NBER WORKING PAPER SERIES

DOES SCHOOL LUNCH FILL THE “SNAP GAP” AT THE END OF THE MONTH?

Agustina Laurito
Amy Ellen Schwartz

Working Paper 25486
http://www.nber.org/papers/w25486

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
January 2019

This research was supported by USDA grant no. 59-5000-5-0115 to the National Bureau of Economic Research, entitled, "Using FoodAPS for Research in Diet, Health, Nutrition, and Food Security." The views expressed are those of the authors and not necessarily those of the Economic Research Service, Food and Nutrition Service, or the U.S. Department of Agriculture. We thank participants at NBER FoodAPS Conference in Washington, DC, the Association for Policy Analysis and Management (APPAM) Fall Research Conference in Chicago, IL, and the Summer Seminar Series of the Institute of Education and Social Policy (IESP) at New York University. We also thank the editors of the Southern Economic Journal and two anonymous reviewers for their valuable comments. The views expressed herein are those of the authors and do not necessarily reflect the views of the National Bureau of Economic Research.

Does School Lunch Fill the “SNAP Gap” at the End of the Month?
Agustina Laurito and Amy Ellen Schwartz
NBER Working Paper No. 25486
January 2019
JEL No. I38,J18

ABSTRACT

This paper examines the relationship between the timing of SNAP benefit payments and participation in school lunch and breakfast using the National Household Food Acquisition and Purchase Survey (FoodAPS). An event study approach examines participation over the five-day window before and after the SNAP payment. We find that school lunch participation decreases 17 to 23 percentage points immediately after the SNAP payment among 11-18 year olds while breakfast drops 19 to 36 percentage points. The decline begins the day prior to payment. We find no effects for 5-10 year olds. Models examining participation over the full SNAP month using individual fixed effects yield similar findings. Among teenagers, participation in school lunch and breakfast decline in the first two weeks of the SNAP month, increasing afterwards. Non-school meals show the opposite pattern. Overall, results indicate SNAP households rely more on school lunch and breakfast toward the end of the SNAP month. Adolescents substitute away from school meals to non-subsidized meal options earlier in the SNAP benefit cycle.

Agustina Laurito
Department of Public Administration
University of Illinois at Chicago
400 S. Peoria Street, Room 2113 AEH (MC 278)
Chicago, IL 60607
malaurit@uic.edu

Amy Ellen Schwartz
Maxwell School of Citizenship and Public Affairs
Center for Policy Research
Syracuse University
426 Eggers Hall
Syracuse, NY 13244
amyschwartz@maxwell.syr.edu

1. Introduction

In 2016, approximately 16% of households with children in the United States (U.S.) were food insecure. This means that a significant number of Americans, at some point, were unable to cover their food and nutrition needs (Coleman-Jensen et al., 2017). Children are not exempt from experiencing food insecurity. In 2016, children were food insecure in roughly 8% of these households (Coleman-Jensen et al., 2017). There are several programs in the country to help families and their children meet their nutrition and food needs. Two of the largest are the Supplemental Nutrition Assistance Program (SNAP) and the National School Lunch Program (NSLP). There is evidence that these programs contribute to ameliorate food insecurity (i.e. Hoynes and Schanzenbach, 2015), however, much remains to be learned about their effectiveness, and how households use them. Further, while many families with children are likely to use both SNAP and school lunch, little research documents the relationship between them.

According to a recent report from the White House Council of Economic Advisers (2015), monthly SNAP payments are insufficient to cover a family's food needs for the entire month. Persuasive empirical evidence shows that, indeed, food consumption, purchases and caloric intake decrease toward the end of the SNAP benefit cycle, especially during the last week of the SNAP month (Shapiro, 2005; Hoynes and Schanzenbach, 2015). That is, there is a "SNAP gap" at the end of the month. Is there a countervailing increase in school lunch participation? To what extent does the NSLP ameliorate this exhaustion of benefits, that is "close the SNAP gap"?

This paper answers these questions using newly available data from the National Household Food Acquisition and Purchase Survey (FoodAPS), a nationally representative survey that tracks food acquisitions for all members of a household – including children – for seven days. We take advantage of the longitudinal nature of FoodAPS and construct a child by day dataset with measures of SNAP participation, days since SNAP payment, and measures of daily school and non-school meal participation.[2] We use two distinct empirical strategies. First, we use an event study approach leveraging the subset of FoodAPS households that received their SNAP payment during data collection week. For this analysis, we compare school meal participation for children in these households in the five weekdays before SNAP payment to participation in the five weekdays after the SNAP payment. This strategy yields an estimate of the short-run effect of SNAP on school meal participation. Second, we examine the evolution of participation in school meals over the full SNAP month exploiting the panel nature of our data to estimate models with individual fixed effects.

To preview our findings, short-run models show a decline in both school lunch and breakfast right after SNAP payment among 11-18 year olds. Specifically, lunch participation drops by 17 percentage points and breakfast participation declines by 20 percentage points for this age group. We find some evidence of an "anticipation effect" in which school meal participation decreases 18 percentage points the day before SNAP pay and continues to drop following benefit receipt (23 percentage points). School breakfast also declines – 25 percentage points the day before SNAP pay rising to 36 percentage points in the days after payment. Finally, among 11-18 year olds, non-school breakfast increases substantially after SNAP benefits. Younger children seem less responsive. There is no significant change in school meal participation for 5-10 year olds around the SNAP payment date, although non-school breakfast acquisitions decrease after SNAP payments.

Full month models yield similar results. We find that 11-18 year olds drop school meal

[2] We will refer to our main outcome variables as measuring participation in school or non-school meals, but because FoodAPS only records food acquisitions we do not know if children actually ate the meal they acquired.

participation in the first two weeks of the SNAP benefit cycle. On days 11 to 15, teenagers are 23 percentage points less likely to acquire lunch and 22 percentage points less likely to have breakfast relative to days 26 to 30 of the SNAP month. For all school meals, participation increases after that. We observe the opposite pattern for non-school meals. As before, results for 5-10 year olds are generally not significant.

In sum, this paper provides evidence that school meals may offset declines in food consumption at the end of the SNAP month, especially for teenagers who are less likely to participate in school meal programs. This group, however, substitutes away from school meals early in the SNAP month. We test the robustness of our findings in a number of ways. The findings are encouraging. Specifically, our results are robust to the inclusion of calendar week controls to account for the receipt of other forms of payment, and to the inclusion of an indicator for SNAP payments that occur on a weekend. Further, stratifying the sample by “school level” (elementary school vs. middle and high school) rather than age group yields similar results. Finally, we note that we do not observe the same patterns in meal participation (both school and non-school) over the calendar month among children in non-SNAP households.

The rest of the paper is organized as follows. Section 2 reviews the literature and develops a theoretical framework. Section 3 describes the FoodAPS data, our measures, and sample. Section 4 outlines the empirical strategy. We discuss results and robustness tests in section 5 and conclude in the last section.

2. Literature Review and Theory

Supplemental Nutrition Assistance Program (SNAP)

In 2008, SNAP became the new name of the Food Stamp Program to reflect the increased emphasis on nutrition as well as higher benefit amounts. In 2016, close to 23 million households participated in the program making it the largest food assistance program in the U.S. To qualify for SNAP, households need to meet either categorical eligibility or certain income, resource, and employment requirements.[3] SNAP recipients redeem their benefits electronically using an Electronic Benefit Transfer (EBT) card to purchase eligible food items. In 2016, there were 260,115 stores authorized to accept SNAP. In 2015, the SNAP participation rate for all eligible individuals was 83%, while the participation rate of employed poor persons was lower at 72% (Farson Grey and Cunnyngham, 2017). Overall, households below the poverty line participate more than those above but still eligible, as do households with children (Farson Grey and Cunnyngham, 2017). In 2015, over 40% of SNAP participants were 18 years old or younger and the vast majority reside in urban areas. That same year, the average income of SNAP participants was $786, and SNAP benefits averaged $254.

SNAP and food consumption

A large and rich body of work documents the relationship between SNAP and various outcomes including spending and consumption (Hoynes and Schanzenbach, 2009; Gundersen and Ziliak, 2003), food security and nutrition (Castellary et al., 2016; Hoynes and Schanzenbach, 2015) and health (Gibson, 2003; Seligman et al., 2014). A subset of this literature focuses on children, and, among these, many study the effects of SNAP on BMI and obesity (Gibson, 2004; Schmeiser, 2012). More recently, attention has shifted to investigating how the timing of SNAP benefits influences behavior and consumption. This is an important issue, especially for households with children because of the consequences for food security. Indeed, in 2009, most households with children had exhausted at least half of their SNAP benefits within two weeks,

[3] For additional details see USDA, FNS: http://www.fns.usda.gov/snap/eligibility#Employment%20Requirements

and nearly 50% had used almost all of their benefits (Castner and Henke, 2011). This exhaustion in benefits has consequences for a household's food consumption.

In an earlier study, Wilde and Ranney (2000) find that consumption decreases during the SNAP month, suggesting this drop is the result of households making larger shopping trips at the beginning of the month, possibly due to transportation constraints. Using survey data, Shapiro (2005) finds a decline in caloric intake at the end of the SNAP month. Contrary to Wilde and Ranney (2000), he finds no difference, however, for households that make frequent trips. More recently, Todd (2015) finds decreases in the consumption of certain products such as milk, vegetables and meat especially in the period before the benefit increase of the American Recovery and Reinvestment Act (ARRA) of 2009. Benefit increases reduce this cyclicality but do not completely eliminate it (Todd 2015; Todd and Gregory 2018).

SNAP recipients also report purchasing and eating a greater variety of foods at the beginning of the month (Darko, Eggett, and Richards, 2013; Seefeldt and Castelli, 2009). Castellari and colleagues (2016) use the Nielsen Homescan Consumer Panel Dataset (NHCPD) to examine consumption patterns of bread, milk, beer, soft drinks, and tobacco throughout the SNAP month. They find that purchases are higher on benefit receipt dates, and total consumption is affected by whether benefit payments happen on a weekend.

Other behaviors are affected as well. For example, SNAP recipients are more likely to shop at grocery stores and "big box" stores and more likely to eat at home earlier in the SNAP month than later when they are more likely to shop at convenience stores (Damon, King, and Leibtag, 2013). Using FoodAPS, Smith et al. (2016) find that SNAP households spend more money on food at home on the day of benefit receipt, and this spending declines in the days after. That is, SNAP households are more likely to make large food purchases at the start of the benefit cycle than later in the month.

While current research shows that household food purchases and consumption of certain goods decrease at the end of the SNAP month, evidence of the effects of SNAP benefit exhaustion on child food consumption is limited. Most research focused on children examines the effect of the timing of SNAP payments on health and school outcomes. Two recent studies estimate the relationship between the timing of SNAP payments and academic outcomes. Gassman-Pines and Bellows (2018) find a curvilinear relationship between the timing of SNAP payments and test scores. Test scores peak around day 17 and start decreasing after that. Cotti, et al. (2018) show that math test scores decrease toward the end of the SNAP month, and especially in the four days after receipt of SNAP payments.

National School Lunch Program (NSLP) and National Breakfast Program (SBP)

The NSLP is a federal program that provides low-cost or free lunches to eligible children in schools and other childcare institutions. Created in 1946 through the National School Lunch Act, it is the second largest food assistance program in the country. In its first year of operation it provided meals for over 7 million children. The number of children served has increased substantially since then, and by 2016, more than 31 million children received school lunches at a cost of $13.6 billion. The NSLP defines students as eligible for *free lunch* if their family income is at or below 130 percent of the poverty threshold and eligible for a *reduced-price lunch* if family income is between 130 and 185 percent of the poverty threshold. The price of lunch for all other students is established by local food authorities (USDA, FNS, 2017).[4]

[4] Lunches served under this program must meet certain federal nutrition requirements including the availability of fruits and vegetables, and whole grains. Attention to the nutritional value of school meals increased with the Healthy Hunger Free Kids Act of 2010. There are specific limits on calories and sodium content. The decision of what food items are served remains with local food authorities, and schools and districts that participate in these programs get reimbursed for each lunch served (reimbursable meals).

Some schools participate in the School Breakfast Program (SBP), founded in 1966 by the Child and Nutrition Act and administered by the USDA. Unlike the NSLP, not all schools participate in the SBP. USDA (2017) reports that in 2016 over 100,000 schools and other childcare institutions participated in the NSLP, while only about 87,000 schools participated in the SBP. Accordingly, while more than 31 million students participated in the NSLP, less than half as many (14.6 million) participated in the SBP in 2016. We focus on the larger program – NSLP – but we also examine school breakfast.

School meal participation and child outcomes

Not all eligible children participate in NSLP or SBP and utilization varies among those who participate, due to a variety of factors. First, some students will not utilize school breakfast because their school does not participate in the program. Second, participation and utilization may be dampened by stigma associated with these subsidized meals. Using data from the Panel Study of Income Dynamics, Mitcherva and Powell (2009) find a positive correlation between the share of students eligible for free lunch and school meal participation. Marples and Spillman (1995) report that high school students are more likely to eat school lunch if their friends do. Finally, students may prefer other meal options. For example, schools may offer competing options through “a la carte” menu items that are preferred (Gundersen, 2015).

Research examining the effects of school meals on child nutrition and obesity has yielded mixed findings. While some studies find school lunch improves child nutrition and obesity (Gleason and Suitor 2003; Gundersen et al. 2012), others find little evidence that the NLSP improves diet (Campbell et al. 2011; Battacharya, Currie, and Haider 2004) and it may even increase child obesity (Schanzenbach, 2009; Millimet, Tchernis, and Husain, 2010). Nord and Romig (2006) suggest the NSLP can improve food insecurity. Few of these studies, however, are recent enough to reflect the changes in the NSLP induced by the Healthy Hunger Free Kids Act of 2010.

As for school breakfast, Battacharya, Currie, and Haider (2006) find positive impacts of participation on dietary quality, Millimet, Tchernis, and Husain (2010) find improvements in child obesity, and Imberman and Kugler (2014) document positive impacts of Breakfast in the Classroom (BIC) on test scores in a large urban school district in the Southwest of the United States. In contrast, Corcoran et al. (2016) find no evidence that BIC reduces obesity or improves academic performance in New York City. Similarly, Schanzenbach and Zaki (2014) analyze experimental data and find little evidence that BIC improves health or academic achievement, as well as little improvements on nutrition.

So far, research on school meal programs is mixed and research that examines the school lunch program tend to consider it independently of the overall food safety net. Indeed, there is little evidence of how school meal participation, nutrition, and consumption of school meals vary with a family's resources throughout the month, in particular for SNAP participants. This paper adds to the literature by examining the relationship between SNAP and school meals. We improve on existing studies using a detailed dataset that allows us to track the food acquisitions of children in SNAP households for a period of seven days. Since households are surveyed at different points of the SNAP benefit cycle we are able to provide insight into how families use school lunch and breakfast over the SNAP month, that is, into whether (or how much) there is substitution between SNAP and the NSLP and the SBP.

Why might school meal participation change after SNAP payments?

If there is complete consumption smoothing for SNAP families in anticipation of regular benefit receipt, there may be no change in school meal participation over the SNAP month, as families balance out of school purchases and in school consumption. That is, the timing of SNAP benefits may not affect school meal participation if families do not increase school lunch to compensate for low balances toward the end of the SNAP month. However, existing evidence indicates consumption smoothing is not complete (Wilde and Ranney 2000; Shapiro 2005; Todd 2015; Todd and Gregory 2018). Families employ different strategies to compensate for this exhaustion in SNAP benefits. Schenck-Fontaine, Gassman-Pines, and Hill (2017) surveyed African-American families in Durham, North Carolina, finding that SNAP households are more likely to borrow money from social networks starting in the third week of the SNAP month. Use of food banks comes after borrowing and not until the last week of the cycle.

While these papers do not explore school meals, they suggest they may have a role in supporting food consumption when SNAP benefits run low. Families may increase reliance on school lunch at the end of the SNAP month as benefits are exhausted and then reduce reliance after the SNAP payment (the beginning of the SNAP month) opting to bring lunch from home, or purchase from other vendors. That is, school lunch participation may decline at the start of the SNAP month compared to later in the benefit cycle. Notice, however, that the precise timing of this change may be ambiguous. Studies on behaviors in and around payday for individuals receiving social security (also a fixed income with a regular payment schedule) show sharp increases in expenditures on the day of benefit receipt and days after pay. For total expenditures, those increases begin two days before peaking on payday (Stephens, 2003). Changes in school meal participation might begin the day before the SNAP payment day in an “anticipation effect”.

Further, the relationship between SNAP and school lunch may vary by student age. Middle and high school students have lower school meal participation rates than elementary school students (Mirtcheva and Powell, 2009) which may be due to greater sensitivity to stigma or greater access to competing options (including open campuses). For example, recent qualitative evidence shows that middle school students report buying breakfast in convenience stores on the way to school rather than eating school breakfast and that other students often make fun of children eating school breakfast (Bailey-Davis et al., 2012). Thus, we stratify all our models by age.

3. Data and Measures

The main source of data for this paper is FoodAPS, a nationally representative survey of 4,826 households co- sponsored by the USDA's Economic Research Service (ERS) and the Food and Nutrition Service (FNS). FoodAPS is a rich and detailed dataset with information on food acquisitions during seven days for the primary respondent, and for the other members of the household, including school-age children. In addition, FoodAPS includes information about participation in other nutrition programs, in particular for children who participate in school lunch (breakfast), as well as detailed information on what items were acquired as part of a meal, where the acquisition took place (such as home or school), and the meal's nutritional information.[5] The survey was administered between April 2012 and January 2013. Data collection was a multi-step process that consisted of an initial interview with the primary respondent.[6] This interview took place prior to the first day of data collection. During the week of data collection, all members of a household aged 11 or older recorded food acquisitions in a food book, while the primary respondent recorded meal acquisitions for those aged 10 or younger and completed the Meals and Snack Forms (M&SF). The M&SF indicate for all survey

[5] FoodAPS is composed of household level data, individual level data, food at home and food away from home event, item, and nutrient data. For more details on the structure and different datasets that are part of FoodAPS see FoodAPS User's Guide, November 2016.
[6] The primary respondent is the household's main food shopper or meal planner (FoodAPS User's Guide, November 2016)

participants in the household whether they acquired breakfast, lunch, dinner or snacks on a given day of the data collection week. In addition to the initial interview, there were three follow-up phone interviews and a final interview with the primary respondent after the last day of data collection (day seven). Financial incentives were provided for respondents to complete interviews or assigned tasks.[7] In order to ensure the validity of reported food acquisitions food book entries were verified during the three phone interviews, and to the extent possible all data discrepancies (i.e. duplicate entries, partial entries) were resolved.

Building a child-day dataset

We begin by identifying children in FoodAPS individual dataset (FI). There are a total of 3,338 school-age children (5 to 18 years old). We match these with the FoodAPS household dataset (FH) to identify children that are poor (in household with incomes less than 185% of poverty threshold), in households currently receiving SNAP (1,445) and enrolled in K-12.[8]

We obtain data on meal acquisitions from FoodAPS' Food Away From Home dataset (FAFH). These meal-level data include all food acquisitions recorded by children in their own food books (age 11-18) or reported by the primary respondent (age 5-10). The data also provide information about the type of meal (e.g. lunch), date, and place of the acquisition (e.g. school) among other information. Because these data only record acquisitions that happened away from home, and some meals may occur in the home or are prepared at home to eat at school, we supplement the FAFH data with the M&SF. Recall that these data only indicate whether a child had a lunch, breakfast, dinner, or snack on a given day of data collection and it is filled out by

[7] The primary respondent received a base incentive of $100, and a $10 gift card for each of the three follow up interviews. Children aged 11 to 14 years old received a $10 gift card if they filled their food books or reported their food acquisitions to the primary respondent. Respondents aged 15 or older received a $20 gift card (FoodAPS User's Guide, November 2016).

[8]Thus, we exclude children that do not attend school, dropped out, are not old enough to be in school, are home schooled or in some other type of school (not K-12).

the primary respondent. This means that the M&SF data do not contain any additional details regarding the *location* of the meal.

Our final dataset includes child-day observations that have lunch (breakfast) information from one of these two data sources. We drop child-day observations with no lunch (breakfast) recorded on either dataset. Further, for our main analyses we restrict our sample to children interviewed when school was in session, excluding those interviewed during summer and other breaks.[9] These sample restrictions result in a total of 1,173 children amounting to 7,532 child-day observations and 5,529 child-day *weekday* observations with lunch, and 5,242 child-day weekday observations when school was in session for breakfast. (Of 6,314 weekday child-day observations when school was in session, lunch (breakfast) data was missing from both the FAFH and M&SF for 785 (1,072). We see no differential missing data rates between younger kids and older kids.)[10]

Table 1 shows demographic characteristics of the resulting sample by SNAP status. As shown, the 794 children in SNAP households differ from the 379 poor children in non-SNAP households. Specifically, SNAP children are more likely to be non-white or live in public housing, and less likely to live in a rural area, and in a household with a car than poor children in non-SNAP households. Further, SNAP children are more likely to participate in school lunch. Specifically, they are 13 to 16 percentage points more likely to get a *school* lunch and correspondingly 14 to 18 percentage points less likely to have a *non-school* lunch than non-SNAP kids, but we see no differences in school and non-school breakfast participation.[11]

[9] We exclude 2,613 observations due to this restriction. The full sample including children interviewed during summer and when school was in session includes 9,427 observations and 1,468 children.
[10] Of the observations with missing lunch 10 percent (334) are aged 11-18 and 15.1 percent (451) are aged 5 to 10. As for breakfast, 15.6 percent (520) of 11 to 18 year olds report no breakfast data and 18.5 percent (552) of 5 to 10 year olds do so.
[11] These results come from a regression of school and non-school meal participation indicators on a dummy equal 1 if child *i* is in a SNAP household and 0 if she is not. These models include demographic controls and day of the

Measures

Our key measures capture daily participation in school lunch and breakfast as well as non-school lunch and breakfast. "School lunch" equals one if the child or primary respondent reported acquiring lunch on a given day at school in the FAFH dataset or if lunch was classified as a *school lunch* based on the items acquired (FAFH-item dataset)[12], and if lunch was free and part of a reimbursable meal.[13] It is zero if the child did not acquire a school lunch (but acquired another type of lunch reported in the FAFH-event data or in the M&SF), or if she or he report having no lunch at all in the M&SF. Similarly, our non-school lunch measure equals one if the child or primary respondent reported getting lunch on a given day of data collection, and lunch was not coded as a school lunch. We create school and non-school breakfast measures similarly. Unfortunately, FoodAPS does not provide daily attendance data, so we are unable to isolate meal acquisition on days attending school only.

Overall, lunch participation is high. On an average day, 90% of children have a lunch and 79% a breakfast. There are some differences by age level. Roughly, 88% of 5-10 year olds have lunch and 84% breakfast. In contrast, 92% of 11-18 year olds have lunch and 74% breakfast.[14]

4. Empirical Strategy

We exploit two plausibly exogenous sources of variation. One is the timing of SNAP benefit receipt, and the other is the timing of FoodAPS data collection. We take advantage of the

week and interview month fixed effects. Sample limited to children interviewed when school was in session. Results reported in table A1 in the appendix.

[12] According to the FAFH Item data codebook, food items were identified as part of a school meal using the School Nutrition Dietary Assessment Study (SNDA-IV) collected during 2009-2011. Thus, the FAFH-item dataset includes variables that classified items as part of a school meal, indicating whether those items are part of a reimbursable meal or not. We use the variables MENUID and MENUGRP as well as NONSCHLITEM to identify subsidized school meals from non-school meals that may have happened at school.

[13] We also created an alternative measure that equals 1 for free school lunch and school lunches that cost between $0.3 and $0.4 and would qualify as reduced-price meals. There are very few observations in this group (93 overall) and all results reported in the paper are not sensitive to using this measure. Results available from authors.

[14] All reported means weighted by household sampling weights.

fact that in most states the date of SNAP benefit receipt is assigned based on the social security number, case number, or first letter of recipients' last name,[15] and so the precise timing is credibly exogenous and uncorrelated with other key variables. (See Figure A1 for the distribution of SNAP pay dates in our data.) Second, we use the timing of FoodAPS data collection relative to the SNAP benefit cycle, which is also random. The implication is that we have variation in the time of SNAP payments that is uncorrelated with relevant household characteristics in the survey. (See Figure A2 for the frequency distribution by days since SNAP pay in our data.)

We use two distinct empirical approaches. The first estimates a short-run effect of SNAP on school lunch and breakfast participation. The second explores patterns of participation over the entire SNAP month. Our first analyses focus on the households that received a SNAP payment during data collection week (days one to seven).[16] There are a total of 170 school-aged children in these households amounting to 1,008 kid-day weekday observations and 806 kid-day observations when school was in session. For most children in this sample we have observations both before and after SNAP pay, however, for those in households that received payments on the first (last) day of data collection we only have data for their post (pre) SNAP pay period.[17]

We estimate the following baseline specification for lunch participation and breakfast participation separately:

$$meal_{idm} = \alpha + \beta PostSNAPpay_{idm} + X'_{idm}\theta + \delta_d + \mu_m + \varepsilon_{idm}$$

[15] For additional details on the distribution schedule in 2012 (year of the survey) see: Economic Research Service (ERS), U.S. Department of Agriculture (USDA). SNAP Distribution Schedule Database, SNAP Policy Data Sets. https://www.ers.usda.gov/data-products/snap-policy-data-sets/
[16] Note that we use ERS cleaned variable of days since SNAP payment, which assumes for current SNAP households a 30-day benefit cycle.
[17] Of the 806 kid-day observations there are a total of 305 observations before SNAP pay and 501 after SNAP pay. While we observe most children for five days that is not the case for all of them. To be exact we observe 84.4% of kids for all seven days of data collection, and over 90% for at least four days. Also note that because we include children that receive SNAP pay from day one to seven of the data collection week we may observe some children for five days after SNAP pay and for no days before, while we may observe others for five days pre SNAP pay and no days after. The rest will have at least one day pre SNAP pay and at most four days post SNAP pay.

where meal equals 1if *i* had a "school lunch" (breakfast), or a "non-school lunch" (breakfast) on day *d* interview month *m.* "Post SNAP pay" equals 1 on the day of SNAP pay and every day after SNAP, and it is zero for all days before SNAP pay. X is a vector of individual and demographic indicators capturing gender, race, whether *i* attends a traditional public school, and whether the household lives in a rural area, in public housing, or has a car. δ and μ are day of the week and interview month fixed effects. β is the coefficient of interest and it captures the short-run effect of SNAP payments on meal participation within a five-day window around the SNAP payment. It provides a causal estimate of the effect of SNAP payment on school (and non-school) meal participation if the timing of SNAP payments within the data collection window is random.

To test this condition, we performed a balance test comparing the demographic composition of children before and after SNAP pay. To do so, we regress the "Post SNAP pay" indicator on the set of individual and household level demographic characteristics. The model also includes day of the week and interview month fixed effects. We then test for the joint significance of demographic controls. Result from this test (in table A1) show that demographic controls do not predict SNAP payment and that the two samples are comparable.

We estimate an extended specification of this model in which we break the "Post SNAP pay" dummy into a series of dummy variables indicating: two days pre SNAP pay, one day pre SNAP pay, day of SNAP pay and post SNAP pay for all days after benefit receipt. In this model the reference group are days 3 to 5 prior to SNAP payments. This extended specification will shed light on the existence of pre-trends in participation, and especially on the possibility of an "anticipation effect". All models are weighted using household sampling weights.[18]

---

[18] Standard errors are computed using Taylor series linearization that account for the complex structure of the survey. We also computed standard errors using the household replicate weights and jackknife repeated replication

The second analyses examine participation over the full SNAP month in a model linking participation to a set of indicator variables capturing the number of days since the household received the SNAP payment in five-day intervals. These models use all 1,173 children in the sample.[19] Individual fixed effects α_i address concerns with unobserved time-invariant individual heterogeneity. The rest of this model is as before. Specifically, we estimate:

$$meal_{idm} = \alpha_i + \beta_1 D1to5_{idm} + \beta_3 D6to10_{idm} + \beta_4 D11to15_{idm} + \beta_5 D16to20_{idm} + \beta_6 D21to25_{idm} + \delta_d + \mu_m + X'_{idm}\theta + \varepsilon_{idm}$$

D1to5 is an indicator variable taking a value of one for observations in the first five days following the SNAP payment, and zero otherwise. *D6to10* identifies observations in the following five days, and *D11to15*, *D16to20* and *D21to25* are defined accordingly. The reference period is the last five days in the SNAP month, *D26to30.* Regressions are weighted using the household sampling weights, and standard errors are clustered at the household level. For ease of interpretation, we estimate all regressions using linear probability models.[20] Coefficients should be interpreted directly as percentage point changes in the probability of school (non-school) meal participation.

5. Results

Short-run effect of SNAP on meal participation

We begin by showing demographic characteristics of the different analysis samples in table 2. Overall, the event study and the full sample look similar. However, children in the event study sample are more likely to live in a rural area (36.6% versus 18.7%). Table 3 shows mean

---

technique and we also tested the sensitivity of our estimates using the household weights and clustering the standard errors at the household level. In all cases standard errors were similar.

[19] We observe 80.39% of children for five weekdays (and seven days overall).

[20] We also estimated the short-run results using logit, which yielded qualitatively similar results. These tables are available from authors.

meal participation for SNAP children by sample. As shown, lunch and breakfast participation is lower in the event study sample than in the non-event study sample (85.7% compared to 91.6% for lunch, and 68.9% versus 82.5% for breakfast). In general, however, school and non-school meal participation is comparable across the three samples. Roughly, 46 to 48% of children participate in school lunch compared to 40 to 43% that acquire non-school lunches. School breakfast participation rates are much lower – around 22%.

As shown in table 4, we first show results from our baseline model estimating the effect of SNAP pay on school lunch and breakfast participation. We show both unadjusted and adjusted models with individual and household level controls for completeness, but adjusted models are our preferred specification and so we focus our discussion of the results on those. To begin, we find large decreases in both school lunch (17 percentage points) and breakfast (20 percentage points) participation for children aged 11 to 18 after SNAP pay (columns 2 and 4 in panel B). In contrast, lunch participation does not change for children aged 5 to 10. That said, results suggest school breakfast might decline by roughly 8 percentage points for this group (column 4 in panel A), but this coefficient is only significant at the 10% level.

Columns 6-8 show results for non-school meals. Here we find positive, albeit insignificant coefficients for teenagers and that non-school breakfast participation decreases substantially (13 percentage points) for 5-10 year olds immediately after SNAP pay.

Gaining a full understanding of this short-run effect, however, requires uncovering any trends in participation in the period before families receive the SNAP benefit. As shown in Table 5, an extended specification reveals that school lunch and breakfast participation starts decreasing the day before or two days before SNAP pay and is magnified after payment. Specifically, 11-18 year olds are 18 percentage points less likely to acquire a school lunch the day *before* SNAP pay and 23 percentage points less likely to do so *after* SNAP receipt (column 2, panel B). School breakfast drops 19 percentage points two days before SNAP and continues to decline relative to the last days of the SNAP benefit cycle. In the days after SNAP receipt, 11-18 year olds are 36 percentage points less likely to acquire a school breakfast than in the days before SNAP benefit payment (column 4, panel B).

Is there an opposite trend in non-school meal participation? Non-school meal acquisitions increase for 11-18 year olds and the increase begins the day before SNAP pay. Results are positive for both non-school lunch (insignificant) and breakfast (significant). Column 8 shows non-school breakfast acquisitions rise substantially the day before SNAP pay (26 percentage points) and continue to rise after SNAP pay (24 percentage points). Taken together, these suggest that 11-18 year olds substitute school meals for non-school options, and especially non-school breakfast when they can. We find no such effects for 5-10 year olds, but we do see a large decrease in non-school breakfast participation after SNAP pay of 28 percentage points (column 8, panel A).

Overall, findings from these extended specifications provide some evidence of "anticipation effects" whereby children substitute away from school lunch (breakfast) in the day (two days) just before a scheduled SNAP payment. Although a fully satisfying theoretical and empirical investigation of this effect is outside the scope of this paper, it is possible that this reflects household willingness (or ability) to draw down cash or reserves of food at home (allowing students to bring lunch or purchase it from outside vendors) in anticipation of an inflow of new benefits the next day (or day after). To be clear, it may also reflect student decisions, rather than household decisions, per se, which is consistent with our finding of this effect within the teenagers but not the younger children. (That is, teenagers may "splurge" using their own resources at the very end of the SNAP month.)

School and non-school meal participation over the SNAP month

Results discussed so far focus on the short-term impact of the SNAP payment on school and non-school meal participation. While they provide evidence that 11-18 year olds substitute away from school meals at the start of the SNAP benefit cycle, they provide limited insight into school meal utilization throughout the entire month. If school meals help ameliorate declines in food consumption at the end of the SNAP month as our event study results suggest, at which point in the SNAP benefit cycle do families rely more on school meals? Figure 1 shows results from the full month specification with fixed effects by age for school lunch and non-school lunch participation and figure 2 shows similar results for breakfast.[21] As shown, among 11-18 year olds, school lunch participation drops in the first two weeks of the SNAP month reaching the lowest point on days 11 to 15 (23 percentage point decline), and increasing afterwards. Non-school lunches increase correspondingly in the first two weeks of the SNAP month for this age group, peaking on days 11 to 15 with a 22 percentage point increase. Results for 5-10 year olds are generally not significant. Figure 2 shows similar results for breakfast. School breakfast acquisitions drop in the first two weeks of the SNAP benefit cycle for 11-18 year olds reaching the lowest point in the second week with a decline of 21 percentage points and increasing afterwards. Non-school breakfast acquisitions increase up to days 11 to 15 (19 percentage points) and then decline. Among 5-10 year olds, we see increases in school breakfast in the first 10 days of the SNAP month and declines afterwards (although coefficients are largely insignificant). That said, by days 20 to 25 of the SNAP month there is a large and statistically significant drop in school breakfast and a corresponding increase in non-school breakfast. Thus, school breakfast

[21] For these results in tabular form, see tables A3 and A4 in appendix. These tables also include for completeness unadjusted models, models with only demographic controls, as well as our preferred specification with fixed effects.

may play a different role in younger children's food acquisitions (and perhaps consumption). These results also highlight differences in how older and younger kids use school meals. Note that children and adolescents in non-SNAP households do not show this pattern of participation in school and non-school meals throughout the calendar month (see figures A3 and A4 in appendix).

Robustness tests

We investigate the sensitivity of our results to alternative ways of controlling for the timing of payments. In particular, we might be concerned that other payments may be made at the same time – or complementary times – to SNAP payments. Unfortunately, while FoodAPS includes information on other sources of income, it does not provide details on the timing of these payments. We investigate potential bias in two ways. First, since payments are more likely to be made on the first of the month, we re-estimate our models adding an indicator for the first of the month. Results are substantively similar.[22] Second, since some sources of income, may be received on another day of the month – such as the 15th of the month – we re-estimate with, calendar week controls (in five-day intervals). As shown in tables 6 and 7, results are qualitatively unchanged in short-run models, although some breakfast coefficients are smaller and lose statistical significance. Of particular interest, the *anticipation effect* remains. Full month specifications results are also qualitatively similar.[23]

We explore the robustness of results in a number of other ways. First, we re-estimated our baseline specifications adding an indicator variable for whether the SNAP payment was received on a weekend, following the Castellari et al (2016) finding that weekend payments affect households' consumption and purchasing behavior differently. As shown in Tables A5 and

[22] Available from authors.
[23] Available from authors.

A6, our findings remain largely unchanged. (Full month results are also largely uncharged by the addition of this variable.)[24]

Second, we stratified models by school level instead of age following the logic that, differences in children's ability to procure non-school meals may vary by grade level (K-elementary school vs middle and high school) rather than by age. For example, students in middle and high school might have open campuses that may be less common for children in elementary school and kindergarten. Tables 8 and 9 show results for the baseline and the extended specifications. Overall, results are robust to this alternative. As before, baseline results in table 8 show a drop in school lunch participation only for children in middle and high school of 19 percentage points. School breakfast acquisitions decline for K-elementary students and middle and high school students after SNAP pay by 15 percentage points and 19 percentage points, respectively (column 4) providing additional evidence that children use school lunch and breakfast quite differently. The extended specification in table 9 also confirms results reported above. Declines in school lunch acquisitions begin the day before SNAP pay for children in middle and high school with a 21 percentage point drop (column 2). This decline continues after SNAP pay and it is roughly 25 percentage points. School breakfast also decreases for children in K-elementary school immediately after SNAP pay (panel A, column 4). This decline begins two days before SNAP payments for children in middle school and high school and magnitudes are similar as those reported in models stratified by age.

Full month models stratified by grade show declines in school lunch and breakfast for children in middle and high school earlier in the SNAP month and increases in non-school meal acquisitions toward the end of the month.[25] Results for children in K-elementary school are

[24] Available from authors.
[25] Tables available from authors.

similar to those reported for 5-10 year olds.[26]

6. Discussion

In this paper, we examine the relationship between the timing of SNAP benefit payments and school lunch and breakfast participation. We use two empirical strategies that allow us to estimate effects in the short-run (over a five-day window) as well as over the full SNAP month. Results using the two strategies yield similar conclusions. Teenagers 11 to 18 years old substantially decrease their school meal participation immediately after SNAP payments and for the first two weeks of the benefit cycle. In contrast, they seem to increase their non-school meal acquisitions during this time. Specifically, we find decreases between 17 percentage points and 36 percentage points for school meals and increases between 13 percentage points and 26 percentage points for non-school meals. These are not small changes. For example, recent evidence on universal free lunch in New York City found increases in lunch participation ranging from 5 to 11 percentage points for poor and non-poor students, respectively (Schwartz and Rothbart, 2016). Interestingly, we do not see similar decreases in school lunch participation post SNAP pay for 5-10 year olds. This is an important finding because middle and high school students are less likely to participate in school meals (Mirtcheva and Powell, 2009) and they are also less protected from food insecurity relative to younger children (Moffitt and Ribar 2018). Adolescents may have more attractive competing options or the stigma associated with subsidized lunches is higher for them, preferring to bring lunch from home or purchase from other vendors instead. FoodAPS, unfortunately, does not provide information about the school

[26] We tested the robustness of our results to alternative age breakdowns. We re-estimated all models stratifying the sample between 5-12 year olds and 13-18 year olds. We still see declines in school lunch and breakfast for adolescents that are of similar magnitude as those reported in the paper but are only statistically significant in the extended specification for school breakfast. Note that in the short-run models our sample for teenagers is cut by almost half, thus we are likely underpowered to detect any statistically significant differences for this group. Full month models are consistent with reported results. Tables available from authors.

food environment facing children, whether they have access to an open campus, or whether schools serve “a la carte” menu items. Thus, we are limited in our ability to explore how these characteristics of the meal options available to children affect their choices. As for where teenagers acquire non-school meals, our examination of the FAFH data suggest 11-18 year olds do use outside options such as restaurants and other fast food places, groceries and convenience stores, as well as family and friends when they can, which aligns with qualitative evidence (Bailey-Davis et al, 2013). Interestingly, we observe that most non-subsidized meals away from home happen at school. Future research could use the FAFH items dataset to try to uncover differences in the items acquired between meals at school coded as subsidized options and those that are not on days before and after SNAP benefit receipt to determine the role that competing options play in children’s meal choices. It is important to note that any analyses that explore non-school options are limited by the inability to use FoodAPS to fully distinguish meals (and the items of those meals) that were brought to school but prepared in the home, which could be another important source of substitution for children. Indeed, of non-school meals reported in FoodAPS roughly 73% appear in the M&SF only, suggesting a large share of non-school options are meals prepared at home to eat at school. These competing options may vary substantially in quality or nutritional value. This analysis may provide helpful insights into the design and benefits of school meal programs relative to multiple competing options (Kline and Walters 2016).

Overall, findings in this paper suggest that school lunch may ameliorate declines in food consumption at the end of the SNAP month. As such, it provides additional insights into the different coping strategies of SNAP households to maintain food consumption throughout the SNAP month. Specifically, our findings suggest that SNAP households do not fully smooth consumption. Older children increase reliance on school meals toward the end of the SNAP cycle but choose non-subsidized options earlier in the SNAP month. That said, whether this behavior results in decreases in healthy eating or declines in nutritional intake remains a question for future work, as suggested by Cotti et al. (2018) which shows lower academic performance at the end of the SNAP cycle.

Finally, while we are unable to directly explore the interaction between SNAP, school meals, and other income sources (i.e.cash benefit programs or wages) since FoodAPS does not include their receipt dates, these interactions may be important and warrant future work drawing on alternative data sources.

The findings in this paper may prove useful for school food managers and future work might fruitfully explore the determinants of participation in school meals and the potential implications for policy and practice. Menu planning is the responsibility of local school food authorities and knowing when children are more (less) likely to rely upon school meals might usefully inform decisions regarding offerings. There is, to our knowledge, no research examining changes in school lunch provision in response to changes in family resources over the month, though Figlio and Winicky (2005) suggest that school authorities may respond to other incentives such as accountability pressures by altering the caloric content of school meals.

As for policy implications unrelated to the school food environment, we need to further understand possible consequences of the substitution between school and non-school meals for children's health and diet. The quality of school meals has improved with the adoption of the Healthy Hunger Free Kids Act in 2010 and our own estimates using FoodAPS suggest that participation in school meals is positively correlated with the Healthy Eating Index (HEI). Specifically, we estimate that acquiring school lunch on a day increases the HEI by 5 to 7 points for 11-18 year olds and 5-10 year olds, respectively. Thus, it would be important to understand whether the decrease in non-school meals we find in this paper negatively impacts the quality of teenagers' diet.

There are some limitations worth noting. The relationship between SNAP and school lunch may depend on where people live. While the cost of living varies across the different states and areas of the country, SNAP benefits remain the same, which may negatively affect a household's resources. The relationship between school meal participation and SNAP may, thus, vary across states and cities. Further, there may also be differences based on access to food outlets. Families with less access to SNAP eligible stores may make one trip at the start of the month and use more school lunch toward the end of the month compared to families that make frequent trips. Exploring these differences is a task for future work. Second, FoodAPS collects no information about school outcomes, and as a result, we are unable to dig deeper on the alternative meal options facing children. Specifically, we are unable to distinguish children who do not acquire lunch at school because they use outside options versus those who were absent from school on that day.

Finally, more work should be done regarding the role of summer meals and their ability to ameliorate food insecurity at the end of the SNAP month. The Summer Food Service Program ("Summer Meals Program") provides free meals to children aged 18 and under living in low income areas. According to the FNS, however, only 3.8 million children participate in the Summer Meals Program. Using FoodAPS, we find suggestive evidence that the availability of school meals during the school year might protect young children's lunch consumption compared to the summer months.[27] Understanding whether the Summer Meal Program can play

[27] Using a difference-in-difference approach, we investigate whether the probability of having lunch (any lunch) after SNAP pay differs between school year and the summer months. To do so, we estimate the baseline model with

a similar role when school is not in session and under what circumstances can have important policy implications.

an interaction between "Post SNAP pay" and "school year", and a "school year" dummy. Results show that after SNAP pay 5-10 year olds are 13 percentage points more likely to have a lunch during the school year relative to the summer months; however, this coefficient is not statistically significant. For teenagers our difference-in-difference estimate suggest a decline in lunch (-0.05 percentage points) but this coefficient is also not statistically significant. There are only 202 observations interviewed during the summer in this sample, and only 73 observations aged 5-10 years old and 129 aged 11-18 years old, severely limiting our ability to extract meaningful conclusions from these models.

References

Bailey-Davis, L., Virus, A., McCoy, T.A., Wojtanowski, A., Vander Veur, S.S., and Foster, G.D. (2013). Middle school student and parent perceptions of government-sponsored free school breakfast and consumption: a qualitative inquiry in an urban setting. *Journal of the Academy of Nutrition and Dietetics*, 113(2), 251-257.

Bhattacharya, J., Currie, J., and Haider, S. (2004) Evaluating the impact of school nutrition programs. *USDA Final Report.* Available: https://www.ers.usda.gov/webdocs/publications/43524/49046_efan04008fm.pdf?v=4208

Bhattacharya, J., Currie, J., and Haider, S. (2006). Breakfast of champions? The school breakfast program and the nutrition of children and families. *Journal of Human Resources,* 91(3), 445-466.

Campbell, B.L., Nayga, R.M., Park, J., and Silva, A. (2011) Does the National School Lunch Program improve children's dietary outcomes? *Amer. J. Agr. Econ.*, 93(4), 1099-1130.

Castellari, E., Cotti, C., Gordanier, J., and Ozturk (2016). Another Saturday night: food stamp timing and monthly consumption patterns. Available: http://ssrn.com/abstract=2729479

Castner, L., and Henke, J. (2011) Benefit redemption patterns in the Supplemental Nutrition Assistance Program. U.S. Department of Agriculture. Available: https://fns-prod.azureedge.net/sites/default/files/ARRASpendingPatterns.pdf

Coleman-Jensen, A., Rabbitt, M.P., Gregory, C.A., and Singh, A. (2017) Household food security in the United States in 2016, ERR-237, U.S. Department of Agriculture, Economic Research Service. Available: https://www.ers.usda.gov/webdocs/publications/84973/err-237.pdf?v=42979

Corcoran, S.P., Elbel, B., and Schwartz, A.E. (2016) The effect of Breakfast in the Classroom on obesity and academic performance: evidence from New York City. *Journal of Policy Analysis and Management*, 35(3), 509-532.

Cotti, C., Gordanier, J., and Ozturk, O. (2018). When does it count? The timing of food stamp receipt and educational performance. *Economics of Education Review*, *66*, 40-50.

Damon, A.L., King, R.P., and Leibtag, E. (2013) First of the month effect: Does it apply across food retail channels? *Food Policy*, 41, 18-27.

Darko, J., Eggert, D.L., and Richards, R. (2013) Shopping behaviors of low-income families during a 1-month period of time. *Journal of Nutrition Education and Behavior*, 45(1), 20-29.

Farson Gray, K., and Cunnyngham, K. (2017) *Trends in Supplemental Nutrition Assistance Program participation rates: Fiscal year 2010 to fiscal year 2015.* Prepared by Mathematica Policy Research for the USDA Food and Nutrition Service. Available: https://fns-prod.azureedge.net/sites/default/files/ops/Trends2010-2015.pdf

Figlio, D. N., and Winicki, J. (2005). Food for thought: the effects of school accountability plans on school nutrition. *Journal of public Economics*, 89(2-3), 381-394.

Gassman-Pines, A., & Bellows, L. (2018). Food Instability and Academic Achievement: A Quasi-Experiment Using SNAP Benefit Timing. *American Educational Research Journal*, 55(5), 897-927.

Gibson, D. (2003). Food Stamp Program participation is positively related to obesity in low- income women. *The Journal of Nutrition.* 133(7), 2225-2231.

Gibson, D. (2004). Long-term Food Stamp Program participation is differentially related to overweight in young girls and boys. *The Journal of Nutrition* 134 (2), 372-379.

Gleason, P.M., and Suitor, C.W. (2003). Eating at school: how the National School Lunch Program affects children's diets. *Amer. J. Agr. Econ.* 85(4), 1047-1061.

Gundersen, C., and Ziliak, J. P. (2003). The role of food stamps in consumption stabilization. *Journal of Human Resources*, 1051-1079.

Gundersen, C., Kreider, B., and Pepper, J. (2012). The impact of the National School Lunch Program on child health: a nonparametric bounds analysis. *Journal of Econometrics*. 166(1), 79- 91.

Gundersen, C. (2015). Food assistance programs and child health. *The Future of Children*. 25(1), 91-109.

Hoynes, H. W., & Schanzenbach, D. W. (2015). *US food and nutrition programs* (No. w21057). National Bureau of Economic Research.

Imberman, S.A., and Kugler, A.D. (2014). The effect of providing breakfast in class on student performance. *Journal of Policy Analysis and Management*. 33(3), 669-699.

Kline, P., and Walters, C. R. (2016). Evaluating public programs with close substitutes: The case of Head Start. The Quarterly Journal of Economics, 131(4), 1795-1848.

Marples, C., and Spillman, D. (1995). Factors affecting students' participation in the Cincinnati public schools lunch program. *Adolescence*, 30(119): 745-754.

Millimet, D.L., Tchernis, R., and Husain, M. (2010). School nutrition programs and the incidence of childhood obesity. *The Journal of Human Resources*. 45(3), 640-654.

Mitcherva, D., and Powell, L. (2009). Participation in the national school lunch program: Importance of school-level and neighborhood contextual factors. *Journal of School Health*, 79(10), 485-494.

Moffitt, R. A., & Ribar, D. C. (2018). Child age and gender differences in food security in a low-income US inner-city population. *European Economic Review*.

National Household Food Acquisition and Purchase Survey (FoodAPS): User's Guide to Survey Design, Data Collection, and Overview of Datasets. U.S. Department of Agriculture, Economic Research Service, November 2016.

Nord, M., and Romig, K. (2006). Hunger in the Summer. *Journal of Children and Poverty*, 12:2: 141-158

Schanzenbach, D.W. (2009). Do school lunches contribute to childhood obesity? *The Journal of Human Resources*. 44(3), 684-709.

Schanzenbach, D.W., and Zaki, M. (2014). Expanding the School Breakfast Program: impacts on children's consumption, nutrition, and health. *NBER.*Working Paper 20308.

Schenck-Fontaine, A., Gassman-Pines, A., and Hill, Z. (2017). Use of Informal Safety Nets during the Supplemental Nutrition Assistance Program Benefit Cycle: How Poor Families Cope with Within-Month Economic Instability. *Social Service Review*, 91(3), 456-487.

Schmeiser, M.D. (2012). The impact of long-term participation in the Supplemental Nutrition Assistance Program on child obesity. *Health Economics*, 21(4), 386-404.

Schwartz, A.E., and Rothbart, M.W. (2017). Let them eat lunch: The impact of universal free meals on student performance. Center for Policy Research Working Paper No. 203, Maxwell School, Syracuse University: https://www.maxwell.syr.edu/uploadedFiles/cpr/publications/working_papers2/wp203.pdf

Seefeldt, K.S., and Castelli, T. (2009). *Low-Income women's experience with food programs, food spending, and food related hardship: Evidence from qualitative data* (Contractor Cooperator Report) United States Department of Agriculture.

Seligman, H.K., Bolger, A.F., Guzman, D., Lopez, A., and Bibbins-Domingo, K. (2014).

Exhaustion of food budgets at months' end and hospital admissions for hypoglycemia. *Health Affairs*, 33(1), 116-123.

Shapiro, J.M. (2005). Is there a daily discount rate? Evidence from the food stamp nutrition cycle. *Journal of Public Economics*, 89(2), 303-325.

Smith, T. A., Berning, J. P., Yang, X., Colson, G., and Dorfman, J. H. (2016). The effects of benefit timing and income fungibility on food purchasing decisions among supplemental nutrition assistance program households. *American Journal of Agricultural Economics*, 98(2), 564-580.

Stephens, M. (2003). "3rd of tha month": Do social security recipients smooth consumption between checks?" *The American Economic Review*, 93(1), 406-422.

Todd, J. E. (2015). Revisiting the Supplemental Nutrition Assistance Program cycle of food intake: Investigating heterogeneity, diet quality, and a large boost in benefit amounts. *Applied Economic Perspectives and Policy*, 37(3), 437-458.

Todd, J. E., & Gregory, C. (2018). Changes in Supplemental Nutrition Assistance Program real benefits and daily caloric intake among adults. *Food Policy*, *79*, 111-120.

U.S. Council of Economic Advisers. (2015). Long-Term Benefits of the Supplemental Nutrition Assistance Program. Retrieved January 11: https://www.whitehouse.gov/sites/whitehouse.gov/files/documents/SNAP_report_final_nonembargo.pdf

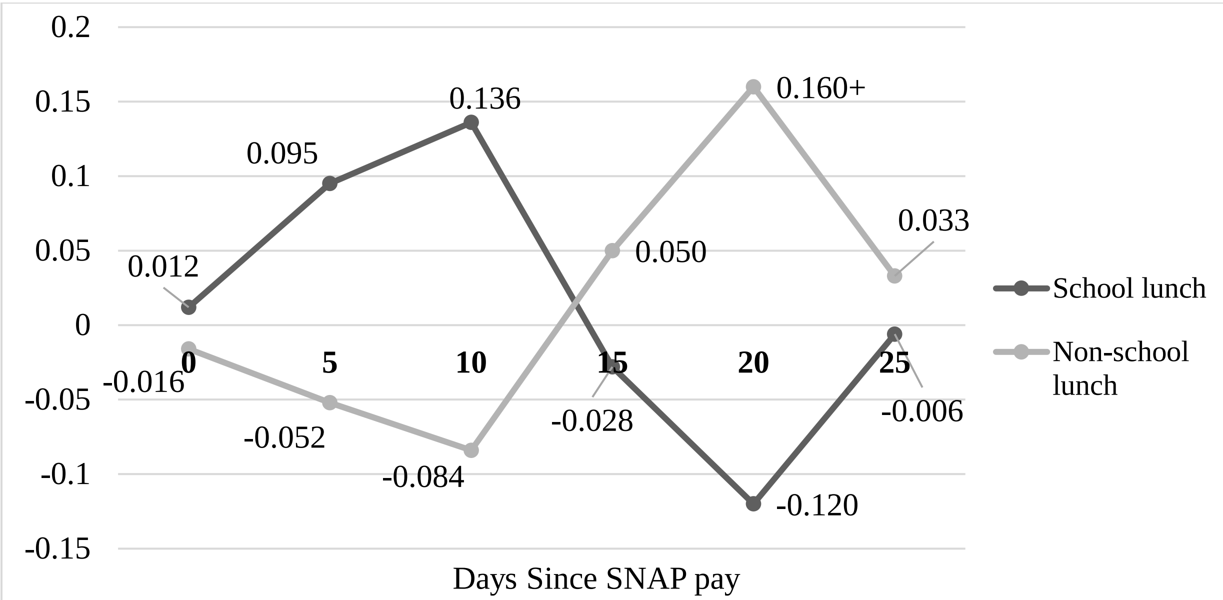
USDA, Food and Nutrition Service (FNS) (2017). National School Lunch Program fact sheet. USDA. Available: https://fns-prod.azureedge.net/sites/default/files/cn/NSLPFactSheet.pdf

Wilde, P.E., and Ranney, C.K. (2000). The monthly food stamp cycle: shopping frequency and food intake decisions in an endogenous switching regression framework. *American Journal of Agricultural Economics*, 82(1), 200-213

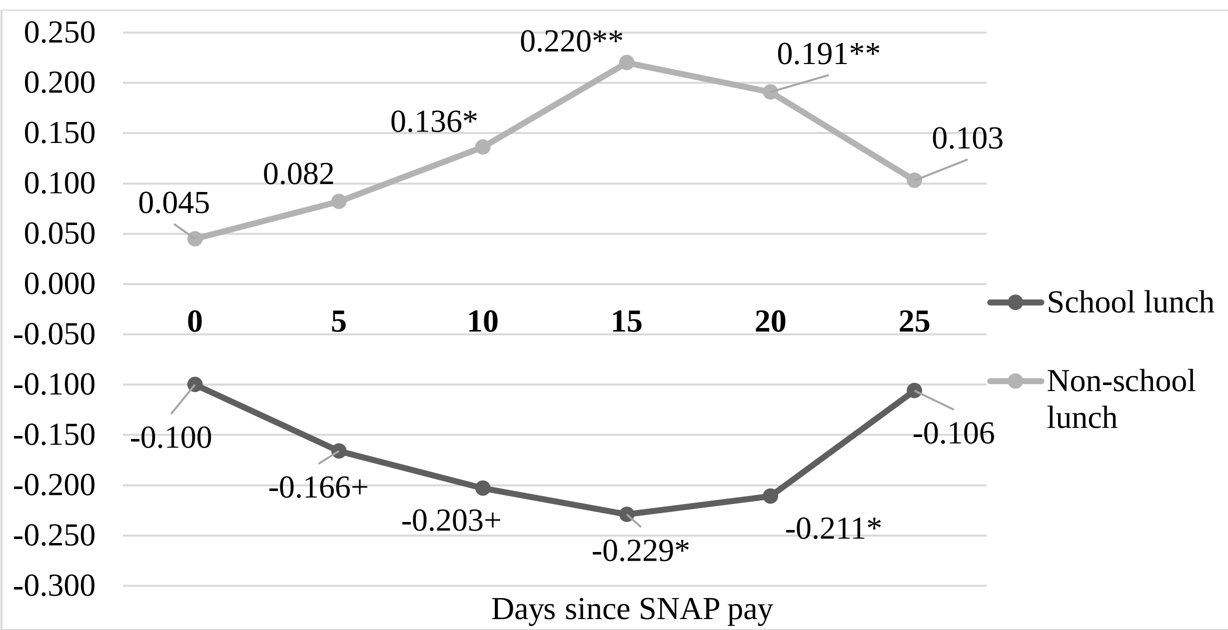
Figures

Figure 1: SNAP and lunch participation, full SNAP month models individual fixed effects

A. Age 5-10



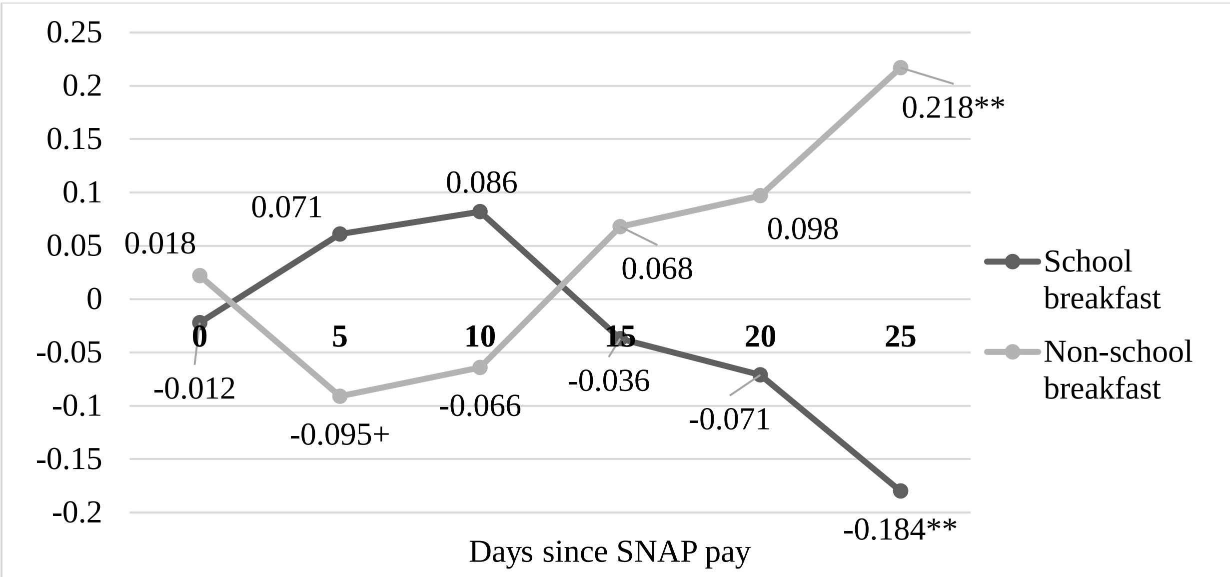
B. Age 11-18



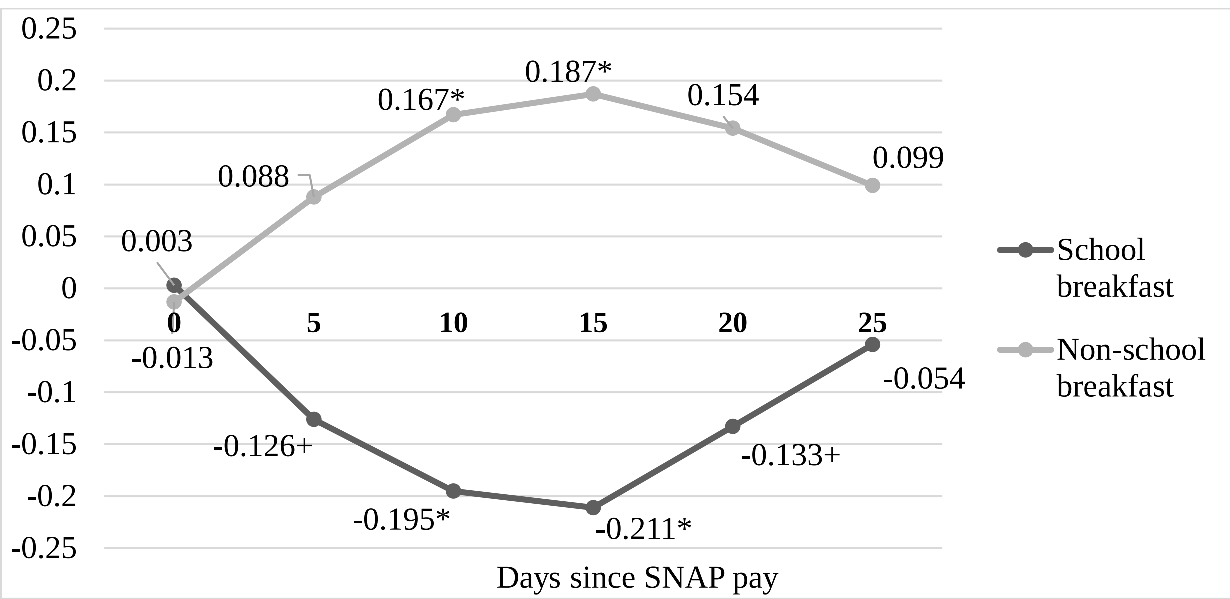
Notes: Graphs show coefficients from full month fixed effects models stratified by age. All models include day of the week, interview week, and individual fixed effects. Sample restricted to SNAP children interviewed when school was in session. All models are weighted using the sample household weights and standard errors are clustered at the household level. ** p<0.01, * p<0.05, + p<0.1

Figure 2: SNAP and breakfast participation, full SNAP month models individual fixed effects

A. Age 5-10



B. Age 11-18



Notes: Graphs show coefficients from full month fixed effects models stratified by age. All models include day of the week, interview week, and individual fixed effects. Sample restricted to SNAP children interviewed when school was in session. All models are weighted using the sample household weights and standard errors are clustered at the household level. ** p<0.01, * p<0.05, + p<0.1

Tables

Table 1: Demographic characteristics, SNAP and non-SNAP children

	SNAP	Non-SNAP
Non-white	71.61	54.14
Female	46.52	50.40
Age	10.52	11.73
Public housing	14.85	7.79
Public school	92.67	92.94
Rural area	23.52	33.85
Household has car	79.30	84.44
Number of children = 1,173	794	379

Notes: Weighted means using household sampling weights. Sample restricted to children interviewed when school was in session. Sample includes children in SNAP household and those in households with income less than 185% of the poverty threshold.

Table 2: Mean demographic characteristics by sample type, school year, SNAP

	Event study sample	Non-event study sample	Full sample
Non-white	72.1	71.4	71.6
Female	45.6	46.9	46.5
Age	10.9	10.4	10.5
Public housing	14.5	15.0	14.8
Rural	36.6	18.7	23.5
Public school	94.3	92.1	92.7
Has car	80.0	79.0	79.3
Observations	170	624	794

Notes: Weighted means using household sampling weights. Event study sample includes children in K-12 receiving SNAP payments during FoodAPS data collection week. All samples restricted to children interviewed when school was in session and in SNAP households.

Table 3: Mean lunch and breakfast participation by sample type, school year, SNAP

	Event study sample	Obs.	Non-event study sample	Obs.	Full sample	Obs.
Lunch	85.7	806	91.6	2,936	90.1	3,742
School	46.4	806	48.5	2,936	48.0	3,742
Non-school	39.3	806	43.1	2,762	42.1	3,742
Breakfast	68.9	784	82.5	2,762	78.7	3,546
School	22.6	784	22.1	2,762	22.3	3,546
Non-school	46.3	784	60.4	2,762	56.5	3,546

Notes: Weighted means using household sampling weights. Event study sample includes children in K-12 receiving SNAP payment during data collection week. All samples restricted to children interviewed when school was in session and in households receiving SNAP.

Table 4: Regression results, SNAP and meal participation, baseline model

	School lunch		School breakfast		Non-school lunch		Non-school breakfast	
DV:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A. Age 5-10								
Post SNAP pay	0.037	-0.009	-0.085	-0.077+	-0.103	-0.085	-0.091	-0.127*
	(0.076)	(0.063)	(0.065)	(0.043)	(0.063)	(0.069)	(0.067)	(0.052)
Observations	367	367	354	354	367	367	354	354
R-squared	0.181	0.376	0.201	0.291	0.126	0.178	0.222	0.289
A. Age 11-18								
Post SNAP pay	-0.146+	-0.169*	-0.184*	-0.195*	0.039	0.046	0.089	0.074
	(0.077)	(0.074)	(0.087)	(0.084)	(0.063)	(0.061)	(0.083)	(0.089)
Demographic controls	N	Y	N	Y	N	Y	N	Y
Day of the week FX	Y	Y	Y	Y	Y	Y	Y	Y
Interview month FX	Y	Y	Y	Y	Y	Y	Y	Y
Observations	439	439	430	430	439	439	430	430
R-squared	0.365	0.415	0.23	0.263	0.3	0.374	0.363	0.408

Standard errors in parentheses

** p<0.01, * p<0.05, + p<0.1

Notes: Demographic controls include: female, non-white, public housing, rural area, public school, household has car. All models are weighted using household sampling weights and account for the complex structure of the survey. Post SNAP pay equals 1 on the day of SNAP pay and every day after. Sample restricted to children in households receiving SNAP pay during data collection and interviewed when school was in session.

Table 5: Regression results, SNAP and meal participation, extended specification

	School lunch		School breakfast		Non-school lunch		Non-school breakfast	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A. Age 5-10								
Two days before SNAP pay	0.163	0.051	0.007	0.004	-0.019	0.071	-0.136	-0.145
	(0.115)	(0.122)	(0.113)	(0.075)	(0.146)	(0.133)	(0.122)	(0.101)
One day before SNAP pay	-0.024	-0.037	-0.004	0.014	-0.019	0.025	-0.146	-0.161
	(0.168)	(0.143)	(0.146)	(0.120)	(0.133)	(0.134)	(0.110)	(0.110)
Day of SNAP pay	0.053	-0.069	-0.168	-0.174+	-0.030	0.017	0.053	-0.001
	(0.123)	(0.120)	(0.119)	(0.090)	(0.110)	(0.122)	(0.077)	(0.087)
Post SNAP pay	0.072	0.001	-0.068	-0.048	-0.132	-0.071	-0.234*	-0.284**
	(0.127)	(0.128)	(0.124)	(0.086)	(0.121)	(0.130)	(0.110)	(0.083)
Observations	367	367	354	354	367	367	354	354
R-squared	0.188	0.379	0.206	0.298	0.131	0.182	0.257	0.322
B. Age 11-18								
Two days before SNAP pay	0.075	0.022	-0.216+	-0.190*	-0.045	0.025	0.139	0.197
	(0.122)	(0.082)	(0.106)	(0.080)	(0.118)	(0.088)	(0.132)	(0.120)
One day before SNAP pay	-0.155	-0.182+	-0.251*	-0.246**	0.176	0.182+	0.268**	0.255**
	(0.122)	(0.093)	(0.106)	(0.086)	(0.119)	(0.094)	(0.087)	(0.049)
Day of SNAP pay	-0.195	-0.218*	-0.270+	-0.250*	0.116	0.129	0.116	0.131
	(0.131)	(0.105)	(0.142)	(0.117)	(0.118)	(0.096)	(0.125)	(0.106)
Post SNAP pay	-0.172	-0.228*	-0.344**	-0.355**	0.077	0.113	0.242*	0.240**
	(0.128)	(0.106)	(0.116)	(0.102)	(0.112)	(0.088)	(0.094)	(0.084)
Demographic controls	N	Y	N	Y	N	Y	N	Y
Observations	439	439	430	430	439	439	430	430
R-squared	0.377	0.425	0.258	0.290	0.311	0.382	0.385	0.427

Standard errors in parentheses

** p<0.01, * p<0.05, + p<0.1

Notes: Demographic controls include: female, non-white, public school, public housing, rural area, household has car. All models have day of the week and interview month fixed effects. Sample is restricted to children in households receiving SNAP payments during data collection week (including first and last day of data collection). All models are weighted using household sampling weights and account for the complex structure of the survey.

Table 6: Robustness test, SNAP and meal participation, calendar week controls, baseline model

	School lunch		School breakfast		Non-school lunch		Non-school breakfast	
DV:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A. Age 5-10								
Post SNAP pay	0.009	0.013	-0.052	-0.043	-0.157	-0.172+	-0.140	-0.176+
	(0.103)	(0.082)	(0.074)	(0.064)	(0.101)	(0.086)	(0.114)	(0.087)
Observations	367	367	354	354	367	367	354	354
R-squared	0.196	0.381	0.332	0.389	0.165	0.228	0.242	0.303
B. Age 11-18								
Post SNAP pay	-0.171*	-0.180*	-0.090	-0.083	0.105	0.097	0.075	0.062
	(0.070)	(0.075)	(0.066)	(0.067)	(0.072)	(0.071)	(0.076)	(0.071)
Demographic controls	N	Y	N	Y	N	Y	N	Y
Day of the week FX	Y	Y	Y	Y	Y	Y	Y	Y
Interview month FX	Y	Y	Y	Y	Y	Y	Y	Y
Calendar week FX	Y	Y	Y	Y	Y	Y	Y	Y
Observations	439	439	430	430	439	439	430	430
R-squared	0.408	0.453	0.288	0.322	0.328	0.402	0.375	0.424

Standard errors in parentheses

** p<0.01, * p<0.05, + p<0.1

Notes: Demographic controls include: female, non-white, public housing, rural area, public school, household has car. Calendar week calculated in five-day intervals. All models are weighted using household sampling weights. Post SNAP pay equals 1 on the day of SNAP pay and every day after. Sample restricted to children in households receiving SNAP pay during data collection and interviewed when school was in session.

Table 7: Robustness test, SNAP and meal participation, extended specification, calendar week controls

	School lunch		School breakfast		Non-school lunch		Non-school breakfast	
DV:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A. Age 5-10								
Two days before SNAP pay	0.141	0.065	-0.121	-0.089	-0.101	-0.006	-0.153	-0.145
	(0.119)	(0.123)	(0.120)	(0.095)	(0.124)	(0.121)	(0.117)	(0.101)
One day before SNAP pay	-0.039	-0.038	-0.089	-0.064	-0.041	0.002	-0.144	-0.151
	(0.170)	(0.142)	(0.121)	(0.103)	(0.129)	(0.130)	(0.116)	(0.108)
Day of SNAP pay	0.022	-0.039	-0.173*	-0.154+	-0.127	-0.091	-0.015	-0.048
	(0.148)	(0.126)	(0.084)	(0.084)	(0.134)	(0.121)	(0.082)	(0.077)
Post SNAP pay	0.039	0.030	-0.110	-0.080	-0.218	-0.192	-0.288+	-0.334**
	(0.158)	(0.128)	(0.111)	(0.088)	(0.129)	(0.123)	(0.157)	(0.111)
Observations	367	367	354	354	367	367	354	354
R-squared	0.202	0.384	0.337	0.393	0.171	0.232	0.273	0.334
B. Age 11-18								
Two days before SNAP pay	0.079	0.027	-0.169+	-0.135+	-0.023	0.047	0.136	0.194
	(0.129)	(0.091)	(0.091)	(0.070)	(0.139)	(0.112)	(0.124)	(0.115)
One day before SNAP pay	-0.103	-0.117	-0.182*	-0.159+	0.170	0.164+	0.242*	0.221**
	(0.123)	(0.095)	(0.089)	(0.083)	(0.131)	(0.095)	(0.102)	(0.060)
Day of SNAP pay	-0.172	-0.177+	-0.197	-0.148	0.152	0.150	0.105	0.123
	(0.127)	(0.103)	(0.121)	(0.102)	(0.136)	(0.116)	(0.122)	(0.092)
Post SNAP pay	-0.194	-0.235*	-0.216*	-0.201*	0.170	0.188	0.242*	0.237*
	(0.127)	(0.113)	(0.093)	(0.082)	(0.137)	(0.115)	(0.108)	(0.090)
Demographic controls	N	Y	N	Y	N	Y	N	Y
Observations	439	439	430	430	439	439	430	430
R-squared	0.415	0.459	0.301	0.332	0.337	0.408	0.393	0.439

Standard errors in parentheses

** p<0.01, * p<0.05, + p<0.1

Notes: Demographic controls include: female, non-white, public school, public housing, rural area, household has car. All models have day of the week, interview month, and calendar week fixed effects (five-day intervals). Sample is restricted to children in households receiving SNAP payments during data collection week. All models are weighted using household sampling weights.

Table 8: Robustness test, SNAP and meal participation, baseline specification by grade level

	School lunch		School breakfast		Non-school lunch		Non-school breakfast	
DV:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A. K-Elementary School								
Post SNAP pay	0.016	-0.029	-0.157*	-0.149**	-0.089	-0.073	-0.042	-0.062
	(0.060)	(0.066)	(0.071)	(0.049)	(0.060)	(0.072)	(0.074)	(0.080)
Observations	439	439	426	426	439	439	426	426
R-squared	0.177	0.343	0.147	0.260	0.124	0.155	0.209	0.254
B. Middle and High School								
Post SNAP pay	-0.178+	-0.192*	-0.178+	-0.187+	0.062	0.066	0.089	0.070
	(0.093)	(0.087)	(0.095)	(0.092)	(0.081)	(0.074)	(0.094)	(0.098)
Demographic controls	N	Y	N	Y	N	Y	N	Y
Day of the week FX	Y	Y	Y	Y	Y	Y	Y	Y
Interview month FX	Y	Y	Y	Y	Y	Y	Y	Y
Observations	367	367	358	358	367	367	358	358
R-squared	0.305	0.385	0.227	0.272	0.259	0.379	0.308	0.373

Standard errors in parentheses

** p<0.01, * p<0.05, + p<0.1

Notes: Demographic controls include: female, non-white, public housing, rural area, public school, household has car. All models are weighted using household sampling weights and account for the complex structure of the survey. Sample restricted to children in households receiving SNAP pay during data collection week and interviewed when school was in session.

Table 9: Robustness test, SNAP and meal participation, extended specification by grade level

	School lunch		School breakfast		Non-school lunch		Non-school breakfast	
DV:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A. K-Elementary School								
Two days pre SNAP pay	0.121	0.034	-0.083	-0.049	0.026	0.100	-0.139	-0.136
	(0.122)	(0.113)	(0.162)	(0.111)	(0.163)	(0.160)	(0.108)	(0.087)
One day pre SNAP pay	-0.062	-0.081	-0.115	-0.096	-0.001	0.061	-0.087	-0.060
	(0.166)	(0.150)	(0.155)	(0.113)	(0.125)	(0.134)	(0.091)	(0.098)
Day of SNAP pay	0.037	-0.061	-0.257+	-0.233*	-0.027	0.005	0.050	0.010
	(0.106)	(0.122)	(0.149)	(0.101)	(0.108)	(0.122)	(0.092)	(0.104)
Post SNAP pay	0.020	-0.050	-0.216	-0.194+	-0.093	-0.028	-0.143	-0.149
	(0.109)	(0.129)	(0.147)	(0.096)	(0.110)	(0.131)	(0.108)	(0.110)
Observations	439	439	426	426	439	439	426	426
R-squared	0.183	0.346	0.151	0.263	0.126	0.157	0.226	0.266
B. Middle and High School								
Two days pre SNAP pay	0.086	0.036	-0.181+	-0.154+	-0.076	-0.006	0.198	0.246+
	(0.135)	(0.077)	(0.103)	(0.082)	(0.122)	(0.062)	(0.136)	(0.127)
One day pre SNAP pay	-0.209	-0.206+	-0.231*	-0.196*	0.220	0.198+	0.298**	0.258**
	(0.146)	(0.102)	(0.104)	(0.076)	(0.139)	(0.105)	(0.093)	(0.057)
Day of SNAP pay	-0.273+	-0.264*	-0.260+	-0.214+	0.181	0.170	0.159	0.152
	(0.150)	(0.112)	(0.153)	(0.107)	(0.141)	(0.106)	(0.138)	(0.103)
Post SNAP pay	-0.216	-0.254*	-0.325*	-0.324**	0.101	0.125	0.275*	0.253**
	(0.151)	(0.115)	(0.120)	(0.098)	(0.136)	(0.096)	(0.102)	(0.084)
Demographic controls	N	Y	N	Y	N	Y	N	Y
Observations	367	367	358	358	367	367	358	358
R-squared	0.326	0.400	0.250	0.293	0.281	0.392	0.334	0.395

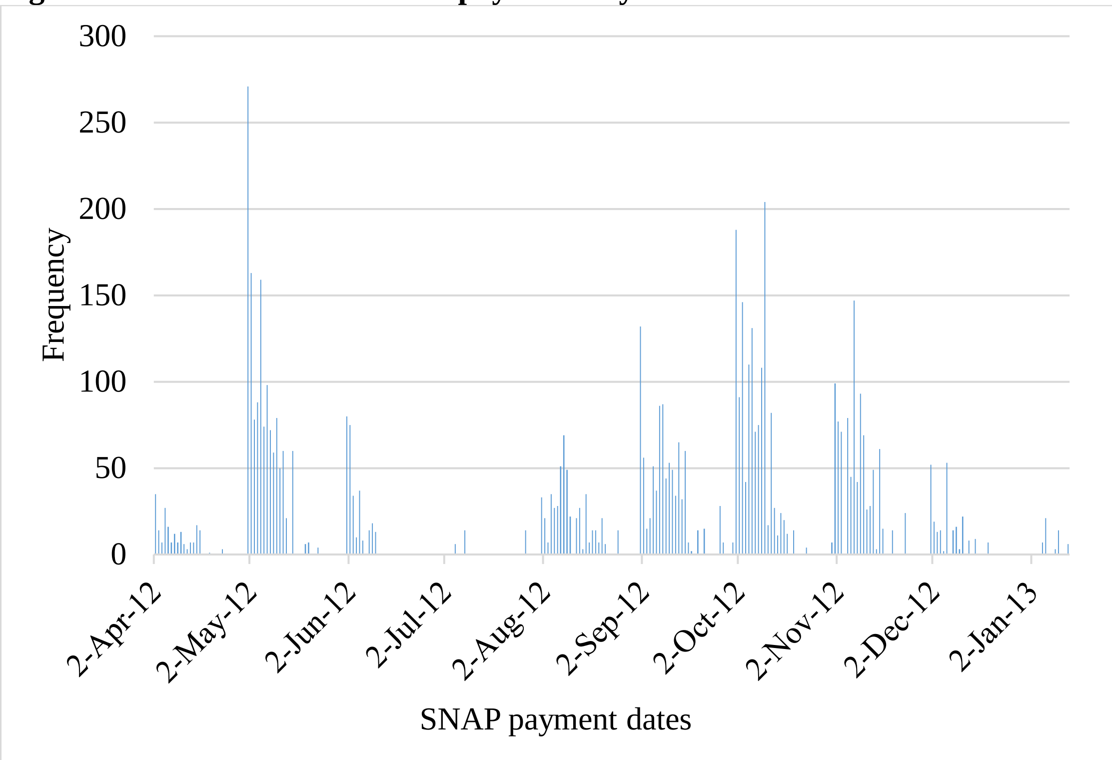
Standard errors in parentheses

** p<0.01, * p<0.05, + p<0.1

Notes: Demographic controls include: female, non-white, public housing, rural area, public school, household has car. All models have day of the week fixed effects and interview month fixed effects. All models are weighted using household sampling weights. Sample restricted to children in households receiving SNAP pay during data collection week and interviewed when school was in session.

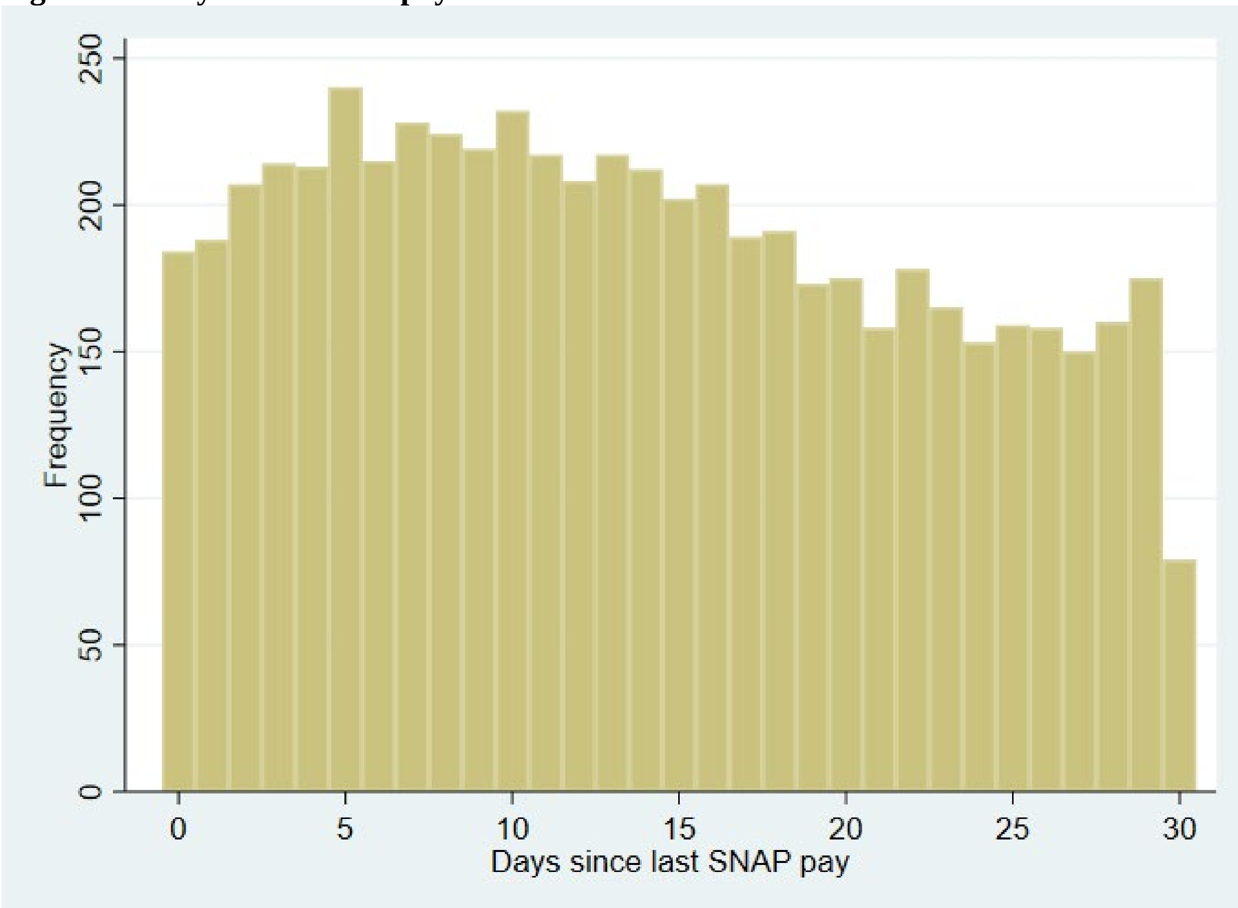
Appendix

Figure A1: Distribution of SNAP payment days



Notes: SNAP payment dates estimated based on the SNAPDAYS variable in FoodAPS, which counts the days since SNAP payment relative to each day of data collection.

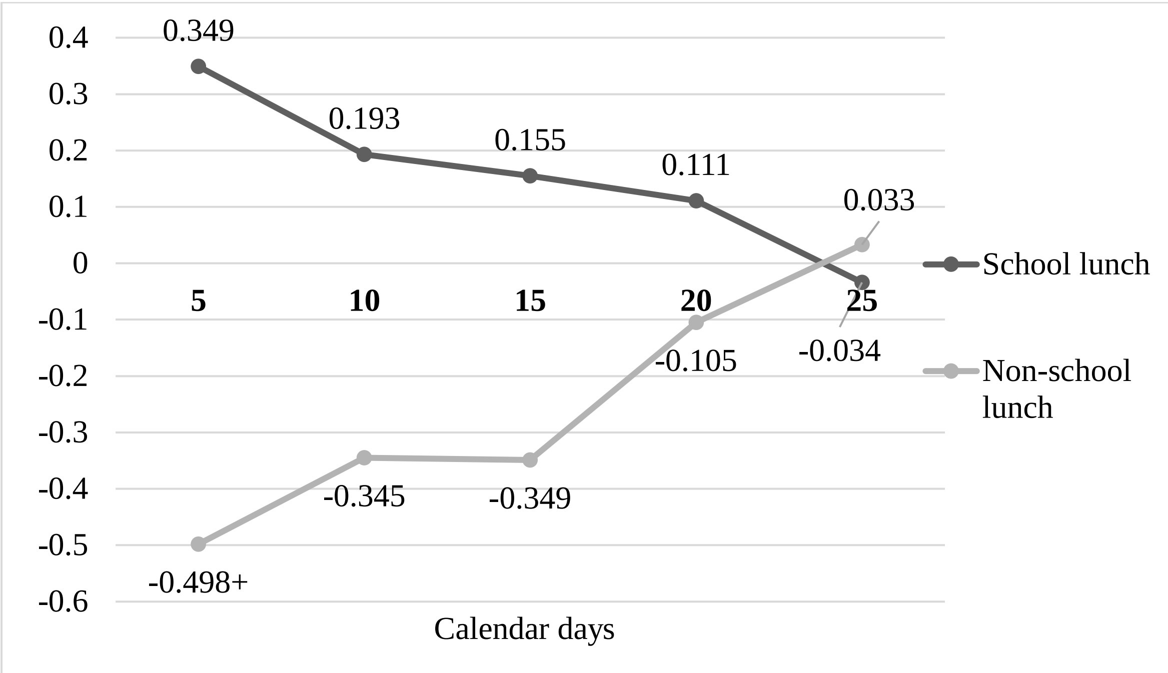
Figure A2: Days since SNAP pay distribution



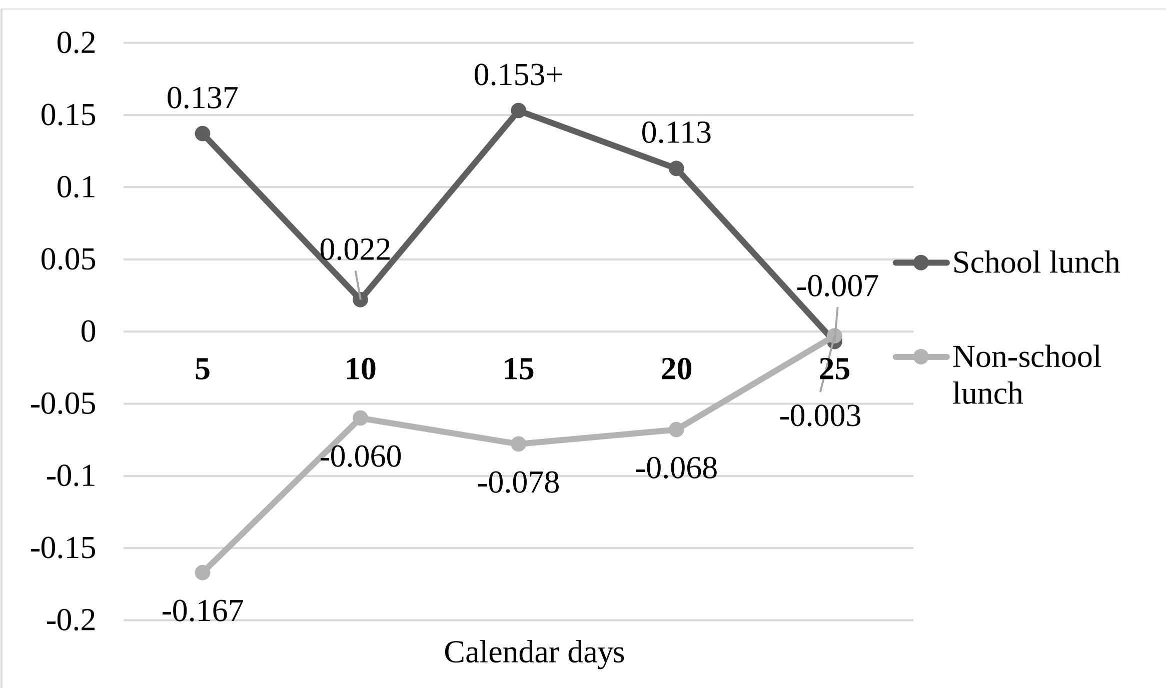
Notes: Days since SNAP pay are the ERS cleaned SNAPDAYS variable that assumes 30-day benefit cycle.

Figure A3: Lunch, calendar month, non-SNAP sample, individual fixed effects

A. Age 5-10



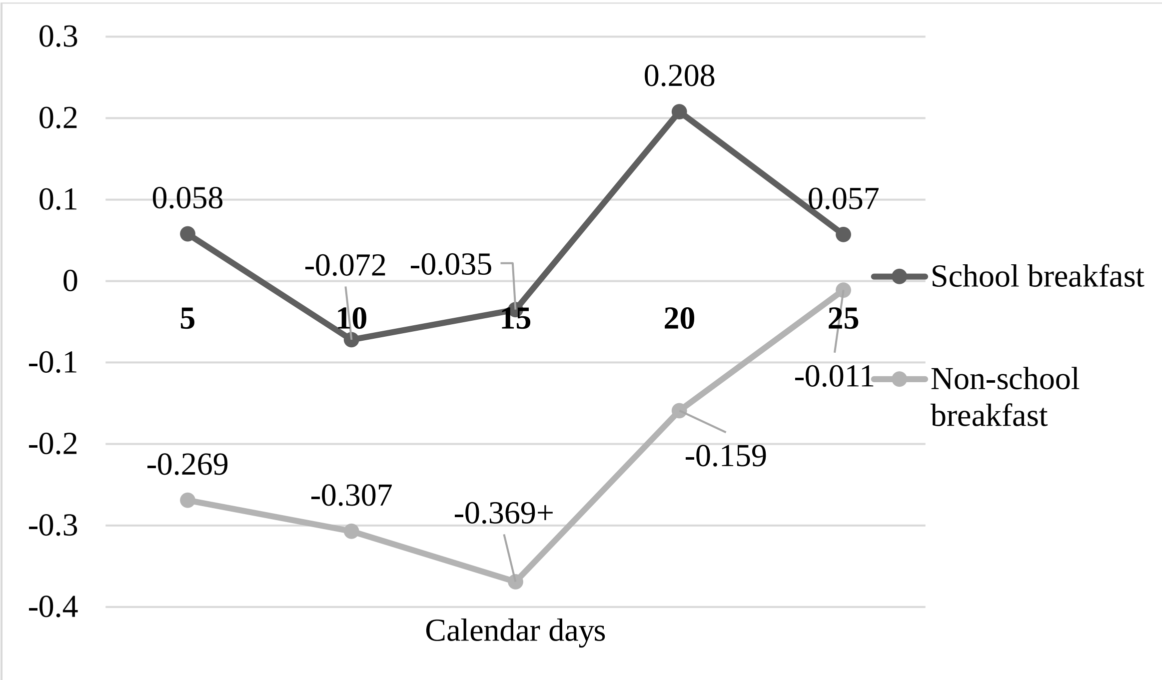
B. Age 11-18



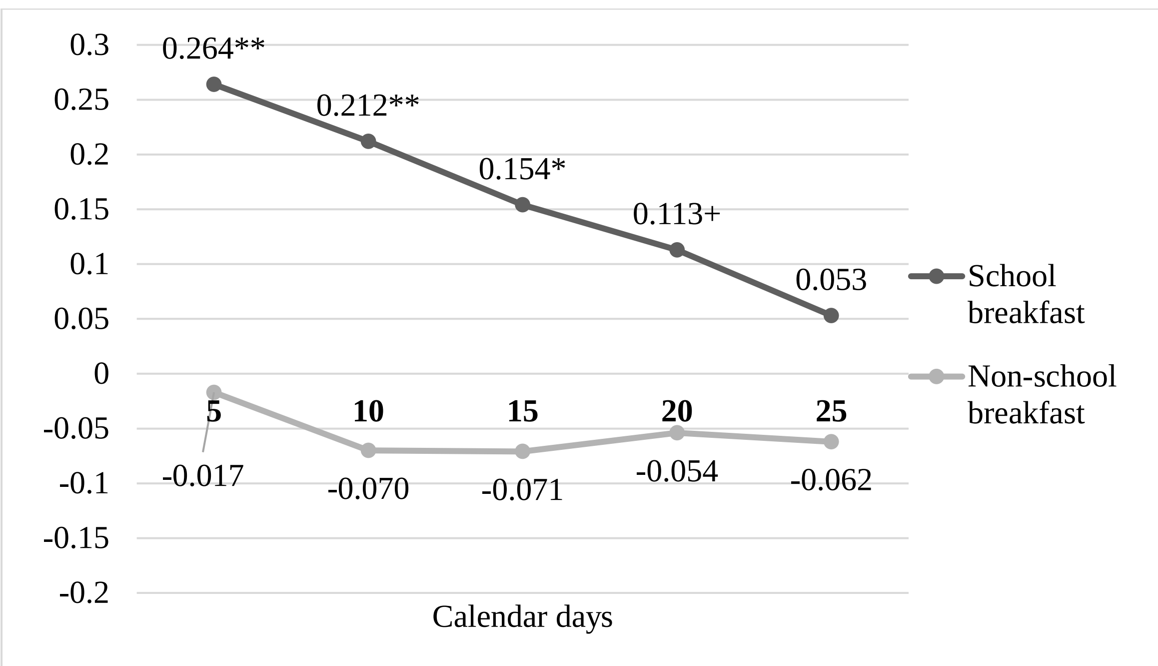
Notes: Graphs show coefficients from full month models stratified by age. All models include day of the week, interview week, and individual fixed effects. Sample restricted to non-SNAP children interviewed when school was in session. All models are weighted using the sample household weights and standard errors are clustered at the household level. ** p<0.01, * p<0.05, + p<0.1

Figure A4: Breakfast, calendar month, non-SNAP sample, individual fixed effects

A. Age 5-10



B. Age 11-18



Notes: Graphs show coefficients from full month models stratified by age. All models include day of the week, interview week, and individual fixed effects. Sample restricted to non-SNAP children interviewed when school was in session. All models are weighted using the sample household weights and standard errors are clustered at the household level. ** p<0.01, * p<0.05, + p<0.1

Table A1: Probability of school and non-school meal participation, SNAP and non-SNAP children by age

	School lunch		Non-school lunch		School breakfast		Non-school breakfast	
DV:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A. Age 5-10								
SNAP	0.112+	0.135*	-0.200**	-0.183**	0.054	0.046	-0.096	-0.058
	(0.059)	(0.051)	(0.051)	(0.046)	(0.042)	(0.040)	(0.060)	(0.063)
Observations	2,527	2,527	2,527	2,527	2,426	2,426	2,426	2,426
R-squared	0.050	0.089	0.072	0.124	0.032	0.046	0.024	0.064
B. Age 11-18								
SNAP	0.179**	0.158*	-0.180**	-0.144*	0.059	0.052	-0.057	-0.028
	(0.065)	(0.060)	(0.060)	(0.054)	(0.036)	(0.035)	(0.062)	(0.053)
Demographic controls	N	Y	N	Y	N	Y	N	Y
Day of the week FX	Y	Y	Y	Y	Y	Y	Y	Y
Interview month FX	Y	Y	Y	Y	Y	Y	Y	Y
Observations	3,002	3,002	3,002	3,002	2,816	2,816	2,816	2,816
R-squared	0.101	0.139	0.084	0.138	0.049	0.056	0.030	0.081

Standard errors in parentheses
** p<0.01, * p<0.05, + p<0.1
Notes: Demographic controls include: female, non-white, public housing, public school, rural area, household has car. Sample includes children in households that receive SNAP benefits and those in households with incomes less than 185 of the poverty threshold not on SNAP. Sample restricted to those interviewed when school was in session (excludes summer and other breaks). All models weighted using household sampling weights.

Table A2: Balance test, before and after SNAP pay, age 5-18 yrs. old

DV: Post SNAP pay	School in session (1)	Full Sample (2)
Non-white	0.100	0.001
	(0.116)	(0.100)
Female	0.012	0.017
	(0.042)	(0.035)
Public School	0.093	0.158
	(0.147)	(0.108)
Rural area	0.203+	0.188+
	(0.114)	(0.093)
Public housing	0.017	0.062
	(0.108)	(0.074)
Has car	0.033	-0.026
	(0.098)	(0.077)
Age less than 11 yrs. old	0.022	-0.023
	(0.039)	(0.031)
Includes Summer	N	Y
Day of the week FX	Y	Y
Interview month FX	Y	Y
F-stat	0.57	1.6
Prob>F	0.77	0.18
Observations	806	1,008
R-squared	0.164	0.172

Standard errors in parentheses

** p<0.01, * p<0.05, + p<0.1

Notes: Sample restricted to children in households receiving payment during data collection week (including first and last day of data collection). Full sample includes children interviewed when school was in session and those interviewed during summer break. All models are weighted using household sampling weights and account for the complex structure of the survey.

Table A3: Regression results, SNAP and lunch participation by age, full SNAP month specification

	School lunch			Non-school lunch		
DV:	(1)	(2)	(3)	(4)	(5)	(6)
A. Age 5-10						
Day of SNAP pay	0.096	0.106	0.012	-0.069	-0.086	-0.016
	(0.107)	(0.089)	(0.081)	(0.096)	(0.085)	(0.084)
Days 1-5 since SNAP	0.020	0.019	0.095	-0.052	-0.035	-0.052
	(0.081)	(0.075)	(0.071)	(0.078)	(0.075)	(0.089)
Days 6-10 since SNAP	0.074	0.058	0.136	0.045	0.011	-0.084
	(0.093)	(0.085)	(0.090)	(0.089)	(0.083)	(0.097)
Days 11-15 since SNAP	-0.029	-0.046	-0.028	0.104	0.074	0.050
	(0.089)	(0.086)	(0.095)	(0.096)	(0.091)	(0.102)
Days 16-20 since SNAP	-0.159*	-0.145+	-0.120	0.245**	0.238**	0.160+
	(0.079)	(0.080)	(0.100)	(0.085)	(0.083)	(0.095)
Days 21-25 since SNAP	0.006	-0.008	-0.006	0.074	0.079	0.033
	(0.080)	(0.080)	(0.095)	(0.080)	(0.075)	(0.082)
Observations	1,846	1,846	1,846	1,846	1,846	1,846
R-squared	0.064	0.116	0.705	0.086	0.147	0.670
Number of children			388			388
B. Age 11-18						
Day of SNAP pay	-0.101	-0.105	-0.100	0.093	0.093	0.045
	(0.111)	(0.107)	(0.092)	(0.106)	(0.100)	(0.067)
Days 1-5 since SNAP	-0.021	-0.031	-0.166	0.008	0.005	0.082
	(0.102)	(0.099)	(0.111)	(0.085)	(0.080)	(0.063)
Days 6-10 since SNAP	0.125	0.148	-0.203+	-0.132	-0.173*	0.136*
	(0.100)	(0.095)	(0.110)	(0.090)	(0.084)	(0.069)
Days 11-15 since SNAP	0.027	0.068	-0.229*	-0.046	-0.096	0.220**
	(0.100)	(0.094)	(0.105)	(0.091)	(0.084)	(0.075)
Days 16-20 since SNAP	-0.127	-0.102	-0.211*	0.087	0.037	0.191**
	(0.093)	(0.091)	(0.094)	(0.086)	(0.082)	(0.071)
Days 21-25 since SNAP	0.004	-0.004	-0.106	-0.060	-0.056	0.103
	(0.098)	(0.099)	(0.085)	(0.096)	(0.097)	(0.067)
Observations	1,896	1,896	1,896	1,896	1,896	1,896
R-squared	0.092	0.132	0.718	0.075	0.128	0.674
Number of children			401			401
Demographic controls	N	Y	N	N	Y	N
Individual fixed effects	N	N	Y	N	N	Y

Standard errors in parentheses (clustered at the household level)
** p<0.01, * p<0.05, + p<0.1
Notes: Demographic controls include female, non-white, public school, rural area, public housing, household has car. All models include day of the week and interview month dummies. Sample restricted to children interviewed when school was in session. All models are weighted using the household sampling weights.

Table A4: Regression results, SNAP and breakfast participation by age, full SNAP month specification

	School breakfast			Non-school breakfast		
DV:	(1)	(2)	(3)	(4)	(5)	(6)
A. Age 5-10						
Day of SNAP pay	-0.103	-0.099	-0.012	0.059	0.043	0.018
	(0.093)	(0.088)	(0.073)	(0.123)	(0.112)	(0.092)
Days 1-5 since SNAP pay	-0.101+	-0.096	0.071	-0.077	-0.076	-0.095+
	(0.065)	(0.062)	(0.049)	(0.095)	(0.088)	(0.056)
Days 6-10 since SNAP pay	-0.077	-0.084	0.086	0.097	0.060	-0.066
	(0.087)	(0.082)	(0.069)	(0.120)	(0.112)	(0.074)
Days 11-15 since SNAP pay	-0.116	-0.126	-0.036	0.113	0.075	0.068
	(0.081)	(0.079)	(0.072)	(0.114)	(0.107)	(0.081)
Days 16-20 since SNAP pay	-0.076	-0.081	-0.071	0.163	0.157	0.098
	(0.090)	(0.090)	(0.092)	(0.110)	(0.104)	(0.097)
Days 21-25 since SNAP pay	-0.027	-0.029	-0.184**	0.142	0.134	0.218**
	(0.082)	(0.080)	(0.069)	(0.099)	(0.094)	(0.073)
Observations	1,774	1,774	1,774	1,774	1,774	1,774
R-squared	0.047	0.060	0.689	0.058	0.089	0.735
Number of children			373			373
B. Age 11-18						
Day of SNAP pay	-0.113	-0.114	0.003	-0.010	-0.006	-0.013
	(0.106)	(0.106)	(0.088)	(0.119)	(0.113)	(0.089)
Days 1-5 since SNAP pay	-0.140+	-0.142+	-0.126+	0.039	0.032	0.088
	(0.074)	(0.074)	(0.074)	(0.088)	(0.081)	(0.065)
Days 6-10 since SNAP pay	-0.088	-0.083	-0.195**	-0.036	-0.048	0.167*
	(0.079)	(0.079)	(0.083)	(0.102)	(0.092)	(0.078)
Days 11-15 since SNAP pay	-0.162*	-0.149*	-0.211**	0.008	-0.004	0.187*
	(0.076)	(0.075)	(0.087)	(0.106)	(0.095)	(0.091)
Days 16-20 since SNAP pay	-0.151+	-0.147	-0.133+	0.096	0.076	0.154
	(0.091)	(0.089)	(0.080)	(0.104)	(0.100)	(0.102)
Days 21-25 since SNAP pay	0.019	0.020	-0.054	0.055	0.077	0.099
	(0.081)	(0.080)	(0.072)	(0.108)	(0.103)	(0.091)
Observations	1,772	1,772	1,772	1,772	1,772	1,772
R-squared	0.106	0.111	0.699	0.054	0.104	0.718
Number of children			377			377
Demographic controls	N	Y	N	N	Y	N
Individual fixed effects	N	N	Y	N	N	Y

Standard errors in parentheses (clustered at the household level)
** p<0.01, * p<0.05, + p<0.1

Notes: Demographic controls include: non-white, female, public school, rural area, public housing, household has car. All models include day of the week and interview month dummies. Sample restricted to children interviewed when school was in session. All models are weighted using the housing sample weights.

Table A5: Robustness test, SNAP and meal participation, baseline specification, weekend SNAP pay

DV:	School lunch (1)	School breakfast (2)	Non-school lunch (3)	Non-school breakfast (4)
A. Age 5-10				
Post SNAP pay	-0.013	-0.071+	-0.096	-0.150**
	(0.064)	(0.042)	(0.067)	(0.048)
Weekend SNAP pay	-0.034	0.087	-0.084	-0.298+
	(0.111)	(0.127)	(0.113)	(0.161)
Observations	367	354	367	354
R-squared	0.376	0.296	0.183	0.337
B. Age 11-18				
Post SNAP pay	-0.161*	-0.184*	0.036	0.067
	(0.068)	(0.077)	(0.053)	(0.083)
Weekend SNAP pay	0.090	0.127	-0.110	-0.076
	(0.113)	(0.099)	(0.120)	(0.138)
Observations	439	430	439	430
R-squared	0.418	0.272	0.379	0.410

Standard errors in parentheses

** $p<0.01$, * $p<0.05$, + $p<0.1$

Notes: All models include demographic controls: female, non-white, public housing, rural area, public school, household has car. All models have day of the week fixed effects and interview month fixed effects. All models are weighted using household sampling weights and account for the complex structure of the survey. Sample restricted to children in households receiving SNAP pay during data collection week and interviewed when school was in session.

Table A6: Robustness test, SNAP and meal participation, extended specification, weekend SNAP pay

DV:	School lunch (1)	School breakfast (2)	Non-school lunch (3)	Non-school breakfast (4)
A. Age 5-10				
Two days pre SNAP pay	0.054	0.000	0.076	-0.130
	(0.119)	(0.075)	(0.136)	(0.106)
One day pre SNAP pay	-0.036	0.011	0.026	-0.150
	(0.141)	(0.122)	(0.137)	(0.115)
Day of SNAP pay	-0.086	-0.155+	-0.007	-0.071
	(0.122)	(0.079)	(0.111)	(0.076)
Post SNAP pay	-0.001	-0.048	-0.075	-0.283**
	(0.128)	(0.081)	(0.131)	(0.075)
Weekend SNAP pay	-0.050	0.068	-0.074	-0.259
	(0.108)	(0.129)	(0.112)	(0.162)
Observations	367	354	367	354
R-squared	0.380	0.301	0.186	0.356
A. 10-18				
Two days pre SNAP pay	0.030	-0.175*	0.015	0.189
	(0.075)	(0.074)	(0.076)	(0.119)
One day pre SNAP pay	-0.163+	-0.214**	0.160+	0.238**
	(0.087)	(0.076)	(0.085)	(0.054)
Day of SNAP pay	-0.189+	-0.201+	0.094	0.104
	(0.094)	(0.099)	(0.077)	(0.104)
Post SNAP pay	-0.216*	-0.335**	0.099	0.229**
	(0.095)	(0.091)	(0.073)	(0.078)
Weekend SNAP pay	0.073	0.124	-0.089	-0.068
	(0.118)	(0.090)	(0.121)	(0.132)
Observations	439	430	439	430
R-squared	0.427	0.299	0.385	0.429

Standard errors in parentheses

** p<0.01, * p<0.05, + p<0.1

Notes: All models include demographic controls: female, non-white, public housing, rural area, public school, household has car. All models have day of the week fixed effects and interview month fixed effects. All models are weighted using household sampling weights and account for the complex structure of the survey. Sample restricted to children in households receiving SNAP pay during data collection week and interviewed when school was in session.

Data Appendix

Data used for this paper comes from the Food Acquisition and Purchase Survey (FoodAPS) **restricted files**, which we accessed through the NORC data enclave. We use five of FoodAPS data sources as detailed below:

Individual level data (FI)
This is individual level dataset provides demographic and other information about FoodAPS participants. The data contain one observation per survey respondent. We use this data source to identify children in the FoodAPS sample. We identify children using their age (AGEGROUP). Additionally, we use this dataset to obtain basic demographic information: gender, race, whether the child attends public school, and school level. The school level variable (SCHLEVEL) allows us to restrict our sample to children attending K-12 school. These data include one observation per child, so in creating our final dataset we transform them into a child-day panel.

Household level data (FH)
We matched the child sample to the household level data using the unique household identifier (HHNUM). FH data provide information on the characteristics of the household, including their SNAP status. This dataset allows us to identify children in current SNAP households (SNAPNOWHH) and those that are poor but not on SNAP (using the TAGETGROUP variable). We also use this dataset to construct additional control variables: such as whether the household lives in a rural area (RURAL), in public housing (HOUSINGPUB), and whether the household has a car (AUTO). This dataset also includes the variable SNAPDAYS, which counts the days since SNAP payment relative to the survey date. There are two versions of this variable, in this paper we use the ERS cleaned version, which assumes a 30-day benefit cycle. After matching children from FI to their household we create the child-day panel.

Food away from home event data (FAFH-event)
This is an event (meal) level dataset. That is, these data include a meal identifier as well as the ability to match that meal to an individual in FI. We matched the child-day data using a unique identifier that is the combination of the individual id (PNUM/WHOGOTPNUM) and the household id (HHNUM) and day. We use the event level dataset to select meals that happened at school or not, as well as to identify whether those meals were free or not.

Food away from home item data (FAFH-item)
This is an item-level dataset that provides information about the specific items in each event (meal) in FAFH-event. We use these data to identify meals that are classified as school meals (MENUID and MENUGRP). The FAFH-item data also provide and indicator of whether items in the meal are not part of reimbursable meals (NONSCHMEALITEM). We matched these variables to FAFH-Event data using the common event identifier (EVENTID).

Meals and Snack Forms (M&S)
This is an individual level dataset that provides information whether an individual acquired a breakfast, lunch, snack, or dinner on a given day. This data source provides no additional information. We match these data to the child-day dataset we constructed by unique child id as described before and day.