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Local food prices and the purchasing power of SNAP benefits

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ABSTRACT

While the nominal value of Supplemental Nutrition Assistance Program (SNAP) benefits is fixed across states (except for Hawaii and Alaska), variation in food prices across the U.S. is dramatic. We provide new evidence describing geographic variation in the purchasing power of SNAP benefits, measured by the extent to which SNAP-recipient households are able to afford the Thrifty Food Plan (TFP), the U.S. Department of Agriculture (USDA) food plan on which legislated SNAP benefit levels are based. For more than one-quarter of SNAP households, SNAP benefits are too low to cover the cost of the TFP at the primary stores where they report shopping. SNAP purchasing power increases somewhat as we assume households can travel farther to shop and increases much more with the assumed ability to identify and travel to the *lowest-cost* store in a given area. It is unlikely, however, that SNAP households are sufficiently informed and mobile to shop at the lowest-cost store in a large (e.g., 10 to 20-mile) geographic area. We demonstrate that aggregate dollar shortfalls for SNAP households who cannot afford the TFP could be completely eliminated by redistributing from households in low-cost areas to those in high-cost areas, e.g., by indexing SNAP benefits to local food prices.

1. Introduction

The Supplemental Nutritional Assistance Program (SNAP, formerly known as Food Stamps), is one of the largest government assistance programs for the poor in the United States, with nearly 1 in every 8 Americans participating in the program and benefit payments exceeding 65 billion dollars in 2018. A substantial body of literature has demonstrated that SNAP leads to short- and long-run improvements in outcomes like health, education, and economic self-sufficiency, particularly for those who receive benefits as children, and significantly reduces food insecurity in recipient households.[1] Despite the program's successes, rates of food insecurity among SNAP recipients remain high, at over 50 percent (Coleman-Jensen et al., 2012), indicating that many SNAP households may be unable to afford a nutritious diet.

Because SNAP benefit levels are determined nationally and fixed across states (except for Alaska and Hawaii), differences in local food prices across the country can generate wide variation in the *real* value – or purchasing power – of SNAP benefits. Using data on food prices across 35 market groups in the U.S., Todd et al. (2010) and Todd et al. (2011) demonstrate dramatic variation in regional food prices, with prices ranging from 70 to 90 percent of the national average at the low end to 120–140 percent at the high end.[2] Gregory and Coleman-Jensen (2013) confirm that households in market areas with higher food prices are more likely to be food insecure.

This paper provides new evidence describing geographic variation in the purchasing power of SNAP benefits using a unique, nationally representative data set that allows us to match detailed information on SNAP households to the *local* food prices these households face, including at the stores where they actually shop. We measure SNAP purchasing power by calculating the fraction of SNAP-recipient households that are able to afford the local cost of the Thrifty Food Plan (TFP), a food plan constructed by the U.S. Department of Agriculture (USDA) to represent a nutritious diet at a minimal cost. Weighing SNAP benefits against the local cost of the TFP is sensible because the TFP

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[1] For a recent, comprehensive review of the SNAP program and its impacts, see Hoynes and Schanzenbach (2016). Recent evidence of the positive effect of SNAP on health outcomes can be found in East (2016); Gregory and Deb (2015); Hoynes, Schanzenbach, and Almond (2016); Schmeiser (2012); and Almond, Hoynes, and Schanzenbach (2011), among others. SNAP's beneficial impact on food insecurity is documented in recent work by Schmidt, Shore-Sheppard, and Watson (2016); Shaefer and Gutierrez (2013); Mykerezi and Mills (2010); Nord and Golla (2009); Yen, Andrews, Chen, and Eastwood (2008), and reviewed in Gregory, Rabbitt, and Ribar (2015).

[2] Both studies use data from the Quarterly Food at Home Price Database (QFAHPD).

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serves as the basis for legislated SNAP benefits,[3] and because the TFP is a standardized index that is not influenced by any (endogenous) changes in food choices that recipients make in response to higher prices.

Using data from the National Household Food Acquisition and Purchase Survey (FoodsAPS) and FoodAPS-Geography Component (FoodAPS-GC) data sets, we are able to account for variation in local food prices at a much tighter geographic level than has been possible in prior research. Rather than rely on regional food price indices, we link households to multiple local measures of the cost of the TFP they face, using prices from the stores where they are likely able to shop (e.g., stores within given distances) and from the stores at which they report shopping. We then compare several measures of the local cost of the TFP to the financial resources available to the household to spend on food (either SNAP benefits plus 30 percent of net income, or the maximum SNAP benefit for the household's family size).

One key finding is that many SNAP households are unable to afford the TFP at their local stores. For more than one-quarter of SNAP households, SNAP benefits are too low to cover the cost of the TFP at the primary stores where they report shopping. We examine the extent to which SNAP purchasing power increases as households are assumed to be able to travel longer distances to shop. The fraction of recipients who can afford the TFP is fairly stable across different geographic proximity measures but increases slightly as we allow for households traveling farther. For instance, 74 percent of SNAP recipient shoppers can afford the TFP at the median-cost store within 2.5 miles, 75 percent can afford the TFP at the median-cost store in a 20-mile radius, and 77 percent can afford the TFP at the median-cost store in their county.

On the other hand, if one assumes SNAP-recipient households can identify and shop at the store with the lowest TFP cost in their area, the fraction that can afford the TFP is much higher. Of course, the assumption that households can identify and travel to the area store with the lowest TFP cost ignores the potentially high cost of such travel for low-income SNAP shoppers. Even if shoppers were perfectly informed about area stores' prices, traveling to the lowest-cost store may involve significant costs (both financial and time costs) that could outweigh their savings on food. These costs are likely to be higher for the 33 percent of FoodAPS SNAP recipients who do not have a car, or for the 86 percent living in metropolitan areas that often have higher prices.

We also consider the average dollar shortfalls for SNAP households who cannot afford the TFP (at mean or median area prices). For the 20–25 percent of SNAP households for whom benefits are found to be insufficient, we compute the average difference between the local cost of the TFP and the resources available to the household to spend on food. These households face sizeable average shortfalls of approximately $160 per month, compared to approximately $230 in monthly benefits received and approximately $560 in average monthly income.

An important takeaway from these results is that in the aggregate, the dollar shortfalls for SNAP households who cannot afford the TFP could be completely eliminated by redistributing some benefits from households whose SNAP benefits are *more than* sufficient to afford the TFP. That is, policy makers could make the TFP affordable for 100 percent of SNAP households without any additional benefit expenditures by adjusting SNAP benefits for geographic variation in food prices. In the discussion that follows, we explore how the government might go about such an adjustment using existing/available data sets on area food prices, and estimate the aggregate costs of increasing SNAP benefits for those in high-cost counties based on county-level TFP prices.

Our study contributes to the literature on food assistance and food security in a few key ways. We provide some of the first evidence on the purchasing power of SNAP benefits relative to local food prices and show the extent to which SNAP benefits go further when households are able to travel longer distances to shop, or to identify the lowest-cost stores in their areas. This evidence adds to our growing understanding of how and where SNAP households shop. Ver Ploeg et al. (2015) show that SNAP shoppers travel farther (an average of 3.4 miles) to shop at their primary store than to the closest area store that accepts SNAP (on average, 2 miles away from home). While there are a number of possible reasons for traveling beyond the closest store, one possibility is that SNAP households are trying to make their benefits go as far as possible by choosing stores with low prices. However, our evidence suggests that many SNAP households' primary stores are *not* the local stores at which the TFP costs the least. This may be because SNAP households are unable to identify the minimum-TFP-cost store, are buying different bundles than the TFP (and perhaps choosing their primary stores based on the prices of the items they *are* buying), or are choosing stores based on other factors altogether (e.g., selection or proximity to work or public transportation).

More broadly, our analysis relates to other work on how high or low local prices can affect the real value of nominally equitable policies. Çakır et al. (2018); and Leibtag & Kumcu (2011) demonstrate that substantial regional variation in produce prices is likely to affect the buying power and nutritional benefits of the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) fixed-value voucher for purchasing fruit and vegetables. Beyond the literature on food assistance and nutrition programs, Albouy (2009) shows that the nominally equal rates of federal taxation across the country result in substantial penalties in high-wage urban areas and subsidies for low-wage rural areas.

Finally, our work highlights that geographic variation in SNAP purchasing power can provide a source of plausibly exogenous variation in the (real) generosity of benefits. Whereas prior quasi-experimental evaluations of SNAP have focused on the rollout of the program or on changes in eligibility, in related work we use variation in SNAP purchasing power to estimate the impacts of changes in legislated SNAP benefit generosity on child health (Bronchetti, Christensen, and Hoynes 2019), and on the nutritional content of SNAP recipients' diets (Bronchetti, Christensen, and Hansen, 2017). Further research using this approach could add valuable, policy-relevant evidence on the program's short- and long-run impacts.

The paper proceeds as follows. Section 2 provides background on the Thrifty Food Plan (TFP) and describes the FoodAPS data and our methods, including how we construct measures of the local cost of the TFP. Section 3 presents our main results and discusses some of the limitations of our analysis. Section 4 discusses the policy implications of our findings, and Section 5 concludes.

2. Methodology

This paper provides new evidence on the purchasing power of SNAP benefits by assessing SNAP households' ability to buy a specific bundle of food – the USDA's Thrifty Food Plan (TFP) – given local food prices. To do so, we match information on SNAP households in the National Household Food Acquisition and Purchase Survey (FoodAPS) to information on the food retail environment in each household's surrounding area from the FoodAPS Geography Component (FoodAPS-GC).

2.1. The Thrifty food Plan (TFP) and local food prices

We use the TFP to measure the local cost of food for low-income households because the TFP serves as the basis for legislated SNAP benefit allotments and because it provides a standardized bundle of

[3] The national average price of the TFP is used as the basis for legislated maximum SNAP benefit levels. Household benefit levels are then set such that households should be able to purchase the TFP with benefits plus 30 percent of their net income (i.e., gross income minus allowed deductions). Said differently, a household's SNAP entitlement is the maximum benefit for its size minus 30 percent of its net income.

foods, unaffected by demand responses to local prices. The TFP was constructed by the USDA to specify a food plan that would be as close as possible to the desired consumption bundle of low-income households, subject to the constraints that the bundle was affordable, provided sufficient food energy, and reflected a nutritious diet (Wilde and Llobrera 2009).[4] The end result is a set of market baskets – one for each of 15 age-gender groups – that specify the quantities of 59 food categories that could be consumed to obtain a nutritious diet at minimal cost. SNAP maximum benefits are based on the cost of the TFP for a family of four, with two adults and two children (ages 6–8 and 9–11), and then adjusted for family size. In 2018 the national average cost of the TFP for such a family was $148.70 per week.

The first step in our research is to link each SNAP household to measures of what it would cost to purchase the TFP from local stores. The FoodAPS-GC contains retail food price data compiled by researchers at the University of Illinois and the University of Florida (see Gundersen et al., 2016). The researchers used Information Resources, Inc. (IRI) scanner data on UPC-level sales to construct the price-per-pound for each of the TFP food categories, and then computed weekly store-level basket prices as the sum of these prices times the quantities specified in the TFP. We summarize this price data in Table 1. Overall, stores have an average of 6900 UPC items, with 46 percent of stores selling all of whole grains, dark green vegetables, and whole fruit. Restricting to stores with more variety, 29 percent of included stores have items in at least 28 of the 29 TFP food categories (hereafter "full TFP stores"), with an average of 16,800 UPC items.

A concern here is that not all stores are in the IRI data, and not all IRI data was made available to researchers.[5] Comparing the IRI in FoodAPS to TDLinx stores (the largest national database of stores, compiled by the Nielsen Corporation) to assess coverage of stores by IRI, Fan et al. (2018) show that IRI data covers 90 percent of club stores, mass merchandisers, dollar stores, and drug stores; 74 percent of grocery stores; and 53 percent of convenience stores. While these coverage rates are reasonably high, some large chains that participate in the IRI (including, e.g., CVS, Kroger, Safeway, Publix, and Walmart) only provide aggregate price data for regional marketing areas (RMA), not store-level prices (see Muth et al., 2016).[6] DellaVigna and Gentzkow (2019) show that chains set uniform or nearly uniform prices across stores, so we are not especially concerned about this as a potential bias to our estimates. Nevertheless, it is important to remember that even if pricing is uniform across stores in these chains, the geographic variation in food prices captured by our measures of the local TFP cost will reflect both the set of stores that is available to a household within a certain distance and the prices at the non-RMA stores in that set. We note, also, that our measures of the local cost of the TFP are based on stores that are represented in the IRI data shared with FoodAPS and not *all* stores at which respondents might shop, and that some households may not have an IRI store in their immediate area. We return to this issue below.

The data set contains two cost variables, *basket_price* and *low_basket_price*, which can be used to reflect the cost of the TFP at a store. The first takes the median price-per-pound for each TFP category, multiplies that price by the quantity (in pounds) prescribed for the TFP, and sums across TFP categories. The latter makes the same calculation, but computes the median price-per-pound only among items in the lowest decile of prices for that TFP category. We employ the latter measure throughout our analysis for three reasons. First, Gundersen et al. (2016) note that their basket price calculations may overestimate the cost of the TFP because they are based on a store's sales of all food items in each TFP category, including goods that low-income households may be less likely to purchase. Using the *low_basket_price* index helps to mitigate this because it focuses on low-priced items within each category. Second, the assumption that SNAP households purchase lower priced items within food categories seems reasonable. Finally, using the lower of the two estimates of TFP cost will tend to bias us toward more conservative (i.e., higher) estimates of SNAP purchasing power.

Fig. 1 demonstrates substantial geographic variation in this measure of TFP cost, both across counties and across smaller areas (defined by a 3.4-mile radius around the census block group centroid).[7] Reassuringly, our estimates of median TFP costs center around $140, which is similar to the published national average weekly TFP cost estimate for this time period of $144.[8]

We match households to local basket prices by both location and survey week. For subjects surveyed in January 2013, after store price data became unavailable, we assign the basket price from the final week of store price data (from December 2012).[9] We then multiply the weekly cost by 4.3 to obtain a monthly figure for comparison with monthly SNAP benefits.

The estimated cost of the TFP also varies according to a household's size and age-gender composition. The TFP cost used for determining SNAP benefit levels, as well as the estimates in the FoodAPS-GC, are for a family of four, with two adults (male and female, both ages 19–50) and two children (age 6–8 and age 9–11). We adjust for family size using the standard adjustment suggested by the USDA Center for Nutrition Policy and Promotion (CNPP)[10] but we do not fully disaggregate the TFP cost estimates in the FoodAPS-GC to account for the

[4] For each of 15 age-gender groups and 59 food categories, the USDA used food intake data from the National Health and Nutrition Examination Survey (NHANES) to compute average consumption among low-income households. The USDA then used data from the ACNielsen Homescan Panel to create a database of food prices and assign prices to each of the 59 food groups. Nutrient constraints were taken from the *Dietary Guidelines for Americans* and the Institute of Medicine, and food category quantity constraints were based on the USDA's *MyPyramid* recommendations. See Carlson et al. (2007) for more details.

[5] IRI data generally includes a "census" component of companies that provide data for *all* locations of their stores, and a "sample" component that is a representative sample. IRI does not share its proprietary sample component, so the FoodAPS data contains only the census component. For more information, see Muth et al. (2016, p. 20).

[6] Chains providing this data are referred to as Regional Market Area (RMA) stores. Overall, 32 percent of stores are RMA stores, while 56 percent of stores with 28 or more TFP categories are RMA stores. For further information on the coverage of stores in the FoodAPS-GC data, see https://www.ers.usda.gov/media/8582/priceindexdata.pdf, p. 10.

[7] To reduce the risk of disclosing confidential FoodAPS information, the USDA Economic Research Service (ERS) prevents us from showing a map or geographic distribution of these prices, as the FoodAPS-GC data only contain prices from the primary sampling units and neighboring counties in which FoodAPS households reside. FoodAPS prevents disclosure of data at the county level or a finer geographic level.

[8] The basket price measure might underestimate the true cost of the TFP at a store because IRI stores that do not sell particular items prescribed by the TFP do not include a price estimate for that item or food category. This would tend to bias our estimates of SNAP purchasing power upward, since basket prices will be the sum of fewer positive values. Column 3 of Table 4 shows that results are similar when we use only stores with near-complete TFP baskets. See https://www.cnpp.usda.gov/USDAFoodPlansCostofFood/reports for TFP measures over time.

[9] Ignoring the week of basket price data collection completely, and instead assigning respondents to the average TFP price over the entire survey period yields nearly identical estimates.

[10] This adjustment is described in the monthly USDA Cost of Food report, as follows: "The costs given are for individuals in 4-person families. For individuals in other size families, the following adjustments are suggested: 1-person—add 20 percent; 2-person—add 10 percent; 3-person—add 5 percent; 4-person—no adjustment; 5- or 6-person—subtract 5 percent; 7- (or more) person—subtract 10 percent. To calculate overall household food costs, (1) adjust food costs for each person in household and then (2) sum these adjusted food costs." See https://www.cnpp.usda.gov/sites/default/files/CostofFoodSep2016.pdf, for more information.

Table 1
Summary of IRI basket price data.

	All	Stores with > =28 TFP Categories	Stores with 29 TFP Categories
Total observations	1,186,954	381,590	231,246
Average weeks observed per store	51	57	64
Stores (N)	23,147	6,659	3,623
Stores with a price every week (N)	21,756	6,474	3,614
RMA stores (N)	7,409	3,744	3,497
Stores with a price every week (%)	94%	97%	100%
RMA stores (%)	32%	56%	97%
TFP categories per store	23.92	28.66	29.00
UPC count	6,891.5	16,831.6	23,768.2
UPC count: whole grain	13.4	45.2	65.3
UPC count: dark green veg	14.3	47.3	64.1
UPC count: whole fruit	106.2	304.6	427.7
Stores with any whole grain (%)	58%	100%	100%
Stores with any dark green veg (%)	54%	100%	100%
Stores with any whole fruit (%)	96%	100%	100%
Stores with whole grain, dark green veg, and whole fruit (%)	46%	100%	100%

Notes: Table summarizes the food price data available in the FoodAPS-GC, containing repeated weekly observations of UPC counts, TFP categories, and prices at stores in IRI data. The first column summarizes all stores while the second and third are restricted to stores with a weekly average of at least 28, or all 29, TFP categories available for purchase.

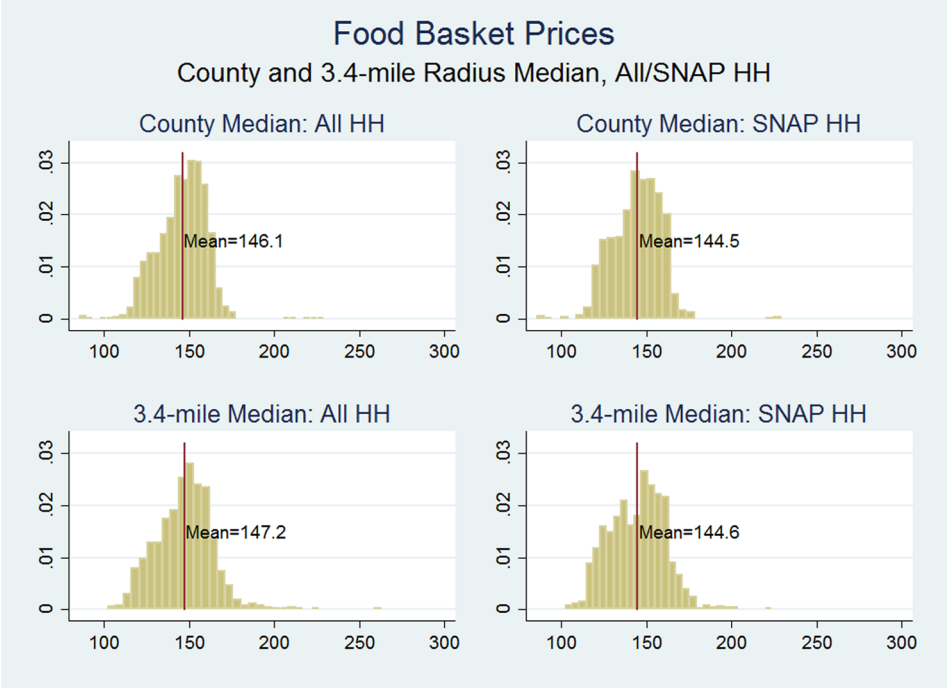

Fig. 1. Geographic variation in FoodAPS-GC low-cost basket prices (Distribution of median low-cost basket prices within county and 3.4-mile radius, for all FoodAPS households and SNAP-recipient households).

age and gender composition of sample households. For example, our TFP cost estimates will be the same for a family with 2 adults and one teenager as for a family with a single mother and two young children, even though these households have different nutritional needs.[11]

We analyze the purchasing power of SNAP to purchase the TFP using multiple measures of the local TFP cost faced by respondent households, which involve different assumptions about how and where respondents shop:

- basket cost at the primary and alternate stores at which the respondent reports shopping, as well as the average of these two basket costs
- the mean, median, and minimum basket cost in the respondent's county
- the mean, median, and minimum basket cost at stores within an X-mile radius of the respondent's census block group centroid (where X = 20, 10, 5, 3.4, 2.5) [12]
- the mean, median, and minimum basket cost at the X stores nearest to the respondent's census block group centroid (where X = 10, 5, 2, 1).

[11] This simplification is unlikely to make a significant difference—among FoodAPS SNAP families with four people, the average number of children is 1.85, close to the 2 assumed by the formula. The cost of the TFP for a child is approximately 90% of the cost for an adult woman and 80% of the cost for an adult man.

[12] We choose 3.4 miles here because that is the population weighted average of the straight-line distance to shoppers' primary store.

Given that some local stores may not be in the FoodAPS-GC data, either because they do not participate in IRI or are not in the subset of IRI stores shared with end users, it is encouraging that even at the smallest geographic level (a radius of 2.5 miles), we are able to link over 80 percent of all SNAP households to a local TFP cost estimate. Of course, that percentage rises as we use larger areas to estimate the local TFP cost faced by the household. We also investigate the characteristics of respondents whom we can link to a store and compare them to characteristics of those without IRI-covered stores near them. SNAP households for whom we cannot observe a local TFP cost estimate tend to be older and less likely to live in a metro area, but are otherwise similar to those whom we can match to a local store.[13] Finally, in the Appendix we demonstrate that our results are qualitatively very similar if we use a consistent sample that only includes SNAP households for whom we can observe a TFP cost estimate in the smallest radius we describe above (2.5 miles).[14]

2.2. Data on SNAP households and food shopping

The FoodAPS is a nationally representative survey of nearly 5000 households, conducted by the USDA's Economic Research Service (ERS) between April 2012 and mid-January 2013. FoodAPS data include detailed information on the food purchases and acquisitions of nearly 5000 households, as well as information on their demographic characteristics, income and employment, and SNAP participation. An advantage of the FoodAPS data is that survey responses are matched to SNAP administrative records so that self-reports of SNAP participation and benefit receipt can be confirmed (see Clay et al., 2016). We focus on the sample of FoodAPS respondent households who received SNAP benefits in the past month.[15] These SNAP participant households are oversampled by the survey: Of the 4826 households in the dataset, 1581 (33 percent) were receiving SNAP benefits at the time of interview.

While the primary focus of the survey was a detailed tracking of all food acquired by the household (both quantities and expenditures) from all sources over a one-week period, the data set's Geography Component (FoodAPS-GC) contains detailed information on the food retail environment in each household's surrounding area. Using these data, we are able to match households to stores (and prices) at the level of the census block group, rather than to stores within a wider geographic area, as in prior research. Geographic identifiers are masked in the public data, but they are made available to researchers on a restricted-use basis.[16]

It is worth considering how reliably the FoodAPS measures outcomes related to food spending and shopping, SNAP participation, and income. Clay et al. (2016) compare the FoodAPS to data from other national surveys that gather information on these topics. They document that FoodAPS finds a five percent greater amount of spending on food than the Bureau of Labor Statistics' (BLS) Consumer Expenditure Survey (although there is no difference for households with children), and significantly more food insecurity than in either the National Health Interview Survey (NHIS) or the Current Population Survey-Food Security Supplement. However, the main variables of interest to our analysis are SNAP participation and income. Compared to data from the Survey of Income and Program Participation (SIPP), FoodAPS estimates a nearly identical rate of SNAP participation (13.6 percent). For SNAP participating households, FoodAPS estimates somewhat higher average incomes than does the SIPP. Because FoodAPS cannot precisely measure the SNAP unit(s) within the household, it may overestimate income for each SNAP household (e.g., a household containing two SNAP units would be treated as a single SNAP unit, with all household income attributed to it). In Section 2.3, we explain that to the extent that FoodAPS overestimates income for SNAP households, this is likely to bias our estimates of SNAP purchasing power upward (i.e., toward 100 percent).

2.3. Measuring resources available to the household to purchase food

To analyze the purchasing power of SNAP benefits, we compare each household's resources for purchasing food to the local TFP cost estimates described above. We describe SNAP purchasing power as the fraction of households who can afford the TFP based on two measures of the resources available for purchasing food: (1) SNAP benefits received plus 30 percent of net income and (2) the maximum legislated SNAP benefit for the household's size.

We estimate a household's net income by subtracting from its reported gross income all the SNAP-allowed deductions for costs associated with housing, earnings, dependent care, medical expenses and child support payments. We use household-level and person-level data to estimate the amount of these deductions.[17] Of particular importance is the excess shelter deduction, not only because of its size, but because it is the primary deduction that would help to offset geographic variation in other prices (i.e., of non-food items). The excess shelter deduction allows households to deduct any shelter expenses (e.g., mortgage or rent, plus utilities) that exceed 50 percent of their income after all other deductions have been made, up to a cap ($459 in 2012).

We use 30 percent of income because SNAP benefit amounts are designed with the assumption that recipient households spend approximately 30 percent of their cash resources on food. Accordingly, a family's SNAP benefit is determined by subtracting 30 percent of the family's net income from the maximum legislated benefit, which is set equal to the national average cost of the TFP. When the deductions described above reduce a household's net income to zero, the household receives the maximum benefit. Approximately 10 percent of SNAP recipient households in our sample are determined to have no net income and thus receive the maximum benefit.

Given how SNAP benefit levels are calculated, our two measures of household resources for food spending (benefits plus 30 percent of net income and the SNAP maximum benefit level) would be identical with perfect reporting and program administration, and if we correctly calculate the deductions from gross income.[18] In practice, however, there

[13] See Appendix Table 1.

[14] Please see Appendix Tables 2, 3, 4, and 5 for tables constructed analogously to Tables 2 through 5 in the main paper.

[15] The household interview file contains variables indicating SNAP participation as reported in the initial interview (SNAPNOWREPORT) and reported SNAP participation status that is revised per the match to administrative data (SNAPNOWHH). We use SNAPNOWHH to define the sample of SNAP recipient households. See page 20 of the FoodAPS documentation at https://www.ers.usda.gov/media/8804/0_foodaps-user-guide-puf.pdf.

[16] See http://www.ers.usda.gov/data-products/foodaps-national-household-food-acquisition-and-purchase-survey.aspx. Due to data access restrictions, we are unable to share these data; however, the USDA has made available a public use data set without geographic identifiers.

[17] The full list of deductions can be found at https://www.fns.usda.gov/snap/eligibility#What deductions are allowed in SNAP? deductions are allowed in SNAP? FoodAPS asks respondents about many of these, which we use to calculate net income: medical expenses for the elderly (EXPPOPMEDICAL60), rent/mortgage (EXPRENTMRTG), heating and cooking fuel (EXPHEATFUEL), electricity (EXPELECTRIC), property taxes (EXPPROPTAX), home insurance (EXPHOMEINS), child care (EXPCHILDCARE), and child support owed (EXPCHILDSUPP).

[18] Another option in lieu of calculating net income from reported gross income and deductions would be to use the data on benefits and family size to back out net income. In theory this should yield results that are identical to those we find using maximum benefits for a given family size, and the two measures are likely to be very similar in practice. Differences between these three measures arise exclusively from misreporting. We prefer to use the measure of net income calculated from gross income and deductions (which requires the most self-reported data) and the SNAP maximum benefit entitlement (requiring the least self-reported data) to cover the full range of possibilities.

are small but meaningful differences in the results for these two measures. We describe these further below.

In addition to calculating the fraction of households that can afford the local cost of the TFP, we also compute average dollar shortfalls for households for whom SNAP benefits are found to be insufficient to purchase the TFP. Specifically, we calculate the average difference between the cost of the TFP and the household's SNAP benefits plus 30 percent of net income (or the maximum SNAP benefit). We are particularly interested in the distribution of these differences, which sheds light on the feasibility of some policy options, like the adjusting SNAP benefits for local food prices (i.e., redistributing from low food price areas to higher food price areas).

3. Results

3.1. SNAP purchasing power and distance to shop

Table 2 displays evidence on the purchasing power of SNAP benefits, measured as the fraction of SNAP households who can afford the local cost of the TFP. In the top panel, we show that only 77 percent of SNAP households in the FoodAPS data find their SNAP benefits plus 30 percent of net income to be sufficient to afford the national average cost of the TFP ($145). Because maximum SNAP allotments are set according to the national average TFP cost, all households can afford the statutory TFP cost under the maximum benefit.

More interesting is the share of SNAP households who can afford the TFP at their *local* stores, also displayed in the top panel. Measuring household resources for food as SNAP benefits plus 30 percent of net income, we find that 76 percent of households could afford the TFP at the store located nearest to them, and only 73 percent could afford the TFP at the primary store at which they shop. If SNAP households are assumed to receive the maximum SNAP benefit for their size, these fractions are notably lower, at 68 percent and 63 percent, respectively. These differences may be a result of our overestimating net income (perhaps by underestimating the value of allowed deductions from gross income). If this is the case, our estimates in the first column paint too optimistic a picture of the ability of SNAP households to afford the TFP.[19]

Next, we use TFP cost estimates from increasingly local geographic regions—from the national average and Census region-level average TFP costs down to the TFP cost at stores within a 2.5-mile radius. The table also shows results for the 10, 5, 2, and 1-nearest stores. For each set of stores, we compute the fraction of households who can afford the mean, median, and minimum of TFP prices (panels B, C, and D, respectively). We note that the sample size decreases as the TFP cost measure becomes increasingly local because, e.g., not all households can be linked with a TFP cost within 2.5 miles. This could be because there is no store within 2.5 miles, or it could be because stores within that radius are not IRI stores (and therefore, are not observed in the FoodAPS-GC TFP price data). Appendix Table 2 demonstrates that the results are very similar when we limit the analysis to a consistent sample by including only households for whom we have a local TFP cost measure for all of the proximity measures we consider (i.e. households who have an IRI store within 2.5 miles).

Irrespective of how tightly we define the geographic area in which

Table 2
Fraction of SNAP recipient households that can afford the local cost of the TFP.

	(1) *SNAP Benefits + 30% Net Income Exceeds Local TFP Cost?*		(2) *Maximum SNAP Benefit Exceeds Local TFP Cost?*	
Measure of TFP Cost	% of Households	Sample Size	% of Households	Sample Size
Panel A.				
Statutory TFP cost ($145)	77%	1444	100%	1581
Mean TFP cost of all stores in IRI data ($156)	68%	1444	0%	1581
TFP cost, nearest store to respondent	76%	1290	68%	1414
TFP cost, primary store where respondent reports shopping	73%	723	63%	798
TFP Cost, alternate store where respondent reports shopping	77%	504	70%	552
Mean TFP cost, primary and alternate stores	74%	985	69%	1082
TFP cost, store where respondent shopped most	73%	629	63%	689
Panel B. Mean TFP cost at stores within respondent's:				
Census region	72%	1444	74%	1581
State	75%	1444	76%	1581
County	74%	1436	76%	1572
20-mile radius	74%	1338	73%	1464
10-mile radius	73%	1311	74%	1433
5-mile radius	71%	1224	74%	1338
3.4-mile radius	72%	1174	74%	1281
2.5-mile radius	71%	1123	72%	1225
10 nearest stores	73%	1338	79%	1464
5 nearest stores	71%	1332	72%	1458
2 nearest stores	73%	1332	72%	1458
Panel C. Median TFP cost at stores within respondent's:				
Census region	75%	1444	83%	1581
State	75%	1444	76%	1581
County	77%	1436	75%	1572
20-mile radius	75%	1338	73%	1464
10-mile radius	75%	1311	73%	1433
5-mile radius	74%	1224	72%	1338
3.4-mile radius	74%	1174	74%	1281
2.5-mile radius	74%	1123	72%	1225
10 nearest stores	75%	1338	77%	1464
5 nearest stores	74%	1332	71%	1458
Panel D. Minimum TFP cost at stores within respondent's:				
Census region	100%	1444	100%	1581
State	99%	1444	100%	1581
County	94%	1436	100%	1572
20-mile radius	94%	1338	100%	1464
10-mile radius	92%	1311	100%	1433
5-mile radius	90%	1224	99%	1338
3.4-mile radius	89%	1174	100%	1281
2.5-mile radius	89%	1123	99%	1225
10 nearest stores	89%	1338	100%	1464
5 nearest stores	87%	1332	98%	1458
2 nearest stores	81%	1332	85%	1458

Notes: The first and third columns display the survey-weighted fraction of households who can afford the local cost of the TFP. The local cost of the TFP is based on weekly store-level "basket prices" computed from IRI scanner data on UPC-level sales (see Gundersen et al., (2016)). Respondent households are matched to weekly basket prices at IRI stores according to household's census block group and week of interview. Some households do not have an IRI store within the given radius of their home, causing the sample size to fall as we decrease the distance to the respondent's home when defining the "local" cost of the TFP. See Appendix Table 2 for results using consistent samples of households who have non-missing TFP price estimates within the smallest radius (2.5 miles).

[19] Note that each fraction is calculated for the sample of households for which we can calculate the given measure of local TFP cost using FoodAPS-GC data. For example, if the store located nearest to the household store is not an IRI-participating store, the FoodAPS-GC will not contain price data for that household-store combination, and the household will not be included our sample for that calculation. Sample sizes differ between columns 1 and 2 because income data are missing for some households. Estimates are nearly identical when we restrict the maximum benefits sample to those for whom we can also calculate net income (keeping sample sizes equal across columns 1 and 2). Results available upon request.

households shop, we find that between 71 percent and 79 percent of households can afford to purchase the mean or median TFP cost at *local* stores.[20] For example, when the estimated TFP cost is based on prices at stores within 2.5 miles from the block group centroid where a respondent resides, we find that 74 percent of households can afford the median TFP cost with SNAP benefits plus 30 percent of net income. This share only increases by 3 percentage points, to 77 percent, when we compare household resources to the county-level median TFP cost. As above, the fraction that can afford the TFP at median store prices is slightly lower when we compare maximum benefit levels to the estimated TFP cost instead of SNAP benefits plus 30 percent of net income.

In the bottom panel of Table 2, we describe what happens to SNAP purchasing power when one assumes that SNAP recipients can identify and shop at the *lowest* cost store within a given area. Not surprisingly, the fraction of households that can afford the TFP using their SNAP benefits plus 30 percent of net income increases dramatically, ranging from 81 percent when we assume shoppers purchase the TFP at the lowest cost of the two nearest stores, to 94 percent when they purchase the TFP at the minimum-cost store in the entire county. We also note that SNAP households report traveling an average of 3.4 miles to their primary stores, at which 73 percent of them can afford to purchase the TFP. By our calculations, SNAP purchasing power increases meaningfully if these households instead shop at the *lowest-cost* store within that same distance, with 89 percent of them able to afford the TFP.

While more SNAP households can afford the TFP at the minimum-cost store in their areas, we caution against too optimistic an interpretation of these results for several reasons. First, recall that we are already imposing the assumption that within any given store, shoppers purchase TFP items with prices in the lowest decile of prices for that TFP category; nonetheless, the fraction of shoppers who can afford this price at the lowest-cost store in their county (using their SNAP benefits plus 30 percent of net income) is still meaningfully lower than 100 percent. Second, given the large size of most counties (the median is over 600 square miles), it seems extremely unlikely that most shoppers are able to identify and travel to such a store. Even if shoppers were to do so (e.g., travel halfway across a median-sized county to shop at the store with lowest TFP cost), they would incur significant travel costs (both financial and time), which may outweigh their savings on food. These costs are likely to be higher for the 33 percent of FoodAPS SNAP recipients who do not have a car, or for SNAP recipient households who live in high-priced, urban areas. While significant savings might be achievable by traveling 10+ miles to the lowest TFP-cost store in the county, the barriers to doing so are likely to be prohibitively high in this population. Finally, our estimates of the minimum TFP cost within a given area may understate the true local cost of the TFP because stores without *any* foods in a certain TFP category will have an artificially low TFP cost in our data.[21] We discuss this issue further below and conduct a robustness check using TFP cost measures that come only from stores that have items (and thus, prices) for at least 28 of the 29 TFP categories. Indeed, our estimates of SNAP purchasing power are significantly lower when we do so.

In Table 3 we describe the characteristics of households with high versus low SNAP purchasing power (i.e., for whom the SNAP maximum benefit is sufficient versus insufficient to purchase the TFP at the county median price). Of course, recipient households with low SNAP purchasing power are significantly more likely to live in high food price areas (defined as the 75th percentile of national TFP estimates) and more likely to reside in metropolitan areas. They also have higher average incomes and are more likely to have a college degree, suggesting that the extra income urban residents tend to earn is not sufficiently large to accommodate the increase in the price of food. Most other measures, including those related to material hardship, do not differ significantly across the two samples, perhaps due to the limited size of the samples. For example, households with low SNAP purchasing power appear somewhat less likely to own a car, suggesting perhaps greater difficulty in traveling to low-cost stores in their areas, but the difference is not statistically different from zero. Similarly, we do not find any significant differences in the unconditional means of variables measuring food security or budgetary strain (i.e., trouble paying bills) for these two groups.

Table 3 also includes information on the type of stores at which household shop. Only two to five percent of SNAP households report that their primary store is neither a supermarket nor a superstore, and differences across purchasing power are not significant. 45–47 percent have a primary store that is a supermarket, while 50–51 percent have a primary store that is a superstore. These stores are likely to have all types of food in the TFP available for purchase, an issue which we return to below.

3.2. Robustness Checks

In Table 4 we present the results of several checks on our main estimates of SNAP purchasing power. First, if take-up of SNAP benefits is endogenous with respect to local prices, and households facing higher local prices are more likely to participate, estimates of SNAP purchasing power among our sample of SNAP-participating households may be too low. To check this, we also conduct the analysis on a sample of FoodAPS households imputed to be eligible for SNAP benefits. FoodAPS uses the Household Survey of Income and Program Participation + (MATH SIPP+) Microsimulation model to impute eligibility for SNAP based on four different simulation models (Leftin, et al. 2014). We use the indicator for eligibility that is generated by their model 4, which differs from the other models in that it allows for multiple SNAP units in a household (whereas models 1 and 2 do not) and adjusts reported net earnings by a factor of 1.4 to approximate gross earnings (while model 3 does not). Model 4 identifies 2405 FoodAPS households as containing an eligible SNAP unit. Eligible households that do not take up SNAP are widely assumed to be better off, on average, than households that do enroll, so readers should interpret these results with caution.

Column 1 of Table 4 shows the fraction of SNAP-eligible households that can afford the local cost of the TFP assuming they receive the maximum SNAP benefit for their size.[22] We find that SNAP purchasing power for these households is generally lower than for SNAP recipients (see Table 2), suggesting we are unlikely to be underestimating SNAP purchasing power when we focus on the selected sample of households who have taken up SNAP.

A second concern is that our main results may be based on a sample of disproportionately urban households because many rural areas lack an IRI-participating store and thus, SNAP households in those areas cannot be matched with a local TFP cost. If food prices tend to be higher in urban areas, this may cause us to underestimate SNAP purchasing power in Table 2. In column 2 of Table 4, we explicitly limit the sample to households in that live in metropolitan areas.[23] We note that the sample size decreases only about 10 percent from that in Table 2 (column 2), consistent with our sample of FoodAPS SNAP households

[20] When we refer to local stores, we do not include the comparisons to TFP costs within the household's state or Census region.

[21] Recall that basket price estimates are not scaled or corrected for missing food categories; when a store has no items in a food category the basket price is just a sum of fewer positive terms.

[22] We use maximum SNAP benefits as the measure of resources available to the household to avoid confounding any effects of the change in sample with effects of having to use simulated SNAP benefits for households that do not receive them. In results not shown here, we find that the FoodAPS simulated SNAP benefits are much higher for the sample of SNAP-recipient households than the self-reported, administratively confirmed benefit amounts.

[23] Again for the sake of comparison, we use a household's maximum SNAP benefit as the measure of resources available for spending on food.

Table 3
Average characteristics of SNAP households, by SNAP purchasing power.

	(1) Low SNAP PP *(Max SNAP Benefit < Local TFP Cost)*	(2) High SNAP PP *(Max SNAP Benefit > Local TFP Cost)*	(3) p-value
Household size	3.03	2.87	0.39
Household max age	50.88	49.33	0.28
Household min age	27.02	28.13	0.66
Household per capita income	865.38	783.11	0.36
Household income (monthly)	2402.43	1947.86	0.05
Percent of federal poverty line	142.51	124.04	0.11
Household has earned income	0.51	0.53	0.63
Household has car	0.61	0.69	0.24
Travel time to primary store (minutes)	11.21	11.61	0.73
Chooses primary store because of prices	0.64	0.60	0.38
Primary store is small (FoodAPS definition)	0.03	0.05	0.33
Primary store is small (SNAP definition)	0.02	0.05	0.20
Primary store is supermarket	0.47	0.45	0.89
Primary store is superstore	0.51	0.50	0.82
Household member has college degree	0.19	0.09	0.00
Household has elderly member	0.3	0.27	0.36
Number of children in Household	1.09	1.03	0.54
Lives in metro area	0.97	0.83	0.01
High food security	0.34	0.32	0.47
Marginal food security	0.25	0.21	0.22
Low food security	0.24	0.26	0.61
Very low food security	0.17	0.21	0.35
Trouble paying bills	0.29	0.28	0.57
High food price area	0.88	0	0.00
Northeast	0.23	0.09	0.25
Midwest	0.24	0.34	0.34
South	0.33	0.43	0.23
West	0.21	0.14	0.48
Number of observations	382	1190	

Notes: Table shows average characteristics of households for whom resources (defined as maximum benefit for household size) are insufficient/sufficient to purchase the TFP at the county median price. Local cost of the TFP is estimated as described in Table 2. Estimates are survey-weighted; column (3) displays p-value on F-test for equality.

disproportionately living in metropolitan areas. We find that the fraction of households who can afford the local cost of the TFP is, not surprisingly, slightly lower here than in Table 2, but still tends to be around 70–75 percent.

Finally, as we described above, the primary measures of local TFP costs may understate the true cost of the TFP because stores that do not sell *any* items in a particular TFP category will have basket prices that are artificially low. In column 3 we show the results of a robustness check wherein we employ TFP cost measures that come from "full TFP stores"—those that have items (and thus, prices) for at least 28 of the 29 TFP categories.

The results, displayed in column 3 of Table 3, indicate significantly lower SNAP purchasing power for households shopping within local areas. The fraction who can afford the TFP is generally several points lower than indicated by the corresponding estimates in Table 2. For example, now only 54 percent of households can afford the TFP at full TFP stores within a 3.4-mile radius (the average reported distance SNAP households travel to shop), a reduction of 20 percentage points relative to the corresponding estimate in Table 2.

While we attempted in Table 2 to provide conservative estimates of the fraction of SNAP households who can afford the TFP by keeping the sample of stores at which we estimated TFP prices as large as possible, the more dismal estimates in column 3 of Table 4 may better reflect the true purchasing power of SNAP shoppers at the stores where they actually shop. As demonstrated in Table 3, the vast majority of SNAP households report that their primary store for food purchases is a supermarket or superstore, i.e., a full TFP store.

3.3. Do SNAP households shop at the local store with the lowest Prices?

Our results in Tables 2 and 4 consistently show that the fraction of SNAP households who can afford the TFP is substantially higher if households are assumed to be able to shop at the minimum-TFP cost stores in their local areas. A natural question is to what extent households *do* identify and shop at the area stores with the lowest prices. When asked for their reasons for choosing their primary stores, the reason SNAP households reported most frequently was low prices (59 percent). (The next most frequent reason was proximity.)

We examine directly whether the household's reported primary store is, indeed, the local store at which the TFP costs the least. To do so, we limit the sample of SNAP households to those whose primary store is one of the IRI stores in the FoodAPS-GC, and continue to limit the set of stores to those with items in at least 28 out of 29 TFP categories (so that our TFP price estimates are not artificially low). We find that the fraction whose primary store is also the lowest TFP-cost store in their local (2.5-mile) area is around 47 percent.[24] This fraction is somewhat lower, but broadly consistent with the 59 percent whose stated preferences for low prices affected their choice of their primary store.

On the other hand, this also suggests that roughly half of SNAP households are *not* shopping at the lowest TFP-cost stores nearby. This may be because additional factors weigh into households' decisions about where to shop, SNAP households are buying other items than those in the TFP (and choosing stores with low prices for *those* items), and/or these households are choosing primary stores with TFP prices that are also quite low, but not the very lowest in their area. Examining the data directly, we find that households whose primary stores are *not* the lowest TFP-cost stores in their local areas are significantly more likely to list quality of items or a store loyalty program as reasons for their choice of primary store than those who shop at the lowest TFP-cost store, and significantly less likely to report low prices as a reason for their store preference.

3.4. Budget shortfalls

While the result that roughly a quarter of SNAP-recipient households in our sample are unable to purchase the TFP at local prices is striking, the fraction of households who can or cannot afford the TFP is only one measure of SNAP purchasing power. Here, we shed light on the degree to which households with low SNAP purchasing power fall short of being able to afford the TFP.

Table 5 contains estimates of the average dollar shortfall for SNAP-recipient households for whom SNAP purchasing power is too low to afford the local cost of the TFP. This shortfall is calculated as the difference between SNAP benefits plus 30 percent of net income and the local cost of the TFP, or between maximum SNAP benefits and the cost of the TFP. Using benefits plus 30 percent of net income for the measure of resources available to the household, those who are unable to afford the TFP face a shortfall of $159–174 each month (if facing the mean TFP cost in their area) or $145–164 each month (if facing the median TFP cost). Measuring with the maximum benefit yields average

[24] The analogous fraction of households for whom the store at which they spent the most is also the lowest TFP-cost store within 2.5 miles is very similar, at 48 percent.

Table 4
Fraction of households that can afford the local cost of the TFP: alternative samples and robustness checks.

	(1) SNAP Eligible Households *Maximum SNAP Benefit Exceeds Local TFP Cost?*		(2) Urban SNAP Households *Maximum SNAP Benefit Exceeds Local TFP Cost?*		(3) Full TFP Stores *Maximum SNAP Benefit Exceeds Local TFP Cost?*	
Measure of TFP Cost	% of Households	Sample Size	% of Households	Sample Size	% of Households	Sample Size
Panel A.						
Statutory TFP cost ($145)	100%	2405	100%	1430	100%	1581
TFP cost, nearest store to respondent	62%	2168	66%	1284	63%	395
TFP cost, primary store where respondent shops	57%	1222	58%	710	63%	776
TFP Cost, alternate store where respondent shops	65%	852	68%	511	71%	510
Mean TFP cost, primary and alternate stores	63%	1643	66%	971	69%	1059
TFP cost, store where respondent shopped most	58%	1074	59%	617	63%	689
Panel B. Mean TFP cost at stores within respondent's:						
Census region	71%	2405	70%	1430	74%	1581
State	71%	2405	75%	1430	76%	1581
County	69%	2395	74%	1427	76%	1572
20-mile radius	69%	2242	71%	1325	69%	1449
10-mile radius	66%	2189	73%	1306	68%	1371
5-mile radius	67%	2043	73%	1246	68%	1257
3.4-mile radius	66%	1962	73%	1194	64%	1176
2.5-mile radius	63%	1879	71%	1148	57%	1074
10 nearest stores	70%	2242	76%	1325	63%	1365
5 nearest stores	64%	2237	70%	1325	56%	1137
2 nearest stores	68%	2237	70%	1325	57%	696
Panel C. Median TFP cost at stores within respondent's:						
Census region	78%	2405	81%	1430	83%	1581
State	73%	2405	75%	1430	76%	1581
County	71%	2395	72%	1427	75%	1572
20-mile radius	69%	2242	70%	1325	52%	1449
10-mile radius	68%	2189	71%	1306	49%	1371
5-mile radius	67%	2043	71%	1246	54%	1257
3.4-mile radius	68%	1962	73%	1194	54%	1176
2.5-mile radius	68%	1879	71%	1148	53%	1074
10 nearest stores	72%	2242	75%	1325	61%	1365
5 nearest stores	64%	2237	68%	1325	55%	1137
Panel D. Minimum TFP cost at stores within respondent's:						
Census region	100%	2405	100%	1430	100%	1581
State	100%	2405	100%	1430	100%	1581
County	100%	2395	100%	1427	100%	1572
20-mile radius	99%	2242	100%	1325	100%	1449
10-mile radius	100%	2189	100%	1306	97%	1371
5-mile radius	98%	2043	99%	1246	97%	1257
3.4-mile radius	98%	1962	100%	1194	89%	1176
2.5-mile radius	97%	1879	99%	1148	81%	1074
10 nearest stores	99%	2242	100%	1325	81%	1365
5 nearest stores	97%	2237	98%	1325	67%	1137
2 nearest stores	82%	2237	84%	1325	59%	696

Notes: For each sample, the first column displays the survey-weighted fraction of households who can afford the local cost of the TFP. The local cost of the TFP is estimated as described in Table 2. Eligibility for SNAP is estimated in FoodAPS using the MATH SIPP+ approach (Leftin et al., 2014); we use Model 4. See text for further discussion.

shortfalls that are generally smaller.

These average shortfalls are large relative to households' SNAP benefits and incomes. For the sake of illustration, consider SNAP-recipient households who cannot afford the TFP at median county-level prices. On average, such households face a dollar shortfall of $160, receive $235 per month in benefits, and have net income of $557 per month. Therefore, the $160 difference between the local TFP cost and their available resources for purchasing food is approximately 68 percent of benefits, or 29 percent of net income.

3.5. Limitations of our analysis

Our analysis is impacted by two main data limitations, which affect how our results should be interpreted. First, we study SNAP purchasing power with respect to local variation in food prices only, without controlling for local differences in prices of other goods. The one exception is our analysis which uses self-reported SNAP benefits plus 30 percent of net income as the measure of resources available to spend on food. Here, some of the deductions that affect a household's net income (e.g., the excess shelter deduction and deductions for child care costs and medical expenditures for the elderly) will vary with local costs of non-food goods. Beyond this, however, we are unable to control for other costs of living at such a fine geographic level, and it may be that other costs do not follow the same pattern of food cost differences across geography. If local non-food prices are lower where food prices are high, then low SNAP purchasing power is offset by higher purchasing power with respect to other goods. On the other hand, if local non-food prices are positively correlated with food prices across areas, the picture for SNAP households may be more dismal than the one we have painted.

Second, our study focuses on food costs primarily in urban areas because the FoodAPS SNAP sample is comprised almost entirely of households who live in metropolitan areas (see Table 3). Only about 10 percent of the SNAP households in our sample reside in non-

Table 5
Size of monthly shortfall for SNAP recipient households who cannot afford the local cost of the TFP.

Measure of TFP Cost	*SNAP Benefits + 30% Net Income Insufficient to Cover Local TFP Cost*		*Maximum SNAP Benefit Insufficient to Cover Local TFP Cost*	
	Average Dollar Amt. of Shortfall	Sample Size	Average Dollar Amt. of Shortfall	Sample Size
Panel A.				
Statutory TFP Cost ($145)	$155	391	–	0
Mean TFP Cost of all Stores in IRI Data ($156)	$150	511	$2	1581
TFP Cost, Nearest Store to Respondent	$170	344	$68	433
TFP Cost, Primary Store where Respondent Reports Shopping	$133	203	$44	257
TFP Cost, Alternate Store where Respondent Reports Shopping	$176	123	$53	157
Mean TFP Cost, Primary and Alternate Stores	$141	264	$45	283
TFP Cost, Store where Respondent Shopped Most	$136	172	$43	223
Panel B. Mean TFP cost at stores within respondent's:				
Census region	$167	488	$45	554
State	$177	434	$39	399
County	$162	425	$55	418
20-mile radius	$174	393	$55	428
10-mile radius	$173	389	$62	396
5-mile radius	$168	377	$67	371
3.4-mile radius	$172	363	$67	345
2.5-mile radius	$173	345	$68	363
10 nearest stores	$172	394	$92	339
5 nearest stores	$164	408	$84	415
2 nearest stores	$159	386	$70	418
Panel C. Median TFP cost at stores within respondent's:				
Census region	$163	440	$12	353
State	$161	422	$18	406
County	$160	394	$20	382
20-mile radius	$157	374	$19	385
10-mile radius	$158	362	$21	381
5-mile radius	$164	354	$30	378
3.4-mile radius	$162	344	$29	323
2.5-mile radius	$159	322	$23	340
10 nearest stores	$151	366	$26	333
5 nearest stores	$145	377	$29	432
Panel D. Minimum TFP cost at stores within respondent's:				
Census region	–	0	–	0
State	$77	21	–	0
County	$95	80	$148	6
20-mile radius	$99	67	–	0
10-mile radius	$107	93	$57	4
5-mile radius	$105	115	$102	12
3.4-mile radius	$114	124	$71	13
2.5-mile radius	$112	131	$32	14
10 nearest stores	$105	149	$15	2
5 nearest stores	$131	191	$27	28
2 nearest stores	$159	276	$51	207

Notes: Table contains the survey-weighted average shortfall between SNAP benefits plus 30 percent of net income (or max benefits for household size) and local TFP cost. Local cost of the TFP is estimated as described in Table 2. Sample is SNAP-recipient households for whom the shortfall is greater than zero (i.e., resources are insufficient to purchase the full TFP).

metropolitan areas, and SNAP purchasing power is likely to be higher in rural areas, suggesting that our estimates understate the extent to which SNAP benefits allow households to afford the TFP overall. That said, other differences between urban and rural areas may offset disparities in SNAP purchasing power, like differences in access to food, the availability of community/non-profit food assistance, and other non-food costs (e.g., transportation). Without a fuller picture of these differences, we caution readers to interpret our results as reflecting SNAP purchasing power for a sample of primarily urban households.

4. Policy implications

From a policy standpoint, it is crucial to consider how large these shortfalls are in aggregate. That is, what would it cost to enable 100 percent of SNAP households to afford the TFP? Would doing so be possible through redistribution, or would it require additional program spending? We explore these questions in Figs. 2 and 3 which display the distribution of budget shortfalls for *all* SNAP recipient households. Fig. 2 displays these shortfalls when households are assumed to be able to spend their SNAP benefit plus 30 percent of net income, and Fig. 3 shows shortfalls calculated using maximum SNAP benefits as the relevant measure of household resources.

The shortfall distributions are centered around small negative amounts, where negative amounts reflect *high* SNAP purchasing power, i.e., that household resources are more than sufficient to purchase the TFP. Summing this difference across all SNAP households provides a large negative number on the order of $3 to $5 billion. (These sums are shown in Appendix Table 6) This implies that if it were costless to redistribute some benefit dollars from households who are more than able to afford the TFP in their areas to those who are unable to do so, current levels of program funding and total benefit payments would be adequate to enable every recipient to purchase the TFP locally.

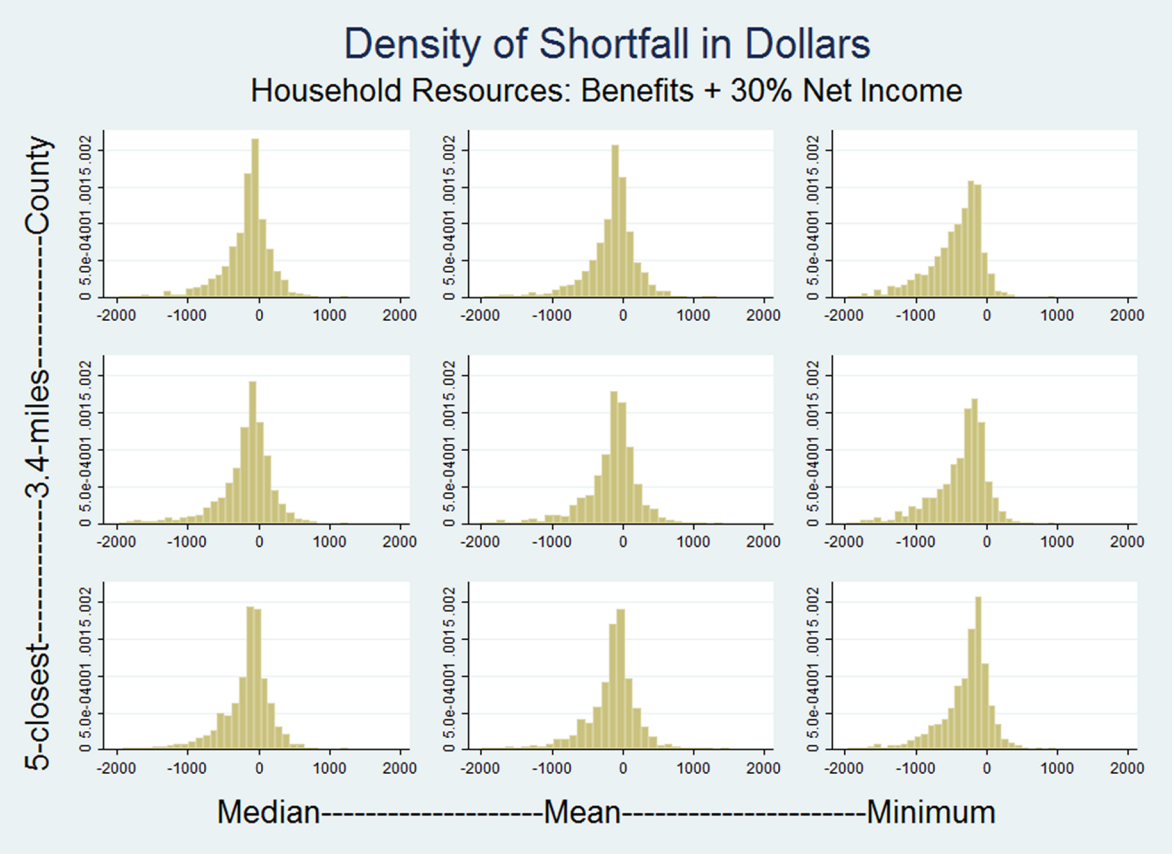

Fig. 2. Distribution of budget shortfalls. (Difference between local TFP cost and SNAP benefit + 30 percent of net income).

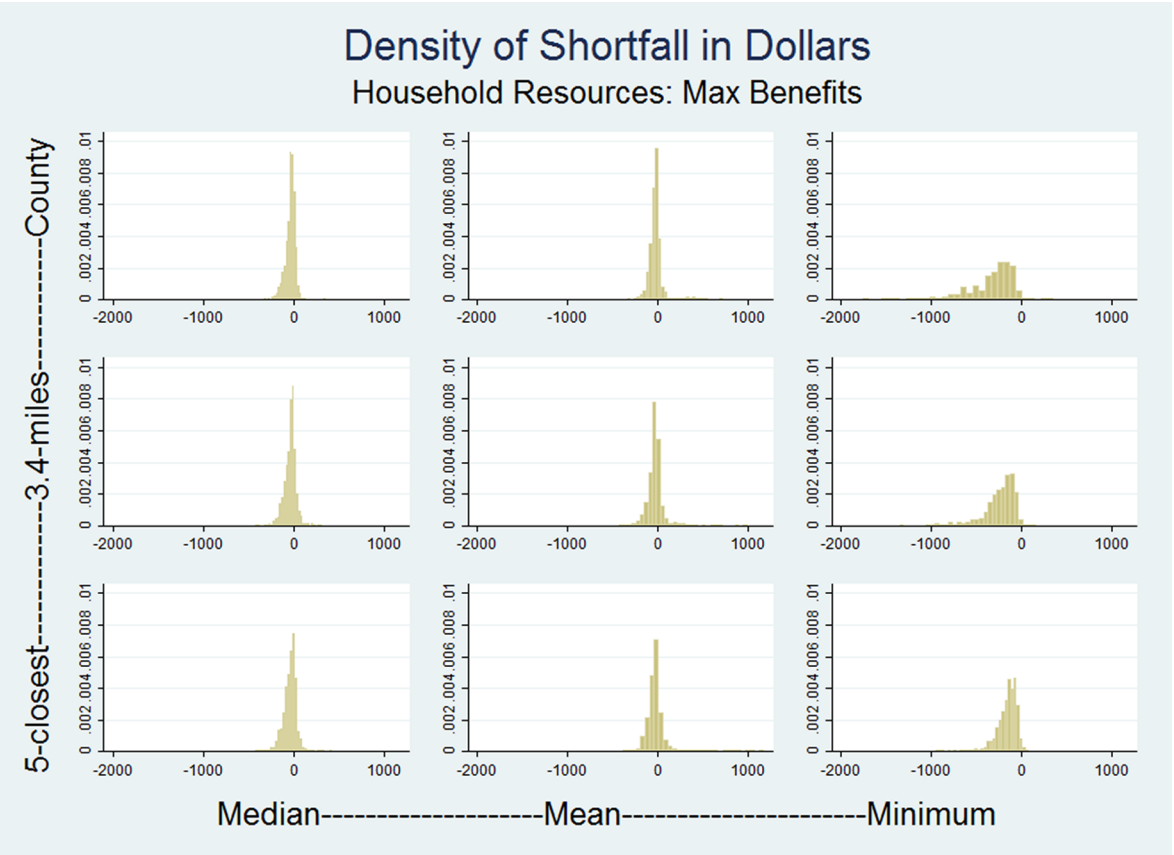

Fig. 3. Distribution of budget shortfalls. (Difference between local TFP cost and maximum SNAP benefit).

An important implication of our results is that indexing benefits according to local food prices would be one way to achieve such redistribution. Of course, adjusting SNAP benefits for geographic variation in food prices is easier said than done. Historically, a lack of data on local food prices has prevented policymakers from considering direct adjustments to SNAP benefits to account for geographic differences in the cost of food. While the Bureau of Labor Statistics (BLS) provides regional CPIs for the four major Census regions and for 27 metropolitan statistical areas (MSAs), the regional price indices are meant to reflect changes in prices within regions over time, *not* to compare prices across areas at a given point in time (Bureau of Labor Statistics, 2018). On the other hand, it seems possible that Nielsen and IRI scanner data could be used by the USDA to calculate regional food price indices. The USDA already has access to these proprietary data, and Nielsen data have been used by *Feeding America* to construct a relative price index at the county level for its *Map the Meal Gap* project (Feeding America 2018).

Of course, we note that adjusting benefits to geographic differences in food prices would mean lowering the maximum benefit in many areas (those with lower food prices), which is prevented by current law. As we describe above, doing so would also presumably lower benefits in rural areas, where access to other forms of food assistance may be lower and non-food costs like transportation costs may be higher. Rather, a permissible – but admittedly more costly – adjustment would be to leave benefits as they are for low- or average-cost areas, and raise the maximum benefit only in areas with higher-than-average food prices (Institute of Medicine and National Research Council, 2013).[25] Such a policy would cost an additional $83 million per month in benefits, or just under $1 billion per year. Compared to the program's $75 billion in benefit payouts in 2012, this reflects an increase in costs of approximately 1 percent.

Table 6 illustrates such an approach, supposing that SNAP households are given benefits equal to the larger of their current legislated benefit or the median cost of the TFP in their county. This adjustment raises the fraction of SNAP households who can afford the local cost of the TFP substantially, often by more than 10 percentage points. For example, when shoppers are assumed to purchase the TFP at the median price in a 3.4-mile radius, we now find that 86 percent of SNAP households can afford the TFP, compared to just 74 percent under current benefits (see Table 2). We estimate that 26 percent of SNAP households would receive increased benefits; the average increase (among those receiving increases) would be just under $20 per month. However, we note that a substantial fraction of households – in the range of 12 to 16 percent – still cannot afford the local cost of the TFP when they are given benefits equal to the median TFP price in their county. This reflects the fact that SNAP households reside in particularly high-priced pockets of their counties. Thus, while adjusting benefits for high county food prices goes a long way toward making the TFP affordable to more SNAP households, such a policy would still leave some households unable to afford the TFP.

Table 6
Fraction of SNAP households who can afford the local cost of the TFP with benefits adjusted for high local food prices. (Household's simulated SNAP benefit set equal to greater of legislated max benefit or county-level median TFP price).

	Simulated SNAP Benefit Exceeds Local TFP Cost?	
Measure of TFP Cost	% of Households	Sample Size
Median TFP cost at stores within respondent's:		
County	100%	1581
20-mile radius	88%	1467
10-mile radius	87%	1442
5-mile radius	86%	1347
3.4-mile radius	86%	1290
2.5-mile radius	84%	1234
Mean TFP cost at stores within respondent's:		
County	100%	1581
20-mile radius	83%	1467
10-mile radius	84%	1442
5-mile radius	84%	1347
3.4-mile radius	83%	1290
2.5-mile radius	80%	1234

5. Conclusions

This study provides new descriptive evidence on the adequacy of SNAP benefits to purchase a low-cost, nutritious diet as specified by the Thrifty Food Plan (TFP), which is the basis for legislated SNAP benefit levels. Acknowledging that a given amount of SNAP benefits will buy less food in areas with high food prices, we estimate the fraction of SNAP households that are able to purchase the TFP at local prices (i.e., the "sufficiency rate"). Using FoodAPS data to answer this question, we account for geographic variation in local food prices in much finer detail than has previously been possible.

Our main findings indicate that a substantial share of SNAP-recipient households – on the order of 20–25 percent – face local TFP prices that are too high to purchase the TFP with SNAP benefits plus 30 percent of net income. This share increases only slightly as we expand the distance within which the household is assumed to be able to shop. For households who are unable to afford the TFP, average dollar shortfalls between the cost of the TFP and SNAP benefits plus 30 percent of income are often as large as $150 per month. When SNAP recipients are assumed to be able to purchase the TFP at the *minimum*-cost store in 10–20 miles, SNAP benefits are sufficient for a much larger fraction of recipient households (90–95 percent). However, the share who can afford the TFP is still less than 100 percent, and the assumption that households are able to identify and travel to the minimum TFP-cost store in a large area seems particularly unlikely for this population. Only 67 percent of SNAP recipient households in our sample have a car, and the vast majority live in metropolitan areas, where the costs of such travel might be prohibitively high. Importantly, we find that sufficiency rates of 100 percent could be achieved *without* additions to total benefit payouts by redistributing some benefit dollars from those for whom SNAP is more than sufficient to purchase the local TFP to those households who are currently unable to afford their local TFP. However, such a redistribution is easier said than done. In fact, we demonstrate that even a policy that provided benefits equal to the maximum of the current legislated benefit or the county-level TFP price would not make the local cost of the TFP affordable for all SNAP households. Because SNAP households reside in particularly expensive parts of their counties, we find that 12 to16 percent of SNAP households are still unable to afford the TFP under such a policy.[26]

Finally, our focus on geographic variation in food prices and in the *real* value of SNAP benefits also suggests a new avenue for research on the food stamp program and its impacts. That legislated SNAP benefit levels are set at the national level presents challenges for quasi-experimental analysis of the causal impacts of SNAP on outcomes of interest. Geographic variation in food prices, however, presents a plausibly exogenous source of variation in SNAP generosity (in real terms), that researchers can use to study the effects of the program on outcomes like health (Bronchetti, Christensen, and Hoynes 2019), food security

[25] See Institute of Medicine and National Research Council (2013), Chapters 2 and 5 for details on the 1975 court decision, and eventual rewriting of the law, that make the TFP the basis for benefits, as well as information on the difficulties of geographic adjustment of SNAP benefits.

[26] This simulation assumes that households face a local TFP price ranging from the median cost of the TFP within a 2.5-mile radius (in which case, 16 percent are unable to afford it) to the median TFP cost at stores within a 20-mile radius (in which case, 12 percent cannot afford the TFP).

(Gregory and Coleman-Jensen 2013), or nutrition (Bronchetti, Christensen, and Hansen 2017).

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CRediT authorship contribution statement

Garret Christensen: Funding acquisition, Conceptualization, Software, Visualization, Formal analysis. **Erin Todd Bronchetti:** Funding acquisition, Conceptualization, Software, Visualization, Formal analysis.

Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.foodpol.2020.101937.

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