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Dollar stores, retailer redlining, and the metropolitan geographies of precarious consumption

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Abstract

For the last twenty years, scholarly research has relied primarily on food deserts as a way to frame geographic disparities in access to healthy foods. The results of this research have been empirically mixed, and the term itself has been critiqued as apolitical. Using the alternative framing of retailer redlining, I analyze the rapid growth of dollar stores in 27 metropolitan areas in the United States. Locations for these stores increased by 62% nationally during this time period, an expansion that was consistent in all regions of the country. Using descriptive statistics, cross-sectional, and first-difference models, I analyze how neighborhoods' racial makeup was associated with changes in dollar store proximity, controlling for household income, population, and overall retailer density. This analysis shows that proximity to dollar stores is highly associated with neighborhoods of color even when controlling for other factors. This result highlights how the growth of dollar stores and similar spaces designed for economically precarious households both reflect and, potentially, contribute to long histories of racial exclusion.

Keywords: Dollar stores, retail redlining, precarity, food access

Over the last decade, dollar stores have become a fixture of the American retail landscape. The number of U.S. locations for the three major dollar store chains—Dollar General, Dollar Tree, and Family Dollar—increased 62% between 2008 and 2018 to nearly 30,000 locations ("Reference USA" 2020). A recent report by the Institute for Local Self-Reliance (ILSR) resulted in more popular attention to this trend (Donahue and Mitchell 2018), and multiple localities have developed ordinances regulating or prohibiting the new stores (Aubrey 2019). These stores offer a range of inexpensive goods, from housewares to food items, in a small retail footprint that fits well in both small rural communities and dense urban neighborhoods. Yet detractors suggest they price out locally owned businesses and profit by selling unhealthy foods and poorly made goods to economically marginalized populations.

Despite their rapid growth, only a few scholarly articles have examined the impact of these stores or the quality of the goods they sell (Racine et al. 2016; Caspi, Pelletier, et al. 2017). In terms of food access, these stores could be grouped with other small retailers (pharmacies, gas stations, or corner stores), but they offer a wider array of foods than these retailers. At the same time, dollar stores offer fewer healthy foods than a small grocery or ethnic market. More broadly, the growth of dollar stores mirrors larger economic trends tied to economic precarity for many households, including the rise of flexible employment, increased housing and healthcare costs, and wage stagnation (Waite and Lewis 2017; Coe 2013). These stores provide low-cost goods that meet immediate needs, but in doing so they may simply make precarity more socially palatable.

This paper contributes to research on this growing trend by analyzing the locational strategies evident in dollar store expansion. I analyze the growth of dollar stores in 27 metropolitan areas across the United States using a longitudinal dataset of retailers authorized to redeem benefits for the Supplemental Nutrition Assistance Program (SNAP, formerly known as food stamps). Using both cross-sectional and first-difference models, I assess the extent to which these retailers target communities of color while controlling for neighborhood economic characteristics. Dollar stores may meet immediate needs for economically and socially marginalized households in areas with few retail options. Moving beyond the food desert framing and drawing on past work on food access and retail redlining, I argue that as spaces of precarious consumption, dollar stores reflect and, arguably, reinforce long histories of racial segregation and economic extraction.

Background

Measuring food access

Widespread geographic interest in analysis of food environments dates to the early 2000s, when the concept of food deserts was popularized (Wrigley 2002; Cummins and Macintyre 2002). Drawing from broader work on social ecology (Stokols 1992) and analysis of retail trends in economic geography (Guy 1996), researchers used the term "food desert" to describe neighborhoods with limited geographic access to healthy, affordable, and culturally appropriate foods (see also USDA Economic Research Service 2009).

Subsequent research on food deserts has used two primary approaches: market basket studies tracking the quality and price of specific goods (Breyer and Voss-Andreae 2013; Block and Kouba 2007) and spatial analysis of store types across a given study area (Zenk, Schulz, and Israel 2005; Liadsky and Ceh 2017; Yan, Bastian, and Griffin 2015). One commonly used measure of food access, the United States Department of Agriculture's (USDA) Food Access Research Atlas, relies solely on the latter approach, combining distance measures—miles to the closest supermarket—with census poverty figures to identify low-income, low-access census tracts (USDA Economic Research Service 2014). Research commonly uses modeling to assess the relationship between these access measures and health outcomes, most often obesity rate. Food deserts have become part of the popular lexicon in discussions of food accessibility, most notably as a policy focus in the U.S. Farm Bill and related research (Ploeg et al. 2012; USDA Economic Research Service 2009).

Despite this, some academic researchers and community activists have been critical of both the empirical validity and theoretical framing of food deserts (Brones 2018a; Widener 2018). Empirically, this research has been conducted mostly in urban areas in the United States, Canada, and the United Kingdom, raising questions about its broader applicability, especially outside the global north (Black, Moon, and Baird 2014; Battersby 2012). Most studies have found little association between measured supermarket proximity to place of residence and dietary related health problems (Lee 2012; Caspi et al. 2012). As policy initiatives have supported new food options in low-access areas, research on shopping options and health outcomes have shown these new stores to have a minimal effect on both shopping habits and diet (Cummins, Flint, and Matthews 2014; Ghosh-Dastidar et al. 2017; Liadsky and Ceh 2017).

In response, food access research has increasingly turned to data on household shopping habits and daily mobility (Vaughan et al. 2017; Colón-Ramos et al. 2018; Chrisinger et al. 2018; Shannon 2015; Widener & Shannon 2014) Using both qualitative and quantitative data, these studies have focused on the ways individuals navigate the food options they encounter, an approach that can highlight the active decision-making individuals utilize even in the face of limited options (Reese 2019; Shannon 2015) and the complexity of factors shaping food shopping decisions (Craven 2017).

At a conceptual level, the metaphor of a desert for food environments is also problematic. It relies on a neoliberal framing of neighborhood food environments, treating them as natural features that emerge through depoliticized market activity. At the same time, as Reese (2019) notes, the desert metaphor implies absence, a deficit oriented approach that stigmatizes low-income communities of color, erases memories of now shuttered local businesses and ignores residents' existing efforts to resist exploitative policies. The geographically bounded nature of food deserts frames low-access neighborhoods as aberrations in an otherwise healthy landscape, problems solved through cooperation with major supermarket chains, rather than a result of the decades-long consolidation of power among these corporate actors (Shannon 2014).

Recognizing both the empirical and conceptual limitations of research on food deserts, multiple alternatives have been suggested. The term "food swamp" is one attempt to reframe the issue, analyzing the density of retailers offering primarily unhealthy foods. This metric has a stronger empirical association with poor health outcomes (Hager et al. 2017; Cooksey-Stowers, Schwartz, and Brownell 2017). Yet the continued use of an ecological metaphor deflects attention from systemic factors (Guthman 2011). Other authors have emphasized the historical and political processes that produce vulnerable neighborhoods, situating them within larger racialized inequalities inherent to both urban development and industrialized food production (McClintock 2011; A. H. Alkon and Agyeman 2011). Karen Washington, for example, has suggested the term food apartheid be used to describe the ways that conventional food system actors profit from the labor and social marginalization of people of color, from farm labor practices through segregated landscapes of food consumption (Brones 2018b). This term highlights the continuity of exploitative practices along the food system and the active role of both policy and institutional actors in producing and maintaining them.

Along a different axis, some authors have used *supermarket redlining* as a way to highlight how inequitable food access aligns with broader patterns of uneven urban development, particularly housing. Eisenhauer (2001) was the first to use this term in academic research, though she notes that was originated by the U.S. Conference of Mayors in the early 1990s. A handful of other authors have used it in the years since (Zhang and Ghosh 2016; Shannon, 2016; D'Rozario and Williams 2005). Historically, redlining refers to geographically based restrictions on home loans common in the mid-20th century, metrics that often used neighborhood racial composition as a deciding factor (Jackson 1987; Hillier 2003). Redlining was one main driver of white flight and suburbanization in the United States during this period (Kruse 2013), and informal versions of these practices continued through the Great Recession (M. B. Aalbers 2014). Supermarkets also became the dominant source for food provisioning during the mid-twentieth century, as their large footprints fit well in emerging, sprawling suburban landscapes (Deutsch 2010). If redlining as a metaphorical process describes policies that implicitly and explicitly support racialized patterns of investment and residential segregation, its use to describe inequities in access to food retailers highlights both the historical connection between suburbanization and supermarkets' retail dominance and the active role of retailers in financially investing in or divesting from neighborhoods based on their sociodemographic composition.

Framing disparities in geographic access to food as supermarket redlining resists the depoliticized metaphor of food deserts or food swamps. It questions language that frames food environments as shaped primarily by the workings of the free market, focusing instead on the ways that corporate food retailers and financial actors are complicit in producing and maintaining inequitable access to major food sources using race as a determining factor. Past research in economic geography has analyzed store locational strategies, noting the influence of factors such as distribution centers (Graff, 2006), cross-sector retail clustering (Ó hUallacháin & Leslie, 2013), or household economic conditions (Rice, Ostander, & Tiwari, 2016). Yet by failing to also include racial segregation and policies that maintain it, these analyses neglect a deeply formative aspect of urban development in the United States. Indeed, through platforms such as ESRI's Business Analyst (ESRI 2018), corporations have easy access to census and other demographic data that includes racial and other non-economic variables. A focus on supermarket redlining explicitly acknowledges past and current practices of racial segregation and the demographic landscapes they have helped create.

Redlining is not a perfect conceptual fit for the expansion of dollar stores and other fringe financial institutions. Its focus on disinvestment is similar to the deficit-focused language of food deserts. In the case of supermarkets, this disinvestment is evident in both site selection and in-store factors including food prices, food quality, and amenities. In contrast, dollar stores may choose to expand specifically *into* low-income communities of color. Still, the bifurcated retail landscape formed through these contrasting locational strategies is symptomatic of a logic mirroring that of redlining: economic exclusion and extraction based on neighborhoods' racial classification.

Indeed, research on exploitative retail practices shows how retailers and financial institutions contribute to neighborhood stigmatization and reinforce racialized patterns of disinvestment. David Caplovitz's *The Poor Pay More* (1967) famously identified the ways that retailers in low-income neighborhoods extracted wealth through high rates of interest and inflated prices. Research on fringe financial institutions such as check-cashing businesses has identified similar trends (Caskey 1994; Gallmeyer and Roberts 2009; Hegerty 2019). As one example, Faber (2018) identified a strong positive association between new check-cashing outlets and foreclosures in New York City in the years following the Great Recession, suggesting that these locations capitalized on the economic precarity of nearby residents. Research on predatory lending in the years surrounding the Great Recession has documented the devastating impact of subprime loans (Squires 2006 are two of many examples; M. Aalbers 2009).

Past research has documented the financial exploitation of low-income households, but the impact is also psychological. In the case of food retail, Ashantè Reese (2019) describes the absence experienced by neighborhood residents when seeing empty or repurposed storefronts in locations that were once vital retail environments. Similarly, a study of minority consumers in "restricted choice environments" found that study respondents expressed "diminished self-esteem, and reduced self-autonomy" as a result of diminished choices. These authors continue, "Racial and ethnic minorities also describe the experience of felt discrimination, in which they attribute their systemic restrictions to their race/ethnicity" (Bone, Christensen, and Williams 2014, 470). The growing body of work in black geographies has consistently framed systematic devaluation and plantation economies as a fundamental component of racial capitalism (Pulido 2017; Robinson 2000; McKittrick 2013). A focus on retail redlining highlights how the investment of dollar stores and similar sites in economically and socially marginalized neighborhoods can play a role in this devaluation by supporting and inscribing racial and economic difference.

Dollar Stores and spaces of precarious consumption

The focus of this article is specifically on dollar stores, which I define as comprised of three major chains: Dollar General, Dollar Tree, and Family Dollar. Locations for these three stores have grown dramatically within the United States in the years following the Great

Recession. A national count of locations in the secondary database Reference USA shows a rapid increase, from 18,090 in 2008 to 29.301 in 2018 (“Reference USA” 2020).

Few researchers have examined the growing prevalence of dollar stores, but as a report from the Institute of Local Self-Reliance suggests, their increase is similar to the growth of big-box retailers such as Walmart, which focused on low-prices on a wide variety of goods (Donahue and Mitchell 2018). Although smaller in size, dollar stores focus on a similar demographic profile. One executive for Dollar General described core customers as “living paycheck to paycheck” and reliant on government assistance (Zoellner 2018). One report found that 30% of Dollar General’s customers earn less than $25,000 per year, compared to just 23% of Walmart’s (Wahba 2019). Compared to big-box retailers, dollar stores can be built both quickly and cheaply, and they focus on the “micro needs” of consumers—single items at low prices—rather than the bulk purchasing common at wholesalers such as Sam’s Club or Costco (Zoellner 2018). In that sense, dollar stores provide just-in-time shopping, the items needed only for today at an affordable price. Some big-box retailers have adopted a similar strategy, and the more prominent example is Walmart’s Neighborhood Market model, which in January 2020 comprised 15% of their retail locations (Walmart 2020). A related format, Walmart Express, was discontinued in 2016, and Dollar General purchased several of these locations after their closure (Malcolm 2016).

A growing number of municipalities around the country have created restrictions around dollar stores, in some cases banning them entirely (Aubrey 2019; Malanga 2019). Supporters of these measures cite the abundance of nutritionally poor foods in these retailers and their association with low-income consumers (Meyersohn 2019). Dollar stores, opponents argue, can either crowd out locally owned businesses or act as poor replacements for shuttered supermarkets (Donahue and Mitchell 2018). Dollar stores are thus often treated as indicative of and contributors to community decline, contributing to neighborhood stigmatization and providing limited economic or health benefits to their communities.

Dollar stores directly address the rising economic precarity of many households. Within geography and other social sciences, precarity is most often used to describe tenuous employment conditions, whether in low-wage labor such as the service industry, the rising sharing economy of services such as Uber, or informal labor done by migrant workers (Waite and Lewis 2017; Coe 2013). Also, neoliberal reforms to the welfare state and increasing costs for housing and healthcare have contributed to the fundamental instability faced by many households (Casas-Cortés 2014). Dollar stores are thus emblematic of what I term *spaces of precarious consumption*, sites that allow for and sustain the persistent precarity of their customers. These spaces also include the fringe financial institutions described above along with related spaces such as food pantries or flea markets (Lambie-Mumford and Green 2017; Dickinson 2017). By focusing on precarious consumers, executives and shareholders benefit from the racialized exploitation of labor. Dollar General alone reported over $25 billion in revenue in 2018 and Dollar Tree (which announced the purchase of Family Dollar in 2014) reported $22 billion, with a 30% gross profit margin (Wahba 2019; Dollar Tree 2019).

To better understand the growth of these retailers, this article analyzes the growth of dollar stores across 27 major metropolitan areas across the United States. I analyze the expansion of these stores across an eight-year time period, from 2008 to 2015, using data on specific locations from the United States Department of Agriculture. Through both descriptive statistics and statistical modeling, this research connects the expansion of each dollar store chain to both racial segregation and economic change during this time period. Specifically, I use this analysis to identify how each dollar store chain is associated with certain regions of racially and economically segregated metropolitan landscapes. In doing so, this research suggests how the growth of dollar stores reflects and reinforces these divisions.

Methods and data

Study Area

My analysis focuses on the three largest metropolitan statistical areas (MSAs) in each of the nine U.S. Census defined divisions (U.S. Census Bureau, n.d.). Within these selected MSAs (see Table 1), I analyze how the three major dollar store chains—Dollar General, Dollar Tree, and Family Dollar—differ in their locational strategies across varied, dense, and often highly segregated residential landscapes. The stratification across census divisions controls for regional differences in urban form and composition. Similarly, including the three largest metropolitan areas in each region is meant to capture effects across a geographically diverse array of metropolitan landscapes.

The MSAs included in the analysis are shown in Table 1. For ease of display, the figure displays only the name of each MSA's largest city instead of the formal MSA title. According to the 2013-2017 American Community Survey, these metropolitan areas are home to 128.3 million individuals. These MSAs ranged in size from the New York-Newark-Jersey City MSA, with a population of 20,031,443 individuals, to Omaha-Council Bluffs, with 904,834. The median MSA (Detroit-Warren-Dearborn) had a population of 4,296,731. Overall, these areas include most major regions of the country except the Pacific Northwest, and both rapidly growing areas such as Atlanta and Phoenix along with cities associated with urban decline such as Detroit and Saint Louis.

East North Central	**Mountain**	**South Atlantic**
Chicago, IL	Phoenix, AZ	Washington, DC
Detroit, MI	Denver, CO	Miami, FL
St. Louis, MO	Las Vegas, NV	Atlanta, GA
East South Central	**New England**	**West North Central**
Nashville, TN	Boston, MA	Minneapolis, MN
Memphis, TN	Providence, RI	Kansas City, MO
Louisville, KY	Hartford, CT	Omaha, NE
Middle Atlantic	**Pacific**	**West South Central**
New York, NY	Los Angeles, CA	Dallas, TX
Philadelphia, PA	San Francisco, CA	Houston, TX
Pittsburgh, PA	Riverside, CA	San Antonio, TX

Table 1: Metropolitan areas included in this research

Demographics and Mixed Metro Neighborhood Classifications

In addition to measures of store proximity, I also use three variables derived from the American Community Survey (ACS) from the U.S. Census for census tracts in selected MSAs: population density (calculated using population estimates and land area), percentage of the population classified as living in poverty, and percentage of the population living in households with annual incomes greater than $150,000. These variables capture related but not necessarily overlapping economic neighborhood characteristics. I include population density as a control for the outcome variable, store proximity. When tested, I found no evidence of multicollinearity between these variables.

ACS estimates are generally pooled across a five-year period. Using the midpoint of each five-year period as a reference point, I use data from the 2006-2010 ACS (used for 2008) through the 2013-2017 estimates (used for 2015). I control for overlap in these pooled samples by further choosing a subset of years for cross-sectional (2008, 2011, and 2015) and first-difference (2011 and 2015) models.

To assess the racial segregation of census tracts in this study, I adapt the methodology used by Holloway, Wright, and Ellis (2012) for their Mixed Metro classification system. Working from census variables related to race, this research classifies census tracts using two criteria, the most prevalent racial classification and the overall diversity of the census tract. More specifically, the algorithm used to develop neighborhood classifications calculates the rate of each racial and ethnic classification at tract level and combines it with a measure of overall entropy, which indicates the diversity of racial groups present within that tract. I adapted this algorithm for the R software package and use it to identify the racial categorization of tracts using ACS data for the years referenced above. The racial classifications in this system are derived from tables provided by the National Historical GIS (NHGIS) database (Manson, n.d.) showing both race and status as Hispanic/Latino. The “Asian” classification combines the Asian and Native Hawaiian/Pacific Islander categories, and the “Other” classification combines those selecting “Some other race” with those selecting two or more races. The original schema disaggregated multiracial individuals, but as NHGIS reports these as a single group (“Two or more races”), I added this count to the “Other” group, similar to Catney, Wright, and Ellis (2019). For cross-sectional models, I prefer the Mixed Metro classification system as it more holistically describes the demographic composition of each tract, identifying the majority group while also including a measure of overall diversity. As a result, it provides greater analytical and explanatory clarity in model results.

Table 2 shows the count of tract classifications using this index for each year in the study period. The most common classification throughout was White, moderate diversity (n=9,807 in

2015), and the second most common was White, low diversity (6,815 in 2015). Several classifications were used for very few tracts including both Native American categories and Other, both moderate and low diversity.

Classification	2008	2009	2010	2011	2012	2013	2014	2015
White, low diversity	8,390	8,083	7,819	7,601	7,374	7,156	7,008	6,815
White, moderate diversity	9,220	9,377	9,490	9,594	9,660	9,748	9,733	9,807
Latino, Low diversity	1,311	1,315	1,340	1,327	1,360	1,333	1,361	1,362
Latino, moderate diversity	3,569	3,639	3,689	3,724	3,758	3,837	3,865	3,918
Black, low diversity	1,727	1,680	1,673	1,613	1,580	1,538	1,516	1,489
Black, moderate diversity	1,735	1,778	1,767	1,813	1,838	1,855	1,873	1,874
Asian, low diversity	23	22	25	23	25	24	26	31
Asian, moderate diversity	555	572	570	587	606	633	650	664
High diversity	1,361	1,424	1,516	1,611	1,692	1,771	1,863	1,932
Native American, low diversity	3	3	4	2	2	2	2	2
Native american, moderate diversity	2	2	1	3	4	3	3	3
Other, low diversity	1	1	1	-	-	-	-	-
Other, moderate diversity	4	5	6	3	2	1	1	4

Table 2: Mixed metro tract classification by year in selected metro areas

Dollar stores, USDA SNAP-authorized retailers, and store proximity measures

This analysis uses locational information on all SNAP-authorized food retailers provided by USDA (personal communication, August 11, 2016). Retailers become SNAP authorized through filing an application with the USDA and stocking at least a modest variety of staple foods (dairy, grains, produce, and meats) (USDA 2016). These data are publicly available through the USDA website or, in the case of historical data, through an email request, and our records begin in 2008. My analysis focuses only on the years 2008 through 2015 to match available data from the ACS. I identify dollar stores by name, with 16,019 locations for Dollar General, 6,384 for Dollar Tree, and 9,888 for Family Dollar. Most locations were already geocoded by USDA, but I geocoded locations without coordinates using ESRI's ArcGIS software package or manual matching. The full dataset is available at an online, public data repository (https://github.com/jshannon75/metrodollars).

As these retailers focus on low- and moderate-income individuals, almost all are SNAP authorized, but this is not universal. For example, strict stocking requirements in Minneapolis prompted a handful of Dollar Tree stores to drop their SNAP authorization (Golden 2016). The rate of SNAP authorization also changed across the period. In 2008, USDA's records include 12,187 locations for all three chains compared to a count of 18,090 records in the *Reference USA* commercial database when searching by store name (see Table A1 in the appendix). However, this gap narrows to only 600 records in 2010 and the two databases are roughly equal after that point. Most of the early discrepancy is also concentrated in Family Dollar (38% SNAP authorized in 2008) and Dollar Tree (45% SNAP authorized) locations. This uptick in authorization rates would match patterns found in other small retailers during this period (Shanon et al., 2018). I use USDA data in this research since it is equivalent to commercial data for most of the study period and can be publicly shared, but I begin my longitudinal analysis in 2011.

I also used these SNAP retailer data to measure the neighborhood store environment. USDA groups retailers into one of 17 store categories. In this analysis, I was interested in eight of these, shown in Table 3. For analytical clarity, I grouped these categories for into three classifications: supermarkets (n=50,292), grocers (n=67,501), small retailers (n=293,820). Most dollar stores are classified as combination grocery/other by USDA, part of the small retailer category. To assess the role of overall store environment on dollar store locations, I analyzed the locations of supermarkets and grocers, since, as described above, dollar stores are often assumed to drive out and/or replace these retailers. While USDA's list of retailers does not include all stores, retailers become SNAP-authorized to draw the same low to moderate-income households that are a core demographic for dollar stores.

USDA classification	**Analytical group**
Large Grocery Store	Grocer
Medium Grocery Store	Grocer
Small Grocery Store	Grocer
Combination Grocery/Other	Small retail
Convenience Store	Small retail
Super Store	Supermarket
Supermarket	Supermarket
Wholesaler	Supermarket

Table 3: USDA retailer classifications

To measure the distribution of stores across MSAs, I calculate the population-weighted average distance to the closest retailer for each of the three dollar-store chains and for SNAP-authorized supermarkets and grocers. I first calculate the Euclidean distance from the centroid of each census block within selected MSAs to the closest location of a retailer for the relevant category using the nngeo package in R software. Euclidean distances are used for computational efficiency and because the distance metric is used to assess neighborhood density and not consumers' travel time. I also calculated distances to the second through fifth closest store, but the findings using these measures were very similar to those from the closest store and are not included in subsequent analysis.

I then average these distances at the census tract level, weighting by population. This controls for industrial or other areas with little residential development. This averaging was done using the following formula:

$$wd_t = \frac{\sum(d_{bt} \times p_{bt})}{\sum p_{bt}}$$

Here, wd_t is the weighted distance in tract t, d_{bt} is the distance to closest retailer in block b in tract t, and p_{bt} is the population of block b in tract t based on 2010 Census data. These weighted distances are calculated for each retailer type in each of the 10 years included in our sample. The resulting metric provides a continuous measure of the retail environment at a fine scale over the study period.

Descriptive analysis and statistical models

An initial round of descriptive analysis uses visualization to understand chain growth across census regions and changing store proximity across Mixed Metro classifications. To control for regional differences, household income, population density, and retail density, I use two regression modeling techniques. First, I use repeated cross-sectional mixed-effect models to identify shifting associations between neighborhood racial composition and store proximity for all stores and by chain. These models provide a snapshot for each of these three years: 2008, 2011, and 2015. These years represent the beginning and endpoints of the data, and 2011 is both a midpoint and point at which the count of stores in USDA retailer data begins to consistently match the counts found on Reference USA. The independent variables for this model include the Mixed Metro classifications; poverty rate, the rate of high-income (>$150,000) households, distance to the closest SNAP-authorized supermarket and grocery, and population density (used as a control variable). This mixed-effects model includes the MSA of each tract as a random effect to control for differences across metropolitan areas such as overall urban form and regional differences in chain concentration. The dependent variable is the distance to the closest location of the relevant dollar store category, which is logged as it is positively skewed. These mixed-effects models are created using the lmer function from the lme4 package in R. This linear mixed-effect model can be described by the following equation (Snijders and Bosker 2011):

$$Y_{ij} = \gamma_{00} + \gamma_{10}x_{1ij} \ldots + U_{0j} + R_{ij}$$

Here, Y_{ij} refers to the observed dependent variable for census tract i in MSA j, γ_{00} is the model intercept, γ_{10} is the regression coefficient for independent variable x_1 for the census tract, U_{oj} is the random effect of MSA j, and R_{ij} is the residual for the census tract. I calculate the intra-class correlation (ICC) for each model to assess whether a mixed-effect was warranted (Sommet and Morselli 2017). The values range from 0.04 to 0.79, with values closer to 1 indicating greater clustering within MSAs. Nine of the twelve models have values higher than 0.3, and four of the twelve have values higher than 0.5, This indicates that mixed-effects models are warranted, as metropolitan area clustering is present for at least some store chains and years.

Second, I use a first-difference model to understand effects within tracts across the study period. These models use the change of values for each variable across two years, providing a control for unobserved characteristics in each tract such as location within the metropolitan area (Allison 2009). Compared to cross-sectional models, first-difference models provide stronger evidence of associations or even causal connections between model variables. Generally, these models show the association of a change in each independent variable with a change in the dependent variable. Because the spread of these stores also appears to have had significant variation between regions and metros, this model also includes a random effect for the tract MSA. More specifically, this model is constructed in the following way:

$$\Delta dist_{ij} = \beta_1 \Delta var_{1ij} + \beta_2 \Delta var_{2ij} \ldots + U_{0j} + R_{ij}$$

Here, $\Delta dist_{st}$ refers to the change in distance to store chain *s* in tract i in census tract j, Δvar_{xij} is the change in value for variable x in the tract, β_x is the parameter estimate for variable x. The ICC for the Closest store model is low (0.05), but the store-specific models are much higher: 0.53 for Family Dollar, 0.93 for Dollar General, and 0.94 for Dollar Tree. This reflects the highly regional nature of store growth for these chains.

For this analysis, I calculate the change in variable values between 2011 and 2015, using 2011 as the point at which USDA SNAP retailer data becomes most reliable. The census variables do include one overlapping year of sample data (2013), which is a potential limiting factor in results. The categorical variable provided through the Mixed Metro approach for demographic composition is not well suited for first-difference models, as the vast majority of tracts (83%) did not change classification during the time period. As a result, I use the rates of racial classification in these models: percent classified as African-American, Asian American, and Hispanic. The rate of residents classified as White is excluded due to multicollinearity, but it effectively acts as a reference variable. The rest of the model variables are similar to the cross-sectional models.

Regional trends in store growth

Figure 1 shows the count of dollar stores in cities within each census division throughout the study period. These graphs show a striking, consistent pattern of growth across regions. In the Pacific division, for example, the number of SNAP-authorized dollar stores increased from 85 to 410 during this period, a 382% increase. In the Middle Atlantic, the increase was 128%, from 503 to 1,149. The West South Central division had the smallest growth, but its increase was still 58%, from 880 stores to 1,389. The growth is steepest in the early years, perhaps reflecting increased rates of SNAP authorization. Even so, every division saw a notable increase in retail locations between 2011 and 2015, ranging from 18% (West South Central) to 102% (Pacific). Dollar store retailers thus expanded significantly across regions throughout this time period.

Less consistent are the chains responsible for this expansion. In the Pacific division, Dollar Tree is the dominant retailer. Its 314 locations in 2015 were notably larger than either Dollar General (39 locations) or Family Dollar (57 locations). In the Middle Atlantic the stores were roughly equal, ranging from 351 locations (Dollar General) to 417 (Family Dollar) in 2015. In the West South Central Region, all chains grew during the time period, but the percentage growth for Dollar General was only 29%, from 471 locations in 2008 to 611 in 2015. Its competitors had fewer stores but increased in similar numbers: Dollar Tree, for example, had 77 locations in 2008 and 229 in 2015. Although the overall pattern of growth was consistent, this figure shows considerable regional variation in both the dominance of particular retail chains and the pattern of growth across chains.

In tracts classified as Black, distance to the closest dollar store decreased by 14% in low diversity tracts (1.08 to 0.93 miles) over the study period and by 20% (1.37 to 1.10 miles) in moderate diversity tracts. As Figure 2 shows, both Dollar General and Dollar Tree have much larger changes than Family Dollar, again partially because these distances were higher in 2011 for those two chains.

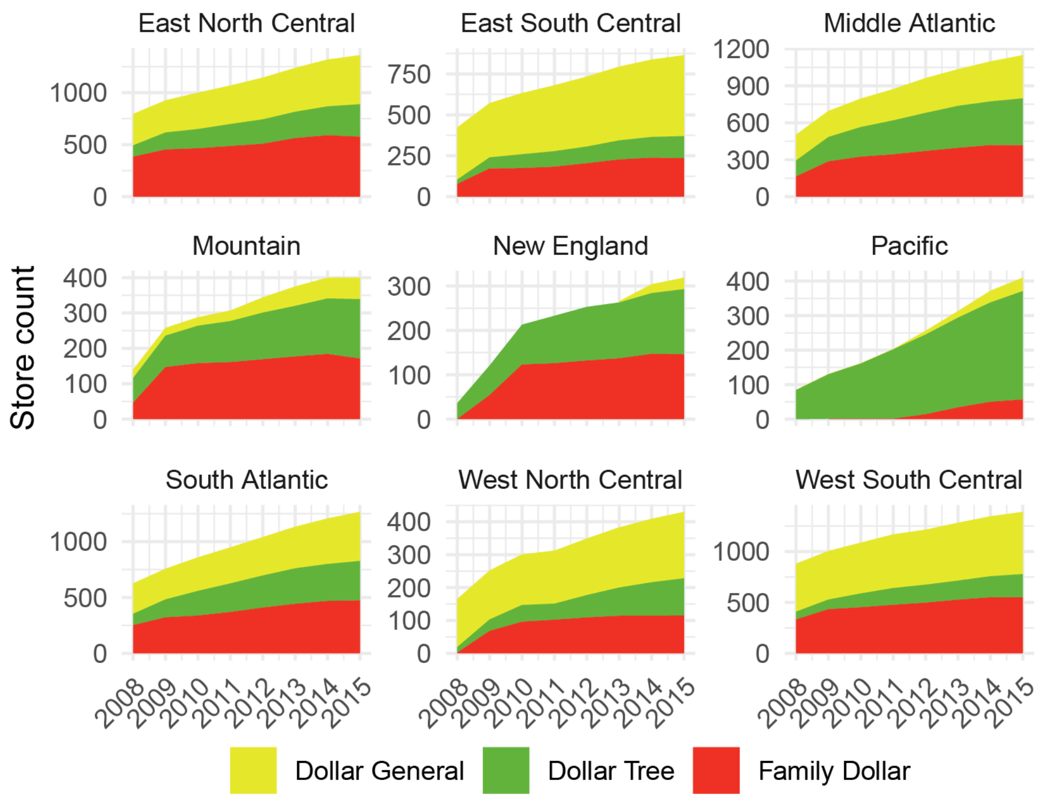

Figure 1: Number of dollar stores by chain across census regions

For tracts classified as Latino, distance to closest dollar store during the time period dropped by 24% in low diversity tracts (from 1.56 to 1.18 miles) and by 21% in moderate diversity tracts (1.68 to 1.33 miles). However, the median distance to the closest Dollar General and Family Dollar retailers increased. For example, in low diversity tracts, the distance to the closest Dollar General changed from 4 miles in 2011 to 4.94 miles in 2015. For Family Dollar, the distance increased from 1.27 miles to 1.75 miles. At the start of the study period, these three racial classifications (White, Black, and Latino) had varying levels of proximity to dollar store retailers. While distance to the closest store drops notably during the study period in all three groups, distances to some chains increase for Latino retailers.

I include SNAP-authorized grocers and supermarkets in Figure 2 for comparison. In contrast to dollar stores, distances to these retailers stayed more or less constant over the study period. Change in the median distance is less than 0.2 miles for most classifications. Yet a comparison to dollar store proximity shows a notable trend. In Black neighborhoods dollar stores are comparatively more proximate when compared to SNAP-authorized supermarkets than in the other two racial classifications. In low diversity Black tracts in 2015, the closest dollar store was 0.93 miles away while the closest supermarket was 1 mile away, a ratio of 0.93. In low diversity White neighborhoods, the closest dollar store was 3.24 miles away while the closest supermarket is 1.75 miles away, a ratio of 1.85. For moderate diversity neighborhoods, this ratio in Black neighborhoods is 1.15, while in White tracts it is 2.01. While the historical movement of White households to sprawling suburban spaces explains the larger overall distances, the disparity in ratios for access to these two retailer types shows a striking difference not accounted for by lower population densities.

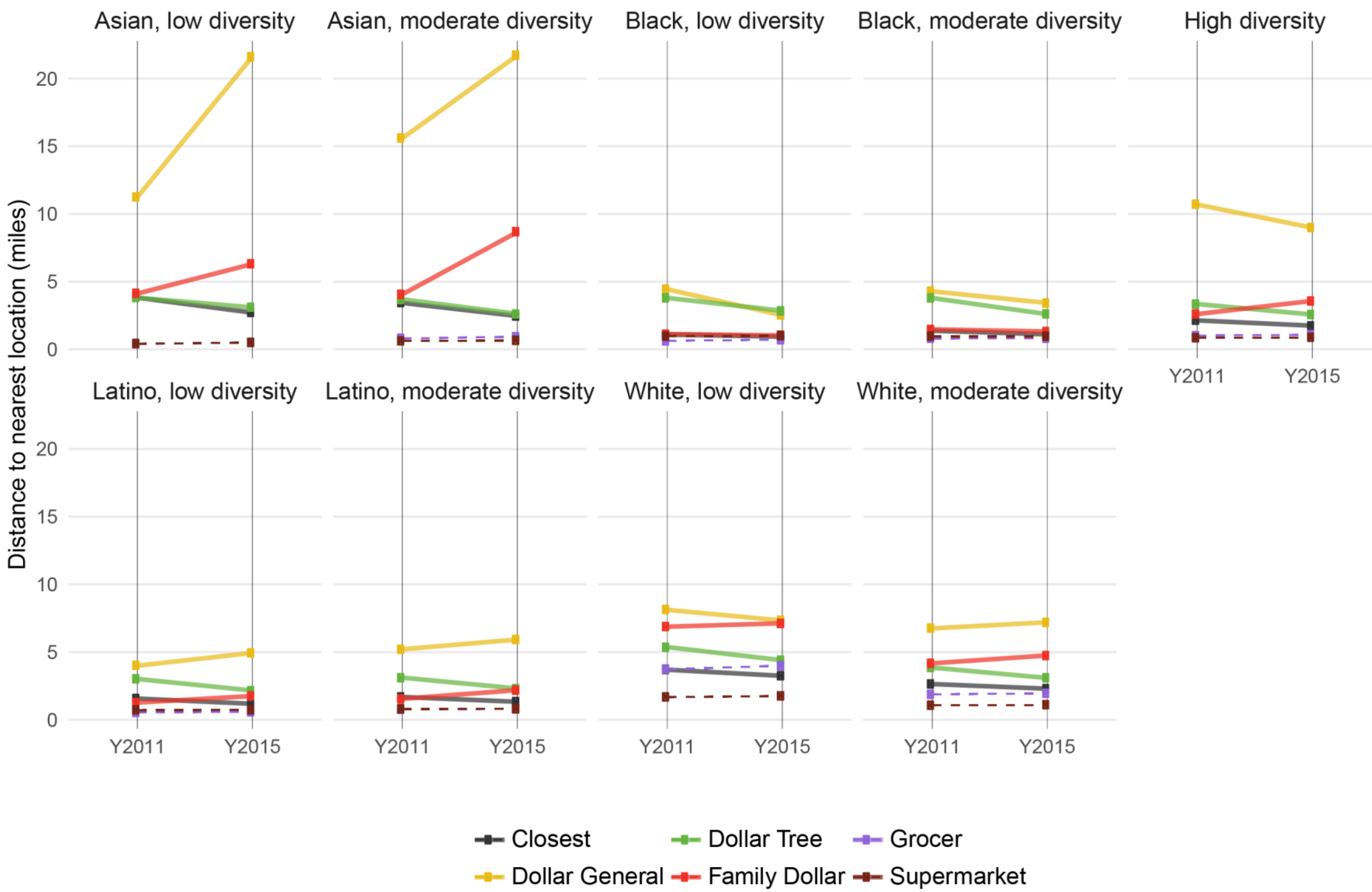

Figure 2: Median distance in miles to the closest retailer by store type and census tract Mixed Metro classification

Cross-sectional mixed-effect models of store proximity

Statistical models provide a more robust understanding of the relationship between tract characteristics and dollar store locations than the descriptive statistics discussed in the previous section. Figure 3 shows the results of repeated cross-sectional mixed-effect models. There are twelve models shown—three years for each of the four store categories. This figure is used rather than a table to make interpretation of these models easier, but a full table of results is shown in the appendix (Table A3).

Since the Mixed Metro classifications are categorical variables, one category must be omitted as a reference. In this case, White, moderate diversity tracts are the most numerous and are omitted. The vertical axis on these graphs shows the exponentiated model coefficients for each variable within these models. In models with a logged dependent variable (retailer distance, in this case), the exponentiated coefficient is interpreted as a percentage increase or decrease. A coefficient of 1.23, for example, means that for every unit increase in x, the y variable increases by 23% compared to the reference category (White, moderate diversity). Likewise, a coefficient of 0.76 indicates that for every unit increase in x, the y variable decreases by 24% compared to the reference category.

Because the magnitude of coefficients differs by variable, these graphs use varying scales along the vertical axis. However, a dashed horizontal line is used in each to mark the value for 1, where a change in the value of x has no significant effect on the value for y. In these graphs, the points show the exponentiated coefficient, and the bars around these points show a 95% confidence interval created from the reported standard errors. A wide range, such as those seen in the Asian, moderate diversity panel, shows a high degree of uncertainty, which was due primarily to a small sample size for that particular variable.

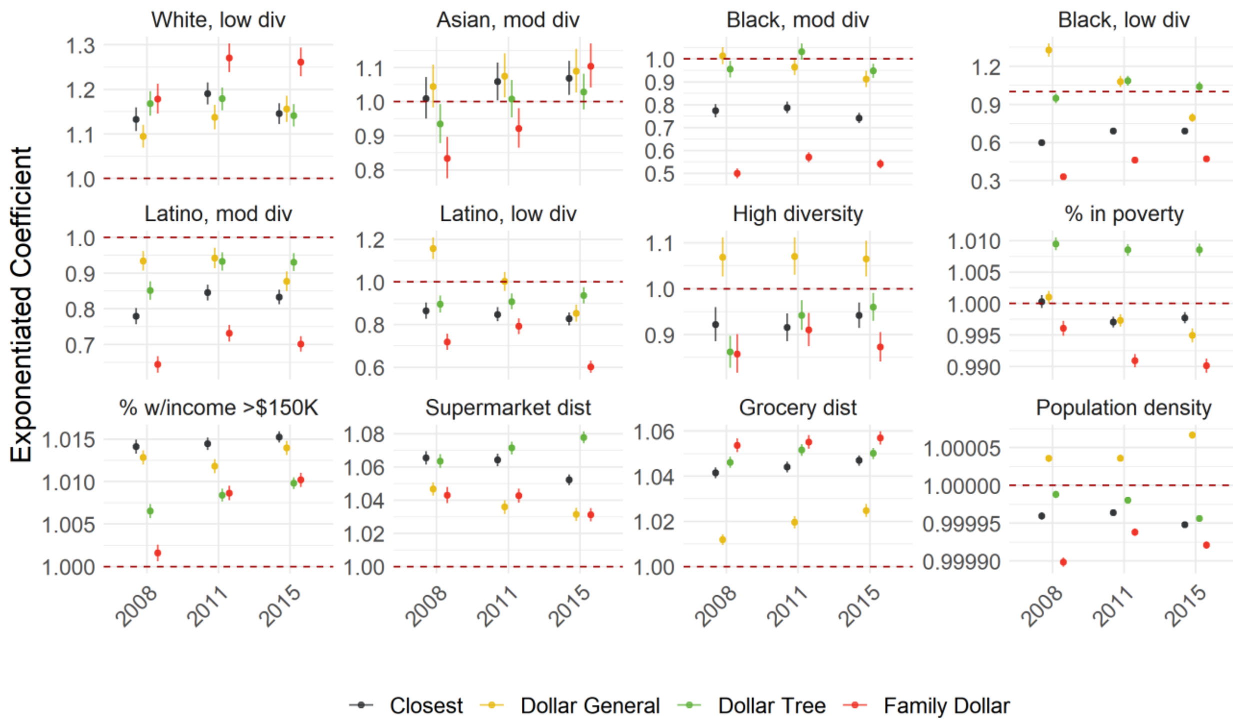

Figure 3: Results of cross-sectional mixed-effect models. Dependent variable is distance to closest store location.

For the Mixed Metro classifications, the models for the closest store of any chain (shown in black in these graphs) indicate that tracts classified as Black or Latino were associated with a closer distance to dollar stores than the reference group (White, moderate diversity), even when controlling for population density, distance to other retailers, and economic characteristics. In 2015, tracts classified as Black, low diversity were 31% closer (coef: 0.689) to these stores than the reference group, and moderate diversity tracts were 26% closer (coef: 0.742). Latino tracts, both low and moderate diversity, follow a similar trend—stores were 17% closer there than in White, moderate diversity tracts. These values are largely stable across the time period. In White, low diversity tracts, the inverse is true. Tracts in this classification were 15% further (coef: 1.144) from the closest dollar store in 2015 compared to the reference group. Stores in Asian, moderate diversity tracts were 6% further away. In high diversity tracts, the closest dollar store was 6% (coef: 0.943) closer than the reference group in 2015.

Broken down by store chain, however, these trends are more mixed. In the case of Dollar General, tracts classified as Black move from coefficients strikingly higher than one in 2008 (1.332, low diversity and above one but non-significant for moderate diversity tracts) in 2008 to significantly below one in 2015 (0.798, low diversity and 0.913, moderate diversity), a downward trend evident in Figure 3. Latino neighborhoods show a similar downward trend from 1.165 (low diversity) and 0.939 (moderate diversity) in 2008 to 0.857 and 0.88 respectively in 2015. Of the three chains examined here, Dollar General had the highest rate of SNAP authorization (99%) in 2008, and so these trends likely correspond with real changes in store locations.

In contrast, the models for Family Dollar show a strong association between tract classification and store distance across years. In Black, low diversity tracts, the closest location was 67% closer (coef: 0.333) in 2008 compared with the reference group, though this effect lessened slightly by 2015 (coef: 0.471). Black, moderate diversity tracts were similar (coef: 0.501 in 2008, 0.541 in 2015), as were Latino, low diversity tracts (coef: 0.723 in 2008, 0.602 in 2015), Latino, moderate diversity tracts (coef: 0.648 in 2008, 0.703 in 2015), and high diversity tracts (coef: 0.862 in 2008, 0.874 in 2015). In contrast, White, low diversity tracts have coefficients higher than one, from 1.174 in 2008 to 1.259 in 2015. Tracts classified as Asian, moderate diversity, have mixed results, moving from lower than one (0.838 in 2008) to higher than one (1.105 in 2015). The overall pattern shows a strong concentration of stores in many communities of color, even when controlling for household income.

Dollar Tree's models are similar to Family Dollar's, but the effect sizes are often smaller. White, low diversity tracts are associated with a 15% greater distance than moderate diversity tracts (coef: 1.168 in 2008, 1.14 in 2015). Conversely, these stores have greater proximity to Latino low and moderate diversity tracts (both 7% closer in 2015) as well as high diversity tracts (4% closer in 2015). Both classifications of African-American and Asian tracts have mixed or non-significant associations. Notably, Dollar Tree is the only chain where higher rates of poverty are associated with greater store distances—a 1% increase in distance for every 1% increase in poverty rate. These results together suggest that this chain is located in moderate-income neighborhoods that are either predominantly Latino, moderate diversity White, or high diversity.

Four control variables are also shown in Figure 3: rates of poverty and high-income households and distances to the closest supermarket and grocer. Both income variables are mostly statistically significant (22 out of the 24 models). Except for Dollar Tree, these models indicate that store proximity is associated with higher rates of poverty. For 2015, the coefficients for the closest store is 0.998 for poverty rate and 1.015 for rates of high-income households. These two variables are both in units of $1,000. Thus, an increase of 5% in poverty rate would be associated with a 1% decrease in store distance while a 5% increase in high-income households would be associated with a 7.5% greater distance.

For distances to other SNAP-authorized retailers, coefficients are higher than one and significant in every model, ranging between 1.01 and 1.078. These results indicate that dollar stores follow a generally similar spatial distribution to other SNAP-authorized groceries and supermarkets.

These cross-sectional models suggest a strong association between tract-level racial composition and proximity to a dollar store. In most cases, non-White tracts—particularly those classified as Black and Latino--are significantly closer to dollar stores than those classified as White, either moderate or low diversity. This association differs by chain. For Dollar General, this pattern emerges at the end of the study period, but for Family Dollar it is consistent across years. Dollar Tree is an exception to this trend, with an apparent concentration in moderate-income, ethnically mixed neighborhoods with relatively low poverty rates. Overall, these models show that dollar stores' locational strategies have a strong association with racial composition, independent of neighborhood economic characteristics, though the nature of this association changes by store chain and racial category.

First-difference models of store proximity

Cross-sectional models provide a snapshot of dollar store locational decisions, but longitudinal analysis can also track change over time. Specifically, by looking at changes to variables within tracts, a first-difference model can control for unobserved factors that do not change over time. The data used in this analysis do have two characteristics that make longitudinal analysis challenging: the lack of Mixed Metro classification shifts across years and the five year pooled sample used for American Community Survey data. While a first-difference model may still be able to identify significant associations between variables, both of these factors limit its power.

As noted in the methods section, I also include the MSA of each tract as a mixed effect due to the significant regional differences in growth for each store chain. Because the dependent variable is change in distance to the closest store, I used the actual value, not its logged equivalent, which affects the interpretation of the model. Instead of percentage change, there is a direct association. A coefficient of 0.5, for example, would mean that an increase of 1 for the independent variable is associated with a 0.5 mile increase in distance to the corresponding retailer. Lastly, percent classified as White is excluded from the model as it was highly correlated with the other racial classifications. For interpretative purposes, it can be read as a reference group.

The results of these models are shown in table 4, both the coefficient for each variable and a corresponding confidence interval. Coefficients lower than zero are highlighted in red, and those higher than one are highlighted in blue. These models show a more limited pattern of association than the cross-sectional models. For the three racial categories, areas with an increased African-American population are associated with a very small increase in distance to Dollar Tree locations—0.01 miles for every 1% increase in population. Percentage Asian American is associated with an increase in distance to Dollar General (0.08 miles for every 1% increase) but a decrease in distance to Family Dollar (-0.07 miles for every 1% increase). An increase in high-income households is associated with an increase in distance to Family Dollar (0.07 miles for every 1% increase), but a decrease in distance to the closest store of any chain (-0.01).

The most notable result of these models is a negative association between dollar store proximity and distance to the nearest SNAP-authorized grocery store. Overall, an increase of 1 mile in distance to the nearest grocer is associated with a -0.01 mile decrease in distance to a dollar store, but for Family Dollar, this coefficient is -0.214. This indicates that Family Dollar became more common in neighborhoods where distances to other small food retailers (not supermarkets) was increasing.

Overall, these models show limited associations with our variables of interest. This may be partially due to the limited time scale, only four years. Demographic shifts can happen rapidly in metropolitan areas, but the ACS data used here is temporally imprecise due to the pooled sample and may not be able to fully capture these details. While the racial characteristics in these models have a weaker association with proximity to dollar stores, the results of the cross-sectional models do indicate a growing connection. The lack of significant findings here may simply mean that chains are expanding into already existing communities of color rather than targeting neighborhoods where the demographics are changing.

Term	Closest		Dollar General		Dollar Tree		Family Dollar	
	Estimate	**CI**	**Estimate**	**CI**	**Estimate**	**CI**	**Estimate**	**CI**
% African-American	0.000	(0.004,-0.003)	0.011	(0.038,-0.016)	0.014	(0.02,0.007)	-0.031	(0.001,-0.063)
% Hispanic	-0.002	(0.002,-0.005)	0.017	(0.041,-0.007)	0.005	(0.011,0)	-0.001	(0.027,-0.028)
% Asian American	-0.001	(0.004,-0.006)	0.077	(0.112,0.043)	0.005	(0.013,-0.004)	-0.073	(-0.033,-0.113)
% in poverty	-0.001	(0.002,-0.004)	-0.018	(0.004,-0.041)	0.003	(0.008,-0.002)	-0.003	(0.023,-0.03)
% w/income >$150K	-0.007	(-0.004,-0.011)	0.017	(0.042,-0.009)	0.000	(0.006,-0.006)	0.074	(0.103,0.044)
Supermarket distance	-0.019	(0,-0.037)	-0.001	(0.132,-0.134)	0.013	(0.044,-0.019)	0.014	(0.17,-0.142)
Grocery distance	-0.011	(-0.003,-0.019)	-0.042	(0.015,-0.1)	-0.003	(0.01,-0.017)	-0.214	(-0.147,-0.282)

Table 4: Results of first difference models

In addition, the negative association between Family Dollar locations and grocers indicates that these retailers are effectively replacing small groceries in many neighborhoods. This is a category that includes many ethnic markets as well as some specialty and independent retailers. The directionality of this association is not clear from this analysis, whether new Family Dollar locations price out these small stores or whether their closure creates space filled by new Family Dollar locations. Yet given this retailer's concentration in high-poverty communities of color, it is a connection that deserves further study.

Discussion and Conclusion

The results of this analysis show a significant association between proximity to dollar stores and patterns of racial segregation in major metropolitan areas. Dollar stores are generally closer to census tracts classified as Black, Asian, Latino, and High diversity than tracts classified as White, even when controlling for household income and population density. These patterns vary somewhat by store chain: Family Dollar was most closely associated with tracts' racial classification in descriptive analysis and cross-sectional models. For Dollar General and Dollar Tree, the association was more moderate, but store proximity in communities of color did increase across the time period. Although it is difficult to ascertain the exact formulas used by these stores to make siting decisions—a topic that should be a priority in future research—the resulting geographic pattern identified here shows racial classification to be a key predictor of store proximity.

Dollar stores have received scant research attention, in part because their growth has happened mostly in the last decade. This analysis reveals that in metropolitan areas, the locational strategies evident in dollar store expansion show clear evidence of retailer redlining. Family Dollar stands out as the retailer that has most clearly targeted communities of color, and my longitudinal analysis indicates that it filled in gaps in communities where small grocers are closing. While they likely play a role in supporting the immediate needs of their customers, dollar stores' corporate model funnels profits out of neighborhoods, contributing little to local economic development and failing to address racialized economic disparities (Donahue and Mitchell 2018).

Past research on retailer locations has analyzed distributional networks and household economic characteristics as explanatory factors (Graff, 2006, Ó hUallacháin & Leslie, 2013) or, in the case of food desert research, utilized naturalistic metaphors that target already stigmatized neighborhoods while neglecting corporate actors (Shannon 2016). This article addresses these issues through an analysis of the growth of three major chains across racially segregated metropolitan landscapes. The growing body of research on racial capitalism and black geographies has described how exploitative, race-based practices are integral—not incidental—to capitalist development (Summers 2019; Reese 2018; McClintock 2018; Ramírez, 2015; Robinson 2000). If the growth of dollar stores is tied to the concurrent expansion of flexible and low-wage employment, particularly within communities of color, then their growth demonstrates how corporate entities benefit from the exploitation of a racialized labor force. Future work on the spread of dollar stores might examine how they contribute to racialized stigma in particular neighborhoods and how residents resist or accommodate their effects.

As a growing number of municipalities restrict the growth of dollar stores (Aubrey 2019), research into the drivers and effects of these policies may also be useful, as they may demonstrate broader political contestations about class and racial identities within these communities. In particular, these regulations on their own may do little to address the underlying financial stressors that have fueled the growth of dollar stores. The extent to which community pushback to their expansion is accompanied by action on higher wages, affordable housing, or access to transportation—all key drivers of precarity—is an indicator of whether the goal of these regulations is to provide better opportunities for residents or simply to remove the stigma of poverty.

One important limitation to note is that the research described in this article focuses specifically on metropolitan areas, while a significant portion of dollar stores' growth has been in small, rural, and mostly white communities. Only 25% of all dollar stores in my full dataset were in the cities used for this analysis. Stores in rural areas may follow a different locational logic. This research is also limited to the United States, and comparison in other national contexts is also needed. Still, my analysis provides a comprehensive analysis of metropolitan areas with a total population of 128 million residents. In these areas, race clearly matters for dollar stores as they consider where to locate and which consumers to target.

Lastly, the impact of dollar stores on food procurement and consumption specifically is beyond the scope of this analysis. This is a question that has been addressed in only two other published studies (Caspi, Lenk, et al. 2017; Racine et al. 2016). Most dollar stores include little in the way of fresh foods, although Dollar General has pledged to include fresh produce in more of its stores (Karst 2019). At the same time, these stores do sometimes carry a selection of frozen fruits and vegetables (Caspi, Lenk, et al. 2017). Given their growing ubiquity in low-income neighborhoods, understanding the ways that individuals make use of dollar stores within broader strategies of food provisioning can identify if and how they contribute to community health. Also, as a fight over food stocking requirements in Minneapolis illustrates (Golden 2016), crafting policies that encourage stocking of healthy foods in dollar stores can be a complicated and contentious process. The still rapid expansion of dollar stores underscores the need to better understand their effects on the health and economic life of local communities.

Research on retail access continues to move on from the conceptually and empirically limited model of food deserts. Through analysis of dollar stores and similar spaces of precarious consumption—their growth and use, as well as community pushback and regulation—future work can outline the ways that retail redlining reshapes neighborhoods' identities, physical health, and economic possibilities. In doing so, it can not only uncover persistently inequitable retail landscapes but also highlight their connection with a long history of racial discrimination and economic exclusion in American cities.

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