Issuance and Incidence: SNAP Benefit Cycles and Grocery Prices

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Abstract

In-kind benefit transfer programs like the Supplemental Nutrition Assistance Program (SNAP) are an increasingly important part of the U.S. safety net. Because states issue SNAP benefits to each recipient once per month, retailers experience predictable cyclicality in consumer demand for food. In response to these fluctuations, retailers face incentives to vary food prices throughout the month, potentially shaping the incidence of the benefits transferred through the SNAP program. Using a large panel data set from households and retailers, we document large intra-month cycles in food expenditures among that closely track state issuance policies. However, we find evidence that retailers do not vary their prices in response to such fluctuations by an economically significant magnitude. This finding is consistent with recent evidence showing that grocery retailers largely adopt a strategy of uniform pricing at the expense of substantial increases in profits.

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Introduction

The Supplemental Nutrition Assistance Program (SNAP or "Food Stamps") is one of the largest antipoverty programs in the United States, serving 1 in 7 Americans with an annual budget of $70.9 billion for fiscal year 2016. About 260,000 food stores participate in SNAP currently, and, in 2010, SNAP consisted of 14% of grocery sales in the United States (Wilde, 2012). Once per month, SNAP participants are issued a lump sum allocation of benefits that can be redeemed for food at grocery stores or other retailers. Prior research suggests that SNAP participants consume more of their benefits early in their benefit cycle than at the end, possibly due to psychological biases such as hyperbolic discounting (Wilde and Ranney, 2000; Shapiro, 2005; Hastings and Washington, 2010). Such biases, if present, reduce the welfare of SNAP participants by causing them to make sub-optimal intra-month benefit allocation decisions.

The focus of our paper is on a second mechanism by which monthly cycles in SNAP benefit consumption can affect the welfare of SNAP recipients; namely, by shaping the incidence of the benefits. If individual SNAP recipients spend a large share of their benefits in the days after receiving them, and if benefits are issued to most SNAP recipients on or near the same days each month, monthly cycles in individuals' benefit redemption will manifest to retailers as predictable variation in aggregate demand for food products. In response, retailers may strategically adjust food prices in low-income neighborhoods over the course of the month to take advantage of SNAP-induced cycles of demand. Such pricing behavior shapes the incidence of the transfer, with the ultimate effect on incidence depending on whether retailers are induced to raise or lower their prices during the parts of the month associated with peak SNAP demand. Because the magnitude – and even direction – of these pricing responses are theoretically ambiguous, it is difficult to predict in advance how they shape the welfare effects of in-kind transfer programs like SNAP. Understanding such dynamics is especially important given that redistributive transfers in the United States are increasingly made in-kind through private providers (Bitler and Hoynes, 2010).

To study the effect of SNAP-induced demand cycles on grocery sales and pricing, we utilize two large panels data sets, one drawn from retail-level transactions and the other from household consumption logs. The transaction-level data consists of weekly product sales for more than 70

national retailer chains, covering over 10,000 food stores in the 48 continuous states and 53 percent of all food sales at grocery stores in the United States. The consumption data is drawn from detailed individual-level panel data on the purchasing behavior of almost 80,000 households. We complement these data sets with food diary data from the National Household Food Acquisition Survey (FoodAPS) as well as administrative SNAP redemption records.

The richness of our data allows us to adopt an identification strategy that leverages variation across states in the distribution schedule of SNAP benefits. For example, in Nevada all SNAP participants receive their benefits on the first of the month, whereas in Missouri the day on which SNAP participants receive their benefits varies by person – a Missourian's issuance day may fall anywhere between the first and the 22nd of the month. We exploit cross-sectional variation in state policy as well as variation in policies across time. Crucially, this approach allows us to control for confounding factors that occur at certain points during the month but that are unrelated to SNAP, such as receiving a paycheck, utility bills, or the issuance of other benefits.

As a first step in our analysis, we investigate the presence of SNAP-induced fluctuations in aggregate food demand. We confirm that such fluctuations are present: we estimate that food expenditures are 6 percent higher in the week that they are issued compared to weeks in which they are not. This variability is more pronounced for stores located in neighborhoods in which a large share of the population is SNAP-eligible – food sales rise by 18 percent in the week in which SNAP benefits are issued in neighborhoods with a high SNAP participation rate. We also provide evidence that at least a portion of these fluctuations are due to SNAP, rather than to other monthly patterns that may differentially affect SNAP recipients, based on the fact that the monthly fluctuations in expenditures closely track the weeks in which a state issues its SNAP benefits. Because most states issue the majority of SNAP benefits at the beginning of the month, we conclude that many retailers in high-SNAP neighborhoods face predictable variation in aggregate food demand over the course of the month.

Having found that a state's SNAP issuance schedule generates predictable variation in aggregate food demand, we next investigate whether stores adjust their prices within the month in response to this variation. To this end, we construct a weekly measure of food prices for each retail

outlet in our data. Linking these prices to a state's SNAP issuance schedule, we find evidence that retailers largely do not alter prices in response to intra-month demand cycles — our estimated 95% confidence intervals exclude price changes of 0.2 percent or greater. We estimate price responses by product type and by individual retailer and find consistently small SNAP-induced price fluctuations. Even in areas with high SNAP prevalence and low market concentration – where demand changes are high and retailers are less constrained by the presence of nearby competitiors when choosing a pricing strategy – we can reject price changes of 0.5 percent or greater in the week that SNAP benefits are issued.

Our paper contributes to a growing literature on grocery retailer pricing strategies. Our price non-response is consistent with recent evidence from DellaVigna and Gentzkow (2017) which suggests that grocery chains largely pursue a strategy of uniform pricing across outlets, despite wide variation in customer demographics and the level of competition. These results provide a nice complement to our paper, in which we estimate pricing responses to quasi-exogenous variation in consumer demand, rather than relying on a structural model. However, our results stand in contrast to those found in Hastings and Washington (2010) who also study how grocery store pricing responds to SNAP-induced fluctuations in demand. Using data from three grocery stores located in a single state, they find that prices were a significant three percent higher in the first week of the month (when the state issued all of its SNAP benefits) than at the end of the month (when SNAP expenditures were relatively low). We build on this analysis in two ways. First, by dramatically expanding the number of stores and retail chains considered, we increase the likelihood that our results will reflect the national grocery store market, rather than the pricing decisions of a single retailer. Second, by exploiting heterogeneity in states' SNAP issuance schedules, our identification strategy allows us to isolate pricing responses that are due to SNAP, rather than to other shocks that happen to occur at the beginning of the month – an important distinction for policies addressing the incidence of in-kind transfers in particular (Duggan and Scott Morton, 2006; Leung and Seo, 2017; Meckel, 2017).

Specifically, our results shed light on the merits of policy reforms that reduce SNAP-induced variability in aggregate food demand. In recent years, a number of states have revamped their

SNAP programs to stagger the days on which participants are issued benefits. In states that adopt such reforms, each individual participant is still issued their monthly allotment of SNAP benefits on a single day of the month, but the day of the month on which benefits are issued differs across participants. Although individual SNAP participants continue to exhibit cyclicality in the use of their benefits over the course of their benefit month, such reforms eliminate *aggregate* cyclicality in food expenditures of the type that would induce the pricing responses we study here.[1] Consequently, the welfare effects of such changes to a state's benefit issuance schedule depend on how retailers adjust prices in response to SNAP-induced fluctuations in aggregate demand. Because we find evidence against pricing responses of this form, our results suggest that concerns over benefit incidence should not play a large role in states' decisions over whether to stagger their benefit issuance schedule, though the policy is likely to reduce complications associated with surges in customer traffic, such as long lines or difficulty stocking shelves or staffing stores.

The paper is structured as follows. Section I reviews state policies on the timing of SNAP issuance. Section II describes our data. Section III investigates the effect of SNAP issuance policy on food expenditures at the retailer- and household-level. Section IV investigates the effect of issuance policy on food prices. Section V concludes.

I. SNAP Issuance Policies

In each state, households participating in SNAP receive their monthly allotment of benefits on a single day each month. In some states, each participating household receives their benefits on the same day as every other participating household. States that issue all SNAP benefits on a single day mostly do so on the first of the month. In contrast, other states stagger benefit issuance over multiple days – e.g., some households may receive their monthly benefits on the first, some on the third, and some on the fifth day of the month. Among states that stagger benefit issuance, there exists considerable variation in the number of days on which benefits are issued. For example, Wyoming staggers its benefit issuance across the first four days of the month, whereas Missouri

[1] Another reform that has been proposed is to stagger the issuance of SNAP benefits over the course of the month for a given *individual*. Because such policies would also affect the aggregate cyclicality associated with SNAP-induced demand, they too would affect benefit incidence to the extent that retailer pricing responses occur.

issues benefits between the first and 22nd days of the month.

Table 1 provides a summary of the SNAP issuance policies from 2004 to 2012. The table highlights that in recent years, the trend among states has been to switch from issuing all benefits on a single day to staggering benefit issuance over the course of multiple days. By the end of 2012, 65 percent of states staggered the issuance of SNAP benefits over a period of at least 10 days and 20 percent of states over a span of 15 days or more. For more detailed information on SNAP issuance policies by states, see Appendix Table A.

There are two main rationales for why a state might choose to begin issuing SNAP benefits to different individuals on different days over the course of the month. First, if the timing of SNAP issuance affects the timing of food expenditures, staggering issuance can reduce hassles for both consumers and retailers caused by so many people wanting to buy food at the same time. For example, the United States Department of Agriculture, which administers SNAP, recommended in 2012 that states stagger the days on which SNAP benefits are issued to reduce the "strain on SNAP clients and on participating retailers [from] surges in customer traffic at SNAP authorized stores." In addition, a second rationale for staggering SNAP issuance is to shift the incidence of the benefit from retailers to consumers. That is, if SNAP participants receive their benefits on different days in the month, retailers will be unable to capture the benefits of the program by raising food prices during periods of peak food demand.

For either of these benefits to materialize, however, it must be that SNAP issuance is what causes the fluctuations that others have observed in food expenditures and retailer prices. In later analyses, we investigate how much, if any, of the monthly cyclicality in these variables is driven by the timing of SNAP issuance.

II. Data

Our primary data comes from two data sets collected by the Kilts-Nielsen center, one collected at the retailer level and one collected at the household level. The Kilts-Nielsen data offers many of the same benefits as the data employed by Hastings and Washington (2010), such as a large panel of households over multiple years, as well as detailed price and expenditure data at the UPC

level. However, an important advantage of our data is that it contains a large number of stores from across the United States and operated by multiple chains. This feature of our data allows us to exploit variation in SNAP issuance policies across states and over time. We supplement these data sets with data from the USDA's National Household Food Acquisition and Purchase Survey (FoodAPS) and administrative data on SNAP issuance and redemption from Illinois (described in section III.C).

A. Retailer Price and Sales Volume Data

To study the effect of issuance policy on retailer pricing, we utilize the Kilts-Nielsen Retail Scanner data set. The data contains point of sale records from approximately 35,000 retail stores in the United States for the 48 contiguous states between 2006 to 2012, capturing 53 percent of food sales nationwide during this time period. When a cashier scans the purchased product's bar code, an Electronic Cash Register (ECR) records the product's Universal Product Code (UPC) and assigns the price. After the customer pays, data from the sale is saved by the ECR. Although stores may change their prices at the daily level, Nielsen receives pricing data at the weekly level, with the sales week ending on a Saturday.[2] For a given product, the price that we observe is equal to the volume-weighted average price for sales during the days covered in the reference week. Nielsen does not receive price data for UPCs that were not sold in a given store and week. Each observation in the data includes the number of units sold and the average price of each UPC sold by store and week.

In addition to price and quantity, the data contains information on several store characteristics including retail chain, parent company, and retail channel (grocery, drug, mass merchandiser, convenience or liquor store) identifiers. Since the majority of SNAP redemptions occur in grocery stores, we restrict our pricing analysis to the 10,070 retailers in that category. Panel A of Table 2 presents summary statistics for this sample. The majority of these stores are large retailers and we find an average annual food sales volume of almost 8 million dollars per store. While the

[2]All stores report price and volume data for a seven-day period, but this period may not end on a Saturday; for example, stores may submit data that aligns with their promotion week instead. Rather than including the exact dates used by each retailer, Nielsen assigns the data to the "best fit Saturday," e.g., the Saturday that most closely matches the promotion week. Since no information is provided on the actual date range for the weekly data by retailer, we use the given week-ending data.

data includes county-level geographic information for each store, we also impute store zip code based on data from the second Kilts-Nielsen data set, the Consumer Panel (described below).[3] We link these geographic identifiers to estimates of SNAP participation from the Food and Nutrition Services Department at the USDA and measures of grocery store accessibility from the USDA's Food Access Research Atlas. The stores in our sample are located in zip codes in which 10 percent of residents are SNAP participants and 6 percent of residents are have limited access to grocery stores in addition to living in a low-income area.[4]

B. Household Expenditure Data

i. Nielsen Consumer Panel Data

Our first data set on household expenditures comes from the Kilts-Nielsen Consumer Panel. This data set includes 40,000 to 60,000 households each year from 2004 to 2013.[5] In-home optical scanners allow participants to record the exact product information of purchases by scanning the product's UPC. Each observation in the data includes household expenditures by product (defined at the UPC-level), store, and date. All households remain in the data for at least one year and the majority remain for longer – Nielsen reports an annual retention rate of about 80 percent.

We observe 78,480 households who participate in the sample for an average of four years each, yielding a total of 298,704 household-year observations. The data contains demographic information on household income, family size, marital status, and state, county and ZIP code of residence, along with several other demographic variables. We proxy for SNAP participation using a household's SNAP eligibility, which we calculate based on income and household size.[6] We

[3]The Consumer Panel data contains information on each household's 5-digit zip code of residence as well as the store identifier for any shopping trips the household makes. For each store included in the Consumer Panel (roughly two thirds of the stores in the Retailer data), we assign the store a zip code equal to the most frequent zip code of residence of its shoppers. Our analyses include these XXX stores for which we are able to impute a zip code.

[4]In the Food Access Research Atlas, households are classified as low-access if they live more than one mile away from the nearest supermarket in urban areas or more than ten miles away in rural areas. Additionally, households are classified as low-income if their census tract of residence as a poverty rate is 20 percent or greater, median family income is less than or equal to 80 percent of the State-wide median family income, or the tract is in a metropolitan area and has a median family income less than or equal to 80 percent of the metropolitan area's median family income.

[5]Households are recruited through the mail and internet and are rewarded with monthly prize drawings and gift points in return for their participation. The selection process is designed to recruit a sample that is demographically representative at the national level and within individual markets.

[6]Household income is reported in sixteen income ranges. We assign each household an income level equal to the

observe household income information with a two year lag; hence we restrict our sample to years between 2004 and 2011. We estimate that 13 percent of households are eligible for SNAP per year. Panel B of Table 2 presents additional summary statistics for our sample by SNAP eligibility.

ii. FoodAPS Data

The second household expenditures data set comes from the National Household Food Acquisition Survey (FoodAPS). This dataset contains detailed information on daily food purchases for a nationally representative sample of 4,826 households (or 14,317 individuals) over the period between April 2012 and January 2013. Each participating household kept a detailed diary of all food acquired at home and away from home over a seven-day period. Food purchased for home consumption was recorded using home scanners, and household members were asked to keep receipts for all purchases. Total daily household expenditure is calcuted as the sum of expenditures from these two sources and aggregated to the calendar week level.[7]

While this data set is significantly smaller than the Consumer Panel data set, one major advantage of the FoodAPS data is that we observe SNAP status, not just estimated eligibility, determined by a combination of self-reports and administrative data. Low-income households were oversampled resulting in a sample with 1,581 SNAP-participating households, 1,195 households below 185 percent of the federal poverty line who were not receiving SNAP, and 2,048 households above 185 percent of the poverty line. The data also includes rich demographic information for both individuals and households. Panel C of Table 2 reports summary statistics of this sample by SNAP status and income level.

midpoint of the indicated range.

To be eligible for SNAP, a household's total income must be less than 130 percent of the Federal Poverty Line, which varies with household size. Additionally, SNAP eligibility requires a household's net income (total income minus a set of SNAP-defined deductions) not exceed 100% of the federal poverty line. Due to data limitations, our eligibility measure uses the restrictions on total income only.

[7] The data contains household weights that were designed to make the 4,826 households sampled more reflective of the demographics of the broarder US population. However, as most households had observations spanning two distinct calendar weeks, the final sample weights were adjusted in proportion to the number of days each household participated in the survey in each week. For example, if a household began its food diary on the 5th of the month and had a sample weight of x, then its sample weight for week 1 was 3/7*x and its sample weight for week 2 was 4/7*x.

III. SNAP Benefit Timing and Intramonth Expenditure Patterns

This section investigates the link between the timing of SNAP benefit issuance and within-month expenditure patterns using retailer-level data as well as household-level data.

A. Retailer Data

This section explores within-month expenditure patterns at the store level by SNAP issuance policy using the Kilts-Nielsen Retail Scanner data. As described in Section II, this data set contains weekly sales data by product (UPC) for over 10,000 grocery stores across the country. Since SNAP benefits can only be used to purchase food, we restrict our analysis to expenditures on SNAP-eligible items since expenditures on these products are most likely to be affected by SNAP issuance date. We weight our measures of food expenditure by the expenditure of SNAP-eligible households from the Consumer Panel to ensure that our estimate of demand focuses on products that are actually purchased by SNAP customers. Lastly, to maintain a consistent bundle of goods across weeks within a store-month we drop any UPC-store-month combination in which the UPC is not sold in the store in all weeks of the month.

We use the following econometric model to estimate within-month food sales patterns across stores with different SNAP issuance policies:

$$Y_{swmy} = \sum_{w=2}^{4} \alpha_w week_w + \delta_m + \eta_y + \theta_i \tag{1}$$

where Y_{iwmy} is log weekly food sales volume for store s in week w of month m of year y, $week_w$ indicates the week of the month for $w\epsilon\{2,3,4\}$, and δ_m, η_y , and θ_s are month, year, and store fixed effects, respectively. All regressions are volume-weighted and standard errors are clustered at the retailer level. In this regression, α_w measures the change in food expenditure within a store between the first and the w^{th} week of the calendar month. We repeat this regression for five different SNAP issuance policies: (1) all benefits issued within the first day of the calendar month, (2) all benefits issued within the first week of the calendar month, (3) all benefits issued within the second week of the calendar month, (4) benefit issuance staggered across the first two weeks

of the calendar month, and (5) benefit issuance staggered across the first three or more weeks of the calendar month.

Table 3 presents results from these analyses. Column 1 displays results for stores in states that issue all benefits in the first day of the month. We find that total food expenditures are between 6 and 8 percent higher in the first week of the calendar month relative to other weeks in the month. These results are similar for stores in states that issue all benefits within the first week of the month (column 2). While these results are consistent with SNAP issuance leading to an increase in food expenditure in the week of SNAP issuance, this cyclicality expenditures may be attributable to calendar month patterns in income receipt of expenditure that are unrelated to the SNAP program, such as timing of rent payments or other bills, paycheck receipt Stephens Jr. (2006), or receipt of other monthly benefit programs such as TANF or Social Security (Stephens Jr., 2003; Mastrobuoni and Weinberg, 2009, 2010). To determine if this intramonth cyclicality in food demand is a result of the SNAP program, we compare our results from stores in states that issue all benefits in the first week of the month to states with different issuance staggering policies. For example, food sales in stores in the two states that issue all benefits in the second week of the month (column 3) are roughly four percent higher in weeks 2 and 3 – the first two weeks of benefit receipt – than in weeks 1 and 4. Column 4, which includes states that stagger issuance over the first two weeks of the month, shows that while food sales are still highest in week 1, the decline in sales from week 1 to week 2 is only half as large as in states that issue all benefits in the first week. In states that stagger issuance across the first three to four weeks of the month (column 5), food sales are only 2 to 3 percent higher in the first week of the month and these differences are largely not statistically significant. Taken together, these results suggest that at least part of the intramonth cyclicality in food expenditure is driven by the SNAP program.

To capture the variation in issuance policy within a single regression, we also consider the following econometric model:

$$Y_{swmy} = \beta\, FracIssue_{swmy} + \sum_{w=2}^{4} [\gamma_w week_w] + \delta_m + \eta_y + \theta_s \tag{2}$$

where $FracIssue_{swmy}$ is the fraction of SNAP benefits issued in week wmy in the state in which

store s is located. In this regression, β represents the percent increase in food expenditure for weeks in which 100 percent of SNAP benefits are issued relative to weeks in which no benefits are issued. The results presented in column 6 of Table 3 suggest that if 100 percent of a state's SNAP benefits are issued in a given week, food expenditure is 5.7 percent higher than in weeks in which no SNAP benefits are issued.

If the cyclicality in food demand is driven by the SNAP program, we would also expect that this cyclicality would be more extreme in stores that serve a larger SNAP population. To test this theory, we repeat the analysis in column 6 of Table 3 for stores located in zip codes with different SNAP participation levels. Table 4 presents the results of this analysis. Column 1 shows that even in stores located in areas with low SNAP prevalence, there is a small amount of cyclicality associated with the SNAP issuance policy: food expenditure is 1.7 percent higher in weeks where 100 percent of SNAP benefits are issued relative to weeks with no issuance. However, this estimate grows monotonically with local SNAP prevalence; it exceeds 18 percent for stores located in zip codes in which over 25 percent of the population receive SNAP.

B. Household Expenditure Data

The previous section provides evidence that within-month patterns in retailer food sales closely follow SNAP issuance cycles and are more pronounced in high-SNAP neighborhoods. This section uses two household-level expenditure data sets to provide an additional check on our interpretation of the retailer-level patterns. The household-level data allow us to estimate patterns of expenditure for SNAP versus non-SNAP households.

i. Nielsen Consumer Panel

This section uses the Nielsen Consumer Panel, a household-level panel data set that contains daily household expenditures for an average of four years. As mentioned in Section II, we are able to estimate a household's SNAP-eligibility using annual income and household size. Our regression analysis uses the following econometric model to compare food expenditures across the first four weeks of the calendar month for SNAP-eligible and ineligible households:

$$Y_{iwmy} = \sum_{w=2}^{4} [\alpha_w week_w + \beta_w SNAP_{iy} * week_w] + \gamma SNAP_{iy} + \delta_m + \eta_y + \theta_i \quad (3)$$

where Y_{iwmy} is log food expenditure for household i in week w of month m and year y, $SNAP_{iy}$ is an indicator variable for whether a household is eligible for SNAP in a given panel year, $week_w$ indicates the week of the month for $w\epsilon\{2,3,4\}$, and δ_m, η_y , and θ_i are month, year, and household fixed effects, respectively. All regressions include population weights and standard errors are clustered at the household level. In this regression, α_w measures the percent change in food expenditure within a household between the first and the w^{th} week of the calendar month for households that are ineligible to receive SNAP benefits. Similarly, β_w reflects the additional within-household percent change food expenditure between the first and the w^{th} week of the month, for SNAP-eligible households relative to ineligible households.[8]

Panel A of Table 5 presents these results for households living in states that issue all benefits within the first week, states that stagger benefit issuance across the first two weeks, and states that stagger benefit issuance across three or more weeks of the calendar month, respectively. In states that issue all SNAP benefits in the first week, the coefficients of the non-interacted week variables (α_w) indicate that for SNAP-ineligible households, food expenditures are slightly higher (1 to 4 percent) during the first week of the month than in subsequent weeks. However, for SNAP-eligible households, the cyclicality in food purchases is substantially more pronounced. Relative to ineligible households, SNAP households reduce their food expenditures from the first week of the month by an additional 9.8 percent in the second week, 16.3 percent in the third week, and 20.0 percent in the fourth week.[9] Column 2 (which includes states that issue benefits on days that span the first two weeks of the month) shows that food expenditure in SNAP households relative to non-SNAP households is constant across the first two weeks of the month, but significantly decreases in the second half of the month. Column 3, which considers states that stagger benefit issuance on days that span at least the first three weeks of the month, shows that food expenditure

[8]Since not every household purchases food in a given week, our expenditure measure is missing in weeks without any purchases. Therefore, the outcome in Table 5 is the intensive margin, i.e., within-month percent differences in households expenditures, conditional on the household spending a positive amount during the week. We repeat this analysis using household food expenditure in dollars in Appendix Table B as a robustness check and find similar patterns.

[9]These estimates are very similar to those reported in Hastings and Washington (2010).

is almost completely constant for both SNAP-eligible and ineligible households. These patterns are consistent with it being the timing of SNAP issuance – rather than other factors – that drives the observed cyclicality in intra-month food expenditures.

Column 4 of Table 5 presents the results from the following alternative econometric model which combines all issuance policies into one regression:

$$Y_{iwmy} = \beta\, FracIssue_{iwmy} * SNAP_{iy} + \alpha FracIssue_{iwmy} + \gamma SNAP_{iy} + \sum_{w=2}^{4} [\gamma_w week_w] + \delta_m + \eta_y + \theta_i \quad (4)$$

where $FracIssue_{swmy}$ is the fraction of SNAP benefits issued in week w in state of residence s of household i while Y_{iwmy}, $SNAP_{iy}$, $week_w$, δ_m, η_y , and θ_i are defined as in 3. In this regression, α represents the percent increase in food expenditure among SNAP-ineligible households in weeks in which 100 percent of SNAP benefits are issued relative to weeks in which no benefits are issued. Similarly, β measures this effect for SNAP-eligible households relative to SNAP-ineligible households. The results suggest that if 100 percent of a state's SNAP benefits are issued in a given week, food expenditure is an insignificant 0.6 percent higher among SNAP-ineligible households and 19.2 percent higher among SNAP-eligible households (relative to ineligibles).

ii. FoodAPS

One concern with the Nielsen Consumer Panel data is that we are only able to measure SNAP eligibility and not SNAP participation. To address this concern, we repeat the analyses described in Section III.B.i using data from the National Household Food Acquisition Survey (FoodAPS). While this data set is significantly smaller than the Consumer Panel and only tracks each household's expenditure data for seven days, it has a few distinct advantages. First, the FoodAPS data contains information on SNAP participation data at the time of interview through both self-reports and administrative records which is significantly more accurate than our estimates of SNAP-eligibility derived from annual income and household size in the Consumer Panel. Second, the estimates of food expenditure in the FoodAPS data are likely to be more complete since participants are asked

to record their expenditures for a significantly shorter period of time.[10]

Panel B of Table 5 repeats the analyses in Panel A with a few distinctions. First, our outcome variable is calculated as the average daily food expenditure per household in the week in logs; if a household's seven-day data interview period spanned two calendar weeks, the household was counted in two weeks. Relatedly, since we only observe households in at most two calendar weeks, we do not include household fixed effects in our regressions. Instead, we control for a variety of household demographics including household size as well as sex, age, age-squared, number of children, marital status, race, and education of the primary respondent. Regressions use household weights and are clustered at the household level.[11]

These results are largely consistent with the results from Panel A, but much larger in magnitude. For example, column 5 shows that food expenditure among SNAP recipients (relative to non-recipients) in states that issue all SNAP benefits in the first week of the month is highest in the week of benefit issuance (as in column 1), but decreased by 93 percent in week 4 relative to week 1 (versus 20 percent in the Consumer Panel). We observe similar patterns in states that stagger benefit issuance over the first two weeks of the month and across three or more weeks. Taken together, column 8 estimates that food expenditure is 66 percent higher among SNAP households (relative to non-recipients) during weeks in which 100 percent of a state's SNAP benefits are issued (versus 19 percent in the Consumer Panel). The difference in magnitude between these estimates and our previous ones may be due to the smaller amount of measurement error associated with the FoodAPS data in food expenditure and/or SNAP-enrollment, or it may simply reflect sampling error associated with the smaller FoodAPS sample size.

[10]For example, Nielsen estimates that approximately 30 percent of household consumption is accounted for in the consumer panel data. This is roughly in line with a comparison of estimates of weekly food expenditure from the two data sets (see Table 1).

[11]Since most households had observations spanning two calendar weeks, the final sample weights were adjusted in proportion to the number of days each household participated in the survey in each week. For example, if a household began its food diary on the 5th of the month and had a sample weight of x, then its sample weight for week 1 was 3/7*x and its sample weight for week 2 was 4/7*x.

C. Within-State Variation in Issuance Policy

The identification strategy in the previous section relies on cross-sectional variation in issuance policy by state. If issuance policy were correlated with unrelated cross-state variation in monthly expenditures patterns for SNAP recipients, our results could be biased. While most states have maintained a consistent issuance policy during our sample period, a few states have made changes. We focus our analysis on one state, Illinois, for two reasons. First, Illinois changed its policy in February 2010, which leaves us with several years of data before and after the policy change. Second, Illinois's change in issuance policy was particularly large: the state switched from issuing all benefits on the first of the month to issuing benefits on days spanning the first 23 days of the month.[12]

Table 6 provides estimates of Illinois' policy change using the Nielsen Retailer data (Panel A) and Consumer Panel data (Panel B). Column 1 and 2 considers data from Illinois before and after the policy change, respectively. Regressions in Panel A follow the model in equation 1, but interact the week dummies with an indicator for whether the store was located in a high-SNAP zip code, i.e., zip codes with at least 15 percent of residents receiving SNAP. Regressions in Panel B follow the model in equation 4. This effect is more pronounced in the Consume Panel than in the Retailer data – Panel A suggests a more gradual decline in cyclicality by week, but expenditure in high-SNAP stores was still significantly lower in weeks 3 and 4 relative to low-SNAP stores.

We supplement this analysis with administrative data on SNAP benefit issuance and redemption obtained from the Illinois Department of Human Services. This data provides daily aggregate measures of the number of households receiving SNAP benefits and the amount of SNAP benefit dollars that were redeemed through food purchases from January 2008 to August 2014. The administrative data spans two additional policy change: in June 2013, Illinois changed its policy from issuing SNAP benefits on the first 23 days of the month to issuing benefits on the first ten days on the month; and then in March 2014, Illinois reversed this decision by re-instating a policy that staggers benefit issuance across days 1 through 23.[13]

[12] In contrast, while Idaho changed its issuance policy early in our sample period (November 2009), the change was from issuing all benefits on the first of the month to staggering issuance across the first five days of the month.

[13] These issuance changes applied to most, but not all, SNAP recipients in the state. Specifically, households that do not receive government provided health insurance in addition to SNAP follow a different issuance schedule. See

Figure 3 plots aggregate issuance and redemption data by calendar day for each of the four issuance policies that were in place in Illinois during our sample period. In each graph, the bars represent the fraction of SNAP households that received their benefits on each calendar day while the line represents the proportion of total SNAP benefits that were redeemed. Figure 3a, which presents data during the period in which all benefits were issued on the first of the month, shows a dramatic spike in the redemption of SNAP benefits in the first week of the month – 45 percent of all benefits are redeemed in the first week of the month and two thirds of benefits are redeemed in the first two weeks. Figure 3b presents the same analysis for the first period in which Illinois staggered its issuance date between the first and 23rd days of the month. While a third of households still receive their benefits on the first, the issuance date is spread more or less evenly across the rest of the issuance period. As in Figure 3a, redemptions closely track the issuance policy – 30 percent of benefit dollars were redeemed in each of the first two weeks and roughly 20 percent in the second two weeks of the month. Figures 3c and 3d also provide evidence that as SNAP benefits are issued across a larger number of days, redemption patterns smooth across the month accordingly; conversely, as the SNAP issuance period contracts, redemption peaks during the period of issuance.

IV. SNAP Benefit Timing and Retailer Pricing

The previous section provides evidence from several data sources that demand for food by SNAP participants is characterized by monthly fluctuations. In states with compressed benefit issuance schedules, this leads to predictable cyclicality in aggregate food sales, especially in locations where SNAP participants comprise a large portion of customers. As a result, retailers may strategically set prices to maximize profits taking this intramonth cyclicality into account. However, the magnitude – and even direction – of these pricing responses are theoretically ambiguous. This section empirically estimates retailer response to these SNAP-induced demand fluctuations.

the Illinois Department of Human Services website for more details.

A. Retailer Price Response by Issuance Policy

To investigate the effect of SNAP issuance timing on retailer pricing, we use the Nielsen Retail Scanner data. As described in Section II, this data set contains weekly price and sales data by product for over 10,000 grocery stores across the country. Following Hastings and Washington (2010), we create an expenditure-weighted food price index for each store-week:

$$log(P_{st}) = \sum_{k} \omega_k log(P_{kst}) \tag{5}$$

where P_{kst} is the unit price for UPC k sold in store s on date t and ω_k denotes the expenditure share for UPC k among SNAP-eligible households in the Consumer Panel data between 2004 and 2011. We normalize the shares to sum to one within a given store and year-month combination. Because Nielsen does not report a price for weeks in which a UPC was not sold in a given store, to maintain a consistent bundle of goods across weeks within a store-month we drop any UPC-store-month combination in which the UPC is not sold in the store in all weeks of the month.

We estimate a similar econometric model to that described in Equation (4) to estimate within-month pricing patterns across stores with different SNAP issuance policies:

$$\log(P_{st}) = \beta\, FracIssue_{swmy} + \sum_{w=2}^{4} [\gamma_w week_w] + \delta_m + \eta_y + \theta_s \tag{6}$$

where $\log(P_{st})$ is the price index defined above for store s on date t. $FracIssue_{swmy}$ is the fraction of SNAP benefits issued in week w in the state of store s. $Week_w$ is an indicator for week w, and δ_m, η_y , and θ_s are month, year, and store fixed effects, respectively. All regressions are volume-weighted and standard errors are clustered at the retailer level.

Table 7 presents these results for the full sample and by local SNAP prevalence. We find that in the full sample (column 1), the coefficients on the week dummy variables suggest that food prices are slightly lower in the first week of the month than in all other weeks. These price changes are small (between 0.1 and 0.3 percent) but statistically significant. This finding suggests that there is some (albeit quantitatively minor) pricing cyclicality that is not related to SNAP-issuance. We also find statistically significant, yet economically insignificant estimates of the coefficient on the

fraction of benefits issued in the week. Our estimate of 0.0007 for the coefficient on $FracIssue_{swmy}$ implies that if 100 percent of a state's SNAP benefits were issued in one week, prices in that week would be 0.07 percent higher than if no SNAP benefits were issued in that week. While small in magnitude, this result is qualitatively consistent with a model in which retailers increase their prices in response to SNAP-induced increases in food demand.

Columns 2 through 5 of Table 7 present price regression results for stores in zip codes where SNAP participation is less than 5 percent, 5-15 percent, 15-25 percent, and greater than 25 percent, respectively, mirroring the food expenditure analyses from the same data set in Table 4. Column 2 shows that the coefficient on the fraction of SNAP benefits issued in a given week is statistically indistinguishable from zero suggesting that food prices do not fluctuate with the SNAP issuance cycle at all in stores located in low SNAP-use areas. This estimate increases monotonically with SNAP prevalence. However, even in areas with the highest SNAP prevalence, where food expenditure was 18 percent higher in weeks in which 100 percent of SNAP benefits are issued than in other weeks, prices were only 0.2 percent higher in those weeks.

So while overall, these results are consistent with price responses increasing with the local proportion of SNAP recipients, the most striking takeaway from these results is how small in magnitude this effect is. In particular, our point estimates are amuch smaller than those found in previous research. Using estimates from the highest SNAP stores suggests that we can reject a price increase of 0.3 percent in the first week of the month in first-of-the-month states with 95 percent confidence – an effect that is roughly 10 times smaller in magnitude than the estimates measured in Hastings and Washington (2010).

B. Price Response by Retailer

One reason that we may observe very small price responses to rather large and predictable intra-month changes in food sales induced by the SNAP issuance schedule, especially in neighborhoods with high SNAP prevalence, is that our results may mask differences in pricing strategies across retailers. For example, some retailers may engage in cyclical pricing strategies, such as those observed in Hastings and Washington (2010), while others adopt a loss-leader model (Chevalier,

Kashyap and Rossi, 2003). This section repeats our analyses by retailer, focusing only on stores located in zip codes in which at least 15 percent of the population receives SNAP.

Figure 2 presents estimates of the efffect of the issuance policy from our food expenditure regression in Table 4 and the food price regression in Table 7 separately for the 66 retailers with stores located in high-SNAP areas. Each point on the graph represents one retailer and plots the expenditure coefficient on the x-axis and the price coefficient on the y-axis. For example, the a point with coordinates (20,5) represents a retailer for whom food expenditure is 20 percent higher and food prices are 5 percent higher in weeks in which 100 percent of SNAP benefits were issued than in weeks where no benefits are issued.

These results suggest that there is considerable variation in SNAP-induced cyclicality in demand across retailers, even in high-SNAP areas. All but three retailers experienced an increase in food sales in SNAP issuance weeks, however, the magnitude of that increase differed greatly by retailer with an average increase of 12.5 percent in weeks in which 100 percent of SNAP benefits were issued (as shown by the red point). In contrast, there was very little variation in price response across retailers: price responses ranged from a 0.8 percent increase to a 1.5 percent decrease with the vast majority of retailers exhibiting less than a half percent change. This suggests that our main results are not simply masking variation across retailers, but rather very few retailers seem to change their prices – either by increasing or decreasing – in response to the large changes in food demand.

C. Price Response by Product

Another concern is that our price index – which creates one weekly price per store weighted by purchases of SNAP-eligible households – may mask differences in price response by product. For example, retailers may only strategically price products that are in high demand among SNAP recipients or products that see the highest SNAP-induced intramonth cyclicality in demand. Figure 3 repeats the analysis in Figure 2 by product rather than retailer, focusing on the top ten products purchased by SNAP-eligible households in the Consumer Panel data and limiting the data to stores in the same high-SNAP zip codes.[14]

[14]See Appendix Table C for corresponding tables.

The results show a similar pattern to those in the analysis by retailer. We observe substantial difference in SNAP-induced cyclicality of demand by product: frozen food sales are 18 percent higher in weeks where 100 percent of SNAP benefits are distributed while milk sales are only 5 percent higher. However, the corresponding price responses are consistently small across product types. Additionally, we do not find that the products with the highest cyclicality in demand show the largest price responses.

D. Price Response by Market Concentration

One potential reason that we do not see economically significant price responses is that retailers lack the market power to raise prices without substantially reducing the demand by SNAP participants. That is, it could be that although SNAP participants wish to purchase more food right after benefits are issued, they may be indifferent to which store they make their additional purchases at. In this case, a price increase by a particular grocery store could drive SNAP participants away. This explanation is consistent with recent findings that low-income consumers are more likely to price shop than other consumers (Kaplan and Menzio, 2013).[15] If so, we would expect to see more pricing effects by retailers in regions where the retailer has fewer competitors. In those neighborhoods, consumers would be less likely to respond to the higher prices by switching to a different retailer to make their SNAP purchases.

We test this hypothesis by examining the retailer response among stores that are located in areas with limited access to grocery stores versus those located in areas with several other competitors. We define a store to be in a "low market concentration" area if thre are no additional grocery stores from our data set located in the same zip code. Table 8 repeats our price analysis for stores located in low versus high market concentration neighborhoods and by low and high SNAP prevalence, where "high SNAP" areas are defined as zip codes where more than 25 percent of the population received SNAP. As we predicted, the price response is largest in stores located in low competition, high SNAP neighborhoods. However, the price response remains incredibly small even in these areas suggesting that it is unlikely that fear of losing SNAP participants to competitors is a chief

[15] In fact, if SNAP recipients search more intensely for low prices at the start of their benefit month when they make larger shopping trips, it may be optimal for retailers to engage in *countercyclical* pricing.

reason that retailers do not respond to SNAP-induced fluctuations in food demand.

V. Discussion

That retailers do not meaningfully raise prices in response to predictable fluctuations in SNAP participants' food demand is somewhat surprising. After all, simple economic theory suggests that profit-maximizing retailers would raise prices when faced with an outward shift in the demand curve. Moreover, the cyclicality we observe in food expenditures is economically significant – we estimate that SNAP-eligible households living in states that issue all SNAP benefits on the first of the month spend 20 percent more on average in the first week of the month than in the fourth compared to non-SNAP households. Why wouldn't retailers take advantage of these patterns to boost their profits?

One possible explanation is that even savvy retailers are constrained in their ability to exploit SNAP-induced demand fluctuations by their non-SNAP customers. That is, even if a retailer were to raise prices in response to increased demand by SNAP participants, doing so would run the risk of driving away price sensitive non-participants. However, if this explanation for our observed (non)effect were correct, one would expect to observe larger pricing fluctuations in those neighborhoods where a greater fraction of participants participate in SNAP. Yet, as described in the previous section, the amount of pricing cyclicality in high-SNAP neighborhoods barely exceeds the amount in low-SNAP neighborhoods. Even in neighborhoods for which one in five households is SNAP-eligible, the monthly cyclicality we observe in food prices is all but negligible. This suggests that the presence of non-SNAP customers is not the main driver of the lack of price cyclicality we observe. However, it is certainly possible that if SNAP-participants constituted a sizable majority of all purchasers, retailers would become more willing to account for SNAP-induced demand when setting prices.[16]

Another possible explanation for why retailers do not raise prices in response to SNAP-induced

[16]For example, in the context of the Special Supplemental Nutrition Program for Women Infants and Children (WIC) program, grocery stores have set up "WIC-only" outlets in which they stock WIC-eligible foods. By targeting WIC participants, such retailers enjoy a greater ability to charge above-market prices without driving away non-WIC customers.

fluctuations demand is if SNAP participants are too price-elastic with respect to any particular retailer. That is, although SNAP participants may be inelastic with respect to the day on which they purchase food, they may be quite flexible as to the particular retailer at which they shop.[17] Yet this explanation is also in some tension with the results of the empirical analysis described above. In particular, if SNAP participants' price sensitivity were responsible for the lack of a price response by retailers, we would expect to see more pricing cyclicality in neighborhoods in which the retailer has fewer competitors – that is, neighborhoods in which there are fewer alternatives for SNAP participants to substitute to for their food purchases. However, recall that we observe nearly identical monthly pricing patterns in low-food-access and high-food-access neighborhoods. Consequently, the high price elasticity of SNAP participants is also unlikely to be the primary explanation for why retailers do not set prices to account for monthly cycles in SNAP-induced demand.

A final possibility is that retailers may not set prices in response to SNAP-induced demand because their behavior is constrained by social norms against engaging in actions that could be considered as exploiting SNAP participants. Such norms may be internal – the retailers may themselves believe this behavior to be improper – or it could result from a fear that would-be customers would object to this behavior and as a result the retailer would lose profits. If this explanation is correct, it would underscore the importance of accounting for social norms in the behavior of firms as well as individuals (where it has been widely studied). Because we have provided evidence against other potential explanations for why retailers do not appear to account for SNAP-induced demand cycles when setting prices, we conclude that the role of social norms in shaping retailer behavior is worthy of further exploration.

[17] This explanation is consistent with recent findings that low-income consumers are more likely to comparison shop based on prices than are other consumers (Kaplan and Menzio, 2013).

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Table 1: Issuance Policy by State

Issuance Policy	State Abbreviation
Week 1 Only	AK*, CT, HI, ID*, **IL***, MT, ND*, NE, NH, NJ, NV*, **OK***, RI*, VA*, VT*, WY
Week 2 Only	ME, SD
Weeks 1 and 2	AR, AZ, CA, CO, DC, DE, FL, GA, IA, IN, KS, KY, LA, MA, MD, **MI**, MN, **NC**, NY, OH, OK, OR, PA, SC, TN, TX, UT, WA, WI, WV
Spread (3+ Weeks)	AL, **IL**, **MI**, MO, MS, **NC**, NM

Source: USDA Food and Nutrition Services

* Denotes states issuing benefits on the first day of the month.

Bolded states appear multiple times due to policy changes.

Additionally, four states changed their policy in the last quarter of 2012: Georgia, South Carolina, and Tennessee spread issuance over 3+ weeks and Virginia spreads issuance over weeks 1 and 2.

Alaska and Hawaii are not included in our data.

Table 2: Summary Statistics

	Full Sample (1)	SNAP (2)	Non-SNAP (3)	Poor Non-SNAP (4)	Non-Poor (5)
Panel A. Nielsen Retailer Data					
Number of Grocery Stores	10,070				
Average Annual Food Sales ($)	7.9M				
Average Local SNAP Prevalence	10.1				
% Low-Income, Low-Access	6.0				
Panel B. Nielsen Consumer Panel Data					
Number of Households	78,480				
Years in Panel	3.8				
Number of Household-Years	298,704	25,311	273,393		
SNAP-eligibile	12.5				
Household Demographics					
Household Income	57,366	12,372	63,799		
Household Size	2.4	2.4	2.4		
Number of Children	0.9	1.0	0.9		
Married (%)	46.1	25.0	49.1		
Non-White (%)	25.7	27.3	25.5		
Weekly Household Expenditure					
Food Expenditure ($)	35.46	32.54	35.88		
Any Food (%)	76.81	75.27	77.03		
Panel C. FoodAPS Data					
Number of Households	4,826	1,581		1,195	2,048
Number of Individuals	14,317	5,414		3,335	5,564
Household Demographics					
Female (%)	67.6	73.5		66.2	66.8
Age	49.8	45.9		52.9	49.7
HS Diploma (%)	90.3	74.0		81.5	95.9
Non-white (%)	23.8	40.9		28.2	19.3
Number of Children	0.68	1.03		0.61	0.63
Married (%)	44.2	22.0		29.8	52.3
Hispanic (%)	12.7	24		18.5	9.0
Household size	2.42	2.90		2.17	2.39
Daily Food Expenditure ($)	17.29	13.80		11.29	19.51

Source: Nielsen Retailer Scanner data, 2006-2012 (Panel A); Nielsen Consumer Panel, 2004-2011 (Panel B); National Household Food Acquisition Survey (Panel C).

"Poor" refers to households below 185 percent of the Federal Poverty Line.

The table reports mean characteristics for full sample and by SNAP eligibility (Panel A), participation (Panel B).

Table 3: Food Sales Response by Issuance Policy

	1st Day	1st Week	2nd Week	Weeks 1-2	Weeks 1-3+	All States
	(1)	(2)	(3)	(4)	(5)	(6)
Fraction Issued						0.0565***
						(0.0104)
Week 2	-0.0688***	-0.0618***	0.0351*	-0.0293***	-0.0294	-0.0166***
	(0.0083)	(0.0059)	(0.0147)	(0.0069)	(0.0190)	(0.0052)
Week 3	-0.0787***	-0.0656***	0.0399**	-0.0404***	-0.0189	-0.0078
	(0.0097)	(0.0090)	(0.0103)	(0.0070)	(0.0274)	(0.0061)
Week 4	-0.0615***	-0.0474***	-0.0030	-0.0445***	-0.0230*	-0.0076
	(0.0137)	(0.0108)	(0.0082)	(0.0071)	(0.0122)	(0.0053)
N	322,514	488,836	31,042	2,551,928	201,650	3,273,456

Source: Nielsen Retail Scanner Data, 2006-2012.

Standard errors clustered at the retailer level in parentheses.

All specifications include store, year, and calendar month fixed effects.

Outcome variable: log weekly food sales volume.

"Fraction Issued" is the fraction of a state's SNAP benefits issued in that week.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4: Food Sales Response by SNAP Prevalence

	Less than 5	5-15	15-25	GT 25
	(1)	(2)	(3)	(4)
Fraction Issued	0.0170**	0.0536***	0.1102***	0.1819***
	(0.0066)	(0.0092)	(0.0169)	(0.0365)
Week 2	-0.0304***	-0.0202***	-0.0012	0.0211
	(0.0036)	(0.0048)	(0.0089)	(0.0137)
Week 3	-0.0127*	-0.0111*	-0.0034	0.0038
	(0.0066)	(0.0062)	(0.0075)	(0.0206)
Week 4	-0.0014	-0.0092	-0.0200**	-0.0428**
	(0.0052)	(0.0057)	(0.0077)	(0.0174)
N	967,066	1,558,059	592,264	142,399

Source: Nielsen Retail Scanner Data, 2006-2012.

Standard errors clustered at the retailer level in parentheses.

All specifications include store, year, and calendar month fixed effects.

Outcome variable: log weekly food sales volume.

"Fraction Issued" is the fraction of a state's SNAP benefits issued in that week.

Columns 1 through 4 include stores located in zip codes where the proportion of the population receiving SNAP is less than 5 percent, 5 to 15 percent, 15 to 25 percent, and greater than 25 percent, respectively.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5: Log Food Expenditure Patterns by SNAP Issuance Policy

	Panel A: Consumer Panel Data				Panel B: FoodAPS Data			
	1st Week	Week 1-2	1-3+ Weeks	All States	1st Week	Week 1-2	1-3+ Weeks	All States
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
SNAP*Fraction Issued				0.1918***				0.662***
				(0.0100)				(0.166)
Fraction Issued				0.0063				0.047
				(0.0040)				(0.126)
SNAP*Week 2	-0.0984***	0.0111	0.0173		-0.730*	0.020	0.285	
	(0.0187)	(0.0099)	(0.0216)		(0.408)	(0.154)	(0.259)	
SNAP*Week 3	-0.1632***	-0.0845***	0.0299		-0.696	-0.191	-0.083	
	(0.0200)	(0.0094)	(0.0256)		(0.427)	(0.148)	(0.269)	
SNAP*Week 4	-0.2002***	-0.1548***	-0.0246		-0.925**	-0.398**	-0.011	
	(0.0205)	(0.0092)	(0.0244)		(0.374)	(0.176)	(0.336)	
Week 2	-0.0276***	-0.0160***	-0.0109*	-0.0095***	-0.0573	0.115	-0.253	0.064
	(0.0045)	(0.0018)	(0.0058)	(0.0021)	(0.184)	(0.073)	(0.130)	(0.061)
Week 3	-0.0093*	-0.0039**	0.0116**	0.0034	-0.048	-0.055	-0.011	-0.027
	(0.0051)	(0.0018)	(0.0058)	(0.0029)	(0.188)	(0.077)	(0.135)	(0.081)
Week 4	-0.0379***	-0.0288***	-0.0199***	-0.0295***	-0.004	0.081	-0.083	0.0675
	(0.0053)	(0.0019)	(0.0058)	(0.0030)	(0.170)	(0.076)	(0.146)	(0.090)
SNAP	0.1127***	0.0508***	0.0185	-0.0515***	0.235	-0.047	-0.143	-0.341***
	(0.0197)	(0.0094)	(0.0293)	(0.0064)	(0.267)	(0.116)	(0.202)	(0.069)
N	1,406,707	8,787,540	847,699	11,116,301	603	4,748	1,120	

Panel A: Nielsen Consumer Panel, 2004-2011; outcome = log weekly household food expenditure;
all specifications control for household, year, and calendar month fixed effects.
Panel B: National Household Food Acquisition Survey (FoodAPS); outcome = log daily household food expenditure;
all specifications control for household demographic characteristics.
Columns 1-3, 5-7: includes households located in states where all SNAP benefits are issued in the first week only,
the first two weeks, or across three or more weeks, respectively. Columns 4 & 8 include all households.
Standard errors clustered at the household level in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Food Expenditure Patterns by Issuance Policy, Illinois

	Issue Date: 1st	Issue Date: 1-23rd
	(1)	(2)
Panel A: Log Food Expenditure by Local SNAP Prevalence, Retailer Data		
High SNAP x Week 2	-0.0949**	-0.0104
	(0.0315)	(0.0106)
High SNAP x Week 3	-0.1107***	-0.0701**
	(0.0277)	(0.0243)
High SNAP x Week 4	-0.1102***	-0.0927**
	(0.0296)	(0.0294)
Week 2	-0.0664***	-0.0948***
	(0.0071)	(0.0147)
Week 3	-0.0670***	-0.0946***
	(0.0189)	(0.0281)
Week 4	-0.0358***	-0.0470***
	(0.0072)	(0.0109)
N	63,403	44,504
Panel B: Log Food Expenditure by Household SNAP-eligibility, Consumer Panel Data		
SNAP*Week 2	-0.0878**	0.0048
	(0.0421)	(0.0571)
SNAP*Week 3	-0.1322***	0.0003
	(0.0385)	(0.0579)
SNAP*Week 4	-0.1567***	-0.0543
	(0.0366)	(0.0564)
Week 2	-0.0242***	-0.0024
	(0.0075)	(0.0149)
Week 3	-0.0056	0.0109
	(0.0082)	(0.0157)
Week 4	-0.0209**	-0.0113
	(0.0085)	(0.0149)
SNAP	0.1030***	-0.0888
	(0.0375)	(0.0795)
N	376,300	135,862

Source: Nielsen Retailer Data, 2006-2012 (Panel A); Nielsen Consumer Panel, 2004-2011 (Panel B).
Standard errors clustered at the household/[retailer] level in parentheses.
All specifications control for household/[store], year, and calendar month fixed effects.
Outcomes: log food volume (Panel A), log weekly household food expenditure (Panel B).
Includes store/households located in Illinois prior to March 2010 when all SNAP
benefits were issued on the first of the month (column 1) and after the policy
change which staggered issuance across the first 23 days of the month (column 2).
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7: Food Price Response by SNAP Prevalence

	All Stores	Less than 5	5-15	15-25	GT 25
	(1)	(2)	(3)	(4)	(5)
Fraction Issued	0.0007*	0.0005	0.0006*	0.0009	0.0015**
	(0.0004)	(0.0005)	(0.0004)	(0.0006)	(0.0008)
Week 2	0.0030***	0.0029***	0.0031***	0.0031***	0.0033***
	(0.0003)	(0.0004)	(0.0003)	(0.0003)	(0.0005)
Week 3	0.0034***	0.0030***	0.0035***	0.0037***	0.0042***
	(0.0006)	(0.0006)	(0.0006)	(0.0009)	(0.0013)
Week 4	0.0013**	0.0011*	0.0013**	0.0013	0.0013
	(0.0006)	(0.0006)	(0.0006)	(0.0009)	(0.0011)
N	3,273,456	967,066	1,558,059	592,264	142,399

Source: Nielsen Retail Scanner Data, 2006-2012.
Standard errors clustered at the retailer level in parentheses.
All specifications include store, year, and calendar month fixed effects.
Outcome variable: log weekly food price index.
"Fraction Issued" is the fraction of a state's SNAP benefits issued in that week.
Columns 2 through 5 include stores located in zip codes where the proportion
of the population receiving SNAP is less than 5 percent, 5 to 15 percent,
15 to 25 percent, and greater than 25 percent, respectively.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

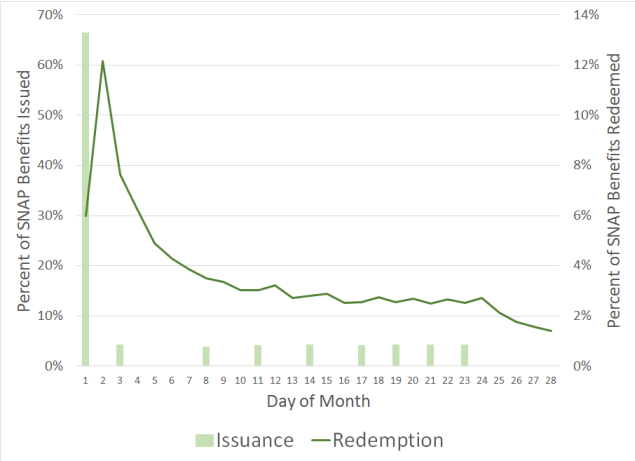
Table 8: Price Response by SNAP Prevalence and Market Concentration

	High Market Concentration		Low Market Concentration	
	Low SNAP	High SNAP	Low SNAP	High SNAP
	(1)	(2)	(3)	(4)
Fraction Issued	0.0006*	0.0011	0.0007	0.0021*
	(0.0004)	(0.0007)	(0.0006)	(0.0012)
Week 2	0.0030***	0.0033***	0.0031***	0.0036***
	(0.0004)	(0.0005)	(0.0004)	(0.0006)
Week 3	0.0035***	0.0044***	0.0032***	0.0043**
	(0.0006)	(0.0009)	(0.0008)	(0.0018)
Week 4	0.0013**	0.0013	0.0012	0.0018
	(0.0006)	(0.0009)	(0.0007)	(0.0016)
N	2089038	78999	1028351	77068

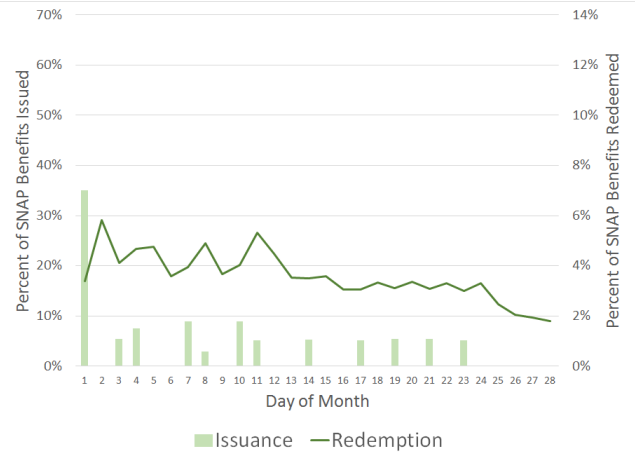
Source: Nielsen Retail Scanner Data, 2006-2012.
Standard errors clustered at the store level in parentheses.
All specifications control for store, year, and calendar month fixed effects.
Outcome variable: log food price index.
"Fraction Issued" is the fraction of a state's SNAP benefits issued in the given week.
"Low concentration" refers to stores with no other Nielsen grocery stores in the same zip code.
"Low SNAP" refers to stores in zip codes with less than 25 percent of residents receiving SNAP.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure 1: Illinois SNAP Issuance and Redemption

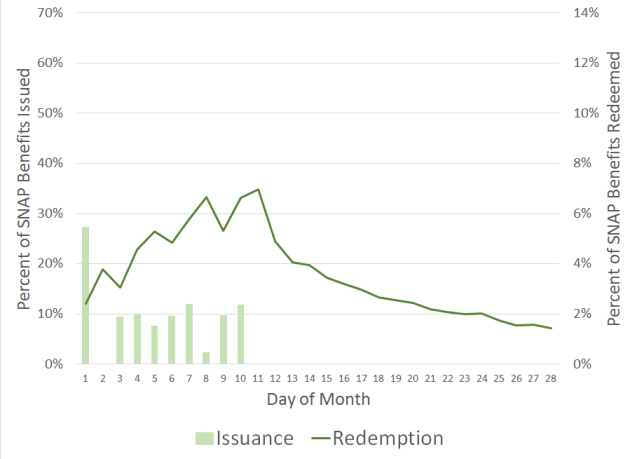
(a) Jan 2008 to Feb 2010: Issued on Day 1



(b) March 2010 June 2013: Issued Days 1 to 23



(c) July 2013 to Feb 2014: Issued Days 1 to 10



(d) March 2014 to August 2014: Issued Days 1 to 23

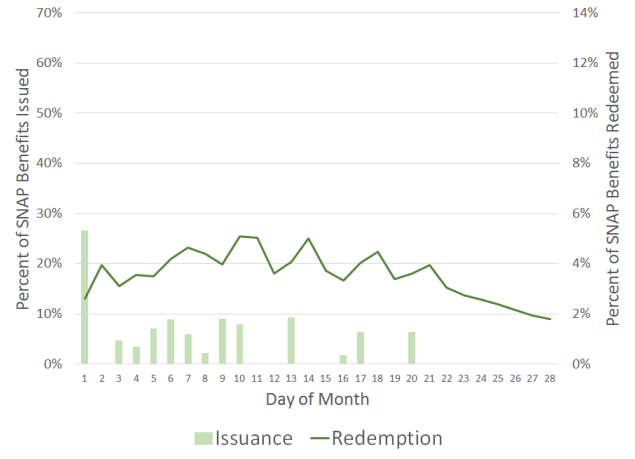


Figure 2: Price versus Sales Response by Retailer

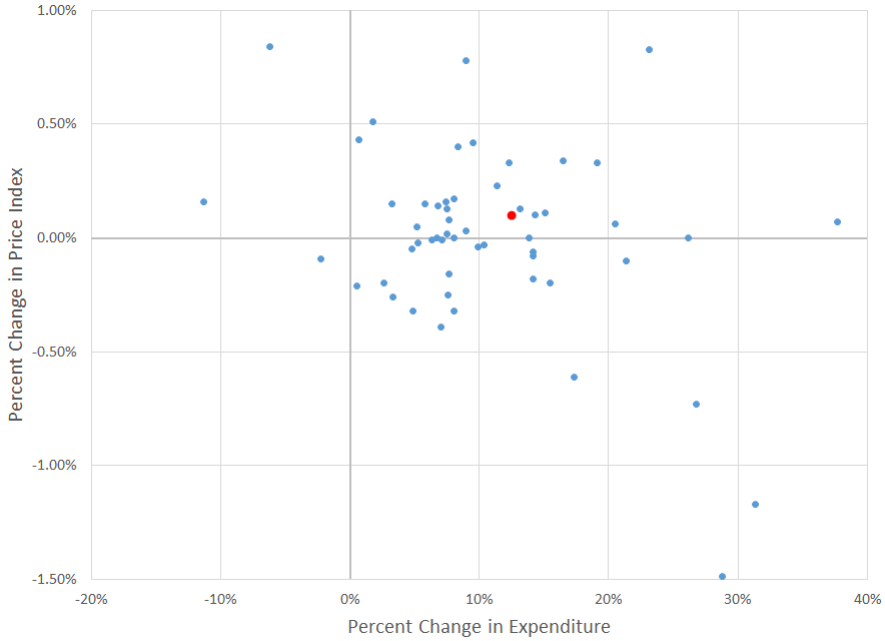
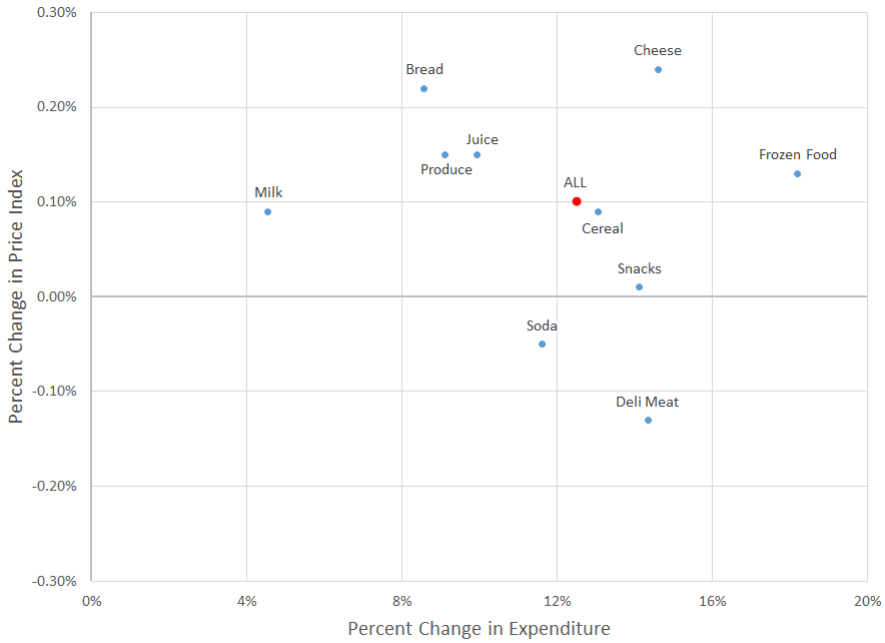


Figure 3: Price versus Sales Response by Product Group



Appendix Table A: SNAP Issuance Policy by State

	Current Issuance Policy		Previous Issuance Policy		Change Date
	First Day	Last Day	First Day	Last Day	
Alabama	4	18			
Alaska	1	1			
Arizona	1	13			
Arkansas	4	13	5	15	3/1/2005
California	1	10			
Colorado	1	10			
Connecticut	1	3			
Delaware	5	11			
D.C.	1	10			
Florida	1	15			
Georgia	5	23	5	14	9/1/2012
Hawaii	3	5			
Idaho	1	1	1	5	9/1/2009
Illinois	1	23	1	1	2/15/2010
Indiana	1	10			
Iowa	1	10			
Kansas	1	10			
Kentucky	1	10			
Louisiana	5	14			
Maine	10	14			
Maryland	6	15			
Massachusetts	1	14			
Michigan	3	21	1	9	1/1/2011
Minnesota	4	13			
Mississippi	5	19			
Missouri	1	22			
Montana	2	6			
Nebraska	1	5			
Nevada	1	1			
New Hampshire	5	5			
New Jersey	1	5			
New Mexico	1	20			
New York	1	10			
North Carolina	3	21	3	12	7/1/2011

Current issuance policy refers to issuance policy as of 2012 year end.

Appendix Table A (cont.): SNAP Issuance Policy by State

	Current Issuance Policy		Previous Issuance Policy		Change Date
	First Day	Last Day	First Day	Last Day	
North Dakota	1	1			
Ohio	1	10			
Oklahoma	1	10	1	1	4/1/2011
Oregon	1	9			
Pennsylvania	1	10			
Rhode Island	1	1			
South Carolina	1	19	1	10	9/1/2012
South Dakota	10	10			
Tennessee	1	20	1	10	10/1/2012
Texas	1	15			
Utah	5	15			
Vermont	1	1			
Virginia	1	9	1	1	10/1/2012
Washington	1	10			
West Virginia	1	9			
Wisconsin	2	15			
Wyoming	1	4			

Current issuance policy refers to issuance policy as of 2012 year end.

Appendix Table B: Food Expenditure Patterns by SNAP Issuance Policy

	Panel A: Consumer Panel Data				Panel B: FoodAPS Data			
	1st Week	Week 1-2	1-3+ Weeks	All States	1st Week	Week 1-2	1-3+ Weeks	All States
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
SNAP*Fraction Issued				7.8748***				11.050***
				(0.4418)				(2.629)
Fraction Issued				0.3736**				0.040
				(0.1669)				(1.952)
SNAP*Week 2	-4.4986***	0.6665*	0.4722					
	(0.8676)	(0.4018)	(0.9472)					
SNAP*Week 3	-6.6651***	-3.4856***	1.2151					
	(0.8892)	(0.3756)	(1.2145)					
SNAP*Week 4	-7.9626***	-5.8485***	-1.5747					
	(0.9423)	(0.3593)	(0.9662)					
Week 2	-1.0446***	-0.6161***	-0.4260*	-0.2931***	1.073	2.773**	-3.809**	1.662
	(0.1947)	(0.0718)	(0.2185)	(0.0854)	(2.639)	(1.304)	(1.756)	(1.054)
Week 3	-0.4921**	-0.1574**	0.4172*	0.1885	0.365	-0.320	0.742	0.064
	(0.2131)	(0.0721)	(0.2339)	(0.1183)	(2.393)	(1.148)	(2.224)	(1.332)
Week 4	-1.8375***	-1.4089***	-1.0805***	-1.3302***	-0.928	1.332	-0.124	0.684
	(0.2175)	(0.0737)	(0.2312)	(0.1202)	(2.319)	(1.301)	(2.733)	(0.151)
SNAP	4.7710***	2.1515***	0.2970	-1.9410***	7.896	0.0126	-2.649	-5.244***
	(0.9714)	(0.3514)	(1.0133)	(0.2416)	(5.110)	(1.607)	(3.435)	(0.871)
N	1,814,976	11,320,176	1,110,384	14,337,792	705	5,761	1,398	7,929

Panel A: Nielsen Consumer Panel, 2004-2011; outcome = weekly household food expenditure in dollars;
all specifications control for household, year, and calendar month fixed effects.

Panel B: National Household Food Acquisition Survey (FoodAPS); outcome = daily household food expenditure in dollars;
all specifications control for household demographic characteristics.

Columns 1-3, 5-7: includes households located in states where all SNAP benefits are issued in the first week,
the first two weeks, or across three or more weeks, respectively. Columns 4 & 8 include all households.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix Table C: Food Sales and Price Patterns by Product Group

	Soda	Bread	Milk	Deli Meat	Froz Food	Snacks	Cheese	Juice	Produce	Cereal
	1503	1501	2506	3002	2008	1507	2502	507	4001	1005
Panel A: Food Expenditures										
Frac Iss	0.1163***	0.0858***	0.0456***	0.1435***	0.1820***	0.1412***	0.1460***	0.0994***	0.0911***	0.1307
	(0.0212)	(0.0162)	(0.0087)	(0.0215)	(0.0269)	(0.0255)	(0.0254)	(0.0184)	(0.0169)	(0.0230)
Week 2	-0.0211**	0.0354***	0.0079*	0.0042	0.0822***	0.0189	0.0248**	0.0329***	0.0323***	0.0406
	(0.0083)	(0.0077)	(0.0044)	(0.0110)	(0.0169)	(0.0126)	(0.0112)	(0.0070)	(0.0088)	(0.0120)
Week 3	-0.0066	0.0236**	0.0093	-0.0310**	0.0311	-0.0076	0.0232	0.0212**	0.0162	0.0101
	(0.0108)	(0.0102)	(0.0060)	(0.0138)	(0.0229)	(0.0122)	(0.0141)	(0.0090)	(0.0120)	(0.0176)
Week 4	-0.0253*	-0.0568***	-0.0478***	-0.0924***	-0.0998***	-0.0726***	-0.0220*	-0.0543***	-0.0592***	-0.0835
	(0.0149)	(0.0104)	(0.0052)	(0.0111)	(0.0180)	(0.0097)	(0.0119)	(0.0073)	(0.0116)	(0.0140)
Panel B: Food Prices										
Frac Iss	-0.0005	0.0022**	0.0009	-0.0013	0.0013	0.0001	0.0024***	0.0015*	0.0015	0.0009
	(0.0033)	(0.0009)	(0.0006)	(0.0015)	(0.0013)	(0.0016)	(0.0009)	(0.0008)	(0.0012)	(0.0011)
Week 2	0.0140***	-0.0016***	-0.0002	0.0048***	-0.0024**	0.0066***	0.0030***	-0.0003	-0.0030***	-0.0067
	(0.0012)	(0.0005)	(0.0004)	(0.0013)	(0.0010)	(0.0015)	(0.0005)	(0.0004)	(0.0006)	(0.0009)
Week 3	0.0101***	0.0009	-0.0010	0.0082***	0.0008	0.0095***	0.0052***	0.0023*	-0.0019	-0.0044
	(0.0030)	(0.0006)	(0.0007)	(0.0013)	(0.0007)	(0.0030)	(0.0015)	(0.0014)	(0.0015)	(0.0016)
Week 4	-0.0006	0.0048***	-0.0006	0.0064***	0.0040***	0.0045	0.0037***	0.0042***	0.0005	0.0041
	(0.0039)	(0.0010)	(0.0008)	(0.0011)	(0.0011)	(0.0032)	(0.0013)	(0.0012)	(0.0014)	(0.0020)
N	734616	734555	734484	734530	734456	734625	734506	734615	734268	734559