The Impact of the SNAP Distribution Cycle on Student Non-Cognitive Outcomes

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Draft: December 11, 2019

Abstract

This paper analyzes the effect of the Supplemental Nutrition Assistance Program (SNAP) benefit distribution cycle on student non-cognitive outcomes. In 2017, an average 42.1 million individuals participated in the program each month, and for the lowest-income households, these benefits can account for up to 50% of food-at-home spending. Given the importance of SNAP in these families' food budgets, there are several key policy questions related to the potential impacts that this monthly distribution cycle can have on these vulnerable households. This research contributes to a growing literature on the consequences of households exhausting their SNAP benefits before receiving their next distribution. Using the student specific interview date and student characteristics from the Early Childhood Longitudinal Study – Kindergarten sample (ECLS-K) it is possible exploit the exogenous variation in these student ECLS-K interview dates relative to statewide SNAP benefits distribution dates to investigate the impact on student outcomes. By temporally matching these two datasets creates a unique database of the time lag between a family's SNAP benefit receipt date and ECLS-K students survey response. This dataset is used to test hypotheses related to the impact of the potential depletion of benefits on eighth grader non-cognitive outcomes; locus of control; self-concept; and internalizing behavior scores. Results indicate that among SNAP participating households, non-white male students interviewed more than two weeks after the first potential distribution date exhibit worse outcomes across all measures of non-cognitive outcomes than white male students interviewed in the same time frame. Across all estimations, female students do not experience the same end of the month effect that males do. These findings contribute to the growing discussion around SNAP distribution; that SNAP participants could potentially benefit from multiple benefit distribution or increased resource access.

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1. Introduction

In 2017, 15.7% of households with children (12 million children) under 18 years old were food insecure. African American and Hispanic households with children experience food insecurity at roughly double the rate of white households (Croquist and Lauffer 2019). A number of studies have shown a negative relationship between food insecurity and nutritional intake (Cook et al. 2004) as well as general health (Gundersen and Ziliak 2015), in addition to academic and psychological outcomes (Alaimo, Olson, and Frongillo 2001; Jyoti et al. 2005; Slopen et al. 2010; Howard 2011; Murphy et al. 1998; Alaimo, Olson, and Frongillo 2002).[2] The Supplemental Nutrition Assistance Program (SNAP) is one of the ways in which the U.S. Federal Government via the U.S. Department of Agriculture helps alleviate some of this food insecurity through monthly cash-like benefits for food purchases.

An average of 42.1 million individuals participate in SNAP monthly. The United States Department of Agriculture (USDA) found that, in 2017, only 13.3% of food insecure households did not participate in SNAP. Among participants, 30% of children were school-aged children, ages 5-17. Of the 8.59 million SNAP households with children, 40.6% are non-white (Croquist and Lauffer 2019).[3] Before SNAP benefits, 38.8% of SNAP households had gross income less than or equal to half the poverty guidelines. When accounting for the value of SNAP benefits as a source of income, 10% of SNAP households would move above the poverty guidelines. SNAP has been shown to improve household food consumption (Beatty and Tuttle 2015), improve child birth weight (Almond, Hoynes, and Schanzenbach 2011; Currie and Moretti 2006), and reduce BMI for children (Schmeiser 2012).

In 2009, the USDA reported that the average SNAP-participating household had less than a quarter of their initial benefits left by the middle of the month, with nearly half spending the majority of their benefits in the first two weeks (Castner and Henke 2011). Given these findings, it is unsurprising that among the low-income households that received SNAP benefits in the last 30 days, a third of them still

[2] For a full review of the consequences of food insecurity among many different demographics, please see (Gundersen, Kreider, and Pepper 2011).
[3] Non-white refers to African Americans, Hispanics and Asians and those identified as other or more than one race/ethnicity.

obtain food from a food pantry (Croquist and Lauffer 2019). This suggests that the value of benefits is not enough for these households. Consistent with these results, other research found there to be a cyclical spending pattern for beneficiary households across the month such as significant decreases in the food expenditure in the last two weeks (Tiehen, Newman, and Kirlin 2017), higher propensity for borrowing money three weeks after benefit distribution (Schenck-Fontaine, Gassman-Pines, and Hill 2017) and increased caloric deficits at the end of the month (Wilde and Ranney 2000; Shapiro 2005; Todd 2015).

In addition to these general effects, there is also evidence of potential heterogeneity between genders and race over the benefit distribution cycle. For example, Todd (2015) finds that adult African Americans eat less frequently throughout the day relative to whites, and in comparison to females, males also eat less frequently. Kharmats et al. (2014) find that African Americans increase intake of fats and protein in the early and late stages of benefit distribution month. Hamrick and Andrews (2016) find that days since benefit issuance appears to increase the likelihood of a day without eating for all SNAP participants, while also finding that in general, African Americans had a higher probability of not eating during the day compared to white participants.

These findings reveal the additional hardship experienced at the end of the month among an already vulnerable population and has led researchers to investigate the consequences of the benefit distribution cycle on various educational and behavioral outcomes.[4] Gassman-Pines and Bellows (2018) provide the first evidence of the impact of the SNAP benefit cycle's effect on children's cognitive function using student data on math and reading scores from North Carolina. Results show a quadratic relationship between scores and days since distribution, where reading and math scores peak 17 and 19 days after benefit receipt, respectively.[5]

[4] While the findings discussed here are more relevant to cognitive achievement and behavioral problems, additional research has looked at the impact of the SNAP distribution on crime rates (Carr and Packham 2018), purchasing habits (Castellari et al. 2016), emergency room and hospital visits (Cotti, Gordanier, and Ozturk 2018a; Seligman et al. 2014), and drunk driving fatalities (Cotti, Gordanier, and Ozturk 2016).

[5] When testing for racial differences, authors found no statistically significant differences by race/ethnicity due to the SNAP cycle, although African American students appear to peak in test performance earlier than their white classmates.

Cotti, Gordanier, and Ozturk (2018) utilize individual-level administrative data from South Carolina to examine the impact of SNAP distribution on student performance on statewide exams. Evidence suggests that academic performance is negatively affected when a student's exam is more than 26 days after benefit receipt. In addition, this research shows notably larger, statistically significant effects on test performance for both African American boys and girls compared to white and other races more than 26 days after receiving SNAP benefits. The closest complement to the present work is Gennetian et al. (2016), which studies the impact of the SNAP distribution cycle on disciplinary infractions for fifth to eighth grade students data from Chicago Public Schools. Using a difference-in-difference approach, comparing SNAP participants to non-SNAP participants at different times of the month, they find that disciplinary infractions spike at the end of the month for all students, but a higher incidence rate is found among SNAP participants. Specifically, results show that males experience higher rates of disciplinary action than females.

This paper provides the first evidence of the impact of the SNAP distribution schedule on student non-cognitive outcomes. Using the exogenous variation in interview days to study the impact of time since distribution on three different non-cognitive outcomes among eighth graders from households participating in SNAP. Given previous research exploring the racial and gender heterogeneity in SNAP participation and in the effect of the distribution cycle on outcomes, heterogeneity analysis is performed testing differences between gender and race (white vs. non-white). Results indicate that SNAP participating non-white (African American, Hispanic, Asian and other) male students feel worse about themselves (self-concept), feel as though they have less control over their lives (locus of control) and have higher incidence of anxious and depressed thoughts (internalizing behavior) more than two weeks after benefit distribution compared to SNAP participating white male students also interviewed more than two weeks after benefit distribution. This paper addresses the potential pathways through which the effect of benefit distribution affects non-cognitive outcomes. Also, when accounting for potential correlation in non-cognitive outcomes within individual students, results are robust providing additional insights.

2. SNAP Background

The Supplemental Nutrition Assistance Program (SNAP) is a federally funded means-tested transfer program providing funds to households or individuals to be used to purchase most foods at authorized retailers. SNAP is unlike most means-tested programs in that eligibility is not targeted to a singular group (such as adults with children, aged, or disabled individuals) or dependent on work status (serving both working and non-working poor). Benefits are primarily a function of household size and household income, where the amount of benefits received decreases as income increases.

On the same day each month, households receive benefits on their Electronic Benefit Transfer (EBT) cards, which act like a debit card, for food purchases. Most grocery store foods can be purchased except for hot foods intended for immediate consumption, vitamins, paper products, pet foods, alcohol and tobacco.[6] In the fiscal year 2017, $70 billion dollars had been spent on SNAP, the majority (92%) of which were in the value of benefits distributed to more than 40 million individuals. The average monthly benefits per person in 2017 was $125.99.[7]

3. Data

This research utilizes the Early Childhood Longitudinal Survey, Kindergarten (ECLS-K) 1998/99 eighth grade restricted access sample provided by the Institute of Educational Services.[8] This survey followed students from kindergarten through eighth grade to study child development, school readiness, and early school experiences, with follow-up interviews in first, third, fifth and eighth grade. The ECLS-K sample used a multistage probability sample design to select a nationally representative sample of children attending kindergarten in 1998-99 (Tourangeau et al. 2006). First, counties or groups of counties were selected to act as the primary sampling units. Next, schools within the primary sampling unit were selected and, finally, a sample of children within the schools were chosen. The eighth grade sample used

[6] A list of available food items can be found on the USDA-Food and Nutrition Service website.
[7] In 2007, the year that data from this analysis was collected, the average monthly benefits per person was $96.18 which in 2017 dollars is equal to $116.29.
[8] The Institute of Educational Services (IES) act as the statistics, research, and evaluation branch of the U.S. Department of Education.

in this paper consisted of all children eligible to be re-interviewed after their fifth grade interview regardless of response status.[9] For each student, there are accompanying parent, teacher, and school administrator surveys, each of which is linked to the corresponding student. These data contain information on household SNAP participation, food insecurity measures, food consumption information, non-cognitive outcomes, and household, parental, and school characteristics.

12,130 children who were eligible to participate in the survey in eighth grade from previous rounds, however only 9730 students completed their surveys; specifically completing the child assessment or had complete family structure data of the parent interview. 2,300 students did not respond to the survey and 100 students were ineligible (death or moved out of country), unknown eligibility (they moved and could not be located) or moved and located but were not followed. The primary sample is composed of those students whose household participated in SNAP at least once in the past 12 months (860), were successfully interviewed in both third and eighth grade, and lastly have full set of covariates for all given controls (570).[10] Given the potential data issues associated with exclusion due to missing covariates, a test for potential differences between the missing sample and those remaining is done, finding that for most variables there is not a statistically significant difference between the excluded and included sample of SNAP participating students.[11]

The key outcomes used for this analysis are three different non-cognitive measures derived from a self-assessed student questionnaire. The first is locus of control, which measures the amount of control a student feels they have over their own life. The second is self-concept, which ascertains how the students feel about themselves. The last is internalizing behavior problems, which measures students' depression

[9] Students were considered ineligible if they moved out of the country, were deceased, or moved to another school and were not sub-sampled for follow-up in the fifth grade (Tourangeau et al. 2006).

[10] Non-SNAP participating students are used for various naïve estimations and robustness checks throughout the paper, which is comprised of 6010 additional students who were interviewed in third and eighth grade and were not missing any of the selected covariates. In addition, 990 total students from each the third and eighth grade (510) sample are used in order to perform a single non-causal fixed effect estimation to be discussed later.

[11] Results are found in Appendix Table A-3. There does exist a marginally statistically significant difference between the locus of control scores(p-value=0.080), such that the sample used feels less control over their life than the excluded sample. Also, there is a significant difference in non-white students within the final sample (0.000), also household size (0.005) and school characteristics generally exhibit differences between the sample.

and anxiety levels. Students were asked to respond to how true each question was or how much they agree with different statements, with responses ranging from "not true at all/strongly disagree" (which took a value of 1), to "strongly agree/very true" (4). For all outcomes of interest, higher scores signify better outcomes.[12]

Summary statistics for the 570 SNAP students can be found in Table 1. Students, on average, have locus of control scores of -0.26 and average self-concept score of -0.17, and an average internalizing behavior score of 2.84.[13] 32% of the students are from food insecure households. 58% the students are non-white and 48% are male. The average household size is nearly five people and the average non-white population in the schools the sample children attend is roughly 50%.

INSERT TABLE 1 HERE

3.1. Heterogeneity

Given the potential heterogeneity in a variety of outcomes between race and gender, means-tests between these groups were performed (See Appendix Tables A-4 to A-7). Results show that within the sample white students have a significantly lower self-concept scores (feel worse about themselves) compared to non-white students, while non-white students have significantly lower internalizing behavior scores (more anxious/depressed). Students from non-white households tend to have larger households than white households and have participated in SNAP for longer (Table A-4). In addition, non-white households have lower income relative to white households, and this holds when looking across racial

[12] For example, if a student responded strongly agree to "I feel good about myself" it means they have a good self-concept. If a student responded strongly agree "Every time I try to get ahead, something or somebody stops me", it would indicate they have poor locus of control. Similarly, a high valued response to questions like "I often feel lonely" indicate that students are evidence that students are experiencing higher levels of internalizing behavior problems. Each item for each scale were standardized independently to a mean of zero and a standard deviation of one. The scores used in this analysis are the average of the standardized questionnaire scores. Two out of the three scores (locus of control and self-concept) are designed such that higher scores indicate higher levels of each concept, for consistency, a monotonic transformation was applied to the scores for internalizing behavior problems, so that a higher value is indicative of lower internalizing behavior problems (less anxiety or depression). Appendix Tables A-1 and A-2 present the questions used to derive the scores used in this research.

[13] Locus of control scores range from -2.35 to 1.25, self-concept scores for -3.06 to 1.02, and internalizing score from 1 (more anxiety/depression) to 4 (less anxious and depressed).

differences by gender. Differences between male and female students show that females have worse internalizing behavior scores than males, and it is a statistically significant difference (Table A-5).

In terms of racial differences for each gender, results show that white males have, on average, worse self-concept scores than non-white males (Table A-6). Non-white females have significantly lower internalizing behavior scores than white females and are from households who had utilized SNAP benefits for longer in the past year. In addition, more non-white females are from households where household income is below $25,000 (Table A-7).

3.2. Calculating Days since Benefits

To calculate the length of time that has passed since benefit receipt for each student at the time of their ECLS-K interview, students are matched to their state's SNAP benefit distribution schedule.[14] Most states distribute benefits over a range of days based on a variety of criteria, such as SNAP case numbers and first letters of last names. ECLS-K data only provides information on whether households participated in SNAP in the last 12 months, and if so, for how many months. Without knowing the exact date that households received their benefits, all households within a state are assigned the earliest distribution day available in their month of interview in their state.

Specifically, any effect of the distribution cycle on non-cognitive outcomes due to the uniform assignment of the earliest distribution date for each student in a given state found would be biased downward. For instance, if a household was interviewed on the 25th, and received benefits on the 6th of the month, but was assigned the 1st of the month, this measure is inflating the length of time that they would have had benefits. This means their benefits are less likely to have ran out by the time they are interviewed. Meaning that any effect found is potentially biased downward from observing earliest possible treatment in benefits.[15]

[14] Source: USDA-ERS SNAP Policy Data Sets, SNAP Distribution Schedule Database. Accessed April 2019. Counties within Ohio set their own schedule based on the state-level distribution, which is not provided, thus any students from Ohio are assigned the state-level mandates. Summary of state distribution dates found in Appendix Table A-8.

[15] Additional robustness checks to determine whether household interview dates are correlated with household characteristics are also performed. Results show that the interview date is as good as random (Appendix A-9). Given that interviewers likely would

Once students are matched with the corresponding distribution date, a continuous variable of days since benefit distribution is generated by calculating the difference between the first day of benefit distribution within the state and the individual student interview dates. For example, a student belonging to a household that was interviewed on March 28th but lived in a state where the first date of benefit distribution was March 4th would be assigned a value of 24 days since benefit distribution. If a student was interviewed on April 8th but that household receives benefits on the 10th of the month, then it would mean that at the time of the survey they have yet to receive their April benefits, and thus it has been 29 days since last receiving benefits (March 10th). Figure 1 visualizes these examples, with orange dots representing all possible benefit distribution days within the sample, and blue dots representing potential interview days.[16]

Insert Figure 1 Here

This paper uses two primary measures for days since benefit distribution. The first is the continuous measure and is used estimate the effect of each additional day since benefit receipt on non-cognitive outcomes. Next, an indicator variable for more than 13 days after household received benefit is used to test for a cumulative, rather than individual day effect, on outcomes. If the effect is not seen for each individual day, then a cumulative effect could be seen. This would be consistent given the frequent end of the month effect found in prior research discussed earlier (Schenck-Fontaine, Gassman-Pines, and Hill 2017; Tiehen, Newman, and Kirlin 2017; Castner and Henke 2011). Within the sample, the average student is interviewed about 17 days after their states first SNAP distribution date. Two-thirds of the students are interviewed more than 13 days after the benefits are distributed.

interview students in the same school on the same or neighboring days, the statistical significance related to a handful of school characteristics is not surprising.

[16] Those households who receive benefits on the same day that they are interviewed are assumed to not have used the benefits to purchased food and are assigned the number of days since the benefit distribution the month before.

4. Methods

This goal of this paper is to understand to what extent if at all, the SNAP benefit distribution cycle affects eighth grader non-cognitive outcomes. This paper first establishes if any relationship (non-causal), exists between SNAP and non-cognitive outcomes. A naïve estimate is used to determine whether a relationship exists using the following equation among a sample of eighth graders who were interviewed in both third and eighth grade, and those who have a full set of covariates for all given controls. This is done using the following specification:

$$Outcome_{is} = \beta_0 + \beta_1(SNAP\ Participation)_{is} + Controls_i\gamma + \delta_m + \delta_s + \varepsilon_{is} \qquad (1)$$

Where $Outcome_{is}$ is each non-cognitive outcome: locus of control; self-concept; and internalizing behavior problems for student *i* in state *s*. $SNAP\ Participation_{is}$ denotes whether household *i* in state *s* participated in SNAP at any time in the 12 months before student interview. $Controls_i$ is a vector of controls, including household, child, and school controls taken from the corresponding ECLS-K survey. Specifically, parental characteristics such as parental age, race, income, education, marital status, household size, and household participation in Temporary Assistance for Needy Families program. Child controls include child race, age, and gender. School controls include school level participation in USDA school lunch or breakfast programs, whether the school is public or religious, the percent of non-white students, whether snacks are available on campus, and whether the school has problems with crime, gangs, or drugs. δ_m and δ_s are interview month and state of residence fixed effects. ε_{is} represents student error-terms.

Further, potential issues arise in interpreting the effect of SNAP participation on non-cognitive outcomes, β_1, as it could be biased due to other household unobservable characteristics affecting both SNAP participation and student outcomes, such as parental stress, parental cognitive and non-cognitive outcomes, and other early childhood adversity. This is addressed through the incorporation of previous

internalizing behavior scores, and the usage of fixed effect estimations.[17] Controlling for previous internalizing behavior score captures some of the unobservable characteristics that influenced the student in third grade that might still be active and influencing non-cognitive outcomes in eighth grade.[18] Student level fixed-effect estimation account for time-invariant unobservables at the household level that may affect both SNAP participation and non-cognitive outcomes such as parent cognitive and non-cognitive outcomes.[19]

To address the primary research question, this paper uses the eighth-grade sample of students from SNAP participating households to investigates how days since SNAP benefit distribution impacts students' non-cognitive outcomes using the following framework:

$$Outcome_{is} = \beta_0 + \beta_1(Days\ Measure)_{is} + Controls_i\gamma + \delta_m + \delta_s + \varepsilon_{is} \qquad (2)$$

$Days\ Measure_{is}$ is used to represent the two primary measures of time since distribution; the continuous number of days since SNAP benefits were distributed to the household, an indicator variable to signal that the students were interviewed more than 13 days after benefit distribution. $Controls_i$ include the same parent, child, and school characteristics used in Equation 1. Households were not asked to report whether they received SNAP in the month prior to their interview, just how many months, a control for percent of months out of the past 12 months in which they received benefits is used to control for likelihood of participation at the time of interview. In order to investigate the potential heterogeneity by race and gender found in the previous literature regarding benefit usage and overall non-cognitive outcomes, Equation 2 is used on the various subsamples (males, females, whites, non-whites) to investigate the effect on outcomes for each group ($H_O: \beta_{1,male} = 0$).

[17] Locus of control and self-concept scores were unavailable in prior years so internalizing behavior is used regardless of outcome measured to capture some measure of non-cognitive ability.

[18] The fixed-effect estimations use the third and eighth grade students who were interviewed in both grades, had all their covariates in eighth grade, and whose households did not participate in SNAP in third grade but did in eighth grade ($0_{third}, 1_{eighth}$) or participated in SNAP in both grades ($1_{third}, 1_{eighth}$).

[19] It does not however account for time-varying factors such as changes in the household's economic opportunities.

In addition, due to some within gender racial differences in the effect of the distribution cycle on cognitive outcomes in other research, Equation 2 is modified to the following to examine within group variation:

$$Outcome_{is} = \beta_0 + \beta_1(Days\ Measure)_{is} * Group\ 1_{is} + \beta_2(Days\ Measure)_{is} * Group\ 2_{is}$$
$$+\beta_3 Group\ 1_{is} + Controls_i\gamma + \delta_m + \delta_s + \varepsilon_{is} \qquad (3)$$

Where $(Days\ Measure)_{is} * Group\ 1_{is}$ is an interaction between the days measure and a dummy variable for whether the child is part of Group 1 (non-white). Similarly, $(Days\ Measure)_{is} * Group\ 2_{is}$is an interaction between the days measure and a dummy variable for whether the child is part of Group 2 (white). This approach allows for two potential tests: one to directly tests if the effect of the benefit cycle is homogenous across the two groups ($H_O: \beta_{1,male} = \beta_{2,male}$), and if the effect is statistically significant for the group in question ($H_O: \beta_{1,male} = 0,\ \beta_{2,male} = 0$). All regressions are estimated using robust standard errors.

Additional robustness checks are performed investigating potential pathways, within-student correlations among non-cognitive outcomes, and potential time trends. Specifically, Equations 2 and 3 are used to estimate the effect of days since benefit distribution on the students' exercise, consumption of healthy foods (fruits) and unhealthy foods (soda) among the SNAP participating students.[20] To address potential correlation among all non-cognitive outcomes, seemingly unrelated regressions are used. Various methods are used to test whether results are driven by a general time trend such as if the end of the month distribution effect is present for non-SNAP households, and randomization of days since distribution values.

[20] To do this, $Outcome_{is}$ is replaced by each of these variables in a separate set of regressions.

5. Results

5.1. Non-Causal Relationship

Table 2 displays the coefficients of Equation 1 investigating the potential, non-causal relationship between SNAP participation and non-cognitive outcomes (columns 1 to 6) among all eighth-grade students who were successfully interviewed in both third and eighth grade, and those who have full set of covariates for all given controls. Results show there to be a statistically significant negative relationship between locus of control and SNAP participation (column 1), which is robust to the inclusion of previous scores (column 2). The same relationship is not statistically significant for self-concept and internalizing behavior, although a consistent negative relationship is found (columns 3-6). Columns 7 and 8 present results from the fixed-effect estimation on the third and eighth grade sample of SNAP participating households in the eighth-grade sample. Results show that SNAP participation has a statistically significant negative effect on internalizing behavior problems, reducing eighth grade scores by -0.153 points (SE=0.0755) when controlling for unobserved time-invariant characteristics. There are additional effects on internalizing behavior scores for students interviewed more than two weeks after benefit distribution; being interviewed beyond 13 days and being on SNAP reduces eighth grade internalizing behavior scores by -2.02 (SE=1.23) although only marginally statistically insignificant.

Insert Table 2 Here

5.2. Impact of Days since Distribution

Table 3 presents results for the impact of days since household distribution receipt on non-cognitive outcomes among SNAP participating students in eighth grade who had participated in the third-grade interview and were not missing any covariates in either grade. There does not appear to be a statistically significant effect for additional days on any of the non-cognitive outcomes. Despite the lack of statistical significance, the continuous measure has the expected sign; as time between distribution and interview increases, students exhibit worse outcomes.

Insert Table 3 Here

Given the findings mentioned earlier of decreased food expenditure and increased resource constraints on the second half of the month, it is important to test the impact of reduced nutritional intake in the last two weeks of the month. To account for the end of the month effect, a dummy variable for interviews more than 13 days since benefit distribution is used and does not appear to have a statistically significant impact on any non-cognitive outcomes, but all have the expected negative sign.

5.3. Heterogeneity

Using the same sample, this paper next investigates the potential heterogeneous effects of the benefit cycle on outcomes. This is done in response to previous research, which established differences in the effect of food insecurity and the distribution cycle by gender and race. Tables 4 through 6 present results for the effect of being interviewed more than 13 days after distribution on each non-cognitive outcome for different subgroups; males and females (columns 1 and 2), whites and non-whites (columns 3 and 4) and white males, non-white males (column 5), white females and non-white females (column 6).[21]

First, there does not appear to be a statistically significant effect due to the distribution cycle on locus of control for any individual group (Table 4). However, in column 5, non-white males interviewed more than two weeks after distribution have a significant reduction of -0.276 in their score compared to non-white males interviewed in the same time frame (significant at the 10% level, SE=0.160), while white males do not appear to be affected by the timing of the interview (a much smaller effect of -0.0837 with a large standard error of 0.139).[22] However, the coefficients do not appear to be statistically different from one another.

Insert Table 4 Here

Next, Table 5 presents the results for students' self-concept score. Like the results for locus of control, results show that interview timing is, on average, not significantly associated with changes in self-concept score for individual groups. However, once again, male non-white students with late interview dates have a significantly lower self-concept score (-0.324 points, SE=0.161) compared to male

[21] Results for locus of control are found in Table 4, self-concept are in Table 5 and internalizing behavior is in Table 6.
[22] The difference in the effect of late interview dates does not vary significantly between the white and non-white males.

non-white students with a similar interview date (0.0967 points, SE=0.155). No significant effect on females is found.

Insert Table 5 Here

Finally, Table 6 provides results for the effect of being interviewed at the end of the benefit cycle on student internalizing behavior scores. Findings here are consistent with the other non-cognitive scores, in which non-white males see a statistically significant decrease not seen for to white males in the last two weeks of the benefit cycle. Specifically, as in the analysis for locus of control and self-concept, non-white males experience an additional decrease two weeks after distribution (-0.321 points, SE=0.133), while white males do not (0.043 points, SE=0.141). This suggests that male non-white students are disproportionately affected by the "end of the month" effect of resource constraints.

Insert Table 6 Here

6. Robustness Checks

6.1. Potential Pathways – Other Outcomes

In order to understand the potential mechanisms driving these results, Equation 3 (Table 7) is used to evaluate the impact of being interviewed in the latter half of the benefit distribution cycle on child exercise frequency (Panel A), the consumption of healthy foods (fruits, Panel B), and unhealthy foods (soda, Panel C).[23] There is not a significant effect on exercise frequency. Further, white students, specifically white males, reduce fruit consumption at the end of the month whereas the same is not true for non-white male students. In addition, there is increased soda consumption at the end of the month for non-white males but no effect on white males. These results suggest that while white students may also experience some negative effects on their consumption behavior towards the end of the month, it is non-white students that likely experience a larger psychological burden of those changes to the extent that unhealthy eating is associated with greater stress.

[23] These variables are dummy variables to indicate whether the student participated in the activity at all in the past 7 days at the time of their interview. These questions are part of a food consumption questionnaire, which had its own completion date and uses the difference between this date and state distribution to calculate the effect on behavior. In addition, due to missing observations for these variables, samples vary from previous models.

Insert Table 7 Here

6.2. Seemingly Unrelated Regressions

While previous estimates have investigated the impact of days since benefit distribution on each non-cognitive outcome as if they were unrelated, it is possible that these values could be correlated for a given individual. Seemingly unrelated regressions allow the error terms from each regression for non-cognitive outcomes to be correlated for one another for each student. Table 9 presents results for the primary sample and the heterogeneity analysis for the various subgroups examined thus far. These results show that accounting for the correlation in the error terms increases the efficiency of the models and there is now a marginally significant effect for locus of controls for males (Table 8 – Panel A - column 2). Similarly, there is a statistically significant decrease in internalizing behavior outcomes among males and non-white students (Table 8 – Panel C – columns 2 and 5). All results for non-white male students relative to white males in the last two weeks of the benefit cycle are robust to the new specification and have stronger statistical significance. These results highlight the importance of accounting for other non-cognitive outcomes when exploring any one non-cognitive outcome, while also highlight the effect of the benefit distribution cycle on outcomes.

Insert Table 8 Here

6.3. SNAP vs. Non-SNAP households

Given that these results show that there is an end of month effect for some groups, particularly males and non-white students, it is important to identify that these results are not being driven a general end of month effect, and are indeed related to the depletion of SNAP benefits at the end of the month. This is tested using the eighth-grade students who were not missing any covariates, were interviewed in third and eighth grade and the loosened restriction of whether the household was on SNAP (6430 students). Each household is assigned the number of days since their state benefit distribution, regardless of their SNAP status, in the same manner used for the SNAP only sample as discussed in Section 3.2. This is then used

to create the dummy variable for whether the interview took place more than two weeks since benefit distribution. Equation 3 is then estimated with our measure of time but where the two groups of interest are SNAP and Non-SNAP participating households. Results for each of the non-cognitive outcomes are presented (Tables 9 and 10) for the full sample (Table 9 column 1) and then broken down by race (Table 9 columns 2 and 3), gender (Table 9 columns 4 and 5) and then by race for each gender (Table 10).

Insert Tables 9 and 10 Here

Results are consistent with earlier findings for the SNAP only sample, where additional end of the month effects having a negative effect on male locus of control (Table 9 panel A column 2) and self-concept (Table 9 panel B column 2) for SNAP participating students. In addition, non-white students participating in SNAP have worse internalizing behavior scores in the last two weeks compared to their non-white non-SNAP participating classmates in the same time frame. Previous results showed that non-white males on SNAP experience decreases in all non-cognitive outcomes at the end of the cycle, while their white-male classmates did not. In this robustness check, non-white male students on SNAP experience an additional decrease in all non-cognitive outcomes at the end of the month that their non-SNAP, non-white classmates do not. White male students do not see such an effect, regardless of their SNAP status, and no effect for female students of either race. These robustness checks provide support that the end of the month effect found for SNAP students is not a general time trend and primarily found for SNAP only students.[24]

6.4. Randomization

Another method to ensuring these results are being driven by SNAP benefit cycle rather than an overall time trend is to randomize the distribution date for the SNAP participating households, with an expectation that no statistically significant result is found. To do this, each student is randomly reassigned a "days since benefit distribution" value from the pre-existing sample of days since and analysis is redone

[24] Tables A-10 and A-11 present results for interactions between the continuous measure of days since distribution for students from SNAP and non-SNAP households. Results are consistent with Tables 9 and 10.

with the new randomized date variable acting as the independent variable of interest. First, all identification is removed from each student and then data are sorted by the original days since distribution variable. Second, each observation is randomly assigning a value from a random uniform distribution between 1 and 550, to create a unique random identifier for each date value. Then, students were also assigned a value from another random uniform distribution also ranging between 1 and 550 and matched to the newly assigned random days variable based on the random identification number. Regression analysis generally finds no statistically significant results.[25]

7. Conclusion

This paper provides the first evidence of the effect of the SNAP distribution cycle on non-cognitive outcomes for students by exploiting variation between the essentially random student interview dates and state distribution schedules to calculate how long since their household received benefits. Results show that male non-white students interviewed more than 13 days after their benefit distribution experience a worsening of all three non-cognitive outcomes compared to white male students with similar interview dates. Female students, regardless of race, do not experience these end of cycle effects on non-cognitive outcomes.

These results add to a growing literature that attempts to understand the consequences of the current SNAP benefit distribution cycle, specifically looking at the consequences of the described nutritional shortcoming. By examining how students' self-reported non-cognitive scores are impacted at the end of the month, this paper finds that male students and non-white students are often worse off, specifically experiencing higher levels of depression and anxiety at the end of the month than their counterparts who were interviewed earlier in the month. While no such results are found for females this could be due to intra-household resource allocation that is beyond the scope of the current study.

[25] Table A-12 presents heterogeneity analysis similar to the primary results discussed in Section 5.3. Specifically, no significant effect is found for interviews more than two weeks since distribution between white and non-white males and females as previously found. While results by race and gender are no presented, they are generally not significant. A single marginally significant (10%) positive effect was found for female internalizing behavior, dissimilar to earlier results, which is likely a spurious result.

While this paper could not directly investigate the exact cause of the heterogeneous effect of the distribution cycle on outcomes, such as limited resources, it is possible that the lack of nutrition due to the households inability to smooth consumption throughout the month is likely a contributor, and that the deficits are more pronounced for those households that are food insecure (Shapiro 2005). One potential policy implication could be the need for additional distribution days or school feeding programs to help bridge the gap that has been identified. Given the clear differences seen between male and female children, further research could explore intra-household behavior at the end of the distribution cycle in order to explore potential causes of these effects.

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Result tables redacted pending IES approval