47	25.08	13.05
	(3.87)	(3.59)	(3.97)	(3.89)
Urban				
No	26.02	39.47	26.95	15.84
	(2.54)	(2.53)	(2.48)	(2.49)
Yes	29.49	41.38	22.47	14.21
	(2.34)	(2.23)	(2.59)	(2.76)
Uses Food Management Company				
No	28.88	41.89	26.56	15.84
	(1.98)	(1.95)	(2.10)	(1.94)
Yes	20.52**	32.22***	17.94**	11.79
	(3.19)	(2.50)	(2.80)	(5.05)
School Meal Program Implementation Characteristics				
Uses Direct Certification				
No	19.11	33.67	21.80	15.96
	(3.94)	(3.92)	(3.74)	(6.15)
Yes	28.92**	41.40*	25.67	15.01
	(1.85)	(1.85)	(2.04)	(1.90)
Direct Certification Method				
None	19.11	33.67	21.80	15.96
	(3.95)	(3.92)	(3.74)	(6.15)
Nonmatching, active	19.81	35.54	18.87	7.54
	(2.42)	(3.75)	(3.67)	(2.11)
District-level matching, passive	35.07***	44.96**	32.44**	20.85
	(2.93)	(3.13)	(3.19)	(2.74)
State-level matching, passive	25.21	38.54	20.70	11.52
	(3.14)	(2.70)	(2.98)	(3.55)
Other methods	32.63	46.24	27.22	16.28
	(7.44)	(8.98)	(7.69)	(8.22)
Provision 2 or 3 Base Year				
No	26.97	40.70	25.35	14.28
	(1.85)	(1.84)	(1.97)	(1.90)
Yes	30.83	38.51	29.43	25.34***
	(3.81)	(7.53)	(5.51)	(2.08)

TABLE A.4 *(continued)*

	All Students	Free Certified	Reduced-Price Certified	Not Certified
Uses Electronic POS Technology				
No	21.04	37.86	19.43	7.41
	(2.89)	(5.65)	(3.54)	(1.77)
Yes	28.56**	41.11	27.02*	16.50***
	(2.03)	(2.02)	(2.08)	(2.16)
Sample Size	**225**	**225**	**225**	**225**

Source: APEC study data.

Notes: All figures are weighted. Standard errors, presented in parentheses, account for clustering in the survey design.

*Significantly different from zero at the .10 level, two-tailed test. Italics indicate the reference group for significance tests.
**Significantly different from zero at the .05 level, two-tailed test.
***Significantly different from zero at the .01 level, two-tailed test.

APEC = Access, Participation, Eligibility, and Certification; POS = Point of Sale; SFA = School Food Authority; SBP = School Breakfast Program.
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APPENDIX B

STIGMA AND THE GRADE STRUCTURE OF ELEMENTARY AND MIDDLE SCHOOLS

As a part of this project, we investigated whether we could make inferences about the effect of stigma on school meal participation using differences in the grade structure of elementary and middle schools as a natural experiment. The rationale of this investigation is as follows: If stigma is related to meal participation and if stigma is more strongly exhibited in the presence of older students, then we would expect otherwise similar fifth- and sixth–grade students in middle schools to have lower participation rates than those in elementary schools. In order to assess this question, we estimated the regression model described in Chapter II on a sample that consisted only of fifth- and sixth-grade students. The coefficient of interest is that on the binary variable associated with being in middle school.

We found that fifth and sixth graders in middle schools do not have significantly lower lunch or breakfast participation rates than those in elementary schools (Appendix Tables B.1 and B.2). Although univariate analyses show significantly lower meal participation rates for fifth and sixth graders in middle schools compared to those in elementary schools, these differences are no longer significant when controls for other characteristics are included. Furthermore, robustness checks showed that sixth-grade middle school students have lower participation rates than seventh graders. Thus, districts that place sixth graders in middle schools may have unobserved characteristics that are associated with lower meal participation. Any negative relationship between meal participation and school type in our analysis of fifth- and sixth-grade students may be related to these unobserved characteristics rather than to stigma. Based on this evidence, we did not pursue this analysis further.

TABLE B.1

CHANGES IN STUDENT-LEVEL NSLP PARTICIPATION RATES ASSOCIATED WITH SCHOOL TYPE AND OTHER FACTORS, BY STUDENT MEAL PROGRAM CERTIFICATION CATEGORY FOR 5TH- AND 6TH-GRADE STUDENTS
(Percentages of Eating Occasions)

	All Free and Reduced-Price Certified	Free Certified	Reduced-Price Certified	Denied Applicant
Student Characteristics				
Middle School	-7.34	-7.87	-2.32	-12.34
	(4.79)	(4.72)	(9.87)	(8.76)
Male	-2.02	-2.05	-2.78	17.16*
	(2.80)	(3.42)	(9.70)	(9.24)
African American or Hispanic	-0.31	-2.75	10.77	-11.92
	(3.22)	(3.50)	(11.05)	(9.56)
Family Characteristics				
Parental Educational Attainment				
High school degree	2.17	4.34	0.25	-2.51
	(4.29)	(4.73)	(8.48)	(11.34)
More than high school degree	2.38	4.76	-7.08	-3.76
	(4.37)	(4.85)	(11.44)	(12.88)
Household Income	-0.45	-0.70	1.08	-1.75
	(0.95)	(1.26)	(1.02)	(2.25)
Employed Household Member	6.73	8.27*	-24.27*	36.68***
	(4.24)	(4.14)	(13.61)	(13.48)
Number of Children	2.08*	2.55*	-1.10	-5.97
	(1.13)	(1.30)	(2.46)	(4.38)
Experienced Food Insecurity Outcome	-3.96	-2.22	-11.67	2.30
	(2.87)	(3.11)	(8.49)	(7.56)
Attitudes Toward School Meals				
Student's Satisfaction with School Meal Taste				
Very satisfied	2.50	1.35	11.55*	16.12
	(3.67)	(4.87)	(6.57)	(12.34)
Somewhat satisfied	5.20	6.83	1.23	24.24**
	(3.93)	(4.11)	(8.40)	(10.03)
School Characteristics				
Percentage of Student Body Certified for Free/Reduced-Price Meals	-0.19*	-0.20	-0.45***	0.11
	(0.12)	(0.14)	(0.13)	(0.24)
Enrollment				
801 to 1,200	4.36	5.59	-1.13	14.45
	(4.25)	(4.28)	(8.88)	(9.54)
Greater than 1,200	3.15	5.11	-4.68	11.69
	(5.34)	(6.33)	(12.74)	(17.29)
Located in Urban Area	-0.43	-0.98	3.24	7.17
	(4.67)	(5.52)	(8.80)	(9.94)

TABLE B.1 *(continued)*

	All Free and Reduced-Price Certified	Free Certified	Reduced-Price Certified	Denied Applicant
School Meal Program Implementation Characteristics				
Uses Direct Certification	-1.99	0.59	-0.45	12.26
	(5.33)	(5.33)	(12.61)	(17.83)
Uses Electronic POS Technology	4.91	2.99	22.85	12.12
	(4.71)	(6.39)	(12.19)*	(10.74)
Constant	72.74***	69.89***	101.43***	-2.24
	(8.66)	(10.24)	(20.48)	(36.38)
Sample Size	**350**	**278**	**72**	**61**

Source: APEC study data.

Notes: Figures are coefficient estimates from OLS regressions in which the relevant participation rate is the dependent variable. Participation rates represent percentage of meals received per eating occasion during the full school year, determined based on administrative records. All figures are weighted. Standard errors, presented in parentheses, account for clustering in the survey design. Denied applicants are students who applied for and were denied school meal benefits; this sample is not generalizable to all students not certified for school meal benefits.

*Significantly different from zero at the .10 level, two-tailed test.
**Significantly different from zero at the .05 level, two-tailed test.
***Significantly different from zero at the .01 level, two-tailed test.

APEC = Access, Participation, Eligibility, and Certification; NSLP = National School Lunch Program; POS = Point of Sale.

TABLE B.2

CHANGES IN STUDENT-LEVEL SBP PARTICIPATION RATES ASSOCIATED WITH SCHOOL TYPE AND OTHER FACTORS, BY STUDENT MEAL PROGRAM CERTIFICATION CATEGORY FOR 5TH- AND 6TH-GRADE STUDENTS
(Percentages of Eating Occasions)

	All Free and Reduced-Price Certified	Free Certified	Reduced-Price Certified	Denied Applicant
Student Characteristics				
Middle School	-5.12	-6.34	-1.91	-13.98**
	(5.48)	(5.33)	(7.84)	(6.73)
Male	0.49	3.79	-19.01**	9.63
	(3.55)	(4.22)	(7.56)	(7.33)
African American or Hispanic	3.93	3.00	10.89	13.17**
	(5.91)	(6.26)	(10.70)	(6.21)
Family Characteristics				
Parental Educational Attainment				
High school degree	-2.06	-0.29	2.37	33.75***
	(4.49)	(4.86)	(14.87)	(8.92)
More than high school degree	1.19	6.67	-9.29	11.51
	(6.65)	(7.79)	(12.81)	(9.29)
Household Income	-0.68	-0.61	0.88	-0.69
	(1.08)	(2.02)	(1.52)	(1.40)
Employed Household Member	3.59	4.51	-24.67	14.24
	(4.97)	(5.69)	(15.78)	(10.43)
Number of Children	2.82*	3.77**	-3.87	5.49*
	(1.59)	(1.84)	(3.74)	(2.90)
Experienced Food Insecurity Outcome	-0.98	-0.14	-7.09	-14.71**
	(4.70)	(4.93)	(7.01)	(6.08)
Attitudes Toward School Meals				
Student's Satisfaction with School Meal Taste				
Very satisfied	3.91	5.63	-3.63	9.15
	(5.36)	(7.11)	(10.02)	(9.55)
Somewhat satisfied	1.25	2.39	-1.83	-1.45
	(6.03)	(6.52)	(8.32)	(5.60)
School Characteristics				
Percentage of Student Body Certified for Free/Reduced-Price Meals	-0.10	-0.14	-0.26	0.26
	(0.17)	(0.20)	(0.18)	(0.22)
Enrollment				
801 to 1,200	-2.70	0.51	-16.69	-17.30
	(5.23)	(5.39)	(10.77)	(11.81)
Greater than 1,200	-4.68	1.41	-15.17*	-28.10**
	(9.34)	(9.65)	(8.96)	(11.09)
Located in Urban Area	-8.19	-6.36	-14.18	-28.18***
	(6.27)	(7.02)	(9.23)	(7.25)

TABLE B.2 *(continued)*

	All Free and Reduced-Price Certified	Free Certified	Reduced-Price Certified	Denied Applicant
School Meal Program Implementation Characteristics				
Uses Direct Certification	19.15	21.51	13.69	18.45
	(15.39)	(18.42)	(12.29)	(11.12)
Uses Electronic POS Technology	13.84**	10.00	51.12***	-9.81
	(5.98)	(6.97)	(7.53)	(7.00)
Constant	2.17	-3.75	37.79*	-33.10*
	(20.02)	(23.00)	(19.48)	(18.30)
Sample Size	**319**	**255**	**64**	**58**

Source: APEC study data.

Notes: Figures are coefficient estimates from OLS regressions in which the relevant participation rate is the dependent variable. Participation rates represent percentage of meals received per eating occasion during the full school year, determined based on administrative records. All figures are weighted. Standard errors, presented in parentheses, account for clustering in the survey design. Denied applicants are students who applied for and were denied school meal benefits; this sample is not generalizable to all students not certified for school meal benefits.

*Significantly different from zero at the .10 level, two-tailed test.
**Significantly different from zero at the .05 level, two-tailed test.
***Significantly different from zero at the .01 level, two-tailed test.

APEC = Access, Participation, Eligibility, and Certification; POS = Point of Sale; SBP = School Breakfast Program.

APPENDIX C

VARIATION IN PARTICIPATION OVER THE SCHOOL YEAR

This appendix presents information related to variation in actual and parent-reported participation over the year. Table C.1 shows actual participation rates, based on administrative records data, for each month during the school year. Table C.2 shows participation based on parent-reports at two different points in time, for households in the panel sample. Table C.3 compares participation based on parent reports to actual participation during the relevant months, for households that have data from administrative records and two parent surveys. Each table includes a summary measure of the variation over time. While both actual participation rates and parent reports are fairly consistent over the year, actual monthly participation for individuals can vary widely.

Both administrative records and parent reports reflect limited variation in overall participation rates across months. Monthly participation rates are fairly consistent over the school year, ranging from 67 to 72 percent for the NSLP and from 30 to 37 percent for the SBP across nonsummer months (Table C.1). Estimates of participation rates based on parent reports for the sample of households that completed surveys at two points during the year also are fairly consistent over time, ranging from 88 percent at the time of the initial survey to 92 percent later in the school year (Table C.2).

Administrative records data show greater variation over time in the participation rates for individual students than is reported by parents. The participation rates of individual students can vary considerably from month to month. For example, the difference between the highest and lowest NSLP monthly participation rate for a given student is 47 percentage points, on average (Table C.1). However, individual parent reports of their child's participation are more consistent over time. The average difference between the NSLP participation rates reported in the two household surveys (among those in the sample that completed both) for a given student is just 11 percentage points, while the average difference between the participation rates based on

TABLE C.1

VARIATION ACROSS THE SCHOOL YEAR IN MONTHLY NSLP AND SBP PARTICIPATION RATES AMONG FREE AND REDUCED-PRICE CERTIFIED STUDENTS, BASED ON ADMINISTRATIVE RECORDS DATA

	NSLP	SBP
Percentage of School Days Participated in August		
0 to 20	31.11	67.43
	(3.80)	(3.32)
21 to 80	26.57	23.91
	(2.02)	(2.69)
81 to 100	42.32	8.65
	(3.24)	(1.52)
Mean Percentage of School Days Participated in August	56.09	21.27
	(3.18)	(2.22)
Percentage of school days participated in September		
0 to 20	17.98	56.29
	(3.16)	(3.27)
21 to 80	25.19	27.74
	(1.97)	(2.16)
81 to 100	56.83	15.97
	(3.09)	(1.92)
Mean Percentage of School Days Participated in September	68.11	30.09
	(2.87)	(2.40)
Percentage of School Days Participated in October		
0 to 20	14.96	53.69
	(2.87)	(2.83)
21 to 80	27.72	28.32
	(2.23)	(2.32)
81 to 100	57.31	17.99
	(2.90)	(1.87)
Mean Percentage of School Days Participated in October	70.64	32.76
	(2.69)	(2.14)
Percentage of School Days Participated in November		
0 to 20	13.19	51.11
	(2.61)	(2.78)
21 to 80	27.65	30.98
	(2.33)	(2.04)
81 to 100	59.17	17.92
	(3.12)	(2.03)
Mean Percentage of School Days Participated in November	71.74	34.26
	(2.48)	(2.12)

TABLE C.1 *(continued)*

	NSLP	SBP
Percentage of School Days Participated in December		
0 to 20	14.92	54.40
	(2.89)	(3.01)
21 to 80	35.86	30.95
	(2.78)	(2.36)
81 to 100	49.22	14.65
	(3.11)	(2.24)
Mean Percentage of School Days Participated in December	67.37	31.33
	(2.73)	(2.31)
Percentage of School Days Participated in January		
0 to 20	14.65	49.36
	(2.04)	(2.31)
21 to 80	28.77	34.54
	(2.43)	(2.39)
81 to 100	56.58	16.10
	(3.23)	(2.08)
Mean Percentage of School Days Participated in January	71.02	34.32
	(2.04)	(1.95)
Percentage of School Days Participated in February		
0 to 20	13.76	48.82
	(2.13)	(2.30)
21 to 80	30.57	34.32
	(2.47)	(2.25)
81 to 100	55.67	16.86
	(2.98)	(2.27)
Mean Percentage of School Days Participated in February	71.64	35.38
	(2.12)	(1.89)
Percentage of School Days Participated in March		
0 to 20	14.61	46.53
	(2.02)	(2.46)
21 to 80	26.82	33.80
	(2.36)	(2.99)
81 to 100	58.56	19.67
	(3.00)	(2.46)
Mean Percentage of School Days Participated in March	71.45	37.19
	(2.04)	(1.92)
Percentage of School Days Participated in April		
0 to 20	15.96	49.43
	(2.04)	(2.21)
21 to 80	32.59	33.21
	(2.95)	(2.19)
81 to 100	51.45	17.36
	(3.47)	(2.44)

TABLE C.1 *(continued)*

	NSLP	SBP
Mean Percentage of School Days Participated in April	68.85	34.68
	(2.22)	(2.09)
Percentage of School Days Participated in May		
0 to 20	16.36	50.34
	(1.98)	(2.39)
21 to 80	33.02	34.52
	(2.77)	(2.14)
81 to 100	50.62	15.14
	(3.04)	(2.29)
Mean Percentage of School Days Participated in May	66.85	32.85
	(1.93)	(2.14)
Percentage of School Days Participated in June		
0 to 20	32.82	66.75
	(5.52)	(4.26)
21 to 80	36.73	20.41
	(5.46)	(2.75)
81 to 100	30.44	12.84
	(5.01)	(4.19)
Mean Percentage of School Days Participated in June	49.82	23.39
	(4.57)	(3.90)
Percentage of School Days Participated in July		
0 to 20	45.57	73.68
	(11.69)	(10.55)
21 to 80	20.36	22.35
	(1.89)	(7.06)
81 to 100	34.06	3.97
	(13.56)	(3.60)
Mean Percentage of School Days Participated in July	46.15	18.69
	(10.67)	(8.97)
Number of Percentage Points Difference Between the Highest and Lowest Monthly Participation Rate for the Student Across Nonsummer Months[a] (Percentage)		
0	2.43	21.13
	(0.58)	(2.51)
1 to 20	21.77	16.83
	(2.58)	(1.40)
21 to 40	27.65	18.41
	(2.04)	(1.52)
41 to 60	15.61	17.13
	(1.47)	(1.32)
61 to 80	9.63	14.37
	(1.57)	(1.67)

TABLE C.1 *(continued)*

	NSLP	SBP
81 to 100	22.92 (3.33)	12.14 (1.34)
Mean Number of Percentage Points Difference Between the Highest and Lowest Monthly Participation Rate for the Student Across Non-summer Months	47.17 (2.56)	37.45 (1.77)

Source: APEC study data.

Note: All figures are weighted. Standard errors account for clustering in the survey design.

[a]This measure excludes June, July, and August, because many schools were not in session during those months (resulting in small sample sizes/missing data), and even those schools with nonmissing data were often in session for only a few days during the month.

APEC = Access, Participation, Eligibility, and Certification; NSLP = National School Lunch Program; SBP = School Breakfast Program.

TABLE C.2

VARIATION ACROSS THE SCHOOL YEAR IN REPORTED NSLP AND SBP PARTICIPATION RATES AMONG FREE AND REDUCED-PRICE CERTIFIED STUDENTS, BASED ON PARENT REPORTS FOR ONE OR TWO TARGET WEEKS

	NSLP	SBP
Percentage of School Days Participated in Target Week of the Initial Household Survey		
0	6.03	35.74
	(1.48)	(3.24)
1 to 20	0.82	4.39
	(0.40)	(1.19)
21 to 40	2.52	3.56
	(0.71)	(0.74)
41 to 60	3.46	3.43
	(0.85)	(0.67)
61 to 80	12.14	10.29
	(2.16)	(2.10)
81 to 100	75.04	42.58
	(2.53)	(2.89)
Mean Percentage of School Days Participated in Target Week of the Initial Household Survey	87.95	55.12
	(1.60)	(3.02)
Percentage of School Days Participated in Target Week of the Panel Household Survey		
0	3.38	32.16
	(0.76)	(2.76)
1 to 20	0.05	4.28
	(0.05)	(1.42)
21 to 40	2.64	2.16
	(0.78)	(0.50)
41 to 60	3.12	3.43
	(0.62)	(0.75)
61 to 80	7.82	9.59
	(1.24)	(1.33)
81 to 100	82.99	48.39
	(1.67)	(2.69)
Mean Percentage of School Days Participated in Target Week of the Panel Household Survey	91.92	59.47
	(0.96)	(2.68)
Number of Percentage Points Difference Between Participation Rate from Initial Household Survey and That from Panel Survey for the Student		
0	68.13	57.08
	(2.51)	(2.21)
1 to 20	15.87	17.34
	(2.19)	(2.12)
21 to 40	6.19	5.74
	(1.02)	(0.90)
41 to 60	3.35	5.11
	(0.83)	(1.10)
61 to 80	1.43	5.61
	(0.45)	(1.10)
81 to 100	5.03	9.11
	(1.37)	(1.30)
Mean Number of Percentage Points Difference Between Participation Rate from Initial Household Survey and That from Panel Survey for the Student	13.40	21.83
	(1.50)	(1.40)

TABLE C.2 *(continued)*

	NSLP	SBP
Sample Size	**780**	**715**

Source: APEC study data.

Note: All figures are weighted. Standard errors account for clustering in the survey design.

APEC = Access, Participation, Eligibility, and Certification; NSLP = National School Lunch Program; SBP = School Breakfast Program.

TABLE C.3

VARIATION ACROSS THE SCHOOL YEAR IN NSLP AND SBP PARTICIPATION RATES AMONG FREE AND REDUCED-PRICE CERTIFIED STUDENTS, BASED ON PARENT REPORTS FOR ONE OR TWO TARGET WEEKS AND ADMINISTRATIVE RECORDS FOR THOSE MONTHS

	NSLP	SBP
Percentage of School Days Participated in Target Week of the Initial Household Survey		
0	4.30	36.84
	(1.49)	(3.82)
1 to 20	0.76	4.59
	(0.38)	(1.82)
21 to 40	2.04	3.07
	(0.66)	(0.87)
41 to 60	3.59	3.24
	(1.01)	(0.87)
61 to 80	10.22	10.43
	(2.81)	(3.22)
81 to 100	79.09	41.82
	(2.90)	(3.12)
Mean Percentage of School Days Participated in Target Week of the Initial Household Survey	90.37	54.20
	(1.60)	3.46
Percentage of School Days Participated in Target Week of the Panel Household Survey		
0	3.06	32.48
	(0.92)	(3.33)
1 to 20	0.08	3.86
	(0.08)	(1.48)
21 to 40	2.24	2.94
	(0.95)	(0.79)
41 to 60	3.01	2.94
	(0.84)	(1.06)
61 to 80	8.70	9.90
	(1.66)	(1.74)
81 to 100	82.92	47.87
	(2.18)	(3.15)
Mean Percentage of School Days Participated in Target Week of the Panel Household Survey	92.30	59.19
	(1.03)	(3.19)
Number of Percentage Points Difference Between Participation Rate from Initial Household Survey and That from Panel Survey for the Student		
0	69.98	57.59
	(3.12)	(2.92)
1 to 20	16.53	15.49
	(3.22)	(2.91)
21 to 40	6.60	6.00
	(1.35)	(1.17)
41 to 60	3.41	4.63
	(1.11)	(1.77)
61 to 80	0.58	7.27
	(0.29)	(1.72)
81 to 100	2.89	9.00
	(1.04)	(1.61)

TABLE C.3 *(continued)*

	NSLP	SBP
Mean Number of Percentage Points Difference Between Participation Rate from Initial Household Survey and That from Panel Survey for the Student	10.84	22.52
	(1.24)	(1.92)
Percentage of School Days Participated in Month Covered by the Initial Household Survey, According to Administrative Records Data		
0	8.28	35.91
	(4.00)	(4.73)
1 to 20	3.80	14.04
	(1.33)	(3.04)
21 to 40	4.21	8.76
	(1.21)	(2.19)
41 to 60	5.75	11.18
	(1.49)	(2.26)
61 to 80	12.64	8.90
	(2.05)	(2.09)
81 to 100	65.33	21.21
	(4.19)	(3.07)
Mean Percentage of School Days Participated in Month Covered by the Initial Household Survey, According to Administrative Records Data	74.41	34.98
	(3.97)	(3.30)
Percentage of School Days Participated in Month Covered by the Panel Household Survey, According to Administrative Records Data		
0	10.60	38.60
	(2.21)	(3.72)
1 to 20	3.17	9.99
	(1.12)	(1.89)
21 to 40	4.94	9.09
	(1.13)	(1.61)
41 to 60	8.74	8.15
	(1.79)	(1.73)
61 to 80	20.24	18.80
	(2.91)	(3.12)
81 to 100	52.30	15.37
	(2.91)	(2.63)
Mean Percentage of School Days Participated in Month Covered by the Panel Household Survey, According to Administrative Records Data	69.34	35.42
	(2.28)	(2.92)
Number of Percentage Points Difference Between Participation Rate in Month Covered by the Initial Household Survey and That in Month Covered by the Panel Survey, According to Administrative Records Data		
0	11.82	28.00
	(2.31)	(3.56)
1 to 20	56.99	36.38
	(3.56)	(3.38)
21 to 40	14.38	20.53
	(2.19)	(3.42)
41 to 60	4.90	7.01
	(1.26)	(1.75)
61 to 80	4.97	6.32
	(1.36)	(2.86)
81 to 100	6.94	1.76
	(2.55)	(0.72)

TABLE C.3 *(continued)*

	NSLP	SBP
Mean Number of Percentage Points Difference Between Participation Rate in Month Covered by the Initial Household Survey and That in Month Covered by the Panel Survey, According to Administrative Records Data	20.89 (2.10)	18.71 (1.70)
Sample Size	**466**	**391**

Source: APEC study data.

Note: All figures are weighted. Standard errors account for clustering in the survey design.

APEC = Access, Participation, Eligibility, and Certification; NSLP = National School Lunch Program; SBP = School Breakfast Program.

administrative records for those two months is 21 percentage points (Table C.3). This finding may suggest that some parents report on their child's usual participation rather than that for a specific week (due to recall error, perhaps), or it could be an artifact of the data, because less variation is possible during a week than a month.

APPENDIX D

SUBGROUP FINDINGS

This appendix contains additional findings related to subgroups. Table D.1 presents actual and parent-reported participation rates in the NSLP, by school and student characteristics. Table D.2 does the same for the SBP. Patterns of subgroup differences are generally similar for estimated participation rates based on parent reports for short periods of time and for actual participation rates during longer periods.

Both parent reports and administrative records data indicate higher rates of NSLP and SBP participation in schools serving younger children (Tables D.1 and D.2). For example, parent reports based on a week indicate an NSLP participation rate of 73 percent among high school students, compared to 90 percent among middle school students and 91 percent among elementary school students (Table D.1). Administrative records data for the month show NSLP participation rates of 47 percent for those in high school, 75 percent for middle school students, and 80 percent for elementary school students.

For the SBP, parent reports and administrative records data both show higher rates of participation in smaller schools and in schools with more students certified for free or reduced-price meals (Table D.2). For example, measures of participation rates in schools with more than 1,200 students range from 21 percent (based on administrative data for a month) to 33 percent (based on parent reports for a week), while rates for schools with no more than 400 students are 47 percent based on administrative data for a month and 64 percent based on parent reports for a week. SBP participation is also higher among students certified to receive free meals than it is among those certified for reduced-price meals.

Parent reports indicate higher rates of NSLP and SBP participation among those whose parents also report greater student and parent satisfaction with the school meal program (Tables D.1 and D.2). For example, the SBP participation rate according to parent reports for a week is 57 percent among students whose parents are very satisfied with the school meal program, but

TABLE D.1

AVERAGE RATE OF NSLP PARTICIPATION AMONG FREE AND REDUCED-PRICE CERTIFIED STUDENTS, BASED ON PARENTS' REPORTS AND ADMINISTRATIVE RECORDS, BY SCHOOL AND STUDENT CHARACTERISTICS

	Parent-Reported Data		Administrative Records Data	
Characteristics	Based on Previous Day	Based on Previous Week	For the Month Covered by Parent Reports	For the Year
School Type				
Elementary school	80.03	91.24	79.51	75.34
	(2.52)	(0.84)	(3.61)	(1.79)
Middle school	78.30	90.14	74.51	67.65***
	(4.16)	(2.33)	(3.40)	(2.77)
High school	62.81***	73.25***	47.04 ***	44.51***
	(3.80	(3.01)	(4.80)	(4.48)
School Enrollment (Number of Students)				
1 to 400	77.43	89.56	78.15	73.38
	(4.04)	(2.21)	(3.31)	(3.50)
401 to 800	79.83	91.24	79.44	73.66
	(2.89)	(1.22)	(2.04)	(1.68)
801 to 1,200	80.80	88.56	69.96	69.60
	(2.96)	(1.13)	(6.72)	(3.12)
More than 1,200	68.36	80.95**	62.32**	55.26***
	(3.95)	(3.55)	(7.12)	(6.04)
Percentage of Student Body Certified for Free/Reduced-Price Meals				
0 to 25	78.64	84.93	67.71	63.42
	(6.08)	(3.34)	(7.86)	(7.95)
26 to 50	74.39	86.71	72.06	66.78
	(3.22)	(2.00)	(3.64)	(3.56)
51 to 75	73.88	89.00	77.11	69.44
	(3.57)	(2.01)	(2.55)	(2.06)
76 to 100	83.31	90.67	75.46	73.21
	(2.60)	(1.19)	(5.50)	(2.76)
Student Certification Status				
Free	79.26	89.68	75.49	70.25
	(1.99)	(0.97)	(2.66)	(1.76)
Reduced-price	71.17	84.70***	70.82**	67.81
	(5.47)	(1.66)	(2.50)	(1.97)
Student's Satisfaction with School Meal Program				
Very satisfied	83.26	92.95	76.77	72.29
	(1.93)	(0.73)	(3.26)	(1.67)
Somewhat satisfied	78.34**	88.58***	74.74	70.06
	(2.20)	(1.27)	(2.36)	(1.99)

TABLE D.1 *(continued)*

Characteristics	Parent-Reported Data		Administrative Records Data	
	Based on Previous Day	Based on Previous Week	For the Month Covered by Parent Reports	For the Year
Somewhat dissatisfied	66.78***	85.19***	72.85	64.94***
	(5.48)	(2.78)	(3.59)	(2.68)
Very dissatisfied	68.32**	76.27***	65.79**	64.64
	(6.70)	(6.25)	(5.62)	(5.00)
Parent's Satisfaction with School Meal Program				
Very satisfied	82.77	91.73	75.69	71.21
	(1.98)	(0.81)	(2.81)	(1.64)
Somewhat satisfied	73.72**	87.84***	75.07	68.44
	(4.40)	(1.32)	(2.55)	(2.21)
Somewhat dissatisfied	70.71***	82.91***	74.91	70.75
	(4.11)	2.82)	(2.72)	(2.72)
Very dissatisfied	63.25***	82.61	66.73	67.34
	(6.71)	(5.62)	(6.59)*	(3.94)

Source: APEC study data.

Note: All figures are weighted. Standard errors account for clustering in the survey design.

*Significantly different from zero at the .10 level, two-tailed test.
**Significantly different from zero at the .05 level, two-tailed test.
***Significantly different from zero at the .01 level, two-tailed test.

APEC = Access, Participation, Eligibility, and Certification; NSLP = National School Lunch Program.

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TABLE D.2

AVERAGE RATE OF SBP PARTICIPATION AMONG FREE AND REDUCED-PRICE CERTIFIED STUDENTS, BASED ON PARENTS' REPORTS AND ADMINISTRATIVE RECORDS, BY SCHOOL AND STUDENT CHARACTERISTICS

	Parent-Reported Data		Administrative Records Data	
Characteristics	Based on Previous Day	Based on Previous Week	For the Month Covered by Parent Reports	For the Year
School Type				
Elementary school	47.72	59.42	40.72	37.99
	(2.84)	(2.15)	(3.10)	(2.54)
Middle school	37.88**	45.14**	30.97**	28.28**
	(4.67)	(5.81)	(3.74)	(3.49)
High school	22.65***	32.71***	15.89***	17.59***
	(2.88)	(3.10)	(2.09)	(1.99)
School Enrollment (Number of Students)				
1 to 400	52.44	63.69	47.23	40.70
	(3.61)	(2.99)	(3.43)	(2.91)
401 to 800	48.52	60.68	39.80	36.21
	(3.53)	(2.57)	(2.65)*	(2.63)
801 to 1,200	35.28***	45.55***	29.29***	30.81**
	(3.10)	(3.26)	(4.68)	(3.33)
More than 1,200	27.55***	33.42***	21.05***	21.72***
	(3.21)	(4.02)	(3.52)	(3.72)
Percentage of Student Body Certified for Free/Reduced-Price Meals				
0 to 25	31.81	40.70	23.77	25.14
	(7.16)	(7.31)	(7.01)	(6.50)
26 to 50	32.73	40.98	28.93	26.59
	(3.00)	(2.99)	(2.79)	(2.28)
51 to 75	42.80	56.76**	38.31*	35.20
	(3.24)	(3.30)	(2.94)	(2.83)
76 to 100	52.64**	61.74**	39.67*	37.80*
	(4.27)	(3.41)	(4.80)	(3.45)
Student Certification Status				
Free	45.31	56.44	37.49	34.55
	(2.57)	(1.97)	(2.24)	(1.95)
Reduced-price	31.64***	39.25***	26.88***	27.23***
	(3.79)	(3.29)	(2.83)	(2.39)
Student's Satisfaction with School Meal Program				
Very satisfied	45.09	56.81	37.69	35.07
	(3.25)	(2.60)	(2.68)	(2.16)
Somewhat satisfied	46.08	56.88	36.12	33.75
	(2.37)	(2.05)	(2.54)	(2.22)
Somewhat dissatisfied	28.88***	37.74***	31.80	25.82***
	(4.10)	(4.48)	(3.81)	(2.80)
Very dissatisfied	37.18	39.95***	28.38*	32.35
	(7.89)	(6.95)	(5.10)	(4.80)
Parent's Satisfaction with School Meal Program				

TABLE D.2 *(continued)*

Characteristics	Parent-Reported Data		Administrative Records Data	
	Based on Previous Day	Based on Previous Week	For the Month Covered by Parent Reports	For the Year
Very satisfied	46.76	57.36	36.03	33.59
	(2.58)	(2.32)	(2.47)	(2.11)
Somewhat satisfied	38.34*	51.22**	36.84	33.83
	(4.25)	(2.31)	(2.19)	(1.94)
Somewhat dissatisfied	42.08	43.16***	34.18	31.65
	(5.09)	(4.60)	(3.96)	(3.06)
Very dissatisfied	26.48***	33.11***	28.31	33.00
	(6.92)	(8.12)	(6.31)	(5.60)

Source: APEC study data.

Note: All figures are weighted. Standard errors account for clustering in the survey design.

*Significantly different from zero at the .10 level, two-tailed test.
**Significantly different from zero at the .05 level, two-tailed test.
***Significantly different from zero at the .01 level, two-tailed test.

APEC = Access, Participation, Eligibility, and Certification; SBP = School Breakfast Program.

only 40 among those whose parents are very dissatisfied (Table D.2). Administrative records data for longer time periods show similar patterns, but the differences are smaller and not as consistently statistically significant.

The remaining tables in this appendix show the results of univariate analyses of how accurately individual-level parent reports for a week estimate their child's actual participation over a longer time period for key subgroups. Table D.3 presents the differences between individual parent reports for a week and their children's actual participation for the month, in the NSLP and SBP. Table D.4 shows the differences between individual-level parent-reported data for a week and actual individual-level participation for the year.

TABLE D.3

INDIVIDUAL-LEVEL DIFFERENCES BETWEEN MONTHLY NSLP AND SBP PARTICIPATION RATES FOR FREE AND REDUCED-PRICE CERTIFIED STUDENTS, AND ESTIMATES BASED ON PARENTS' REPORTS OF THEIR CHILDREN'S PARTICIPATION FOR A TARGET WEEK, BY SCHOOL AND STUDENT CHARACTERISTICS

	Mean Absolute Value of Percentage Point Difference Between Estimate Based on Parent Reports For a Week and Actual Monthly Participation Rate	
Characteristics	NSLP	SBP
School Type		
Elementary school	17.80	27.93
	(3.29)	(1.74)
Middle school	23.44	31.00
	(3.25)	(2.10)
High school	33.47 ***	27.33
	(2.93)	(1.60)
School Enrollment (Number of Students)		
1 to 400	17.66	28.49
	(2.00)	(2.33)
401 to 800	18. 30	29.74
	(1.92)	(2.20)
801 to 1,200	25.29	25.90
	(6.02)	(2.97)
More than 1,200	24.92*	26.81
	(3.87)	(1.38)
Percentage of Student Body Certified for Free/Reduced-Price Meals		
0 to 25	21.08	19.30
	(3.86)	(4.79)
26 to 50	21.29	25.79
	(2.16)	(2.32)
51 to 75	18.66	29.14*
	(2.28)	(1.78)
76 to 100	21.71	30.65**
	(4.95)	(2.00)
Student Certification Status		
Free	20.47	29.83
	(2.25)	(1.44)
Reduced-price	21.36	21.30***
	(2.13)	(2.08)
Student's Satisfaction with School Meal Program		
Very satisfied	20.52	27.56
	(2.92)	(1.68)
Somewhat satisfied	20.5 4	30.89*
	(2.15)	(1.86)
Somewhat dissatisfied	21.10	24.70
	(2.27)	(3.81)

TABLE D.3 *(continued)*

Characteristics	Mean Absolute Value of Percentage Point Difference Between Estimate Based on Parent Reports For a Week and Actual Monthly Participation Rate	
	NSLP	SBP
Very dissatisfied	20.31	29.54
	(3.53)	(3.96)
Parent's Satisfaction with School Meal Program		
Very satisfied	20.94	29.22
	(2.45)	(1.63)
Somewhat satisfied	20.13	28.54
	(2.55)	(2.09)
Somewhat dissatisfied	16.46	24.44
	(1.86)*	(3.48)
Very dissatisfied	26.29	24.64
	(6.24)	(4.67)

Source: APEC study data.

Note: All figures are weighted. Standard errors (shown in parentheses) account for clustering in the survey design.

*Significantly different from zero at the .10 level, two-tailed test.
**Significantly different from zero at the .05 level, two-tailed test.
***Significantly different from zero at the .01 level, two-tailed test.

APEC = Access, Participation, Eligibility, and Certification; NSLP = National School Lunch Program.

TABLE D.4

INDIVIDUAL-LEVEL DIFFERENCES BETWEEN ANNUAL NSLP AND SBP PARTICIPATION RATES FOR FREE AND REDUCED-PRICE CERTIFIED STUDENTS, AND ESTIMATES BASED ON PARENT REPORTS OF THEIR CHILDREN'S PARTICIPATION FOR A TARGET WEEK, BY SCHOOL AND STUDENT CHARACTERISTICS

	Mean Absolute Value of Percentage Point Difference Between Estimate Based on Parent Reports For a Week and Actual Annual Participation Rate	
Characteristics	NSLP	SBP
School Type		
Elementary school	21.48	31.08
	(1.22)	(1.60)
Middle school	28.89 ***	33.27
	(2.29)	(2.24)
High school	38.59***	29.20
	(2.72)	(1.60)
School Enrollment (Number of Students)		
1 to 400	22.14	31.69
	(2.18)	(2.09)
401 to 800	22.64	33.71
	(1.21)	(2.12)
801 to 1,200	26.15	26.82*
	(2.12)	(1.79)
More than 1,200	34.73***	29.37
	(3.07)	(1.37)
Percentage of Student Body Certified Free/Reduced-price		
0 to 25	25.38	21.84
	(4.65)	(3.70)
26 to 50	27.83	28.93
	(2.12)	(2.17)
51 to 75	25.53	33.36***
	(1.41)	(1.58)
76 to 100	23.15	32.51**
	(2.02)	(1.84)
Student Certification Status		
Free	25.34	32.99
	(1.16)	(1.32)
Reduced-price	24.72	23.54***
	(1.48)	(1.64)
Student's Satisfaction with School Meal Program		
Very satisfied	24.07	31.38
	(1.33)	(1.43)
Somewhat satisfied	25.56	33.36
	(1.36)	(1.75)
Somewhat dissatisfied	28.03**	24.01***
	(2.03)	(2.42)

Table D.4 *(continued)*

Characteristics	Mean Absolute Value of Percentage Point Difference Between Estimate Based on Parent Reports For a Week and Actual Annual Participation Rate	
	NSLP	SBP
Very dissatisfied	24.64	33.82
	(3.17)	(3.54)
Parent's Satisfaction with School Meal Program		
Very satisfied	25.08	33.34
	(1.23)	(1.51)
Somewhat satisfied	25.42	29.30**
	(1.58)	(1.68)
Somewhat dissatisfied	23.73	26.65*
	(1.94)	(3.35)
Very dissatisfied	27.35	29.26
	(3.00)	(4.19)

Source: APEC study data.

Note: All figures are weighted. Standard errors (shown in parentheses) account for clustering in the survey design.

*Significantly different from zero at the .10 level, two-tailed test.
**Significantly different from zero at the .05 level, two-tailed test.
***Significantly different from zero at the .01 level, two-tailed test.

APEC = Access, Participation, Eligibility, and Certification; NSLP = National School Lunch Program.

APPENDIX E

FACTORS ASSOCIATED WITH PARTICIPATION

This appendix presents additional information related to factors associated with actual and parent-reported participation in the NSLP and SBP. Table E.1 provides complete regression results related to the NSLP, and Table E.2 does the same for the SBP. Some of the factors found to be associated with actual participation over the school year are also associated with parent-reported participation for shorter periods of time, but others are not.

NSLP

- *Factors associated with both administrative records and parent reports:* Students' satisfaction with school meals is positively associated with actual participation and both measures of parent-reported participation in the NSLP (Table E.1). For example, according to parent reports for a week, students who are very satisfied with the taste of school meals are 16 percentage points more likely to obtain an NSLP lunch than those who are not satisfied; according to administrative records, they are 8 percentage points more likely to obtain a school lunch. School level also is associated with the administrative records and both parent-reported measures of participation in the NSLP. Both actual NSLP participation and parent reports for a week—but not parent reports for a day—are associated with student race/ethnicity.

- *Factors associated with administrative records but not with parent reports:* The employment of a household member and the school's use of electronic POS technology are both positively associated with actual participation in the NSLP over the school year, but not with parent reports for shorter periods of time (Table E.1). For example, according to administrative records, students at schools that use electronic POS technology are 9 percentage points more likely to obtain a NSLP lunch than those at other schools, but parent reports do not show this finding.

- *Factors associated with parent reports but not with administrative records:* Food insecurity is found to be positively associated with one measure of parent-reported participation in the NSLP and SBP, but is not associated with the other parent-reported measure nor with actual participation (Table E.1). In particular, parent reports for a day indicate that students in households that have experienced food insecurity outcomes are 5 percentage points more likely to obtain an NSLP breakfast than other students, but parent reports for a week and administrative records for the year do not show a statistically significant association between food insecurity and NSLP participation.

TABLE E.1

FACTORS ASSOCIATED WITH STUDENT-LEVEL NSLP PARTICIPATION RATES, BASED ON PARENT REPORTS AND ADMINISTRATIVE RECORDS

	Administrative Records, Year	Parent Report, Previous Day	Parent Report, Previous Week
Student Characteristics			
Male	0.88	0.75	0.17
	(1.12)	(1.98)	(1.27)
African American or Hispanic	3.37*	5.24	3.23**
	(1.83)	(3.24)	(1.52)
Family Characteristics			
Parental Educational Attainment			
High school degree	1.33	-0.03	-1.01
	(1.46)	(2.52)	(1.52)
More than high school degree	1.59	2.60	-0.80
	(2.02)	(2.33)	(1.88)
Household Income	0.34	0.82	-0.01
	(0.51)	(0.77)	(0.51)
Employed Household Member	5.48***	0.45	1.42
	(1.84)	(2.76)	(1.61)
Number of Children	0.27	0.07	0.55
	(0.31)	(0.72)	(0.40)
Experienced Food Insecurity Outcome	2.31	5.49*	-0.07
	(1.54)	(2.96)	(2.00)
Attitudes Toward School Meals			
Student's Satisfaction with School Meal Taste			
Very satisfied	7.89***	16.94***	16.23***
	(2.43)	(4.15)	(3.03)
Somewhat satisfied	5.51**	14.76***	14.24***
	(2.19)	(3.82)	(2.92)
School Characteristics			
School Type			
Middle school	-5.57**	0.42	0.16
	(2.77)	(3.92)	(2.72)
High school	-28.49***	-14.83***	-15.87***
	(4.97)	(5.21)	(3.12)
Percentage of Student Body Certified Free/Reduced-Price	-0.05	0.00	-0.01
	(0.07)	(0.08)	(0.04)
Enrollment			
801 to 1,200	-3.43	3.78	-1.35
	(3.16)	(3.06)	(1.67)
Greater than 1,200	-5.36	-2.83	-2.17
	(4.65)	(6.54)	(2.90)
Located in Urban Area	-3.37	5.77	0.42
	(3.22)	(3.80)	(1.97)

TABLE E.1 *(continued)*

	Administrative Records, Year	Parent Report, Previous Day	Parent Report, Previous Week
School Meal Program Implementation Characteristics			
Uses Direct Certification	-0.02	-4.89	0.16
	(2.52)	(5.09)	(2.31)
Uses Electronic Point-of-Sale Technology	8.87**	-2.61	-3.81
	(4.10)	(5.75)	(3.17)
Constant	56.70***	61.34***	78.82***
	(6.98)	(9.71)	(6.57)
Sample Size	**2,060**	**2,040**	**2,055**

Source: APEC study data.

Note: All figures are weighted. Standard errors account for clustering in the survey design.

*Significantly different from zero at the .10 level, two-tailed test.
**Significantly different from zero at the .05 level, two-tailed test.
***Significantly different from zero at the .01 level, two-tailed test.

APEC = Access, Participation, Eligibility, and Certification; NSLP = National School Lunch Program.

TABLE E.2

FACTORS ASSOCIATED WITH STUDENT-LEVEL SBP PARTICIPATION RATES, BASED ON PARENT REPORTS AND ADMINISTRATIVE RECORDS

	Administrative Records, Year	Parent Report, Previous Day	Parent Report, Previous Week
Student Characteristics			
Male	3.88**	4.19	0.46
	(1.68)	(3.20)	(2.20)
African American or Hispanic	1.11	3.86	3.44
	(2.39)	(3.32)	(3.14)
Family Characteristics			
Parental Educational Attainment			
High school degree	-2.69	-9.90***	-7.67***
	(1.92)	(3.63)	(2.72)
More than high school degree	-2.85	-9.04*	-9.43**
	(2.79)	(4.74)	(3.70)
Household Income	-0.45	-0.77	-1.32
	(0.68)	(0.98)	(1.07)
Employed Household Member	-2.13	-5.27	-6.48**
	(2.35)	(3.93)	(2.85)
Number of Children	2.04***	1.41	2.97***
	(0.63)	(1.14)	(0.84)
Experienced Food Insecurity Outcome	2.11	4.75	8.83**
	(1.76)	(3.59)	(3.88)
Attitudes Toward School Meals			
Student's Satisfaction with School Meal Taste			
Very satisfied	5.22*	10.28**	16.78***
	(3.01)	(4.48)	(4.12)
Somewhat satisfied	4.54	8.67*	14.36***
	(2.81)	(4.44)	(3.78)
School Characteristics			
School Type			
Middle school	-4.75	-3.24	-2.91
	(3.30)	(4.19)	(4.03)
High school	-12.87***	-15.83***	-8.44
	(3.66)	(5.53)**	(5.62)
Percentage of Student Body Certified Free/Reduced-Price	0.14	0.20	0.25***
	(0.12)	(0.09)	(0.09)
Enrollment			
801 to 1,200	-4.69	-11.12***	-12.26***
	(3.86)	(4.09)	(3.99)
Greater than 1,200	-5.73	-8.46	-15.54***
	(4.41)	(5.22)	(5.39)

TABLE E.2 *(continued)*

	Administrative Records, Year	Parent Report, Previous Day	Parent Report, Previous Week
Located in Urban Area	-11.22**	-6.15	-7.30*
	(5.08)	(4.17)	(4.26)
School Meal Program Implementation Characteristics			
Uses Direct Certification	0.81	-6.49	-1.43
	(3.71)	(8.09)	(6.89)
Uses Electronic Point-of-Sale Technology	2.90	-1.10	-3.10
	(3.78)	(5.88)	(3.81)
Constant	20.75**	38.84***	34.19***
	(9.05)	(11.02)	(10.45)
Sample Size	**1,790**	**1,772**	**1,780**

Source: APEC study data.

Note: All figures are weighted. Standard errors account for clustering in the survey design.

*Significantly different from zero at the .10 level, two-tailed test.
**Significantly different from zero at the .05 level, two-tailed test.
***Significantly different from zero at the .01 level, two-tailed test.

APEC = Access, Participation, Eligibility, and Certification; SBP = School Breakfast Program.

SBP

- *Factors associated with both administrative records and parent reports:* As in the NSLP, students' satisfaction with school meals is positively associated with actual participation and both measures of parent-reported participation in the SBP (Table E.2). For example, according to parent reports for a week, students who are verysatisfied with the taste of school meals are 17 percentage points more likely to obtain an SBP breakfast than those who are not satisfied; according to administrative records, they are 5 percentage points more likely to obtain an SBP breakfast. School level is associated with the administrative records the parent-reported measure of participation based on a day—but not parent reports for a week—for the SBP. The number of children in the household and urban location are both associated with actual SBP participation and estimated participation based on parent reports for a week, but not for a single day.

- *Factors associated with administrative records but not with parent reports:* Gender is associated with actual participation in the SBP over the school year, but not with parent reports for shorter periods of time (Table E.2).

- *Factors associated with parent reports but not with administrative records:* Food insecurity is found to be positively associated with one measure of parent-reported participation in the SBP (as in the NSLP), but is not associated with the other parent-reported measure nor with actual participation (Table E.2). For example, parent reports for a week indicate that students in households that have experienced food insecurity outcomes are 9 percentage points more likely to obtain an SBP breakfast than other students, but neither parent reports for a day nor administrative records for the year show a statistically significant association between food insecurity and SBP participation. Parents' education, the proportion of students certified to receive free or reduced-price meals at the school, and school size are associated with both parent-reported measures of SBP participation during a short period of time, but not with actual participation over the year. A household member's employment is found to be associated with one measure of parent-reported SBP participation, but not with the other parent-reported measure nor with actual participation.

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