# *The Impact of Dollar Store Expansion on Local Market Structure and Food Access*

El Hadi Caoui
U of Toronto

Brett Hollenbeck
UCLA Anderson

Matthew Osborne
U of Toronto

Latest version: June 3, 2024*
First version: July 25, 2022

**Abstract**

This paper studies the expansion of dollar store chains in the U.S. since 2008, which has generated public interest in their impact on retail markets and food accessibility. We show evidence that dollar store chains compete strongly with the grocery segment and find that their expansion has led to a large decline in the number of grocery stores and a significant reduction in fresh produce consumption for households with low income and high travel costs. The impact of dollar store entry increases in the number of entries. We find no significant changes in spending in other product categories.

*Keywords: retail entry, dollar store, food access, nutritional inequality*

*JEL Classification: L13, D43, L51*

*Caoui: elhadi.caoui@rotman.utoronto.ca. Hollenbeck: brett.hollenbeck@anderson.ucla.edu. Osborne: matthew.osborne@rotman.utoronto.ca. This paper was split from an earlier draft with the same title. The second half of the earlier draft is now a separate manuscript entitled 'Dynamic Entry & Spatial Competition: An Application to Dollar Store Expansion'. We are grateful to Emek Basker, Paul Ellickson, and Mathieu Marcoux for helpful discussions of this paper. We thank Victor Aguirregabiria, Hunt Allcott, Limin Fang, Paul Grieco, Sylvia Hristakeva, Yao Luo, Chuck Weinberg and seminar and conference participants at the University of Toronto, UCLA, Rochester, UVA, Yale, JHU, UT Austin, U of Melbourne, Washington University of Saint Louis, University of Iowa, Stanford GSB, Chicago Booth, IIOC, SICS, CEA, ISMS Marketing Science Conference, ET Symposium, and the Food Access at Dollar Stores (FADS) Workshop for their helpful comments and suggestions. The findings and conclusions in this paper have not been formally disseminated by the U.S. Department of Agriculture (USDA) and should not be construed to represent any agency determination or policy. The analysis, findings, and conclusions expressed in this paper also should not be attributed to Circana. This research was conducted in collaboration with USDA under a Third Party Agreement with Circana. All estimates and analyses in this paper based on Circana, Inc. data are by the authors and not by Circana, Inc.

# 1 Introduction

The growth of large chain retailers over the past several decades has transformed the retail sector in the United States, with implications for competition, labor markets, and aggregate outcomes such as inflation and productivity. A more recent and less studied phenomenon is the broad and dramatic rise of the dollar store retail format. Following previous waves of growth by large retail chains, the three main dollar store chains (Dollar General, Dollar Tree, and Family Dollar) have, in many ways, become the dominant mode of retailer in many markets, impacting competition, affordability, convenience, and food accessibility for a significant portion of the population.

The distinguishing features of these chains are the use of single or limited price points, particularly selling most goods for $1, and assortments consisting of small serving-size basic consumables, clearance or irregular goods, and notably, a lack of fresh produce. Beginning in the 1950s, these chains exhibited slow but steady growth over the decades that followed, establishing themselves primarily in small towns in rural areas. Following the 2008 recession, the growth of this format has been and continues to be exceptionally rapid.[1] In 2021, there were more of these stores operating than all the Walmarts, CVS, Walgreens, and Targets combined by a large margin. During the period 2018-2021, roughly half of all retail stores that opened in the U.S. were dollar stores.

The growth of dollar store chains has raised a number of policy issues: in particular, many policymakers have expressed concerns that the rapid entry of dollar store chains in their cities has forced out local independent retailers, including neighborhood grocery stores. The latter may be especially concerning to the extent it reduces access to produce and other perishable food items for low-income residents, creating "food deserts." These concerns and others have led many localities to ban dollar store chains from entering or pass dispersal regulations limiting their store density.[2]

[1] The top three chains were collectively opening stores at the rate of 3.75 stores a day over the past decade (authors' calculations).

[2] A partial list of cities that have banned dollar store entry or passed ordinances restrict-

Broadly speaking, the arguments for and against dollar store chains fall along these lines. Proponents argue that they introduce additional choice into underserved retail markets and that their strategy of entering in low-rent areas and opening multiple stores in the same market results in greater convenience for customers who can make short trips for specific items rather than long trips to the nearest big box store, which could be a large distance away.

Opponents maintain that the aggressive entry strategy of dollar store chains has caused the exit of local independent retailers and prevented the entry of other retailers. Even if consumers value the convenience of the dollar stores, their strategy of offering basic consumables and household products efficiently using a low fixed cost model and avoiding the costly and complex provision of perishable food results in them capturing a large share of nearby grocers' profits. This could leave grocers unprofitable on the basis of food sales alone and potentially lead to exit, reducing convenient access to fresh produce and exacerbating nutritional inequality. Yet despite the extensive public and policy debate surrounding these issues, the academic literature has yet to study these claims or the broader effects of dollar store chain expansion.

In this paper, we provide new empirical evidence on the core issues in this policy debate. Our primary research questions are the following: what has been the effect of dollar store expansion on local retail markets, and particularly on the number of independent grocery stores? Downstream of market structure, what has been the effect on consumers and their spending patterns, particularly spending on fresh or perishable food? For each of these questions, we both estimate average effects and use our granular data to analyze distributional impacts.

We leverage data from several sources. We track the number and type of retail stores, including dollar stores, across the U.S. using the Supplemental Nutrition Assistance Program (SNAP) Retailer panel, a yearly panel of SNAP-authorized retailers from 2008 to 2019. An advantage of this dataset is

ing the number of dollar stores that may enter includes: Birmingham AL, Atlanta GA, New Orleans LA, Akron OH, Oklahoma City OK, Tulsa OK, and Fort Worth TX. See https://ilsr.org/dollar-store-restrictions/

that it covers small independent retail stores, which are typically absent from other retail census used in the literature. We match the data on store openings and closings to the Circana (previously named IRI) Consumer Network panel, which contains household-level data on all retail purchases for a large nationwide sample of consumers.

We first use an event study design to study the effects of dollar store entries on local market structure. We control for market-level demographics and demographic trends, as well as market-year fixed effects, and consistently find that dollar store entries are associated with a significant decrease in the number of independent grocery stores.[3] The effect size is roughly the loss of one grocery store for every three dollar stores when measured in the area 0-2 miles around the entry location. In the area 2 to 5 miles away, the effect size becomes substantially smaller, suggesting the effects are local. The previous literature on the market structure effects of retail chain expansion has shown that big box chains such as Walmart do not compete intensely with local "mom and pop" grocery stores due both to vertical differentiation and their spatial distribution (Ellickson and Grieco (2013)). Our results suggest that because of dollar stores' vertical positioning and spatial pattern of entry, their entry, by contrast, has led to large negative effects on these grocery stores.

When studying how consumer shopping behavior changes with dollar store entry, we find that households shift a share of their purchases away from grocery and convenience stores to the dollar stores. Households also decrease their spending (and volumes purchased) on produce by modest but significant amounts (4% to 7.3%), an effect that is increasing in the number of dollar store entries and acts in part through grocery store exits. This average effect masks important heterogeneity across households: low-income households (annual

[3]We follow the definition of "grocery stores," which are distinct from "supermarkets and supercenters" in the USDA SNAP panel. Grocery stores are store primarily focused on selling food and consumable products, carry all four staple food categories, have annual revenue below $2m, and are generally independently owned. Supermarkets/centers have annual revenue above $2m, carry all four staple food categories, are part of a retail chain, and typically have ten or more checkout lanes with registers, bar code scanners, and conveyor belts. This definition has been used to define supermarkets in previous studies, e.g., Ellickson and Grieco (2013).

income less than $45,000) and households with high travel costs (proxied by vehicle access) experience large declines in fresh produce spending (around 15%) whereas high income households (annual income above $70,000) are not affected. This finding is consistent with the notion that, in low-income areas, consumers rely more on independent stores for their food purchases, because high travel costs limit their access to large chain grocers (Ellickson and Grieco (2013)).

The estimated reduction in fresh produce spending due to dollar store entry explains between 13% and 27% of the difference in fresh produce spending between high and low income households. By contrast, we do not find evidence that dollar stores lead to significant changes in spending on other food categories (e.g., canned produce, dairy, meats).[4]

**Related Literature.** This paper contributes to three lines of research in economics. The first is the study of the evolution of the U.S. discount retail sector. This literature has focused on the impact of big box retailers (e.g., Walmart, K-Mart) and the supercenter format on market structure and competition (Jia (2008), Zhu and Singh (2009), Basker and Noel (2009), Igami (2011), Ellickson and Grieco (2013), Grieco (2014), Arcidiacono et al. (2020)), on labor markets (Basker (2005)), and the role of chain and density economies (Holmes (2011), Ellickson et al. (2013)). A key finding in this literature is that Walmart's entry primarily harmed larger chain retailers in the local area within two miles of entry (Ellickson and Grieco (2013)). Small local retailers were not substantially harmed due to travel costs and horizontal and vertical differentiation between firms. Our results suggest that, whereas small local retailers were not in direct competition with big-box retailers like Walmart, the dollar store format is more of a direct competitor to these stores and has had a large impact on local retail markets as a result. The rise of the dollar store format, therefore, has a distinctive impact on retail and raises unique

[4] Our results complement earlier work on "food deserts," such as Allcott et al. (2019), who find limited impacts from grocery store entries on produce purchases of nearby households. We find consistent results on grocery store entries, but much larger (negative) impacts from grocery exits, suggesting an asymmetry in how different changes to market structure impact consumer behavior.

policy questions.

Our findings are in line with recent and emergent work studying the dollar store format: Feng et al. (2023) show that, despite their limited food assortments, dollar stores represent a growing share of food purchases especially in small markets. Chenarides et al. (2021) find that dollar store entry in a food desert area increases the likelihood that it remains a food desert; Lopez et al. (2023) show that dollar store entry is associated with grocery store exit, lower retail employment and sales, with these effects being larger in rural communities. In concurrent work, Chenarides et al. (Forthcoming) study the impact of dollar store expansion using a dynamic model of entry and data from Texas. They find that dollar stores benefit supermarkets by displacing the competitive fringe of small independent retailers. In subsequent work, Schneier et al. (2023) investigates the effects of the first dollar store entry in a zipcode on prices paid and basket size. Cao (2022) studies the welfare implications of dollar stores' entry via increased retail variety and supply of private-label products. Concurrent work by Caoui et al. (2024) estimates a dynamic game of spatial competition between dollar stores and rival retailers. They find in counterfactual simulations that dollar store entry led to a 31% to 33% reduction in the number of grocery and convenience stores and that, in response, grocery retailers spatially differentiate by entering higher income locations. Relative to these other works, this paper is the first to establish a direct link between dollar store-induced changes in market structure and changes in consumers' shopping behavior. We show that dollar store entry impacts household consumption—especially for low-income households with higher travel costs—and that this effect is partly driven by the exit of nearby grocery stores.

Second, this paper is related to the study of consumers' grocery shopping behavior and food accessibility. There is an extensive literature studying nutritional inequality in the U.S., with studies focusing on price-, access-, and nutrition education-based interventions (Levi et al. (2019)). Studies of food access have focused on introduction of grocery stores to markets designated as "food deserts," with case studies around individual store entries having found

mixed results (Cummins et al. (2005), Cummins et al. (2014), Elbel et al. (2015), Dubowitz et al. (2015), Liese et al. (2014), Rose and Richards (2004), Ver Ploeg and Rahkovsky (2016), Weatherspoon et al. (2013)). Notably, Allcott et al. (2019) study a large number of grocery store and supermarket entries and find they have only small effects on the nutrition of nearby consumers and that nutritional inequality in the U.S. is largely explained by demand factors rather than limited food access, with differences in access and prices, explaining only about 10% of nutritional inequality. Levi et al. (2020) find that access to grocery stores impacts fruit and vegetable spending by affecting shopping frequency, but only among households with a low value of nutrition and at distances of less than 1 mile. Hristakeva and Levine (2022) leverage hurricane-induced temporary grocery store closures to detect supply-side effects and find that households affected by these closures shift the location and nutritional value of their purchases for a substantial period of time even after the grocery store has reopened. Byrne et al. (2022) study the effect of SNAP participation by retailers on consumers' shopping behavior and participating stores' inventory and revenue. They find that new SNAP retailers have a limited inventory of foods (e.g., no fresh produce) and do not significantly impact SNAP-eligible households' nutritional choices or prices paid in the 6 months following adoption.

We contribute to this literature by studying large numbers of dollar store and grocery store entry events, as well as large numbers of grocery store exits, to measure the impact of these events on households' shopping behavior, including spending on produce. We find results consistent with previous research (e.g., Allcott et al. (2019)) that entry of a grocery store or supermarket has a limited impact on shopping behavior and nutritional choices, but we depart from this literature in that we find that the exit of existing grocery stores and the entry of large numbers of dollar stores do have significant impacts on food purchases. If consumers' shopping behavior is characterized by inertia or habit persistence, as suggested by the store choice literature in marketing (Ho et al. (1998)), this could generate asymmetric effects between grocery store openings and closings. Our results are therefore consistent with other work (e.g.

Dubois et al. (2014)) nding that the supply side has a meaningful impact on nutritional outcomes.

The rest of the paper proceeds as follows: Section 2 describes the data and institutional details and provides descriptive statistics. Section 3 presents reduced-form static and dynamic event study results for the impact of dollar store entry on local market structure and consumers' shopping behavior. Section 4 concludes.

# 2 Industry Background, Data, and Descriptive Statistics

In this section, we describe the history and nature of the dollar store chains, present our data sources, and provide some descriptive statistics on the industry.

Dollar General originated the dollar store concept in 1955, selling a wide selection of low-cost basic goods at a single $1 price point. The format became popular and a number of competing variety retailers adopted it, including Family Dollar, founded in 1959. Through decades of steady growth and consolidation among competing chains, by the 2000s there remained three major dollar store chains: Dollar General, Family Dollar, and Dollar Tree. These chains distinguish themselves from other retailers by o ering low prices in the form of a single price point or a limited number of round number price points.

Unlike other discount retailers like Aldi, they do not achieve their discounts by o ering small selections and a large share of private labels. Instead, they o er moderately sized selections and a mix of major brand products and private labels.[5] The stores are built in the 8,000-12,000 sq ft range and carry 10,000-12,000 SKUs. They also save costs by employing few employees and not o ering fresh produce. They primarily sell basic consumables in small formats, seasonal products, and irregular or outdated products o -loaded by

[5] For instance, private labels represented 12% of Dollar General's merchandise mix (Shih et al. (2019)).

major brands. Another distinguishing feature is their market entry strategy, with a focus on small and low income markets under-served by big box retailers. We discuss these markets in greater detail below.

The dollar store chains have grown rapidly over the past several decades, particularly so after the recession of 2008. By 2021, Family Dollar operated roughly 7,100 stores, Dollar General operated 18,000 stores, and Dollar Tree owned 4,350 stores. The combined nearly 30,000 stores are substantially more than the number of Wal-Marts (5,300 stores), Targets (1,900 stores), CVS (9,900 stores), and Walgreens (9,300 stores) combined and is significantly larger than the number of Subway restaurants (21,000 restaurants), the largest U.S. restaurant chain and is similar to the number of Starbucks locations worldwide. The three chains earned a combined $47 billion in revenue in 2019. In 2015, the two smaller chains, Dollar Tree and Family Dollar, merged citing several potential complementarities between the two businesses: e.g., targeting broader ranges of customers, optimizing their combined real estate portfolio, exploiting synergies in sourcing, procurement, and distribution networks.[6]

Data: We combine several data sources to study dollar store expansion and the effects on consumers and local market structure.

The first is the SNAP Retailer panel, a yearly panel of SNAP-authorized retailers from 2008 to 2019. This dataset contains information on over 400,000 U.S. retailers including their chain affiliation and store type, as well as small independent retailers. The SNAP retailer panel contains any store that accepts SNAP benefits. In addition to dollar stores, this includes convenience stores, combination stores (stores selling a combination of general merchandise and food products), grocery stores, drugstores, gas stations, supermarkets, and supercenters. We use the store type variable provided in the SNAP Retailer panel (rather than the store name) to classify stores by type (e.g., dollar, grocery, convenience store). Table 1 shows store counts by type in the SNAP panel. As far as we know, the SNAP retailer data is novel in the economics

[6] "Dollar Tree completes acquisition of Family Dollar." Dollar Tree, Press Release, July 6, 2015.

literature.[7] The primary bene ts of this public data source are that it is an annual measure and contains nearly the full universe of retailers in this industry. Crucially for this study, the panel includes small independent stores, which are typically absent from other retail census data used in the literature.

A drawback of this dataset is that entry into the SNAP program may not necessarily indicate the start of operation of a physical store. In particular, as the SNAP program debuted in 2008, there may have been delays in stores joining the program for the rst few years. We alleviate this concern in two ways. For chains, we can compare store counts in the SNAP panel against publicly disclosed store counts in chains' annual reports to investors. We do not nd any signi cant discrepancies between the two sources. For independent stores, this approach is not possible: instead, we drop the rst few years in the sample and restrict our analysis to the period from 2010 to 2019.

Table 1: Number of SNAP retailers by type (all U.S.)

| Store type | Number of stores |
|---|---|
| Grocer | 65,240 |
| Supermarket/center | 51,695 |
| Small retail | 283,140 |
| Combination Grocery/Other | 78,174 |
| Convenience Store | 204,966 |

Note: Combination grocery/Other includes dollar stores and drug stores. Convenience stores include gas stations.

We also compile data from the Circana Consumer Network panel, which we complement with the Circana MedPro ler dataset.[8] The Consumer Network data contains household-level panels on all retail purchases for a nationwide sample of consumers. The MedPro ler data contain nutritional information for

[7] The dataset has been used in the geography literature studying retail proximity (e.g., Shannon et al. (2018)).

[8] The Circana Consumer Network household panel data come from the National Consumer Panel (NCP), a joint venture between Circana and Nielsen to collect consumer data to provide consumer and marketing insights. For more backgorund about the history and applications of scanner data in economics research, see Dubois et al. (2022).

food purchases (e.g., sugar, sodium) and consumer health metrics (e.g., BMI). We observe the census tract a household resides in, which is more precise than other scanner datasets (e.g. Nielsen Homescan provides the household's zip-code). This allows us to conduct our analysis at a more granular geographic level and construct more precise measures of retail proximity. Although the household scanner data is standard in the IO literature, we include informative summary statistics of spending by retail channel and food category in Table A1 of the Appendix.[9] These statistics show that spending at dollar stores is relatively low compared to other retail channels (e.g., supermarkets, supercenters). The largest expenditure share at dollar stores is for soda, snacks, candy, and crackers; whereas fresh produce spending is close to zero.[10]

Finally, we collect market-level data on demographic characteristics from the Census and ACS at the census tract level. This allows us to study how market characteristics and consumer demographics a ect dollar stores and other retailers' entry behavior and pro ts.

## 2.1 Summary statistics on dollar store entry

Figure 1 shows the total number of stores at the national level over the period 2010-2019. The total number of stores operated by the three major dollar store chains increases by 12,870 during this period. This increase is the net e ect of 14,554 store entry events and 1,684 store exit events. The number of grocery stores falls by 13% from its high in 2012. The number of supermarkets and supercenters is relatively stable over the sample period.

[9] We note that the \Grocery" retail channel in the Circana data includes both grocery stores and supermarkets. In this paper, when studying the impact on market structure, we distinguish between independent grocery stores and supermarket chains.

[10] Studies have compared household scanner data with data from other sources (e.g., Consumer Expenditure Survey, FoodAPS, and supermarket chains' own databases) to assess differences in reporting, see for instance Einav et al. (2010) for Nielsen Homescan and Sweitzer et al. (2017) for Circana Consumer Network. These studies nd discrepancies in reported prices and consistently lower expenditures in the household scanner datasets, especially for unpackaged and random weight products. Therefore, our measures of annual spending likely underestimate the true value. To alleviate this problem, we perform robustness checks in our reduced form analysis by imposing a minimum number of weeks a household reports spending.

Figure 1: Store counts by rm type

We use demographic information from the Census and the Circana Consumer Network to document consumer heterogeneity across locations with varying dollar store densities. Table 2 shows summary statistics of census demographic information for the locations entered by dollar store chains prior to 2010, during the 2010-2019 period, and locations never entered. A location is de ned at the Census Tract level. Dollar store entry occurs in locations that have signi cantly lower incomes per capita and rents than other locations, and a signi cantly higher share of the population that is black or below the poverty line.[11]

Finally, we characterize the household types that display a revealed preference for the dollar store format. First, we compare the demographics of households with a large spending share at the dollar store channel (top 95th percentile and above) post-dollar store entry to households with no spending

[11]The patterns that emerge using the Census or ACS data are consistent with household demographics in the Circana Consumer Network panel. Table A2 in Appendix A shows that households experiencing many dollar stores entries have lower (household) income, are more likely to have a female household head, without children, and are less likely to be white, married, employed, with access to a vehicle.

Table 2: Market Summary Statistics

| | (1) Pre-2010 Entry Only | (2) 2010-2019 Entry | (3) Never Entered |
|---|---|---|---|
| N | 9778 | 12872 | 50378 |
| Mean Population | 4689.9 | 4962.8 | 4263.9 |
| | (2193.5) | (2566.1) | (2295.8) |
| Mean Income | 22686.3 | 23538.8 | 31315.2 |
| | (7520.7) | (8178.7) | (16696.5) |
| Mean Residential Rents | 753.9 | 785.9 | 1064.8 |
| | (252.6) | (275.4) | (455.8) |
| Mean Share White | .738 | .739 | .713 |
| | (.24) | (.253) | (.254) |
| Mean Share Black | .166 | .162 | .127 |
| | (.225) | (.234) | (.210) |
| Mean Share in Poverty | .176 | .165 | .136 |
| | (.108) | (.106) | (.118) |
| Share HH w/ Vehicle Access | .911 | .917 | .904 |
| | (.084) | (.091) | (.135) |

Notes: Unit of observation is the Census Tract. Means are computed using 2019 data. Standard deviation across tracts appears in parentheses below each row.

at the dollar store channel post-entry. This comparison is only among households in locations with dollar store entries and is shown in Table 3. Comparing columns 1 and 2 shows that these two groups di er on several dimensions: households with high dollar store spending shares are signi cantly more likely to be low income, with a female household head, from a minority group, unmarried, unemployed, and without access to a vehicle. The latter group also spends less on fresh produce and at the grocery retail channel.

Second, to isolate preferences that are not merely due to dollar store proximity, we identify households with high dollar store spending who have no dollar stores within 2 miles. All else equal, these households are willing to travel longer distances to shop at this store format and may, therefore, bene t from entry as it reduces their travel costs. To implement this comparison, we select the sample of households with no dollar stores within 2 miles and regress their dollar store spending per year on household demographics (age, income, education, race, household size, marital status, occupation, and weekly hours worked), their retail environment (number of stores by format within 2 miles and from 2 to 5 miles of the household), and the survey year. Controlling for the retail environment is important because low-income households with no dollar stores within 2 miles may also lack access to other retailers (grocery and

Table 3: Demographics of Circana panelists experiencing at least one dollar store entry over the sample period

| | By DS Spending Share Post-DS Entry | | |
|---|---|---|---|
| Variable | No Spending | High Spending (Top 5%) | (t-stat) |
| Income (000s) | 75.08 (45.68) | 41.02 (32.38) | 96.6 |
| Low-Income (< 35k) | 0.21 (0.41) | 0.55 (0.50) | -69.6 |
| High-Income (> 100k) | 0.22 (0.42) | 0.04 (0.20) | 71.7 |
| Years education | 15.13 (2.18) | 13.91 (2.08) | 57.5 |
| No female head | 0.17 (0.38) | 0.14 (0.34) | 9.6 |
| No male head | 0.24 (0.42) | 0.42 (0.49) | -36.9 |
| With children | 0.17 (0.37) | 0.12 (0.33) | 13.8 |
| Age | 57.00 (13.10) | 59.47 (11.41) | -20.8 |
| Household Size | 2.21 (1.22) | 2.00 (1.17) | 17.8 |
| White | 0.83 (0.37) | 0.65 (0.48) | 38.1 |
| Black | 0.08 (0.26) | 0.26 (0.44) | -44.1 |
| Married | 0.60 (0.49) | 0.45 (0.50) | 30.3 |
| Employed | 0.57 (0.50) | 0.41 (0.49) | 32.3 |
| No vehicle | 0.04 (0.20) | 0.10 (0.30) | -8.5 |
| Pre-Entry Fresh Produce Spending | 142.10 (140.42) | 66.64 (69.54) | 88.2 |
| Pre-Entry GS Channel Spending | 1929.54 (1434.27) | 1186.75 (965.85) | 69.6 |
| Pre-Entry DS Channel Spending | 2.20 (24.76) | 223.87 (267.30) | -88.7 |
| Observations | 63,535 | 11,452 | |

Note: The unit of observation is the household-year, for the subsample of households who experience at least one dollar store entry within 2 miles over the sample period. The table shows mean values and standard errors are in parenthesis. Columns (High Spending) shows households with a share of spending at the dollar channel in the 95th percentile or above (9% of total spending). For households with two household heads, we use the mean of age, employment hours, educational attainment for male and female household heads. Household Income is available in 12 bins. Mean income is computed by taking the mid-range of each bin. The top bin (> $100k) is coded as $150,000.

supermarkets).

We find that the main dimensions of heterogeneity are race and household income. Figure 2 shows the estimated coefficients for income and race. Low income households and black households have significantly higher spending at dollar stores, even when such stores are located far from the household.

# 3 Impact of Dollar Store Entry on Market Structure and Consumer Purchases

## 3.1 Effects on Market Structure

In this section, we present evidence on the impact of dollar store chain entry on local retail markets. Our goal is to evaluate whether or not dollar store

Figure 2: These figures show the estimated coefficients on income and race in the regression of dollar store spending on household demographics and their retail environment. Results are for the subsample of households with no dollar stores within 2 miles. Year fixed effects are included. For household income, the first bin corresponds to income less than $10,000, bin 7 corresponds to income in the range $35,000 to $45,000, bin 10 to income in the range $60,000 to $70,000, the highest bin corresponds to income greater than $100,000 per year. Standard errors are clustered at the household level.

chain entry leads to decreases in the number of local grocery retailers. We use our data containing the annual universe of retailers and study the period of rapid expansion of dollar store chains between 2010 and 2019.

During this time period, we observe 14,554 dollar store chain entries. To study the local effects of these entries, we break markets into locations defined as Census tracts. For each location, we obtain its population-weighted centroid and define distance bands around each location using radii of 0-2mi, 2-5mi, and 5-10mi. Our main outcome of interest is the number of independent grocery stores.

Our identification strategy for measuring the effects of dollar store chain entry on these outcomes is to use tract-level fixed effects to account for time-invariant unobserved market characteristics and county-year fixed effects to account for time-varying trends at the market level (see Ellickson and Grieco (2013) for a similar approach). We also incorporate time-varying demographic variables at the census tract level. These are intended to control for local

trends in population or income associated with economic shocks. We include population, median income, and level of residential rents as well as the annual growth rate in each of these variables. We also include a time-varying measure of overall business activity by constructing the total number of active businesses (excluding grocery and dollar stores) at the tract-year level, which we label \business density."

We estimate e ects using the following speci cation:

$$Y_{lbt} = \quad DS_{lt} + \quad X_{lbt} + \quad _{l} + \quad _{mt} + \quad _{lbt} \tag{1}$$

where $_{l}$ and $_{mt}$ represent location and county-time xed e ects, and the objects of interest are the coe cients on the number of dollar store chain entry events in location $l$ in period $t$. The outcome variable $Y_{lbt}$ is the number of independent grocery stores at distance band $b$ around the entry location $l$ in period $t$. We also de ne $X_{lbt}$, the local demographics (including growth rates), at this level. To capture potential non-linear e ects of changes in market structure, we include $DS_{lt}$ as a categorical variable.

Figure 3: The e ects of dollar store entry on grocery stores measured in the 0-2 mile radius around entry (left panel) and in the 2-5 mile radius around entry (right panel). Results are from an event study analysis using a heterogeneity-robust estimator proposed by Callaway and Sant'Anna (2021). Con dence bands show the uniform sup-t con dence intervals adjusted for multiple hypothesis testing.

Before estimating Equation (1), we show graphical results via an event

study analysis over the years before an after the dollar store chain entry occurs. In this speci cation, we estimate:

$$Y_{lbt} = \sum_{} E_{l;t} + X_{lbt} + {}_{l} + {}_{mt} + {}_{lbt} \quad (2)$$

where $E_{lt}$ denote a dummy for whether a dollar store entry has occurred in location $l$ by period $t$. This di ers from the speci cation in Equation (1) in that the coe cients on dollar store entry are subscripted by , the di erence in years measured relative to the entry date. This allows for both dynamic policy e ects, such as a delay in the e ect on local markets as the dollar store's sales ramp up, and for detecting the presence of pre-trends in grocery store activity prior to dollar store entry. For this analysis, we also focus only on a binary dummy for whether or not an entry occurs, rather than the number of entries. The omitted category is = 1 so that all cumulative e ects are relative to the period before entry.

This design is essentially a Di erence-in-Di erence with a staggered roll-out of treatment. This type of empirical design has been shown to have the potential for biased results (Goodman-Bacon (2021), Sun and Abraham (2021)). Consequently, we present results based on heterogeneity-robust estimators, e.g., Callaway and Sant'Anna (2021)[12]. We plot the results in Figure 3 in the manner suggested by Freyaldenhoven et al. (2021), with con dence intervals adjusted for multiple hypothesis testing. The left panel shows the e ects of dollar store entry on the number of grocery stores in the 0-2mi radius and the right panel shows e ects in the 2-5mi radius. In both panels, we detect no pre-trend in the number of grocery stores, followed by a clear downward trend after the time of dollar store entry. Several years after the initial dollar store entry, the e ect on the number of grocery stores grows quite large.

In Table 4, we show estimates of Equation (1) for di erent speci cations of controls and xed e ects where the outcome variable is the number of

[12] In Figure A1 of Appendix A, we present results from the TWFE implementation (corresponding to Equation (2)) as well as several other heterogeneity-robust estimators based on imputation (Borusyak et al. (2021)) and manual aggregation (Sun and Abraham (2021)) that have been suggested in the literature and they provide consistent results.

independent grocery stores within a 0-2 mile radius of the centroid of location l. We find that there is a consistent negative effect on the number of grocery stores that is increasing in the number of dollar store entries. This effect is small for a single dollar store entry, but increases to -.32 for two entries, and then to a decrease of more than 1 grocery stores in locations with 3+ entries.

Table 4: Effects of DS Entry (0-2mi) on Number of Grocery Stores

| | (1) All Markets | (2) All Markets | (3) All Markets |
|---|---|---|---|
| First DS Entry | -0.109 | -0.0717 | -0.0705 |
| | (0.0147) | (0.0137) | (0.0160) |
| Two DS Entries | -0.557 | -0.323 | -0.307 |
| | (0.0300) | (0.0267) | (0.0289) |
| Three+ DS Entries | -1.716 | -1.036 | -0.976 |
| | (0.0636) | (0.0512) | (0.0521) |
| Year FE | Yes | | |
| Demographic Controls | Yes | Yes | Yes |
| Business Density | | | Yes |
| Census Tract FE | Yes | Yes | Yes |
| Market*Year FE | | Yes | Yes |
| Observations | 559,846 | 557,635 | 453,657 |
| F-stat | 128.1 | 87.3 | 89.6 |
| Adjusted $R^2$ | 0.98 | 0.98 | 0.98 |
| Mean Pre-Entry | 2.71 | 2.71 | 2.71 |

Notes: Unit of observation is the location-year. Standard errors (in parenthesis) clustered at the location level. Controls for time-varying local demographics (income, population, residential rents, and the one-year percent change in each) and business density are included.

Table 5 shows how these effects vary by the distance from the entry location. We study regions defined by radii of 0-2mi, 2-5mi, and 5-10mi from the entry location.[13] The results show a substantial fall in the number of grocery stores in the 2-mile radius around where the dollar store entry occurs. In the area 2-5 miles from the dollar store entry there is a smaller but still significant

[13] Each demographic variable is calculated for the region where effects are being measured.

e ect when there are more than one entrants, and in the area 5-10 miles away there are no detectable negative e ects of dollar store entry.

Three conclusions follow from these results. First, the negative e ect of dollar store entry on grocery stores that we nd is not spuriously driven by larger market-level or regional economic shocks. Second, shopping patterns for dollar stores and independent grocery stores seem to take place primarily over fairly small distances. And third, in the local area in which a dollar store entry takes place the e ects on grocery stores is increasing in the number of dollar stores that enter.

We also repeat this analysis for other store types and show the results in Table A3. We nd a substantially smaller but still signi cant negative e ect of dollar store entry on the number of convenience stores and supermarkets in the 0-2mi radius, but no e ect on supercenters and a small positive e ect on other dollar stores, possibly suggesting economies of scale in entry.

The e ects estimated in the previous analysis could include indirect e ects or spillovers from treated to control locations. For instance, grocery stores may relocate from dollar store entry locations to nearby locations, or alternatively, dollar store entries may be correlated across multiple locations in a given market. To address concerns of spillovers to control locations, we drop all locations that experience dollar store entries in 2-5mi and 5-10mi radii at any point in the sample period. We re-estimate the speci cation in Table 4 on this subsample. By de nition, the control locations in this robustness check do not experience any dollar store entry within 10mi over the sample period, whereas the treatment locations experience some dollar store entry only in the 0-2mi radius. The results are shown in Table A4. Despite the much smaller sample size, we nd a statistically signi cant negative e ect of dollar store entry on the number of grocery stores, that remains qualitatively similar to our baseline results.

Table 5: E ect of DS Entry (by distance band) on Number of Grocery Stores

| | (1) 0-2m | (2) 2-5m | (3) 5-10m |
|---|---|---|---|
| First DS Entry | -0.0705 | -0.108 | 0.0293 |
| | (0.0160) | (0.0184) | (0.0180) |
| Two DS Entries | -0.307 | -0.224 | 0.0578 |
| | (0.0289) | (0.0332) | (0.0347) |
| Three+ DS Entries | -0.976 | -0.509 | 0.286 |
| | (0.0521) | (0.0581) | (0.0614) |
| Demographic Controls | Yes | Yes | Yes |
| Business Density | Yes | Yes | Yes |
| Census Tract FE | Yes | Yes | Yes |
| Market*Year FE | Yes | Yes | Yes |
| Observations | 453,657 | 307,321 | 263,488 |
| F-stat | 89.6 | 29.9 | 14.2 |
| Adjusted $R^2$ | 0.98 | 0.99 | 0.99 |
| Mean Pre-Entry | 2.72 | 3.97 | 6.28 |

Notes: Unit of observation is the location-year. Standard errors (in parenthesis) clustered at the location level. Time and location xed e ects are included. Controls for time-varying local demographics (income, population, residential rents, and the one-year percent change in each) and business density are included, each is calculated for the radius area corresponding to the dependent variable.

## 3.2 E ects on Consumers' Shopping Behavior

This section studies how dollar store entry and grocery store exit a ects households' shopping behavior. We exploit variation in local supply within household in an event study framework, as in Allcott et al. (2019). We begin by analyzing how the changes in market structure highlighted in the previous section a ect aggregate food spending. Next, we show that the adverse impact of dollar store entry on the number of grocery stores is re ected in spending and trip diversion from the grocery to the dollar store retail channel. Finally, we examine how the above market structure changes translate into spending on various food categories and the nutritional value of households' shopping

baskets. We aim attention at spending and volume of purchases of fresh produce, speci cally, because access to this particular food group has been at the center of the dollar store policy debate.

In this section, the unit of analysis is the household{year. We again consider both static and dynamic (event study design) speci cations. Let $DS_{bct}$ denote the number of dollar store entries that have occurred within distance band $b$ (e.g., 0-2mi, 2-5mi) from census tract $c$ by period $t$. Let $X_{it}$ denote time-varying household characteristics (e.g., age, education, employment, marital status). Let $Y_{ict}$ denote the outcome variable for household $i$ living in census tract $c$ in period $t$. We consider the following static speci cation

$$Y_{ict} = DS_{bct} + X_{it} + _i + _t + _{ict} \quad (3)$$

where $_i$ and $_t$ are household and time xed e ects.

As the e ects we estimate are likely persistent and heterogeneous over time, we also consider a dynamic speci cation in an event study framework. Let $E_{bct}$ denote a dummy for whether a dollar store entry has occurred within distance band $b$ (e.g., 0-2mi, 2-5mi) from census tract $c$ by period $t$. We consider the following dynamic speci cation

$$Y_{ict} = \sum E_{bc;t} + X_{it} + _i + _t + _{ict} \quad (4)$$

Spending and number of trips by retail channel.

Table 6 shows the e ect of dollar store entry (within 2 miles of the household) on spending and the number of yearly trips by retail channel.[14] The results indicate that dollar stores divert spending away primarily from the grocery and convenience retail channels, but not from supercenters or club stores. Entry is associated with an increased number of trips to the dollar channel, from .84 to

[14] Retail channels, as de ned by Circana, correspond to broad retail categories. The "Grocery" channel includes both supermarkets and grocery stores but excludes supercenters and club stores. Other smaller retail categories (in terms of spending share), not shown in Table 6, include farmers' markets, military commissaries, and bulk food stores which also see sales diversion to dollar stores.

Table 6: E ect of DS Entry (0-2mi) on Spending and Number of Trips by Retail Channel

| | | Spending by Channel | | | | Trips by Channel | | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) Aggregate | (2) Grocery | (3) Dollar | (4) SC/Club | (5) Conv | (6) Grocery | (7) Dollar | (8) SC/Club | (9) Conv |
| First DS Entry | -30.82 | -20.85 | 5.063 | -5.612 | -0.991 | -0.913 | 0.670 | -0.141 | -0.162 |
| | (6.590) | (5.048) | (0.493) | (3.845) | (0.413) | (0.169) | (0.0509) | (0.102) | (0.0478) |
| Two DS Entries | -6.746 | -8.324 | 5.949 | -1.104 | 0.108 | -0.888 | 1.060 | 0.416 | -0.158 |
| | (12.28) | (9.946) | (0.952) | (7.219) | (0.702) | (0.339) | (0.100) | (0.201) | (0.0989) |
| Three+ DS Entries | 40.52 | 30.05 | 10.48 | -7.074 | -2.105 | -0.450 | 1.572 | 1.269 | -0.539 |
| | (21.03) | (16.79) | (1.644) | (11.19) | (1.409) | (0.625) | (0.187) | (0.338) | (0.184) |
| Observations | 570,689 | 570,689 | 570,689 | 570,689 | 570,689 | 570,689 | 570,689 | 570,689 | 570,689 |
| F-stat | 838.8 | 426.7 | 4.14 | 928.2 | 2.24 | 48.0 | 6.84 | 674.5 | 2.79 |
| $R^2$ | 0.83 | 0.84 | 0.77 | 0.84 | 0.68 | 0.84 | 0.81 | 0.84 | 0.75 |
| Adjusted $R^2$ | 0.79 | 0.80 | 0.71 | 0.80 | 0.61 | 0.81 | 0.76 | 0.80 | 0.70 |
| Mean Pre-Entry | 2917.3 | 1768.3 | 32.3 | 777.2 | 14.6 | 57.8 | 4.85 | 22.4 | 2.16 |

Notes: Unit of observation is the household-year. Standard errors (in parenthesis) clustered at the household level. Year and household xed e ects are included. Controls for time-varying household demographics (income, education, age, household size, marital status, occupation, weekly hours worked) are included. Results are shown for all panelists in the sample. The rst column shows aggregate spending. SC/Club stands for the Supercenter and Club store channel. Conv stands for the convenience store channel.

5:5 trips following one entry and 5:8 following two entries. The impact of entry on the number of grocery and convenience trips is negative and signi cant.

Spending on fresh produce and dollar store entry.

Next, we turn to the e ect on fresh produce spending, a key outcome of interest for policymakers. Table 7 shows the e ect of dollar store entry within 2mi and from 2 to 5mi of the household on fresh produce spending. Overall, we nd a negative and signi cant e ect of entry within 2mi of the household on produce spending across samples (all households, those part of a balanced panel, and those part of a balanced panel and reporting random weight products). The magnitude of the e ect increases with the number of dollar store entries but is overall modest in size.

We investigate the heterogeneity in this e ect by household characteristics. Figure 4 shows the coe cients on dollar store entry for the balanced panel (column (2) of Table 7) interacted with household income (in 12 bins, top panel) and vehicle access (bottom panel). The results indicate that the negative e ect of dollar store entry on fresh produce spending is mainly driven by lower-income households (income up to $45,000 or bins 1 to 7). For this

Table 7: E ect of DS Entry (by distance band) on Fresh Produce Spending

| | 0-2mi | | | 2-5mi | | |
|---|---|---|---|---|---|---|
| | (1) All | (2) Bal | (3) Bal/RW | (4) All | (5) Bal | (6) Bal/RW |
| First DS Entry | -0.945 | -1.609 | -3.216 | 0.0319 | 0.478 | 0.520 |
| | (0.588) | (0.951) | (1.267) | (0.504) | (0.872) | (1.199) |
| Two DS Entries | -3.431 | -5.366 | -7.262 | 0.315 | -0.492 | -0.0342 |
| | (1.148) | (1.621) | (2.143) | (0.782) | (1.197) | (1.669) |
| Three+ DS Entries | -5.209 | -8.323 | -7.465 | -1.292 | -2.692 | -0.677 |
| | (1.934) | (2.410) | (3.236) | (1.098) | (1.545) | (2.151) |
| Observations | 570,689 | 246,851 | 154,988 | 570,689 | 246,851 | 154,988 |
| F-stat | 55.3 | 6.36 | 4.35 | 55.2 | 6.25 | 4.17 |
| $R^2$ | 0.76 | 0.74 | 0.78 | 0.76 | 0.74 | 0.78 |
| Adjusted $R^2$ | 0.71 | 0.72 | 0.74 | 0.71 | 0.72 | 0.74 |
| Spending Pre-Entry | 130.9 | 146.4 | 155.4 | 126.1 | 137.9 | 144.6 |

Notes: Unit of observation is the household-year. Standard errors (in parenthesis) clustered at the household level. Year and household xed e ects are included. Controls for time-varying household demographics (income, education, age, household size, marital status, occupation, weekly hours worked) are included. The balanced panel (\Bal") corresponds to households observed for at least 9 consecutive years. The \RW" panel reports complete purchases of random weight products.

group, a single dollar store entry reduces spending by 2.3% to 13.8%, two entries reduce spending by 5.1% to 25.8%, and three or more entries reduce spending by 7.24% to 30.44% depending on the household income bin. Moreover, households without vehicle access (a proxy for travel costs) experience a signi cantly larger decline in their fresh produce spending following one and two entries, although this group is small.

To put these e ects into a broader perspective, we compute the di erence in fresh produce spending between low and high-income households, controlling for household size, age, and year indicators. We compare households with annual income below $45,000 to households with annual income greater than $70,000. We nd that the reduction in fresh produce spending due to dollar store entry explains between 13.2% and 27% of the di erence in fresh produce spending across high and low income households.

Table 7 shows that these e ects are localized spatially. Entry of dollar stores in the 2-5mi distance band (columns (4) to (6)) does not signi cantly

Figure 4: The effect of dollar store entry at the 0-2mi band around the household on fresh produce spending, by household income bin (top panel) and access to vehicle (bottom panel). Results are shown for the balanced panel. For household income, the first bin corresponds to income less than $10,000, bin 7 corresponds to income in the range $35,000 to $45,000, bin 10 to income in the range $60,000 to $70,000, the highest bin corresponds to income greater than $100,000 per year. Standard errors are clustered at the household level.

a ect produce spending. Figure 5 shows the corresponding event study plots for the balanced sample, using a two-way  xed e ect as well as a heterogeneity-robust estimator (Callaway and Sant'Anna (2021)).[15] Consistent with the static analysis, we  nd that the e ects are localized and negative only at the 0-2mi range. Moreover, the negative impact on fresh produce spending is dynamic, with the magnitude increasing in the time since entry.

Figure 5: The e ects of dollar store entry at the 0-2mi (left panel) and 2-5mi (right panel) bands around the household on spending on fresh produce. Results are from an event study analysis on the balanced panel, using a TWFE and a heterogeneity-robust estimator proposed by Callaway and Sant'Anna (2021). Household and year  xed e ects are included. Con dence bands show the uniform sup-t con dence intervals adjusted for multiple hypothesis testing.

As a robustness check, we also perform the event study analysis on sub-samples of households controlling for the number of weeks a household reports spending (see footnote 10 for a discussion of known under-reporting issues in the Nielsen and Circana household scanner data). The results, shown in Figure A3 in Appendix A, are quantitatively similar.

Spending on fresh produce and grocery store exit.

The reduction in fresh produce spending documented above may be due to a direct e ect (e.g., substitution away from produce due to preferences for the

[15] We experiment with several other heterogeneity-robust estimators based on imputation (Borusyak et al. (2021)) and manual aggregation (Sun and Abraham (2021)). Results are shown in Figure A2 of Appendix A.

dollar store format and products) and an indirect e ect (e.g., reduced access to produce from changes in market structure). We provide evidence that the impact of dollar store entry on fresh produce spending acts in part through exits of grocery stores and reduced access. Table 8 shows the e ect of dollar store entry on fresh produce spending, controlling for the number of grocery store exits (all in the 0-2mi radius). Given the e ect heterogeneity uncovered in Figure 4, we interact these market structure changes with household income (below or above bin 7).

Comparing column (1), which includes dollar store entries only, to column (2) indicates that, for low-income households, grocery store exits explain a signi cant proportion (43%) of the e ect of dollar store entry on fresh produce spending. For instance, the aggregate e ect of three dollar store entries on low-income households' spending ($15.86 in column (1)) can be decomposed into a direct e ect (-$8.17 in column (2)) and an indirect e ect from one grocery store exit (-$6.82 in column (2)).[16]

Spending on other food categories.

One argument in favor of dollar store entry is its potential for lowering prices and increasing cost savings for consumers. We therefore test whether dollar store entry reduces total expenditure on other food categories. Table 9 show spending on food categories ranging from Soda and Snacks to Meals (soup, rice, and pasta). The majority of changes in spending are insigni cant, except for frozen produce, on which spending increases following three or more entries. We note, however, that the latter e ect is not robust when broken down by income.[17]

Quantities of fresh produce purchased.

[16] Section 3.1 shows that three dollar stores entries displace on average one grocery store. We also run alternative speci cations for Table 8 (e.g., including only grocery store exits but not dollar store entries) and consistently nd that grocery store exits lead to a reduction in fresh produce spending for low-income households.

[17] Frozen produce spending increases following three or more entries only for households in income bins 4 and 5 ($15,000 to $25,000 per year). The e ect does not display the monotonicity found for fresh produce spending and displayed in Figure 4.

Table 8: Decomposition of the E ect of DS Entry (0-2mi) on Fresh Produce Spending

| | Dependent Variable: Spending on Fresh Produce | | | |
|---|---|---|---|---|
| | (1) | | (2) | |
| | Balanced | | Balanced | |
| High income | | | | |
| First DS Entry | 2.010 | (1.177) | 1.223 | (1.191) |
| Two DS Entries | -1.414 | (2.008) | -2.567 | (2.067) |
| Three+ DS Entries | -3.378 | (3.027) | -4.493 | (3.153) |
| Low income | | | | |
| First DS Entry | -7.488 | (1.265) | -5.168 | (1.272) |
| Two DS Entries | -11.58 | (2.145) | -6.647 | (2.196) |
| Three+ DS Entries | -15.86 | (3.146) | -8.174 | (3.257) |
| | | | | |
| High income | | | | |
| First GS Exit | | | 1.782 | (1.240) |
| Two GS Exits | | | 1.657 | (1.897) |
| Three+ GS Exits | | | -0.610 | (2.738) |
| Low income | | | | |
| First GS Exit | | | -6.827 | (1.171) |
| Two GS Exits | | | -11.81 | (1.750) |
| Three+ GS Exits | | | -13.51 | (2.672) |
| Observations | 246,851 | | 246,851 | |
| F-stat | 7.25 | | 7.61 | |
| $R^2$ | 0.74 | | 0.74 | |
| Adjusted $R^2$ | 0.72 | | 0.72 | |
| Spending Pre-Entry | 146.4 | | 146.4 | |

Notes: Unit of observation is the household-year. Standard errors (in parenthesis) clustered at the household level. Year and household xed e ects are included. Controls for time-varying household demographics (income, education, age, household size, marital status, occupation, weekly hours worked) are included. The balanced panel corresponds to households observed for at least 9 years. Low income refers to households with annual income in bin 7 ($35,000 to $45,000) or lower. High income corresponds to households in bin 8 or higher.

Table 9: E ect of DS Entry (0-2mi) on Spending by Product Category

| | Dependent Variable: Spending by Product Category | | | | | | |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| First DS Entry | -0.521 | 0.209 | 1.171 | -0.588 | -2.685 | -0.900 | 1.604 |
| | (0.399) | (0.344) | (1.939) | (0.709) | (1.301) | (1.076) | (1.681) |
| Two DS Entries | 0.190 | 0.920 | -0.457 | 0.887 | -1.554 | -0.987 | 3.915 |
| | (0.681) | (0.637) | (3.388) | (1.247) | (2.216) | (1.840) | (2.939) |
| Three+ DS Entries | 1.551 | 2.767 | 1.789 | 1.881 | -0.572 | 2.152 | 7.898 |
| | (1.010) | (0.990) | (5.065) | (1.843) | (3.353) | (2.989) | (4.542) |
| Observations | 246,851 | 246,851 | 246,851 | 246,851 | 246,851 | 246,851 | 246,851 |
| F-stat | 10.9 | 5.66 | 14.8 | 17.8 | 22.3 | 15.8 | 8.67 |
| $R^2$ | 0.66 | 0.67 | 0.79 | 0.73 | 0.79 | 0.75 | 0.75 |
| Adjusted $R^2$ | 0.62 | 0.63 | 0.76 | 0.70 | 0.77 | 0.72 | 0.72 |
| Spending Pre-Entry | 64.8 | 39.9 | 491.5 | 153.8 | 351.1 | 214.7 | 331.7 |

Notes: Unit of observation is the household-year. Standard errors (in parenthesis) clustered at the household level. Year and household xed e ects are included. Controls for time-varying household demographics (income, education, age, household size, marital status, occupation, weekly hours worked) are included. Results are shown for the balanced panel. Each column corresponds to a product category: (1) is canned produce, (2) is frozen produce, (3) is soda, snacks, candy and crackers, (4) is meals (incl. rice, pasta, soup), (5) is dairy, (6) is refrigerated and frozen meats, (7) is refrigerated and frozen baked goods, desserts, dough, and beverages.

Finally, we investigate whether these changes in fresh produce spending translate into meaningful changes in volumes consumed. While lower expenditures might reflect a reduction in consumption, it might also reflect the fact that consumers potentially face lower prices, if for instance, grocery stores respond to entry by lowering fresh produce prices. We isolate the effect on quantities purchased by computing volumes of fresh produce purchased. Figure 6 shows an event study plot of the effect of dollar store entry on the volume of fresh produce purchased in ounces. The results indicate that entry within 2mi of the household leads to a significant reduction in volumes of fresh produce purchased of approximately 5%. For completeness, we include the corresponding static analysis in Table A5 of Appendix A.

Figure 6: The effects of dollar store entry at the 0-2mi (left panel) and 2-5mi (right panel) bands on fresh produce volume purchased. Results are from an event study analysis on the balanced panel, using a TWFE and a heterogeneity-robust estimator proposed by Callaway and Sant'Anna (2021). Household and year fixed effects are included. Confidence bands show the uniform sup-t confidence intervals adjusted for multiple hypothesis testing.

On the whole, the findings in sections 3.1 and 3.2 point to a large impact of dollar store expansion on market structure and a modest but significant impact on consumers' dietary choices. The latter average effect masks important heterogeneity across consumers: low-income households (annual income below $45,000) and households with high travel costs experience large declines in fresh produce spending whereas higher-income households are not affected.

While previous research (e.g., Allcott et al. (2019)) has shown that entry of grocery stores and supermarkets has economically small e ects on healthy grocery shopping, the analysis above demonstrates that (1) grocery stores are driven out by dollar store entry in close proximity; (2) the exit of many grocery stores is associated with a moderate but signi cant reduction in spending on and volumes of fresh produce. This asymmetric impact of grocery store entries and exits on healthy grocery shopping may be tied to consumer inertia in store and brand choices (Ho et al. (1998), Dubé et al. (2010)). Inertia in households' shopping may create asymmetries in the response to positive or negative shocks to their retail environment.

# 4 Conclusion

The rise of dollar store chains has profoundly reshaped the U.S. retail sector. By 2021, more than 75 percent of the U.S. population lives within  ve miles of a dollar store. This rapid expansion has been met with growing scrutiny from policymakers. Proponents claim that dollar stores broaden shopping options and improve convenience for consumers in underserved areas. Advocates of tighter controls argue that these chains threaten local independent stores, discourage entry by full-line grocery stores, and limit consumers' access to fresh produce. In many municipalities, controls take the form of zoning ordinances that limit dollar store density.

Despite the extensive public policy debates, there remains a need for careful empirical evidence supporting the arguments advanced. This paper brings new data and methods to bear on these questions. We quantify the impacts of dollar stores' expansion and focus on two sets of outcomes. First, we consider market structure, that is, the geographic layout and number of retail stores by format. This outcome is particularly important as it a ects retail proximity, convenience, and product variety. Second, we consider consumers' shopping behavior, including their spending across retail formats and food categories (e.g., fresh produce).

Our analysis demonstrates that dollar store entry leads to a signi cant re-

duction in the number of grocery stores, especially in close proximity (0{2mi) from the entry location. We nd that markets lose one grocery store for every three new dollar stores. Dollar store entry and subsequent grocery store exits are associated with lower household spending and volumes purchased of fresh produce. Moreover, we highlight the distributional consequences of these ndings: fresh produce consumption and grocery access decrease most for consumers who initially tend to eat less healthfully and have higher transportation costs|low income, older, from minority groups, without access to a vehicle. Overall, we nd that negative shocks to food availability have a meaningful impact on consumers' dietary choices. These results add nuance to the literature on the determinants of nutritional inequality.

The welfare implications of dollar store expansion are arguably multifaceted. Dollar store entry may a ect consumer welfare through changes in prices (both at dollar stores and through their competitors' response), changes in store convenience (or travel costs), and changes in product availability and the ensuing composition of consumers' shopping baskets. In the medium to long-run, changes in consumers' dietary choices can have important implications for health outcomes. While the existing data and the many channels above prevent an estimation approach that accounts for all these dimensions in a single model, we view this paper as a necessary rst step in quantifying this impact and informing the debate around the place of the dollar store format in the U.S. retail landscape.

# References

Allcott, Hunt, Rebecca Diamond, Jean-pierre Dub e, Jessie Handbury, Ilya Rahkovsky, and Molly Schnell. 2019. \Food Deserts and the Causes of Nutritional Inequality." The Quarterly Journal of Economics 1{52.

Arcidiacono, Peter, Paul B. Ellickson, Carl F. Mela, and John D. Singleton. 2020. \The competitive e ects of entry: Evidence from supercenter expansion."American Economic Journal: Applied Economics12 (3): 175{206.

Basker, E., and M. Noel. 2009. \The Evolving Food Chain: Competitive E ects of Wal-Mart's Entry into the Supermarket Industry." Journal of Economics and Management Strategy 18 977{1009.

Basker, Emek. 2005. \Job creation or destruction? Labor market e ects of Wal-Mart expansion." Review of Economics and Statistics 87 (1): 174{183.

Borusyak, Kirill, Xavier Jaravel, and Jann Spiess. 2021. \Revisiting Event Study Designs: Robust and E cient Estimation."

Byrne, Anne, Xiao Dong, Erik James, Jessie Handbury, and Katherine Meckel. 2022. \Welfare Implications of Increased Retailer Participation in SNAP." https://www.ers.usda.gov/amber-waves/2019/august/ .

Callaway, Brantly, and Pedro H.C. Sant'Anna. 2021. \Di erence-in-Di erences with multiple time periods." Journal of Econometrics 225 (2): 200{230, Themed Issue: Treatment E ect 1.

Cao, Yue. 2022. \The Welfare Impact of Dollar Stores."

Caoui, El Hadi, Brett Hollenbeck, and Matthew Osborne. 2024. \Dynamic Entry & Spatial Competition: An Application to Dollar Store Expansion."

Chenarides, Lauren, Clare Cho, Rodolfo M. Nayga, and Michael R. Thomsen. 2021. \Dollar stores and food deserts." Applied Geography 134 (June): 102497.

Chenarides, Lauren, C Metin, and Timothy J Richards. Forthcoming. \Dynamic Model of Entry: Dollar Stores." American Journal of Agricultural Economics

Cummins, S., E. Flint, and S.A. Matthews. 2014. \New neighborhood grocery store increasing awareness of food access but did not alter dietary habits or obesity." Health A airs 33 (2): 283{291.

Cummins, S., M. Petticrew, C. Higgings, A. Findlay, and L. Sparks. 2005. \Large scale food retailing as an intervention for diet and health: quasi-experimental evaluation of a natural experiment." J Epidemiol Community Healthy 59 1035{1040.

Dubois, Pierre, Rachel Gri th, and Aviv Nevo. 2014. \Do Prices and Attributes Explain International Di erences in Food Purchases?." American Economic Review 104 (3): 832{867, https://ideas.repec.org/a/aea/aecrev/v104y2014i3p832-67.html .

Dubois, Pierre, Rachel Gri th, and Martin O'Connell. 2022. \The Use of Scanner Data for Economics Research." Technical Report 22-1286, https://ideas.repec.org/p/tse/wpaper/126393.html .

Dubowitz, T., M. Ghosh-Dastidar, D. Cohen, R. Beckman, E. Steiner, G. Hunter, K. Florez, C. Huang, C. Vaughan, and J. Sloan. 2015. \Changes in diet after introduction of a full service supermarket in a food desert." Health A airs 34 (11): 1858.

Dub e, Jean Pierre, Gunter J. Hitsch, and Peter E. Rossi. 2010. \State dependence and alternative explanations for consumer inertia." RAND Journal of Economics 41 (3): 417{445.

Einav, Liran, Ephraim Leibtag, and Aviv Nevo. 2010. \Recording discrepancies in Nielsen Homescan data: Are they present and do they matter?." Quantitative Marketing and Economics 8 (2): 207{239.

Elbel, B., A. Moran, LB. Dixon, K. Kiszko, J. Cantor, C. Abrams, and T. Mijanovich. 2015. \Assessment of a government-subsidized supermarket in a high-need area on household food availability and children's dietary intakes." Public Health Nutrition 18 (15): 2881{2890.

Ellickson, P., S. Houghton, and C. Timmins. 2013. \Estimating Network Economies in Retail Chains: A Revealed Preference Approach." RAND Journal of Economics 169{193.

Ellickson, Paul B., and Paul L.E. Grieco. 2013. \Wal-Mart and the geography of grocery retailing." Journal of Urban Economics 75 (C): 1{14.

Feng, Wenhui, Elina T. Page, and Sean B. Cash. 2023. \Dollar Stores and Food Access for Rural Households in the United States, 2008{2020." American Journal of Public Health 113 (3): 331{336, PMID: 36657091.

Freyaldenhoven, Simon, Christian Hansen, Jorge P erez P erez, and Jesse M. Shapiro. 2021. \Visualization, Identi cation, and Estimation in the Linear Panel Event-Study Design." NBER Working Papers 29170, National Bureau of Economic Research, Inc, https://ideas.repec.org/p/nbr/nberwo/29170.html .

Goodman-Bacon, Andrew. 2021. \Di erence-in-di erences with variation in treatment timing." Journal of Econometrics 225 (2): 254{277, Themed Issue: Treatment E ect 1.

Grieco, Paul L. E. 2014. \Discrete games with exible information structures: an application to local grocery markets."RAND Journal of Economics 45 (2): 303{340.

Ho, Teck, Christopher S. Tang, and David R. Bell. 1998. \Rational Shopping Behavior and the Option Value of Variable Pricing."Management Science 44 (12-Part-2): S145{S160.

Holmes, T.J. 2011. \The Di usion of Wal-Mart and Economics of Density." Econometrica 79 253{302.

Hristakeva, Sylvia, and Julia Levine. 2022. \Grocery Store Closures and Household Nutritional Choices."Working Paper.

Igami, Mitsuru. 2011. \Does Big Drive Out Small?."Review of Industrial Organization 38 (1): 1{21.

Jia, Panle. 2008. \What Happens When Wal-Mart Comes to Town: An Empirical Analysis of the Discount Retailing Industry." Econometrica 76 (6): 1263{1316.

Levi, Retsef, Elisabeth Paulson, and Georgia Perakis. 2019. \Optimal Interventions for Increasing Healthy Food Consumption Among Low Income Households."MIT Sloan Research PaperNo. 6053-19

Levi, Retsef, Elisabeth Paulson, and Georgia Perakis. 2020. \Fresh Fruit and Vegetable Consumption: The Impact of Access and Value."MIT Sloan Research Paper No. 5389-18

Liese, A., B. Bell, T. Barnes, N. Colabianchi, J. Hibbert, C. Blake, and D. Freedman. 2014. \Environmental in uences on fruit and vegetable intake: results from a path analytic model."Public Health Nutrition 17 (11): 2595{2604.

Lopez, Rigoberto, Keenan Marchesi, and Sandro Steinbach. 2023. \Dollar Store Expansion, Food Retail Competition, and Rural Employment."

Rose, D., and R. Richards. 2004. \Food store access and household fruit and vegetable use among participants in the US Food Stamp Program." Public Health Nutrition 17 (11): 2595{2604.

Schneier, Camilla, Yixin Sun, and Fern Ramoutar. 2023. \Buck Wild : The Impact of the Dollar Store on Households and Local Retail Competition."

Shannon, Jerry, Grace Bagwell-Adams, Sarah Shannon, Jung Sun Lee, and Yangjiaxin Wei. 2018. \The mobility of food retailers: How proximity to SNAP authorized food retailers changed in Atlanta during the Great Recession." Social Science and Medicine 209 (November 2017): 125{135.

Shih, Willy, Stephen Kaufman, and Rebecca Mckillican. 2019. \Dollar General (A)." Harvard Business School Case 607-1 1{28.

Sun, Liyang, and Sarah Abraham. 2021. \Estimating dynamic treatment e ects in event studies with heterogeneous treatment e ects." Journal of Econometrics 225 (2): 175{199, Themed Issue: Treatment E ect 1.

Sweitzer, Megan, Derick Brown, Shawn Karns, Mary K Muth, Peter Siegel, and Chen Zhen. 2017. \Food-at-Home Expenditures: Comparing Commercial Household Scanner Data From IRI and Government Survey Data." USDA ERS Technical Bulletin (1946): , www.ers.usda.gov.

Ver Ploeg, M., and I. Rahkovsky. 2016. \Recent evidence on the e ects of food store access on food choice and diet quality." USDA Economic Research Service

Weatherspoon, D., J. Oehmke, A. Dembele, M. Coleman, T. Satimanon, and L. Weatherspoon. 2013. \Price and expenditure elasticities for fresh fruits in an urban food desert." Urban Studies 50 (1): 88{106.

Zhu, Ting, and Vishal Singh. 2009. \Spatial competition with endogenous location choices: An application to discount retailing." Quantitative Marketing and Economics 7 (1): 1{35.

# A Supplementary Tables and Figures

Table A1: Household Spending by Retail Channel and Food Category in Circana Consumer Network (in $ per year)

| Variable | Mean | Median | Std.Dev |
|---|---|---|---|
| Aggregate Spending | 2,908.3 | 2,560.4 | 1,753.1 |
| Spending in Grocery Channel | 1,765.8 | 1,456.4 | 1,422.7 |
| Spending on Fresh Produce | 88.6 | 52.7 | 112.7 |
| Spending on Can/Frozen Produce | 63.3 | 43.3 | 70.5 |
| Spending on Soda, Snacks, Candy | 227.4 | 159.5 | 235.4 |
| Spending on Dairy | 221.7 | 169.8 | 205.7 |
| Spending on Refg./Frozen Meat | 127.0 | 85.3 | 142.9 |
| Spending on Meals | 94.3 | 66.9 | 98.9 |
| Spending on Frozen Other | 145.5 | 92.6 | 175.9 |
| Spending in Dollar Channel | 33.7 | 1.0 | 108.6 |
| Spending on Fresh Produce | 0.6 | 0.0 | 7.0 |
| Spending on Can/Frozen Produce | 1.2 | 0.0 | 6.4 |
| Spending on Soda, Snacks, Candy | 14.6 | 0.0 | 45.4 |
| Spending on Dairy | 1.5 | 0.0 | 10.5 |
| Spending on Refg./Frozen Meat | 0.9 | 0.0 | 8.0 |
| Spending on Meals | 2.8 | 0.0 | 14.9 |
| Spending on Frozen Other | 1.6 | 0.0 | 13.1 |
| Spending in SC/Club Channel | 767.0 | 377.4 | 1,027.2 |
| Spending on Fresh Produce | 38.6 | 7.8 | 83.4 |
| Spending on Can/Frozen Produce | 27.3 | 6.9 | 51.8 |
| Spending on Soda, Snacks, Candy | 134.8 | 58.0 | 206.2 |
| Spending on Dairy | 87.0 | 27.1 | 142.3 |
| Spending on Refg./Frozen Meat | 71.0 | 20.0 | 123.8 |
| Spending on Meals | 37.7 | 11.0 | 66.4 |
| Spending on Frozen Other | 57.8 | 12.7 | 115.9 |
| Spending in Convenience Channel | 14.4 | 0.0 | 88.0 |
| Spending on Fresh Produce | 0.1 | 0.0 | 4.0 |
| Spending on Can/Frozen Produce | 0.1 | 0.0 | 2.0 |
| Spending on Soda, Snacks, Candy | 3.3 | 0.0 | 24.2 |
| Spending on Dairy | 1.6 | 0.0 | 13.4 |
| Spending on Refg./Frozen Meat | 0.2 | 0.0 | 3.9 |
| Spending on Meals | 0.2 | 0.0 | 3.5 |
| Spending on Frozen Other | 0.4 | 0.0 | 6.4 |
| Observations (Household-Year) | 618,621 | | |

Note: SC/Club stands for Supercenter and Club store retail channel. Meals includes products such as pasta, rice, and soup.

Table A2: Household Demographics by Number of DS Entries in Circana Consumer Network

| | | By Number of DS Entries | | | |
|---|---|---|---|---|---|
| Variable | All Panelists | 0 | 1 | 2 | 3+ |
| Income (000s) | 66.81 (43.90) | 68.67 (44.64) | 64.89 (43.01) | 62.77 (41.99) | 59.30 (40.07) |
| Low-Income (< 35k) | 0.27 (0.45) | 0.26 (0.44) | 0.29 (0.45) | 0.30 (0.46) | 0.32 (0.46) |
| High-Income (> 100k) | 0.17 (0.38) | 0.18 (0.39) | 0.16 (0.36) | 0.14 (0.35) | 0.12 (0.32) |
| Years education | 14.64 (2.15) | 14.67 (2.14) | 14.60 (2.16) | 14.62 (2.17) | 14.63 (2.18) |
| No female head | 0.10 (0.30) | 0.09 (0.28) | 0.11 (0.31) | 0.13 (0.34) | 0.15 (0.36) |
| No male head | 0.26 (0.44) | 0.24 (0.43) | 0.28 (0.45) | 0.31 (0.46) | 0.36 (0.48) |
| With children | 0.22 (0.41) | 0.26 (0.44) | 0.17 (0.38) | 0.13 (0.34) | 0.13 (0.33) |
| Age | 56.17 (13.12) | 54.72 (13.42) | 57.98 (12.49) | 59.36 (11.96) | 60.04 (11.27) |
| Household Size | 2.38 (1.29) | 2.49 (1.33) | 2.25 (1.21) | 2.11 (1.17) | 2.08 (1.21) |
| White | 0.82 (0.39) | 0.84 (0.37) | 0.82 (0.39) | 0.75 (0.43) | 0.65 (0.48) |
| Black | 0.10 (0.30) | 0.08 (0.27) | 0.10 (0.31) | 0.17 (0.38) | 0.28 (0.45) |
| Married | 0.64 (0.48) | 0.67 (0.47) | 0.62 (0.48) | 0.56 (0.50) | 0.50 (0.50) |
| Employed | 0.56 (0.50) | 0.59 (0.49) | 0.53 (0.50) | 0.48 (0.50) | 0.45 (0.50) |
| No vehicle | 0.03 (0.18) | 0.03 (0.16) | 0.03 (0.18) | 0.06 (0.23) | 0.09 (0.29) |
| Observations | 618,621 | 381,672 | 158,875 | 51,341 | 26,733 |

Note: The unit of observation is the household-year. The table shows mean values and standard errors are shown in parenthesis. The four right-most columns show the subsample of households who experienced a given number of entries over the sample period (2010-2019). For households with two household heads, we use the mean of age, employment hours, educational attainment for male and female household heads.

Figure A1: The e ects of dollar store entry at the 0-2mi and 2-5mi bands on the number of independent grocery stores. Results are from an event study analysis on the balanced panel, using a TWFE and heterogeneity-robust estimators proposed by Borusyak et al. (2021), Sun and Abraham (2021), and Callaway and Sant'Anna (2021). For the latter paper, con dence bands show the uniform sup-t con dence intervals adjusted for multiple hypothesis testing.

## Table A3: E ects of DS Entry (0-2mi) By Store Type

| | (1) Grocery Stores | (2) Convenience Stores | (3) Combination Stores | (4) Supermarkets | (5) Supercenters | (6) Other Dollar Stores |
|---|---|---|---|---|---|---|
| First DS Entry | -0.0729 | 0.0121 | -0.0158 | -0.0421 | -0.00395 | 0.00362 |
| | (0.0138) | (0.00589) | (0.00576) | (0.00425) | (0.00431) | (0.00135) |
| Two DS Entries | -0.327 | -0.0286 | -0.00318 | -0.0723 | -0.0335 | 0.0317 |
| | (0.0267) | (0.0103) | (0.00993) | (0.00781) | (0.00767) | (0.00274) |
| Three+ DS Entries | -1.041 | -0.122 | 0.0495 | -0.135 | -0.0176 | 0.0721 |
| | (0.0511) | (0.0173) | (0.0167) | (0.0131) | (0.0137) | (0.00483) |
| Demographic Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Business Density | Yes | Yes | Yes | Yes | Yes | Yes |
| Census Tract FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Market*Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 557,635 | 557,635 | 557,635 | 557,635 | 557,635 | 557,635 |
| F-stat | 79.4 | 29312.3 | 567.7 | 75.6 | 8.23 | 94.4 |
| $R^2$ | 0.99 | 1.00 | 0.95 | 0.98 | 0.98 | 0.89 |
| Adjusted $R^2$ | 0.98 | 1.00 | 0.94 | 0.98 | 0.97 | 0.86 |
| Mean Pre-Entry | 2.71 | 6.24 | 0.70 | 1.70 | 1.61 | 0.074 |

Notes: Unit of observation is the location-year. Standard errors (in parenthesis) clustered at the location level. Controls for time-varying local demographics (income, population, residential rents, and the one-year percent change in each) and business density are included.

## Table A4: E ects of DS Entry (0-2mi): Robustness to Nearby Entry

| | (1) All Markets | (2) Markets without Nearby Entry |
|---|---|---|
| First DS Entry | -0.0729 | -0.0874 |
| | (0.0138) | (0.0208) |
| Two DS Entries | -0.327 | -0.165 |
| | (0.0267) | (0.0440) |
| Three+ DS Entries | -1.041 | -0.647 |
| | (0.0511) | (0.279) |
| Demographic Controls | Yes | Yes |
| Business Density | Yes | Yes |
| Census Tract FE | Yes | Yes |
| Market*Year FE | Yes | Yes |
| Observations | 557,635 | 60,172 |
| F-stat | 79.4 | 7.35 |
| $R^2$ | 0.99 | 0.96 |
| Adjusted $R^2$ | 0.98 | 0.93 |
| Mean Pre-Entry | 2.71 | 2.71 |

Notes: Column (2) only uses observations with no dollar stores entrants in the 2-5mi and 5-10km radii at any point during the sample period. The unit of observation is the location-year. Standard errors (in parenthesis) clustered at the location level. Controls for time-varying local demographics (income, population, residential rents, and the one-year percent change in each) and business density are included.

Figure A2: The e ects of dollar store entry at the 0-2mi and 2-5mi bands on spending on fresh produce. Results are from an event study analysis on the balanced panel, using a TWFE and heterogeneity-robust estimators proposed by Borusyak et al. (2021), Sun and Abraham (2021), and Callaway and Sant'Anna (2021). For the latter paper, con dence bands show the uniform sup-t con dence intervals adjusted for multiple hypothesis testing.

Table A5: E ect of DS Entry (by distance band) on Total Oz of Fresh Produce, and Total Fat, Sugar, Sodium Purchased

| | 0-2mi | | | | 2-5mi | | | |
|---|---|---|---|---|---|---|---|---|
| | (1) Fresh Produce (Oz) | (2) Fat (g) | (3) Sugar (g) | (4) Sodium (mg) | (5) Fresh Produce (Oz) | (6) Fat (g) | (7) Sugar (g) | (8) Sodium (mg) |
| First DS Entry | -10.40 | -37.04 | 409.9 | -3086.3 | 0.669 | -82.97 | -70.19 | -2923.6 |
| | (8.656) | (126.2) | (227.8) | (6390.3) | (7.956) | (120.4) | (197.4) | (6116.1) |
| Two DS Entries | -38.87 | 328.5 | 611.0 | 10186.6 | -14.43 | 1.263 | 96.61 | 518.9 |
| | (14.79) | (216.1) | (457.8) | (10539.3) | (10.90) | (166.7) | (290.6) | (8592.3) |
| Three+ DS Entries | -55.24 | 340.1 | -22.77 | 29150.4 | -27.94 | 57.51 | 204.6 | 5316.9 |
| | (21.45) | (331.4) | (944.9) | (16584.6) | (14.13) | (209.0) | (394.4) | (10478.1) |
| Observations | 246,851 | 246,851 | 147,512 | 246,851 | 246,851 | 246,851 | 147,512 | 246,851 |
| F-stat | 8.47 | 29.3 | 10.4 | 23.2 | 8.49 | 29.3 | 10.3 | 23.1 |
| $R^2$ | 0.75 | 0.80 | 0.87 | 0.71 | 0.75 | 0.80 | 0.87 | 0.71 |
| Adjusted $R^2$ | 0.72 | 0.77 | 0.84 | 0.68 | 0.72 | 0.77 | 0.84 | 0.68 |
| Mean Pre-Entry | 1,444 | 38,133 | 60,586 | 1,460,188 | 1,426 | 39,528 | 62,367 | 1,515,818 |

Notes: Unit of observation is the household-year. Standard errors (in parenthesis) clustered at the household level. Year and household xed e ects are included. Controls for time-varying household demographics (income, education, age, household size, marital status, occupation, weekly hours worked) are included. Results are shown for the balanced panel.

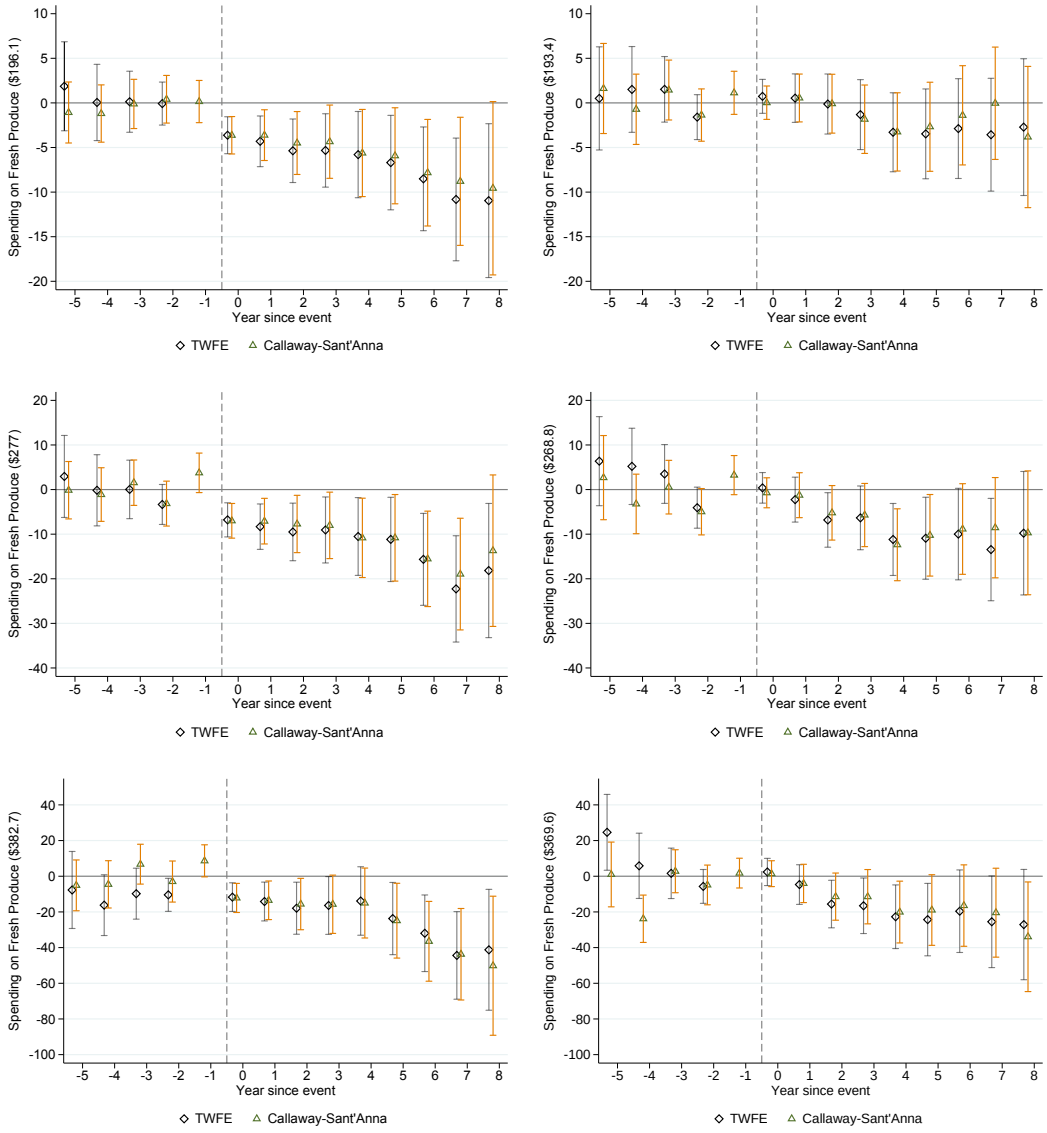


Figure A3: The effects of dollar store entry at the 0-2mi (left panels) and 2-5mi (right panels) bands around the household on fresh produce spending. Results are from an event study analysis on the balanced panel for households who reported spending for at least 10 (top panels), 20 (middle panels), and 30 (bottom panels) weeks per year. Estimates use a TWFE and a heterogeneity-robust estimator proposed by Callaway and Sant'Anna (2021). Household and year fixed effects are included. Confidence bands show the uniform sup-t confidence intervals adjusted for multiple hypothesis testing.