

Measuring Effects of SNAP on Obesity at the Intensive Margin

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Abstract. The effect of the Supplemental Nutrition Assistance Program (SNAP) on obesity has been the focus of much debate. However, causal interpretation of estimates from previous studies is complicated by endogenous participation and misreporting of SNAP. To mitigate the severity of these biases, we employ a strategy that examines only individuals who report participating in SNAP and investigate the effects of SNAP on adult weight at the *intensive margin*. We utilize a quasi-experimental variation in SNAP amount per adult due to the timing of school eligibility for children. Children of SNAP households automatically qualify for in-school nutrition assistance programs, thus freeing extra benefit for adults. A greater proportion of school-age children eligible for free in-school meals proxies for an exogenous increase in the amount of SNAP benefits available per adult. Using data from the National Longitudinal Survey of Youth-1979 we show that school meals represent a non-trivial part of the food budget for the family. Intensive margin increases in SNAP benefits have no effect on obesity levels for the full sample of those who report SNAP participation. To isolate the effects of SNAP from other potential changes when a child enters school our preferred specification examines adults living in households with at least one child under 5 years of age (not yet school-age eligible). In this setting we find that additional SNAP benefits reduce BMI and the probability of being obese for SNAP adults.

JEL Codes: I1, I38, H51, H53

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1. Introduction

Obesity rates among the U.S. adult population have reached staggering numbers. Flegal et al. (2010) reports that as of 2008, over one third of U.S. adults were considered obese and that 72.3% of men and 64.1% of women were considered overweight or obese.¹ The prevalence of obese adults hovered around 13-15% during the 1960's and 1970's, but striking increases in the 1980's and 1990's have elevated obesity rates to 31% by the year 2000 and 35.7% by 2010 (Flegal et al., 2002; Ogden et al., 2012).

The increase in obesity prevalence is of major concern to public health officials and researchers. Overweight and obese adults have a much higher risk of developing coronary heart disease, type 2 diabetes, cancer, high blood pressure, and other adverse health conditions (Dixon, 2010). Furthermore, obesity has surpassed cigarette smoking as the leading cause of preventable morbidity in the United States (Jia and Lubetkin, 2010). Finkelstein et al. (2009) approximated the costs of treating obesity-related illness in adults in 2008 to almost \$147 billion annually with a considerable amount incurred by taxpayers through Medicare and Medicaid. More recent estimates suggest obesity-related illness are costing over \$209 billion annually (Cawley and Meyerhoefer, 2012).

The higher prevalence of obesity found in low-income households has reinforced the focus of examining food assistance programs that are targeted to the poor.² The Food Stamp Act of 1964 led to the creation of the federally funded Food Stamp Program (Supplemental Nutrition Assistance Program or SNAP as of October 2008) in charge of reducing food insecurity and

¹ Obesity in adults is defined as having a Body Mass Index (BMI) of 30 or higher while overweight adults fall under a BMI range of 25-29.9. Adult BMI is calculated as weight divided by height squared (kg/m^2).

² See Surgeon General's Call to Action to Prevent and Decrease Overweight and Obesity (2001).

providing adequate levels of nutrition to families with financial constraints.³ Fewer than 10 million low-income Americans were participating in the program in the early 1970's, but by 2014 over 46 million received some amount of SNAP benefits (USDA, 2015). The introduction and growth of the largest food assistance program in the nation coinciding with the dramatic increase in obesity rates has prompted the question of whether the social program that was implemented to reduce hunger among the poorest families in the U.S. has in fact been contributing to the rise in obesity rates.

Previous studies have focused on estimating the effects of SNAP on weight outcomes at the extensive margin by comparing participants and income-eligible non participants (Baum, 2011; Fan, 2010; Gibson, 2003; Meyerhoefer and Pylypchuk, 2008; Kaushal, 2007). Overall, the findings suggest SNAP participation may have a small positive effect on weight gain for women and no significant effect on men. However, causal interpretation of estimates from previous research is complicated by endogenous participation and misreporting of SNAP. Although great efforts have been made to address endogenous participation into SNAP, misreporting of SNAP has largely been ignored. Previous studies have shown that misreporting of SNAP in surveys, in some instances over 30% of participants, is a serious issue that has significant consequences when overlooked (Bitler et al., 2003; Brachet, 2008; Meyer et al., 2009; Vassilopoulos et al., 2011). A recent paper by Almada, McCarthy, and Tchernis analyzes the effects of participation in SNAP on obesity and show that the estimates of the effects are exceptionally sensitive to misreporting (Almada et al., 2015)

This paper adds to the existing literature on SNAP and adult obesity by exploring a new identification strategy that focuses only on those who report participation. Though not a random

³ More information about SNAP is available at <http://www.fns.usda.gov/snap/rules/Legislation/Default.htm>

sample, there are two distinct benefits to examining only those who report participating in SNAP. First, this approach minimizes our concerns with endogenous participation in SNAP and misreporting of true participation status. Secondly, we are able to identify the effect of SNAP on weight outcomes at the intensive margin rather than extensive margin. Intensive margin effects of SNAP are relevant to recent policy debates discussing changes to the amount of benefits households receive through rule changes regarding income deductions and/or benefit indexing adjustments (CBO Report, 2012).

We identify exogenous variations in SNAP by examining the proportion of school-age children in SNAP households who automatically qualify for in-school nutrition assistance programs. A greater proportion of school-age children eligible for free in-school meals proxies for an exogenous increase in the amount of SNAP benefits available per adult. Using data from the National Longitudinal Survey of Youth-1979, we show that school meals represent a non-trivial part of the food budget for the family. We find that increases in SNAP benefits have no effect on obesity levels for the full sample of those who report SNAP participation. To isolate the effect of SNAP from other potential changes when a child enters school our preferred specification examines adults living in SNAP households with at least one school-age child and at least one child under 5 years of age who is not yet school-age eligible. For this subsample we find that increases in SNAP benefits, due to increases in the share of children eligible for in-school meals, reduce BMI and the probability of being obese. Specifically, when one child in a household of four becomes school-age eligible, adult BMI is expected to decrease by 0.22 units and the probability of being obese decreases by 2.58 percentage points.

2. Background

2.1 SNAP Eligibility Rules and Benefits

Basic rules of eligibility are set and administered by federal legislation and the United States Department of Agriculture – Food and Nutrition Service.⁴ Although certain eligibility rules have been amended over time, generally a household must not exceed a set income threshold in order to be eligible for SNAP. Specifically, households must pass a “Gross Income Test⁵” which puts a monthly limit on the amount of income all household members can earn in order to qualify. The limit is based on household size (additional members increase limit) and 130% of the current federal poverty levels (FPL). A lower monthly income limit (100% FPL) is also used once certain allowable deductions are considered.⁶ Lastly, there is a “Resources Test⁷” in which federal guidelines establish that households may have up to a certain amount in countable resources in order to qualify for SNAP.

If a household meets the criteria for eligibility, the household is given an Electronic Benefit Transfer (EBT) card, similar to a debit or credit card, which is credited with money (SNAP benefits) on a monthly basis that can be used to purchase food items at SNAP

⁴ <http://www.fns.usda.gov/snap/rules/Legislation/about.htm>

⁵ According to the state of New York “Income can include: Regular job (wages), income before strike, on-the-job-training, military reserves, national guard, work study, alimony, child support, educational assistance (grants, scholarships, etc.), friends or relatives (other than loans), public assistance, pensions or retirement, Supplemental Security Income (SSI), Social Security benefits, veterans benefits, unemployment benefits, worker’s compensation, babysitting, taxi driving, cleaning homes or other buildings, farming/ranching, income from a roomer, income from a boarder or arts and crafts.”

⁶ The “Net Income Test” allows certain amounts of standard deductions based on household size and earned income. Deductions are also allowed for dependent care costs (when needed for work, training, or education), medical expenses for elderly or disabled, legally owed child support payments, and certain shelter costs. After any deductions are made, the household must not exceed a net income limit in order to pass the net income test.

⁷ According to the USDA-FNS, the exact procedure for handling certain resources is determined by individual states. Furthermore, resource test are only considered in a handful of states. (<http://frac.org/federal-foodnutrition-programs/snapfood-stamps/eligibility/>)

participating stores.⁸ Prior to the introduction of EBT cards in the late 1990s, SNAP benefits were issued via mail or through local agencies in the form of monthly paper coupons or stamps. The amount of benefits received varies according to the size, expenses, and income of each household. For example, as of 2014, a two-member household can receive at most \$347 per month in SNAP benefits, and a four-member household can receive at most \$632 per month. SNAP eligible households earning other income are allotted less than the maximum benefit amount as these households are expected to spend a portion of their earned income on food.⁹

2.2 Literature on SNAP and Obesity

The intended purpose of SNAP is to provide adequate levels of nutrition to families in need. However, economic theory cannot definitively predict the effect of SNAP participation on obesity outcomes. Weight gain and SNAP participation can be modeled through an intra-household utility maximization framework. SNAP benefits increase disposable income, resulting in an income effect that increases the resources available for both food and non-food expenditures. Depending on preferences, recipients may choose to maximize their utility by either using SNAP benefits to increase food expenditure or using benefits to offset spending and increase non-food expenditure. Fraker et al. (1995), find evidence that the in-kind nature of SNAP benefits increase spending on food items more so than an equivalent cash transfer. Excess spending on food items has a potential to lead to overconsumption of calories and weight accumulation.

⁸ Several restrictions are placed on SNAP benefits including the purchase of alcohol, tobacco, and pet food products and other non-food items. The EBT system has been implemented in all States since June of 2004 (source: <http://www.fns.usda.gov/ebt/general-electronic-benefit-transfer-ebt-information>)

⁹ According to the USDA-FNS “The net monthly income of the household is multiplied by 0.3, and the result is subtracted from the maximum allotment for the household size to find the household's allotment.” (source: <http://www.fns.usda.gov/snap/eligibility>)

On the other hand, increased food expenditure may not necessarily lead to increased calorie intake. Greater spending on food purchases by SNAP recipients could be the result of purchasing more expensive and potentially higher quality and healthier foods that help maintain or even reduce weight. Wilde et al. (2000) examine food choices of a sample of SNAP recipients and find that, on average, SNAP recipients consume greater amounts of meats, sugars, and fats compared to non-recipients. Similarly, Whitmore (2002) finds that recipients who are constrained by the in-kind nature of the benefits spend more on soft drinks and juices than if they had received the equivalent amount of benefits in cash. Cole and Fox (2008) find that SNAP participants obtain a significantly larger percentage of their total energy intake from solid fats, alcoholic beverages, and added sugars compared to low-income nonparticipants. In addition they find that, relative to higher-income nonparticipants, SNAP participants are far less likely to consume sufficient quantities of vitamins and minerals. These studies are suggestive of a positive link between SNAP participation and weight gain.

Another potential mechanism linking SNAP to gradual weight gain relates to how the benefits are administered in conjunction with the harmful consequences of chronic dieting, often referred to as the “Food Stamp Cycle”. Blackburn et al. (1989) have found that a persistent pattern of over- and under-consumption of calories (binge eating followed by periods of restricting food intake) can lead to “permanent metabolic and physiologic alterations which promote weight gain and make subsequent loss of weight more difficult” (Blackburn et al., 1989). Chronic dieting may be an issue for SNAP participants because the benefits are received on a monthly basis. Monthly distribution of SNAP benefits may induce recipients to over-consume foods at the beginning of the month and then unintentionally under-consume at the end of the month when benefits are running low or completely used up. This can be particularly

problematic for the poorest participants who do not have other sources of income to help smooth their caloric intake throughout the month. A recent report from New York City's Human Resources Administration (Fellner, 2012) shows that over 40% of NYC SNAP cases have balances of less than \$20 by the end of the second week of benefit receipt. Wilde and Ranney (2000) find that SNAP recipients who shop once a month for groceries have a significantly lower caloric intake during the week immediately prior to receiving next month's benefits. For those who do not shop once a month, they find that food expenditures for SNAP recipients are highest immediately after receiving the benefits. Further evidence of chronic dieting by SNAP recipients is reported by Hastings and Washington (2008) and Shapiro (2005). If difficulties smoothing one's food consumption can lead to weight gain then greater amounts of benefits has the potential to reduce obesity for those receiving SNAP. Ultimately, the effects of additional SNAP benefits on adult weight must be sought out empirically.

In order to determine the causal effects of SNAP on obesity researchers usually must deal with two main sources of bias. First, estimates can be biased if one does not account for non-random selection into SNAP.¹⁰ Second, the effects of SNAP can suffer from misreporting bias if true participation is misclassified. Although studies have applied sophisticated empirical approaches to mitigate selection bias, even the most convincing studies have done little, if anything, to address participation misclassification.

¹⁰ Selection bias occurs if those who choose to participate in SNAP are systemically different (preferences and/or behaviors) than those who do not, and this distinction affects weight. For example, suppose only individuals who have a stronger preference for food, and are eligible, choose to participate in SNAP. This group would show a positive correlation between SNAP participation and higher weight level. Similarly, individuals who are eligible for SNAP but choose not to participate due to stigma concerns may also be concerned with stigma associated with looking overweight. This group would show a positive correlation between non-participation in SNAP and lower weight level.

Ver Ploeg and Ralston (2008) conduct a thorough review of the existing literature on SNAP and adult obesity. Their analysis of the more “rigorous” studies in which attempts were made to control for selection bias and time-invariant characteristics suggests that, in general, SNAP participation seems to be positively related to BMI measures and propensity to be obese in adult women, but has no significant effects in adult men. For example, to control for selection bias, both Baum (2011) and Gibson (2003) estimate fixed-effect models using longitudinal survey data and find positive effects of SNAP participation on BMI and the probability of being obese for adult women. In an attempt to control for participation endogeneity Meyerhoefer and Pylypchuk (2008) use variation in state SNAP outreach expenditures, electronic fingerprint requirement, and recertification periods to instrument for SNAP participation. Their estimates suggest that SNAP participation increases the probability of being obese by 6.7% in adult women but has no significant impact on adult men. Kaushal (2007) exploits the variation in state responses to the federal ban of SNAP benefits for immigrants in accordance to the 1996 Personal Responsibility and Work Opportunity Reconciliation Act. Estimating a difference-in-difference model, she finds that SNAP participation is not associated with any significant increases in BMI in both adult immigrant men and women. A more recent study by Fan (2010) applies a difference-in-difference strategy with propensity score matching and finds no statistically significant effects of SNAP participation on BMI or probability of being overweight or obese for low-income women.

A recent look at the extent of misclassification of SNAP participation in survey data suggests the issue is quite problematic. Meyer et al. (2009) find that under-reporting of program participation in five nationally representative surveys is highly prevalent and increases over time. Their estimates suggest that one third of SNAP beneficiaries do not report participation in the

program which can significantly bias the effects of participation. Bitler et al. (2003) find under-reporting of SNAP recipients by about 15 percent in both the CPS Food Security Supplements and Survey of Income and Program Participation. Bollinger and David (1997) also examine cases of under and over-reporting of SNAP participation in the SIPP. Although they find that cases of over-reporting (false positives) are rare and minimal (approximately 0.3 percent), under-reporting is nontrivial and accounts for approximately 12 percent of all responses.

To our knowledge, only a few studies have considered participation misreporting while estimating treatment effects of SNAP on obesity. Vassilopoulos et al. (2011) apply nearest neighbor propensity score matching methods to the 2005-2006 National Health and Nutrition Examination Survey (NHANES) to estimate the effects of SNAP participation on obesity. They incorporate misreporting by conducting various sensitivity tests that place bounds on the degree of misreporting. Their findings suggest that adult SNAP participation is associated with a 10.5 percent greater probability of being obese. However, they caution that any effects linking SNAP participation and obesity are only robust when the prevalence of misclassification errors is less than 10 percent. In a different approach, Kreider et al. (2012) examine the effects of SNAP participation on child obesity and other health outcomes using 2001 – 2006 NHANES data. The authors simultaneously address selection and misreporting bias using partial identification (layering process) and bounding methods. Similar to Vassilopoulos et al. (2011), Kreider et al. (2012) consider the effects of misreporting bias by testing various restrictions on the size of the classification errors. Their findings suggest that SNAP participation reduces the likelihood that a child is obese only when misreporting rates are less than 4%. Using a similar approach, Almada et al. (2015) find considerable rates of SNAP participation underreporting in the NLSY79 and that failing to account for misreporting overstates program effects by nearly 100 percent.

Altogether, these findings warrant future research that accounts for potential misreporting bias to obtain more accurate effects of SNAP on obesity.

3. Methods and Data

There are two main issues in trying to estimate the causal effect of SNAP participation. First, households choose to participate based on information unobserved by the researcher which leads to selection bias. Second, in survey data there are high levels of SNAP participation misreporting which also leads to bias. In this paper we suggest an alternative identification strategy that alleviates selection and misreporting biases by only focusing on those reporting participation in SNAP and estimating the effects of SNAP at the intensive, rather than an extensive margin.

3.1 Identification

The identification strategy relies on the direct certification rule implemented by The Richard B. Russell National School Lunch Act of 1986. The law allows children from SNAP households to automatically qualify for in-school food assistance programs (USDA: Moore et al., 2013). Specifically, school-age children from SNAP households can receive up to two free meals per day as part of the National School Lunch Program and School Breakfast Program.¹¹ Furthermore, there is no reduction in SNAP benefits once children from these households become eligible for these in-school programs. Therefore, we can identify exogenous variations

¹¹ According to the USDA-FNS (<http://www.fns.usda.gov/cnd/lunch/AboutLunch/NSLPIFactSheet.pdf>) “Children from families with incomes at or below 130 percent of the poverty level are eligible for free meals.” The NSLP and SBP are federally assisted meal programs for low income children attending public and nonprofit private schools. Households who receive SNAP benefits automatically qualify NSLP and SBP. Legislation mandates local education agencies to use direct certification to automatically enroll children of SNAP recipients into NSLP. The NSLP (SBP) are administered in over 100,000 (89,000) schools nationwide and currently serves over 31 million (12 million) children each day.

in benefits from variations in the proportion of school-age children in SNAP households. As the share of school-age children increases, the same amount of SNAP benefits are available, but are needed for fewer in-home meals.

We can get a sense of the additional SNAP resources available when children participate in the in-school meals programs by means of an example for a typical SNAP household. In 2014 a family of four can receive up to \$632 in SNAP benefits while reimbursement rates for the NSLP and SBP in the contiguous states were \$3.10 and \$1.89, respectively.¹² When a child in the household becomes school-age eligible, she automatically qualifies for a free breakfast and lunch at school. Using these reimbursement rates, we calculate that on a typical month with 20 school days in-school meals equate to approximately \$100 in additional food assistance or approximately 16% of the maximum amount of SNAP benefits allotted to this household. We consider this amount to be a conservative estimate given that meal production at schools benefit from greater economies of scale. In addition, households that receive less than the maximum amount of SNAP benefits (due to some earned income) would experience an even greater percentage increase in benefit amount. To put this into perspective, the temporary SNAP benefit increases from the 2009 American Reinvestment and Recovery Act amounted to only \$36 a month on average for a family of four.¹³

3.2 Econometric Model

¹² For more information on school meal reimbursement rates see <http://www.fns.usda.gov/school-meals/rates-reimbursement>

¹³ Additional information on SNAP and the ARRA is available through the Center on Budget and Policy Priorities at <http://www.cbpp.org/cms/?fa=view&id=3899>

To estimate the effects of additional SNAP benefits on obesity we are interested in changes in the proportion of school-age children within SNAP households. The effects can be estimated from the following fixed-effect model:

$$Y_{it} = c + \delta PSAC_{it} + \beta X_{it} + \alpha_i + \pi_t + u_{it} \quad (1)$$

In equation (1) our outcome of interest, Y_{it} , takes the form of a continuous measure of BMI, the linear probability of being overweight (BMI of 25 or more), or obese (BMI of 30 or more) for respondent, i , in year, t . The parameter of interest, δ , captures the effects of changes in the amount of available SNAP benefits for respondent, i , on the outcomes described above. We estimate this effect for respondent, i , at time, t , from changes in the proportion of school-age children, $PSAC_{it}$ while controlling for a vector of demographic controls, X_{it} , and unobserved individual and time fixed-effects α_i, π_t .

Computationally, equation (1) estimates the impact of exogenous variations in SNAP benefit amounts on the BMI and likelihood of being overweight or obese over time within each adult respondent. A fixed-effect approach minimizes bias stemming from the inability to control for unobservable characteristics that differ between respondents that may influence weight outcomes. However, fixed-effects models are still susceptible to bias if some unobserved characteristics that impact obesity are changing over time. We discuss this further in section 4.4.

In our empirical analysis a positive coefficient for δ would indicate that additional benefits are contributing to weight gain for adults in SNAP households. Conversely, a negative coefficient on δ would point to decreases in adult weight from additional SNAP benefits. More precisely, the sign and magnitude of δ indicates how changes in SNAP benefit availability from

changes in the share of school-age children in a respondent's household affect BMI and likelihood of being overweight or obese.

3.3 Data: National Longitudinal Survey of Youth - 1979 Cohort

The NLSY79 contains data on a nationally representative sample of 12,686 men and women who were between the ages of 14 and 22 when they were first surveyed in 1979. The dataset is comprised of three subsamples: 1) a cross-sectional sample of 6,111 youths designed to be representative of non-institutionalized civilian youths, 2) A supplemental sample of 5,295 youths designed to oversample civilian Hispanic, black, and economically disadvantaged nonblack/non-Hispanic youths, and 3) a military sample of 1,280 youths. The cohort was interviewed annually through 1994 and then every two years until present time. Retention rates for NLSY79 respondents who were still considered eligible for interviews were close to 90 percent during the first 16 waves and since then have only decreased slightly (BLS, 2012).

The NLSY79 contains several key variables that are useful for our analysis. Measures of weight were self-reported in pounds for the following survey years: 1981, 1982, 1985, 1986, 1988, 1989, 1990, 1992, 1993, 1994, 1996, 1998, 2000, 2002, 2004, 2006, and 2008. Height measures were self-reported in 1981, 1982 and 1985. We use the 1985 height measure to calculate each respondent's BMI for all the corresponding years with weight information.¹⁴ ¹⁵We exclude from the analysis any observations without a BMI measure and females who indicated

¹⁴ We use 1982 measures of height if height was not reported in 1985. A total of 1515 respondents report their height in 1982 but do not report their height in 1985.

¹⁵ There are concerns that self-reported weight and height measures could suffer from systematic reporting error that may bias coefficient estimates. Several studies have indicated that the extent of weight and height misreporting in the NLSY79 is minimal and has trivial impact on coefficient estimates (Baum 2011; Cawley 2000; Lakdawalla and Philipson 2002).

being pregnant in a particular survey wave. This produces a subsample of 132,349 respondent-year observations.

The NLSY79 also contains a rich set of demographic variables pertaining to each respondent. We include household size, number of children in the household, age of the respondent and each member living in the household, indicators for race, gender, marital status, current employment status, number of hours worked per calendar year, and limited measures of physical activity. The survey collects information on the total net income of each respondent's household, the respondent's highest level of education, the highest level of education of each respondent's mother, and total dollar amount of SNAP benefits received during the past year for each surveyed wave. The intention of this study is to only examine adults who report receiving SNAP benefits. Therefore, we begin observing individuals in the 1985 survey wave once all respondents have reached adult age.¹⁶ In addition, we are interested only in observations for years when respondents report receiving any positive amount of SNAP benefits. The final sample consists of 2,078 individual adults with BMI measures who report receiving SNAP benefits in at least 2 survey waves. The 2,078 adults are observed across 15 different survey waves (unbalanced) resulting in 10,634 respondent-year observations.

Because we are unable to determine a child's actual in-school food assistance program participation status in the NLSY79, we use child school-age eligibility to proxy for participation.¹⁷ Tchernis et al. (2012) find that 97% and 70% of children from SNAP households in the Early Child Longitudinal Study – Kindergarten 1998 cohort are also participating in the NSLP and SBP, respectively. Approximately 78% of female SNAP households also participate

¹⁶ Average age in the 1985 wave is 23.7 ranging from 20 – 28 years of age.

¹⁷ NLSY79 Child and Young Adult supplement survey reveals that an overwhelming majority of children of NLSY79 respondents attend public schools where NSLP and SBP are primarily administered.

in free and/or reduced school meal programs in the 2001-2004 Survey of Income and Program Participation (Reese, 2006). To calculate the number of school-age children living with the respondent, we use available information on the age of all the members who live in the respondent's household.¹⁸ We consider a child to be of school-age if she is between the ages of 6 and 14. We start the cutoff at six years old given that the average age when a child first enters kindergarten is just over five and a half and only 9% of children are older than six years old when they first enter kindergarten (U.S. Dept. of Education, 2012). Although the majority of U.S. children are enrolled in school through age 17, because of lower NLSP and SBP participation rates among high school students due to stigma concerns and higher average household incomes, we limit our school-age eligibility cutoff to 14 years of age (Ralston et al., 2008). We test the sensitivity of our age restrictions in section 4.4.

3.4 Summary Statistics

A summary of descriptive statistics for the sample of NLSY79 respondents who report receiving SNAP benefits throughout the 15 waves are presented in Table 1. The respondents are grouped into three pooled survey wave categories to provide average measures over time. Waves 1985, 1986, 1988, and 1989 are pooled in column 1, waves 1990, 1992, 1993, and 1994 in column 2, and waves 1996, 1998, 2000, 2002, 2004, 2006, and 2008 in column 3. SNAP benefits are reported in 2008 dollars adjusted by the CPI Food and Beverage index. The data show that the average amount of SNAP benefits per household per year decreases from \$3,347 to \$2,989 from the 1985-1989 waves to the 1990-1994 waves and down to \$1,881 for the most recent pooled waves. We see similar reductions over time of SNAP benefits per person and per

¹⁸ Child's date of birth, date of death, and date of interview/survey was also used to cross check the age of the various children in the household and to address missing information in the data.

adult in households. Interestingly, average household incomes also decrease over time. A share of the reductions in household benefits and incomes can be attributed to the reductions in household size over time. Average number of children increases and later decreases as household compositions change over time. We find that the percent of respondents who hold a high school degree or higher increases over the time period however, the education level of the respondent's mother stay fairly constant. The percent of respondents who are currently employed vary substantially over time. In the early 1990s only 17.9% of respondents reported being employed whereas in the 1996-2008 survey period almost 48% reported currently being employed. Although some of the differences over time can be attributed to respondent attrition, the major differences we observe for SNAP benefits and employment status is likely due to the increases in employment support and work requirements for welfare participants due to the Personal Responsibility and Work Opportunity Act of 1996.

Race, ethnicity, gender, regional locations are all relatively constant over the different time periods. The data do show significant increases in obesity levels throughout. Average BMI increases from 25.38 in the early periods to 27.38 in the middle periods and up to 29.55 in the later periods. Obesity rates also increase from 18.8% to 28% and up to 39.8% in the later periods. The percent of respondents who are overweight or obese increases by almost 30 percentage points throughout our time period. The data show that in the latest survey waves almost 70% of all respondents are considered overweight. The increases in obesity rates observed in the NLSY79 sample of SNAP adults are slightly larger than the national average obesity rates documented by the CDC.¹⁹

4. Empirical Results

¹⁹ For more information on national adult obesity rates and trends see <http://www.cdc.gov/obesity/data/adult.html>

4.1 Pooled Ordinary Least Squares

We begin by exploring how the inclusions of various controls affect the associations between additional SNAP benefits and obesity levels. The first three columns of Table 2 present the results from pooled OLS regressions. Results from column 1 do not include covariates of any kind while results from column 2 include controls for gender, age, race and ethnicity, household size, poverty status, marriage status, regional location status, income and income squared, education level of respondent and respondent's mother, and employment status. Results in column 3 include year dummies in addition to the aforementioned demographic characteristics. Each row corresponds to a separate regression for each outcome of interest.

The results from column 1, row 1 show a substantial positive correlation (1.7866) between proportion of school-age children and BMI. Our coefficient estimate suggests that additional SNAP benefits from one child becoming school-age eligible in a household of four (PSAC going from 0 to 0.25) is associated with an increase in nearly 0.45 BMI units. Similarly, without controlling for demographics or year dummies, we find a strong positive correlation between additional SNAP benefits and the probabilities of being overweight (column 1, row 2) and obese (column 1, row3). This same increase in the proportion of school-age children is associated with a 2.9 and 2.8 percentage point increase in the likelihood of an adult in a SNAP household being considered overweight and obese, respectively. The inclusion of demographic controls decreases both the magnitude and significance of our pooled OLS results as shown in columns 2. Conditioning on demographic characteristics of the respondent reduces the association between additional SNAP benefits and adult BMI by about a factor of five and is no longer statistically significant. A similar reduction in magnitude is seen on the probabilities of being overweight or obese. We find no direct correlation between additional benefits and

obesity for our full sample of adults that report receiving SNAP conditional on both demographic characteristics and year fixed-effects (column 3). The pooled OLS results highlight the substantial explanatory power observable characteristics and year dummies have on obesity outcomes of our NLSY79 sample of adult SNAP recipients. However, we are careful not to interpret these OLS estimates as causal effects because our findings are likely suffering from omitted variable bias.

4.2 Individual Fixed-Effects

To address potential omitted variable bias from time-invariant unobservable factors we estimate our model applying the individual fixed-effects specification described in section 3.2. Our results are estimated using robust standard errors clustered at the individual level. In this longitudinal framework the fixed-effects specification uses within household variation to estimate treatment effects. We are interested in the variation of SNAP benefits from changes in the proportion of school-age children within each individual's household. In our dataset 60% of the observations experienced substantial variation in the share of school-age children while only 15% of the participants experienced no variation.

As was done for the pooled OLS specification, we present the results for each obesity outcome as a separate regression (by row) with different sets of controls (by column). Column 4 of Table 2 suggests that an increase in SNAP benefits has a statistically significant positive effect (1.5394) on the BMI and the probabilities of being overweight (0.1178) and obese (0.0869) of adults who report receiving SNAP. However, similar to the pooled OLS point estimates, conditioning on observable characteristics and year dummies decreases the size and significance of the effects for each outcome of interest as presented in columns 5 and 6 of Table 2. Again, the

results highlight the substantial explanatory power of year dummies and observable characteristics on obesity.

Our individual fixed-effects coefficient estimates have signs consistent with a positive, albeit minute, relationship between SNAP benefits and obesity. The estimated point estimates for BMI and overweight suggest that additional SNAP benefits available to adults when one child in a household of four becomes school-age eligible (PSAC from 0 to 0.25), increases adult BMI by 0.037 units or the probability of being overweight by 0.36 percentage points. We find an even smaller and statistically insignificant percentage point increase for the probability of being obese. Overall, we find that additional SNAP benefits have no effect on adult weight outcomes. Thus far, our intensive margin results are in line with previous work that finds no effect of SNAP participation on obesity (Fan, 2010; Kaushal, 2007).

4.3 Subsample Analysis

In this section we examine a subsample of our data in an attempt to isolate the effect of SNAP versus other potential mechanism affecting obesity. When children enter school there are many changes at the household level that are not accounted for in a fixed-effect framework. For example, when a child enters school time spent on childcare can be replaced with other activities that influence obesity such as devoting more time to employment, preparing home cooked meals, exercising, sleeping, etc. Courtemanche (2009) and Ruhm (2005) separately show that additional hours dedicated to labor force participation lead to increases in BMI and the probability of being obese in adults. To eliminate some of these channels we concentrate on a subsample of individuals with at least one child under the age of five in the household. Focusing on households with at least one child who is not yet school-age eligible allows us to isolate the

exogenous increase in SNAP availability from other behavioral changes.²⁰ Morrill (2011) applies a similar strategy in which a child's youngest sibling's eligibility for kindergarten is used to instrument for maternal labor force participation. To test the effectiveness of this approach to our data we examine how changes in proportion of school-age children affect employment status and number of hours worked for different sample groups. In Table 3 we present the associations between changes in the proportion of school-age children and both the labor force participation and the number of hours worked by SNAP reporting status. The first panel of Table 3 presents the results for the full sample of SNAP adults (row 1) and the subsample of SNAP adults living with at least one child under the age of five (row 2). The results suggest that adults in SNAP households living with children who are not yet school-age eligible are significantly less likely to be employed and, if employed, less likely to work more hours when the proportion of school-age children increases. We examine the same relationship for SNAP income-eligible adults who do not report receiving benefits in the second panel (rows 3 and 4) and third panel (row 5 and 6) of Table 3. We find a similar association, yet less pronounced, for adults who do not report receiving SNAP with incomes at or below 130% of the federal poverty line (rows 3 and 4) and between 130% and 200% of the federal poverty line (rows 5 and 6). These findings add credibility to the notion of isolating the effects of SNAP from other potential weight affecting mechanisms by examining adults living in households with at least one child who is not yet school-age eligible.

The effect of additional SNAP benefits on obesity outcomes for both the full sample and the subsample of SNAP adults with at least one child under the age of five are presented in panel

²⁰ The American Time Use Survey reports average hours per day spent on various activities by presence and age of youngest child in the household. According to the 2012 ATUS, adults living in households with the youngest child under the age of 6 spend, on average, 30 minutes less (60 minutes less if not employed) on leisure and sport activities (exercise, socializing, watching TV, relaxing, playing games and computer use, etc.) per day compared to adults in households with the youngest child between 6-17 years of age.

1 of Table 4. Row 1 of Table 4 duplicates the results for the fixed-effects specification that controls for demographic characteristics and year dummies on the full sample of SNAP adults (column 6 of Table 2). The results for the subsample of SNAP adults are presented in row 2 of Table 4 with a different obesity outcome under each column. For the sample of SNAP adults living in households with at least one child under five years of age we find that greater amounts of SNAP benefits significantly *reduce* adult BMI. The effect on BMI has the opposite sign compared to the point estimate for the full sample of SNAP adults (-0.8941 versus 0.1474) and is statistically significant at the 5% level. Our results indicate that, for adults living with a child under the age of five, additional SNAP benefits from one child entering school in a household of four reduces adult BMI by 0.22 units (-0.8941×0.25). We find that the effect on the probability of being obese is also reversed and substantially larger in magnitude compared to the estimate for the full sample of SNAP adults (-0.103 versus 0.0037). The coefficient estimate suggests that one child entering school (from a household of four) decreases the probability an adult is obese by 2.58 (-0.103×0.25) percentage points, statistically significant at the 5% level. The subsample of SNAP recipients with at least one non-school-aged child consist of fewer observations (4,929 compared to 10,634 from the full sample), but we are better able to isolate the direct effects of SNAP on this smaller sample. The sign reversal and increased magnitudes of our effects suggest that the full sample estimates are upwardly biased from other potential channels affecting weight when children enter school.

4.4 Sensitivity Analysis

In this section we discuss sensitivity analyses that further suggest the effects on obesity outcomes are driven primarily by additional SNAP benefit receipt from children entering school. First, we estimate the effect of changes in the proportion of school-age children on obesity for

income eligible non-SNAP participating households. If we find changes in obesity levels in these adults it would not be due to SNAP benefits, but rather other mechanisms.²¹ Next, we perform sensitivity tests on the school-eligible age cutoffs. If we find effects of SNAP on obesity when children are not old enough to participate in the SBP and NSLP then it is possible that changes in weight are driven by other mechanisms.

To examine how changes in the proportion of school-age children affect weight outcomes of non-SNAP adults we use the sample of NLSY79 respondents who do not report receiving SNAP and who have household incomes at or below 130% of the federal poverty level. The results for the full sample of income-eligible non-participants and the subsample of these non-participants with at least one child not yet school-age eligible are presented in panel 2 of Table 4. The results from row 3 suggest that changes in the proportion of school-age children *increase* both BMI (0.348) and the probability of being obese (0.0287) for income eligible non-SNAP adults. In row 4 we restrict the sample to those income-eligible adults who do not report participating in SNAP living in households with at least one child who is not yet school-age eligible. Although still positive in magnitude, we no longer see a statistically significant effect on BMI or the probability of being obese. We perform similar analysis for non-SNAP reporting adults with incomes between 130% and 200% of the federal poverty lines (panel 3) in rows 5 and 6 of Table 4. For this group, the point estimates more closely resemble those of the SNAP sample, but are measured with less precision.

To further test whether our findings are in fact driven by additional SNAP benefits rather than other potential mechanisms when children enter school we examine the interaction of SNAP

²¹ We suspect that many of the income eligible non-participants are indeed receiving SNAP but incorrectly reporting their status and potentially bias the comparisons. Meyer et al. (2009) find that false negative rates of SNAP reporting in survey data can be over 30%. For further discussion on SNAP misreporting rates and its implications particular to the NLSY79 see Almada et al. (2014).

participation and the proportion of school-age children on weight outcomes. This approach is analogous to a difference-in-difference design that estimates the effect of SNAP on adult obesity before and after children are school-age eligible (with varying degrees of intensity). Each panel in Table 5 presents the point estimates for the interaction term between proportion of school-age children and a SNAP dummy variable for the adults in the two different income groups. In the first panel of Table 5 we combine the sample of adults who report receiving SNAP benefits with the sample of adults living in households at or below 130% of the federal poverty level who did not report participating in SNAP. Our analysis for the sample of adults living in households with at least one child less than 5 years of age (row 2) shows that a greater availability of SNAP benefits from increases in the proportion of school-age children significantly reduces adult BMI and the probability of being obese for adults who report participating in SNAP relative to adults who report no participation. The intensive margin effects of SNAP on obesity are seen primarily for the poorer income group (at or below 130% FPL). We find smaller and less precise effects for the sample of adults between 130% and 200% of the federal poverty level whose children are only eligible for reduced price lunches and breakfasts (panel 2 of Table 5).²² Altogether, these results are suggestive that the reductions in obesity found in section 4.3 are driven primarily by increases in SNAP benefits.

We next test whether our results are sensitive to age of school eligibility. We repeat the analyses performed above but now assume school-age eligibility to be between the ages of 4 and 14 rather than ages 6 to 14. This analysis allows us to test whether other sources of benefits may increase the availability of SNAP resources for adults with children who are slightly younger than the average age of entering kindergarten. For example, mothers with children up to the age

²² Children qualify for reduced price meals if family income is between 130% - 185% of the FPL (USDA-FNS)

of 5 are eligible to receive WIC benefits for additional food purchases.²³ In addition, some children may be receiving other in-school meals available through Head Start or other preschool programs. Panel 1 of Table 6 presents the results for the new school-age eligibility cutoff of 4-14. Additional SNAP benefits have no effect on adult obesity levels for the full sample of adults using the younger school-age eligibility cutoff (row 1 of Table 6). The results from row 2 (households with a younger child present) appear closer in magnitude but are not statistically significant relative to the results from our preferred age eligibility cutoff (ages 6 – 14). We do not find strong evidence that suggests WIC or preschool programs, in conjunction with SNAP, affect adult obesity levels. Rows 3 and 4 of Table 6 present the estimated effects when we expand the age cutoff to also include children in high school (ages 6 – 18). For this range, the point estimates are similar but less precise compared to those using our preferred age cutoff range. We posit the difference could be attributed to lower NSLP and SBP participation rates among high school-aged children and/or higher levels of food consumption, and thus more use of household SNAP benefits, by this older group.

5. Discussion

In this paper we present the first causal effects of additional SNAP benefits on adult obesity. Our focus is only on individuals who report SNAP participation and we use variation in household composition to examine differences in the effective amount of SNAP benefits available to adults in the NLSY79. We find no effect of increased SNAP benefits on weight outcomes for the full sample. In our preferred specification we find that additional SNAP benefits per adult, proxied by a greater proportion of school-age children in the household,

²³ Our results are robust to the inclusion of a WIC dummy control variable. Results are not shown but available upon request.

decreases weight among adult recipients. Specifically, when one child in a household of four enters school, adult BMI is expected to decrease by 0.22 units while the probability of being obese decreases by 2.58 percentage points. Our results are consistent with prior research that finds greater SNAP benefits are associated with lower BMI levels (Jilcott et al., 2011a; Jilcott et al., 2011b).

There are a number of possible mechanisms discussed in the literature that can explain reductions in BMI and the likelihood of being obese from exogenous increases in SNAP benefits. Decreases in BMI levels from increases in SNAP benefits may be the result of a transition from lower quality (cheap) to higher quality (more expensive) foods that help maintain or even reduce weight (Drewnowski and Specter, 2004). Another potential mechanism may be that additional SNAP benefits are alleviating the negative consequences of chronic dieting stemming from the “Food Stamp Cycle” hypothesis (Ver Ploeg and Ralston, 2008). An increase of SNAP benefits to households with little to no additional sources of income may be providing enough income to purchase food for the entire month greatly reducing the need to “diet” or go without food towards the end of the cycle. Finally, we cannot rule out the possibility of a pure income effect from additional SNAP benefits that frees up non-SNAP income for the consumption of goods that promote weight loss (e.g. gym memberships). However, our analysis on non-SNAP reporting adults suggests that the pure income effect may not be the primary driver of our findings.

Our findings have several implications relevant to current deliberations regarding SNAP policy. On April of 2012, the Congressional Budget Office discussed the possibilities of changing benefit amounts by adjusting how SNAP is indexed with the Thrifty Food Plan or by changing the number and/or amount of deductions from individuals’ gross income. Likewise,

the American Reinvestment and Recovery Act (ARRA) of 2009 included provisions that increased the amount of SNAP benefits available to participants by approximately 15 percent. Recent legislation repealed the ARRA benefit increases in late 2013 resulting in approximately a 10 percent drop in overall benefits per household. Based on our results, intensive margin changes could have significant impacts on the prevalence of obesity among SNAP recipients. Presumably, decreasing the amount of SNAP benefits to each household could amount to significant cuts in government spending but may have adverse health consequences to households who rely on these benefits.

Future research is needed to help uncover the exact mechanisms through which a greater amount of SNAP benefits lead to healthier weight outcomes. Using consumer expenditure or administrative data to examine purchasing behavior and redemption patterns amongst SNAP households with and without school-age children could shed light on such mechanisms involving food choice. Changes in food choices amongst adults with school-age children could stem from healthier eating habits learned in school and then brought home. Healthier eating habits learned at school in conjunction with an exogenous increase in SNAP may help explain the weight loss we find among adult SNAP recipients in the NLSY79. Future work should also examine food consumption choices of SNAP recipients pre and post-ARRA policy changes to provide additional insights on purchasing behavior and redemption patterns given changes in SNAP benefit amounts.

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Table 1: Descriptive Statistics of NLSY79 SNAP Recipients Over Time

Variable Name	(1) 1985-1989	(2) 1990-1994	(3) 1996-2008
SNAP Benefits per HH per year (2008 USD)	3,347 [5,920]	2,989 [2,550]	1,881 [1,990]
SNAP Benefits per Person in HH per year (2008 USD)	969 [1,603]	877 [670]	699 [648]
SNAP Benefits per Adult in HH per year (2008 USD)	2,246 [4,502]	2,380 [1,951]	1,674 [1,900]
Total Net Family Income per year (2008 USD)	22,518 [82,960]	19,310 [14,252]	17,099 [16,508]
Age (years)	25.64 [2.68]	30.87 [2.68]	40.08 [4.67]
Household Size	3.86 [1.78]	3.67 [1.78]	2.91 [1.69]
Number of Children	1.96 [1.38]	2.17 [1.51]	1.64 [1.55]
Proportion of Children in HH	0.466 [0.228]	0.525 [0.256]	0.435 [0.310]
Proportion of School-Age Ch. in HH	0.172 [0.207]	0.288 [0.248]	0.251 [0.261]
Education (1= High School or more)	0.606 [0.488]	0.669 [0.470]	0.738 [0.439]
Mother's Education (1= High School or more)	0.357 [0.479]	0.374 [0.484]	0.379 [0.485]
Employed (1= currently employed)	0.325 [0.468]	0.179 [0.415]	0.479 [0.500]
Hours Worked per year if Employed	862 [895]	1,245 [913]	1,274 [1,061]
Marital Status (1= Married)	0.337 [0.473]	0.324 [0.468]	0.236 [0.424]
Urban (1= lives in urban area)	0.699 [0.458]	0.746 [0.435]	0.682 [0.465]
Hispanic (1= Hispanic)	0.104 [0.305]	0.113 [0.317]	0.100 [0.300]
Black (1= Black)	0.353 [0.478]	0.356 [0.479]	0.342 [0.475]
Female (1= Female)	0.766 [0.422]	0.695 [0.460]	0.696 [0.460]
Body Mass Index	25.38 [6.09]	27.38 [6.70]	29.55 [7.59]
Obese (1= BMI equal to 30 or more)	0.188 [0.391]	0.280 [0.449]	0.398 [0.489]
Overweight (1= BMI equal to 25 or more)	0.409 [0.491]	0.574 [0.495]	0.698 [0.459]
Underweight (1= BMI equal to 18.5 or less)	0.064 [0.246]	0.034 [0.180]	0.019 [0.135]
WIC (1= currently participates in WIC)	-	0.247 [0.431]	0.141 [0.347]
Number of Observations	3,608	3,745	3,281

Note: Weighted sample means with standard errors in brackets. All SNAP benefits are reported in 2008 dollars adjusted by the CPI Food and Beverage Index. Total Net Family Income is reported in 2008 dollars adjusted by the CPI Index.

Table 2: Additional SNAP Benefits from Increases in the Proportion of School-Age Children (age 6-14) have no Effect on Adult Obesity Conditional on Observable Demographic Characteristics and Year Dummies

OUTCOME VARIABLES	Pooled OLS			Fixed-Effects		
	(1)	(2)	(3)	(4)	(5)	(6)
(1) BMI	1.7866*** (0.4158)	0.3687 (0.4239)	0.0474 (0.4435)	1.5394*** (0.2230)	0.6552*** (0.1904)	0.1474 (0.1931)
(2) Pr(Overweight) BMI \geq 25	0.1171*** (0.0269)	0.0432 (0.0264)	0.0046 (0.0280)	0.1178*** (0.0193)	0.0638*** (0.0184)	0.0143 (0.0195)
(3) Pr(Obese) BMI \geq 30	0.1098*** (0.0257)	0.0192 (0.0256)	-0.000953 (0.0274)	0.0869*** (0.0178)	0.0335* (0.0174)	0.00371 (0.0188)
Demographic Characteristics	N	Y	Y	N	Y	Y
Year Dummies	N	N	Y	N	N	Y
R-squared (1)	0.004	0.089	0.093	0.011	0.238	0.250
R-squared (2)	0.003	0.067	0.077	0.007	0.085	0.098
R-squared (3)	0.004	0.060	0.063	0.005	0.082	0.088
N-T Observations	10,634	10,634	10,634	10,634	10,634	10,634
Number of Respondents				2,078	2,078	2,078

Notes: Each row corresponds to a separate regression. Baseline controls consist of gender, age, race and ethnicity dummies, household size, poverty status, marriage status, regional location status, income and income squared, respondent and respondent's mother level of education, and employment status. Robust standard errors in parentheses clustered on individuals *** p<0.01, ** p<0.05, * p<0.1

Table 3: Living with Children Who Are Not yet School Eligible Significantly Reduces Adult Labor Force Participation

VARIABLES (Sample)	(1) Currently Employed	(2) Hours Worked/yr.	(3) Zero Hours Worked/yr.	N-T
Panel 1: SNAP Recipients				
(1) Proportion of School-Age Children (Full Sample)	0.0738*** (0.0238)	239.58*** (41.98)	-0.126*** (0.0250)	10,634
(2) Proportion of School-Age Children (HHs with Child < 5)	0.0767 (0.0479)	112.66 (78.34)	-0.0710 (0.0488)	4,929
Panel 2: Non-SNAP <130% FPL				
(3) Proportion of School-Age Children (Full Sample)	0.0496** (0.0229)	196.7*** (51.53)	-0.0868*** (0.0226)	16,336
(4) Proportion of School-Age Children (HHs with Child < 5)	0.0909 (0.0640)	78.58 (136.4)	-0.0958 (0.0587)	4,784
Panel 3: Non-SNAP 130% – 200% FPL				
(5) Proportion of School-Age Children (Full Sample)	0.0442** (0.0185)	23.97 (51.09)	-0.0162 (0.0166)	15,082
(6) Proportion of School-Age Children (HHs with Child < 5)	0.0036 (0.0573)	71.12 (116.5)	-0.0238 (0.0489)	5,413

Note: All specifications include age, household size, education, and dummies for poverty status, marital status, and year as controls. Robust standard errors in parentheses clustered on individuals *** p<0.01, ** p<0.05, * p<0.1

Table 4: Proportion of School-age Children on Adult Obesity by SNAP Reporting Status and Household Income Level

VARIABLES (Specification)	(1) BMI	(2) Overweight BMI ≥ 25	(3) Obese BMI ≥ 30	N-T
Panel 1: SNAP Recipients				
(1) Proportion of School-Age Children (Full Sample)	0.1474 (0.1931)	0.0143 (0.0195)	0.0037 (0.0188)	10,634
(2) Proportion of School-Age Children (HHs with Child < 5)	-0.8941** (0.4349)	0.0215 (0.0431)	-0.103** (0.0401)	4,929
Panel 2: Non-SNAP ≤130% FPL				
(3) Proportion of School-Age Children (Full Sample)	0.348** (0.173)	-0.0022 (0.0201)	0.0287* (0.0169)	16,336
(4) Proportion of School-Age Children (HHs with Child < 5)	0.271 (0.438)	-0.0046 (0.0541)	0.0409 (0.0401)	4,784
Panel 3: Non-SNAP 130% – 200% FPL				
(5) Proportion of School-Age Children (Full Sample)	-0.0829 (0.133)	-0.0048 (0.0186)	-0.0155 (0.0165)	15,082
(6) Proportion of School-Age Children (HHs with Child < 5)	-0.279 (0.373)	-0.0689 (0.0528)	-0.0567 (0.0469)	5,413

Note: Columns 2 and 3 are estimated using a linear probability model. Row 1 examines the changes in the proportion of school-age children in SNAP households on obesity. Row 2 examines SNAP households with at least one child under the age of five. Rows 3 and 5 examine adults who do not report using SNAP benefits at or below 130% and between 130% and 200% of the Federal Poverty Level, respectively including baseline controls and year dummies. Rows 4 and 6 restrict each income group subsample to adults living in households with a child under the age of five. Robust standard errors in parentheses clustered on individuals

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

Table 5: Interaction of Proportion of School-Age Children and SNAP dummy on Adult Obesity by Income Level

VARIABLES (Specification)	(1) BMI	(2) Overweight BMI ≥ 25	(3) Obese BMI ≥ 30	N-T
Panel 1: At or Below 130% FPL				
(1) PSAC x SNAP (Full Sample)	-0.183 (0.202)	0.0257 (0.0220)	-0.0201 (0.0191)	26,970
(2) PSAC x SNAP (HHs with Child < 5)	-0.789* (0.427)	-0.0344 (0.0507)	-0.0848** (0.0425)	9,713
Panel 2: 130% – 200% FPL				
(3) PSAC x SNAP (Full Sample)	0.256 (0.206)	0.0032 (0.0227)	0.0249 (0.0209)	25,716
(4) PSAC x SNAP (HHs with Child < 5)	-0.0453 (0.443)	0.0064 (0.0537)	-0.0600 (0.0455)	10,342

Note: Columns 2 and 3 are estimated using a linear probability model. Rows 1 and 3 examine the interaction between the proportion of school age children and reporting receiving SNAP benefits (1 = yes) at or below 130% and between 130% and 200 of the Federal Poverty Level, respectively while rows 2 and 4 restrict the sample to adults living in households with at least one child under the age of five. All rows include baseline controls and year dummies. Robust standard errors in parentheses clustered on individuals *** p<0.01, ** p<0.05, * p<0.1

Table 6: Variations in School-Age Eligibility Cutoffs on Adult Obesity Levels

VARIABLES (Specification)	(1) BMI	(2) Overweight BMI ≥ 25	(3) Obese BMI ≥ 30	N-T
Panel 1: Ages 4 to 14				
(1) Proportion of School-Age Children (Full Sample)	-0.0571 (0.184)	-0.0007 (0.0184)	0.0092 (0.0176)	10,634
(2) Proportion of School-Age Children (HHs with Child < 4)	-0.525 (0.424)	0.0450 (0.0477)	-0.0364 (0.0451)	4,194
Panel 2: Ages 6 to 18				
(3) Proportion of School-Age Children (Full Sample)	0.00664 (0.00673)	0.0172 (0.0204)	0.0115 (0.0205)	10,634
(4) Proportion of School-Age Children (HHs with Child < 5)	-0.900* (0.479)	0.0210 (0.0441)	-0.0770* (0.0405)	4,929

Note: Columns 2 and 3 are estimated using a linear probability model. All rows use baseline controls and year dummies. Rows 1 and 2 assume school-age eligibility between the ages of 4 and 14 years of age. Row 2 restrict the sample to adults living in households with a child under the age of four to test whether participation in the Head Start Program or other preschool programs increase availability of SNAP resources for adults. Rows 3 and 4 assume school-age eligibility between the ages of 6 and 18 years of age. Row 4 restricts the sample to adults living in households with a child under the age of five. Robust standard errors in parentheses clustered on individuals *** p<0.01, ** p<0.05, * p<0.1