

# Buck Wild: The Impact of the Dollar Store on Households and Local Retail Competition\*

Camilla Schneier

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## Abstract

Dollar stores have dramatically changed the food retail landscape of the United States. This expansion has raised concern that dollar stores negatively impact consumer welfare and food choices. This paper estimates the effects of the dollar store on household shopping basket, substitution across retailers, and welfare. Leveraging the first dollar store entry into a zip code, we show that dollar store entry expands the set of goods purchased by households without significantly affecting local retail competition, thus increasing household welfare. In a model of household consumption, we estimate the value of the first dollar store entry at 2% of household's annual grocery expenditure. Demand estimates indicate little substitution between dollar stores and preexisting retailers, alleviating concerns that dollar stores cause unhealthy eating.

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\*Contact: [cschneier@uchicago.edu](mailto:cschneier@uchicago.edu), University of Chicago. I am grateful to Milena Almagro, Joe Battles, Marianne Bertrand, Eric Budish, Neil Cholli, Thomas Covert, Michael Dinerstein, Jean-Pierre Dubé, Greg Kaplan, Michael Galperin, Mikhail Golosov, Veronica Guerrieri, Matthew Notowidigdo, Fern Ramoutar, Francesco Ruggieri, Yixin Sun, Alexander Torgovitsky, Rachel Williams and participants at the Food Access at Dollar Stores (FADS) workshop, Urban Economics Association 2023 Europe Meeting, University of Chicago Economics internal seminars for helpful comments on the paper. I am grateful to Yixin Sun, who contributed to earlier versions of the draft. Researcher(s)' own analyses calculated (or derived) based in part on data from Nielsen Consumer LLC and marketing databases provided through the NielsenIQ Datasets at the Kilts Center for Marketing Data Center at The University of Chicago Booth School of Business. The conclusions drawn from the NielsenIQ data are those of the researcher(s) and do not reflect the views of NielsenIQ. NielsenIQ is not responsible for, had no role in, and was not involved in analyzing and preparing the results reported herein. This research was supported in part through the computational resources and staff contributions provided for the Mercury high performance computing cluster at The University of Chicago Booth School of Business which is supported by the Office of the Dean. This research is funded by the Becker Friedman Institute at the University of Chicago. I am grateful for support from the National Science Foundation Graduate Research Fellowship.

# 1 Introduction

The dollar store has emerged as an important food source for many Americans. With over 35,000 stores in America – more than there are Walmart, Starbucks, and McDonald’s combined, and having opened half of new retail stores in 2022, policymakers and academics have become concerned with how dollar stores have changed consumer shopping and welfare.<sup>1</sup> In the best case, the dollar store increases supply, and the increase in supply translates to more choices for consumers and higher consumer welfare. In the worst case, the supply-side response from other retailers leads to a net reduction in supply which shrinks the household choice set and decreases household welfare. In this scenario, grocery stores and other retailers are out competed and exit the market, creating food deserts.<sup>2</sup> Overall, the dollar store debate centers on the effect of dollar store entry on consumer behavior and local competition, and the implication for consumer welfare.

This paper quantifies the impact of the the first dollar store entry on consumer welfare and assesses which aspects of the dollar store bundle have the biggest effects. We find that the dollar store increases the household choice set, households do not significantly change their shopping patterns to other store formats, and that on average, grocery stores do not exit. In response to the dollar store, we find that the average household reacts by reducing the varieties and quantities consumed: the average household reduces the number of unique bar codes purchased by 6%, the quantity of dry goods consumed by 4%, and total food expenditures by 5%.<sup>3</sup> That is, the household consumption bundle shifts from a larger bundle with more variety and higher prices towards a smaller bundle with lower prices but fewer varieties. Next, we investigate which features of the dollar store drive this effect, as the dollar store bundle sells low-cost products, small package sizes, and few varieties. Our demand estimates indicate that households that the households’ welfare gain from the dollar store comes entirely from the dollar stores’ low-price goods. We quantify value of the dollar store and find that the lowest-income household values the dollar store at 2% of annual grocery expenditure.

To understand how the dollar store changes the household choice set, we establish stylized facts on the the types of goods the dollar store provides. We find that dollar stores offer much lower prices, fewer varieties, and largely dry goods. First, for the same product, dollar stores are much cheaper than all other store types: compared to grocery stores, we find that dollar stores consumers pay 23% less for the same product, even after controlling for the size of the good. Second, dollar stores have much less variety in their offerings at every level; compared to grocery stores, dollar stores have 20% fewer unique

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<sup>1</sup>For example, see [this North Carolina Public Radio](#) article on the topic.

<sup>2</sup>Critics also worry that dollar stores are [cheap](#) per good but not per unit. We show this is not the case in our data.

<sup>3</sup>Quantity is measured in ounces, a unit of weight popular in the United States.

bar codes. Third, we find that dollar stores specialize heavily in dry goods, and offer a different product assortment than grocery stores.

Surprisingly, first we show that the dollar store does not induce a price response from preexisting retailers. This may be because retailers are adding a fixed percentage on top of the unit cost of a product, the revenue loss due to dollar store entry is not sufficient to change incumbents' prices, or because retailers price uniformly and homogenously across stores.<sup>4</sup> Second, we show that grocery stores do not exit following the first dollar store entry. Third, we show that households continue taking the same number of trips to other store types, including grocery stores, after the first dollar store enters. This result corroborates the understanding that the grocery store is essential to households (as shown in [Allcott et al. \(2019\)](#)). Given these three facts, we reason that first dollar store does not preclude shopping at other store types and the first dollar store entry is not accompanied by a decline in the household choice set. To ensure we have isolated the effect of the dollar format on consumers, we rule out other potentially important channels through which the dollar store could have reduced household expenditure.

To understand how consumers and retailers react to the dollar store, we employ an event study model of the first dollar store entry into a zip code. For households, we study how the dollar store affects expenditures, prices, quantities, varieties, and shopping trips to other retailers. For retailers, we study the effect on prices and grocery store exit. We find that the first dollar store entry results in a 5% decrease in household food expenditures. These household savings are driven by substitution from the grocery store and the discount store to the dollar store, a reduction in quantity, and an overall decrease in consumption variety. We focus on the first dollar store entry because it is the most common margin – most consumers have zero or one dollar stores in their zip code – and can most cleanly capture the effect of the dollar store format on consumers. We find that the dollar store effect is persistent, lasting for at least five years after the first entry.

Mechanically, three channels can contribute to the observed drop in expenditure: (1) product choices stay the same, price decreases (2) product choices stay the same, but quantity decreases, and (3) household product choices change. We rule out the price channel; for the same consumption bundle, households do not pay lower prices than the state average. Surprisingly, we instead observe that households are re-optimizing product choices such that their consumption bundle shifts from a larger bundle with more variety and higher prices towards a smaller bundle with lower prices but fewer varieties. The results suggest that the dollar store offers new price-size-variety combinations.

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<sup>4</sup>[Arcidiacono et al. \(2019\)](#) find a null price effect in response to discount store entry, and argue that this is because retailers add a fixed percentage on top of the unit cost of a product. [DellaVigna and Gentzkow \(2019\)](#) and [Hitsch et al. \(2019\)](#) document uniform pricing and promotional behavior within retailers.

We investigate whether the results change for different populations. We show that dollar stores locate disproportionately in lower-income neighborhoods and sparse retail environments (we consider non-metro neighborhoods and food deserts). We re-run our event-study analysis for different income groups, as well as for households in sparse retail environments. We find that although lower-income groups and households in sparse retail environments tend to shop more on average at the dollar store, the patterns – reductions in average household total food expenditure and a decline in unique bar code variety – largely hold across all groups.

We quantify the effect of the dollar store on consumer welfare with a discrete-choice, random coefficients nested logit model of consumer demand. We compute value of the dollar store as the compensating variation, the compensation required for a household without a dollar store to be indifferent to a household with a dollar store. We find that the lowest-income household would have to be compensated 2% of yearly grocery expenditure to be equally well off without the dollar store.

To estimate demand and welfare, and since prices and quantities are determined in equilibrium, we introduce a novel instrument which exploits a plausibly exogenous change in the cost for the dollar store (and other retailers) to enter a neighborhood. Throughout the 2010s, several non-food brick and mortar stores (e.g., Blockbuster) went bankrupt, and these national-level bankruptcies forced these retailers to close their stores in a short time frame. These national bankruptcy-induced closures were independent of the local demand for food, however, by creating additional vacancies, these store closings lowered the fixed cost for new retailers including dollar stores and other food retailers to enter the zip code. We leverage these supply-side shocks as exogenous variation in the supply of food.

Demand estimates quantify how consumers value different aspects of the dollar store bundle. These estimates suggest consumers are willing to give up 4-5% of bundle variety for a 1% reduction in price, which corroborates that the low-price low-variety components of the dollar store bundle (documented in section Section 3) are an important channel in driving the reduction in consumer expenditure, consumer variety, and increase in welfare (documented in Section 5 and 7.1). The elasticity of demand between dollar store and a grocery store products is small, and the nest parameter ranges from .75 to .99 (for example, the average elasticity of substitution between grocery produce and dollar store snack is .006). Important to policy, these numbers imply low substitutability between relatively nutritious consumption at the grocery store and non-nutritious consumption at the dollar store (e.g., between grocery produce and dollar store snacks, carbonated beverages, and candy).<sup>5</sup> Also im-

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<sup>5</sup>One popular narrative (for example, [here](#)) is that dollar store entry floods the market with low-quality food, and that the low dollar store prices induce consumers to substitute from nutritious grocery store food (for example, produce at the grocery store) to processed and not-nutritious food at the dollar store (for example, snacks at the dollar store). That

portant to policymakers, consumers tend to prefer the more nutritious product categories, as determined by the relative value of the estimated product group fixed effects. Since dollar stores do not stock the products that provide the most utility to consumers in equilibrium, dollar stores product selection decisions must center on minimizing costs. In sum, demand estimates indicate that dollar store proliferation across the United States is driven by the dollar store’s ability to provide low cost goods.

## 1.1 Related literature

Our work contributes to three strands of literature. First, extensive work on big-box retailers has established the framework for how to study the effect of non-traditional retail formats on consumer welfare and local retail competition. The existing literature finds that big-box stores increase consumer welfare by offering substantially lower prices, while simultaneously driving down revenue at local incumbent stores.<sup>6</sup> While drawing on these tools to study dollar stores, we find that this new retail format is both different from the big box stores in its prices and products, and different from big box stores in its impact on the consumer basket and incumbent retailer competition, and consequently also on consumer welfare.

As dollar stores proliferate across the United States and reach a wider consumer base, a literature is emerging to study this new retail format. This paper is among the first to characterize the contents, location, and consumer base of dollar stores, adding to work that describes dollar store retail environments (Chenarides et al. (2021), Shannon (2021), Grigsby-Calage et al. (2024a), Grigsby-Calage et al. (2024b)), prices and provision of private-label products (Schmall et al. (2021), Cao (2024)), and effects on household food expenditure (Feng et al. (2023)). Crucial to consumer welfare, we find that the overall retail landscape remains unchanged. We conclude this by focusing on a broad class of incumbent retailers and consumer outcomes. In doing so, we add price and consumer trip aspects and expand the set of incumbent retailers studied to our understanding of how incumbents respond to dollar store entry (for work on the effect of dollar stores on grocery and convenience

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is, there is a concern that healthy products at the grocery store are close enough substitutes to unhealthy products at the dollar store that when the dollar store enters, consumers shift to a more unhealthy basket of goods. Our demand estimates indicate that products within store types are much closer substitutes than products across store types. This alleviates the concern that dollar store entry causes a decline in produce purchases at the dollar stores.

<sup>6</sup>For work on the impact of discount stores on consumer welfare, see Hausman and Leibtag (2007), Basker and Noel (2009), Ailawadi et al. (2010), Arcidiacono et al. (2019), and Atkin et al. (2018). For work on retail competition, see Hausman and Leibtag (2007), Basker and Noel (2009), Ailawadi et al. (2010), Arcidiacono et al. (2019), Atkin et al. (2018), Leung and Li (2021), Jia (2008), Ellickson and Grieco (2013), and Arcidiacono et al. (2016). Meanwhile, the effect of big-box retailers on incumbent stores’ prices is ambiguous; for example, a recent paper by Arcidiacono et al. (2019) that challenges previous findings of price competition using new event study methodology.

store entry and exit, see [Chenarides et al. \(2024\)](#), for work on the effect of dollar stores on independent grocery entry and exit, see [Caoui et al. \(2022\)](#) and [Lopez et al. \(2023\)](#)). The lack of grocery store exit is in line with prior findings from [Chenarides et al. \(2024\)](#), which finds no grocery store exit in response to grocery entry, but might appear to contrast with [Caoui et al. \(2022\)](#), which focuses on independent grocers and finds some exit. However, when expanding beyond independent grocers to all grocers, we find no grocery store exit, implying that if an independent grocer exits following the first dollar store entry, a chain grocer enters. Because we are focused on consumer welfare effects, we consider the indirect effect on consumers through changes to all other retail formats.

Two other papers also study the effect of dollar stores on consumer well-being: [Schmall et al. \(2021\)](#) conducted qualitative surveys to understand the impact of the COVID-19 pandemic on food shopping among dollar store shoppers in Fresno, CA and Boston, MA and found positive benefits of dollar stores for consumers. [Cao \(2024\)](#) builds a structural demand model and finds a large positive effects of dollar store on welfare, particularly for low-income households. However, the analysis relies on event study estimates with a single pre-period with pre-trends, finds that the main driver of welfare gains are dollar store amenities, and furthermore finds that these dollar store amenities are preferable to grocery store amenities (amenities are broadly defined as customer service, product display, interior decorations, etc...). In contrast, we find smaller but positive welfare effects, that the main driver of welfare gains are dollar stores' low prices, and that grocery stores are preferable to dollar stores for all income groups. With regard to consumer welfare, this paper offers three main contributions relative to the existing literature. First, this paper uses event study evidence to characterize the consumer response directly, and then quantifies which aspects of the dollar store matter to consumers. Second, the paper finds a small and positive effect of dollar stores on consumer welfare, driven primarily by low prices and a (lack of) indirect effect from dollar store competition with other retailers on the price, entry/exit, and consumer trip margins. Third, this paper addresses the major policy concern – whether dollar stores cause consumers to forgo healthy options – with both the structural demand and event study.

Surprisingly, the empirical findings tie this paper to a literature which highlights the sometimes unexpected effects of supply-side retailers on consumer shopping behavior. One strand of this literature seeks to understand the strong correlation between neighborhood income and availability of healthy foods. For example, [Allcott et al. \(2019\)](#) use grocery entry to study the impacts of access on nutritional inequality and identify that 90% of the difference in nutritional inequality is driven by demand side differences, while only 10% are driven by food access and prices. Ex ante, we might expect that dollar stores play a different role in nutritional inequality. For example, dollar stores are hypothesized to thrive and compete in low income areas and sparse retail environments. However, we also find dollar store entry does not change the

number of trips to the grocery store, and corroborate the result that households will travel to the grocery store regardless of other alternatives. A few other papers document how expansions of the household choice set can result in decreases in consumed product variety and a null price response (see [Illanes and Moshary \(2020\)](#) for this in the context of the liquor market or [Natan \(2020\)](#) in the context of takeout restaurants). In our context, the expanded choice set vis-a-vis dollar store entry induces consumers to reduce quantity and varieties consumed. This paper builds upon the large literature that estimates demand at grocers and similar retailers ([Bell et al. \(1998\)](#), [Smith \(2004\)](#), [Mehta \(2007\)](#), [Song and Chintagunta \(2007\)](#), [Smith and Øyvind Thomassen \(2012\)](#), [Mehta and Ma \(2012\)](#), [Thomassen et al. \(2017\)](#), [Handbury \(2021\)](#), [Leung and Li \(2021\)](#)). Methods-wise, we add a novel cost-shifting instrument to estimate demand.

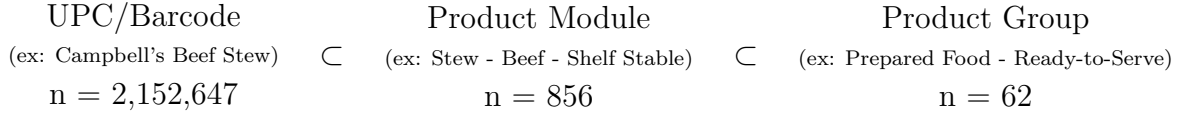
## 2 Data

We use Homescan (HMS) NielsenIQ data between 2008 and 2019 to study the effect of the dollar store on consumers. The HMS data tracks 40,000 to 60,000 US households and their retail purchases. HMS households scan UPCs of all consumer packaged goods they purchase from any store. In addition to transaction variables, HMS also reports demographic variables such as household income, household composition, household size, number of children, race, and the age, education, employment status, and hours work for male and female household heads. NielsenIQ tracks the store type (called channel type) households shop at, allowing us to identify purchases specific to dollar stores, grocery stores, discount stores, etc. For our analysis, we follow NielsenIQ’s definition of store types (dollar stores, grocery stores, club stores, convenience stores, drug stores, and discount stores).

Because many of most salient policy questions are around food tradeoffs, we study the effect of dollar stores on food purchasing behavior. [Figure 1](#) details the food terminology in the NielsenIQ HMS household transactions dataset (figure source: [Handbury \(2021\)](#)). A UPC/barcode uniquely identifies a product, such as “Campbell’s Beef Stew”, which has a different code than “Campbell’s Chicken Noodle Soup”. Products with the same UPC are identical in composition, size, and brand. One level up is what NielsenIQ calls a “product module”, which describes the type of good the UPC/barcode belongs to. Products in the same product module may have different sizes and brands but are very similar within the packaging. One more level up are product groups: product groups contain products that are not identical, but broadly similar (for example “Fresh Produce” and “Snacks” are both product groups). In this example, Campbell’s Beef Stew would belong to the product module “Stew - Beef - Shelf Stable”, which belongs to the product group “Prepared Food - Ready-to-Serve”. Policy concerns of how dollar stores induces changes in shopping behavior have focused on dollar store-induced substitution across

product groups. At the highest level of aggregation, NielsenIQ defines six food departments (dairy, deli, dry grocery, fresh produce, frozen foods, and packaged meats).<sup>7</sup>

Figure 1: NielsenIQ Definitions



For each UPC/barcode bought, we compute price (per good) as the total price paid minus the coupon value, divided by the quantity of the UPC/barcode purchased. In order to compare across similar products with different package sizes, we compute the price per unit as the price per good divided by the amount (or size) of the product. We focus on food purchases.<sup>8</sup> We define quantities as the amount or the weight in ounces of each good.<sup>9</sup> For the event study, the panel is balanced by restricting the sample to any household satisfying two criteria. First, the household is in a zip code with an eventual dollar store entry. Second, the household is observed in the same zip code in the data in the year before and after the dollar store enters.

For demand estimation, we define a market as a set of product groups in stores in a county in a year for each income rank (we follow [Allcott et al. \(2019\)](#)).<sup>10</sup> We subset to the set of households in our event study to keep the underlying data comparable and consistent throughout the paper. That is, we require a balanced panel and only include households in zip codes that will eventually receive a dollar store. We split our households into four groups by income rank and compute separate demand parameters for each income group, as income is an important dimension of heterogeneity (dollar stores disproportionately exist in low income neighborhoods), different income groups are expected to have different price elasticities, and because this is standard practice (for example, see [Allcott et al. \(2019\)](#), [Atkin et al. \(2018\)](#)). In addition, we drop observations whenever the price for that good is zero.

We use dollar store locations compiled from a [database of Supplemental Nutrition Assistance Program \(SNAP\) authorized retailers](#). This data spans 1990-

<sup>7</sup>For fresh produce, department and product group are the same.

<sup>8</sup>Furthermore, we eliminate magnet data from the sample.

<sup>9</sup>NielsenIQ provides weight data in ounces (weight), pounds (weight), fluid ounces (volume), quarts (volume), and counts (dimensionless). Because they are the most popular units, we use ounces for our quantity for dry goods and fluid ounces for liquid goods, converting measurements in pounds and quarts. We impute weight measured in counts whenever possible, and eliminate data when we cannot impute a weight. The list of imputed weights is found in Table [A.6](#).

<sup>10</sup>To estimate demand, we use a county to define a market – as opposed to a zip code, which we used in the event study analysis. In the event study analysis, we consider the effect on the households located nearest to the dollar store. However, the market for food is likely larger than a zip code, especially for grocery stores.



2019, and records the date and location of a store when it enters the SNAP database. Since the majority of locations from the major dollar store chains had become SNAP retailers by 2008, and new stores after that period are likely to automatically enroll in SNAP, we focus on the time period between 2008 and 2019. We subset our SNAP data to the five biggest dollar store chains, roughly 85% of all dollar stores.<sup>11</sup>

For grocery store counts in each zip by year we use the ZIP Code Business Patterns (ZBPs) as in [Allcott et al. \(2019\)](#).

The retail closing instrument is constructed with data from Infogroup, which provides a historical, yearly directory information for U.S. companies, including name, address, estimated sales and number of employees. Specifically, we compute the number of retailers in each zip in each year for the most popular non-food retailers that went bankrupt throughout the 2010s. In [Table A.2](#) we include a list of retailers and their bankruptcy year, and in [Figure A.12](#) we plot the number of stores in each year.

### 3 Descriptive Statistics - What is a Dollar Store?

In this section, we describe what makes a dollar store unique to other store types. Dollar stores are conceptualized by a single price point (1\$). And while dollar stores do not necessarily restrict themselves to the \$1 price, they are united by their ability to provide low-price merchandise at fixed price points. To document this and other key characteristics of the dollar store, we regress prices – both for the good and per unit – on store type using the consumer panel for different aggregations of goods:

$$\log(y_{ikst}) = StoreType_s + \alpha_{kct} + \epsilon_{ikst} \quad (1)$$

$$\log(y_{ijst}) = StoreType_s + \gamma_{jct} + \epsilon_{ijst} \quad (2)$$

where  $i$  is a purchase of a good,  $k$  is the barcode (upc),  $j$  is product module,  $s$  is the store type,  $c$  is the county, and  $t$  is month-year.  $y_{ikst}$  and  $y_{ijst}$  are our outcomes of interest. Our fixed effects specification allows us to observe differences across stores for the same product in the same location within the same month. As a result, our analysis is restricted to goods that are available across stores.

Prices across stores is the first outcome of interest, and [Table 1](#) documents that dollar stores are able to offer significant price reductions. On average, dollar stores charge 11 percent lower prices for products with identical barcodes (as compared to grocery stores), as shown in column (1). This price reduction far

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<sup>11</sup>As the SNAP dataset is not standardized, finding all true dollar stores outside of these chains would be extremely burdensome. In addition, these five chains make up roughly 85% of all dollar stores, and we are thus able to capture most of the market with these.

outpaces discount stores, which are only 3 percent cheaper on average than grocery stores. These reductions are even bigger when we compare prices for the same product module, rather than barcode. As seen in column (2), the average product price at the module level is 47% lower at dollar stores relative to other retailers.

Table 1: Price Effects of Dollar Stores

Dependent Variables: Model:	log(Price)		log(Price per Unit)
	same bar code	same product	same product
<i>Variables</i>			
Dollar Store	-0.1106 (0.0156)	-0.4655 (0.0096)	-0.2384 (0.0089)
Discount	-0.0311 (0.0017)	0.0410 (0.0024)	-0.0067 (0.0022)
Club	0.4359 (0.0197)	0.9212 (0.0095)	0.1984 (0.0060)
Convenience	-0.00006 (0.0091)	-0.1500 (0.0073)	0.0825 (0.0089)
Drug	-0.0733 (0.0032)	-0.1980 (0.0054)	-0.0655 (0.0034)
<i>Fixed-effects</i>			
county_upc_month	Yes		
county_product_month		Yes	Yes
<i>Fit statistics</i>			
Observations	479,718,710	479,718,710	479,718,710
R <sup>2</sup>	0.92327	0.54447	0.77713
Within R <sup>2</sup>	0.01631	0.11964	0.00636

*Clustered (county name) standard-errors in parentheses*

*Notes:* Table reports coefficient from regressing log price per good and price per unit of good on a store type variable. We only use sales from dollar stores, discount stores, club stores, and drug/convenience stores. Grocery stores are used as the reference group. Data is based on consumer panel microdata for years 2008-2018. Column (1) reports coefficients with county by barcode by month-year fixed effects. Column (2) and (3) report coefficients with county by product module by month-year fixed effects. Standard errors are clustered at the county level.

This price reduction is halved to 24% when the outcome is price per unit (i.e. an ounce of beef soup), as shown in column (3)<sup>12</sup>. That is, dollar stores offer smaller package sizes within the same product module, a finding confirmed by the same regression with log size of the good as the outcome. As shown

<sup>12</sup>There are no differences in size within the same barcode.

in Table A.1, dollar store goods are 24% smaller for identical product module units compared to other store types in the same county during the same month.

Beyond the sheer size of the price and size reductions, dollar stores also stand apart in how heterogeneous these effects are. Figures A.8 and A.9 show dollar stores’ price per unit and size effects for each product group. While discount stores are quite uniform in their price and size effects, dollar stores vary greatly from product to product. Notably, almost all dollar store products are on average cheaper than those same goods at grocery stores. With the exception of milk, ice cream, and gum, dollar store shoppers receive discounts on every other product, even on a per unit basis.

Next, we turn to product variety across store types. First we collapse the data down to count the number of unique barcodes in a county and run the following regression:

$$\log(N_{sct}) = \beta StoreType_s + \alpha_{ct} + \varepsilon_{sct} \quad (3)$$

where  $N_{sct}$  is the number of unique barcodes in county  $c$  at month-year  $t$  at store type  $s$ . We control for county by month-year fixed effects. We also examine number of product modules and number of product groups as the outcome variable.

Grocery stores by far have the most variety in every product aggregation level, as shown in Table 2 below. Grocery stores are the reference store type in the regression; compared to dollar stores, groceries have 20 times more barcodes, 10 times more product modules, and 5 times more product groups available. Dollar stores variety offerings are on par with that of Club stores, much less than discount stores, but far more than convenience and drug stores.

Dollar stores are not only offering less variety, but product offerings also differ. Figure 2 shows the top six product groups, as ranked by consumer expenditure share at each store. Grocery store consumers purchase large amounts of cheese, deli meats, and fresh produce, offerings typically not found at a dollar store. In fact, dollar stores look much more similar to discount stores.

Taken altogether, a picture emerges of an average dollar store, which offers a limited selection of products, a limited variety of brands within those products, likely at smaller sizes than available at other retailers, but all in all at a much lower price than anywhere else.

## 4 Empirical Analysis of the Impact of Dollar Store Entry

Our goal is to understand the effect of dollar stores on consumers and preexisting retailers. In theory, the dollar store can indirectly impact the consumer

Table 2: Variety Effects of Dollar Store

Dependent Variables: Model:	log(No. of UPCs) (1)	log(No. of Modules) (2)	log(No. of Product Groups) (3)
<i>Variables</i>			
Dollar Store	-2.871 (0.0807)	-2.341 (0.0590)	-1.643 (0.0478)
Discount	-0.6223 (0.0717)	-0.4018 (0.0483)	-0.2050 (0.0285)
Club	-2.649 (0.0702)	-1.990 (0.0564)	-1.308 (0.0452)
Convenience	-4.696 (0.0990)	-3.926 (0.0715)	-2.910 (0.0578)
Drug	-3.515 (0.0427)	-3.059 (0.0404)	-2.248 (0.0489)
<i>Fixed-effects</i>			
county_name-state_name-month_year	Yes	Yes	Yes
<i>Fit statistics</i>			
Observations	1,528,436	1,528,436	1,528,436
R <sup>2</sup>	0.83265	0.81585	0.76054
Within R <sup>2</sup>	0.77464	0.76376	0.70110

*Clustered (state\_name) standard-errors in parentheses*

*Notes:* Table reports coefficient from regressing log variety in a county-month-year on a store type variable. We only use sales from dollar stores, discount stores, club stores, and drug/convenience stores. Grocery stores are used as the reference group. Data is based on consumer panel microdata for years 2008-2018. Standard errors are clustered at the county level.

by putting competitive pressures on local rivals to change prices or exit the market.

We leverage an event study design to examine supply-side changes in response to the first dollar store entry in a zipcode. To investigate the grocery count in a zipcode, we run the following regression:

$$Y_{zt} = \sum_{k=-T_1}^{-2} \beta_k \times D_{zk} + \sum_{k=0}^{T_2} \beta_k \times D_{zk} + \gamma \mathbf{X}_{zt} + \nu_z + \phi_t + \varepsilon_{zt} \quad (4)$$

Let  $Y_{zt}$  denote grocery count in zipcode  $z$  in year  $t$ ,  $D_{zk}$  is the years before or after entry of the first dollar store in a zipcode,  $\mathbf{X}_{zt}$  are lagged zipcode level demographic controls,  $\nu_z$  are zipcode fixed effects, and  $\phi_t$  are year fixed effects.<sup>13</sup> Our parameter of interest is  $\beta_k$ , the amount by which the average zipcode experiences a change in number of grocery stores upon entry of the first dollar store into their zip code. Standard errors are robust and clustered by zip code.

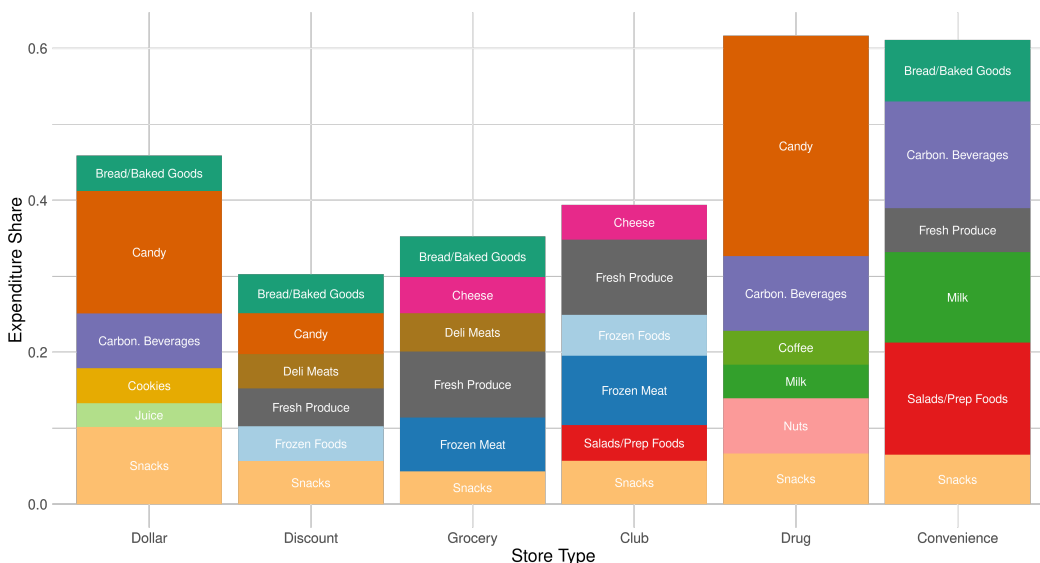
We run an analogous household-level regression at the quarterly level,  $q$ , to investigate visits to other retailers and changes in prices:

$$Y_{iqt} = \sum_{k=-T_1}^{-2} \delta_k \times D_{ik} + \sum_{k=0}^{T_2} \delta_k \times D_{ik} + \sigma_i + \tau_{qt} + \epsilon_{iqt} \quad (5)$$

Here, conditioning on  $\sigma_i$  allows us to look at variation within households, rather than variation across households, and replaces demographic controls. Standard errors are robust and clustered by zip code.

<sup>13</sup>Controls include average household income, proportion of households married, average household size, average age, proportion white, proportion black, and average working hours.

Figure 2: Expenditure Share of 6 Most Popular Products by Store Type



Notes: Figure reports consumer expenditure shares of the top 6 product groups for each store type. Data is based on consumer panel microdata for years 2008-2018.

The panel is balanced by restricting the sample to any household satisfying two criteria. First, the household is in a zip code with an eventual dollar store entry. The control group here is thus the not-yet-treated group. For estimation, we use heterogeneity-robust estimators developed by Callaway and Sant’Anna (2021). This method alleviates concerns over bad control groups, as discussed by the recent literature on staggered roll-out and two-way fixed effect (TWFE) designs (Baker et al., 2022). Second, the household is observed in the same zip code in the data in the year before and after the dollar store enters.

To ensure the cleanest identification, the event is defined as the first dollar store entry in the zip code. That is, the control group comprises the not-yet treated, which is identical for each event. Had the event been defined as higher dollar store entry (e.g. 2nd or 3rd dollar store entry), household substitution between dollar stores within the same zip would likely have contaminated the resulting dollar store effect. Although the first dollar store entry is not without contamination – household could have shopped at a dollar store outside of their zipcode in the pre-period – the first entry provides the cleanest identification possible given the data available.<sup>14</sup>

The assumptions required for the event study design are no anticipation and common trends. While dollar store entry maybe be announced a quarter or so in advance, it is likely that households would not adjust their consumption

<sup>14</sup>Policymakers who have banned dollar store entry tend to operate in areas with at least fifty dollar stores. We do not claim to speak to the normative implications of this many dollar stores in an area.

until the dollar store actually enters. Furthermore, anticipation would likely induce a change in outcomes before entry, but pre-trends are flat. Our identifying assumption is that households in different zip codes that receive dollar stores in different times but will eventually receive a dollar store would have followed the same pattern absent dollar store entry.

A common concern with the event study strategy is dollar store entry is related to other features of the local retail environment that would affect household consumption patterns. However, if dollar stores respond to changes in local demand conditions, household consumption patterns would likely change even before the dollar store enters. To test for changing patterns before dollar store entry, we estimate the treatment effect in the eight quarters leading up to the entry of a dollar store. We find a precisely estimated flat pre-trend before dollar store entry for all outcomes, and a significant trend break at the time of the entry.<sup>15</sup>

## 4.1 Results - No evidence of grocery store exit

Does the first dollar entry crowd out the grocery store? This question stems from media concern that dollar stores induce households to substitute away from healthy products at the grocery store (e.g. grocery store produce) to unhealthy food at the dollar store (e.g. dollar store snacks).<sup>16</sup> One concern is that if dollar stores do not stock highly nutritious fresh foods, then dollar stores crowd out of grocery stores could limit the number of retailers and limit access to healthy food. A second concern is that if healthy food at the grocery store and unhealthy food at the dollar store are close enough substitutes and dollar stores makes unhealthy food relatively cheaper, then a dollar store opening can induce consumers to switch from healthy groceries to unhealthy dollar store products. This concern is tested in three ways: an event study design to understand the effect of dollar store entry on grocery store exit, an event study design to understand the effect of dollar store entry on grocery shopping trips, and demand estimation to understand the elasticity of substitution between products at the dollar store and products at the grocery store.

To understand whether dollar store entry directly causes grocery store exit, we use our event study analysis from Equation 4 to look at the effect of crowd out for the first dollar store. As shown in Figure 3, there is no change in the number of grocery stores after the first dollar entry<sup>17</sup>. This pattern holds

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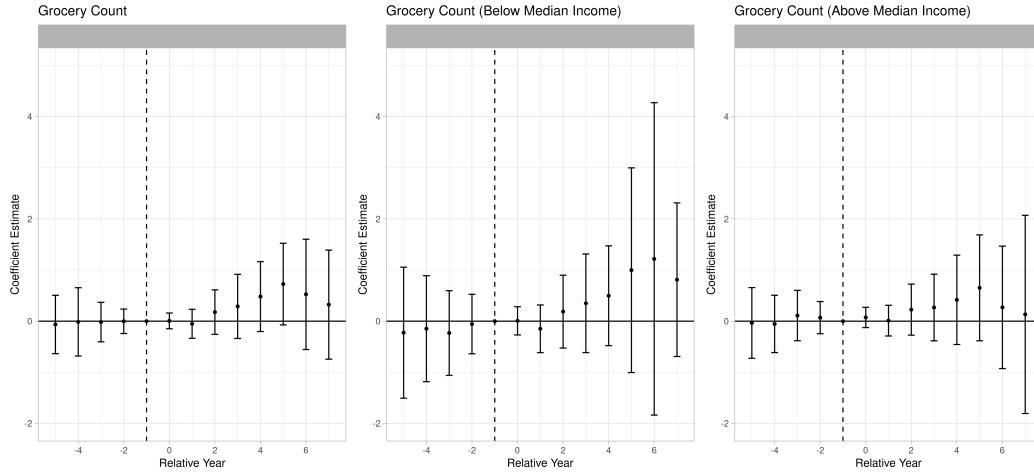
<sup>15</sup>Additionally, we show the event study results with 5-year average zipcode income (using American Community Survey data) as the dependent variable, shown in Figure A.11. We do see some general decline in average income in a zipcode around the time when dollar stores enter. However, note that our event study includes household fixed effects, which would control for this effect.

<sup>16</sup>For example, this [CBS News Article](#) details this possible concern and other common concerns regarding dollar stores.

<sup>17</sup>As robustness, we run the same event study without demographic controls in Figure

across neighborhoods with different socioeconomic characteristics, as shown by the second and third panels. Thus, on average, there is no grocery exit after the first dollar entry. While some of the prior literature has found a small but significant decline in independent grocers, in our setting we find no change in the number of grocers, indicating that independent grocers are replaced by chain grocers. This result alleviates the concern that consumers no longer have the option to shop at for produce at the grocery store following the first dollar store entry.

Figure 3: Effect of First Dollar Store Entry on Grocery Count



*Notes:* This figure reports event study estimates with 95% confidence intervals from Equation 4, using 2008-2018 SNAP and ZBP data. The analysis uses a heterogeneity-robust estimator proposed by Callaway and Sant’Anna (2021). The figure reports the grocery count as the outcome variable. Errors are clustered at the zip code level.

## 4.2 Results - No evidence of local price competition

Price competition is a potentially important aspect of the consumer and local retailer response to the dollar store. Intuitively, the price of the consumer bundle may change due to competition with preexisting retailers or because household choice set expands to include new and cheaper goods. On the supply side, prices may change as a result of increased competitive pressure from an additional store or competition with the dollar store’s lower prices (as shown in Table 1 and Figure A.8, dollar store prices are lower on almost every product group). On the demand side, exposure to cheaper goods might induce households to switch to the cheaper dollar store option (within UPC/barcodes) or might induce to switch to a cheaper variety (across UPC/barcodes).

To understand the effect of the first dollar store on price competition with preexisting retailers, we therefore construct a relative price index (RPI) for each household, following Aguiar and Hurst (2007) and Leung and Li (2021).

A.20, and there is still no grocery store exit.

Intuitively, the relative price index is the household’s expenditure relative to the household’s counterfactual expenditure wherein the household purchases the same goods but at an average state price:

$$RPI_{ist} = \frac{\sum_{j \in J_{it}} p_{jist} q_{jist}}{\sum_{j \in J_{it}} \bar{p}_{jst} q_{jist}} \quad (6)$$

$p_{jit}$  and  $q_{jit}$  are the price and quantity for product module  $j$  for household  $i$  at quarter-year  $t$  in state  $s$ . The numerator in this expression is thus the total expenditures for household  $i$  in quarter-year  $t$ . The denominator in this expression is the total expenditure if prices paid are replaced by the state average price in that product. We chose the state average price because a dollar store is quite small, and using the state average price ensures that the reference price we use is not reacting to the entry event. We will refer to the denominator as the “counterfactual expenditure”, which is constructed by calculating a reference price,  $\bar{p}_{jt}$  for each region  $s$  the household is located in.

$$\bar{p}_{jst} = \sum_{i \in I, d \in t} p_{jist} \left( \frac{q_{jist}}{\bar{q}_{jst}} \right) \quad (7)$$

where  $\bar{q}_{jst} = \sum_{i \in I, d \in t} q_{jist}$  is used for weighting the price by the quantity purchased of the product.

The RPI essentially compares a household’s true expenditure to a “fixed” counterfactual expenditure. A decrease in RPI after a dollar store enters would imply that entry induces a lower priced bundle for households, as compared to the same bundle of goods in other parts of the state. This could be either due to dollar stores offering cheaper prices, and/or a competitive response from other stores as a result of dollar store entry.

In Figure 4, we find a surprising and precise null result of dollar store entry on the RPI. That is, following dollar store entry, households pay the same amount for a representative good as households in the same state, and the confidence interval range between  $\pm .02$  percentage points. This result is surprising since even for the exact same product dollar store products are cheaper, and since consumers reduce expenditures following dollar store entry. Given these two results, one would expect that the dollar store would cause consumers to cut low expenditures due to their low relative prices.

This is not the case: the null relative price index implies that incumbent retailers are not changing prices on existing goods and consumers are not getting a price cut on existing purchases by switching to the dollar store. We discuss the demand-side further in Section 5.1.

Incumbent retailers are not changing prices on existing goods in response to the first dollar store entry. This lack of price reaction is consistent with [Arcidiano et al. \(2019\)](#), who also finds a null incumbent response from Supercenter

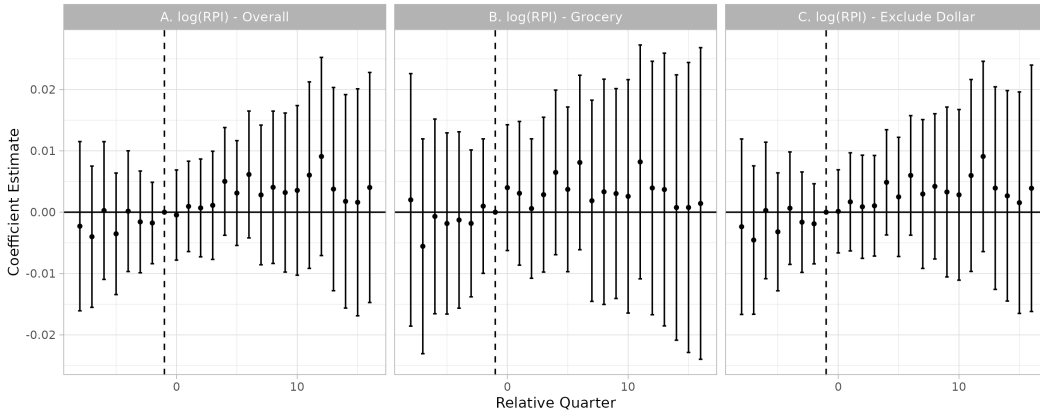


entry. [Arcidiacono et al. \(2019\)](#) argue that the explanation for this is stores routinely employs cost-plus pricing, or markup pricing, where a fixed percentage is added on top of the unit cost of a product. The lack of price reaction is also consistent with uniform pricing from chain retailers which price nationally ([DellaVigna and Gentzkow \(2019\)](#) and [Hitsch et al. \(2019\)](#)).

We further test whether there is a competitive price response by restricting the sample of expenditures a household makes to only grocery purchases (Figure 4 Panel B) and non-dollar store purchases (Figure 4 Panel C). Both these sets of analyses show a null RPI response. The null result in grocery prices shows us that on average, the household pays the same prices relative to the state price purchases at the grocery store before and after dollar store entry. Generalizing this to all non-dollar stores, the relative prices paid by consumers do not change, on average, after entry.

Combining the lack of price movement with the lack of grocery store exit and lack of trade-off in shopping trips between store types, we conclude that in response to the first dollar store, the supply-side of the retail market remains relatively fixed, except for the added choices the dollar store provides.

Figure 4: Effect of First Dollar Store Entry on Prices - State Average Reference Price



*Notes:* Figure reports event study estimates with 95% confidence intervals from Equation 5, using 2008-2019 Homescan data. The analysis uses a heterogeneity-robust estimator proposed by [Callaway and Sant'Anna \(2021\)](#). The dependent variable, the Relative Price Index (RPI), is shown in Panel A and is defined in Equation 6. Panel B and C repeat the analysis, with data restricted to purchases at the grocery store and non-dollar store, respectively. Observations are not weighted for national representativeness. Errors are clustered at the zipcode level.

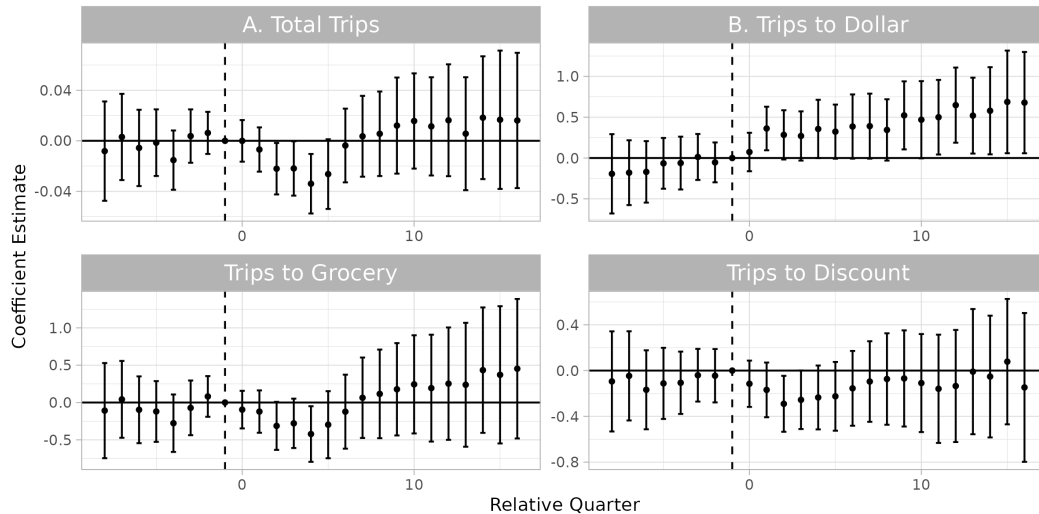
### 4.3 Results - No change in trips to other store types

We might expect that dollar store entry could change household choice sets, or induce reactions by incumbent retailers, if households replaced some trips to other store formats with dollar store trips. To test this, we estimate the effect of dollar store entry on the number of trips to each store type using the specification in Equation 5. Here, the analysis focuses on the effect of entry

on grocery stores and discount stores for two reasons. First, from the policy perspective, substituting away from stores that consistently carry healthy food options (i.e. grocery and discount stores) is a major policy concern. Second, as we will see in Section 5, dollar store entry accompanies a drop in expenditures at grocery and discount stores, but not other store types.

As shown in Figure 5, on average, households take more trips to the dollar store without significantly changing the number of trips to grocery stores and discount stores. Specifically, dollar store trips increase by 5 percentage points each quarter on average, and the effect is significant and persists at least four years after the first dollar store entry. Meanwhile, other trips (overall, to the grocery store, to the discount store), decrease slightly in the third and fourth quarter following dollar store entry but revert back afterwards. The total number of trips do not change after dollar store entry, and the effect is a precise null (the bounds on our estimates are between  $\pm .04$  percentage points each quarter). As a result, trips to other store types decrease, but this decrease is distributed over several store types in such a way that the number of trips to each store types does not change significantly. That is, the lack of significant change in number of trips to other store types provides evidence that on average, households have the opportunity to purchase the same products after the first dollar store entry. Along with a lack of grocery exit, the lack of trade-off in shopping trips between stores types implies that the household choice set is (weakly) increasing following the first dollar store entry.

Figure 5: Effect of First Dollar Store Entry on Households' Log Number of Trips



Notes: Figure reports event study estimates with 95% confidence intervals from Equation 5, using 2008-2019 Homescan data. The analysis uses a heterogeneity-robust estimator proposed by Callaway and Sant'Anna (2021). Observations are not weighted for national representativeness. Errors are clustered at the zipcode level.

In this section, we established the effect of the first dollar store on the local retail market and incumbent stores. A main policy concern is that dollar store

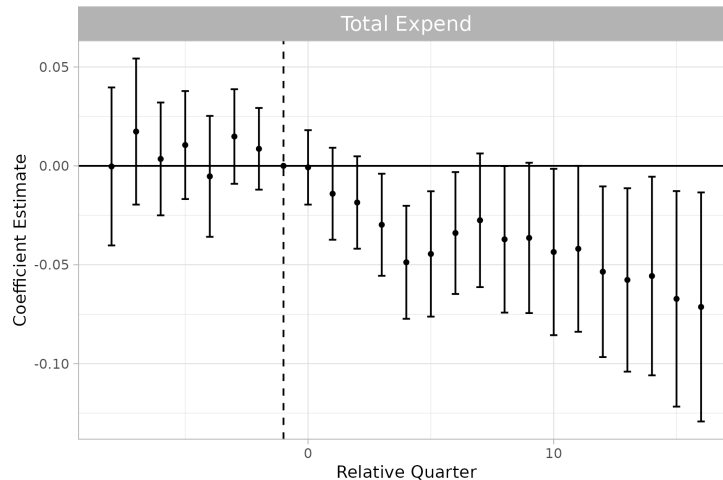
entry could lead to supply-side changes with ambiguous welfare impacts. We presented three pieces of evidence that the consumer choice set remains the same after the entry of the first dollar set: (1) grocery count remains the same, (2) households still visit other retailers at the same rate, and (3) no evidence of change in prices.

## 5 Effect of Dollar Store Entry on Household Consumption

We examine how the dollar store affects household consumption. Since the first dollar store does not induce a significant supply-side response, the first dollar store entry captures the direct effect of the dollar store format on consumers.

First, we document that the dollar store leads to a decrease in total food expenditures. As shown in Figure 6, total food expenditures are flat in the lead-up to the dollar store entry event, start falling as soon as the entry occurs, and stabilize at a negative and significant 5 percentage points. This drop continues even after 16 quarters, demonstrating a persistent effect.

Figure 6: Effect of First Dollar Store Entry on Households' Total Log Food Expenditure

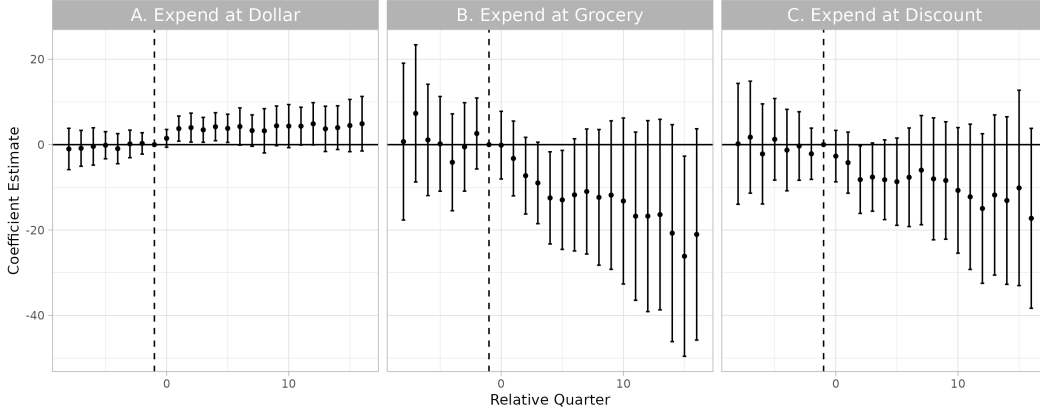


*Notes:* Figure reports event study estimates with 95% confidence intervals from Equation 5, using 2008-2019 Homescan data. The analysis uses a heterogeneity-robust estimator proposed by Callaway and Sant'Anna (2021). The figure reports log of total expenditures of food. Observations are not weighted for national representativeness. Errors are clustered at the zip code level.

This overall decline stems from substitution from grocery stores and discount stores to dollar stores, as seen in Figure 7. The decline in total expenditures is driven by decreased expenditures at grocery and discount stores, which outweighs the increased expenditures at dollar stores. Figure A.13 shows the expenditure response from all six store types of interest. Superstore/Club,

convenience, and drugstores do not exhibit a response from entry, and we thus focus our discussion on grocery and discount stores.

Figure 7: Effect of First Dollar Store Entry on Households' Expenditure at Various Store Types



Notes: Figure reports event study estimates with 95% confidence intervals from Equation 5, using 2008-2019 Homescan data. The analysis uses a heterogeneity-robust estimator proposed by Callaway and Sant'Anna (2021). Observations are not weighted for national representativeness. Errors are clustered at the zipcode level.

We turn our focus to understanding the features of the dollar store format that could explain this drop in expenditure. For household  $i$ , total expenditure at any given time is:

$$E^i = \sum_{j \in J} p_{ij} q_{ij}$$

Mechanically, three distinct components could change such that total expenditures would drop after a dollar store entry: (1) net drop in price of good  $j$ , (2) net drop in quantity of good  $j$ , and (3) change in product choices. In the following sections we explore if each of these three mechanisms contribute to the drop in expenditures. In section 6 we provide a theoretical framework to quantify how these changes translate into welfare. Previewing our results, we find no evidence that the households are buying the same consumption bundle at lower prices. Instead, the expenditure drop is driven by quantity changes: consumers are buying fewer amounts and shifting towards lower priced varieties.

## 5.1 Results - Relative price of the consumer bundle is unchanged

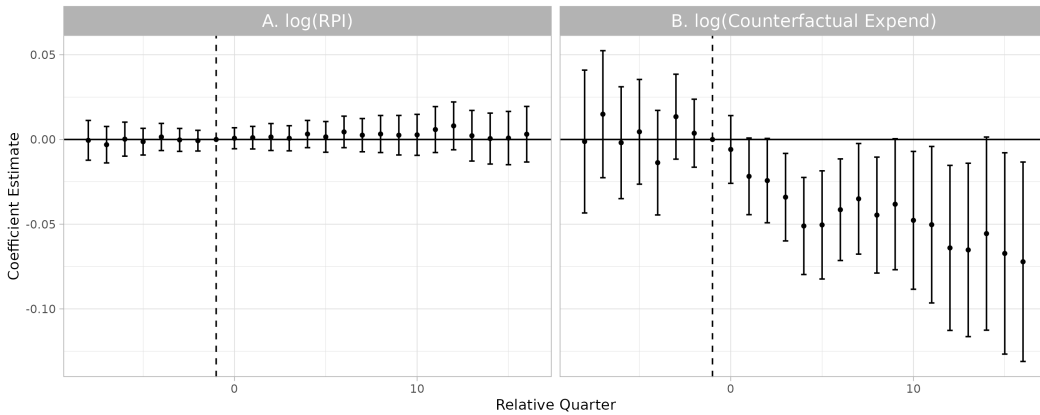
The null relative price index shown in Figure 4 implies that incumbent retailers are not changing prices on existing goods and consumers are not getting a price cut on existing purchases by switching to the dollar store.

If households were purchasing the same goods in the post period as in the pre period, and dollar stores were offering cheaper prices, we should observe

a drop in the relative price index post-entry. We repeat relative price index exercise, but with the reference price set at the county level so that we are comparing household expenditure to prices offered for the same good, but at the county average price. The precise null result we see in Figure 8 provides evidence that this is not the case.

That is, consumers are not enjoying the price cut from switching from a higher-priced good at an incumbent retailer to the exact same but lower-priced good at the dollar store (Table 1 shows that dollar store prices are 10% cheaper than grocery prices for the exact same product).<sup>18</sup> One possible explanation is that consumers are leaving money on the table by not switching to the dollar store for these cheaper products.

Figure 8: Dollar Store Entry on Prices - County Average Reference Price



*Notes:* Figure reports event study estimates with 95% confidence intervals from Equation 5, using 2008-2019 Homescan data. The analysis uses a heterogeneity-robust estimator proposed by Callaway and Sant’Anna (2021). The dependent variable, the Relative Price Index (RPI), on the left side panel is defined in Equation 6. The dependent variable on the right side panel is the counterfactual expenditure, where the reference price is defined in Equation 7. Observations are not weighted for national representativeness. Errors are clustered at the zipcode level.

Instead, consumers use the dollar store to purchase new and/or cheaper and/or fewer varieties. We show this directly by computing the counterfactual expenditure (at the county level), which is the denominator from RPI Equation 6. The counterfactual expenditure is computed as the the household expenditure where prices of each good are replaced by state average prices. As shown in Figure 8, the counterfactual expenditure declines post-entry. In fact, this decline in the counterfactual expenditure mirrors the decline in total food expenditure shown in Figure 6.<sup>19</sup> Assuming that the reference price is unaffected by dollar store entry (said otherwise, assuming that dollar store entry does not affect average food prices at the county or state level), decreases in counterfactual expenditure suggest that decreases in expenditures are driven by quantity changes, variety changes, or both.

<sup>18</sup>Note that a major difference between this result and the significant price differences we observed in Table 1 is that the price difference regressions focused solely on products sold across stores, while the RPI analysis pools all goods purchased both before and after dollar store entry.

<sup>19</sup>The figure is almost the same when the reference price is at the state level.

## 5.2 Results - Households reduce quantities

Next, we analyze whether the first dollar store causes households to purchase less quantity on net. Quantities could decrease if prior to the dollar store entry, the household lacked smaller-sized options and thus purchased more than the optimal amount of goods. In this case, the dollar stores’ small-sized products would allow the household to re-optimize and thus reduce the quantity purchased. To measure quantity in observable units, we compare ounces consumed for different product groups before and after the first dollar store entry.<sup>20</sup> To give a complete picture of food shopping behavior, we measure quantity at the department level, the highest level of aggregation for NielsenIQ.

Figure 9 shows the effect of dollar store entry on households’ quantity purchased using the same event study analysis from Equation 5. No departments show increases in quantities following the entry of the first dollar store. Three departments – fresh produce, deli, and packaged meats – show no change in quantity, although the error bars are large ( $\pm 10$  percentage points) and so the result is noisy. The remaining three departments – dairy, dry grocery, and frozen food – show a 4% reduction in the average quantity consumed. While the drop in quantity is temporary for dairy and frozen foods, the reduction is persistent for dry groceries.

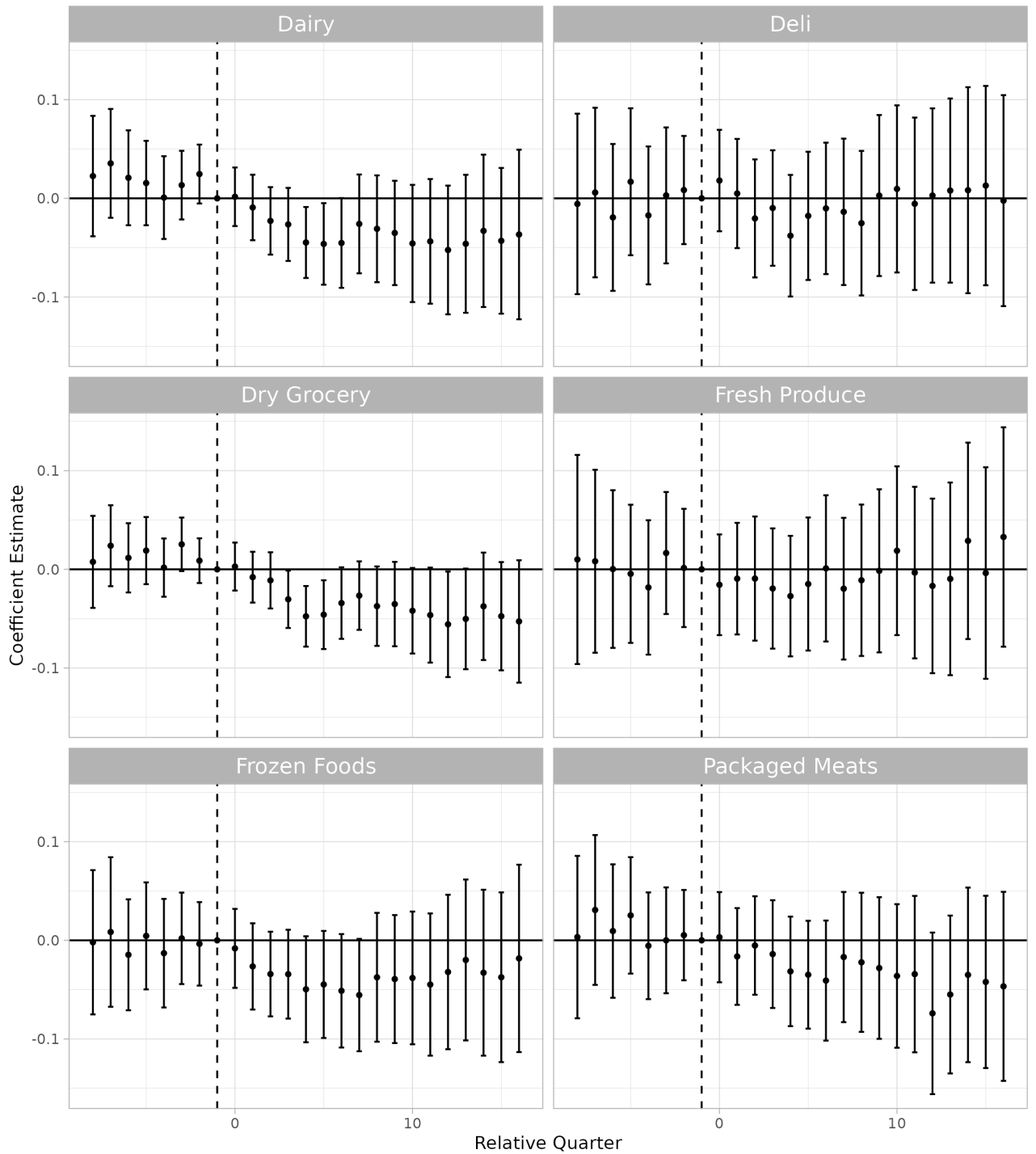
Households most reduce quantities for dry goods, frozen foods, and dairy (as shown in Figure 9), the three most popular departments at the dollar store by expenditure share (as shown in Figure A.6). Interestingly, while households decrease their overall expenditure in dry goods (by about 10 dollars per quarter), the household expenditure share shifts towards dry goods, as shown in Figure A.15. These results are all consistent with the hypothesis that before the dollar store, households were not optimizing on the size of the goods they were purchasing. The dollar stores’ small-sized products allow household to reoptimize and thus reduce the quantity they purchase.

Important for policymakers is the result that households do not significantly change the quantity of fresh produce, speaking to concerns that the dollar store format causes unhealthy eating by inducing a substitution from broadly healthier categories (like fresh produce) to broadly less healthy categories. To investigate further, we also show results of the quantity analysis featuring the ten most popular product groups for dollar, grocery, and discount stores (the most popular categories are shown in Figure 2). Figure A.19 show null changes in quantity for all the selected product groups. These results hold both for more processed items that the dollar store specializes in (shown in purple), as well as for less processed items that are not commonly found at the dollar store

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<sup>20</sup>The majority of product sizes in the HMS dataset are measured in ounces. The liquid measurements are in “fluid ounces” and the weight measurements are in “ounces”. We convert quarts and pounds into fluid ounces and ounces. When possible, we convert “counts” into ounces using an average measure – for example, one egg weighs 1.7 ounces. Data measured in counts that cannot be converted into a weight is excluded from the measurement.

Figure 9: Effect of First Dollar Store Entry on Log Ounces of Each Department



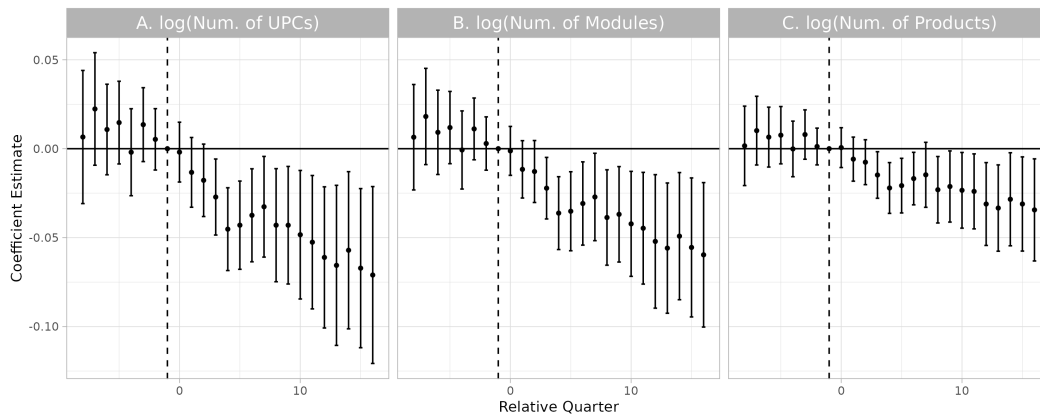
Notes: Figure reports event study estimates with 95% confidence intervals from Equation 5, using 2008-2019 Homescan data. The analysis uses a heterogeneity-robust estimator proposed by Callaway and Sant'Anna (2021). Observations are not weighted for national representativeness. Errors are clustered at the zipcode level.

(shown in green). These nulls suggests that if the first dollar store impacts consumer health, then the effect due to substitution towards away these broad product categories is small.<sup>21</sup>

### 5.3 Results - Households reduce varieties

Finally, we report the effect of the first dollar store on household variety in Figure 10. We investigate three different measures of aggregation: number of distinct UPCs purchased in one quarter, number of distinct modules purchased in one quarter, and number of distinct product groups purchased in one quarter. For all three levels of aggregations, pre-trends are flat in the lead up to dollar store entry, variety declines following dollar store entry, and the effect is persistent. From most disaggregated to most aggregated, UPC/barcode variety captures depth of variety, whereas the number of products groups captures breath of variety. We find persistent and significant declines of unique varieties at all levels of aggregations: UPC/barcodes decline by 6%, product modules decline by 5%, and product groups decline by 1%.<sup>22</sup> That is, we observe that the dollar store shifts consumption towards lower-priced goods, at the expense of variety. We also observe that dollar stores are the store type with the least variety. We quantify how households value price, variety and other product characteristics in the demand estimation.

Figure 10: Effect of First Dollar Store Entry on Consumption Variety



*Notes:* Figure reports event study estimates with 95% confidence intervals from Equation 5, using 2008-2019 Homescan data. The analysis uses a heterogeneity-robust estimator proposed by Callaway and Sant’Anna (2021). The dependent variables here are different definitions for consumption bundle variety for the household at the quarter-year level. Observations are not weighted for national representativeness. Errors are clustered at the zipcode level.

<sup>21</sup>Our “health” result is only a very crude approximation for health. Allcott et al. (2019) uses a Healthy Eating Index (HEI), a multi-dimensional measures that calculates the overall nutritional intake of each food. Further analyses on the nutritional content lies outside the scope of this study. In addition, we do not investigate within product-group changes in health.

<sup>22</sup>For context, the average household in the reference period ( $k = 1$ ) consumes 111 distinct UPCs, 64 distinct product modules, and 33 distinct product groups.



## 6 Theoretical framework

Alone, the empirical results cannot quantify the effect of dollar store entry on consumer welfare or explain which aspects of the dollar store bundle have the largest effects. To quantify these effects, we estimate a model of consumer demand. We then use the model to better understand the policy concerns.

We model demand using a discrete-choice, random coefficient nested logit model<sup>23</sup>. In this model, a household first chooses a store type to shop at – grocery, dollar, club, convenience, discount, or drug – and then chooses which product group to buy within store type: product groups correspond to different broad food categories, such as fresh produce and snacks. Preferences for a product group at a store type depend on price, variety, and product sizes. This specification allows us to quantify which aspect of the dollar stores are more or less valuable to consumers, as the household trades-off more expensive products, larger sizes, and more variety with cheaper products, smaller sizes, and less variety. Household indirect utility is written as

$$\begin{aligned}
 u_{ijst}^m = & \alpha_0^m - \underbrace{\alpha_i^m \log p_{jst}^m}_{\text{price}} + \underbrace{\beta_i^m \log v_{jst}^m}_{\text{variety}} + \beta_2^m (\log v_{jst}^m)^2 + \underbrace{\gamma_i \log size_{jst}^m}_{\text{product size}} \\
 & + \gamma_2 (\log size_{jst}^m)^2 + \underbrace{\psi_j^m}_{\text{product group}} + \xi_{jst}^m + (1 - \underbrace{\lambda^m}_{\text{nest}}) \epsilon_{ijst}^m
 \end{aligned} \tag{8}$$

where each household  $i$  of income group  $m$  in market  $t$  has utility  $u_{ijst}^m$  over product group  $j$  at retailer  $s$ . Household utility depends on the retailer’s price  $p_{jst}^m$ , variety,  $v_{jst}^m$ , and size,  $size_{jst}^m$ . Additionally, utility varies with a market specific demand shock,  $\xi_{jst}^m$ , and idiosyncratic shock  $\epsilon_{ijst}^m$ . The nest parameter,  $\lambda^m$ , indicates the degree of substitution between products within store type nest for income group  $m$ , where as  $\lambda^m \rightarrow 0$ , the nest structure reduces to a logit, and as  $\lambda^m \rightarrow 1$ , all substitution occurs within store type. To allow for more flexible substitution pattern within nest, prices, variety, and size coefficients all include a random coefficient term which is normally

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<sup>23</sup>Our model follows the existing literature but tailored to the empirical results in this paper. [Allcott et al. \(2019\)](#) model grocery demand as a choice of product groups using Cobb Douglas utility and measure consumption in calories. [Handbury \(2021\)](#) model product group choice using a combination of Cobb Douglas and log-logit preferences. [Atkin et al. \(2018\)](#) model households as first choosing a product group and then choosing a store within product group, with Cobb Douglas preferences over product groups and CES preferences over stores within product groups. Also, [Atkin et al. \(2018\)](#) use a Stone price index to aggregate from bar code to store product group. We follow [Atkin et al. \(2018\)](#) to aggregate from bar codes to product groups within stores, but use a nested logit model (instead of CES preferences) which allows for a reduction in total food expenditure following dollar store entry. The model can be represented either as a household choosing one product group within a store, or as a representative household that purchases shares of each product group, for details see [Verboven \(1996\)](#).

distributed and centered around the average value in the population:  $\alpha_i^m \sim N(\alpha^m, \sigma_{\alpha m}^2)$ ,  $\beta_i^m \sim N(\beta, \sigma_{\beta m}^2)$ ,  $\gamma_i \sim N(\gamma^m, \sigma_{\gamma m}^2)$ .

The discrete-choice specification is chosen to accommodate the reductions in household expenditure without taking a stand on what the household does with the saved money. Within the scope of the model, a household can switch from a higher priced good with more varieties to a lower priced good with fewer varieties.

We focus on the level of good aggregation of interest to policymakers. When policymakers hypothesize that “less healthy” products at the dollar stores crowd out other “more healthy” products at the grocery store, they are referring to product groups such as fresh produce and snacks. As a result, the analysis is aggregated to the level of the policy concern, but is not so aggregated as to completely do away with variation in products.<sup>24</sup> So the inside goods comprise the top product groups by expenditure share, which are listed in Table A.4. The outside good comprises all the other less popular product groups, which are listed in Table A.5. Shares are then conditional on a food purchase, and shares of good  $j$  relative to the outside good compares the quantity of a particular product group relative to all the other quantity purchased from the least popular, smaller product groups.

This aforementioned policy concern – dollar store crowding out grocery products – can happen through two channels: (1) grocery store closure, which we rule out in the empirical analysis and (2) close substitutability between different product groups across store types. This policy concern maybe highly relevant if estimates show close substitutability between different product groups across store types and if within-nest substitutability is fairly similar to cross-nest substitutability. In this case, the one solution might be to limit dollar store entry or to encourage dollar stores to shift their composition to mimic a smaller grocery store.<sup>25</sup> If however, the elasticity of substitution between product groups across store types is small, if dollar store market shares are small, and if the nest parameter indicates that substitution patterns are largely within-nest, then the policy recommendation is not to focus on the dollar store, but to instead focus on the composition of products within the store types that have the largest market share.

## 6.1 Aggregation from bar code to product group and store

To aggregate from individual household bar code purchases to a price index for each retailer-product-group, we assume that households’ preferences follow

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<sup>24</sup>For example, higher levels of aggregation group vegetable categories with other dry and frozen goods as opposed to with fresh produce.

<sup>25</sup>Such policies have been suggested, for example, see [here](#) and [here](#).

a Stone price index, as in [Atkin et al. \(2018\)](#). This specification assumes that the household consumes all varieties within the product group, and pays an expenditure-weighted sum of log prices for these varieties that comprise the single product group:

$$\log p_{jst} = \sum_{b \in j} \phi_{bjs} \log \tilde{p}_{bjst} \quad (9)$$

where  $p_{jst}$  is the price of product  $j$  at store  $s$  in market  $t$ , which is comprised of bar codes  $b$ ,  $\phi_b$  is the household’s expenditure on bar code  $b$  divided by the household’s total expenditures on product  $j$  (product group  $g$  at store  $s$ ) within a year, and  $\tilde{p}_b$  is the price paid for bar code  $b$ . To recover  $\log p_{jst}$  in a way that allows different store products to have different qualities, we regress expenditure weighted log bar code prices on store fixed effects and bar code fixed effects, and use the store fixed effects as the store price. We run a regression for each product-group market, so each price is the relative price in the product-group market, and is measured in log dollars.

Then, following this product definition, we compute variety  $v_{jts}$  as the average number of unique bar codes for product group  $g$  at store type  $s$  in market  $t$  and size  $size_{jst}$  as the average size of the bar codes within a product group within a store. Since dollar stores offer small sizes and fewer varieties, we include second order terms to account for decreasing marginal returns and to test whether dollar stores are valued on this margin.

Market shares are computed by summing ounces (weights) of products consumed in each store-product-group. Intuitively, a market that consumes more snacks will have purchased a higher weight (in ounces) of snacks compared to a market that consumes fewer snacks. When the data is provided in a non-ounce unit (for example: pounds), the unit is converted to ounces; when the data is provided in counts (for example, a dozen eggs), the unit is converted to ounces whenever possible using the imputed weights in [Table A.6](#).

## 6.2 Identification

Intuitively, variation in shares and prices across market will allow us to identify demand parameters. For example, comparing shares across markets with higher/lower prices allows us to identify the price coefficient and comparing markets with different amounts of variety and average package sizes across different retailers identifies the effect of product variety and package size size. To identify variance terms for price, variety, and size, we use interaction terms between product characteristics. However, quantity shares and prices are determined simultaneously in equilibrium, and, in particular, demand shocks are likely correlated both with prices and shares. To overcome this endogeneity, we employ several instruments: the average price of the same good in other

markets for the same retailer (following [Hausman et al. \(1994\)](#)) and a “retail closing instrument”.

The average retailer price instrument exploits the idea that local demand shocks are likely uncorrelated with prices in different markets. Intuitively, local pricing decisions can depend on both supply and demand factors, and the average retailer price instrument assumes that the average price in different markets captures the supply component without capturing the idiosyncratic demand in a market. The main threat to identification is that demand shocks may be correlated across several cities. However, since many retailers set prices at the national level ([DellaVigna and Gentzkow \(2019\)](#)), it is even more likely that prices do not reflect such local demand shocks<sup>26</sup>. Thus, we use average retailer price instrument to isolate changes in prices due to changes in cost, and not demand shifters, which in turns allows us to identify our demand parameters. We define the average retailer price instrument as the price from the save retailer averaged over all other counties.

### 6.2.1 Retail Closing Instrument

We introduce a “retail closing instrument” which exploits a plausibly exogenous shock that lowers the cost for a retailer to enter a zip code.<sup>27</sup> Throughout the 2000s and 2010s, technology shocks and other market forces caused a wave of bankruptcies that shut down several major brick and mortar retail chains.<sup>28</sup> These store closures created opportunities for other retailers such as dollar stores to enter. Then, stores such as a dollar stores would have easier access to now-vacant locations, both because the space was now available and because additional vacancies lower market rents, lowering the fixed costs of entry. In turn, the retailer bankruptcy can shift the shares and possibly prices in the market through the availability of stores and competition of new and existing stores. Therefore, we define the retail closing instrument as a binary variable equal to one if the county had a store that went through bankruptcy in the year(s) prior, and zero otherwise. The identifying assumption here is that non-food retail bankruptcies (such as the Blockbuster bankruptcy) only affects local food markets by creating a vacant storefront where another potentially food-providing store can locate.

In order to ensure that the timing of these bankruptcies is unrelated to the local demand for food, we focus on closures that occurred abruptly and bankruptcy that occurred at the national level. We thus leverage bankruptcies of na-

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<sup>26</sup>Even when retailers price uniformly, prices will still vary across markets in our setting as we measure relative prices across retailers in the same market, and different markets are composed of different retailers.

<sup>27</sup>We thank Fern Ramoutar for conceptualizing the use of retail bankruptcies as an instrument.

<sup>28</sup>For anecdotal evidence of what is driving the “retail apocalypse”, see the [New York Times](#), [Washington Post](#), and [Wall Street Journal](#).

tional retail chains that occurred during our study sample, which are listed in Table A.2. These bankruptcies occurred at different points in time, as illustrated in Figure A.12, and local markets had heterogeneous exposure to each bankruptcy.

To test for weak instruments, we regress the endogenous variables, prices and log shares of the nest on the instruments. The F-statistic for prices is 11,340 and for the log group share is 595 and is reported with the first stage in Table A.7.

### 6.2.2 Bankrupt Retailer Closings and Dollar Store Entry

We illustrate the variation we are exploiting with an exercise focused exclusively on dollar store entry. We show that the dollar store entry in a zip code is correlated with retailer bankruptcy in the same zip code only when the size of the bankrupt retailer suited the dollar store. First, we present anecdotal evidence which shows that dollar stores target stores of particular sizes (8,000-10,000 square feet):

“If you want to be profitable, start with an 8,000-square-foot store.”  
 – Wally Lee, director of marketing and technology of supplier of dollar stores.<sup>29</sup>

“Our stores predominantly range from 8,000 - 10,000 selling square feet” – Dollar Tree Annual Report, 2020

“We lease the vast majority of our stores ... this leasing strategy [allows us] to pursue various expansion opportunities resulting from changing market conditions” – Dollar Tree Annual Report, 2020

Then, we regress the first dollar store entry on a modified versions of the retail closing instrument described above. We estimate the probability a dollar store opens in a zip code on whether or not there was a store that experienced a national bankruptcy in the year(s) prior:

$$D_{it} = \Phi\left(\alpha + \sum_k \beta_k Z_{ik} + \lambda_t + \epsilon_{it}\right) \quad (10)$$

In this regression,  $D_{it}$  is an indicator variable for whether the first dollar store has entered zip code  $i$  by year  $t$ ,  $\Phi$  is the normal CDF, and  $Z_{ik}$  indicates the presence of a bankrupt retailer in the zip code  $i$   $k$  years before that the first

<sup>29</sup>Excerpt from New York Times article “The Dollar-Store Economy”

dollar store entry to the zip code. In practice, it can take several years after bankruptcy to shut down stores, and, it can take several years to open a new store in a vacant location. We thus include further lags of the bankruptcy instrument. We report two results: the first using only retailer bankruptcies that had average store footprints between 8,000 and 10,000 square feet and a second placebo check using only national retailers that had average store footprints smaller than 8,000 square feet.

We report results in Table A.8, which show that retail closings are positively correlated with dollar store entry when the size is appropriate and uncorrelated when the size of the store that went bankrupt is too small.

### 6.3 Supply

The model focuses entirely on demand and on the direct effects of the first dollar store entry. Had we observed a significant change in shopping trips, store count, or bundle price, we would have modeled the supply to decompose the change in welfare into the direct effect from the dollar store and the indirect effect from competing retailer response (for an example of this, see [Atkin et al. \(2018\)](#)).

## 7 Estimates

Demand parameters are estimated with general method of moments following [Berry et al. \(1995\)](#) and standard practices in [Conlon and Gortmaker \(2020\)](#). We report demand estimates from the random coefficients nested logit in Table 3, and the nested logit without random coefficients in Table A.9. First, all consumers dislike high prices, prefer variety, and larger package size, but there are diminishing returns for additional larger sizes and additional variety. The average household would be willing to pay .2-.5% for a 1% increase in variety, or would give up 4-5% of variety when the bundle price is 1% lower.<sup>30</sup> This willingness to pay is consistent with the event study results showing that households reduce variety by 1% to reduce expenditures by 5%. Second, intuitively, lower-income households are more price sensitive than higher-income households. Price coefficients range from -1.9 for the lowest-income, most price-sensitive group to -.6 for the highest-income, least price-sensitive group, estimates which are largely comparable with the existing literature. In line with

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<sup>30</sup>The first, second, third, and fourth quartile by income would be willing to pay .29, .22, .56, and 1.14 percent more, respectively, to increase variety by 1%, where variety is measured in number of upcs. In the pre-period, consumers purchased an average of 111 upcs total or 5.8 upcs per product group. The first, second, third, and fourth quartile by income would be willing to give up 3.94, 4.48, 5.23, and 4.90 percent of upc variety, respectively, to decrease prices by 1%.

the descriptive evidence, lower-income households are thus more likely to shop at dollar stores. Third, compared to other store types, dollar stores benefit consumers predominantly through their low prices, as they carry a much more limited selection of product groups compared to these other store types. This contrasts with gains to consumers provided by large discount stores. A dollar store that enters a food desert provides consumers with low prices and novel variety. A dollar store that enters a crowded retail market provides consumers with lower prices but not the variety that the existing retailers already provide. In the crowded market, households may switch from the higher-priced higher-variety bundle to a lower-priced lower-variety bundle due to the distaste for higher prices and the decreasing marginal returns of additional variety and size. The estimates point to the unique role of these novel specialty stores in the existing retail market.

Crucial for those interested in expanding consumer access to product groups like fresh produce is the need to understand *why* dollar stores do not provide these product groups.<sup>31</sup> Put differently, given limited variety, why do dollar stores carry the selection of products they do? Products are selected due to either demand factors, supply factors, or both. If dollar stores select products that provide the highest utility, then the top groups purchased at the dollar store documented in Figure 2 – Candy, Snacks, Carbonated Beverages, Bread and Baked Goods, Cookies, and Juice – should reflect the household’s most-preferred goods. This is not the case: the product group fixed effects which provide a measure household product group preference show that Candy, Snacks, Carbonated Beverages, Bread and Baked Goods, Cookies, and Juice are among the least preferred product groups. Estimates imply that product group selection are based on supply-side or costs considerations.

Those interested in expanding consumer access to fresh produce are also concerned that introduction of the dollar store will cause consumers to substitute away from popular products at preexisting grocers towards popular products at the dollar store, specifically from products like Fresh Produce to products like Candy, Snacks, and Carbonated Beverages. To evaluate the concern, we compare the substitution within- vs. across-nest and compute the elasticity of substitution between popular grocery products and popular dollar store products.<sup>32</sup> Since the nest parameter ranges between .81 and .99, we find that the elasticity of substitution is much higher within nest than across nests; almost all of the substitution patterns occur within-nest or within store type. Thus,

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<sup>31</sup>Dollar stores usually provide a very limited selection of fresh produce, and policymakers have been interested in expanding the fresh produce selection of dollar stores. See [this report](#) for work focused on expanding consumer access to fresh produce by corralling the dollar store to provide such products.

<sup>32</sup>Under the nested logit model, all products are substitutes. Products are by definition closer substitutes within nest than across nests, and the degree of substitution varies with the nest parameter. Product substitutability can vary from a logit model ( $\lambda \rightarrow 0$ ), where all products have the same elasticity of substitution, to where the substitution within-nest is much higher than the substitution across nest, and all substitution occurs within the same nest ( $\lambda \rightarrow 1$ ).

demand estimates suggest that price changes have a much larger effect on substitution patterns within store type than price changes across store types. In the context of policy questions about the dollar store, product groups like fresh produce at the grocery store are poor substitutes for product groups like snacks at the dollar store relative to other products at the grocery store: for example, the average elasticity of substitution between grocery produce and dollar store snacks is .006. In fact, dollar store shares in the market are small at currently observed levels (documented in Figure A.7), and so changes in prices at the dollar store cause little substitution from the grocery store to the dollar store.

One large open question is explaining how dollar stores have proliferated so successfully across the United States. We find the following: (a) consumers dislike high prices, and dollar stores provide the lowest-priced products compared to other retailers (b) consumers prefer more variety and larger product sizes, which dollar stores do not provide compared to retailers (c) dollar stores choose their products due to cost considerations, not demand. Perhaps unsurprising given the name, we find that the demand-side driver of dollar store expansion is the dollar stores' low price point.



Table 3: Demand Estimates

<i>Variable</i>	Income Rank 1	Rank 2	Rank 3	Rank 4
Prices	-1.8953 (.3144)	-2.4173 (.3306)	-1.1059 (.4207)	-.5706 (.3648)
Log Variety	.6673 (.0111)	.9986 (.0655)	1.7461 (.0708)	2.2131 (.0732)
Log Avg. Size	2.7323 (.1037)	1.9591 (.1153)	1.5556 (.0496)	1.5644 (.0542)
Log Variety <sup>2</sup>	-.0315 (.0029)	-.1237 (.0152)	-.2975 (.0173)	-.3981 (.0180)
Log Avg. Size <sup>2</sup>	-.4542 (.0202)	-.3117 (.0210)	-.2515 (.0092)	-.2539 (.0111)
Nest Parameter	.7697 (.0196)	.9900 (.0354)	.9900 (.0359)	.9881 (.0447)
Intercept	-5.4053 (.0946)	-4.4294 (.1185)	-4.4111 (.0925)	-4.6925 (.0946)
<i>Product groups</i>				
Candy	-.4555 (.0187)	-.6103 (.0228)	-.6590 (.0238)	-.7155 (.0292)
Carbonated Beverages	.0119 (.0238)	-.1219 (.0274)	-.0214 (.0319)	-.0903 (.0342)
Cereal	.1533 (.0166)	.1442 (.0185)	.1809 (.0204)	.1379 (.0193)
Cheese	.2667 (.0173)	.3178 (.0156)	.2403 (.0137)	.1987 (.0156)
Coffee	.1846 (.0454)	.1159 (.0617)	.1836 (.0789)	.1363 (.0869)
Cookies	-.0018 (.0186)	.0149 (.0221)	.0569 (.0332)	.0473 (.0357)
Eggs	.6332 (.0178)	.4986 (.0179)	.5092 (.0154)	.4941 (.0181)
Fresh Produce	.1555 (.0156)	.1446 (.0148)	.0872 (.0136)	.0507 (.0156)
Ice Cream, Novelties	.5087 (.0238)	.3783 (.0333)	.4141 (.0418)	.3841 (.0369)
Juices, Drinks	.1457 (.0218)	.0185 (.0246)	.1388 (.0266)	.1301 (.0313)
Meat	.1587 (.0168)	.1988 (.0182)	.1730 (.0164)	.1667 (.0196)
Milk	.4718 (.0219)	.3175 (.0212)	.4028 (.0196)	.4077 (.0211)
Prepared Food	.0210 (.0149)	.0019 (.0175)	-.0298 (.0159)	-.0558 (.0165)
Snacks	-.2989 (.0158)	-.3033 (.0159)	-.3189 (.0142)	-.4072 (.0159)
Soft Drinks: Non-Carbonated	-.0602 (.0410)	-.0592 (.0592)	.0635 (.0695)	.0539 (.0638)
Soup	.1970 (.0175)	.1999 (.0201)	.2343 (.0256)	.1706 (.0253)
Vegetables: Canned, Dried, Frozen	.0826 (.0151)	.0993 (.0155)	.1001 (.0145)	.0564 (.0158)
Yogurt	.5769 (.0186)	.4566 (.0225)	.4126 (.0247)	.3273 (.0224)
<i>Non-Linear</i>				
Log Price	.3629 (.5413)	.4663 (.3272)	.4853 (.4293)	.4088 (.3816)
Log Variety	.0000 (.0000)	.4427 (.0595)	1.1109 (.0716)	1.5149 (.0827)
Log Size	.7931 (.0471)	.4833 (.0448)	.3826 (.0183)	.3978 (.0230)

*Notes:* Table reports coefficients from demand estimation where a market is a county-year-income group. We only use sales from dollar stores, discount stores, club stores, drug stores, convenience stores, and grocery stores. Data is based on consumer panel microdata for years 2008-2019. Income rank 1 is the lowest average income, income rank 4 has the highest average income.

## 7.1 Quantifying the value of the dollar store

To quantify the benefit of the first dollar store to the average household, we estimate the compensating variation, the dollar value which equates the utility of the average household in a zip with a dollar store and the utility of the same household in the same zip but without a dollar store.<sup>33</sup> To use consistent measures of expenditure throughout the paper, we measure the log compensating variation, which we interpret in percentage terms,

$$\log CV^m = \frac{1}{IT} \sum_{i,t} \frac{(1 - \lambda^m)}{\alpha_i} \ln \left( \frac{\left( \sum_{j \in S^{dollar}} e^{(\delta_{jst}^m + \mu_{ijst}) / (1 - \lambda^m)} \right)^{1 - \lambda^m}}{\sum_{s \in S^{no\ dollar}} \left( \sum_{j \in S} e^{(\delta_{jst}^m + \mu_{ijst}) / (1 - \lambda^m)} \right)^{1 - \lambda^m} + 1} \right) \quad (11)$$

where  $\delta_{jst}^m$  is the average utility  $\delta_{jt}^m = \alpha_0^m + \beta_2^m (\log v_{jts}^m)^2 + \gamma_2 (\log size_{jts}^m)^2 + \psi_{g(j)}^m + \xi_{jst}^m$  and  $\mu_{ij}$  is the individual component  $\mu_{ijst} = -\alpha_i \log p_{jst}^m + \beta_i \log v_{jst}^m + \gamma_i \log size_{jst}^m$ .

Qualitatively, household welfare increases after the first dollar store entry because the household choice set is increased. In practice, the welfare effects will be small, since the share of food products sold by the dollar store compared to other store types are small, as shown in Figure A.7. We compute the compensating variation using parameters from the demand estimation and the prices, characteristics, and number of trips from the Nielsen data. We use data in the year after the first dollar store entry to compute the compensating variation.<sup>34</sup>

We report the welfare estimates in Table 4.<sup>35</sup> The benefit to the average household range from 2% for the lowest-income household in the top income rank to .1% for the highest-income household in the bottom income rank.

<sup>33</sup>This is a standard measure of welfare for valuing new goods. For example, see Hausman and Leibtag (2007) in the context of Wal-mart's proliferation.

<sup>34</sup>Specifically, for each market we compute the average compensating variation across consumers using demand coefficients and price, variety, and size data. To compute welfare, we average log compensating variation across markets. We compute welfare using the first period after dollar store entry.

<sup>35</sup>To obtain standard errors, we use the parametric bootstrap (Horowitz (2001)). Specifically, we draw from the errors of the estimated parameters and re-compute average log compensating variation.

Table 4: Welfare Estimates

Variable	Income Rank 1	Rank 2	Rank 3	Rank 4
log CV	0.02137 (0.00082)	0.00113 (0.00009)	0.00174 (0.00560)	0.00142 (0.00183)

*Notes:* Table reports coefficients from demand estimation where a market is a county-year-income group. We only use sales from dollar stores, discount stores, club stores, drug stores, convenience stores, and grocery stores. Data is based on consumer panel microdata for years 2008-2019. Income rank 1 is the lowest average income, income rank 4 has the highest average income. Standard errors are below estimates. Standard errors were estimated using 1000 bootstrap iterations.

## 8 Heterogeneity by Income and Retail Environment

Dollar stores disproportionately locate in low-income neighborhoods (as well as non-metro areas), as shown in Figure A.3, and, on the flip side, dollar store customers are disproportionately low income, as shown in Figure A.5. Since dollar stores strategically locate in specific areas, households in these locations might experience the dollar store differently than the average consumer.<sup>36</sup>

In this section, we investigate how the first dollar store entry affects heterogeneous populations. We repeat our main analysis, but allow for heterogeneity by income as well heterogeneity for different retail environments. We consider two definitions of sparse retail environments: non metro areas (to capture the effect of dollar stores in rural areas) and food deserts. For each dimension of heterogeneity, we focus on the potentially most vulnerable population: the lowest income group and the sparsest retail environments.<sup>37</sup>

Then, we consider the effect of the first dollar store entry on expenditures, quantities, prices, and varieties. For expenditures, we consider both total, dollar store, and grocery store expenditures. We expect dollar store expenditures to increase more for low-income consumers, as well as for consumers in sparse retail environments. To assess whether there maybe a competitive response from local retailers, we look at the effect on grocery expenditures and relative prices. Finally, we compute the effect on quantities and varieties to assess how heterogeneous effects compare to the average. For quantities, we consider the most policy-relevant department, fresh produce.

<sup>36</sup>The media has often highlighted that dollar stores shoppers are [disproportionately low income](#) and [locate disproportionately in rural towns](#).

<sup>37</sup>We report effects for all groups, but specifically discuss the most likely vulnerable in the text. Additional dimensions of sparse retail environments include concentrated retail environments, or places where households shop at relatively few retailers.

First, we consider heterogeneity by income. All income groups increase dollar store expenditures following the entry of the first dollar store, as shown in Figure A.21. However, households in the lowest income group react to the dollar store in a way which is different from other income groups and largely budget neutral. While other household groups react by reducing expenditures and varieties, the lowest income group barely reduces varieties and expenditures, and in a way that is not statistically significant, as shown in Figure A.25 and Figure A.21. Surprisingly, the second and third quantiles of income reduces quantities the most, by almost 5% and 8%, respectively. . Similarly, the lowest income group’s grocery store expenditure, shown in Figure A.23, do not decline significantly following dollar store entry. Intuitively, households in the lowest income group are not using the dollar store to save money, but are using the dollar store to re-optimize their choices at (approximately) the same budget constraint.<sup>38</sup> Meanwhile, the lowest income relative price index (RPI) increases marginally and not significantly (by .01 percentage points), as shown in Figure A.24. Finally, the lowest income households do not change the ounces of fresh produce following the first dollar store entry, as shown in Figure A.26. Overall, this paints a picture of the average household in the lowest income group which continues to operate at its previous budget constraint, and re-optimizes utility but in a way that is budget neutral and in a way that does not change the quantity of fresh produce consumed.

Unlike for the lowest income households, the shopping patterns for households in food deserts and non-urban areas mirror the average trend (although results are less precise due to data availability). That is, households in sparse retail environments increase dollar store expenditures, with household in food deserts spending an additional 15\$ per quarter at the dollar store, well above the average. Similar to the average, households in food deserts and non-urban areas reduce expenditures, grocery expenditures, and variety, and experience the same lack of price change and lack of change in the quantity of fresh produce.

## 9 Conclusion

With over 35,000 dollar stores in the United States, the dollar store format has been subject to scrutiny regarding its effects on consumers. Much of this scrutiny has centered around three related concerns regarding (1) the types of goods supplied and how these goods differ from those provided by traditional retail formats, (2) the effect of dollar stores on local retail competition and the consumer choice set, and (3) the effect of the dollar store on consumer welfare. This paper addresses these questions in the context of the first dollar

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<sup>38</sup>These seemingly disparate facts – that dollar store expenditures decrease while total expenditures do not change – is due to the fact that expenditures reduce marginally at other store types but in such a way that total expenditure is decreasing but not significantly.

store entry. We quantify the effect of the dollar store on households and local retailers, and investigate the mechanisms that drive the supply and demand response.

First, we document the types of goods dollar stores carry and how they differ from goods supplied by other store types. We show that, relative to other store types, dollar store goods are characterized by their low prices, small sizes, and few varieties and we show that dollar store entry introduces mostly dry goods into the market. Even per unit, the dollar store prices are the lowest amongst all other store types. This low-price result voids the concern that dollar stores exploit cash-strapped consumers by charging low prices per good but high prices per unit by only offering small sizes.

However, this concern illustrates the uniqueness of the dollar store format. While dollar stores offer simultaneously the cheapest prices and the smallest sizes, grocery stores tend to exhibit an inverse relationship between price and size. This inverse relationship allows grocery stores to price discriminate across consumers and increase effective prices by shrinking package sizes. Thus, one possible strength of the dollar store is the ability to reverse the traditional inverse relationship between size and price. It seems reasonable that dollar stores stock few varieties because they must guarantee a low price, and can only guarantee a low price per good and price per unit on a limited selection of goods.

In response to the first dollar store entry, we find a lack of supply-side response: while some store types (e.g. grocery stores) see declines in revenue following the first dollar store entry, stores do not change their prices and, on average, there is no grocery exit. On the demand side, in addition to not facing different prices at incumbent retailers, we show that households do not change the number of trips they take to other store types. Thus we conclude that the dollar store expands the household choice set.

Finally, we study the consumer response and quantify the welfare impact of the dollar store. We show that following the first dollar store entry, households reduce expenditures. This drop in expenditure is explained by a shift from a larger consumer bundle with higher prices but more variety to a smaller consumer bundle with lower prices but with less variety. The demand estimates suggest that this shift is driven by dollar store's low prices. We compute the value of the dollar store at 12% of food expenditure per year for the average household.

Our paper ties the literature on the expansion of non-traditional retail formats (such as big box stores) to the literature on how households re-optimize in the face of large product assortments. We show the importance of re-optimizing over varieties and how non-traditional retail formats allow households to purchase new goods and goods more efficiently.

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# A Appendix

## A.1 Tables

Table A.1: Product Size Effects of Dollar Store

Dependent Variable:	log(Size)
<i>Variables</i>	
Dollar Store	-0.2253 (0.0027)
Discount	0.0487 (0.0009)
Club	0.7244 (0.0050)
Convenience	-0.2326 (0.0060)
Drug	-0.1329 (0.0053)
<i>Fixed-effects</i>	
county_product_month	Yes
<i>Fit statistics</i>	
Observations	483,480,789
R <sup>2</sup>	0.82684
Within R <sup>2</sup>	0.06925

*Clustered (county\_name) standard-errors in parentheses*

*Notes:* Table reports coefficient from regressing log size of good on a store type variable. We only use sales from dollar stores, discount stores, club stores, and drug/convenience stores. Grocery stores are used as the reference group. Data is based on consumer panel microdata for years 2008-2018. We report coefficients with county by product module by month-year fixed effects. Standard errors are clustered at the county level.

Table A.2: Non-Food Retailers in the Retail Closing Instrument

Retail Chain	Bankruptcy Year	Dollar-Store Size?	Source
Blockbuster	2010	✓	SEC Form 10-K
Bon-Ton Stores	2018	Large	SEC Form 10-K
Borders	2011	Large	SEC Form 10-K
Charlotte Russe	2018	✓	SEC Form 10-K
Destination Maternity	2019	Small	SEC Form 10-K
Fashion Bug	2013	✓	SEC Form 10-K
Gymboree	2019	Small	SEC Form 10-K
HH Gregg	2017	Large	SEC Form 10-K
Hollywood Video	2010	✓	SEC Form 10-K
KB Toys	2008	Small	Michman and Mazze (2001)
Loehmann's	2014	Large	SEC Form 10-K
Mattress Firm	2018	✓	SEC Form 10-K
Mervyn's	2008	Large	CoStar
Movie Gallery	2010	✓	SEC Form 10-K
Rue 21	2017	✓	SEC Form 10-K
Shopko	2019	Large	SEC Form 10-K
Sports Authority	2016	Large	SEC Form 10-K
Tweeter	2007	✓	SEC Form 10-K

*Notes:* Table reports retailers went bankrupt, the bankruptcy year, and whether the typical store of that retailer would fit the size requirements for a dollar store. A store that is smaller than 5,000 square feet is considered too small, a store that is between 5,000 and 15,000 square feet is considered appropriately sized, and a store that is over 15,000 square feet is considered too large. Dollar stores are typically between 6,000 and 10,000 square feet. *Sources:* Square footage information comes from publicly-available form 10-K SEC filings for average store size of each retailer when available which can be found by searching [here](#). For Mervyn's, the information comes from CoStar, one of the preeminent real estate information sources. The average dollar store size comes from SEC filings, as well as [this Retail Dive](#) and [this New York Times](#) article. The bankruptcy year for each retailer comes from Wikipedia.

Table A.3: Product Groups In Demand Estimation

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Product Groups in Demand
Bread And Baked Goods
Candy
Carbonated Beverages
Cereal
Cheese
Coffee
Cookies
Eggs
Fresh Produce
Ice Cream, Novelties
Juices, Drinks
Meat
Milk
Prepared Food
Snacks
Soft Drinks-Non-Carbonated
Soup
Vegetables- Canned, Dried, Frozen
Yogurt

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*Notes:* The table depicts the product groups in the inside group in demand estimation. The top 20 product groups by expenditure are included in the demand estimation, the top 19 groups by expenditure comprise the inside good, the remaining comprise the outside good.

Table A.4: Product Groups Combined in Demand Estimations

Combined Product Groups	Original Product Groups
Meat	Fresh Meat
	Packaged Meats - Deli
	Unprep Meat/Poultry/Seafood-frozen
Prepared Food	Prepared Food-Ready-To-Serve
	Prepared Food - Frozen
	Prepared Food - Dry Mixes
Juice, Drinks	Juice, Drinks - Canned, Bottled
	Juice, Drinks - Frozen
Vegetables - Canned, Dried, Frozen	Vegetables – Canned
	Vegetables and Grains - Dried
	Vegetables - Frozen
Snacks	Snacks
	Snacks, Spreads, Dips - Dairy
	Pizza/Snacks/Horse Devours-Frozen
	Pudding, Desserts - Dairy

*Notes:* Similar product groups are combined into the same product group for demand estimation.

Table A.5: Product Groups Comprising the Outside Good

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Product Groups that Comprise the Outside Good

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Baby food  
 Baked goods-frozen  
 Baking mixes  
 Baking supplies  
 Breakfast food  
 Breakfast foods-frozen  
 Butter and margarine  
 Condiments, gravies, and sauces  
 Cot cheese, sour cream, toppings  
 Crackers  
 Desserts, gelatins, syrup  
 Desserts/fruits/toppings-frozen  
 Dough products  
 Dressings/salads/prep foods-deli  
 Flour  
 Fruit - canned  
 Fruit - dried  
 Jams, jellies, spreads  
 Nuts  
 Packaged milk and modifiers  
 Pasta  
 Pickles, olives, and relish  
 Pizza/snacks/hors doeuvres-frozen  
 Pudding, desserts-dairy  
 Salad dressings, mayo, toppings  
 Seafood - canned  
 Shortening, oil  
 Snacks, spreads, dips-dairy  
 Spices, seasoning, extracts  
 Sugar, sweeteners  
 Table syrups, molasses  
 Tea

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*Notes:* Product groups that comprise the outside group for demand estimation.

Table A.6: Conversion between counts and food weights in the Nielsen HMS data

Product Group Description	Weight (oz)
Egg	1.7
Fresh Apple	5.7
Fresh Cauliflower	32
Fresh Tomato	6
Fresh Potato	7.5
Fresh Mushroom	2
Fresh Onion	11.09
Fresh Kiwi	4
Fresh Grapefruit	8
Fresh Oranges	4.6
Fresh Lettuce	10.58
Fresh Garlic	1.41

*Notes:* Products that appear as counts in the data are converted into weights (ounces) to keep as much data in the analysis as possible.

Table A.7: First Stage for Hausman, Retail Closing Instruments

Dependent Variables:	Log Price	Log Group Share
Hausman Instrument	0.5978*** (0.0443)	-1.204** (0.4468)
Retail Bankruptcy Instrument	-0.0002* (0.0001)	-0.0289*** (0.0061)
Lagged Retail Bankruptcy	-0.0005** (0.0002)	-0.0150*** (0.0041)
Twice Lagged Retail Bankruptcy	-0.0004** (0.0002)	-0.0360*** (0.0049)
Log Variety	-0.0207*** (0.0029)	0.5377*** (0.0474)
Log Average Size	0.0132** (0.0053)	0.5820*** (0.1409)
Log Variety <sup>2</sup>	0.0039*** (0.0006)	-0.0345*** (0.0116)
Log Average Size <sup>2</sup>	0.0009 (0.0015)	-0.0887*** (0.0255)
<i>Fixed-effects</i>		
product_group_descr	Yes	Yes
<i>Fit statistics</i>		
Observations	730,944	730,944
R <sup>2</sup>	0.08458	0.18074
F-test (1st stage)	11,340.4	594.70

*Clustered (product\_group\_descr) standard-errors in parentheses*  
*Signif. Codes: \*\*\*: 0.01, \*\*: 0.05, \*: 0.1*

*Notes:* First stage estimates from regressions of log shares on prices, varieties, average package size, and group share instrumenting for prices and group shares with the retailer closing and Hausman instrument using 2008-2019 Homescan data.



Table A.8: Probability of Dollar Store Entry

	Dollar Open	
	(1)	(2)
Retail Closing Instrument	0.213*** (0.047)	
Retail Closing Placebo		0.055 (0.224)
<i>Fixed Effects</i>		
year	Yes	Yes
<i>Fit statistics</i>		
Observations	14,278	14,278
Akaike Inf. Crit.	11,224.220	11,244.750
<i>Signif. Codes: ***: 0.01, **: 0.05, *: 0.1</i>		

*Notes:* Table reports probit regression estimates with standard errors from Equation 10. The dependent variable is whether a dollar store enters a particular zip code. The dependent variables are whether the same zip code had store whose parent company underwent a national-level bankruptcy in the year prior. The Retail Closing Instrument subsets to bankruptcies of the correct size, the Retail Closing Placebo subsets to bankruptcies of stores that are too small for a dollar store to enter. The specification also includes a constant and year fixed effects.

Table A.9: Nested Logit Demand Estimates

<i>Variable</i>	Income Rank 1	Rank 2	Rank 3	Rank 4
Price	-2.17 (0.1254)	-2.732 (0.1173)	-1.889 (0.09672)	-1.26 (0.09221)
Log Variety	0.5635 (0.01194)	0.4698 (0.01478)	0.4656 (0.01561)	0.5293 (0.01987)
Log Avg. Size	0.7695 (0.029)	0.5645 (0.03304)	0.6282 (0.03284)	0.5828 (0.04457)
Log Variety <sup>2</sup>	-0.03205 (0.002415)	-0.01891 (0.002287)	-0.01571 (0.002169)	-0.03324 (0.002266)
Log average size <sup>2</sup>	-0.1069 (0.004481)	-0.07418 (0.004826)	-0.09221 (0.004589)	-0.08762 (0.005534)
Nest Parameter	0.9385 (0.01419)	0.99 (0.01864)	0.99 (0.02182)	0.99 (0.03178)
Intercept	-2.527 (0.09913)	-1.957 (0.1294)	-1.992 (0.1467)	-1.921 (0.2211)
<i>Product Groups</i>				
Candy	-0.5657 (0.02096)	-0.6836 (0.02225)	-0.7156 (0.02269)	-0.8189 (0.02951)
Carbonated Beverages	-0.02168 (0.01917)	-0.09733 (0.01986)	-0.05224 (0.01891)	-0.1472 (0.02141)
Cereal	0.2045 (0.01756)	0.1749 (0.01818)	0.1846 (0.01679)	0.137 (0.01835)
Cheese	0.3856 (0.01808)	0.3702 (0.01907)	0.3325 (0.01793)	0.2818 (0.02138)
Coffee	0.2587 (0.02347)	0.2639 (0.02387)	0.3266 (0.02297)	0.2815 (0.02586)
Cookies	0.02799 (0.01988)	0.03683 (0.02059)	0.09339 (0.02022)	0.06513 (0.02287)
Eggs	0.6896 (0.01784)	0.6582 (0.0184)	0.6953 (0.01676)	0.6654 (0.01829)
Fresh Produce	0.2198 (0.01604)	0.1978 (0.01617)	0.1857 (0.01495)	0.1535 (0.01651)
Ice Cream, Novelties	0.5885 (0.0205)	0.5129 (0.02159)	0.5868 (0.02058)	0.5511 (0.02222)
Juices, Drinks	0.1884 (0.01908)	0.08125 (0.01957)	0.167 (0.01745)	0.141 (0.01904)
Meat	0.2334 (0.01625)	0.2353 (0.01663)	0.214 (0.01572)	0.2298 (0.01854)
Milk	0.5298 (0.02101)	0.4177 (0.02171)	0.4743 (0.01993)	0.4678 (0.02115)
Prepared Food	0.028 (0.01569)	0.01096 (0.01629)	0.02863 (0.01519)	0.004749 (0.0169)
Snacks	-0.31 (0.01716)	-0.3404 (0.0175)	-0.318 (0.01666)	-0.4149 (0.01837)
Soft Drinks-Non-Carbonated	0.1467 (0.02813)	0.1392 (0.02717)	0.1975 (0.02523)	0.1778 (0.02947)
Soup	0.2758 (0.01783)	0.2658 (0.01851)	0.2955 (0.01729)	0.2162 (0.01948)
Vegetables- Canned, Dried, Frozen	0.1263 (0.01565)	0.1355 (0.01614)	0.1533 (0.01504)	0.1132 (0.01703)
Yogurt	0.7303 (0.01972)	0.6518 (0.02117)	0.6222 (0.01847)	0.5351 (0.02079)

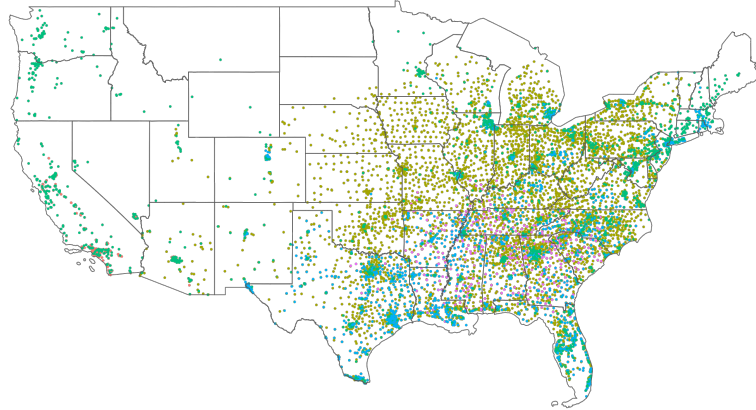
*Notes:* Table reports coefficients from nested-logit demand estimation where a market is a county-year-income group. The nests are the store types: dollar stores, discount stores, club stores, drug stores, convenience stores, and grocery stores. Data is based on consumer panel microdata for years 2008-2019. Income rank 1 is the lowest average income, income rank 4 has the highest average income.

## A.2 Figures

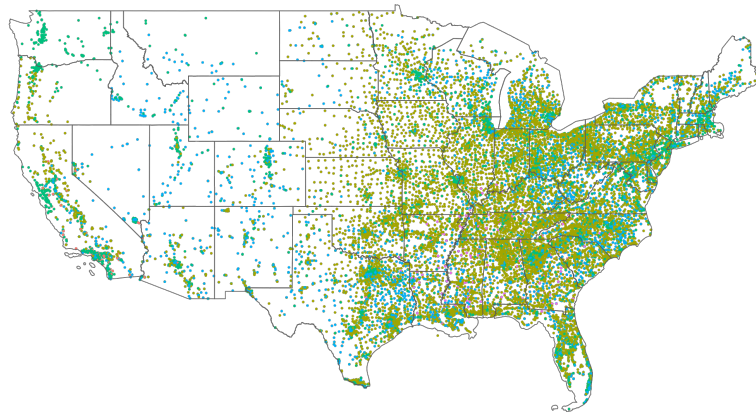
### A.2.1 Descriptives

Figure A.1: Locations of Top 5 Dollar Store Chains, 2008 and 2019

(a) 2008

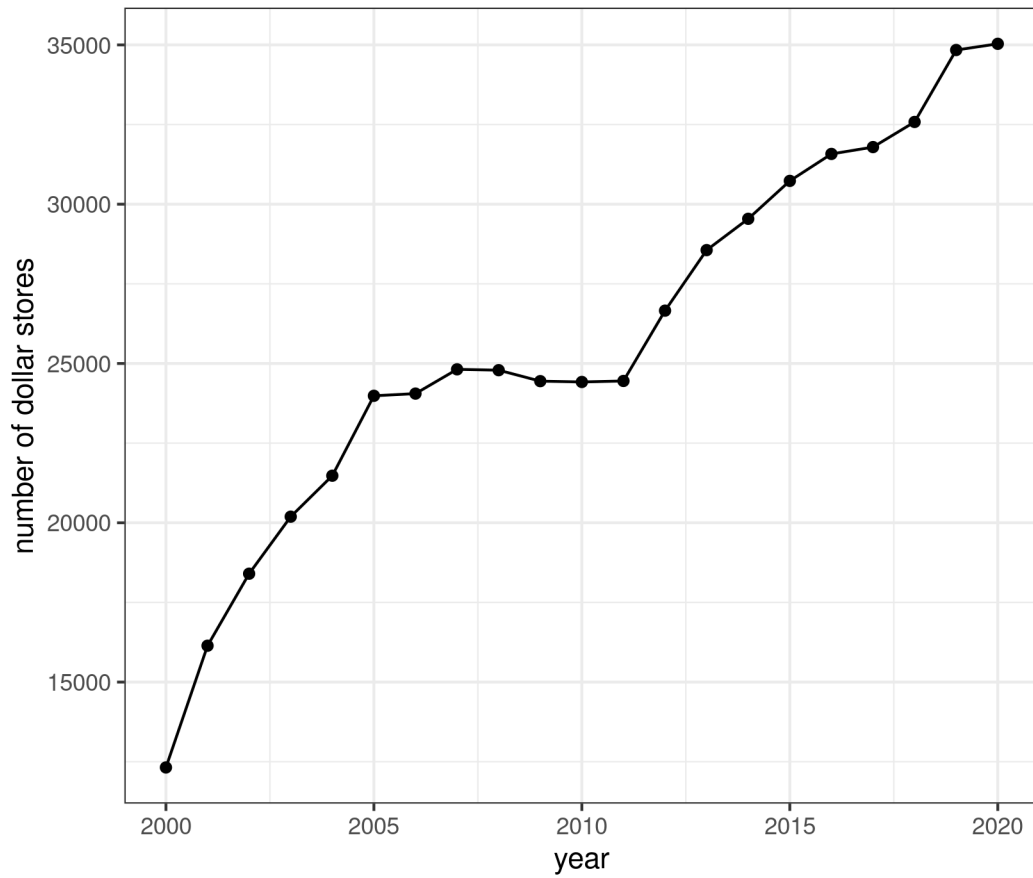


(b) 2019



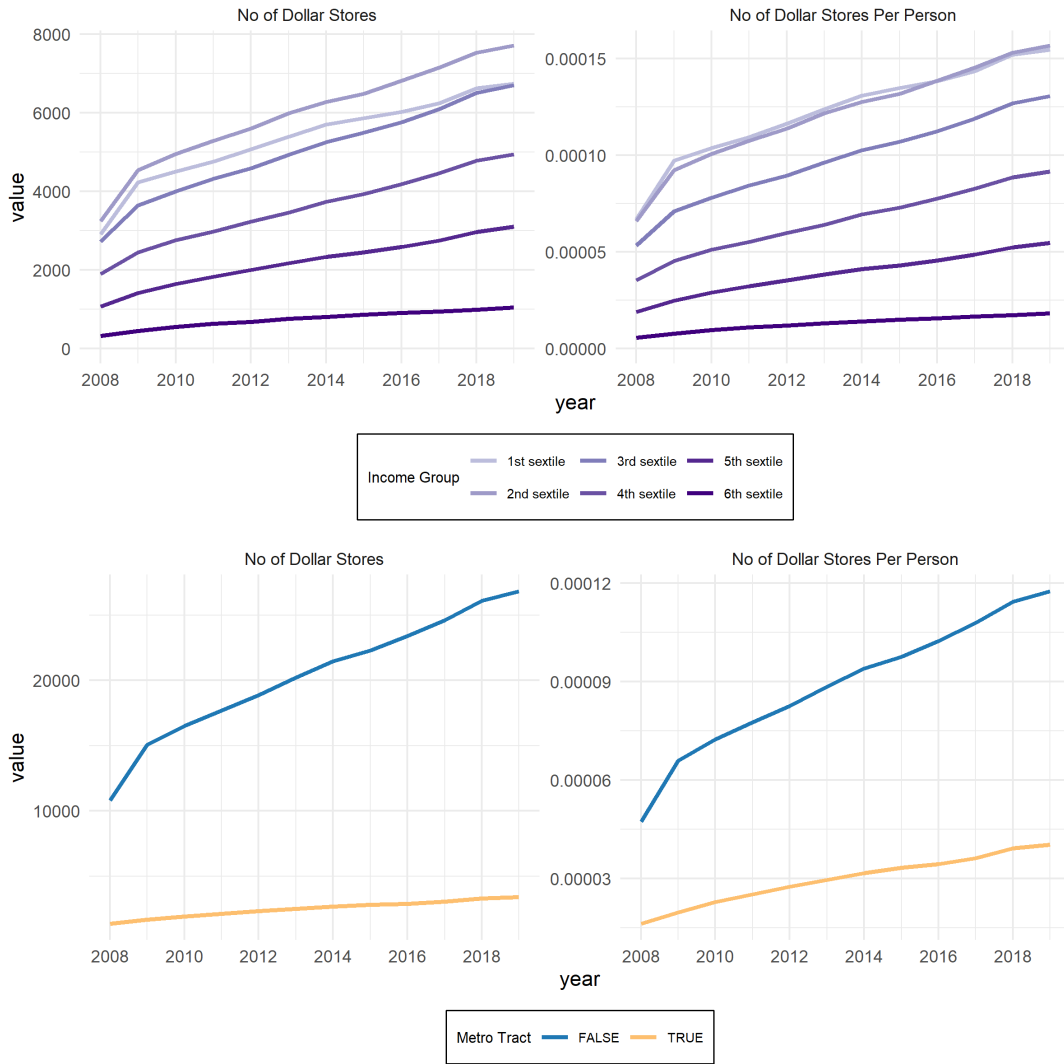
*Notes:* This figure shows the locations of dollar stores from the five largest chains in 2008 and 2019. The maps show the contiguous United States. Each observation is a store, and each color corresponds to a different chain. Source: SNAP.

Figure A.2: Time Series of Dollar Stores



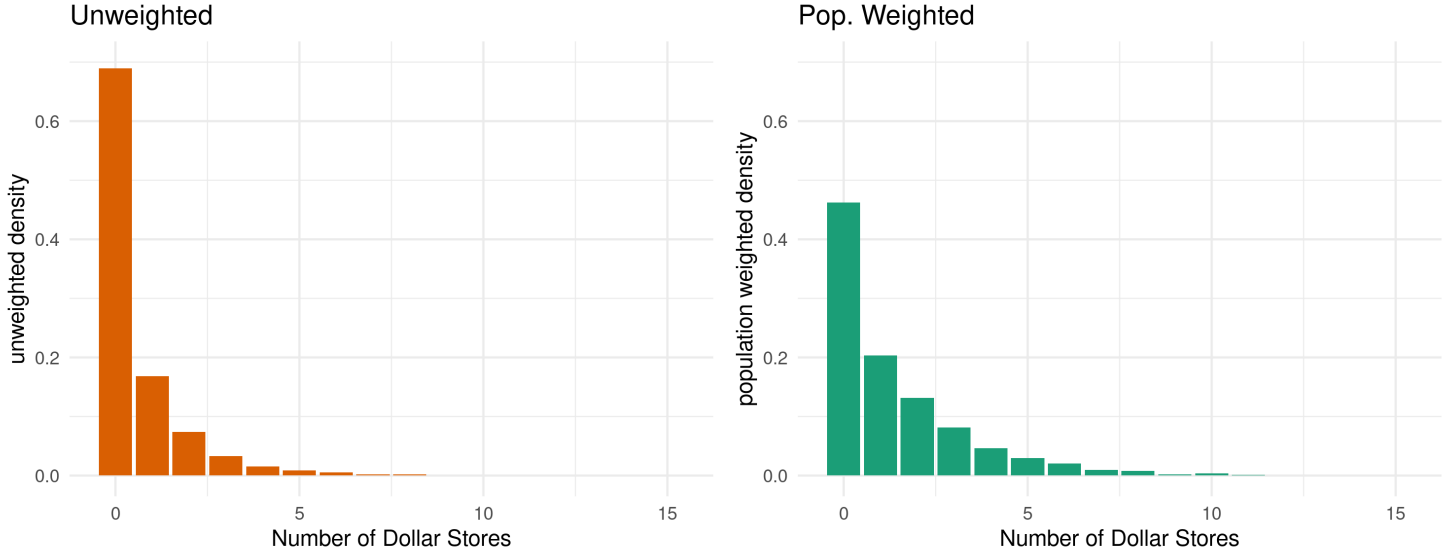
*Notes:* This figure shows the time series of dollar stores from the five largest chains in 2008 and 2019.

Figure A.3: Time Series of Dollar Store Growth by Income and Retail Environments



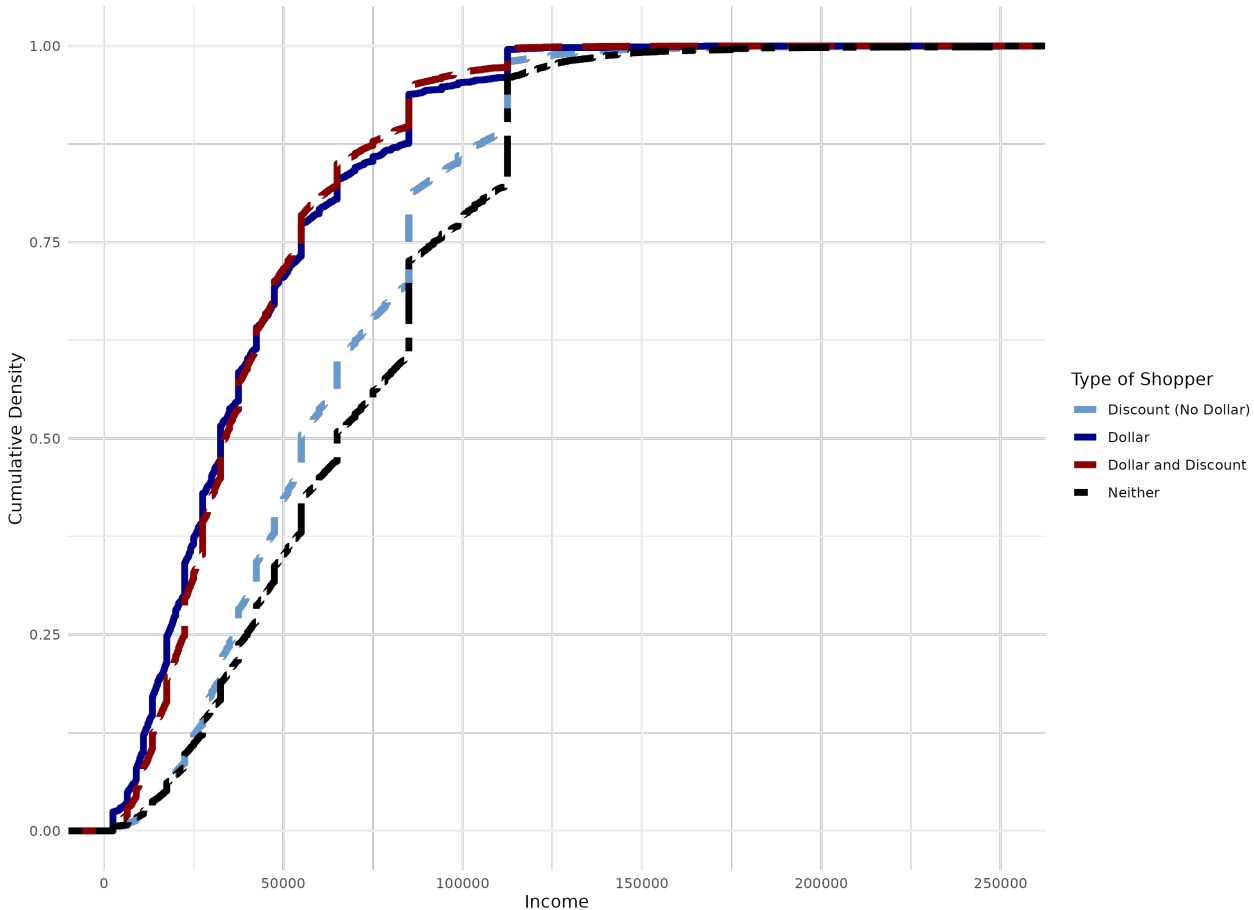
*Notes:* Growth of dollar stores over time by income and sparse retail environments. The top figure shows dollar store growth by income group. The bottom figure shows dollar store growth in metro and non-metro tracts.

Figure A.4: Dollar Store Density in Zip Codes



Notes: The figure plots current dollar store density unweighted (a) and weighted (b) by population. Each observation is a zip code. The modal zip code does not have a dollar store (69% of zip codes when zips are not populated-weighted, 45% of population-weighted zip codes). The modal zip code with at least one dollar store has only one dollar store (60% of unweighted zip codes, 36% of weighted zip codes).

Figure A.5: Income Distribution by Where Households Shop



*Notes:* Figure reports CDF of the household income. The income distributions are broken out by shopper type. Dollar store shoppers are those that spent more than 5% of expenditures that year at dollar stores, and analogously for discount shoppers. Data is based on consumer panel microdata for years 2008-2019.

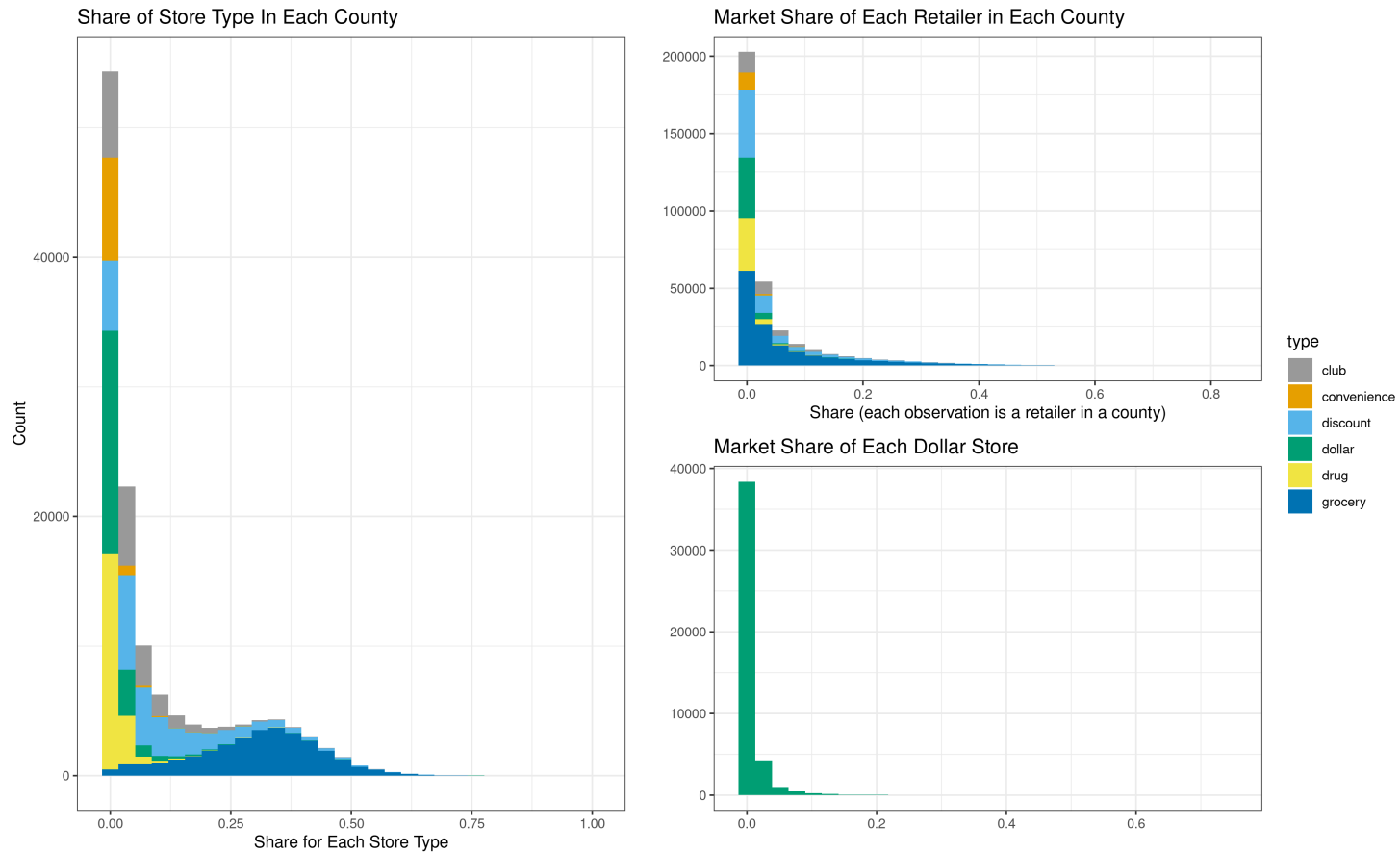
Figure A.6: Department Level Expenditure Shares by Store Type



Notes: Figure reports shares by store type broken down by department, using 2008-2018 Homescan data.

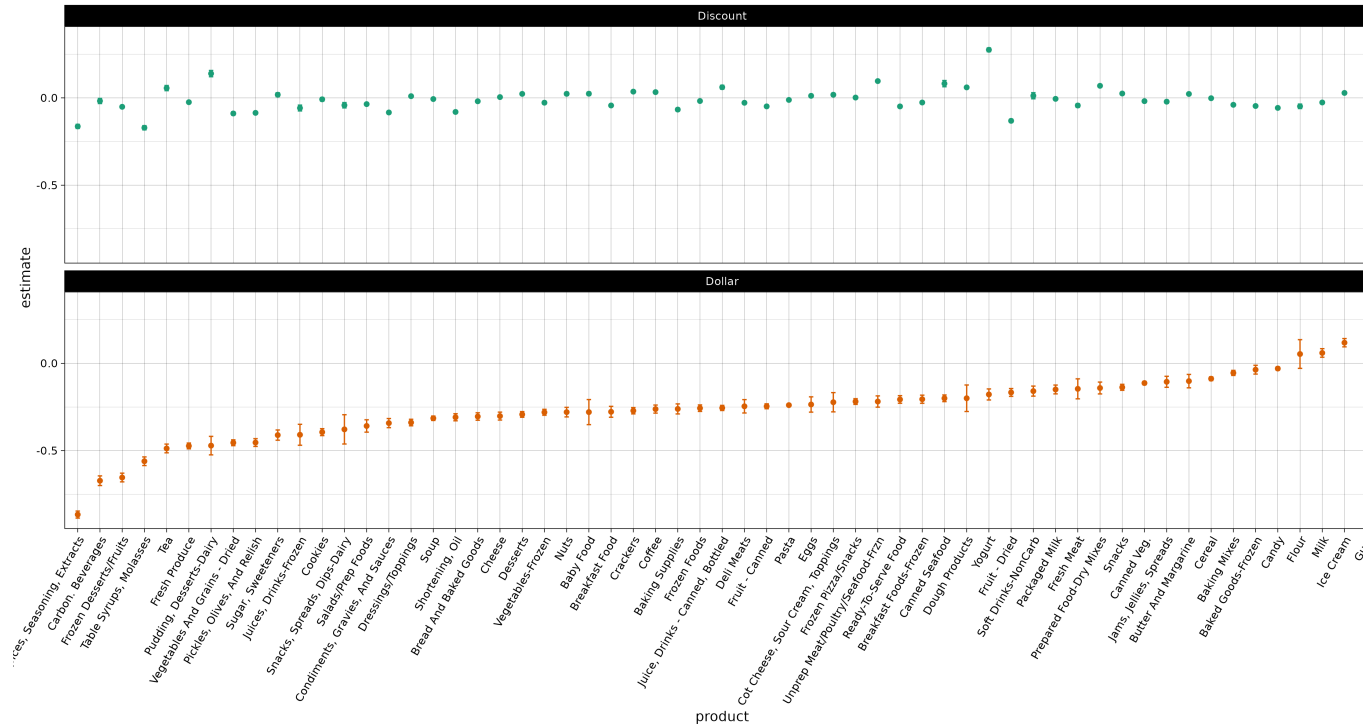


Figure A.7: Share of Each Store Type in each County-Year



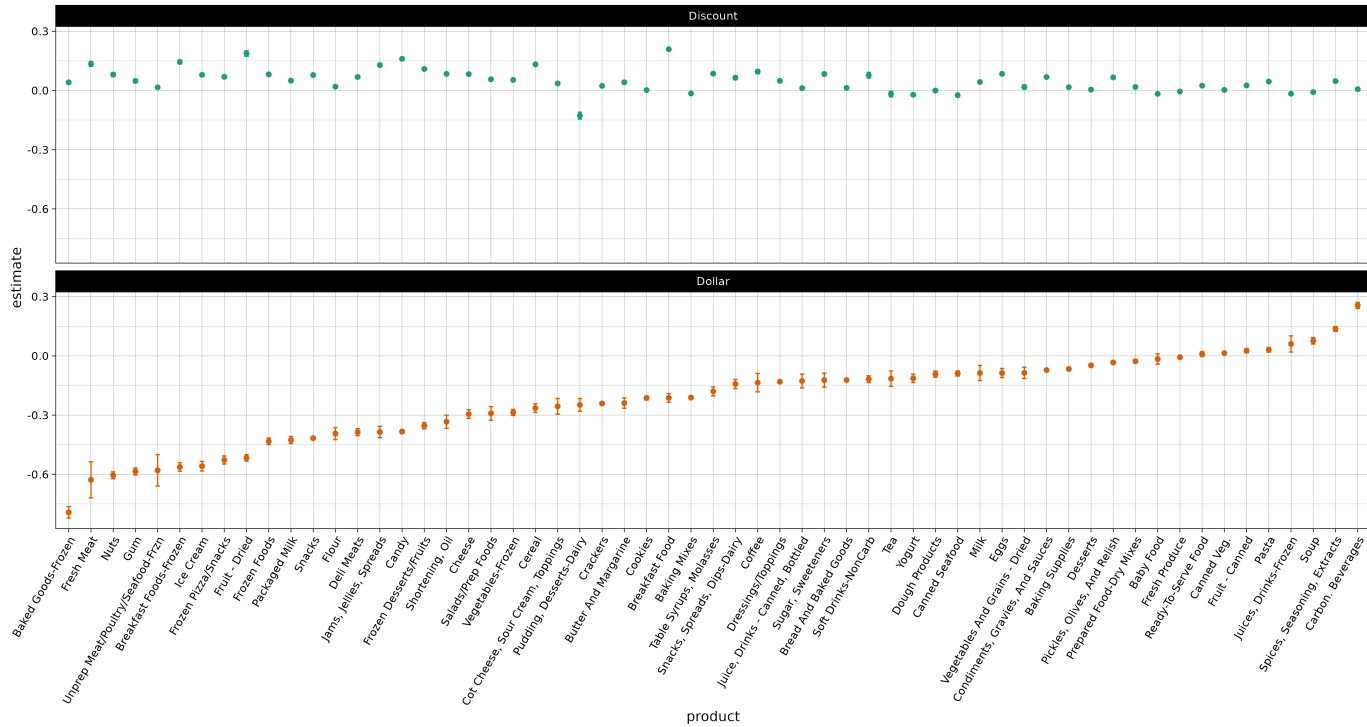
*Notes:* Total quantity shares for each store type in each county, as measured as ounces of product from one store type as a fraction of the total ounces of food products sold in the county. Data comes from the NielsenIQ Homescan panel (2008-2019).

Figure A.8: Price Per Unit Effects By Product Group



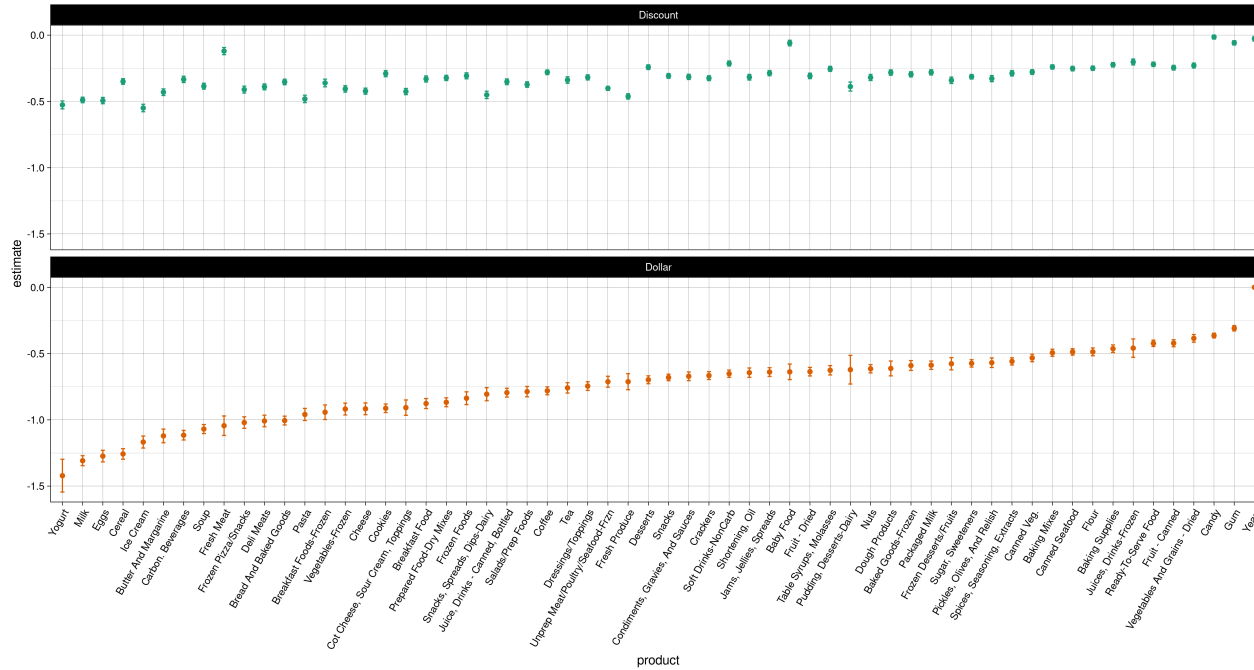
*Notes:* Figure reports coefficients and 95% confidence interval from regression of log price per unit of a good on store type, with county by product module by month-year fixed effects, broken out by product groups. We only use sales from dollar stores, discount stores, grocery stores, club/superstores, and drug/convenience stores. All stores other than dollar stores and discount stores are lumped into one group and used as the reference group for the regressions. Data is based on consumer panel microdata for years 2008-2018. Standard errors are clustered at the county level.

Figure A.9: Size Effects By Product Group



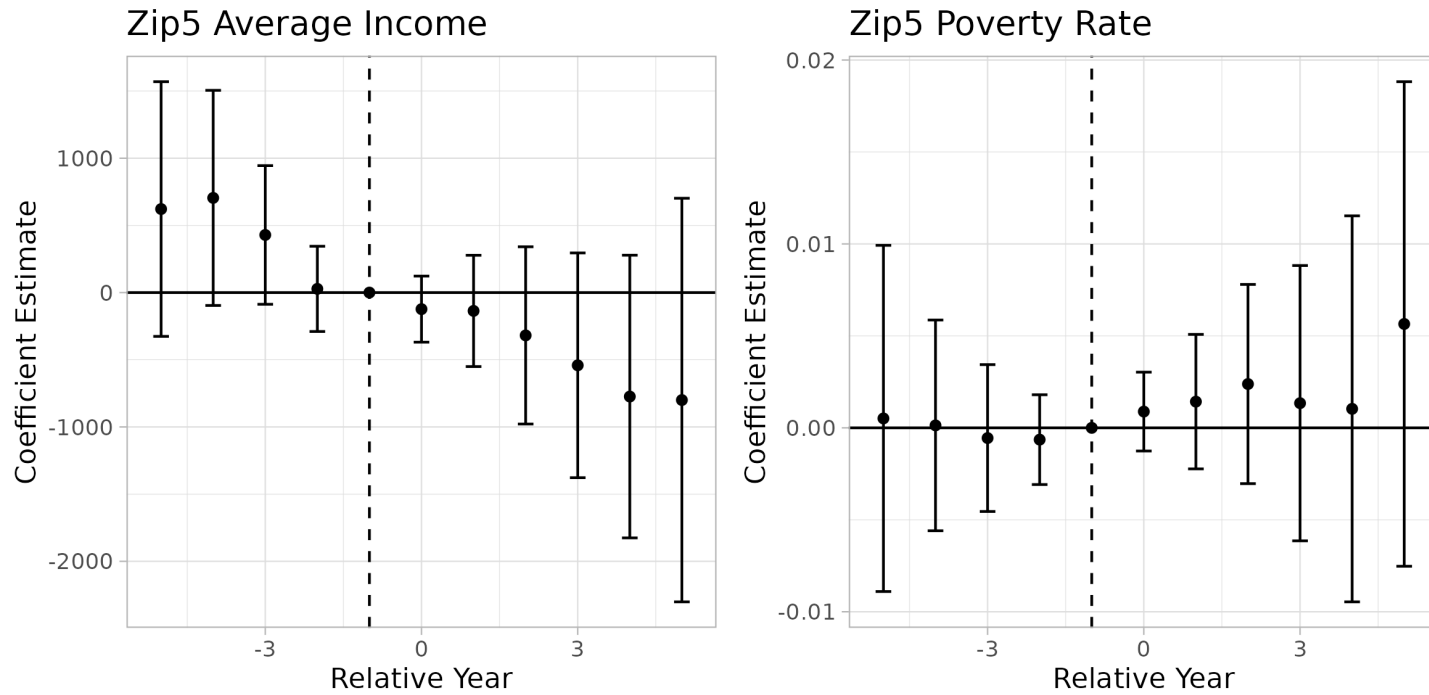
*Notes:* Figure reports coefficients and 95% confidence interval from regression of log size per unit of a good on store type, with county by product module by month-year fixed effects, broken out by product groups. We only use sales from dollar stores, discount stores, grocery stores, club/superstores, and drug/convenience stores. All stores other than dollar stores and discount stores are lumped into one group and used as the reference group for the regressions. Data is based on consumer panel microdata for years 2008-2018. Standard errors are clustered at the county level.

Figure A.10: Variety Effects By Product Group



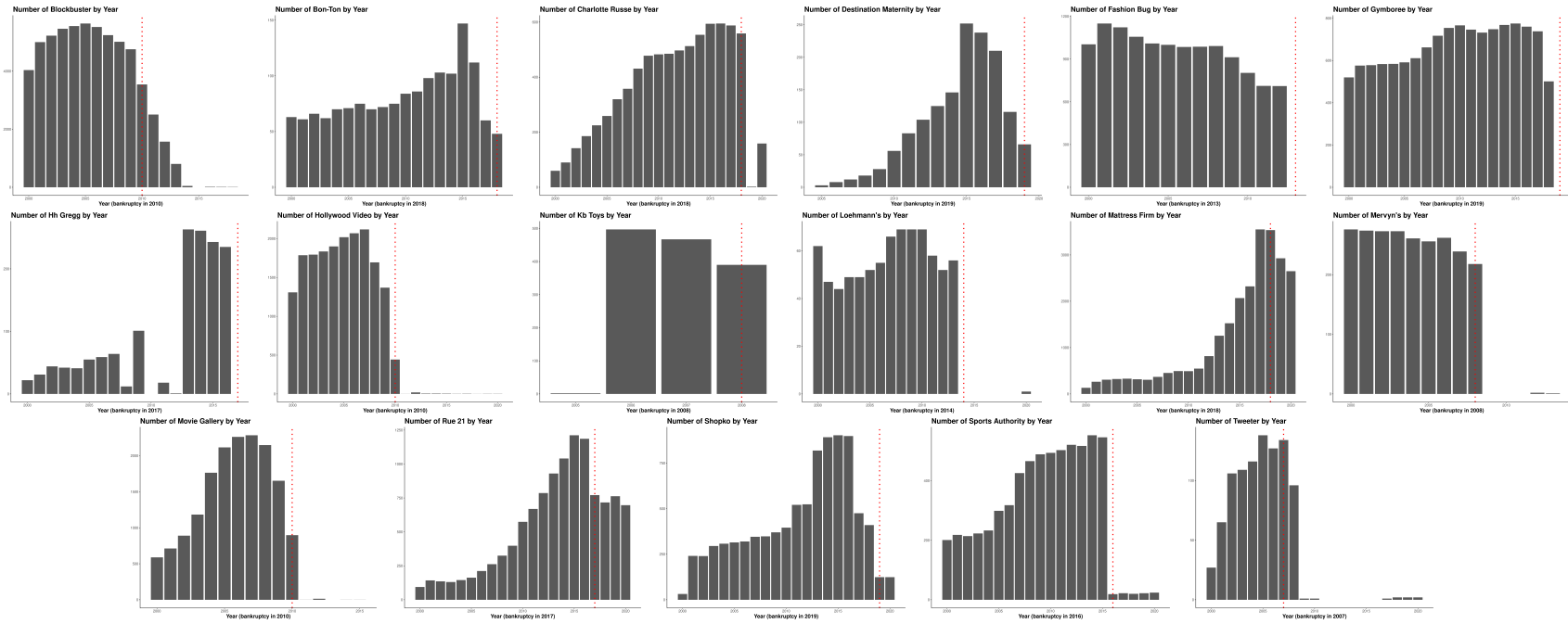
*Notes:* Figure reports coefficients and 95% confidence interval from regression of log size per unit of a good on store type, with county by product module by month-year fixed effects, broken out by product groups. We only use sales from dollar stores, discount stores, grocery stores, club/superstores, and drug/convenience stores. All stores other than dollar stores and discount stores are lumped into one group and used as the reference group for the regressions. Data is based on consumer panel microdata for years 2008-2018. Standard errors are clustered at the county level.

Figure A.11: Dollar Store Entry on Household Income



*Notes:* Figure reports event study estimates of impact on household income with 95% confidence intervals from Equation 5, using 5-year average zipcode income data using American Community Survey Data. The analysis uses a heterogeneity-robust estimator proposed by [Callaway and Sant'Anna \(2021\)](#). Observations are not weighted for national representativeness. Errors are clustered at the zipcode level.

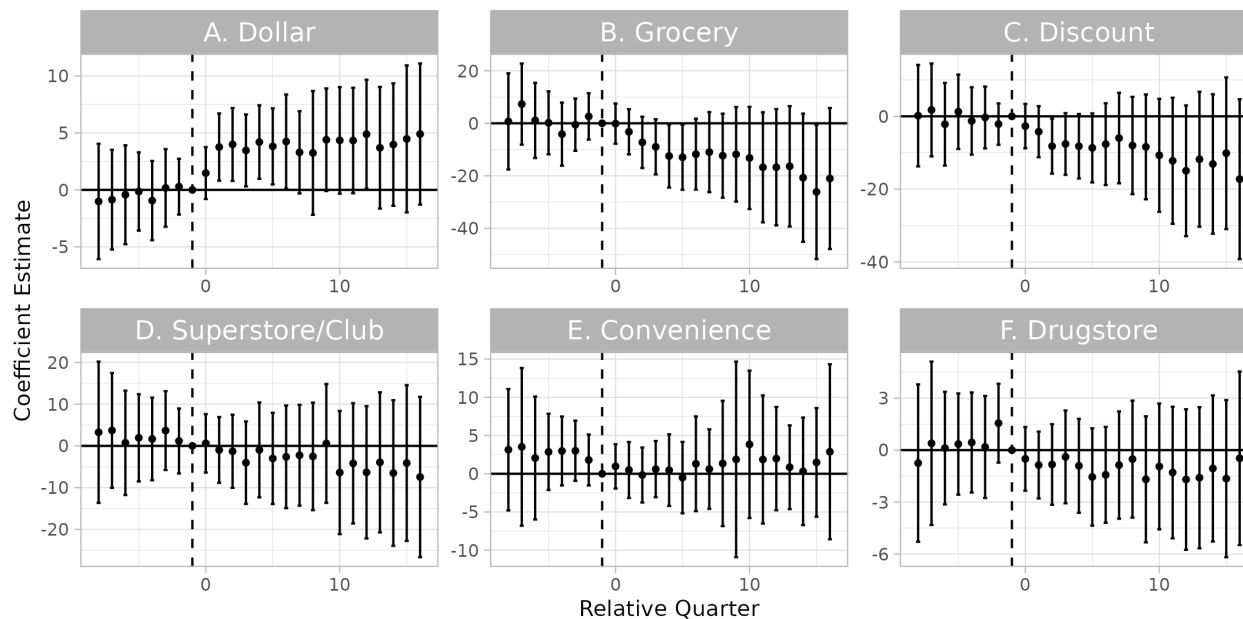
Figure A.12: Store counts by year for each retailer used to compute the retail bankruptcy instrument.



Notes: Figure reports store counts for non-food retailers that went bankrupt throughout the 2010s. Source: Infogroup Historic Data File, 2000-2020.

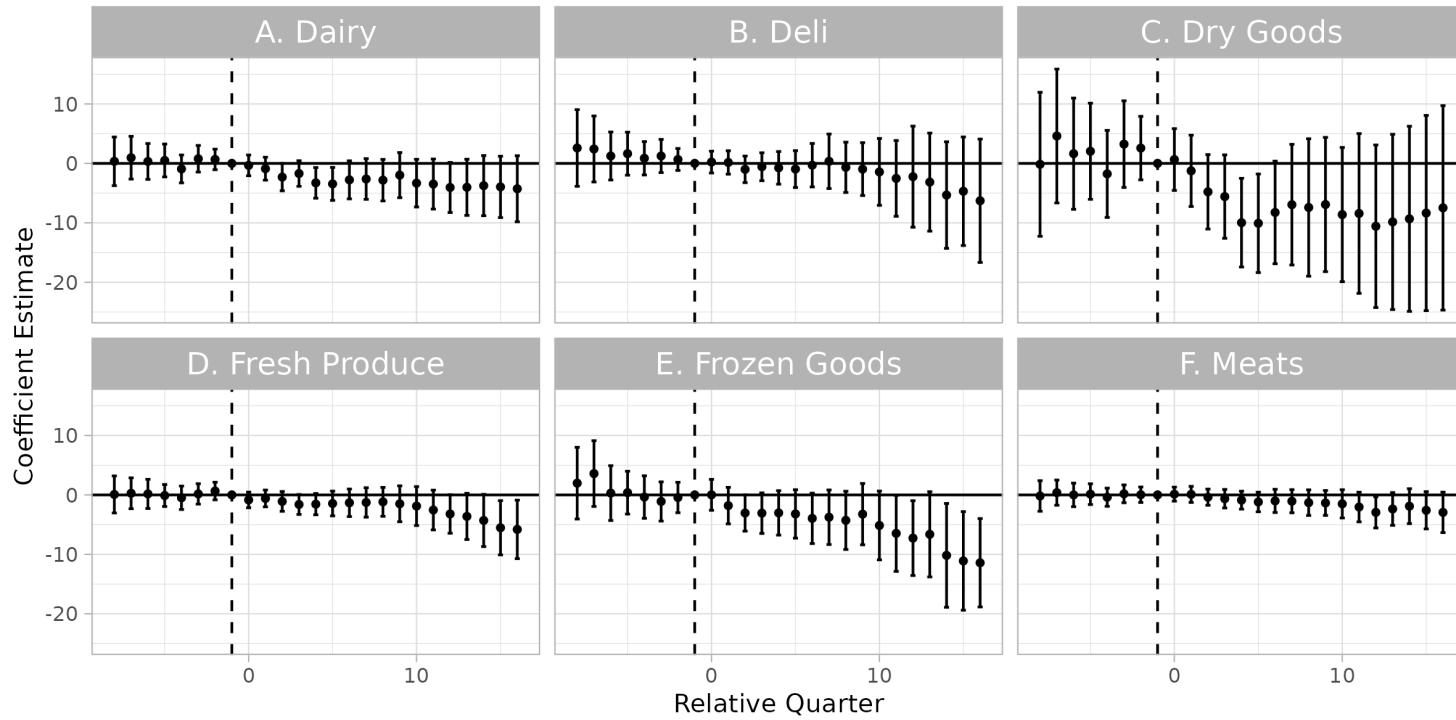
## A.2.2 Effect of Dollar Store Entry on Expenditure, Prices, and Quantities

Figure A.13: Dollar Store Entry on Expenditures by Store Type



*Notes:* Figure reports event study estimates of impact on store-level expenditures with 95% confidence intervals from Equation 5, using 2008-2018 Homescan data. The analysis uses a heterogeneity-robust estimator proposed by Callaway and Sant'Anna (2021). Observations are not weighted for national representativeness. Errors are clustered at the zipcode level.

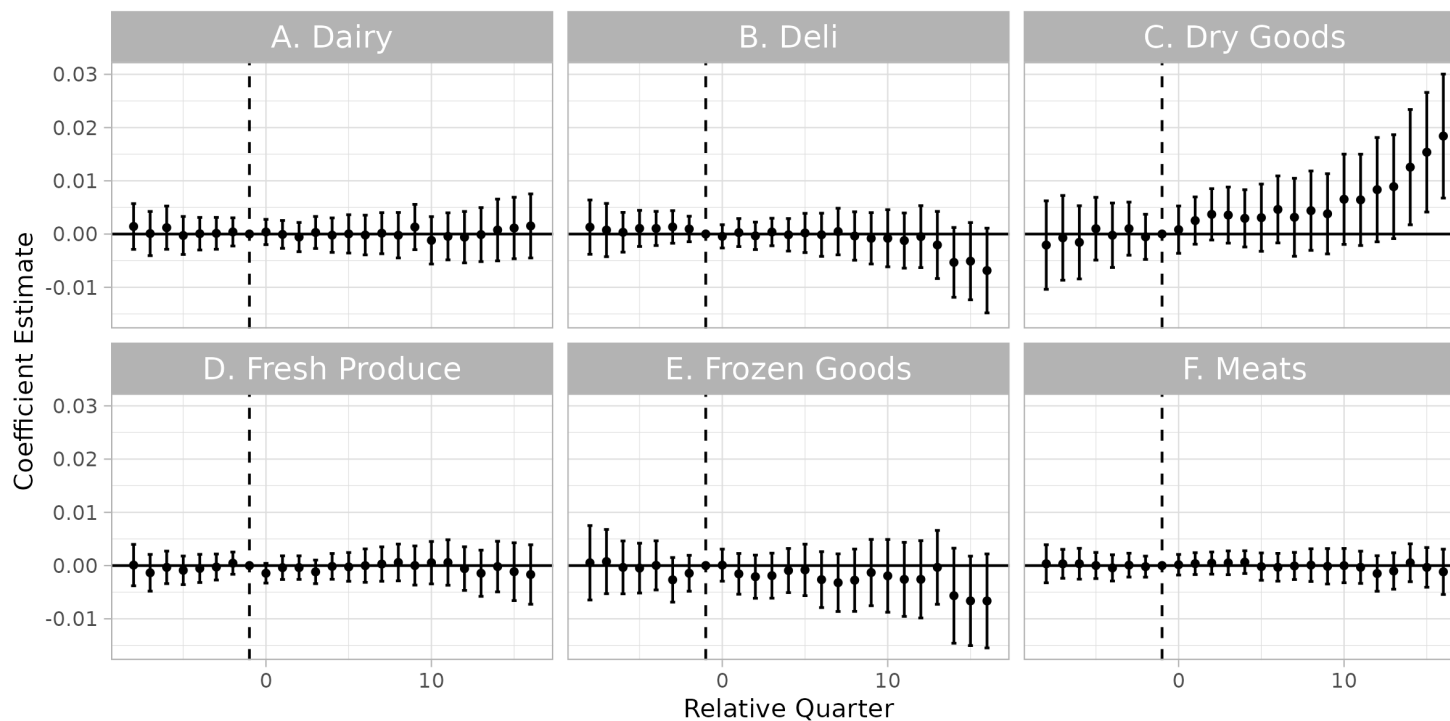
Figure A.14: Dollar Store Entry on Department Expenditure



*Notes:* Figure reports event study estimates with 95% confidence intervals from Equation 5, using 2008-2018 Homescan data. The analysis uses a heterogeneity-robust estimator proposed by Callaway and Sant’Anna (2021). The dependent variables here are different definitions for consumption bundle variety for the household at the quarter-year level. Observations are not weighted for national representativeness. Errors are clustered at the zipcode level.

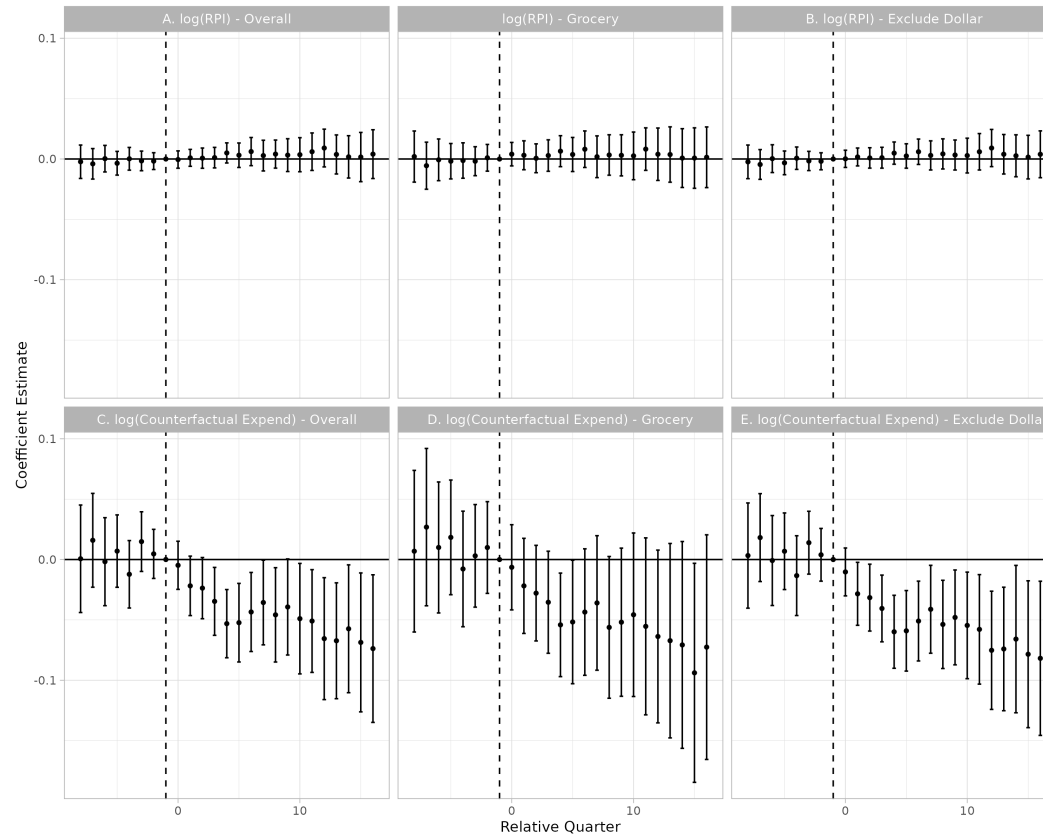


Figure A.15: Dollar Store Entry Fraction of Department Expenditure



*Notes:* Figure reports event study estimates with 95% confidence intervals from Equation 5, using 2008-2018 Homescan data. The analysis uses a heterogeneity-robust estimator proposed by Callaway and Sant’Anna (2021). The dependent variables here are different definitions for consumption bundle variety for the household at the quarter-year level. Observations are not weighted for national representativeness. Errors are clustered at the zipcode level.

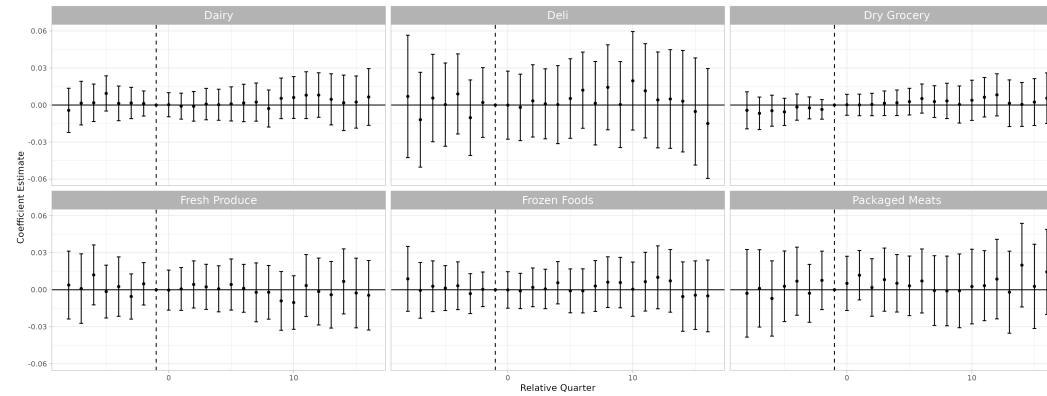
Figure A.16: Effect of Dollar Store Entry on Log Relative Price Index and Counterfactual Expenditure



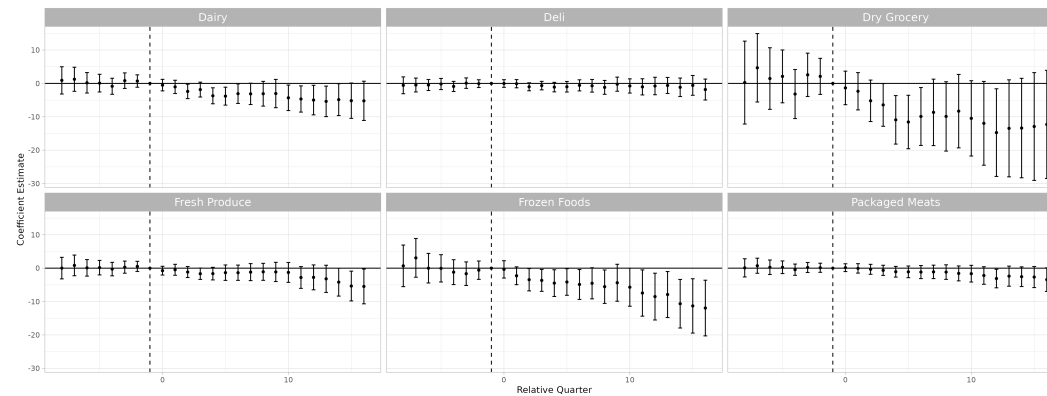
*Notes:* Figure reports event study estimates with 95% confidence intervals from Equation 5, using 2008-2019 Homescan data. The analysis uses a heterogeneity-robust estimator proposed by Callaway and Sant’Anna (2021). Observations are not weighted for national representativeness. Errors are clustered at the zipcode level. The state is used to calculate the average reference price.

Figure A.17: Effect of Dollar Store Entry on Department Relative Price Index and Counterfactual Expenditure

(a) Relative Price Index

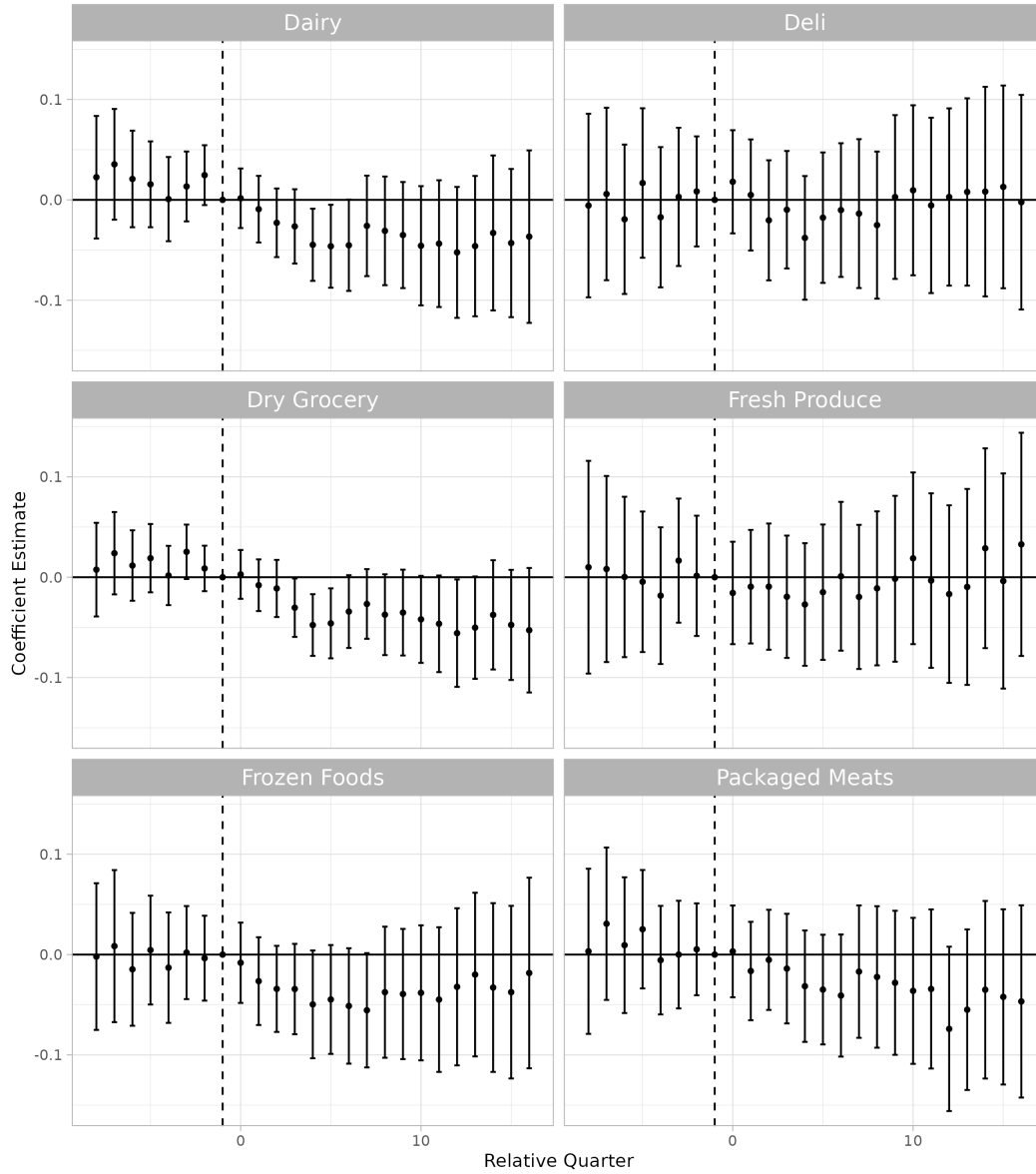


(b) Counterfactual Expenditure



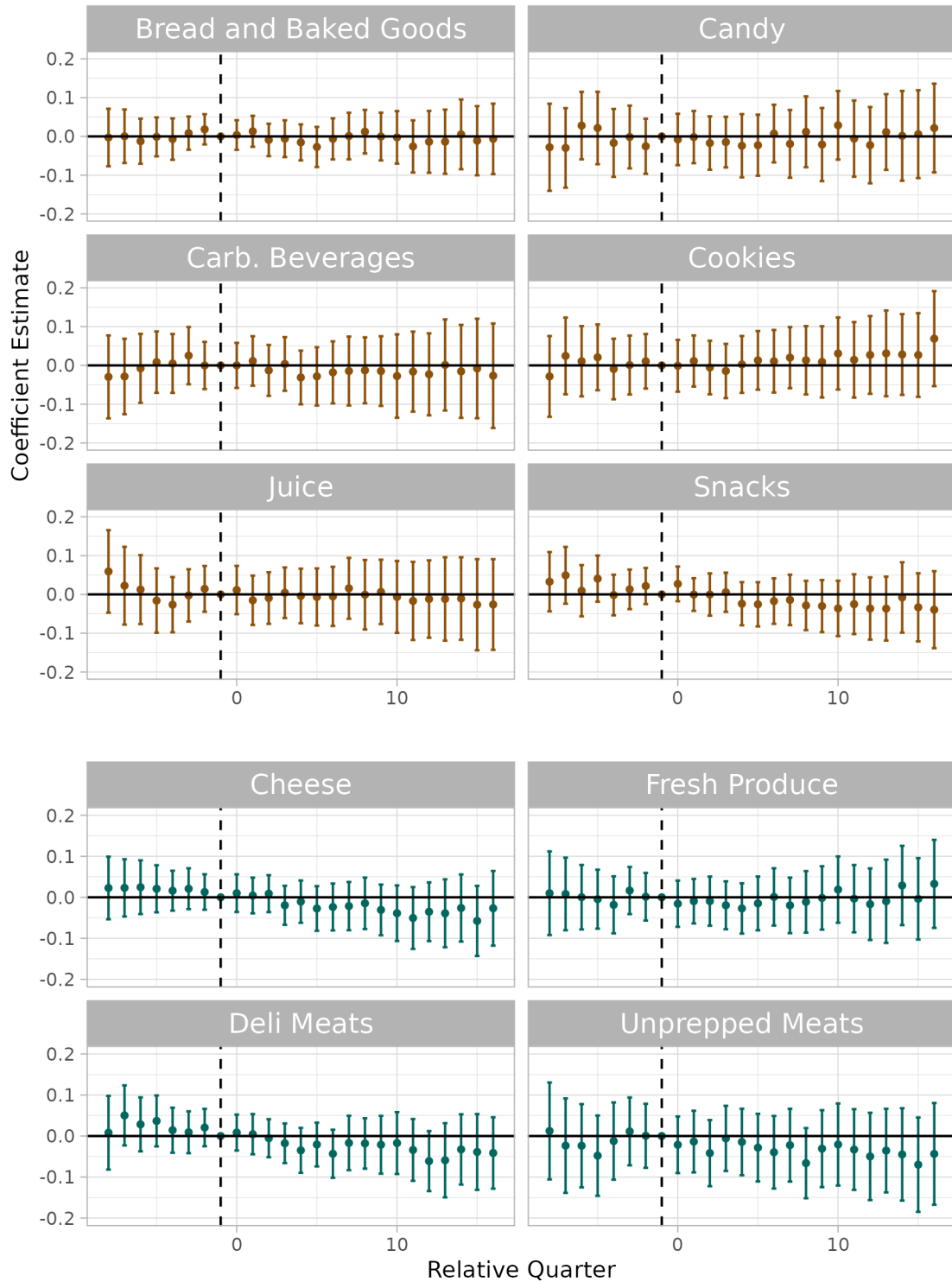
*Notes:* Figure reports event study estimates with 95% confidence intervals from Equation 5, using 2008-2019 Homescan data. The analysis uses a heterogeneity-robust estimator proposed by Callaway and Sant’Anna (2021). Observations are not weighted for national representativeness. Errors are clustered at the zipcode level. The county is used to calculate the average reference price.

Figure A.18: Effect of Dollar Store Entry on Department Log Ounces



*Notes:* Figure reports event study estimates with 95% confidence intervals from Equation 5, using 2008-2019 Homescan data. The analysis uses a heterogeneity-robust estimator proposed by Callaway and Sant’Anna (2021). Observations are not weighted for national representativeness. Errors are clustered at the zipcode level.

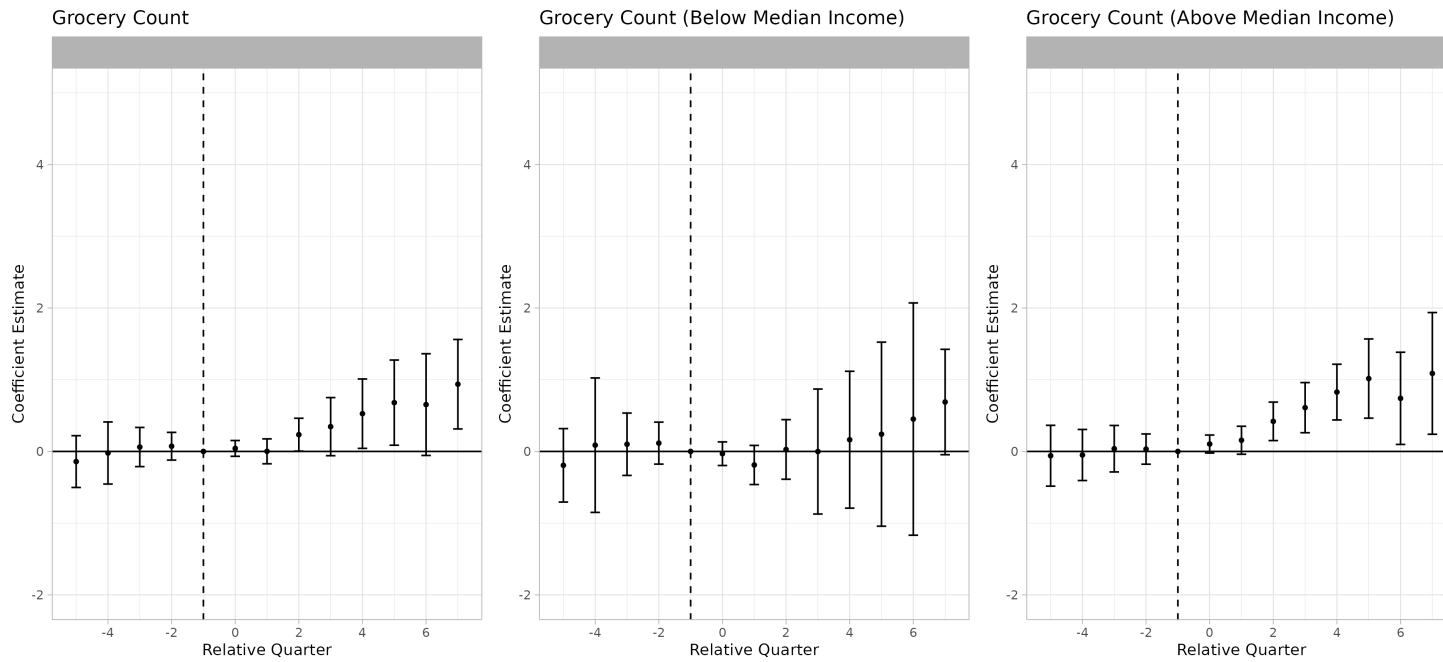
Figure A.19: Effect of Dollar Store Entry on Product Group Log Ounces



*Notes:* Figure reports event study estimates with 95% confidence intervals from Equation 5, using 2008-2019 Homescan data. The analysis uses a heterogeneity-robust estimator proposed by Callaway and Sant’Anna (2021). Observations are not weighted for national representativeness. Errors are clustered at the zipcode level.

### A.2.3 Effect of Dollar Store Entry on Local Retail

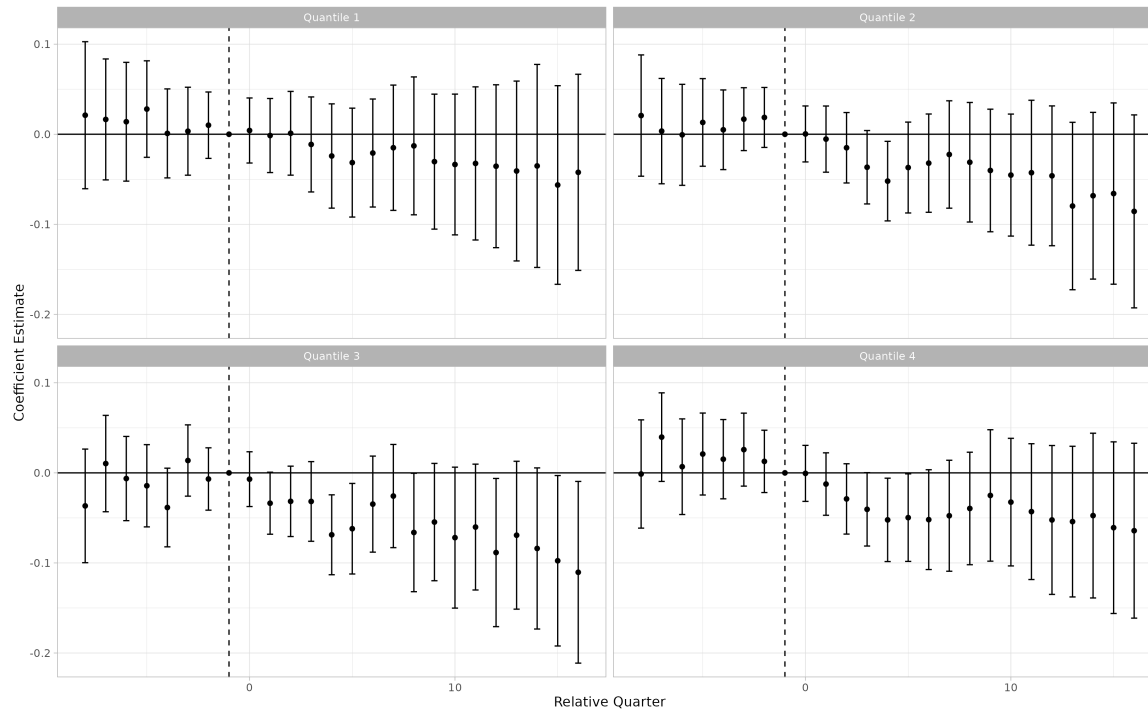
Figure A.20: Dollar Store Entry on Grocery Count: No Demographic Controls



Notes: Figure reports event study estimates with 95% confidence intervals from Equation 4, using 2008-2018 SNAP and ZBP data. The analysis uses a heterogeneity-robust estimator proposed by Callaway and Sant'Anna (2021). The figure reports the grocery count as the outcome variable. Errors are clustered at the zip code level.

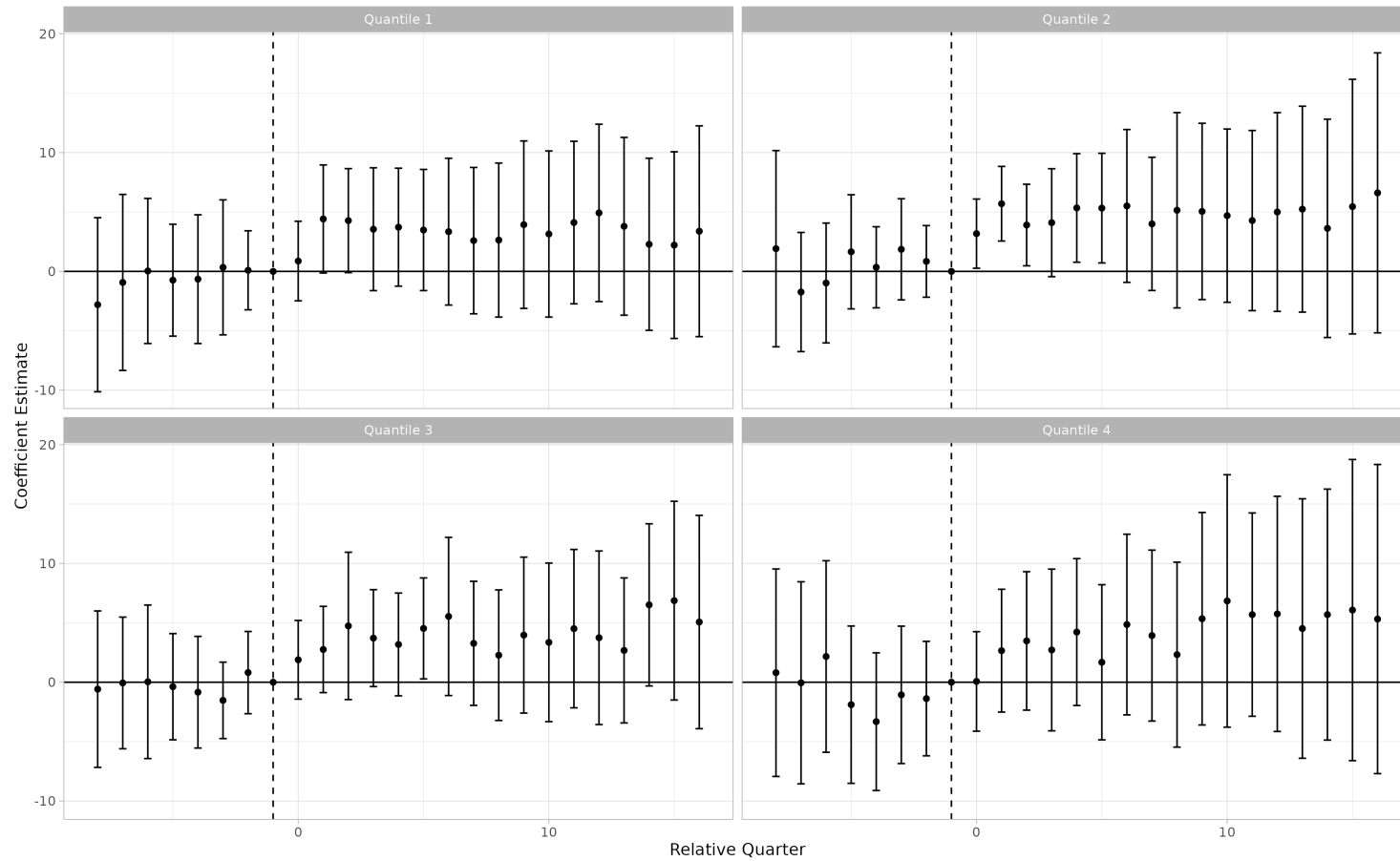
### A.2.4 The Effect of Dollar Store Entry by Income Group

Figure A.21: Log Total Expenditure by Income



*Notes:* Figure reports event study estimates with 95% confidence intervals from Equation 5, using 2008-2019 Homescan data. The analysis uses a heterogeneity-robust estimator proposed by Callaway and Sant’Anna (2021). Observations are not weighted for national representativeness. Errors are clustered at the zipcode level. Income Rank 1 is the lowest income, Rank 4 is the highest income.

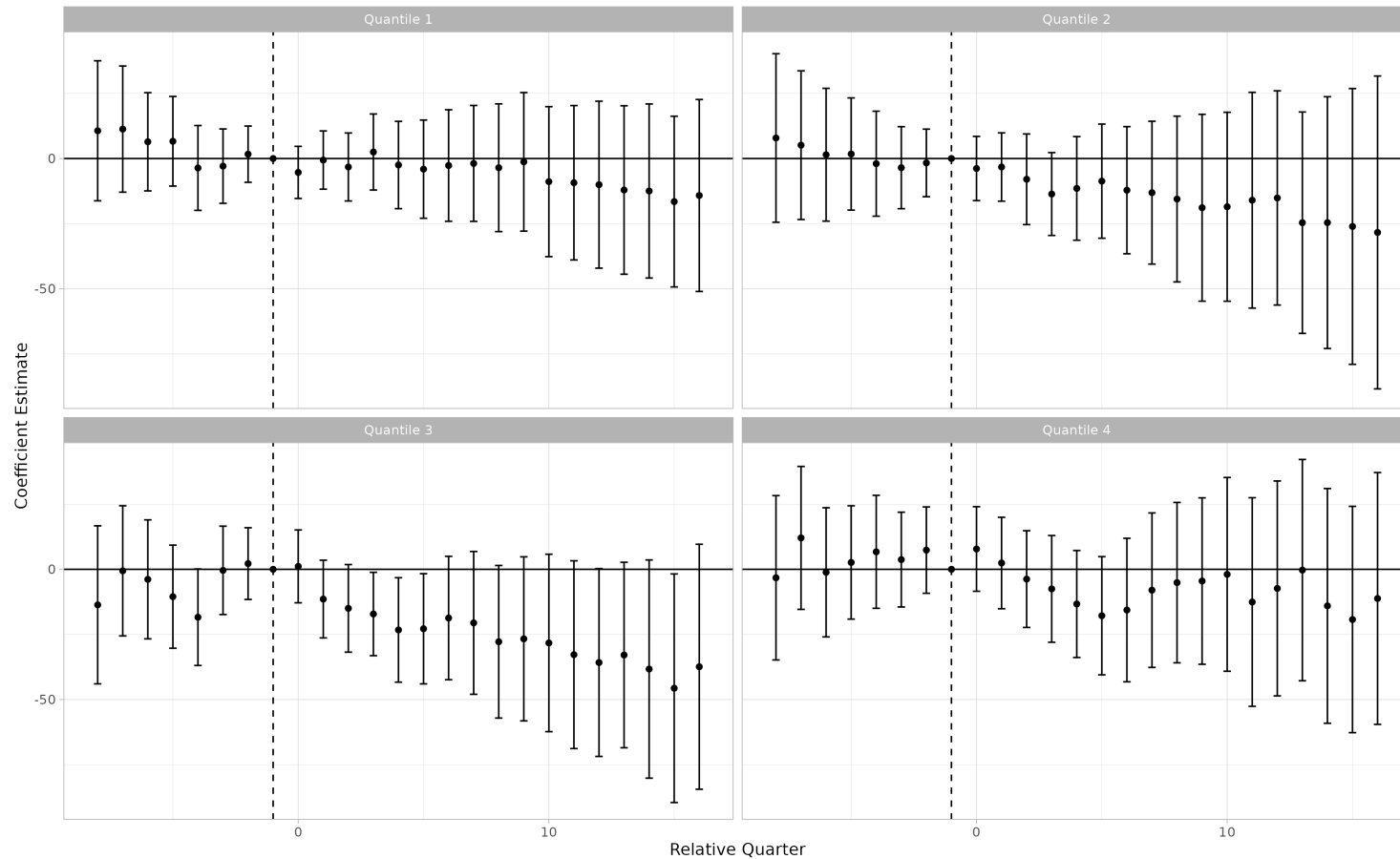
Figure A.22: Dollar Store Log Total Food Expenditure by Income



*Notes:* Figure reports event study estimates with 95% confidence intervals from Equation 5, using 2008-2019 Homescan data. The analysis uses a heterogeneity-robust estimator proposed by Callaway and Sant'Anna (2021). Observations are not weighted for national representativeness. Errors are clustered at the zipcode level. Income Rank 1 is the lowest income, Rank 4 is the highest income.

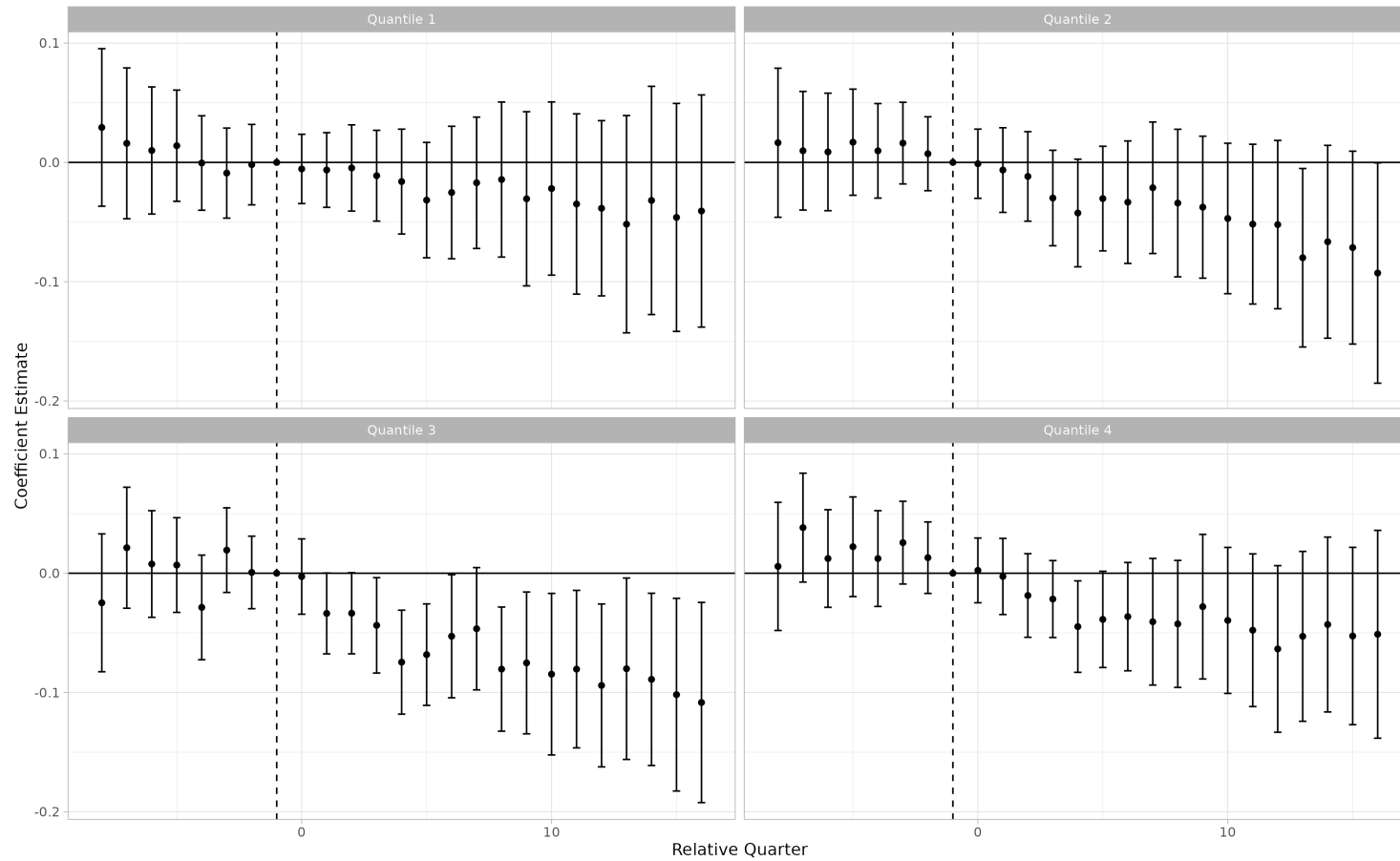


Figure A.23: Grocery Store Log Total Food Expenditure by Income



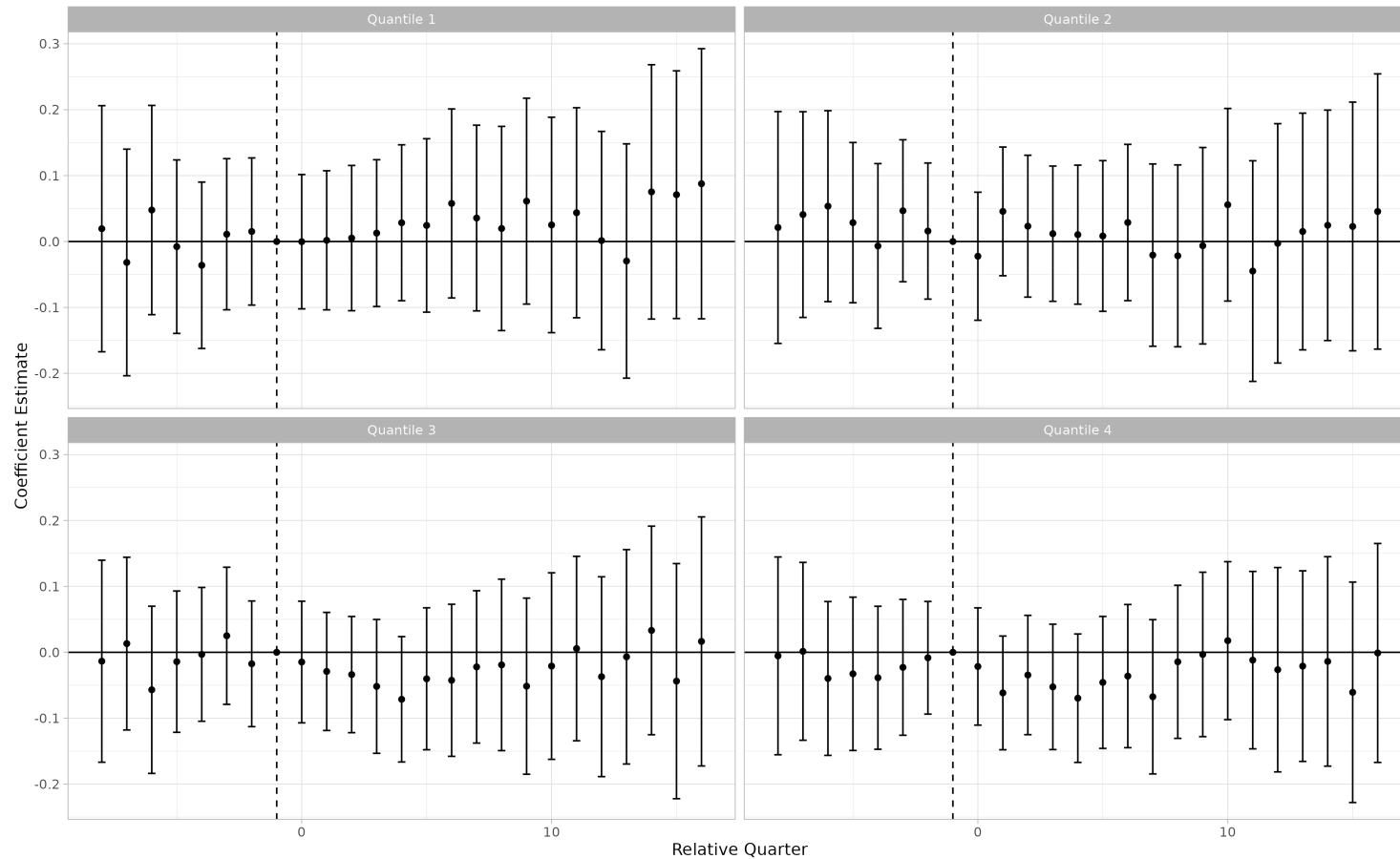
Notes: Figure reports event study estimates with 95% confidence intervals from Equation 5, using 2008-2019 Homescan data. The analysis uses a heterogeneity-robust estimator proposed by Callaway and Sant'Anna (2021). Observations are not weighted for national representativeness. Errors are clustered at the zipcode level. Income Rank 1 is the lowest income, Rank 4 is the highest income.

Figure A.25: Log Number of Unique Varieties by Income



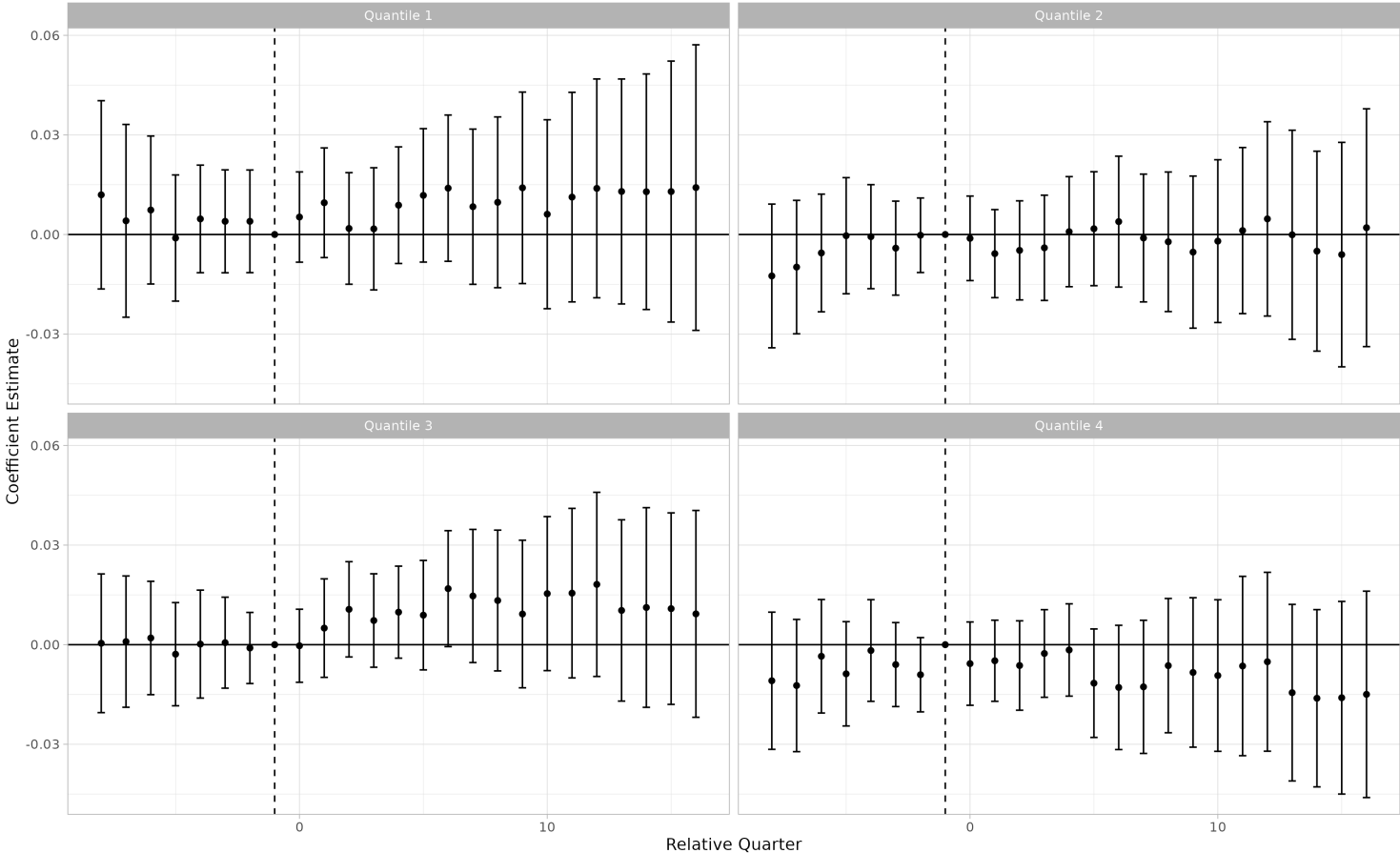
Notes: Figure reports event study estimates with 95% confidence intervals from Equation 5, using 2008-2019 Homescan data. The analysis uses a heterogeneity-robust estimator proposed by Callaway and Sant'Anna (2021). Observations are not weighted for national representativeness. Errors are clustered at the zipcode level. Income Rank 1 is the lowest income, Rank 4 is the highest income.

Figure A.26: Log Quantity of Fresh Produce by Income



*Notes:* Figure reports event study estimates with 95% confidence intervals from Equation 5, using 2008-2019 Homescan data. The analysis uses a heterogeneity-robust estimator proposed by Callaway and Sant’Anna (2021). Observations are not weighted for national representativeness. Errors are clustered at the zipcode level. Income Rank 1 is the lowest income, Rank 4 is the highest income.

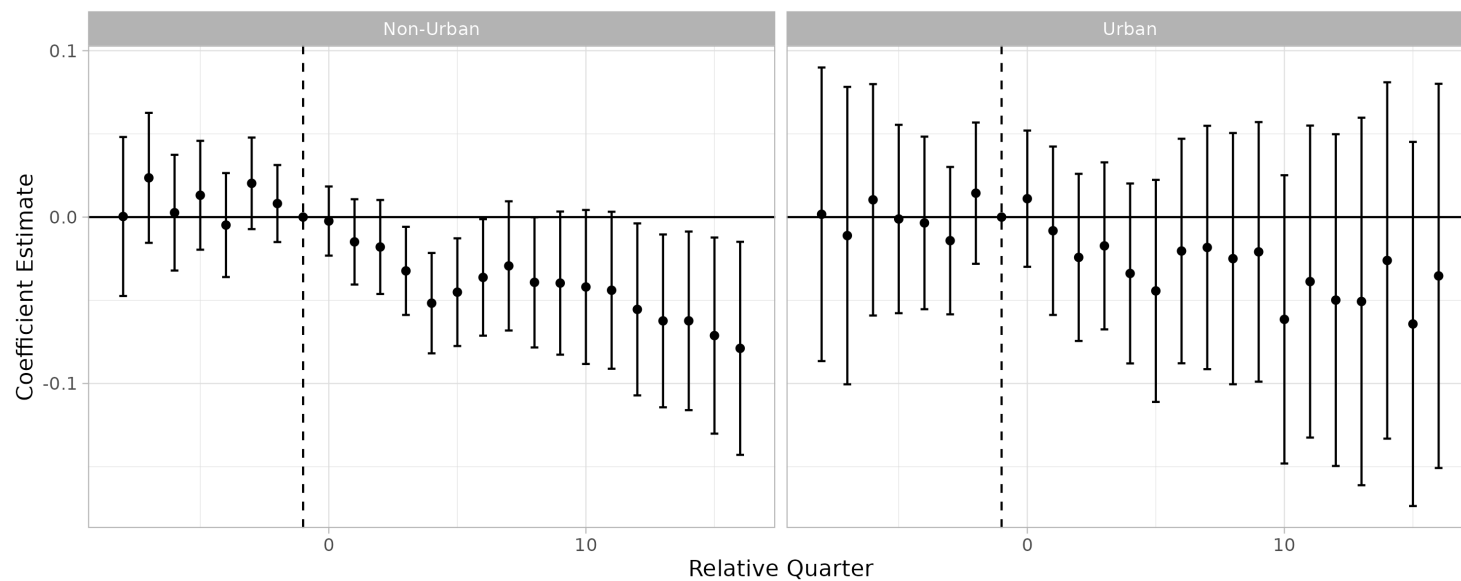
Figure A.24: Log Relative Price Index by Income



Notes: Figure reports event study estimates with 95% confidence intervals from Equation 5, using 2008-2019 Homescan data. The analysis uses a heterogeneity-robust estimator proposed by Callaway and Sant'Anna (2021). Observations are not weighted for national representativeness. Errors are clustered at the zipcode level. Income Rank 1 is the lowest income, Rank 4 is the highest income.

## A.2.5 The Effect of Dollar Store Entry by Urban and Non-Urban Group

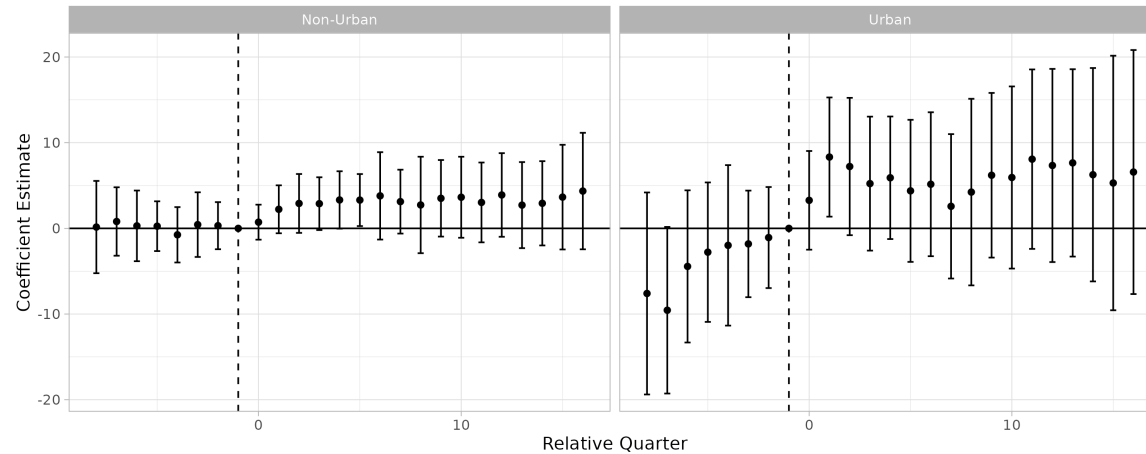
Figure A.27: Log Total Expenditure for Non-Urban and Urban



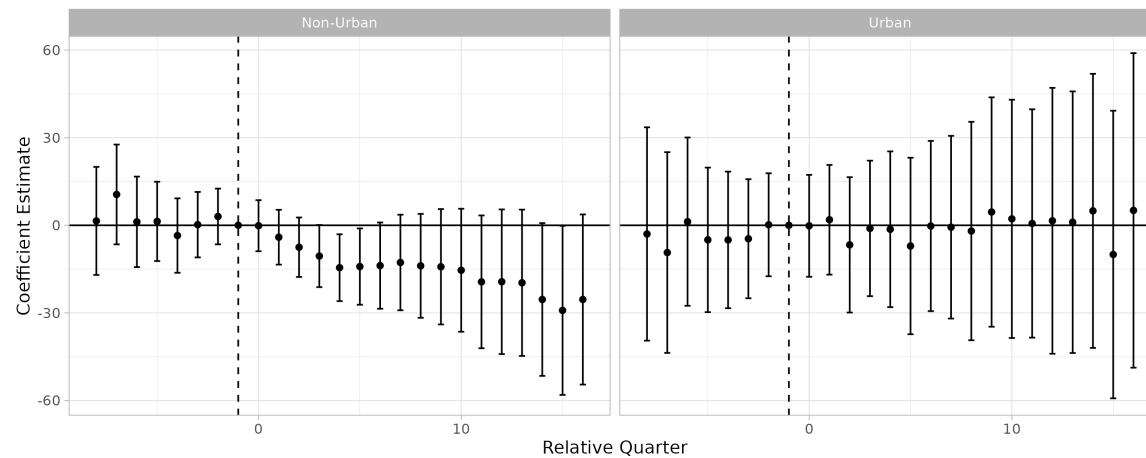
*Notes:* Figure reports event study estimates with 95% confidence intervals from Equation 5, using 2008-2019 Homescan data. The analysis uses a heterogeneity-robust estimator proposed by [Callaway and Sant'Anna \(2021\)](#). Observations are not weighted for national representativeness. Errors are clustered at the zipcode level.

Figure A.28: Heterogeneity by Non-Urban and Urban Households

(a) Dollar Store Total Expenditure



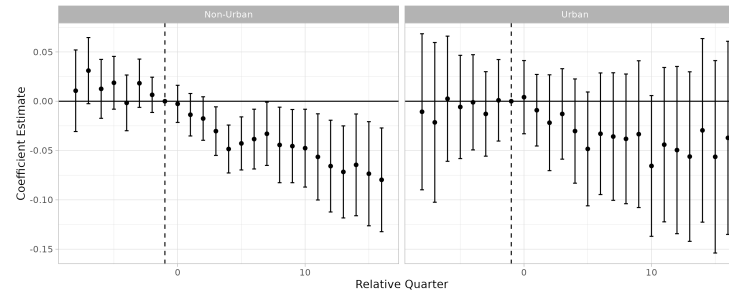
(b) Grocery Store Total Expenditure



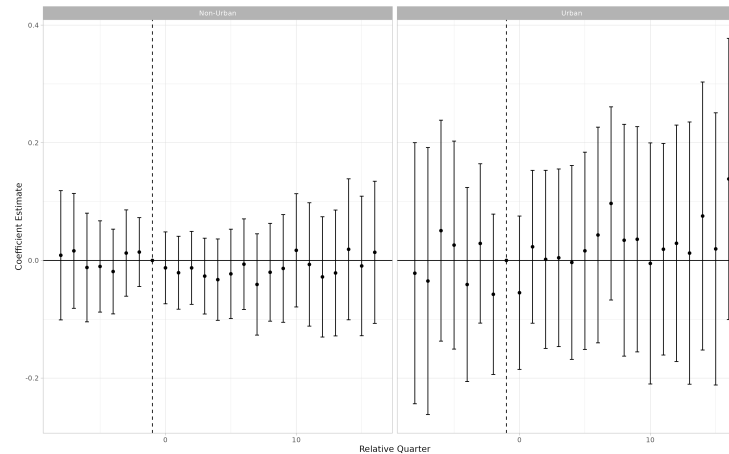
*Notes:* Figure reports event study estimates with 95% confidence intervals from Equation 5, using 2008-2019 Homescan data. The analysis uses a heterogeneity-robust estimator proposed by [Callaway and Sant'Anna \(2021\)](#). Observations are not weighted for national representativeness. Errors are clustered at the zipcode level.

Figure A.29: Heterogeneity by Non-Urban and Urban Households

(a) Log Number of Unique Varieties



(b) Log Quantity of Fresh Produce



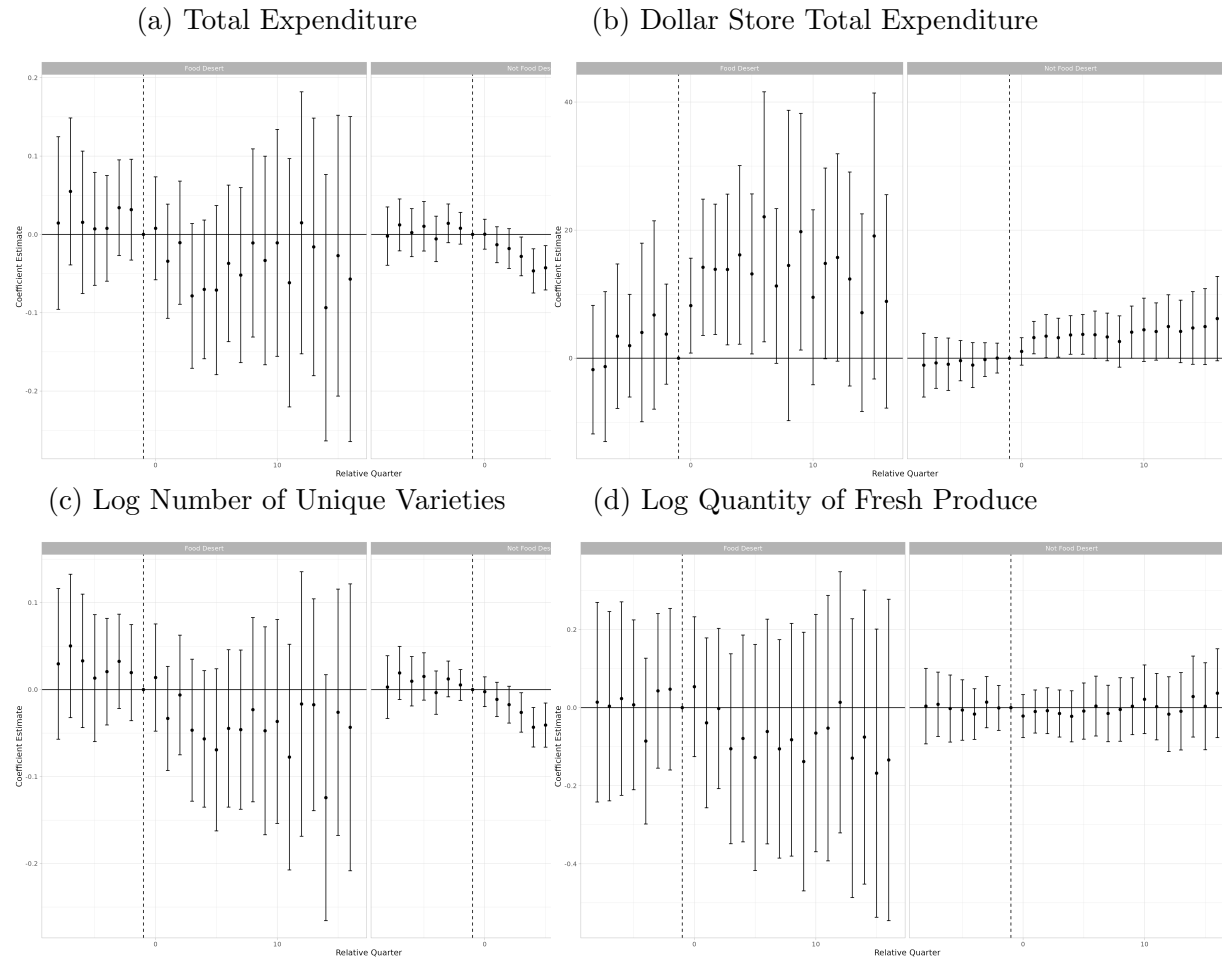
Notes: Figure reports event study estimates with 95% confidence intervals from Equation 5, using 2008-2019 Homescan data. The analysis uses a heterogeneity-robust estimator proposed by Callaway and Sant'Anna (2021). Observations are not weighted for national representativeness. Errors are clustered at the zipcode level.





## A.2.6 The Effect of Dollar Store Entry by Food Desert vs Non Food Desert

Figure A.30: Heterogeneity by Food Desert and Non-Food Desert



*Notes:* Figure reports event study estimates with 95% confidence intervals from Equation 5, using 2008-2019 Homescan data. The analysis uses a heterogeneity-robust estimator proposed by Callaway and Sant’Anna (2021). Observations are not weighted for national representativeness. Errors are clustered at the zipcode level.