Local Food Prices, SNAP Purchasing Power, and Child Health*

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Abstract:

The Supplemental Nutrition Assistance Program (SNAP, formerly food stamps) is one of the most important elements of the social safety net. Unlike most other safety net programs, SNAP varies little across states and over time, which creates challenges for quasi-experimental evaluation. Notably, SNAP benefits are fixed across 48 states; but local food prices vary, leading to geographic variation in the *real* value of SNAP benefits. In this study, we provide the first estimates that leverage variation in the real value of SNAP benefits across markets to examine effects of SNAP on child health. We link panel data on regional food prices to National Health Interview Survey data and use a fixed effects framework to estimate the relationship between local purchasing power of SNAP and children's health and health care utilization. We find that children in market regions with lower SNAP purchasing power utilize less preventive health care. Lower real SNAP benefits also lead to an increase in school absences. We find no effect on reported health status.

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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 plays a crucial role in reducing poverty 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 (Ziliak 2015).

SNAP's primary goals are to improve food security among low-income households, reduce hunger, and increase access to a healthful diet.[2] The extant literature demonstrates that the program succeeds in reducing food insecurity among recipient households (see, e.g., Yen et al. 2008; Nord and Golla 2009; Mykerezi and Mills 2010; Ratcliffe, McKernan, and Zhang 2011; Shaefer and Gutierrez 2011; Schmidt, Shore-Sheppard, and Watson 2016 and the recent review by Hoynes and Schanzenbach 2016). Nonetheless, rates of food insecurity among SNAP households remain quite high, raising the question of whether SNAP benefits are adequate to meet the nutritional needs of recipients (Coleman-Jensen et al. 2014). Indeed, evidence regarding how SNAP benefits impact recipients' nutrition is more mixed (see, e.g., Yen (2010); Gregory et al. (2013)).

Our study provides unique and highly policy-relevant evidence on the impact of variation in the generosity of SNAP benefit levels on child health. Estimating the causal relationship

[1] SNAP benefits paid in 2016 amounted to more than 66 billion dollars. The program has also grown dramatically in the years since 1996 welfare reform, with benefits paid out almost tripling in real terms over the years in this study (1999-2010).

[2] See, for example, the most recently amended authorizing legislation, the Food and Nutrition Act of 2008, available at https://fns-prod.azureedge.net/sites/default/files/snap/Food-And-Nutrition-Act-2008.pdf.

between SNAP and health is difficult because 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 analyzes the rollout of the food stamp program across counties in the 1960s and 1970s and finds that food stamps leads to significant improvements in birth outcomes (Currie and Moretti 2008; Almond, Hoynes, and Schanzenbach 2011) 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, Gregory and Deb 2015),[3] though these state policies had relatively small effects on participation (Ziliak 2015). 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. None of these studies, however, is able to shed light on how changes to legislated SNAP benefit levels might impact health outcomes.

Our approach leverages plausibly exogenous geographic variation in the *real value of SNAP benefits* to identify the effects of variation in SNAP generosity on health for a sample of children in SNAP households. Importantly, the SNAP benefit formula is fixed across the 48 states (benefits 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).[4] Across the

[3] 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.

[4] 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.

continental U.S., maximum benefits vary only with family size. So, in 2016 a family of three would be eligible for a maximum benefit of $511/month regardless of the local cost of living. Though SNAP benefits are implicitly adjusted for variation in the cost of living through allowed deductions (e.g., for housing, and child care) in the calculation of net income, the limited available evidence indicates these adjustments are not sufficient to equalize *real* benefits, particularly in high cost areas (Breen et al. 2011). Gundersen et al. (2011) and the Institute of Medicine (2013) propose this as an area for future research.

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 SNAP purchasing power may also impact health indirectly, with higher food prices causing households to reduce consumption of other inputs into the health production function, like health care.

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 (or "SNAP purchasing power") on children's health care utilization and health. Our measure of regional food prices is the cost of the Thrifty Food Plan (TFP), a nutrition plan that was constructed by the USDA to represent a nutritious diet at minimal cost and is the basis for maximum legislated SNAP benefits (i.e., maximum benefits are set to its national average cost). The QFAHPD includes information on food prices that allows us to construct an estimated TFP price for each of 30 designated "market group" geographic area across the U.S. 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 group-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 30 market areas in trends in the price of the TFP.

Our study contributes to the growing body of evidence on the SNAP program and its effects in a few key ways. First, we provide new evidence on the relationship between SNAP benefit generosity and the health and wellbeing of the SNAP population. Our findings consistently indicate that children in market regions with higher food prices (lower purchasing power of SNAP) utilize less preventive/ambulatory health care. We find that a 10 percent increase in SNAP purchasing power raises the likelihood a child has an annual checkup by 6.3 percentage points (8.1 percent) and the likelihood of *any* doctor's visit by 3.1 percentage points (3.4 percent). While lower real SNAP benefits do not result in significant declines in reported health status, we document significant detrimental impacts on some health indicators, like the number of school days missed due to illness, as well as on children's food security. We confirm that these effects are not driven by relationships between geographic variation in food prices and SNAP participation or health insurance coverage, nor are they present in a placebo sample of somewhat higher-income children.

A second contribution is methodological, in that our approach highlights a new identification strategy for estimating effects of proposed changes in SNAP generosity on other outcomes of interest. To our knowledge, ours is the first study to utilize variation in the real value of SNAP (due to geographical variation in food prices) as a source of identification. This

variation could be leveraged to examine SNAP's impacts on nutrition, food consumption and other spending patterns, birth outcomes, and adult health.[5] While this paper uses data on regional food prices from the QFAHPD, other sources of food price data might also prove fruitful for researchers interested in these questions. An example is the USDA's National Household Food Acquisition and Purchase Survey (FoodAPS), a relatively new, nationally representative survey that gathered information on households' food consumption and their local shopping environments.

More broadly, our findings point to sizeable, beneficial impacts of SNAP (and of increasing the generosity of SNAP benefits) for children's health care utilization, food security, and some measures of their health, benefits which should be weighed carefully against the cost savings of any proposed cuts to the SNAP program. These results also shed light on the expected impact of adjusting benefit levels to account for geographic variation in food prices across market regions. Such adjustments would likely reduce disparities in preventive/ambulatory care, school absenteeism, and food security among low-income children, but may not lead to immediate, contemporaneous improvements in other health outcomes.

The paper proceeds as follows. The next section describes our multiple sources of data on regional food prices, child health, food security, and SNAP participation, and Section 3 lays out our empirical approach. Section 4 presents our main results regarding the impact of SNAP purchasing power on children's health care utilization and health, Section 5 explores mechanisms and several robustness checks, and Section 6 concludes.

[5] Bronchetti, Christensen, and Hansen (2017) link FoodAPS data on SNAP recipients' diets to local data on the cost of the TFP to study the effects of variation in SNAP purchasing power on nutrition among the SNAP population.

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 TFP, the National Health Interview Survey, and the state and county control variables. Additionally, we supplement our main analysis with administrative data on SNAP caseloads and household-level data on food insecurity from the December Current Population Survey (CPS).

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 that 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).[6]

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) for the years from 1999 through 2010. The QFAHPD, created by the USDA's Economic Research Service, uses Nielsen scanner data to compute quarterly estimates of the price of 52 food categories (e.g. three categories of fruit: fresh or frozen fruit, canned fruit, fruit juices; nine categories of vegetables, etc.) for 35 regional market groups. The 35 market groups covered in the QFAHPD include 26 metropolitan areas and 9 nonmetropolitan areas, though for

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

1999-2001 only 4 nonmetropolitan areas are captured.[7] Each market area consists of a combination of counties. 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 area and year during the full 1999-2010 period covered by the QFAHPD, following the methods in Gregory and Coleman-Jensen (2013).[8, 9]

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 the weights are the expenditure shares for the QFAHPD foods within each TFP category (most TFP food categories consist of multiple QFAHPD food groups). We construct *national* expenditure shares by averaging the shares across all market groups. To avoid confounding regional variation in food prices with regional variation in consumption of different food categories, we apply these *national* expenditure shares to each market area's prices when constructing the market group-level cost of the TFP.[10, 11] We use the 2006 specification of the

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[7] In 1999-2001, the QFAHPD identified one nonmetropolitan area for each of the 4 census divisions (east, central, south and west). In 2002 and later, they expanded to include nonmetropolitan 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 four nonmetropolitan areas throughout.

[8] We 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. The remaining six TFP categories contain foods that are accounted for in other parts of the QFAHPD TFP 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)

[9] There are two versions of the QFAHPD: QFAHPD-1, which provides price data on 52 food groups for 1999-2006, and QFAHPD-2, which includes prices for 54 food groups for 2004-2010. We bridge the two series by estimating the average ratio of QFAHPD-1 to QFAHPD-2 for years 2004 through 2006 for each market group. We then apply this ratio to the price data for 1999-2003 (e.g.: the years with information on only 52 food groups).

[10] 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.

[11] 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. We then average these expenditure shares across *all market groups* to generate the national expenditure shares (for each item and period). In 2002, these national expenditure weights are 0.84 and 0.16 for fresh fruit and canned fruit, respectively. We apply these shares to the first-quarter 2002 prices of fresh/frozen and canned fruit in the Hartford market group ($0.218 and $0.244 per 100 grams,

TFP, which features food categories that are relatively closely aligned with the food categories in the QFAHPD data (Carlson et al. 2007).

We assign each household in the NHIS to a market group-level TFP price based on the county of residence and the year of interview. When estimating the relationship between the real value of SNAP benefits and health, 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.[12]

Figure 1 illustrates the variation across regions and over time in the real value of SNAP, equal to the maximum SNAP benefit for a family of 4 divided by the regional cost of the TFP. Panel A displays the value of this ratio in 1999, and Panel B shows its value in 2008 and Panel B shows its 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, but also that there are noticeable changes in SNAP purchasing power within regions over this time period. The changes in 2010 reflect, in part, the increase in SNAP benefits as part of the stimulus package (ARRA); this raised the maximum SNAP benefits in the second half of 2009 and throughout 2010. Appendix Figure 1a shows the trends in the real TFP cost for each of the market group areas. The figure demonstrates the general pattern of rising TFP prices in 2005-2009 followed by a decline in 2010. Appendix Figure 1b shows SNAP

respectively) to compute a price for whole fruit in Hartford for the first quarter of 2002 (0.84×$0.218+0.16×$0.244 = $0.222 per 100 grams).

[12] These results are available upon request.

purchasing power for the market group areas; this illustrates the variation in trends across areas and shows clearly the effect of the ARRA.

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

We use restricted-access micro data from the National Health Interview Survey (NHIS) for the years from 1999-2010 to examine effects on child health and health care utilization.[13] The NHIS surveys approximately 35,000 households per year. By gaining restricted-use access to this data we are able observe the county of residence for each household in the survey. This allows us to link respondents to regional area food prices and access 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 this child's health and health care utilization. Several of the outcomes we study are only available in these Sample Child files, while others (e.g., parent-reported health status) are available for all NHIS respondents in the Person-level file.

Our primary sample includes children ages 17 and under who are citizens of the United States. We impose the citizenship restriction because the post-welfare reform era witnessed dramatic changes to rules regarding non-citizens' eligibility for many social safety net programs, including SNAP.[14] We conduct our main analyses on the sample of children in households who

[13] State and county identifiers are masked in the public use NHIS data. Researchers interested in accessing the restricted geocode data should contact Peter Meyer at rdca@cdc.gov.

[14] We test the robustness of our results to the inclusion of non-citizen children; these results are very similar to our main results. See Appendix Tables 1 –2.

report having received SNAP benefits in at least one of the past 12 months. For the years from 1999 through 2010, there are 44,627 such children; 18,299 of them are also interviewed as Sample Children. While the advantage of limiting our analysis to the SNAP recipients is clear (this is the group most affected by SNAP), non-random selection into SNAP participation would call into question a causal interpretation of our estimates. In Section 4.1, we analyze the impact of SNAP purchasing power on SNAP participation at the county level and document no significant relationship between the real value of SNAP benefits and the per-capita SNAP caseload. As a robustness check in Section 5, we also test the sensitivity of our results using an alternative sample with a high likelihood of being on SNAP—children living with low-educated, unmarried parent(s).

Families with limited resources may respond to higher food prices by reducing consumption of other goods that impact health, like ambulatory or preventive health care. Our primary measures of health care utilization are indicators for whether the child has had a check-up in the past 12 months and whether the child has had *any* doctor's visit in the past 12 months. According to guidelines from the American Academy of Pediatrics (AAP), children should have 6-7 preventive visits before age 1, 3 visits per year as 1-year olds, 2 visits as 2-year olds, and at least one visit per year for ages 3 through 17. We also analyze the relationship between SNAP purchasing power and whether (the parent reports that) a child has delayed or forgone care due to cost in the past 12 months. Finally, we study whether the child has visited the ER in the past year; if lower SNAP purchasing power reduces the use of preventive/ambulatory care, we might expect higher area food prices to increase utilization of ER care.

We also analyze the effects of SNAP purchasing power on several direct measures of child

health that might respond to reduced nutrition, or to reduced consumption of other inputs in the health production function (e.g., health care). Parental respondents report the child's health status on a 5-point scale (1—excellent, 2—very good, 3—good, 4—fair, and 5—poor); we use this measure to construct an indicator for whether the child is in excellent or very good health. As measures of contemporaneous health, we also study whether the child was hospitalized over the past 12 months, the number of school days missed due to illness in the past 12 months (for the sub-sample of school aged children), and an indicator for whether the child missed 5 or more days of school due to illness. In addition, we estimate the relationship between SNAP purchasing power and two longer-term health outcomes that may respond to reduced nutrition or to food insecurity: an indicator for obesity based on height and weight data (for the subsample of children ages 12-17), and whether the child has emotional problems (defined for the universe of children ages 4 and older).

Table 1 displays summary statistics for SNAP recipient children. As expected, SNAP children are likely to be poor, live in single-parent households (only a third live with both parents), and are disproportionately likely to be black or Hispanic. Because such a high fraction (72 percent) of SNAP children receive Medicaid, the rate of uninsurance among this sample is low, at about 7 percent. Health care utilization and health outcomes are worse for SNAP children than for the general population of citizen children in the U.S. Nearly one-quarter of SNAP children went without a check-up in the past year, but 90 percent had at least some sort of doctor's visit during that time. ER utilization is high, at over 30 percent, and more than 5 percent report having delayed or gone without care due to its cost. In terms of health, itself, SNAP children have lower-than-average health status, miss more school days (5, on average, but one-third of

SNAP children missed 5 or more in the past year), and commonly have emotional problems (46 percent of SNAP children 4 or older).

2.3 State and County Control Variables

We include several variables to control for regional policies and prices that might affect child health and be correlated with local food prices. First, we control for local labor market conditions with the county unemployment rate. Second, we include a summary index of state-level SNAP policies developed by Ganong and Liebman (2015), which incorporates 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. Third, we control for other state policies including the minimum wage, state EITC, TANF maximum benefit guarantee amounts, and Medicaid/State Children's Health Insurance Program (CHIP) income eligibility limits. Finally, and perhaps most importantly, we control for prices of other goods by including HUD's fair market rent (measured by county as the "40th percentile of gross rents for typical, non-substandard rental units occupied by recent movers in a local housing market"[15]) and regional Consumer Price Indices (CPIs) for non-food, non-housing categories (apparel, commodities, education, medical, recreation, services, transportation and other goods and services). These are available for 26 metro areas; for the remaining areas, the CPI is calculated within each of the four census regions and for four county population sizes (<50,000, 50,000-1.5 million, >1.5 million).

[15] More specifically, HUD estimates FMRs for 530 metropolitan areas and 2,045 nonmetropolitan county FMR areas.

2.4 Supplemental Data on SNAP Caseloads and Food Insecurity

We investigate the relationship between SNAP purchasing power and SNAP participation in Section 4.1, using administrative data on county-level SNAP caseloads from the U.S. Department of Agriculture (USDA), for the years from 1999 through 2010. We match each county-year observation to that year's TFP price for the market group to which the county belongs.

To further probe mechanisms whereby variation in regional food prices may impact child health, we supplement our main analysis by studying the relationship between SNAP purchasing power and food insecurity. [16] For this analysis we use data from the December Current Population Survey Food Security Supplement (CPS-FSS) for the years from 2001-2010.[17] We identify a sample of 37,277 citizen children, ages 0 to 17, who live in households that report receiving SNAP, and link them to market area TFP prices according to location of residence.[18]

3. Empirical Methods

We estimate the causal impact of variation in the real value of SNAP benefits on measures

[16] Food insecurity is a household-level measure of well-being, defined as being unable to obtain, or uncertain of obtaining, an adequate quantity and quality of food due to money or resources. Very-low food insecurity is defined as food insecurity that includes disrupted or restricted dietary patterns. Prior to 2006, very-low food insecurity was labeled "food insecurity with hunger".

[17] The December food security supplement was not collected in 1999 and 2000.

[18] The public-use food security supplement files reports geographic information on all states, 217 counties, 69 primary metropolitan statistical areas, 173 metropolitan statistical areas (MSA), 40 combined statistical areas (CSA), and 278 core-based statistical areas (CBSA) during our period of analysis. In order to assign CPS observations to a market group, we first identify states that include a single market group and assign all observations in that state to the corresponding market group. Continuing with the next most general geography (CSA), we repeat this process at increasingly more detailed geographies levels to the county identifiers. After this step, we then assign observations living in a non-metropolitan area to the rural market group based on their state of residence (for states with rural areas in a single market group). We match 83.7 percent of CPS observations to a market group using this iterative process.

of child health and health care utilization for children in households who report receiving SNAP benefits during the past 12 months. Throughout, our regressions take the following form:

$$(1) \qquad y_{irt} = \alpha + \beta \ln\left(\frac{SNAPMAX_t}{TFP_{rt}}\right) + X_{irt}\theta + Z_{rt}\gamma + \delta_t + \lambda_r + \varepsilon_{irt}$$

where y_{irt} is the health outcome of individual *i* who resides in region *r* in time *t*. The key independent variable is the natural log of the ratio of maximum SNAP benefits for a family of four (which vary by year, but is constant across regions) to the regional TFP price. The vector X_{irt} contains a set of controls for the child's characteristics, including his/her age (and its square), race, Hispanic ethnicity, family size, 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, age, and citizenship. The state policy variables described in Section 2.3 are included in Z_{rt}, as are a set of regional CPIs in non-food, non-housing consumption categories. All models also include a full set of fixed effects for the year (δ_t) and market group (λ_r). The standard errors are clustered at the market group level.

We have also tested models with additional controls including income, parent-reported health status, and an indicator for insurance coverage, but due to endogeneity concerns, we do not include these in our main specification. The results are generally similar, however, and we report these estimates in the supplementary appendix (Appendix Tables 3 and 4).

Identification in this model comes from variation in trends in the price of the Thrifty Food Plan across market areas. 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 80 percent of the cost of the TFP, while in higher cost areas this falls to less

than 65 percent.[19] More importantly for our identification strategy, these regional differences change over time, with some areas experiencing larger increases in SNAP purchasing power from 1999 to 2010, and others experiencing smaller increases (e.g., purchasing power in some southern metropolitan areas increased nearly 17 percent, but only about 4.5 percent in urban New York).[20]

4. Results

4.1 SNAP Participation

We begin by analyzing the effects of SNAP purchasing power on the SNAP caseload. If variation in the real value of SNAP leads to changes in SNAP participation, then selection may bias our estimates of the effect of SNAP purchasing power on 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 county population. Table 2 displays the results of six different specifications of the model. Each includes year and market group fixed effects, as well as the (log) of the ratio of maximum SNAP benefits to the market group TFP price. 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

[19] Note that since the statutory TFP is constructed using a national average, some areas are, by definition, likely to have SNAP benefits that more than cover the cost of the TFP. However, our construction of market group TFP is unlikely to be exactly identical to the statutory definition. For our identification strategy to be valid however, all that matters is the relative generosity across market groups and trends across market groups.

[20] SNAP benefits in 2010 and 6 months of 2009 include increased benefits provided through the American Recovery and Reinvestment Act (ARRA). ARRA benefits amounted to $62, or about a 13.6 percent increase above the base 2009 levels. Changes in SNAP purchasing power ranged from a decrease of 5.8 percent in San Francisco to 4.3 percent increase in metropolitan areas in Arkansas and Oklahoma over the 1999-2008 period.

state policy variables, including for SNAP, EITC, minimum wages, TANF generosity, 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.

When only year and market group fixed effects are included, the estimated coefficient on SNAP purchasing power is positive and significant, consistent with the SNAP caseload per capita rising when the TFP decreases (and the real value of SNAP increases). However, once any additional controls are added (e.g., even just the county unemployment rate, in column 2), the coefficient drops substantially in magnitude and is no longer statistically different from zero. The addition of the state policy controls (column 3) and the regional prices (column 4) result in an estimate that is even smaller in magnitude. In columns 5, we extend the specification by including a market group linear time trend which leads to little change in the estimated coefficient on SNAP purchasing power. 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.

4.2 SNAP Purchasing Power 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.

We present the results of this analysis in Table 3. Our primary measure of health care

utilization is an indicator for whether the child has had a check-up in the past 12 months (column 1), which is observed only for children in the Sample Child file. We also examine indicators for whether the child has had any doctor's visit in the past 12 months (column 2), whether the child has delayed or gone without care in the past 12 months due to cost (column 3), and whether a child has visited an ER in the past 12 months (column 4). Whether a child has delayed or forgone care is reported in the Person file of the NHIS so is observed for all NHIS children under age 18; we report this estimate in column 5. The model 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).[21] The key independent variable, representing the real value of SNAP, is ln(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 (SNAPMAX/TFP) leads to a 6.3 percentage point (or 8.1 percent) increase in the likelihood of a checkup. We also document a smaller, but significant impact of increased SNAP purchasing power on the probability a child has had *any* doctor's visit over the past 12 months. A ten percent increase in the purchasing power of SNAP lowers the likelihood of delaying/forgoing care by 3.1 percentage points, or 3.4 percent.

The results in columns 3 through 5 indicate that SNAP purchasing power has no statistically significant effect on whether children are reported to have delayed or forgone care due to cost (among all children or in the Sample Child sample), or on whether they have visited the ER in

[21] Individual-level controls include the child's age (and its square), whether the child is black or Hispanic, the child's family size, 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, age, and citizenship.

the past 12 months. However, the coefficients are all negative, suggesting a protective effect of SNAP.

Broadly, we interpret these results as suggesting that children in households facing higher food prices (and thus, lower SNAP purchasing power) receive less preventive and ambulatory care.

4.3 SNAP Purchasing Power and Health Outcomes

Table 4 presents evidence on the extent to which variation in SNAP purchasing power affects child health outcomes. The regression specifications include the same set of controls as in Table 3. Note that several of the outcomes are defined only for sub-samples of children, leading to different numbers of observations across the columns of Table 4. Specifically, obesity is measured only for children ages 12 through 17,[22] 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 are reported for all children, but the other health outcomes are only provided for children in the Sample Child file.

We find no statistically significant relationship between SNAP purchasing power and an indicator for the child's (parent-reported) health status being excellent or very good, nor the likelihood of having been hospitalized in the past year. However, we document a strong

[22] The indicator for obesity is based on BMI calculations, which are affected by some outlying height and weight measurements. We trim the top and bottom of the BMI distribution to exclude the top and bottom percentile. In addition, height and weight information was only collected for children ages 12 and older in years 2008 through 2010. We therefore limit the sample to children ages 12-17.

negative and robust relationship between the real value of SNAP and the number of school days children missed due to illness. For SNAP recipient children, a ten percent increase in SNAP purchasing power is associated with a decrease in missed school days of just over 1 day (or a 22 percent decrease relative to the mean of approximately 5 days missed).

We find no statistically significant effects of real SNAP benefits on obesity nor the propensity to have emotional problems, although we note that these are longer term health problems that often develop over time and may be less likely to respond contemporaneously to higher area food prices. It is possible that these outcomes would be likely to respond only after a longer, cumulative period of food insecurity, poor nutrition, or reduced health care.

We interpret these results 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 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 or limited use of preventive/ambulatory health care.

5. Mechanisms and Robustness Checks

5.1 SNAP Purchasing Power and Food Insecurity

One avenue through which higher area food prices may impact child health is by reducing households' consumption of preventive and ambulatory health care for their children. The

results in Section 4, which point to a significant reduction in yearly check-ups and doctor's visits for those with lower SNAP purchasing power, are consistent with such a mechanism.

However, variation in SNAP purchasing power may also affect health more directly, if children facing higher area food prices are able to consume less (or less nutritious) food. Because the NHIS did not provide information on food security or nutritional intake in the years of data we analyze, we turn to data from the December food security supplement to the CPS to estimate the impact of SNAP purchasing power on food insecurity among SNAP-recipient children.

We display these results in Table 5. The regression specifications include the same set of controls as in Tables 3 and 4. We find that a higher real value of SNAP benefits is associated with an improvement in children's food security: A 10 percent increase in SNAP purchasing power reduces the likelihood a child is food insecure by 6.7 percentage points (a 21.8 percent decrease relative to the mean). The result for very low food security is not statistically significant; however, we note that very low food security is a fairly rare outcome even for SNAP children (only 4 percent of the children in our sample are very food insecure while almost 30 percent are food insecure). In particular, very low food security requires not only that households are uncertain of obtaining an adequate quantity and quality of food due to money or resources, but that they also restrict or disrupt food intake because of lack of resources. It is perhaps not surprising, then, that this more extreme outcome is not significantly responsive to marginal variation in area food prices.

5.2 SNAP Purchasing Power and Health Insurance Coverage

In Table 6 we investigate whether the documented impacts of SNAP purchasing power on health care utilization and health could be explained by a relationship between regional food prices and health insurance coverage. Such a relationship would be unexpected for this sample, given that SNAP recipient children are all likely to be income-eligible for Medicaid or CHIP. Returning to our sample of NHIS children, we estimate equation (1), where the dependent variable is now an indicator for whether the child is uninsured. Reassuringly, for both children in the Sample Child file and all NHIS children, we find no statistically significant effect of SNAP purchasing power on the likelihood a child has no health insurance.

5.3 Robustness Checks

A natural check of our main results is to estimate our models for health care utilization and health outcomes on a "placebo" sample of children that should not be directly affected by SNAP purchasing power (i.e., who are not impacted by SNAP benefits and whose health and health care should not be as vulnerable to higher area food prices).

In Table 7 we present regression results analogous to those in Tables 3 and 4, but for a sample of NHIS children living in households with incomes between 300 and 450 percent of the federal poverty line.[23] Estimated coefficients for our key outcomes (i.e., had check-up, had any doctor's visit, and number of school days missed) are small and statistically insignificant. This is true for most other outcomes, as well. Two exceptions are that we find a statistically significant effect of SNAP purchasing power on whether a child in this placebo sample visited the ER in the

[23] As before, this sample is limited to children ages 0 through 17 who are citizens of the United States.

past year and on whether a child is obese. Recall that neither of these outcomes was found to respond significantly to SNAP purchasing power among SNAP recipient children.

Table 8 displays the results of a series of robustness checks to our main findings regarding the impacts of SNAP purchasing power on health care utilization and health. In panel A, we re-estimate the models including a lead term that uses the *t+1* market area TFP price. This lead specification provides a test for the validity of our fixed effects design. If we find significant effects of future prices (while controlling for current prices) we might be concerned that we are capturing the effects of some other trend in the regions. That is, we estimate:

$$(2) \qquad y_{irt} = \alpha + \beta_1 \ln\left(\frac{MAXSNAP_t}{TFP_{rt}}\right) + \beta_2 \ln\left(\frac{MAXSNAP_{t+1}}{TFP_{r,t+1}}\right) X_{irt}\theta + Z_{rt}\gamma + \delta_t + \lambda_r + \varepsilon_{irt}$$

In 11 of the 13 specifications, the lead of SNAP purchasing power is insignificant. Additionally, our results for the contemporaneous effect of SNAP purchasing power are largely unchanged: The magnitudes of the estimated coefficients for "had checkup" and "school days missed" are quite similar to those in Tables 3 and 4. One exception is that the estimated impact of current-period SNAP purchasing power on whether a child had any doctor's visit in the past 12 months is a third as large and is no longer statistically significant.

The second panel of Table 8 contains results from a model that includes a set of market group linear time trends. This approach places serious demands on the data in that identification now must come from departures in market groups' TFP prices from their trends (assumed to be linear). While the main estimates for health care utilization (had checkup, had any doctor's visit) are qualitatively similar to those in Table 3, they are smaller in magnitude and no longer statistically significant. The estimated impact of SNAP purchasing power on missed school days, however, remains nearly identical in magnitude and significance to that in

Table 4.

Finally, to address concerns that inclusion in our SNAP recipient sample may be endogenous to SNAP purchasing power, we estimate the impacts of variation in SNAP purchasing power on health care utilization and health for a high intent-to-treat population. In particular, we identify a sample of children living with unmarried parent(s) with less than a college education.[24] Again, the estimated impacts on the likelihood of a checkup and on the number of missed school days are quite similar in magnitude to those for our main sample (although the p-value on the coefficient for missed school days rises to 0.141). The estimated relationship between SNAP purchasing power and having had *any* doctor's visit is smaller and no longer statistically significant. Interestingly, we document a negative effect of increased SNAP purchasing power on ER utilization for this somewhat higher-income sample: a 10 percent increase in the ratio (SNAPMAX/TFP) reduces the likelihood of an ER visit by 4.8 percentage points.

6. Discussion and Conclusion

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 8.1 percent and increases the likelihood that children had

[24] Even though this is a high-ITT group, observable characteristics show that it is more advantaged, on average, than the SNAP population.

any doctor's visit in the past 12 months by 3.4 percent.

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 (22 percent more, relative to a baseline mean of 5 missed days, when SNAP purchasing power is reduced by 10 percent). We also find that lower purchasing power of SNAP benefits results in a greater likelihood of food insecurity.

One possible explanation for our finding stronger effects on utilization than on health itself is that most of the 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 could be less likely 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 negatively affects food security, neither translates into substantial detrimental impacts on children's health status.

We also note that our measure of variation in the price of food is constructed using 30 market regions that perhaps mask variation in urban and rural customers who are in fact paying different prices, thus masking why certain SNAP recipients are able to buy relatively inexpensive food and stay relatively healthy. In related work, Bronchetti, Christensen, and Hansen (2017) use food prices measured at a much finer level from the Food Acquisition and Purchase Survey (FoodAPS) and demonstrate that the size of the geographic radius used to

measure whether SNAP benefits were sufficient to buy the TFP (at a store 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. Still, we are optimistic that using datasets with finer geographic variation in food prices may be a fruitful research area in the future.

Finally, our results speak to whether adjusting benefit levels to account for geographic variation in food prices across market regions (30 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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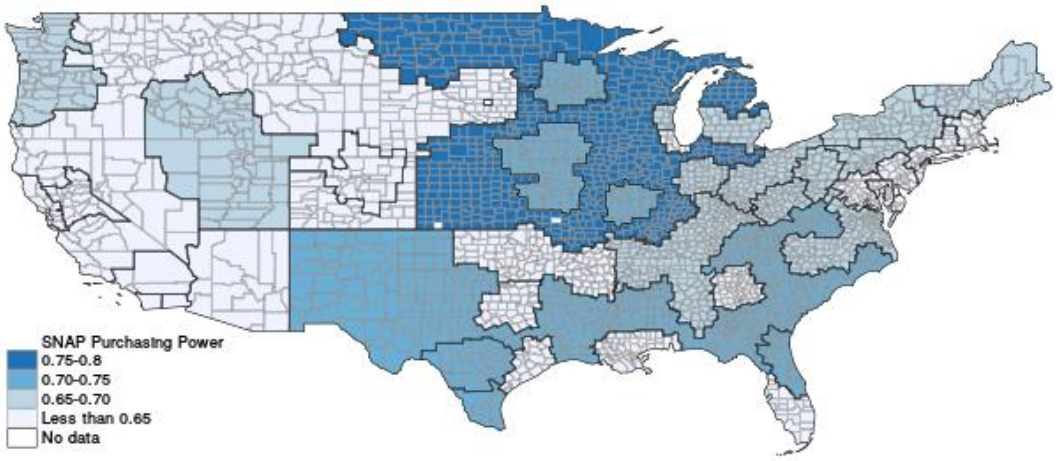
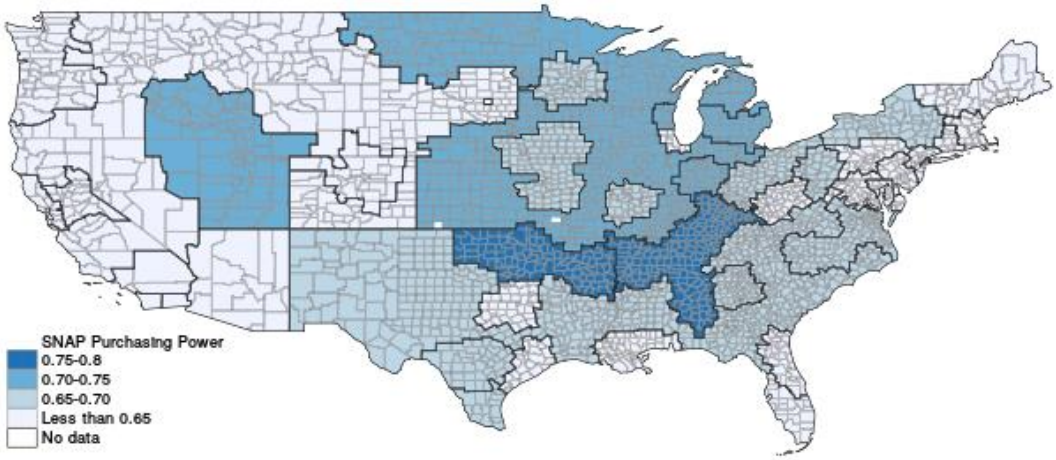
Figure 1: Purchasing Power of SNAP by Market Group

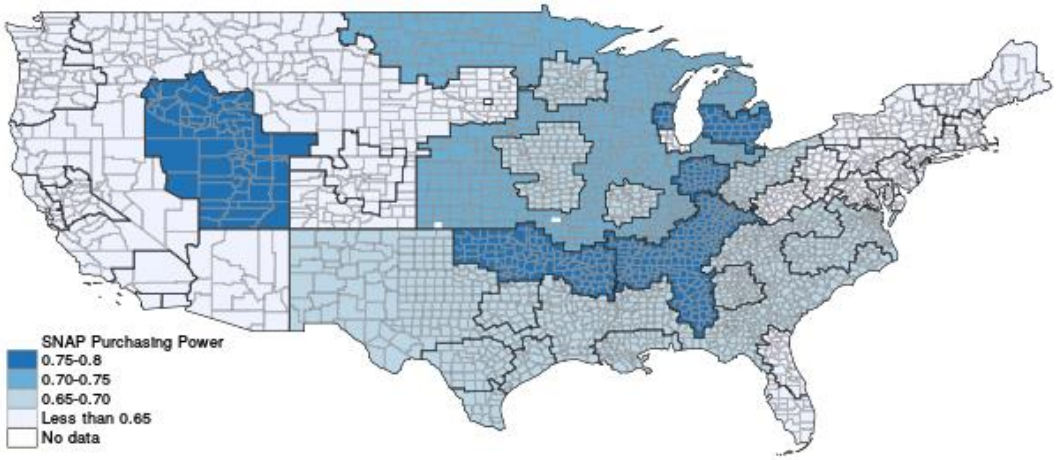
Panel A: 1999



Panel B: 2008



Panel C: 2010



Notes: Maps plot SNAPMAX/TFP for each of the 30 market areas identified consistently in the Quarterly Food at Home Price Database (QFAHPD).

Table 1
Summary Statistics for Samples of U.S. Citizen Children in NHIS who Receive SNAP
(Weighted sample means; standard deviations in parentheses)

Child/Household Characteristics	Sample Children	All Children	*Health Care Utilization*	Sample Children	All Children
TFP price	203	203	Any check-up (12m)	0.770	--
	(14)	(14)		(0.421)	
Max SNAP benefit	143	143	Any doctor's visit (12m)	0.901	
	(12)	(12)		(0.299)	
Income to poverty ratio	0.965	0.896	Any ER visit (12m)	0.315	
	(0.803)	(0.738)		(0.465)	
Child's age	7.4	7.5	Delay/forgo care (12m)	0.058	0.051
	(5.2)	(5.1)		(0.234)	(0.220)
Child is male	0.510	0.507			
	(0.500)	(0.500)	*Health Outcomes*		
Child is black	0.329	0.339	Health status exc. or v. good	0.712	0.700
	(0.470)	(0.473)		(0.453)	(0.458)
Child is Hispanic	0.240	0.260	Hospitalized overnight (12m)	0.086	0.075
	(0.427)	(0.439)		(0.280)	(0.263)
Mother is present	0.934	0.940	School days missed, illness (12	4.96	--
	(0.248)	(0.238)		(9.36)	
Father is present	0.373	0.393	5+ school days missed (12m)	0.332	--
	(0.484)	(0.488)		(0.471)	
Both parents	0.337	0.361	Obese	0.199	--
	(0.473)	(0.480)		(0.399)	
Child receives Medicaid	0.715	0.723	Emotional problem	0.464	--
	(0.451)	(0.448)		(0.763)	
Child has no health insurance	0.072	0.067			
	(0.258)	(0.250)			
Number of observations	18,299	44,627		18,299	44,627

Notes:

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

Outcome = SNAP CASELOAD / POPULATION	(1)	(2)	(3)	(4)	(5)
log(SNAPMax/TFP$_t$)	0.091**	0.024	0.003	-0.004	0.010
	(0.036)	(0.089)	(0.088)	(0.079)	(0.085)
log(SNAPMax/TFP$_{t+1}$)					
Observations	37,277	37,277	37,277	37,177	37,177
R-squared	0.299	0.497	0.514	0.539	0.544
Mean	0.111	0.111	0.111	0.111	0.111
Effect of a 10% increase in SNAP purchasing power	0.0088	0.0023	0.0003	-0.0004	0.0010
Fixed effect for year, county	X	X	X	X	X
County UR		X	X	X	X
State SNAP and other policy controls			X	X	X
Regional price controls				X	X
Linear time trend	No	No	No	No	Yes

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 market group and year. Columns (2)-(6) 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, TANF generosity, 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 goods and services).

Table 3
Effects of Variation in SNAP Purchasing Power on Children's Health Care Utilization
Sample: SNAP Recipient U.S. Citizen Children in the NHIS, 1999-2010

	Children in Sample Child File				All Children
	(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) Delay or forgo care past 12m
log(SNAPMAX/TFP)	0.656***	0.323**	-0.117	-0.178	-0.089
	(0.225)	(0.147)	(0.099)	(0.215)	(0.092)
Mean of dep. var.	0.77	0.901	0.053	0.315	0.051
Effect of 10% increase in SNAP purchasing power	0.063	0.031	-0.011	-0.017	-0.009
As a % of mean of dep. var.	**8.1%**	**3.4%**	-20.9%	-5.4%	-16.6%
N	18,169	18,108	18,296	18,217	44,626
R^2	0.077	0.038	0.024	0.046	0.022

Notes: Results from weighted 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, the child's family size, 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, 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/CHIP income eligibility limits, TANF generosity, 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 goods and services). Finally, all models include year and market group fixed effects. Outcomes in columns 1, 2, and 4 are observed only for children in the Sample Child files.

Table 4
Effects of Variation in SNAP Purchasing Power on Children's Health Outcomes
Sample: SNAP Recipient U.S. Citizen Children in the NHIS, 1999-2010

	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)	-0.069	0.028	-11.43**	-0.148	-0.24	0.055	-0.121	0.02
	(0.208)	(0.124)	(5.374)	(0.272)	(0.374)	(0.468)	(0.199)	(0.065)
Mean of dep. var.	0.701	0.0769	4.955	0.332	0.199	0.464	0.700	0.075
Effect of 10% increase in SNAP purch power	-0.007	0.003	-1.090	-0.014	-0.023	0.005	-0.012	0.002
As a % of mean of dep. var.	-0.9%	3.4%	-22.0%	-4.2%	-11.5%	1.1%	-1.6%	2.6%
N	18299	18291	11420	11420	4471	10779	44,627	44,620
R2	0.033	0.151	0.033	0.041	0.035	0.055	0.032	0.150

Notes: Results from weighted 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 3. 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; information on obesity is consistently available for children ages 12-17, trimmed to exclude the top and bottom percentile of the BMI distribution; and emotional problem defined for the universe of children ages 4 and older.

Table 5

Effects of SNAP Purchasing Power on Food Insecurity

Sample: SNAP Recipient U.S. Citizen Children in the December CPS, 2001-2010

	(1) Child is food insecure	(2) Child is very food insecure
log(SNAPMax/TFP$_t$)	-0.670*	0.0856
	[0.330]	[0.107]
Mean of dep. var.	0.293	0.041
Effect of 10% increase in SNAP purchasing power	-0.0639	0.00816
As a % of mean of dep. var.	**-21.8%**	**19.9%**
N	29,324	29,324
R^2	0.033	0.021

*Notes: Results from weighted 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, the child's family size, 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, age, and citizenship. All regressions also include controls for local economic and policy variables: the state unemployment rate, an index of state SNAP policies (Ganong and Liebman, 2015), the state minimum wage, EITC, and Medicaid/CHIP income eligibility limits, and TANF generosity. Finally, all models include year and market group fixed effects.*

Table 6

Effects of SNAP Purchasing Power on Health Insurance Coverage

Sample: SNAP Recipient U.S. Citizen Children in the NHIS, 1999-2010

	Children in Sample Child File	All NHIS Children 0-17
	(1)	(2)
	No Insurance	No Insurance
$\log(SNAPMax/TFP_t)$	-0.136	-0.071
	(0.146)	(0.136)
Mean of dep. var.	0.068	0.067
Effect of 10% increase in SNAP purchasing power	-0.013	-0.007
As a % of mean of dep. var.	-19.0%	-10.1%
N	18,259	44,540
R^2	0.036	0.033

*Notes: Results from weighted 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, the child's family size, 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, 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/CHIP income eligibility limits, TANF generosity, 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) goods and services. Finally, all models include year and market group fixed effects.*

Table 7

Effects of SNAP Purchasing Power on Health Care Utilization and Health: Robustness Checks

Sample: U.S. Citizen Children in NHIS with Household Incomes between 300 and 450 Percent of Federal Poverty Line, 1999-2010

	A. Health Care Utilization					***B. Health Outcomes***							
	Chldren in Sample Child File				All Children	Chldren in Sample Child File						All Children	
	(1) Had checkup	(2) Doctor's visit	(3) Delay or forgo care	(4) Any ER visit	(5) Delay or forgo care	(1) Health status exc or v good	(2) Hosp. overnight	(3) School days missed	(4) 5+ school days missed	(5) Obese	(6) Emotional problem	(7) Health status exc or v good	(8) Hosp. overnight
$\log(SNAPMax/TFP_t)$	0.232	0.190	-0.049	-0.300**	-0.058	-0.026	-0.051	2.07	-0.095	0.420**	0.285	0.012	-0.013
	(0.208)	(0.125)	(0.049)	(0.116)	(0.044)	(0.107)	(0.053)	(3.14)	(0.151)	(0.159)	(0.275)	(0.104)	(0.045)
Mean of dep. var.	0.756	0.911	0.030	0.175	0.030	0.889	0.051	3.360	0.241	0.113	0.239	0.886	0.054
Effect of 10% increase in SNAP PP	0.022	0.018	-0.005	-0.029	-0.006	-0.002	-0.005	0.197	-0.009	0.040	0.027	0.001	-0.001
As a % of mean of dep. var.	2.9%	2.0%	-15.3%	-16.3%	-18.6%	-0.3%	-9.6%	5.9%	-3.7%	35.4%	11.3%	0.1%	-2.3%
N	24,898	24,887	25,117	25,025	48,616	25,125	25,123	18,189	18,189	8,879	15,644	48,637	48,607
R^2	0.092	0.035	0.008	0.02	0.01	0.023	0.168	0.022	0.020	0.042	0.030	0.023	0.176

*Notes: Results from weighted 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, the child's family size, 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, age, and citizenship. Insurance coverage not included as control in columns 1 and 5. 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, TANF generosity and Medicaid/CHIP 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 goods and services). Finally, all models include year and market group fixed effects. Outcomes in Panel A, columns 1,2, and 4, and outcomes on Panel B, columns 3-6 are observed only for children in the Sample Child files.*

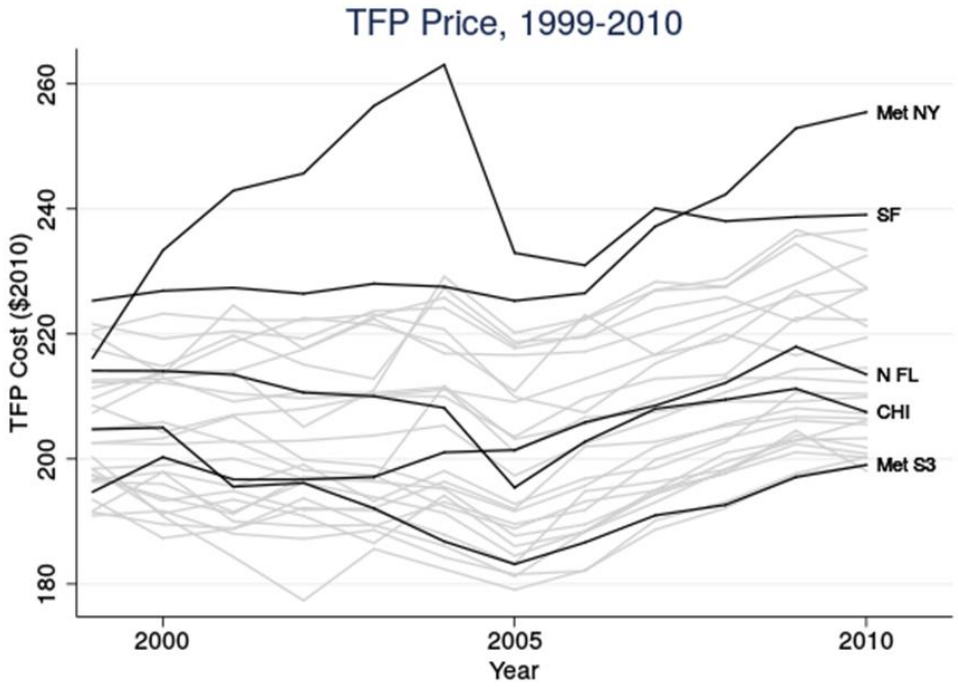
Table 8
Effects of SNAP Purchasing Power on Health Care Utilization and Health: Robustness Checks
Sample: SNAP-Recipient U.S. Citizen Children, 1999-2010

	A. Health Care Utilization					***B. Health Outcomes***							
Robustness Check	Chldren in Sample Child File				All Children	Chldren in Sample Child File						All Children	
A. Include lead term using future TFP price	(1) Had checkup	(2) Doctor's visit	(3) Delay or forgo care	(4) Any ER visit	(5) Delay or forgo care	(1) Health status exc or v good	(2) Hosp. overnight	(3) School days missed	(4) 5+ school days missed	(5) Obese	(6) Emotional problem	(7) Health status exc or v good	(8) Hosp. overnight
$\log(SNAPMax/TFP_t)$	0.517*	0.111	0.023	0.011	0.040	-0.013	-0.094	-13.48**	-0.161	-0.273	0.003	-0.065	0.043
	(0.278)	(0.161)	(0.113)	(0.308)	(0.089)	(0.328)	(0.115)	(5.90)	(0.327)	(0.535)	(0.774)	(0.305)	(0.060)
$\log(SNAPMax/TFP_{t+1})$	0.194	0.260	-0.252**	-0.386	-0.185*	-0.214	0.116	-4.756	-0.303	0.0717	0.266	-0.155	-0.076
	(0.247)	(0.192)	(0.118)	(0.238)	(0.097)	(0.307)	(0.092)	(4.02)	(0.295)	(0.473)	(0.792)	(0.316)	(0.089)
Mean of dep. var.	0.764	0.900	0.055	0.312	0.054	0.700	0.076	4.981	0.333	0.201	0.459	0.697	0.075
Effect of 10% increase in SNAP PP	0.049	0.011	0.002	0.001	0.004	-0.001	-0.009	-1.284	-0.015	-0.026	0.000	-0.006	0.004
As a % of mean of dep. var.	6.5%	1.2%	4.0%	0.3%	7.1%	-0.2%	-11.8%	-25.8%	-4.6%	-13.0%	0.1%	-0.9%	5.5%
B. Include market group-level linear time trends	(1) Had checkup	(2) Doctor's visit	(3) Delay or forgo care	(4) Any ER visit	(5) Delay or forgo care	(1) Health status exc or v good	(2) Hosp. overnight	(3) School days missed	(4) 5+ school days missed	(5) Obese	(6) Emotional problem	(7) Health status exc or v good	(6) Emotional problem
$\log(SNAPMax/TFP_t)$	0.268	0.148	-0.0602	0.0724	-0.0316	-0.282	0.060	-12.53*	-0.018	-0.351	-0.098	-0.228	0.0775
	(0.272)	(0.196)	(0.153)	(0.315)	(0.116)	(0.270)	(0.142)	(6.82)	(0.289)	(0.433)	(0.671)	[0.248]	[0.0637]
Mean of dep. var.	0.770	0.901	0.053	0.315	0.051	0.701	0.077	4.955	0.332	0.199	0.464	0.70	0.07
Effect of 10% increase in SNAP PP	0.026	0.014	-0.006	0.007	-0.003	-0.027	0.006	-1.194	-0.002	-0.034	-0.009	-0.02	0.01
As a % of mean of dep. var.	3.3%	1.6%	-10.8%	2.2%	-5.9%	-3.8%	7.4%	-24.1%	-0.5%	-16.8%	-2.0%	-3.1%	9.9%
C. Alternate Sample: Children of Low-Educated, Unmarried Parents	(1) Had checkup	(2) Doctor's visit	(3) Delay or forgo care	(4) Any ER visit	(5) Delay or forgo care	(1) Health status exc or v good	(2) Hosp. overnight	(3) School days missed	(4) 5+ school days missed	(5) Obese	(6) Emotional problem	(7) Health status exc or v good	(6) Emotional problem
$\log(SNAPMax/TFP_t)$	0.640**	0.100	-0.690	-0.505**	0.013	0.186	-0.065	-11.68	-0.011	0.210	-0.305	0.058	-0.047
	(0.255)	(0.161)	(0.130)	(0.184)	(0.086)	(0.195)	(0.097)	(7.93)	(0.194)	(0.344)	(0.427)	(0.195)	(0.053)
Mean of dep. var.	0.726	0.867	0.061	0.279	0.057	0.708	0.061	4.323	0.305	0.181	0.396	0.705	0.062
Effect of 10% increase in SNAP PP	0.061	0.010	-0.007	-0.048	0.001	0.018	-0.006	-1.113	-0.001	0.020	-0.029	0.006	-0.005
As a % of mean of dep. var.	8.4%	1.1%	-10.9%	-17.3%	2.1%	2.5%	-10.2%	-25.7%	-0.3%	11.0%	-7.3%	0.8%	-7.2%

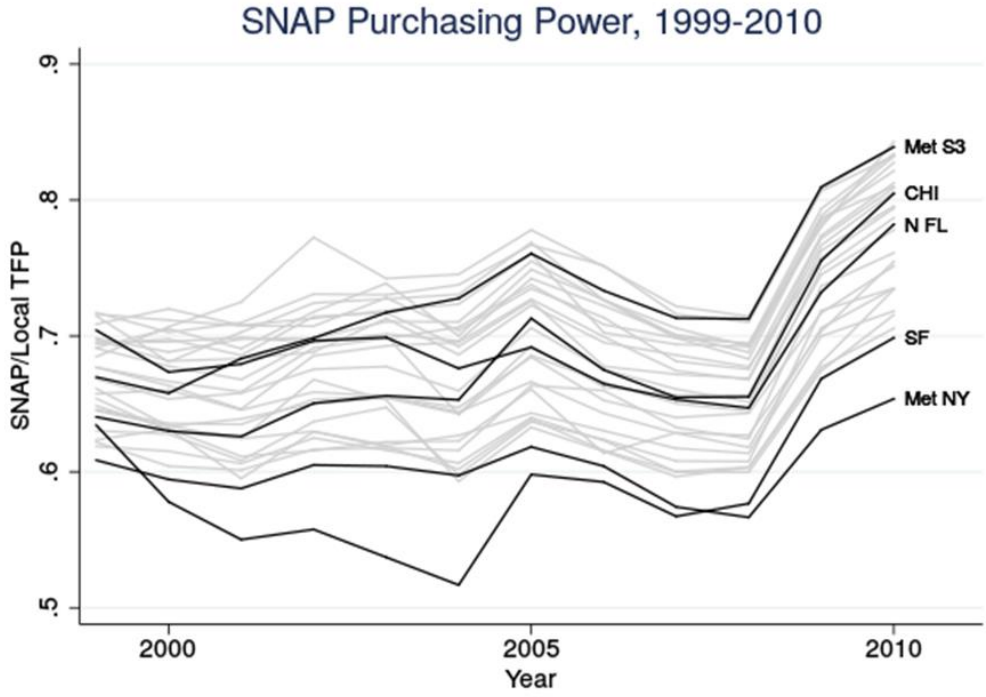
*Notes: Results from weighted OLS regressions. Standard errors in parentheses are corrected for clustering at the market group level; *** p<0.01, ** p<0.05, * p<0.1. All regressions include controls for the child's age (and its square), whether the child is black or Hispanic, the child's family size, 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, age, and citizenship. Insurance coverage not included as control in columns 1 and 5. 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, TANF generosity, and Medicaid/CHIP 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. Outcomes in Panel A, columns 1,2, and 4, and outcomes on Panel B, columns 3-6 are observed only for children in the Sample Child files.*

Appendix Figure 1
Variation across Market Group Areas, 1999-2010

(a) Real TFP Cost 1999-2010



(b) SNAP Purchasing Power



Appendix Table 1
Effects of Variation in SNAP Purchasing Power on Children's Health Care Utilization
Sample: SNAP Recipient Children Ages 0-17 in the NHIS, 1999-2010

	Children in Sample Child File				All Children
	(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) Delay or forgo care past 12m
log(SNAPMAX/TFP)	0.641***	0.288*	-0.126	-0.158	-0.094
	(0.227)	(0.151)	(0.098)	(0.223)	(0.089)
Mean of dep. var.	0.764	0.896	0.055	0.311	0.053
Effect of 10% increase in SNAP purchasing power	0.061	0.028	-0.012	-0.015	-0.009
As a % of mean of dep. var.	**8.0%**	**3.1%**	-21.8%	-4.8%	-17.0%
N	18,765	18,699	18,894	18,815	46,358
R^2	0.082	0.044	0.024	0.047	0.021

Notes: Results from weighted 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 same controls as in Table 3 of the paper. Outcomes in columns 1-4 are observed only for children in the Sample Child files.

Appendix Table 2
Effects of Variation in SNAP Purchasing Power on Children's Health Outcomes
Sample: SNAP Recipient Children Ages 0-17 in the NHIS, 1999-2010

	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)	-0.126	0.023	-11.10**	-0.157	-0.190	0.048	-0.152	0.021
	(0.205)	(0.121)	(5.23)	(0.263)	(0.341)	(0.455)	(0.193)	(0.062)
Mean of dep. var.	0.701	0.076	4.87	0.326	0.196	0.452	0.699	0.073
Effect of 10% increase in SNAP purch power	-0.012	0.002	-1.60	-0.015	-0.018	-0.005	-0.015	0.002
As a % of mean of dep. var.	-1.7%	2.6%	**-32.9%**	-4.6%	-9.2%	-1.1%	-2.1%	2.7%
N	18,897	18,890	11,953	11,953	4,740	11,252	46,359	46,354
R2	0.033	0.148	0.034	0.044	0.034	0.058	0.031	0.148

Notes: Results from weighted 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 4 of paper. Missed school days is defined only for children ages 5 and older who attend school; information on obesity is consistently available for children ages 12-17, trimmed to exclude the top and bottom percentile of the BMI distribution; and emotional problem defined for the universe of children ages 4 and older.

Appendix Table 3
Effects of Variation in SNAP Purchasing Power on Children's Health Care Utilization
Sample: SNAP Recipient U.S. Citizen Children in the NHIS, 1999-2010

	Children in Sample Child File				All Children
	(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) Delay or forgo care past 12m
log(SNAPMAX/TFP)	0.648***	0.301**	-0.100	-0.230	-0.084
	(0.223)	(0.146)	(0.094)	(0.207)	(0.085)
Mean of dep. var.	0.770	0.901	0.053	0.315	0.051
Effect of 10% increase in SNAP purchasing power	0.062	0.029	-0.010	-0.022	-0.008
As a % of mean of dep. var.	**8.1%**	**3.2%**	-18.9%	-7.0%	-15.7%
N	18,126	18,065	18,249	18,171	44,504
R^2	0.087	0.052	0.100	0.063	0.097

Notes: Results from weighted 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 3 of paper but also add controls for family income, whether child has health insurance coverage, and child's health status (1-5). Finally, all models include year and market group fixed effects. Outcomes in columns 1, 2, and 4 are observed only for children in the Sample Child files.

Appendix Table 4
Effects of Variation in SNAP Purchasing Power on Children's Health Outcomes
Sample: SNAP Recipient U.S. Citizen Children in the NHIS, 1999-2010

	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)	-0.074	0.005	-12.16**	-0.179	-0.338	-0.008	-0.140	0.021
	(0.205)	(0.127)	(5.57)	(0.257)	(0.380)	(0.436)	(0.196)	(0.065)
Mean of dep. var.	0.701	0.077	4.96	0.332	0.199	0.463	0.700	0.075
Effect of 10% increase in SNAP purch power	-0.007	0.0005	-1.16	-0.017	-0.032	-0.001	-0.013	0.002
As a % of mean of dep. var.	-1.0%	0.6%	**-23.4%**	-5.1%	-16.1%	-0.2%	-1.9%	2.7%
N	18299	18291	11420	11420	4471	10779	44,627	44,620
R2	0.033	0.151	0.033	0.041	0.035	0.055	0.034	0.150

Notes: Results from weighted 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 4 of paper but also add controls for family income, whether child has health insurance coverage, and child's health status (1-5) when health status is not the outcome of interest. Outcomes in columns (3)-(6) are observed only for children in the Sample Child files.. 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; information on obesity is consistently available for children ages 12-17, trimmed to exclude the top and bottom percentile of the BMI distribution; and emotional problem defined for the universe of children ages 4 and older.