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First of the month effect: Does it apply across food retail channels?

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ABSTRACT

In this study we use detailed daily scanner data on household food purchases to examine monthly food expenditure patterns across food retail channels. We compare food expenditure patterns in high and low-income households comparing those where Supplementary Nutrition Assistance (SNAP) is received in the first 10 days of the month versus households which receive SNAP over the first 15 days of the month. We find that food expenditure patterns vary systematically across the month within different retail channels by income and SNAP payment schedules. Low-income households in early SNAP distribution areas decrease their grocery and mass/club/superstore expenditures at the end of the calendar month and supplement this decrease with increased food expenditures in convenience stores and food away from home. Households in staggered SNAP payment areas show far fewer systematic patterns given the more distributed payment system.

Introduction

Mounting evidence suggests that individuals and households change their consumption and expenditure behavior based on the timing of income payments or government assistance distributions. This gives rise to the so-called "first of the month effect". The timing of government assistance payments received by poorer households varies by state. The timing of these payments can have significant implications for the distribution of food expenditures throughout the month for recipient households. Food expenditures, given their frequency relative to other purchases, may be especially vulnerable to cyclical fluctuations in purchasing patterns. For example, the *New York Times* (Associated Press, 2006, p. 25) reported that the food expenditure cycle in Michigan was so pronounced in poorer neighborhoods that food retailers were lobbying for a change in the way federal assistance benefits were distributed in order to even out swings in customer traffic, which retailers claimed made it difficult to provide consistent food stocks and staff. Anecdotal evidence further suggests that households may employ different food retail channels depending on the time of the month and the food retail landscape in their community. This study makes three contributions toward a better understanding of food expenditure cycles using detailed household food expenditure data for 1601 households in urban areas throughout the United States. We examine (i) whether household expenditures exhibit cyclical patterns for low- and high-income groups in two sub-samples where Supplementary Nutrition Assistance (SNAP) payments are distributed in different intervals, (ii) if food expenditure patterns vary systematically among food retail channels throughout the month between sub-samples, and (iii) if food expenditures on food-away-from-home vary throughout the month for low- versus high-income households according to SNAP payment schedules.

We estimate household food expenditure patterns in order to derive implications for both private sector retail interests, as well as policymakers concerned with the nutrition and food expenditure patterns in low-income households. Food retailers are interested in within-month expenditure patterns since fluctuations in food expenditures – especially for perishable items such as dairy, meat, and eggs – affect inventory management at the retail level. From a public policy perspective, cyclical purchasing patterns for perishables in low-income households may imply that these households experience monthly disruptions in their nutritional balance or are consuming less healthy foods toward the end of the month.

Our study lies at the intersection of an extensive literature documenting consumers' monthly expenditure patterns and a related group of studies that examine food access and prices depending on a consumer's location. Several studies examining expenditure patterns test the theoretical implications of the permanent income hypothesis which implies that consumption should be unaffected by known changes in income (Stephens, 2003). Hall (1978) and Browning and Collado (2001) report evidence supporting the permanent income hypothesis in the United States and Spain, respectively. These studies suggest that people smooth their consumption and do not concentrate their purchases around income

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payments. Other studies suggest that liquidity or credit constraints affect low-income households' consumption behavior (Zeldes, 1989; Jappelli et al., 1998) and that expenditures and consumption decline after the receipt of an income payment (Stephens, 2003; Huffman and Barenstein, 2004).

Several studies have examined expenditure patterns specifically for food. Evidence suggests that low-income households employ cyclical food consumption and expenditure strategies that are dependent on the timing of their paycheck or government transfers (Wilde and Ranney, 2000; Stephens, 2003, 2006; Hastings and Washington, 2010). Wilde and Ranney (2000) find that food stamp recipients cluster their expenditures and typically have one large grocery shopping trip each month as a result of transportation constraints. On the other hand, as Kunreuther (1973) suggests, households with a lack of storage capacity may need to make frequent, small-expenditure trips to nearby stores. Social security checks have also been shown to induce similar food expenditure patterns (Stephens, 2003). More concerning is the finding that this cyclical food shopping pattern results in a drop in food energy intake at the end of the month (Wilde and Ranney, 2000; Shapiro, 2005).

Income and community characteristics influence how much households pay for food as well as where and how they shop. Urban consumers are more likely to shop at smaller grocery stores rather than larger or discount club grocery stores (Chung and Myers, 1999) and pay more for salty snacks, fresh fruits, and vegetables (Steward and Dong, 2011). So-called food deserts, where consumers lack adequate access to healthy food choices, are an increasingly important concern among policymakers.[1] Differences in food environments across communities affect health outcomes of community members (Powell et al., 2007) and result in higher food prices for people in communities where large grocery chains are absent (Steward and Dong, 2011). However, the causal effect between food-deserts and other adverse outcomes has not been conclusively established in the literature.

If low-income urban households are more likely to buy food from smaller, higher-priced retail outlets, especially toward the end of the month, this could imply that the poor are facing higher prices at the same time they are facing binding liquidity constraints. Constraints on low-income households caused by small cash reserves, lack of access to private transportation, and limited home food storage space may make it less attractive to shop in club stores that cater to "stock-up" shoppers. If poor shoppers supplement a monthly grocery store trip with purchases at neighborhood convenience stores and small grocery stores, this implies that low-income households' locations influence their optimal consumption bundles given the higher prices often paid at these smaller stores (Chung and Myers, 1999) and the limited assortment of products they offer. However, exploration of price effects are beyond the scope of this study, which focuses only on cyclical patterns in food expenditure levels across retail channels.

Previous studies establish that low-income shoppers employ cyclical monthly aggregate food (and general) expenditure patterns. This study makes a contribution to this literature by estimating monthly household food expenditures patterns in four different retail channels (grocery, drug, convenience, and mass/club/super stores) as well as aggregate food, and food-away-from-home expenditure patterns. In particular, we are interested in how low-income consumers in two different SNAP distribution regimes allocate their food expenditures among different types of food retail channels. We present findings from an empirical analysis using the 2003 Nielsen Homescan scanner data that documents all household food expenditures for each day in 2003 and the 2003 Consumer Expenditure Survey (CES) that provides a weekly food diary for food-away-from-home expenditures.[2,3] We examine whether households with different income, and SNAP distribution schedules systematically vary food expenditure over the course of a month and whether expenditure patterns change across food retail channels.

In the sections that follow, we discuss a theory of retail choice, describe the data sources and the empirical estimation strategy for this study, present our results, and conclude with a summary discussion.

Theoretical discussion of food purchasing patterns

Kunreuther (1973) provides a formal model of retail choice to predict how households allocate expenditures across different food retail channels. Households maximize their individual utility subject to a fixed food budget that is a function of food prices, quantities, and the cost of transportation from the household to different retail outlets. Further, Kunreuther presents an implicit supply schedule for each good in order to examine the package size effect on consumer purchasing decisions. Kunreuther's model helps frame key factors in a consumer's retail outlet choice such as preferences, retail price, transportation costs, and storage costs.

As Steward and Dong (2011) show, retail price can vary for identical products across retail outlets and food environments. They suggest that price differences are in part due to differences in costs faced by retailers. Price is an important determinant in consumption behavior, however other factors also affect consumers' retail choice, namely cost of transportation, cost of storing the product, and liquidity constraints. If transportation costs between a household and retail outlet are sufficiently high, even though a product may be cheaper in a more distant retail outlet, the consumer may still be willing to pay a higher price at a closer retail outlet, since transportation to the more distant retail outlet would eliminate the price advantage of that store. As Kunreuther points out, the time cost of waiting in line at a large retail outlet can also induce changes in retail preferences.

Inventory or storage costs also differ across households. For households where storage is limited, inventory cost may prevent them from buying in bulk, which may mean paying a higher per unit price for some food products. An important implication of Kunreuther's model is that low-income families who face storage and liquidity constraints will purchase either the same or a smaller optimal package size than higher income households. Another consideration is that household preferences are undoubtedly heterogeneous and their retail choice may be a reflection of these differing preferences interacting with different locations, prices, costs, etc.

Lastly, liquidity constraints cause food purchases by low-income consumers to be concentrated around the time when they receive an income payment or government transfer. In contrast, expenditures by higher income consumer are less sensitive to fluctuations in income. Some authors attribute this pattern to a violation of the permanent income hypothesis (Stephens, 2006), to evidence of differing time preferences, or to quasi-hyperbolic discounting (Huffman and Barenstein, 2004). If households face a liquidity constraint and face different storage and transportation costs, we expect to see differing expenditure patterns across retail

[1] For a review of the literature on food deserts see Beaulac, Kristjansson, & Cummins (2009).

[2] We use a 1601 household subsample of these data to contrast households in two different SNAP distribution areas. Excluded households were either not allocated to a specific market area (primarily rural households), are in market areas where the SNAP disbursement fell outside of our two SNAP schedules of interest, or are not included in our definitions of high or low-income.

[3] We use 2003 data in order to match these data with the comprehensive review of SNAP payment schedules provided by Cole and Lee (2005).

outlets over time. Households may make one or several large grocery store purchases at the beginning of the month, however as the month goes on, and the liquidity constraint tightens, inventory and/or transportation constraints may dominate. If this is the case we expect to see increased expenditures in smaller, nearby food retail outlets by lower income households particularly in areas where SNAP is distributed early in the month.

The above theoretical discussion leads to the null hypothesis that both low and high-income households will show no systematic cyclical consumption pattern across retail outlets. However, if liquidity, storage, and transportation constraints are binding, we would expect to reject the null hypothesis and observe differing intertemporal patterns across retail channels for low-income households and that these expenditure patterns are likely consistent with the timing of a substantial government income payment such as SNAP. We expect all three constraints to be binding for low-income consumers and to observe an increase in spending in smaller convenience and drug stores and possible food-away-from-home outlets as the calendar month progresses, particularly in market areas where SNAP is distributed early in the month. In areas where SNAP payments are distributed throughout the month, we expect that individual households will still likely respond by clustering their expenditures around these payments, but that in the aggregate we will be unlikely to observe a systematic pattern.

Data

We use 2003 Nielsen Homescan and the 2003 CES data in our empirical analysis. The Nielsen Homescan data capture all food-at-home expenditures for the participating households, and identify the date and the name of the store where each purchase was made. The total sample includes 8833 urban, rural and peri-urban households in the United States for all 12 months of 2003. In addition to food expenditures, the data set contains demographic information for each household, including variables that measure household size, household composition, income range, presence of children, and employment status of the household heads. The data include a single measure of all demographic variables for 2003, and therefore all of the demographic variables are time-invariant. Urban households are assigned to a specific market area, which is generally defined as the metro area where the household resides. Market areas are based on metropolitan statistical area definitions as determined by the Office of Management and Budget with some adjustment for retail food market layout. The households represent 52 market areas in the total sample. We include 1601 households from 11 market areas in our analysis. These 11 market areas were chosen because they employ one of two SNAP benefit payment schedules, discussed below. Rural households are not assigned to an urban market area and are not used in this analysis. For more details about the Nielsen Homescan data see Einav et al. (2008). In addition to the primary analysis using the Homescan data, we employ the 2003 CES for the same states included in the 11 market areas to examine food away from home purchasing patterns which are not captured in the Homescan data.

The Homescan data do not include information on the receipt of regular wage payments or of entitlement or assistance programs. There are multiple social safety net programs that may affect expenditure patterns including Social Security Insurance (SSI), Social Security, Temporary Assistance for Needy Families (TANF), and Supplementary Nutrition Assistance for Needy Families (SNAP). The issuance schedules for these programs are detailed in Table 1 for the market areas used in our analysis. During 2003, SSI almost always was distributed on the first of the calendar month. Social security changed its distribution schedule in 1997. Beneficiaries who were eligible for social security before 1997 received benefits on the first of the month; however after 1997 the schedule changed to stagger payments throughout the month according to the recipient's birthday. Since we do not have this information, we cannot account for social security payments. TANF payment schedules vary by state.[4] Cole and Lee (2005) provide detailed information on the distribution of SNAP benefits by state.

As Foley (2011) points out, the SNAP program is employed by far more households than TANF or SSI, covering more than twice the number of families. Further, he also states that food stamps are a more important source of income for recipient families. Given the importance of food stamps and that our study is particularly focused on food consumption across retail channels, we examine changes in food expenditure patterns according to SNAP distribution schedules. The market areas and SNAP distribution schedules as well as the population receiving SNAP are presented in Table 1.

For our analysis we group households by per capita income, which is calculated by dividing the midpoint of the self-reported income range by household size[5] and by SNAP distribution schedules. Households in each market area are divided into two income groups: "low-income", representing the bottom 25% of the income distribution and "high-income", representing the top 25% of the income distribution.[6] We follow the same strategy as Foley (2011) and limit the market areas to compare those market areas where SNAP benefits were distributed in the first 10 days[7] (early payment sample) to those where SNAP payments were distributed over the first 15 days (staggered payment sample). Also, consistent with Foley (2011) we have further limited our sample to market areas which have relatively high SNAP participation rates of over 9% of the total population as documented by Fellowes and Berube (2005), see Table 1.[8] Market areas included in the early payment sample are Detroit, Memphis, New York City, and Washington, DC and those included in the staggered payment sample are Atlanta, Baltimore, Boston, Miami, Milwaukee, New Orleans/Mobile and Philadelphia. The comparison of expenditure patterns in these two SNAP payment samples allows us to observe differences primarily in weeks 2 and 3. We aggregate expenditures by weeks, therefore a majority of the early payment sample receives payments in week 1 (assuming that these payments are evenly distributed over the 10 days) and those households in the staggered sample receive payments in weeks 1, 2, and sometimes 3 (depending on the calendar month). Given this comparison, we expect to observe any differences in expenditure patterns in low-income households in weeks 2 and 3 as mentioned, although it is possible to observe differences in week 4 if the differing SNAP payment schedule affects liquidity at the end of the month.

Descriptive statistics for household characteristics based on Homescan data are presented in Table 2 for households grouped by per capita income quartiles (top and bottom) and SNAP issuance schedules. Low-income households have a mean per capita income of $9417 and high-income households have a mean per capita income of $49,363. The average per capita income in both income groups is relatively consistent across both SNAP payment schedule groups. Average weekly household food expenditures are $45.07

[4] SSI and TANF disbursement dates are obtained from Foley (2011).

[5] This measure of per capita income is subject to error, but it is used only to group households and so does not introduce measurement error into our regression analysis.

[6] Analysis was also conducted using "SNAP eligible" as a group which included about 17 percent of the sample, but because of the measurement error inherent in the per capita income data, we opted to use the bottom 25% of the income distribution to examine how SNAP distribution might affect expenditure patterns.

[7] The only exception in this category is Detroit, which distributes SNAP over the first 9 days.

[8] Foley (2011) uses a 10% SNAP participation cutoff, however we opted to use a 9% cutoff to increase our sample size since two large market areas in our sample (Atlanta and Boston) were between 9% and 10% participation rates according to Fellowes and Berube (2005).

Table 1
SNAP participation and safety net issuance schedule. *Source:* (a) Fellowes and Berube (2005), (b) Cole and Lee (2005) and (c) Foley (2011).

City	Percent of population receiving SNAP	Issuance days			
		SNAP	TANF	SSI	Social security
Early payment sample					
Detroit	12.2	1st–9th	Twice a month, staggered	1st	Staggered
Memphis	12.6	1st–10th	Unknown	1st	Staggered
New York City*	14.8	1st–10th	Unknown	1st	Staggered
Washington, DC	14.3	1st–10th	1st	1st	Staggered
Staggered payment sample					
Atlanta	9.1	5th–14th	Unknown	1st	Staggered
Baltimore	15.3	6th–15th	1st–15th	1st	Staggered
Boston	9.4	1, 2, 4, 5, 7, 8, 10, 11, 13, 14	Unknown	1st	Staggered
Miami	11.3	1st–15th	1st–15th	1st	Staggered
Milwaukee	10.6	2, 3, 5, 6, 8, 9, 11, 12, 14, 15	2nd–15th	1st	Staggered
New Orleans/mobile	20.8/9.9	5th–14th	1st–5th	1st	Staggered
Philadelphia	17.9	First 10 business days	Twice a month, staggered	1st	Staggered

* In New York City, SNAP participation rate is the average of Kings, Bronx, and New York Counties.

Table 2
Descriptive statistics on household demographics.

Variable	Aggregate			Early payment sample			Staggered payment sample		
	Bottom 25%	Top 25%	Total	Bottom 25%	Top 25%	Total	Bottom 25%	Top 75%	Total
Number of households	807	794	1601	239	286	525	568	508	1076
Mean household size	3.36	1.59	2.48	3.44	1.57	2.42	3.33	1.59	2.51
	(1.76)	(0.63)	(1.59)	(1.91)	(0.61)	(1.65)	(1.69)	(0.64)	(1.57)
Weekly expenditure	49.34	40.73	45.07	50.63	41.47	45.64	48.80	40.31	44.79
	(27.42)	(22.96)	(25.66)	(29.29)	(23.33)	(26.59)	(26.60)	(22.76)	(25.21)
Mean per capita income	9417	49,363	29,228	9259	51,259	32,139	9484	48,296	27,808
	(3418)	(15,809)	(22,998)	(3453)	(16,223)	(24,225)	(3405)	(15,485)	(22,248)
Children present	0.51	0.05	0.28	0.52	0.05	0.26	0.51	0.05	0.29
	(0.50)	(0.21)	(0.45)	(0.50)	(0.21)	(0.44)	(0.50)	(0.22)	(0.46)
Senior citizen head	0.19	0.14	0.16	0.22	0.15	0.18	0.18	0.13	0.16
	(0.39)	(0.34)	(0.37)	(0.41)	(0.36)	(0.39)	(0.38)	(0.33)	(0.36)
No male head	0.31	0.34	0.32	0.31	0.33	0.32	0.32	0.34	0.33
	(0.46)	(0.47)	(0.47)	(0.46)	(0.47)	(0.47)	(0.46)	(0.47)	(0.47)

Note: Standard deviations are in parentheses. Calculated using 2003 Nielson Homescan data.

overall. The low-income group has a higher average weekly expenditure ($49.34) than the high-income group ($40.73), but this is expected since the low-income group also has, on average, a larger household size (3.36 versus 1.59) and because our Homescan data do not account for food purchased away from home. Weekly expenditures across all subgroups are consistently between $40 and $50 per week. However, naively comparing means using a *t*-test suggests that across SNAP issuance groups the bottom 25% of the income distribution has a higher average weekly expenditure than the high-income group.

Children are more likely to be present in low-income households. Over 51% of the households in low-income households have children present, while only 5% of high-income households have children in the household. This pattern is similar across households in the early and staggered payment groups. The number of households that have at least one senior citizen household head is relatively consistent across subcategories, between 15% and 22%. Lastly we can see that low-income and high-income households have a similar likelihood of having no male head, around 32%.

Table 3 reports the average weekly food expenditures in aggregate and by retail channel for both income groups and payment samples. Our analysis focuses on four broad retail channels as identified in the Homescan data: Grocery, Convenience, Drug, and Supercenter/Mass Merchandiser/Warehouse Club Store. We analyze shopping behavior using these four retail channel types as each format provides a different combination of food variety, quality, prices, and other retail offerings. Grocery stores (Kroger or Safeway, for example) focus primarily on selling food and offer a wide range of products, while convenience stores (7–11, for example) offer a smaller variety of foods, often at higher prices, but focus on the convenience of smaller package sizes and shorter shopping time. Drug stores (CVS or Walgreens, for example) sell a variety of non-food products and often contain a pharmacy, but have recently increased their food offerings and become an important source of food purchases for many households. Finally, larger, non-food specific retailers, including Supercenters (Wal-Mart, for example), Warehouse Clubs (Costco, for example), and Mass Merchandisers (Target or K-Mart, for example) offer a variety of non-food items, but also sell many food products found in a standard grocery store, but at lower prices. Since the offerings vary across these store formats, it is useful to analyze shopping behavior to note if there are differences across formats in how consumers behave.

The descriptive statistics suggest that spending patterns are indeed different across subgroups and retail channels. The grocery channel has the highest average expenditures for all income and issuance groups (these expenditures include weeks where expenditure equals zero). Simply comparing the expenditure means between weeks 1 and 4, we see that in week 1 the average expenditure in the grocery channel for the low-income households is $36.68 in staggered payment areas and $37.08 in early payment areas whereas by week 4 the average for these groups drops to $34.35 and $35.36 respectively. Given our theoretical framework and the issuance schedule for SNAP, we expect to see a difference

Table 3
Weekly expenditures by income group and retail channel.

	Aggregate		Grocery		Drug		Convenience		Mass/super/club	
	Bottom 25%	Top 25%	Bottom 25%	Top 25%	Bottom 25%	Top 25%	Bottom 25%	Top 25%	Bottom 25%	Top 25%
Staggered payment sample										
Week 1	49.80	39.72	36.68	30.02	0.47	0.41	0.33	0.22	9.09	6.07
	(49.31)	(42.66)	(42.97)	(36.22)	(2.77)	(3.94)	(1.94)	(1.48)	(23.15)	(17.84)
Week 2	50.30	40.31	37.52	30.57	0.48	0.34	0.33	0.26	8.60	6.14
	(49.93)	(41.69)	(44.00)	(35.93)	(2.68)	(1.81)	(1.96)	(1.69)	(22.43)	(16.96)
Week 3	48.45	40.64	36.17	30.95	0.46	0.33	0.32	0.25	8.40	6.04
	(49.75)	(44.32)	(43.99)	(38.00)	(2.40)	(1.88)	(2.13)	(1.67)	(21.06)	(17.74)
Week 4	46.67	40.58	34.35	30.73	0.49	0.40	0.35	0.25	8.60	6.17
	(48.46)	(44.15)	(41.87)	(37.76)	(3.31)	(3.12)	(2.51)	(1.56)	(22.08)	(17.94)
Early payment sample										
Week 1	50.70	40.05	37.08	29.51	0.52	0.63	0.37	0.15	7.90	4.63
	(55.33)	(42.86)	(47.76)	(35.87)	(2.59)	(3.27)	(2.67)	(1.06)	(23.80)	(16.69)
Week 2	51.51	41.79	37.94	30.14	0.44	0.47	0.48	0.16	8.37	5.47
	(55.90)	(42.91)	(46.82)	(35.70)	(2.06)	(2.23)	(5.21)	(1.25)	(26.61)	(18.21)
Week 3	51.32	41.67	37.36	30.45	0.50	0.46	0.57	0.18	8.51	5.42
	(56.91)	(44.37)	(48.12)	(36.40)	(2.61)	(2.60)	(5.34)	(1.55)	(25.76)	(18.50)
Week 4	49.00	42.36	35.46	31.11	0.46	0.54	0.35	0.14	7.83	5.16
	(55.69)	(45.53)	(44.96)	(37.75)	(2.32)	(2.78)	(2.14)	(1.16)	(25.41)	(17.50)

Note: Standard deviations are in parentheses. These figures include weeks where expenditures equal zero. Week 4 represents days 22–28 of the calendar month. Days beyond 28 are excluded. Calculated using 2003 Nielson Homescan data.

in expenditures between week 1 and week 4 in both staggered and early payment groups. Indeed we do see a statistically significant (at the 1% level) difference in average weekly grocery expenditures in both samples for low-income households using a *t*-test to compare week 1 and week 4 means.[9] We do not see a decrease in expenditures in high-income households in the grocery channel where their average weekly expenditure is around $30.00 per week in both the staggered and early payment sample.

We see no deterioration in spending in drug stores for low-income households in the staggered sample, but we do see some deterioration in spending for the high-income households in the staggered sample. Further, in the early payment sample, we see some deterioration in spending for low-income households in drug stores, but apparently no consistent pattern for high-income households. The small magnitude of drug store food expenditures is reflective of the large number of households with zero expenditure in any given week. Average weekly expenditures in drug stores, conditional on some positive expenditure, are approximately $6.00 across subgroups.

In the case of convenience stores, low-income households in the staggered sample show a slight increase in expenditures, whereas we see a slight decrease between weeks 1 and 4 in the early sample. However, interestingly we see a significant increase in expenditures for weeks 2 and 3 in the case of the early payment samples. For high-income households there is no evidence of changing expenditure patterns over the course of the month for either the staggered or early payment samples. Similar to drug store channels, the small magnitude of average weekly expenditures reflects significant censoring. Convenience store expenditures, conditional on some positive expenditure, are about $7.00 per week for low-income households and $4.00 for high-income households. Lastly, we observe a decrease in expenditure throughout the month in the mass/club/super store category for the low-income group in the staggered payment sample, but expenditures in this channel for the early payment sample remain relatively constant. High-income households exhibit a similar pattern in the mass/club/super store category for both SNAP payment samples.

To supplement the aggregate and channel analysis using the Neilson Homescan data, which does not record expenditures on food-away-from-home, the CES is used to examine weekly patterns for food purchased away from home. The CES records detailed information on household expenditures. One important difference between the Homescan and CES data is that the CES records purchases for individual households using an expenditure diary for 1 or 2 weeks. Given this, households in different groups are aggregated to understand monthly patterns. To make the analysis comparable to the Homescan analysis, households are categorized similarly as low-income (bottom quartile of the per capita income distribution) and high-income (top quartile of the per capita income distribution). Households are also assigned to a SNAP payment sample depending on the state in which they are located. Unfortunately the CES does not report metro level location information, and this is one weakness in the comparability between the two samples. Further, a slightly different empirical approach is employed for these data and discussed in the following section. Table 4 reports average weekly expenditures for total food, food at home and food-away-from-home expenditures. Regression analysis concentrates on patterns observed for food-away-from-home expenditures. Descriptive analysis suggests that food-away-from-home is a relatively large portion of total food expenditure for the upper 25% of the income distribution, representing about 43% of total food expenditures overall. In contrast, for the lowest quartile, food-away-from-home represents only about 30–33% of food expenditures. This difference remains fairly consistent in both SNAP payment samples although we see an increase in food away from home expenditures in the early payment sample as the month proceeds.

Econometric model

Consistent with previous studies (Hastings and Washington, 2010; Stephens, 2003), we regress total weekly expenditures on a vector of dummy variables to account for calendar weeks in the month, with the first week excluded, a set of interaction terms to compare low-income versus high-income and staggered versus early payment households, as well as a vector of household fixed effects to account for time-invariant observed and unobserved household characteristics.

There are a number of empirical concerns when using high frequency data to analyze monthly food expenditure patterns in a

[9] Based on a standard *t*-test.

Table 4
Weekly expenditures by income group and food consumption location.

	Total food		Food away from home		Food at home		% Spent on food away from home	
	Bottom 25%	Top 25%	Bottom 25%	Top 25%	Bottom 25%	Top 25%	Bottom 25%	Top 25%
Staggered payment sample								
Week 1	46.46	31.46	14.23	13.16	32.23	18.30	30.6	41.8
	(41.86)	(34.75)	(17.90)	(20.98)	(34.49)	(26.76)		
Week 2	42.02	30.74	13.03	13.91	28.99	16.83	31.0	45.2
	(36.06)	(33.72)	(20.06)	(24.38)	(26.33)	(19.92)		
Week 3	43.20	32.44	11.79	12.06	31.41	20.38	27.3	37.2
	(39.12)	(31.45)	(16.56)	(17.66)	(32.34)	(24.37)		
Week 4	47.61	29.63	12.89	13.31	34.73	16.32	27.1	44.9
	(47.43)	(35.28)	(21.67)	(23.31)	(36.49)	(24.93)		
Total	45.93	31.81	13.49	13.84	32.44	17.96	29.4	43.5
	(42.18)	(37.14)	(20.00)	(27.18)	(33.26)	(24.10)		
Early payment sample								
Week 1	57.36	37.01	17.13	15.41	40.22	21.60	29.9	41.6
	(55.61)	(39.34)	(25.50)	(22.99)	(39.04)	(26.98)		
Week 2	49.15	32.64	14.27	13.07	34.87	19.57	29.0	40.0
	(53.03)	(34.50)	(19.75)	(26.85)	(43.01)	(21.23)		
Week 3	49.51	44.74	20.32	21.74	29.19	23.00	41.0	48.6
	(43.31)	(44.65)	(25.71)	(35.55)	(29.96)	(22.57)		
Week 4	60.69	35.39	22.47	15.17	38.22	20.22	37.0	42.9
	(61.52)	(37.94)	(34.54)	(24.71)	(41.24)	(22.21)		
Total	55.05	37.81	18.46	16.37	36.59	21.44	33.5	43.3
	(52.75)	(39.43)	(26.26)	(27.71)	(38.78)	(24.36)		

Note: Data included in this table come from the 2003 Consumer Expenditure Survey and represent the bottom and top quartiles of the income distribution in the states listed in table 1 for each payment sample. Week 4 represents days 22–28 of the calendar month. Calendar days beyond 28 are excluded.

regression framework. First, daily expenditure data for almost any household will include many zero observations, since few households shop daily. Second, serial correlation is likely to be a problem, since one would expect that food expenditures in the recent past would affect both the probability and level of food purchases on a given day. To address some of these concerns, we follow a two-step procedure described in Hastings and Washington (2010), detailed below. The dependent variable used in this analysis is constructed by aggregating daily food expenditures over a week for each household, with 4 weeks designated for each month. Weeks 1, 2, and 3 are for days 1 through 7, 8 through 14, and 15 through 21 respectively. Week 4 is comprised of all the remaining 7 days in the month. Calendar month days beyond 28 are excluded from the analysis similar to Hastings and Washington (2010) and Stephens (2003). This aggregation mitigates concerns about serial correlation likely present in daily expenditure data.

The panel dataset used for this analysis consists of weekly expenditures for each week in the year for each household in each of the four channels and for aggregate expenditures. As such, each household has 48 observations for each separate regression. Regressions are estimated for several subsets of the data to identify differences across income groups and households in staggered and early payment samples. Weekly food expenditures y_{itc}, for household i, in week t, in channel c, can be described by the following expression:

$$y_{itc} = \beta_0 + grp_i \times week_t\beta' + week_t\alpha' + h_i\lambda' + \epsilon_{itc} \quad (1)$$

in which $week_t$ is a binary variable equal to one when week t is the jth week of the month and zero otherwise; grp_i is a dummy variable for either low-income or early payment households, depending on the specification. This interaction term is used to compare high and low-income households in each payment area directly and further to compare low-income households in staggered and early payment areas, and h_i is a household fixed effect included to account for unobserved heterogeneity and time-invariant differences among households. β_0 is a constant, α' and β' are parameters to be estimated, λ' is a parameter associated with the household level fixed effect, and ε_{itc} is a random error.

To account for the significant effect that the decision to purchase during a given week has on our estimates we adopt a two-step approach employed by Hastings and Washington (2010). The first stage is a linear probability model estimated on the same regressors as in Eq. (1) but with a dependent variable that equals 1 if household expenditure in channel c was greater than zero for week t and zero otherwise. We then estimate Eq. (1) using the expected expenditures in a given channel conditional on a positive expenditure. Since the Tobit model in a panel data setting has been show to yield estimates that are both biased and inconsistent (Heckman and MaCurdy, 1980), this two-step approach is preferable to account for the sometimes large (in the case of drug and convenience store channels) censoring of weekly expenditures. Standard errors are weighted to account for the survey design, and clustered at the market level to account for intra-market correlation in both stages. With 48 observations for each household and 1601 households, the dataset used for this analysis consists of 76,848 observations. Aggregate expenditures and expenditures within four different retail channels are estimated using the specification described.

Another advantage of this empirical approach is that the fixed effect accounts for time-invariant characteristics at the household level that may influence food expenditure patterns. The data used in this analysis include weekly observations for household expenditures, but only a single observation for household characteristics. As such, all demographic information is time-invariant. A household fixed effect accounts for both these observed household characteristics and unobserved characteristics. Further, equations for each retail channel are estimated independently, rather than in a seemingly unrelated regression or generalized least squares approach, since each equation has identical regressors. With identical regressors, equation by equation estimation yields efficient estimates of the coefficients (Wooldridge, 2002).

If low-income households respond to liquidity constraints by clustering expenditures around the time of an income payment or transfer, we expect that the parameter on the week variable will decrease over the course of the month in early SNAP payment areas and have a slower or no deterioration where payments are staggered. We further expect that grocery and mass/club/superstore

expenditures will follow a typical decreasing expenditure pattern across the weeks of the month. However, if transportation and storage constraints are present, we expect that expenditures will remain the same or increase in convenience and drug store channels over the month since these channels are more likely to be located more centrally in transportation and storage constrained areas.

Given the structural differences between the Nielson Homescan data and the CES data a different empirical approach is used for food-away-from-home analysis. The CES data is a weekly diary of food expenditures and therefore is not a panel. However, censoring is still a concern as many households do not spend money on food-away-from-home every week. To make the analysis as comparable as possible with the retail channels analysis we employ weekly expenditures on food-away-from-home as the dependent variable. A Tobit model, with weekly expenditures left-censored at zero, using the same explanatory variables as in (2) is implemented with robust standard errors clustered at the state level. Since this data is not in panel format the concerns of the Tobit being biased and inconsistent are minimized in this cross-sectional setting.

Results

Aggregate food expenditure patterns

Parameter estimates for Eq. (1) for total food expenditure patterns (aggregated across retail channels) are presented in Table 5. Column (1) provides estimates of expenditure patterns comparing low-income and high-income households in markets that receive SNAP payments throughout the first 15 days of the month (the "staggered sample"). We expect to see little difference in spending patterns between low and high-income households in these areas and results support this expectation. In contrast, the second column compares aggregate expenditures in low and high-income households in early SNAP payment areas. As expected we see that low-income households exhibit a deterioration in spending in week 4 compared to high-income households. This expectation is derived from the theoretical expectation that SNAP payments clustered at the beginning of the month will cause a significant decrease in spending as a result of liquidity constraints later in the month. No households in the early payment sample receive payments in either week 3 or 4. Both weeks have negative parameter estimates, and week 4's estimate is large in magnitude (−3.561) and significant at the 5% level. Column (3) documents aggregate expenditure patterns in low-income households and compares households in early versus staggered SNAP payment areas using an interaction term. We see that signs are consistent with expectations in that early payment households spend less in week 2 and 3. In week 2, many staggered sample households are receiving payments whereas relatively few early sample households are receiving payments, and further in week 3 no early payment households are receiving payments whereas some staggered payment households are receiving payments. However, these point estimates are not significant, possibly indicating that these different sub-samples are using channels differently but still exhibit similar aggregate expenditures. These results, especially those in column 2, are consistent with Hastings and Washington (2010), Shapiro (2005) and Wilde and Ranney (2000), all of whom document a decline in food expenditures by low-income households over the calendar month in response to transfers early in the month. These results also provide some evidence that low-income households' expenditure patterns may be influenced by the SNAP issuance schedules, however the proceeding results provide a more complete story of these differences.

Table 5
Expenditure patterns: aggregate food expenditures.

Variables	(1) Staggered	(2) Early	(3) Low-Income
Low-income ∗ week 2	−0.291	−0.577	–
	(0.657)	(1.076)	–
Low-income ∗ week 3	1.786	−2.816	–
	(1.761)	(1.396)	–
Low-income ∗ week 4	−0.821	−3.561**	–
	(1.824)	(0.921)	–
Early Payment ∗ week 2	–	–	−1.082
	–	–	(1.424)
Early Payment ∗ week 3	–	–	−2.395
	–	–	(1.591)
Early Payment ∗ week 4	–	–	0.118
	–	–	(1.199)
Week 2	2.044	1.265	1.772***
	(1.161)	(1.075)	(0.557)
Week 3	−0.924	1.273**	0.861
	(0.728)	(0.393)	(1.119)
Week 4	−2.314	0.483	−3.182***
	(1.523)	(0.635)	(0.660)
Constant	36.326***	36.881***	39.957***
	(0.375)	(0.568)	(0.424)
Observations	51,648	25,200	38,736
R-squared	0.003	0.001	0.002
Number of households	1076	525	807
F test: Low-income × Week(i) = 0	0.0979	0.00819	
F test: Early Payment × Week(i) = 0			0.217

Note: Standard errors are in parentheses.
Estimates are obtained using a two-step household fixed effects model with standard errors adjusted for sampling weights and clustered at the market area level. Calculated using 2003 Nielson Homescan data.
Significance levels are denoted by:
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

Food expenditure patterns among retail channels

Table 6 reports estimates for weekly grocery store expenditures. In column 1, as expected, we do not observe a difference in spending patterns between low-income and high-income households in staggered payment areas. Given the staggered nature of the SNAP distribution schedule, we would not expect to observe significant clustering of expenditures in grocery stores for low-income households. In the early payment areas (column 2), we do observe an expected pattern, that low-income households' grocery expenditures are significantly higher in week 2 than week 1 and significantly less in week 4 than in week 1 as compared to the high-income households. We also observe a negative coefficient for week 3 in early payment areas for low-income households, but the standard error is relatively large. Given that SNAP payments are distributed during the first 10 days of the month for low-income households in column 2, we expect to see a liquidity constraint that binds in these market areas in weeks 3 and 4. In column 3 we do not observe a significant difference in expenditure patterns in grocery stores between early and staggered payment households.

While we see some weak evidence of the effects of differential SNAP payment schedules on expenditure patterns in Tables 5 and 6, evidence in Tables 7–10 suggests that differences in payment schedules may more importantly influence the way in which households supplement grocery store expenditures in other retail channels. In Table 7 we see that food expenditure patterns in drugs stores differ across income and SNAP payment schedules. In column 1 it is clear that low-income households are employing drug stores for food expenditures more than high-income households in staggered and early payment areas. In column 2 we see that coefficients for weeks 2 and 3 are positive and weakly significant while week 4's is not different from zero for early payment households.

Table 6
Expenditure patterns: grocery channel.

Variables	(1) Staggered	(2) Early	(3) Low-Income
Low-income * week 2	0.604	1.703***	–
	(0.684)	(0.240)	–
Low-income * week 3	1.214	−1.421	–
	(1.538)	(1.230)	–
Low-income * week 4	−0.421	−1.426*	–
	(0.999)	(0.534)	–
Early Payment * week 2	–	–	0.819
	–	–	(0.942)
Early Payment * week 3	–	–	0.227
	–	–	(1.143)
Early Payment * week 4	–	–	1.381
	–	–	(0.770)
Week 2	0.749	0.510	1.372
	(0.511)	(0.614)	(0.789)
Week 3	−1.103	1.763*	0.111
	(0.663)	(0.648)	(0.987)
Week 4	−1.666*	0.666	−2.127***
	(0.724)	(0.370)	(0.394)
Constant	22.893***	22.840***	24.779***
	(0.296)	(0.219)	(0.301)
Observations	51,648	25,200	38,736
R-squared	0.002	0.001	0.002
Number of households	1076	525	807
F test: Low-income × Week(i) = 0	0.0366	0.0122	
F test: Early Payment × Week(i) = 0			0.403

Note: Standard errors are in parentheses.
Estimates are obtained using a two-step household fixed effects model with standard errors adjusted for sampling weights and clustered at the market area level. Calculated using 2003 Nielson Homescan data.
Significance levels are denoted by:
** Significant at 5%.
* Significant at 10%.
*** Significant at 1%.

Table 7
Expenditure patterns: drug store channel.

Variables	(1) Staggered	(2) Early	(3) Low-Income
Low-income * week 2	0.034*	0.013*	–
	(0.014)	(0.005)	–
Low-income * week 3	0.028	0.013*	–
	(0.016)	(0.005)	–
Low-income * week 4	0.032*	0.005	–
	(0.015)	(0.005)	–
Early Payment * week 2	–	–	−0.013*
	–	–	(0.006)
Early Payment * week 3	–	–	−0.008
	–	–	(0.009)
Early Payment * week 4	–	–	−0.014***
	–	–	(0.004)
Week 2	−0.031*	−0.025**	0.002
	(0.014)	(0.006)	(0.003)
Week 3	−0.034*	−0.029**	−0.006
	(0.015)	(0.008)	(0.005)
Week 4	−0.027*	−0.015*	0.005*
	(0.013)	(0.005)	(0.003)
Constant	0.046***	0.066***	0.048***
	(0.004)	(0.004)	(0.002)
Observations	51,648	25,200	38,736
R-squared	0.002	0.001	0.000
Number of households	1076	525	807
F test: Low-income × Week(i) = 0	0.000289	3.30e−06	
F test: Early Payment × Week(i) = 0			0.0192

Note: Standard errors are in parentheses.
Estimates are obtained using a two-step household fixed effects model with standard errors adjusted for sampling weights and clustered at the market area level. These results are estimated using 2003 Nielson Homescan data.
Significance levels are denoted by:
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

Table 8
Expenditure patterns: convenience store channel.

Variables	(1) Staggered	(2) Early	(3) Low-Income
Low-income * week 2	−0.002	0.003	–
	(0.002)	(0.003)	–
Low-income * week 3	−0.006**	0.002	–
	(0.003)	(0.003)	–
Low-income * week 4	−0.002	0.000	–
	(0.003)	(0.002)	–
Early Payment * week 2	–	–	0.005
	–	–	(0.003)
Early Payment * week 3	–	–	0.007**
	–	–	(0.003)
Early Payment * week 4	–	–	−0.001
	–	–	(0.003)
Week 2	−0.001	−0.001	−0.002
	(0.001)	(0.001)	(0.002)
Week 3	0.003*	0.002	−0.003
	(0.002)	(0.002)	(0.002)
Week 4	0.003***	−0.000	0.001
	(0.001)	(0.001)	(0.003)
Constant	0.012***	0.010***	0.013***
	(0.001)	(0.001)	(0.001)
Observations	51,648	25,200	38,736
R-squared	0.000	0.000	0.000
Number of households	1076	525	807
F test: Low-income × Week(i) = 0	0.112	0.737	
F test: Early Payment × Week(i) = 0			0.168

Note: Standard errors are in parentheses.
Estimates are obtained using a two-step household fixed effects model with standard errors adjusted for sampling weights and clustered at the market area level. Calculated using 2003 Nielson Homescan data.
Significance levels are denoted by:
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

Further, we do observe a significant and important pattern in column 3 when comparing low-income households across the two SNAP distribution schedules. We see that early sample households spend less in weeks 2 and 4 on food in drug stores than staggered payment households. This suggests that if low-income households are supplementing their food shopping at smaller food outlets like drug and convenience stores, staggered payment households seem to be employing drug store channels more than those households in early payment areas particularly in weeks 2 and 4.

In contrast, Table 8 suggests that early payment households may also be using a supplementary strategy across retail channels, but early payment households seem to be using convenience stores more that staggered payment households. In column 1 we see that low-income households in staggered payment areas have a negative point estimate for weeks 2 through 4 and have significantly less convenience store food expenditure than high-income households in week 3. We see in column 2 that point estimates are all positive in early payment areas but standard errors are large. This supplementary strategy is more pronounced when one compares low-income households in early versus staggered payment areas. We see that early payment households spend significantly more in convenience stores in week 3, the only week in which staggered payment households are receiving payments but early payment households are not. These results suggest that the early payment schedule is inducing some supplementation of food expenditure in convenience stores after these households likely make a larger grocery store trip closer to the time of their SNAP payment.

Table 9 shows the expenditure patterns for the mass/club/superstore channel. Results suggest that early payment households (column 2) are clustering their shopping significantly at the beginning of the month in this channel, or around the time of their SNAP payment. This is not surprising since very few of these outlets are

Table 9
Expenditure patterns: mass/club/superstore store channel.

Variables	(1) Staggered	(2) Early	(3) Low-Income
Low-income * week 2	−0.570	−0.818**	–
	(0.376)	(0.343)	–
Low-income * week 3	0.075	−0.725*	–
	(0.250)	(0.372)	–
Low-income * week 4	0.110	−0.772**	–
	(0.229)	(0.357)	–
Early Payment * week 2	–	–	−0.615
	–	–	(0.488)
Early Payment * week 3	–	–	−1.082**
	–	–	(0.496)
Early Payment * week 4	–	–	−0.754
	–	–	(0.470)
Week 2	0.572**	0.308**	0.002
	(0.247)	(0.143)	(0.283)
Week 3	0.209**	0.058	0.284
	(0.102)	(0.137)	(0.229)
Week 4	−0.128	0.134	−0.017
	(0.164)	(0.085)	(0.160)
Constant	2.114***	1.523***	2.337***
	(0.107)	(0.161)	(0.156)
Observations	51,648	25,200	38,736
R-squared	0.001	0.004	0.002
Number of households	1076	525	807
F test: Low-income × Week(i) = 0	0.0810	0.128	
F test: Early Payment × Week(i) = 0			0.0438

Note: Standard errors are in parentheses.
Estimates are obtained using a two-step household fixed effects model with standard errors adjusted for sampling weights and clustered at the market area level. Calculated using 2003 Nielson Homescan data.
Significance levels are denoted by:
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

Table 10
Expenditure patterns for food away from home.

Variables	(1) Staggered	(2) Early	(3) Low-Income
Low-income * week 2	−1.067	6.721**	–
	(2.876)	(3.017)	–
Low-income * week 3	−0.913	1.752	–
	(1.774)	(6.678)	–
Low-income * week 4	−2.632	14.39***	–
	(2.752)	(4.282)	–
Early Payment * week 2	–	–	3.038
	–	–	(2.518)
Early Payment * week 3	–	–	12.21***
	–	–	(2.276)
Early Payment * week 4	–	–	13.38**
	–	–	(6.782)
Week 2	−1.555	−6.632***	−4.275***
	(3.470)	(2.145)	(1.544)
Week 3	−4.805**	4.565	−7.158***
	(2.048)	(3.213)	(2.176)
Week 4	−1.369	−5.018***	−5.503*
	(2.745)	(1.203)	(2.836)
Constant	7.134***	6.503***	9.807***
	(1.565)	(1.911)	(1.249)
Constant	32.72***	37.69***	29.45***
	(5.359)	(5.841)	(2.187)
Observations	1654	710	1100
F-test: Low-income × Week(i) = 0	0.812	0	4.36e−07

Note: A Tobit model is used to explain weekly expenditures. This table uses 2003 Consumer Expenditure Survey to estimate food away from home expenditures. Robust standard errors are in parentheses clustered at the state level. Significance levels are denoted by:
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

located in city centers and households may make a special trip at the beginning of the month to these stores when SNAP payments are received. It is also consistent with expectations that we would see a negative sign for week 2 since early payment households are only receiving SNAP payments for half of week 2 thus we would expect the total weekly expenditure to be lower. We see no evidence of a differentiated expenditure for staggered low-income households (column 1). We see that all the point estimates for the interaction term comparing staggered and early payment households in column 3 are negative and jointly significant in column 3. Further, week 3, the only week where staggered payment households are receiving payments and early payment households are not, early payment households spend significantly less than staggered payment households on food expenditures in this retail channel. These results suggest that it is likely that both grocery stores and mass/club/superstores are used as "stock-up" shopping outlets and employed by SNAP recipients close to the timing of their SNAP payments, whereas convenience stores in particular and, to a lesser extent, drug stores are used as supplementary food expenditure outlets.

Food expenditure on food-away-from-home

The last expenditure pattern examined is expenditures on food-away-from-home for both low and high-income households in staggered and early payment samples. As discussed above the 2003 CES is used for this analysis. Given the differences in these data sets a direct comparison with the Homescan results should be approached with some caution; however results do provide some evidence of differing expenditure patterns across subgroups in food-away-from-home expenditure. Another point of caution is that it is possible that the composition of food-away-from-home differs across income groups, further complicating the comparison. For example, food-away-from-home for low-income households may be comprised of school lunches and lower priced fast food and restaurant meals whereas high-income households may spend more on high priced restaurant meals. It is, however, undeniable that food away from home is an important source of food expenditure for all households. Table 10 examines the weekly expenditures for food-away-from-home using the same income and geographic categories used in the aggregate and channels analysis in Tables 5–9. Interestingly, we see in column 2 that early payment, low-income households increase their food-away-from-home expenditures in week 2 and week 4 compared to week 1. Week 3 also has a positive sign, but a large standard error. This could be a result of differing SNAP payments, but could also reflect other fluctuations in income throughout the month. A more specific comparison between SNAP distribution schedules is seen in column 3. There is evidence that early payment households are spending more than staggered payment households in weeks 3 and 4. These results suggest that early payment households may be using food-away-from-home as yet another supplementary strategy, similar to their use of convenience stores.

Concluding remarks

This study examines food expenditure patterns for a sample of 1601 households in areas throughout the United States using detailed expenditure data from the 2003 Nielsen Homescan and the 2003 Consumer Expenditure Surveys. We investigate the cyclicity of total food expenditures, expenditures within retail channels, and food-away-from-home expenditures over calendar weeks in a month. We find that consumers use food retail channels

differently depending on their income levels and the differing SNAP payment schedules they face.

Our aggregate results suggest that the decline in expenditures over the calendar month for low-income households is particular to households that receive SNAP payments within the first 10 days of the calendar month (as opposed to the first 15 days). Our primary contribution to the literature lies in the detailed account of how households use different retail channels throughout the month. We find, consistent with our theoretical discussion, that low-income households in early SNAP payment areas cluster both their grocery store and mass/club/superstore food expenditures at the beginning of the month and have significantly lower expenditures in both channels later in the month. Further, households in the early sample supplement their expenditures with food purchases at convenience stores and with food-away-from-home after SNAP payments have been distributed. This pattern is consistent with the suggestion that these households may face liquidity, transportation, and storage constraints and likely make a high expenditure trip that is outside the city center at the beginning of the month and supplement these food purchases with purchases at closer convenience stores and restaurants. It is possible that we do not observe a significantly different expenditure in week 4 from week 1 in the convenience channel for early payment households because they are so severely liquidity constrained that they reduce expenditures across the board, which is substantiated with results documenting their aggregate expenditure patterns.

We also see evidence that low-income households in both staggered and early payment areas increase their expenditures in drug stores after week 1, although it is difficult to argue that this is a supplementation strategy given the inconsistent nature of this pattern across SNAP payment areas. Households in staggered payment areas show few signs of a supplementation strategy overall which could suggest that a more disbursed SNAP distribution schedule is at least evening out retail traffic if not improving the distribution of expenditures at the household level. It is possible and altogether likely that households in staggered areas are still using a similar supplementation strategy but it is unobservable because of the heterogeneity of when households receive their payments and our inability to match households with the exact dates when SNAP payments are received by individual households.

These findings, when coupled with findings such as those in Chung and Myers (1999) that show smaller stores often have higher prices per unit, may suggest that poor urban consumers may pay more for food as liquidity constraints increase toward the end of the month. From a food policy and food security perspective, more research is needed to see if increased expenditures in smaller food retail outlets by low-income urban consumers at certain times during the month means that their food dollar is stretched thinner at the end of the month.

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