The Real Value of SNAP Benefits and Health Outcomes*

Abstract (250 words):

The food stamp program (SNAP) is one of the most important elements of the social safety net and is the second largest anti-poverty program for children in the U.S. (only the EITC raises more children above poverty). The program varies little across states and over time, which creates challenges for quasi-experimental evaluation. Notably, SNAP benefit levels are fixed across 48 states; but local food prices vary widely, leading to substantial variation in the real value of SNAP benefits. In this study, we leverage time variation in the real value of the SNAP benefit across markets to examine the effects of SNAP on child health. We link panel data on regional food prices and the cost of the Thrifty Food Plan, as measured by the USDA's Quarterly Food at Home Price Database, to restricted-access geo-located National Health Interview Survey data on samples of SNAP-recipient and SNAP-eligible children. We estimate the relationship between the real value of SNAP benefits (i.e., the ratio of the SNAP maximum benefit to the TFP price faced by a household) and children's health and health care utilization, in a fixed effects framework that controls for a number of individual-level and region characteristics, including non-food prices. Our findings indicate that children in market regions with a lower real value of SNAP benefits utilize significantly less health care, and may utilize emergency room care at increased rates. Lower real SNAP benefits also lead to an increase in school absences but we find no effect on reported health status.

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Executive Summary

Title: The Real Value of SNAP Benefits and Health Outcomes

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Objectives: Our research provides new evidence on the impact of SNAP benefits on children's health outcomes and health care utilization. While legislated SNAP benefit levels are fixed across 48 states, local food prices vary widely, leading to substantial geographic variation in the *real* value of SNAP benefits. Using information on geographic variation in the cost of the Thrifty Food Plan (TFP) and detailed information on children's health from the National Health Interview Survey (NHIS), we investigate how this variation in the purchasing power of SNAP benefits affects child health outcomes.

Methods: We use data on regional food prices from the USDA's Quarterly Food at Home Price Database (QFAHPD) to construct region-by-year measures of the price of the TFP. We match these measures of regional food prices to restricted-access geo-located NHIS data on the health, income, and demographics of children in the SNAP population. We then estimate the relationship between the real value of SNAP benefits (i.e., the ratio of the SNAP maximum benefit to the TFP price faced by a household) and children's health and health care utilization, in a fixed effects framework that controls for a number of individual-level and region characteristics (including non-food prices in the area). We study this relationship for SNAP recipient children and for children of unmarried mothers with less than a college education.

Outcomes: Our results indicate that children in market regions with higher food prices (lower purchasing power of SNAP) utilize significantly less health care, particularly preventive and/or ambulatory care, and may utilize emergency room care at increased rates. We find significant increases in the number of school days missed due to illness for children facing higher food prices. We find no consistent evidence, on the other hand, that lower SNAP purchasing power results in significant declines in (parent-reported) health status.

Policy Implications: Adjusting benefit levels to account for geographic variation in food prices across market regions (~35 nationally) would help reduce disparities in child healthcare access in low income households, but may not lead to significant improvements in contemporaneous health status.

1. Introduction

The Supplemental Nutrition Assistance Program (SNAP, formerly the Food Stamp program) is the largest food assistance program and one of the largest safety net programs in the United States.[1] SNAP is the second largest anti-poverty program for children in the U.S., with only the EITC (combined with the Child Tax Credit) raising more children above poverty (Renwick and Fox 2016). Eligibility for the program is universal in that it depends only on a family's income and assets; in 2015, 1 in 7 Americans received SNAP benefits. A primary goal of the program is to reduce food insecurity among low-income households.

The literature provides evidence that the SNAP program succeeds in reducing food insecurity among its recipients (see, e.g., Nord and Golla (2009); Mykerezi and Mills (2010); Yen et al. (2008); Ratcliffe, McKernan, and Zhang (2011); Shaefer and Gutierrez (2011) and the recent review by Hoynes and Schanzenbach (2016)). Nonetheless, food insecurity amongst recipient households remains quite high, raising the question of whether SNAP benefits are adequate (Coleman-Jensen et al. 2014). The evidence on the nutrition of SNAP recipients is more mixed (see, e.g., Gregory et al. 2013), and relatively little is known regarding the impact of SNAP program on the health of its recipients.

The question of how SNAP benefits affect health outcomes is an important one, but estimating the causal relationship between SNAP benefits and health is difficult. SNAP benefits and eligibility rules are legislated at the federal level and do not vary across states, leaving few opportunities for quasi-experimental analysis. One set of quasi-experimental studies leverages

[1] Program costs in 2016 amounted to more than 70 billion dollars. The program has also grown dramatically in the years since 1996 welfare reform, with the amount of benefits paid out *quadrupling* over the years in this study (1999-2010).

the rollout of the food stamp across counties in the 1960s and 1970s and finds that food stamps leads to significant improvements in birth outcomes (Almond, Hoynes, and Schanzenbach 2011; Currie and Moretti 2008) and access to food stamps in early childhood leads to significant improvements in adult health (Hoynes, Schanzenbach, and Almond 2016). A second set of studies uses recent state changes in application procedures (e.g. allowing online applications, whether there is a finger printing requirement) as instruments for SNAP participation (Schmeiser 2012) though these state policies had relatively small effects on participation (Ziliak 2015). Gregory and Deb (2015) use the Medical Expenditure Panel Survey and state policy variables and find that SNAP participants have fewer sick days and fewer doctor's visits, but more checkup visits. A third approach is taken by East (2016), who uses variation in eligibility for SNAP generated by welfare reform legislation in the 1990s, and finds that SNAP in early childhood leads to improvements in health status at ages 6-16.

Our research approaches this question from a new angle, investigating the extent to which plausibly exogenous variation in the *real value of SNAP benefits* impacts health. Importantly, SNAP benefits are fixed across the 48 states (they are higher in Alaska and Hawaii) even though the price of food varies significantly across the country (Todd et al. 2010; Todd, Leibtag, and Penberthy 2011).[2] Though SNAP benefits are implicitly adjusted for cost of living through allowed deductions for housing, earnings, dependent care, medical expenses, and child support payments, the limited available evidence indicates these adjustments are not sufficient to

[2] Studying data from the Quarterly Food at Home Price Database (QFAHPD), the authors find that regional food prices vary from 70 to 90 percent of the national average at the low end to 120 to 140 percent at the high end.

equalize *real* benefits, particularly in high cost areas. Gundersen et al. (2011) and the Institute of Medicine (2013) propose this as an area for future research.

Linking nationally representative data from the 1999-2010 National Health Interview Surveys (NHIS) to information on regional food prices from the Quarterly Food-at-home Price Database (QFAHPD), we study the effect of variation in real SNAP benefits on children's health. We relate various child health outcomes to the real value of SNAP benefits (i.e., the ratio of the (national) SNAP maximum benefit to the (market level) TFP price faced by a household) in a fixed effects framework that controls for a number of individual-level and region characteristics (including non-food prices in the area) and state policy variables. Identification comes from differences across the 35 market areas in trends in the price of TFP.

Higher area food prices, and consequently lower SNAP purchasing power, may impact children's health by reducing nutrition if households respond by purchasing and consuming lower quantities of food, or if they purchase less expensive foods of lower nutritional quality. But lower real SNAP benefits may also impact health indirectly, by causing households to reduce consumption of other inputs into the health production function, like health care.

Our study contributes to the growing body of evidence on the relationship between SNAP benefit generosity and the health and wellbeing of the SNAP population. We provide what is to our knowledge the first evidence on the impact of variation in the real value of SNAP (due to geographical variation in food prices) on child health and health care utilization. We find that children in market regions with higher food prices (lower purchasing power of SNAP) utilize less preventive/ambulatory health care, and are more likely to have delayed or forgone care in the past 12 months due to cost. We also find evidence of an increase in ER care for children in

higher food price areas. While lower real SNAP benefits do not result in significant declines in reported health status, we document significant detrimental impacts on some health outcomes, like the number of school days missed due to illness.

2. Data

In this study, we combine three sets of data to estimate the effect of SNAP on children's health. Below we describe the data on the price of the thrifty food plan (Section 2.1), the National Health Interview Survey (Section 2.2) and the state and county control variables (Section 2.3).

2.1 Regional Cost of the Thrifty Food Plan (TFP)

The Thrifty Food Plan (TFP) is a food plan constructed by the USDA, specifying foods and amounts of foods to represent a nutritious diet at a minimal cost. The TFP is used as the basis for legislated maximum SNAP benefit levels. In 2016, the U.S. average weekly TFP cost was $146.90 for a family of four with two adults and two children (ages 6-8 and 9-11).[3]

To assign food prices to our sample of households in the NHIS, we construct data on the regional price of the TFP using the Quarterly Food-at-Home Price Database (QFAHPD) (Todd et al. 2010) which we use for the period 1999-2010. The QFAHPD, created by the USDA's Economic Research Service, uses Nielsen scanner data to compute estimates of the price of 52 food categories (e.g. three categories of fruit: fresh or frozen fruit, canned fruit, fruit juices,

[3] See https://www.cnpp.usda.gov/sites/default/files/CostofFoodNov2016.pdf. (Accessed 1/28/17)

nine categories of vegetables, etc.) for each quarter for each of 35 regional markets. We map the 52 QFAHPD food categories to the 29 TFP food categories to create a single price estimate for the TFP for each market and year during this period. For this mapping, we follow the methods in Gregory and Coleman-Jensen (2013) and come very close to reproducing their estimates. As in this earlier work, we can cleanly link the QFAHPD categories to 23 of the 29 TFP categories without duplication or overlap of QFAHPD prices.[4] We extend their analysis to construct prices by year for the full 1999-2010 period covered by the QFAHPD.[5] The 35 market areas covered in the QFAHPD include 26 metropolitan market areas and 9 nonmetropolitan areas, though for 1999-2001 only 4 nonmetropolitan areas are captured.[6] Each market area consists of a combination of counties.

To map the 52 QFAHPD food group prices to the 29 TFP food group prices in the market basket, we use an expenditure-weighted average of the prices for the QFAHPD foods, where

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[4] In particular, see the description on page 683 and in Table A1.1 of their report. In footnote 5, the authors write: "The remaining 6 TFP groups were not included because their contents were in groups aggregated elsewhere into the TFP basket. For example, popcorn and whole grain snacks and whole grain cereals (including hot cereals) are TFP goods that might have been matched to the QFAHPD categories packaged snacks and whole grain cereal, respectively. However, these QFAHPD goods belong to TFP categories refined grains and whole grains, respectively." Other excluded foods from the six missing categories, with the possible exception of coffee and tea, are similarly accounted for in other parts of the QFAHPD basket.
For details on the construction of the TFP itself, see https://www.cnpp.usda.gov/sites/default/files/usda_food_plans_cost_of_food/TFP2006Report.pdf. (Accessed 1/28/17)

[5] There are two versions of the QFAHPD, QFAHPD-1, which provides price data on 52 food groups for 1999-2006, and QFAHPD-2, which provides price data on 54 food groups for 2004-2010.

[6] In 1999-2001, the QFAHPD identified nonmetro areas in each of the 4 census divisions (east, central, south and west). In 2002 and later, they expanded to include nonmetro areas in each of the 9 census divisions: New England, Middle Atlantic, East North Central, West North Central, South Atlantic, East South Central, West South Central, Mountain and Pacific. For comparability we use the 4 nonmetro areas throughout.

the weights are the expenditure shares for the QFAHPD foods within the (broader) TFP group (most TFP food items consist of multiple QFAHPD food groups). We construct national expenditure shares by averaging the shares from each market group and apply them to each market area. We use the 2006 construction of the TFP, which features food categories that are relatively closely aligned with the food categories in the QFAHPD data (Carlson et al. 2007).

An example (borrowed from Gregory and Coleman-Jensen (2013)) is illustrative. The TFP food category "whole fruit" consists of two QFAHPD food groups: "fresh/frozen fruit" and "canned fruit." In Hartford (market group 1), in the first quarter of 2002, expenditures on fresh/frozen fruit were $35.7 million, and expenditures on canned fruit were $5.8 million. This yields expenditure weights for whole fruit (in Hartford in quarter 1 2002) of 0.86 and 0.13, respectively. Repeating for each market group, we then average these expenditure shares across *all market groups* to generate the national expenditure shares (for this item in this period). In 2002, these national expenditure weights are 0.84 and 0.16 for fresh fruit and canned fruit, respectively. Returning to Hartford, the first-quarter 2002 prices of fresh/frozen and canned fruit in the Hartford market group are $0.218 and $0.244 per 100 grams, respectively. Therefore, the price for whole fruit in Hartford for the first quarter of 2002 is 0.84×$0.218+0.16×$0.244 = $0.222 per 100 grams.[7]

Once we have constructed the market region-by-year TFP prices, we assign them to households in the NHIS based on the household's county of residence (which we map into the QFAHPD market area that includes the county) and the year of interview.

[7] We have also constructed measures of TFP cost using total national expenditure shares (as opposed to averaging the weights across market groups) and obtain very similar estimates of the TFP and effect sizes.

When estimating the relationship between the real value of SNAP benefits and health, as described further below, we measure the purchasing power of SNAP using the ratio of the maximum SNAP benefit to the TFP price faced by the household. Our main regression models use the natural log of this ratio as the key independent variable for ease of interpretation; however, results are qualitatively very similar when the level of the ratio is employed instead.[8]

Figure 1 illustrates the variation across region and over time in the real value of SNAP, equal to the maximum SNAP benefit divided by the regional cost of the TFP. Panel A shows the value in 1999, and Panel B shows the value in 2010. In each case, a darker shading represents a higher SNAP/TFP ratio, or greater SNAP purchasing power. The maps indicate that the real value of SNAP is lower in the west and northeast. Additionally, in 2010 the maximum SNAP benefit was temporarily increased as part of the stimulus package (ARRA).

2.2 National Health Interview Survey (NHIS) Data on SNAP Children

This study uses restricted-access micro data from the National Health Interview Survey (NHIS) for the years from 1999-2010. The NHIS surveys approximately 35,000 households per year. Gaining restricted-use access to this data allows us to observe the county of residence for each household in the survey. The NHIS is unique in the ability to observe county identifiers (allowing us to link respondents to regional area food prices) as well as detailed information on children's health and the characteristics of their parents and households for a large and representative national sample. From each household with children, the survey selects one child at random (the "sample child") and collects more extensive and detailed information on

[8] These results are available upon request.

this child's health and health care utilization. Some of the outcomes we study are only available in these Sample Child files, while others are available for all NHIS respondents in the Person-level file.

We examine several measures of health that might respond to reduced nutrition, or to reduced consumption of other inputs in the health production function (e.g., health care), including health status (an indicator for the child's health being excellent or very good, as reported by the parent), number of school days missed (for the sub-sample of school aged children), obesity, whether the child has emotional problems, and whether the child has been hospitalized overnight in the past 12 months.

We also study the relationship between the real value of SNAP benefits and the utilization of health care. Families with limited resources may respond to higher food price areas by reducing consumption of other goods that impact health, like ambulatory or preventive health care. We study several outcome measures related to health care utilization over the past 12 months, including: whether the child has had a checkup, whether the child has had any doctor's visit, whether the child has delayed or forgone medical care due to cost, and whether the child has had an emergency room (ER) visit.

2.3 State and County Control Variables

We include several variables to control for regional policies and prices that might affect child health. First, we control for local labor market conditions by using the county unemployment rate (from the Census local area unemployment statistics). Second, we use Ganong and Liebman's index of SNAP state policy which includes measures for simplified

reporting, recertification lengths, interview format (e.g. in person or not), call centers, online applications, Supplemental Security Income Combined Application Project, vehicle exemptions for asset requirement and broad-based categorical eligibility (Ganong and Liebman 2015). Third, we control for other state policies including the minimum wage, EITC, and Medicaid/State Children's Health Insurance Program (SCHIP) income eligibility limits. Finally, and potentially most importantly, we control for prices of other goods. This includes HUD's fair market rent, measured by county to the "40th percentile of gross rents for typical, non-substandard rental units occupied by recent movers in a local housing market." We also control for the BLS measure of regional CPIs for non-food, non-housing categories (apparel, commodities, education, medical, recreation, services, transportation and other). These are available for 26 metro areas; for the remaining areas, the CPI is calculated for each of the four census regions and for four county population sizes (<50,000, 50,000-1.5 million, >1.5 million).

3. Empirical Methods

We estimate the causal impact of variation in the real value of SNAP benefits on measures of child health and health care utilization for two samples of children: 1) children in households who report receiving SNAP and 2) children of unmarried mothers with less than a college degree.

Throughout, our regressions take the following form:

(1) $$y_{irt} = \alpha + \beta f(TFP_{rt}, MAXSNAP_t) + X_{irt}\theta + Z_{rt}\gamma + \delta_t + \lambda_r + \varepsilon_{irt}$$

where y_{irt} is the health outcome of individual *i* who resides in region *r* in time *t*. The key independent variable, which we show here as $f(TFP_{rt}, MAXSNAP_t)$, captures the real value of

SNAP and is a function the cost of the thrifty food plan (which varies at the region year level) and the maximum SNAP benefit (which varies at the year level). Our primary measure is the natural log of the ratio of maximum SNAP benefits to the regional TFP price, i.e., $ln\left(\frac{MAXSNAP_t}{TFP_{rt}}\right)$, allowing us to interpret the estimated coefficients as reflecting the effect of an X% increase in the purchasing power of SNAP. The vector, $X_{irt,}$ controls for characteristics of the child and his/her family.[9] The vector Z_{rt} includes the county, market level, and state controls for labor market, state policies and prices as described above. Finally, λ_r and δ_t are market area and year fixed effects. We cluster the standard errors on market area.

Identification in this model comes from variation across market areas and over time in the price of the Thrifty Food Plan. As we showed earlier in Figure 1, there is substantial variation across geographic areas in the purchasing power of SNAP benefits. In lower cost areas the SNAP benefit covers up to 85 percent of the cost of the TFP, while in higher cost areas this falls to 65 to 70 percent.

Table 1 provides summary statistics for the samples of children in SNAP-recipient households (columns 1 and 2) and children of unmarried mothers with less than a college education (columns 3 and 4). The advantage of the SNAP recipient sample is clear; this is the group affected by SNAP. However, there may be selection into who participates in SNAP. Additionally, household surveys underreport program participation, and the severity of the

[9] These controls include the child's age (and its square), indicators for whether the child is black or Hispanic, indicators for the presence of the mother and father in the household, and interactions between the indicators for mother's and father's presence with mother's and/or father's education, citizenship status, employment status, and marital status.

underreporting has increased over time (Meyer, Mok, and Sullivan 2015). The second sample therefore targets a group with a high intent to treat (i.e., a high likelihood of being on SNAP). There are 46,280 total children in SNAP recipient households and 46,311 in the low educated unmarried mother sample. Some of our outcomes are available only for the randomly chosen children in the Sample Child files; for those outcomes there are 18,880 children in the SNAP recipient households and 20,376 in the low educated unmarried mother sample.

The (unweighted) average TFP price faced by our sample is just over $200, and the maximum SNAP benefit covers just under 70 percent of this cost, on average.[10] As expected, children in both samples are likely to be living below the poverty line (67-70 percent of SNAP children, and about half of children with low-educated single mothers). Black and Hispanic children are disproportionately represented in these samples, as are children who live without their fathers. We note that among children of unmarried, low-educated mothers, approximately 14 percent have their fathers present in the household.

In general, SNAP children appear to have slightly worse health care utilization and health outcomes than children of low-educated single mothers. While approximately one-quarter of children went without a check-up over the past year, around 90 percent of them had at least some kind of doctor's visit in the past 12 months, and rates of delaying or forgoing care due to cost are fairly low. Finally, one notable difference between samples is that ER visits appear to be much more common in the "All Children" sample than for the Sample Child sample.

[10] This is significantly higher than the USDA's estimate of the national average TFP cost in 2010, but because Identification comes from the differences across the 35 market areas in trends in the price of TFP, this difference should not impact our results.

4. Results

4.1 SNAP Participation

We begin by analyzing the effects of real SNAP benefits on the SNAP caseload. If variation in the real value of SNAP leads to changes in the SNAP caseload then selection may bias our interpretation of our analysis of child health.

Using data from USDA, we construct a county panel for annual SNAP caseloads covering 1999-2010. We estimate equation (1) where the dependent variable is SNAP caseloads divided by the population in the county. The results are in Table 2. There are four specifications in the table. Each includes fixed effects for year and county as well as the measure of real SNAP benefits. In the second column we add a control for the county unemployment rate, which is a significant determinant of SNAP caseloads (Bitler and Hoynes 2016) and possibly correlated with regional prices. In column 3 we add controls for state policy variables, including for SNAP, EITC, minimum wages and Medicaid. In column 4 we add controls for regional prices, including the county HUD fair market rent and regional CPIs for goods other than food.

The top half of the table measures the purchasing power of SNAP benefits in logs (log(SNAPMAX/TFP)), and the bottom half of the table measures the real value of SNAP in levels (SNAPMAX/TFP). All of the eight coefficients are positive, consistent with the SNAP caseload per capita rising when the TFP decreases (and the real value of SNAP increases). However, none of the coefficients are statistically significant. Comparing the results across the columns, adding the county unemployment rate (column 2) increases the coefficient, but the addition of the state policy controls (column 3) and the regional prices (column 4) do not substantially change the results. Comparing the results across the log and level measures of real SNAP benefits yields

qualitatively similar findings (they are also quantitatively similar given the mean of SNAPMAX/TFP is about 0.7). From this we conclude that there is no significant relationship between the real value of SNAP and SNAP caseloads, and thus we interpret our main results free of concerns about selection. Additionally, given the similarity across the different specifications, we proceed using log(SNAPMAX/TFP) as our primary measure of the purchasing power of SNAP.

4.2 The Real Value of SNAP and Health Care Utilization

The primary goal of our study is to analyze the impacts of variation in the purchasing power of SNAP benefits on outcomes related to child health. We begin by examining evidence for measures of health care utilization, recognizing that families facing higher food prices may respond to the lower real value of their SNAP benefits by reducing out-of-pocket spending on other goods, including health care.

Our primary measure of health care utilization is an indicator for whether the child has had a check-up in the past 12 months, which is observed only for children in the Sample Child file. The American Academy of Pediatrics recommends 6–7 preventive visits in infancy, 3 visits for 1-year olds, 2 visits for 2-year olds, and at least one visit per year for children ages 3 to 17 (AAP, 2010). We also examine indicators for whether the child has had any doctor's visit in the past 12 months, and whether the child has delayed or gone without care in the past 12 months due to cost. Finally, we estimate the relationship between the real value of SNAP benefits and whether a child has visited an ER in the past 12 months. If lower SNAP purchasing power causes a reduction in preventive or ambulatory care, we might expect to see a corresponding

increase in ER usage among those facing higher food prices. These three dependent variables are available in the Person file of the NHIS so are observed for all NHIS children under age 18.

The results are presented in Table 3. Estimates for the sample of SNAP-recipient children are displayed in Panel A, and those for the sample of children of unmarried mothers with less than a college degree are shown in Panel B. The specification includes fixed effects for market group, year, individual controls, and regional controls for unemployment rate, non-food prices, and state safety net policies (similar to column (4) of Table 2). The key independent variable, representing the real value of SNAP, is log(SNAPMAX/TFP).

Among SNAP-recipient children, we find that increased purchasing power of SNAP significantly raises the likelihood a child has had a checkup in the past 12 months. A ten percent increase in the ratio MAXSNAP/TFP leads to a 4.1 percentage point (or 5.4%) increase in the likelihood of a checkup. Among the children observed in the Sample Child (SC) files, we also find a significant relationship between the real value of SNAP and the probability a child has delayed or gone without care in the past year because of its cost. This effect is large: a ten percent increase in the purchasing power of SNAP lowers the likelihood of delaying/forgoing care by 14.8 percentage points, or 25 percent. However, we do not find evidence of a similar relationship between SNAP and delaying/forgoing care in the wider sample of all NHIS children (the coefficient, while still negative, is much smaller in magnitude).

For children with low-educated, unmarried mothers, we find a similarly sized (3.3-percentage point) but statistically insignificant (p=0.11) effect of variation in the purchasing power of SNAP on the likelihood a child receives a checkup. The more striking result is a significant, negative relationship between SNAP purchasing power and ER usage. Specifically,

our estimate for the SC sample indicates that a 10 percent increase in the real value of SNAP benefits leads to a 12.5 percent reduction in the likelihood a child has had an ER visit in the past 12 months. The estimated effect for the "All Children" sample is smaller but is also positive and statistically different from zero.

In both samples, we find no statistically significant effects of SNAP purchasing power on having any doctor's visit in the past 12 months. The coefficients are consistently positive, however, implying more utilization in the presence of higher SNAP purchasing power.

While these results are preliminary, we interpret them as suggesting that children in households facing higher food prices (and thus, a lower real value of SNAP) receive less preventive/ambulatory care and may make greater use of costly ER care. The differences in the magnitudes of the estimates across sub-samples warrants further investigation and may be a result of our decision not to weight these regressions. However, we note that all of the coefficient estimates in Table 3 take the expected signs and tell a qualitatively similar story.

4.3 The Real Value of SNAP and Health Outcomes

The extent to which the real value of SNAP benefits affects health outcomes is addressed in Table 4. The regression specifications include the same set of controls as in Table 3, and again, we present results for the sample of children in SNAP recipient households (Panel A) and for children of low-educated unmarried mothers (Panel B). Note that several of the outcomes are defined only for sub-samples of children, thus leading to different numbers of observations across the columns of Table 4. For example, obesity is measured only for children age 2 and

older,[11] emotional problems are identified for children ages 4 and older, and the number of school days missed is recorded only for children age 5 and older who are in school. Parent reported health status and hospitalization in the past 12 months is reported for all children, but the other health outcomes are only provided for Sample Children.

We find no statistically significant effects of the purchasing power of SNAP and parent reported child health status (which we code as equal to 1 if the reported health is excellent or very good). However, we document a strong negative and robust relationship between the real value of SNAP and the number of school days children miss due to illness. For SNAP recipient children, a ten percent increase in SNAP purchasing power is associated with decrease in missed school days of approximately 1 day (off a mean of about 5, for a 20 percent decrease). For children of low-educated single mothers, the magnitude of the effect is similar, but increased SNAP purchasing power also reduces the likelihood of missing 5 or more school days (by about 13 percent) in this sample.

We find no statistically significant effects of real SNAP benefits on obesity, the propensity to have emotional problems or the propensity to be hospitalized in the past 12 months. However, the coefficients all suggest a protective effect of SNAP.

We cautiously interpret this result as suggesting that variation in the real value of SNAP may have some modest impacts on children's contemporaneous health. A weakness of measuring health using the number of school days missed due to illness is that it may depend on the parent's evaluation of the child's health; however, parent-reported health status, which is also

[11] The indicator for obesity is affected by some outlying height and weight measurements, which warrant further investigation. Our preliminary estimates of the effects of the real value of SNAP on obesity should therefore be interpreted with caution.

a subjective measure, does not appear to respond to variation in the real value of SNAP. On the other hand, the number of missed school days is perhaps the only health outcome we analyze that might be expected to respond contemporaneously to reduced nutrition. (Obesity and emotional problems, for example, are perhaps less likely to develop in a single year.) It is possible that the other outcomes we measure would be likely to respond only after a longer, cumulative period of food insecurity or poor nutrition.

5. Discussion

While our evidence suggests that lower purchasing power of SNAP benefits results in reduced health care utilization and more missed days of school, we find no corresponding decrease in other measures of children's health. One possible explanation for this finding is that the other health measures we consider are more chronic and cumulative in nature (e.g., obesity). However, we also find no evidence of a relationship between SNAP purchasing power and caregiver-reported health status, an outcome which seems unlikely to suffer from the same problem.

A second possible interpretation of our findings is that while lower SNAP purchasing power causes reduced health care utilization among children and may cause reduced nutrition or food security (not documented here), neither translates into detrimental impacts on children's health. Indeed, well over 95 percent of the children in our samples had at least one doctor's visit in the past 12 months, and while variation in the real value of SNAP is found to affect the likelihood of a check-up (or well visit), it does not significantly impact the likelihood of *any* doctor's visit.

We also note that our measure of variation in the price of food is constructed using 35 market regions that perhaps mask variation in urban and rural customers who are in fact paying different prices, or in why certain SNAP recipients are able to buy relatively inexpensive food and stay relatively healthy. In related work, Bronchetti, Christensen, and Hansen (2016) used food prices measured at a much finer level from Food Acquisition and Purchase Survey (FoodAPS) data and demonstrated that the size of the geographic radius used to measure whether SNAP benefits were sufficient to buy the TFP (inside the radius) mattered relatively little. What mattered far more is whether recipients were able to identify and travel to a low cost store in the area.

6. Conclusions

In this paper we provide the first direct evidence on how variation in the real value of SNAP benefits affects children's health care utilization and health outcomes. We find evidence consistent with families adjusting to higher area food prices (and thus, lower SNAP purchasing power) by reducing utilization of preventive/ambulatory medical care. In particular, we document that a 10 percent increase in SNAP purchasing power increases the likelihood a child had a check-up in the past year by 5.4 percent and may reduce the likelihood that children delay or go without care due to cost. Interestingly, we also find reduced SNAP purchasing power to be associated with greater usage of costly emergency room care.

While our findings indicate significant reductions in health care utilization for children facing higher regional food prices, we do not find much evidence that these higher prices cause detrimental impacts on health status, the likelihood of a hospitalization, or other measures of

physical (e.g., obesity) and mental health (e.g., child has emotional problems). One exception is that children facing higher food prices (and thus, lower SNAP purchasing power) miss significantly more days of school due to illness. We view this result as suggestive that SNAP purchasing power may, in fact, impact some measures of health, and plan to explore additional health measures that would be likely to respond contemporaneously to reduced nutrition.

Our results speak to whether adjusting benefit levels to account for geographic variation in food prices across market regions (~35 nationally) would help improve child health and wellbeing. We conclude that such adjustment would reduce disparities in child healthcare utilization and school absenteeism in low-income households, but may not lead to significant improvements in contemporaneous health status.

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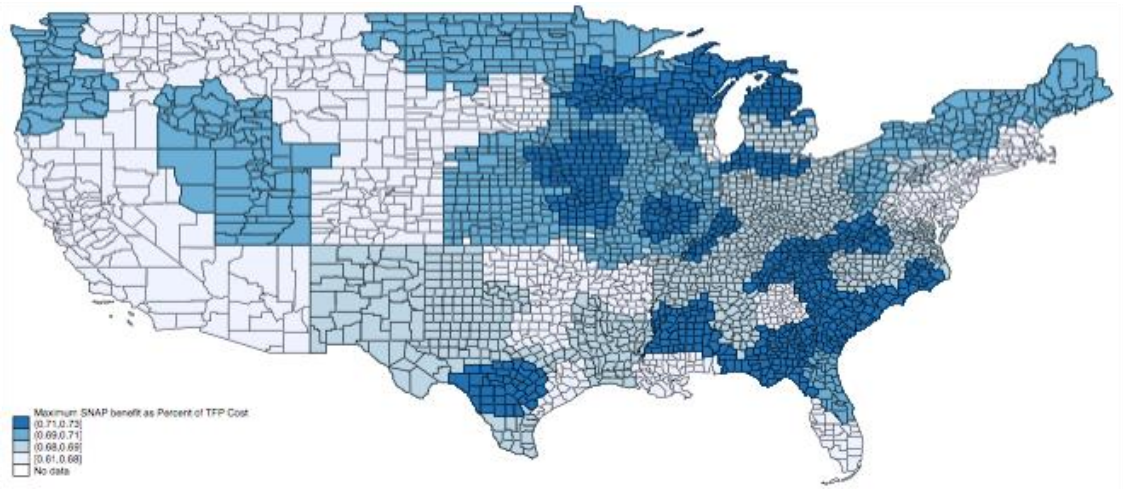
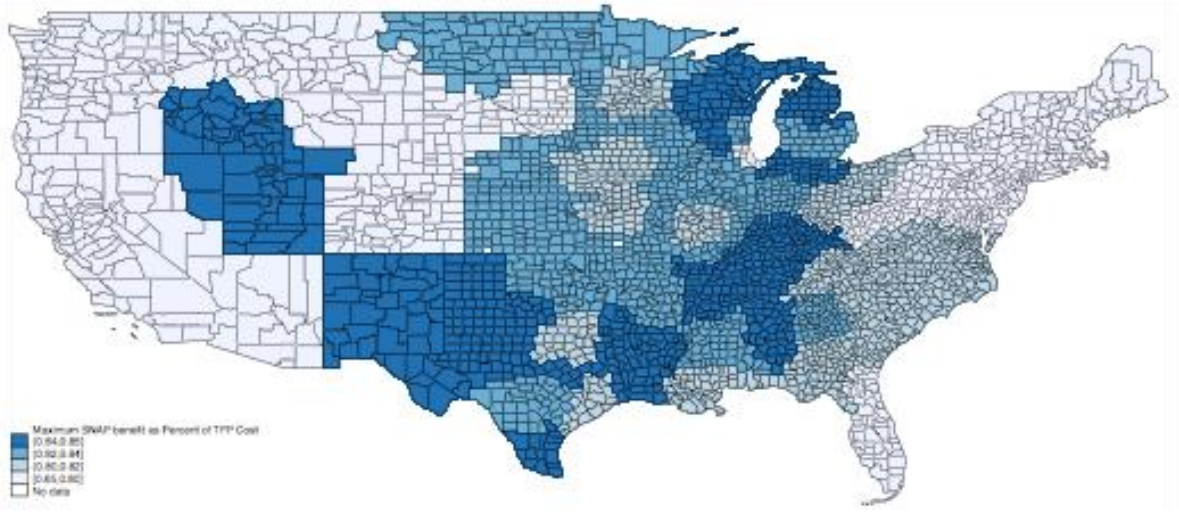
Figure 1
SNAP Purchasing Power by Market Area

Panel A: 1999



Panel B: 2010



Notes: Maps plot SNAPMAX/TFP for each of the 29 market areas identified consistently in the Quarterly Food at Home Price Database (QFAHPD).

Table 1
Summary Statistics for Samples of NHIS Children
(Unweighted sample means; standard deviations in parentheses)

	SNAP Recipients		Low-ed, Unmarried Mothers	
Child/Household Characteristics	Sample Children	All Children	Sample Children	All Children
TFP price	205	205	206	206
	(15)	(14)	(15)	(14)
Max SNAP benefit	143	143	141	141
	(12)	(12)	(10)	(10)
Family income	18,357	18,799	24,943	23,925
	17732	(17809)	(23771)	(23240)
Below poverty line	0.67	0.71	0.48	0.55
	(0.47)	(0.45)	(0.50)	(0.50)
Child's age	7.6	7.8	8.1	8.1
	(5.2)	(5.1)	(5.4)	(5.2)
Child is male	0.49	0.50	0.49	0.50
	(0.50)	(0.50)	(0.50)	0.50
Child is black	0.33	0.33	0.30	0.32
	(0.47)	(0.47)	(0.46)	(0.47)
Child is Hispanic	0.38	0.40	0.38	0.41
	(0.48)	(0.49)	(0.49)	(0.49)
Mother is present	0.94	0.94	1.00	1.00
	(0.25)	(0.24)		
Father is present	0.37	0.39	0.14	0.14
	(0.48)	(0.49)	(0.35)	(0.34)
Both parents	0.34	0.37	0.14	0.14
	(0.47)	(0.48)	(0.35)	(0.34)
Health Care Utilization				
Any check-up (12m)	0.77	--	0.72	--
	(0.42)		(0.45)	
Any doctor's visit (12m)	0.89	0.96	0.86	0.93
	(0.31)	(0.20)	(0.35)	(0.25)
Delay/forgo care (12m)	0.06	0.05	0.06	0.06
	(0.23)	(0.22)	(0.24)	(0.23)
Any ER visit (12m)	0.32	0.72	0.28	0.66
	(0.47)	(0.45)	(0.45)	(0.47)
Health Outcomes				
Health status exc. or v. good	0.70	0.69	0.72	0.70
	(0.46)	(0.47)	(0.45)	(0.46)
Hospitalized overnight (12m)	0.08	0.07	0.07	0.07
	(0.27)	(0.25)	(0.26)	(0.25)
School days missed, illness (12m)	4.96	--	4.20	--
	(9.70)		(7.59)	
5+ school days missed (12m)	0.33	--	0.29	--
	(0.47)		(0.46)	
Obese	0.34	--	0.33	--
	(0.47)		(0.47)	
Emotional problem	0.31	--	0.27	--
	(0.46)		(0.44)	
Number of observations	18,880	46,280	20,376	46,311

Table 2
Effect of SNAP Purchasing Power on Per-Capita SNAP Caseload

Outcome = SNAP CASELOAD / POPULATION	(1)	(2)	(3)	(4)
log(SNAPMAX/TFP)	0.004	0.022	0.020	0.008
	(0.058)	(0.035)	(0.034)	(0.031)
Observations	37,277	37,277	37,277	37,177
R-squared	0.536	0.562	0.568	0.581
Mean	0.105	0.105	0.105	0.105
Fixed effect for year, county	X	X	X	X
County UR		X	X	X
State SNAP and other policy controls			X	X
Regional price controls				X
Outcome = SNAP CASELOAD / POPULATION	(1)	(2)	(3)	(4)
SNAPMAX/TFP	0.010	0.036	0.033	0.010
	(0.086)	(0.052)	(0.050)	(0.044)
Observations	37,277	37,277	37,277	37,177
R-squared	0.536	0.562	0.568	0.581
Mean	0.105	0.105	0.105	0.105
Fixed effect for year, county	X	X	X	X
County UR		X	X	X
State SNAP and other policy controls			X	X
Regional price controls				X

Notes: Data consists of county by year panel for 1999-2010. Results are weighted using county population. Standard errors in parentheses are corrected for clustering at the market group level; *** p<0.01, ** p<0.05, * p<0.1. All regressions include fixed effects for county and year. Columns (2)-(4) add controls for local economic and policy variables: the county unemployment rate, an index of state SNAP policies (Ganong and Liebman, 2015), the state minimum wage, EITC, and Medicaid/SCHIP income eligibility limits, as well as controls for HUD's fair market rent, and regional CPIs for non-food, non-housing categories (apparel, commodities, education, medical, recreation, services, transportation and other).

Table 3
Effects of Variation in SNAP Purchasing Power on Children's Health Care Utilization

A.SNAP Recipient Children	Children in Sample Child File				All NHIS Children Ages 0-17		
	(1) Had a checkup past 12m	(2) Doctor's visit past 12m	(3) Delay or forgo care past 12m	(4) Any ER visit past 12m	(5) Doctor's visit past 12m	(6) Delay or forgo care past 12m	(7) Any ER visit past 12m
log(SNAPMAX/TFP)	0.435**	0.221	-0.148**	-0.106	0.085	-0.050	-0.077
	(0.205)	(0.141)	(0.068)	(0.160)	(0.061)	(0.067)	(0.087)
Mean of dep. var.	0.766	0.895	0.0563	0.324	0.957	0.0498	0.724
Effect of 10% increase in SNAP purchasing power	0.041	0.021	-0.014	-0.01	0.008	-0.005	-0.007
As a % of mean of dep. var.	**5.4%**	2.3%	**-24.9%**	-3.1%	0.8%	-10.0%	-1.0%
N	18,746	18,884	18,884	18,884	46,300	46,300	46,300
R^2	0.083	0.043	0.020	0.046	0.014	0.018	0.008

B. Children of Low-Educated Unmarried Mothers	Children in Sample Child File				All NHIS Children Ages 0-17		
	(1) Had a checkup past 12m	(2) Doctor's visit past 12m	(3) Delay or forgo care past 12m	(4) Any ER visit past 12m	(5) Doctor's visit past 12m	(6) Delay or forgo care past 12m	(7) Any ER visit past 12m
log(SNAPMAX/TFP)	0.343	0.176	-0.052	-0.367**	0.074	0.002	-0.201*
	(0.206)	(0.172)	(0.086)	(0.158)	(0.082)	(0.067)	(0.104)
Mean of dep. var.	0.717	0.861	0.0637	0.281	0.935	0.0557	0.664
Effect of 10% increase in SNAP purchasing power	0.033	0.017	-0.005	-0.035	0.007	0.0002	-0.019
As a % of mean of dep. var.	4.6%	2.0%	-7.8%	**-12.5%**	0.7%	0.4%	**-2.9%**
N	20,202	20,383	20,383	20,383	43,636	43,636	43,636
R^2	0.093	0.057	0.014	0.041	0.025	0.012	0.019

Notes: Results from unweighted OLS regressions. Standard errors in parentheses are corrected for clustering at the market group level; *** p<0.01, ** p<0.05, * p<0.1. All regressions include controls for the child's age (and its square), whether the child is black or Hispanic, indicators for the presence of the mother (and/or father) in the household, and interactions between indicators for the mother's (father's) presence and the mother's (father's) education, marital status, employment status, age, and citizenship. All regressions also include controls for local economic and policy variables: the county unemployment rate, an index of state SNAP policies (Ganong and Liebman, 2015), the state minimum wage, EITC, and Medicaid/SCHIP income eligibility limits, as well as controls for HUD's fair market rent, and regional CPIs for non-food, non-housing categories (apparel, commodities, education, medical, recreation, services, transportation and other). Finally, all models include year and market group fixed effects. Whether a child had a check-up in the past 12 months is observed only for children in the Sample Child files.

Table 4
Effects of Variation in SNAP Purchasing Power on Children's Health Outcomes

A. SNAP Recipient Children	Children in Sample Child File						All NHIS Children 0-17	
	(1) Health status excellent or very good	(2) Hospitalized overnight past 12m	(3) School days missed due to illness	(4) 5 or more school days missed	(5) Obese	(6) Emotional problem	(7) Health status excellent or very good	(8) Hospitalized overnight past 12m
log(SNAPMAX/TFP)	-0.106	0.080	-10.340**	-0.090	-0.140	-0.146	-0.170	0.017
	(0.185)	(0.079)	(3.873)	(0.193)	(0.175)	(0.246)	(0.167)	(0.054)
Mean of dep. var.	0.701	0.078	4.956	0.327	0.342	0.311	0.685	0.068
Effect of 10% increase in SNAP purchasing power	-0.010	0.000	-0.986	-0.009	-0.013	-0.014	-0.016	0.002
As a % of mean of dep. var.	-1.4%	0.0%	**-19.9%**	-2.6%	-3.9%	-4.5%	-2.4%	2.4%
N	18,880	18,872	11,942	11,942	10,624	11,243	46,280	46,274
R^2	0.034	0.150	0.038	0.044	0.089	0.043	0.034	0.141

B. Children of Low-Educated Single Mothers	Children in Sample Child File						All NHIS Children 0-17	
	(1) Health status excellent or very good	(2) Hospitalized overnight past 12m	(3) School days missed due to illness	(4) 5 or more school days missed	(5) Obese	(6) Emotional problem	(7) Health status excellent or very good	(8) Hospitalized overnight past 12m
log(SNAPMAX/TFP)	-0.093	0.061	-10.704***	-0.404***	-0.273	-0.283	-0.097	-0.006
	(0.193)	(0.078)	(3.065)	(0.143)	(0.244)	(0.225)	(0.202)	(0.054)
Mean of dep. var.	0.719	0.075	4.201	0.293	0.330	0.268	0.700	0.068
Effect of 10% increase in SNAP purchasing power	-0.009	0.000	-1.020	-0.039	-0.026	-0.027	-0.009	-0.001
As a % of mean of dep. var.	-1.2%	0.0%	**-24.3%**	**-13.1%**	-7.9%	-10.1%	-1.3%	-0.8%
N	20,376	20,374	13,321	13,321	12,364	12,063	43,611	43,607
R^2	0.030	0.172	0.041	0.048	0.104	0.038	0.027	0.157

Notes: Results from unweighted OLS regressions. Standard errors in parentheses are corrected for clustering at the market group level; *** p<0.01, ** p<0.05, * p<0.1. All regressions include the same controls as in Table 2. Outcomes in columns (3)-(6) are observed only for children in the Sample Child files. Missed school days is defined only for children ages 5 and older who attend school; obesity is defined for children ages 2 and older; and emotional problem defined for the universe of children ages 4 and older.