Finance and Economics Discussion Series
Divisions of Research & Statistics and Monetary Affairs
Federal Reserve Board, Washington, D.C.

Why Are Wal-Mart and Target Next-Door Neighbors?

Jenny Schuetz

2014-81

Why Are Wal-Mart and Target Next-Door Neighbors?

Jenny Schuetz
Board of Governors of the Federal Reserve System
jenny.schuetz@frb.gov

Last revised:
October 6, 2014

Abstract

One of the most notable changes in the U.S. retail market over the past twenty years has been the rise of Big Box stores, retail chains characterized by physically large stores selling a wide range of consumer goods at discount prices. A growing literature has examined the impacts of Big Box stores on other retailers and consumers, but relatively little is known about how Big Box stores choose locations. Because Big Box stores offer highly standardized products and compete primarily on price, it is likely that they will seek to establish spatial monopolies, far from competitor stores. In this paper, I examine where new Big Box stores locate with respect to three types of existing establishments: own-firm stores, other retailers in the same product space (competitors), and retailers in other product spaces (complements). Results indicate that new Big Box stores tend to avoid existing own-firm stores and locate near complementary Big Box stores. However, there is little evidence that new Big Boxes avoid competitors. Firms in the same product space may not be perfect substitutes, or firms may prefer to share consumers in a desirable location rather than cede the entire market to competitor firms.

Keywords: Retail location; spatial competition; agglomeration; Big Box stores
JEL classifications: L81, R12, R32

Acknowledgements
The analysis and conclusions set forth are those of the author and do not indicate concurrence by the Federal Reserve Board. Funding for this project was provided by the METRANS Transportation Center at USC and the Lusk Center for Real Estate. Yuting Hu, Sanggyun Kang, Vincent Reina and Marie Sullivan have provided excellent research assistance. Thanks to Nate Baum-Snow, Marlon Boarnet, Gen Guiliano, Mark Phillips, Chris Redfearn, and participants in the 2013 Rena Sivitanidou Research Symposium for helpful comments.

Section 1) Introduction

Over the last twenty-five years, the rapid growth of Big Box stores has reshaped the business model and physical landscape of retail in the U.S. Although there is not a universally accepted definition of "Big Box", these stores are usually characterized by large-footprint buildings selling a range of consumer goods at discount prices. The business model combines a no-frills shopping environment with firm-wide efficiencies – information technology, networks built around distribution centers, negotiating power with suppliers – that enable them to sell goods at lower prices than many other retailers (Basker 2007, Basker et al 2012; Holmes 2011). Big Box stores can be broadly grouped into two types. General merchandise stores such as Wal-Mart, Target and Costco sell a wide variety of products, from groceries to clothing to household furnishings to electronic appliances. Specialized Big Box stores, sometimes called "category killers", offer considerable depth within a single product category, such as building materials (Lowes, Home Depot) or office supplies (Staples, Office Max). The growth of Big Box as a retail format, and the expansion of individual firms (particularly Walmart), have drawn considerable attention from other retailers, local policymakers, the media and academics. Previous research has considered the impacts of Big Box entry on numerous economic outcomes, such as retail employment growth, retail prices, obesity, consumer welfare, housing prices and new store entry (Basker 2005, Basker 2007, Basker et al 2012, Carden and Couremanche 2011, Ellickson and Grieco 2013, Haltiwanger et al 2010, Hausman and Leibtag 2005, Matsa 2011, Neumark et al 2008, Pennington-Cross and Garate 2014; Pope and Pope 2013). Much less research has examined what factors affect Big Box stores' location choices.[1] In this paper, I

[1] Holmes (2011) discusses Wal-Mart's potential to cannibalize its own stores with increased density. Neumark et al (2008) and Carden and Courtemarche (2013) point out that Wal-Mart's network expanded slowly from the firm's headquarters in Bentonville AR. Pennington-Cross and Garate (2014) find that Walmart-owned "hypermarkets" deter entry by smaller grocery retailers in Chile.

examine where new Big Box stores locate, focusing on the interactions with three types of existing establishments: own-firm stores, other retailers in the same product space (competitors), and retailers in other product spaces (complements). The analysis serves as an empirical test of two competing hypotheses of firm location: do new Big Box stores seek to establish spatial monopolies, outside the market area of rival firms, or do they cluster near competitors to capture some share of their business?

The theoretical debate over firm clustering versus dispersion extends back to models by Hotelling (1929) and Lösch (1954), as well as more recent versions by Eaton and Lipsey (1976), Elizalde (2013), Capozza and Van Order (1978), Irmin and Thisse (1998) and Stern (1972). In these models, firms can distinguish themselves from competitors along three dimensions: price, geographic space and product space (range of goods, quality or other non-price characteristics). In general, if firms have limited ability to differentiate from their competitors in product space, and if consumers are readily able to compare prices, then firms will have greater incentive to choose physical locations farther from their competitors. As Beck and Netz (2002) observe, formal models can lead to predictions of either clustering or dispersion, depending on the specific assumptions used. Empirical studies find mixed evidence of both clustering and dispersion, depending on the industry and empirical setting. Beck and Netz (2002) examine gasoline stations, which sell a relatively homogeneous product and have highly transparent pricing, and find evidence that retailers choose dispersed locations over clusters. Klier and McMillen (2008a and b) find strong clustering patterns among auto parts suppliers (primarily wholesalers rather than retailers). Andersson et al (2013) show that artists cluster near other artists, and near potential consumers of their work. Most relevant to the current analysis, Clapp et al (2014) find that the presence of anchor department stores deters entry by similar anchor

stores, leading to dispersion. Similarly, Big Box retailers appear to be good candidates for dispersion, based on their business model. Both types of Big Box stores – general merchandise and category killers – offer highly standardized product types and brands that are typically available at many other stores. Many Big Box firms advertise low prices as a marketing draw (Walmart's slogan: "Always Low Prices"), and the prices of specific goods are readily available to consumers.[2] Moreover, because of the store size and range of products offered, Big Box stores typically draw from large market areas, from five to fifteen miles, depending on the surrounding population density. Based on these characteristics, it would seem that spatial differentiation is more feasible for these firms than product or price differentiation.

Retail location literature also highlights potential benefits of firm clustering, based on two different forms of agglomeration economies. The first type occurs among stores that sell high specialized, quality differentiated goods, such as furniture, jewelry or original art (Berry 1967; Fischer and Harrington 1996; Picone et al 2009; Schuetz and Green 2014). By clustering near similar retailers, these stores can reduce consumer search costs and attract greater volume of potential consumers. Because consumers choose these products based on idiosyncratic matching of preferences rather than price, co-location does not undermine pricing power of individual retailers. On the face of it, Big Box stores seem unlikely candidates to benefit from this type of clustering. The second form of agglomeration benefits results from an optimal mixture of stores within a shared retail space such as a mall. Proximity to complementary store types can increase revenue for individual stores, such that a single landowner (mall owner or developer) can maximize profits from the entire space by controlling the store mix (Benjamin et al 1992;

[2] Even before recent technology, such as mobile phone apps and in-store computer kiosks that allow consumers to compare prices to other stores, Big Box stores published prices on selected goods on print advertisements, such as newspaper inserts and direct-mail fliers.

Brueckner 1993). This form of agglomeration is more plausibly a factor in Big Box location choice. Big Box stores, particularly general merchandise firms, often serve as anchor tenants in regional power-centers, generating additional customer traffic for adjacent stores, including more specialized Big Box stores. Similarly, locating near an existing retail cluster may be a reaction to information failure: uncertainty about demand in untapped markets could cause retailers to delay entry until a first mover has proven that a given site can be profitable (Caplin and Leahy 1998).

In this paper, I test how the location of new Big Box stores reflects proximity to three types of existing retailers: own-firm stores, competitors and complementary retailers. Using the National Establishment Time Series (NETS) data for California, I identify newly opened Big Box stores over three time periods between 1992 and 2009. New employment per Big Box firm at the PUMA level is estimated as a function of baseline employment in own-firm stores, competitor and complementary firms. The regressions control for a variety of factors affecting underlying site productivity, such as population density and income, as well as proxies for political opposition and zoning rules that could constrain sites available for Big Box stores.

Results indicate that new Big Box stores tend to avoid market areas with existing own-firm stores, and are more likely to open in areas with higher density of complementary stores. However, there is little evidence that prior existence of competitors deters new Big Box entry: new Big Box employment is positively associated with employment density among same-product Big Box stores, even controlling for other location-specific factors. Results are consistent with the hypothesis that firms prefer to share consumers in a desirable location rather than cede the entire market to competitors. Another interpretation is that even among firms selling standardized products, Big Box stores in the same retail sector are not perfect substitutes.

The remainder of this paper is organized as follows. Section 2 provides some context for Big Box retail. Section 3 outlines the empirical strategy and additional data sources. Section 4 presents regression results, while Section 5 concludes.

Section 2: Context of Big Box retail

Although a widely recognized colloquial term, there is no formal definition of "Big Box" stores, and the criteria specified by other researchers have varied based on the available data and research question. For instance, a study by the Columbia Graduate School of Architecture defines Big Box retailers primarily by store physical characteristics, such as building footprint and lot size. Haltiwanger et al (2010) define Big Box firms by firm and establishment size and industry classification.[3] For this analysis, I assembled a master list of Big Box firm names specified by several sources (Haltiwanger et al 2010; Columbia Graduate School of Architecture; National Retailer's Federation and Wikipedia).[4] All establishments affiliated with a parent firm on this list were identified as Big Box stores; Table 1 lists firm trade names, grouped by retail sector (for this analysis, sectors correspond to three-digit NAICS code). The establishments in this study should generally match those used in prior studies, while remaining agnostic on what criteria define Big Box retailers. Moreover, identifying stores based on parent firm rather than establishment size (square footage or employees) allows me to include stores that may be smaller than traditional Big Boxes but are part of well-known Big Box corporations. For instance, Walmart Corporation owns and operates at least five different store types: Walmart Discount Stores, Supercenters, Sam's Club, Neighborhood Markets, and Walmart Express. The first three store types would fit nearly any definition of Big Box, with traditional format buildings larger

[3] http://www.columbia.edu/itc/architecture/bass/newrochelle/extra/big_box.html

[4] Because Haltiwanger et al are constrained in their ability to reveal firm names, it is not possible to directly compare the list of firms, but I rely on the three sources they list as primary references.

than 100,000 square feet, more than 200 employees per store, and offering a wide array of general merchandise goods. However the Neighborhood Markets and Express stores have smaller footprints (15,000-40,000 square feet) and have a product mix closer to a supermarket-pharmacy combination, but still benefit from the cost and logistical advantages of the Walmart firm, and their locations are selected by the parent firm.[5]

Establishment (firm) names, locations and employment counts are obtained from the California subset of the National Establishment Time Series (NETS) database from 1992-2009. The NETS is a longitudinal, establishment-level database constructed by Walls and Associates from the Dun & Bradstreet business register, and covers nearly all U.S. business establishments. Street addresses for each establishment are geocoded to latitude-longitude coordinates and matched with census geographies. A numeric ID matches establishments with shared parent firms, as well as reporting commonly used trade names for establishments and firms. Industry is reported at the 6-digit NAICS level; each 3-digit NAICS grouping within industries 44-45 forms a retail sector. The analysis includes all retailers within California's four largest metropolitan areas (Los Angeles, Sacramento, San Diego, and San Francisco-San Jose). Smaller cities and rural areas are excluded because they may not have a large enough population to support multiple stores in the same product sector.

Big Box firms operate in almost all retail sectors, although the number of firms varies by sector, raising the potential for different firm behavior towards competitors (Table 1). For instance, the building material/equipment sector has two Big Box firms, Home Depot and Lowes, who could in theory exhibit some coordination or cartel-like behavior, while over twenty Big Box firms operate in the general merchandise sector. Three retail sectors have no Big Box

[5] Descriptions of store types and product ranges were obtained from http://corporate.walmart.com/our-story/our-stores/united-states-stores.

firms: Food and beverage stores (445), Gasoline stations (447) and Non-store retailers (454). Two retail sectors have only a single Big Box firm (Motor vehicle dealers (441) and Health and personal care (446)). Single-firm sectors are excluded from this study, because the analysis focuses on competition among same-sector Big Box firms.

Table 2 shows the average number of retail employees per PUMA in the sample MSAs, and employment shares by firm type. PUMAs are chosen as the unit of geography for this analysis because they most closely approximate the expected market size of Big Box retailers (average population 100,000).[6] Following prior literature (Haltiwanger et al 2010; Ellickson and Grieco 2013), non-Big Box retail firms are classified either as "mom-and-pop" or "chain" based on the number of establishments associated with the parent firm. Mom-and-pop includes single-establishment firms and firms with fewer than 25 establishments, while firms with 25 or more establishments are classified as chains.[7]

On average, PUMAs in California's large MSAs have about 7700 retail employees, with 63 percent working for mom-and-pop stores, 23 percent for non-Big Box chains, and only 13 percent employed by Big Box firms.[8] However, Big Box employment as a share of total retail employment varies across retail sectors, as might be expected from the varying number of Big Box firms. The general merchandise sector not only has the largest number of Big Box firms, it has by far the largest Big Box employment share (64 percent) and the lowest employment share

[6] The geographic area of PUMAs varies based on population density. In this sample, the mean land area is 260 square miles, with a median area of 33 square miles. To compare these areas to expected store market areas, we assume that PUMAs are perfect circles and calculate the radius length. The mean area implies a radius of 9 miles, the median area implies a radius of three miles, both of which are within the expected market size.

[7] The NETS data flag each establishment-year as single-establishment, headquarters or branch. Both HQ and branch are here included as chain establishments. A firm may change chain status over time, if the number of establishments operating under the same parent company expands or contracts. Robustness checks classifying all multi-establishment firms of any size as chains yield substantively similar results.

[8] Employment counts are taken from payrolls at a single point in time and are not adjusted to full-time-equivalents. Employment shares by firm type are very similar when calculated for entire study area (i.e. not averaged by PUMA), or when weighting PUMAs by population size or total retail employees.

by mom-and-pop firms (under 15 percent). Building materials has the second-highest Big Box employment share, but Lowe's and Home Depot together account for less than one-quarter of all employment, with large chains making up another 10 percent. Big Box employment shares are lowest in the clothing sector, which also has the highest employment share of non-Big Box chains. It is worth noting that general merchandise Big Box stores carry some products in nearly all retail sectors (home goods, electronics, clothing, etc). Notwithstanding the attention drawn by Big Box firms, employment in the retail industry (at least in the study areas) is still largely made up of small, independent stores.

Big Box firms' relatively small share of retail employment could assist firms that wish to locate far from their competitors: they face many more independent or non-Big Box chain firms, who likely offer a narrower product range and do not benefit from the same logistical capacity and scale economies. Table 3 shows some descriptive statistics on the proximity of new Big Box retailers to existing stores of their own parent firm, and to their geographically closest competitor firms (in this analysis, competitors are defined as other Big Box firms within the same 3-digit NAICS retail sector). For each Big Box store that opened in any of three time periods (1993-95, 2001-03 and 2007-09), I calculate two linear distances: (1) between the new store and existing stores (in 1992, 2000 or 2006) belonging to the same firm, and (2) between the new store and existing Big Box stores belonging to other firms in the same retail sector.

As shown in Table 3, 2250 new Big Box stores opened across the four MSAs during the study time periods; about half of the stores are in the general merchandise sector. The average distance between new Big Box stores and their closest own-firm store was 14 miles. Typical market areas for Big Box stores in urban areas can range from 5 to 15 miles, so this is consistent with firms trying to avoid cannibalizing business at their own stores. Average distances to own-

firm stores vary by retail sector. Furniture and building materials stores locate farthest from own-firm stores, while sports/hobby/music stores and miscellaneous retailers open within 10 miles of own-firm stores. Some of this variation is consistent with different market sizes for underlying product types: stores selling large-ticket, infrequently purchased items will draw consumers from longer distances.

More surprising, the average distance from new Big Box stores to their nearest existing competitor is 6.37 miles, likely within the expected market area of existing stores. Examining differences across retail sectors shows some suggestive patterns. New stores belonging to the two firms in building materials locate farthest from each other, at more than 50 miles. General merchandise – which has the largest number of firms (24) and the highest employment share – has the shortest average distance between new stores and competitors, less than one mile. But it is less obvious why new furniture stores, which locate on average 34 miles from their own-firm stores, are a relatively small four miles from competitors. In all sectors, new stores locate farther from their own-firm stores than from competitors, but the size of the gap is not consistent.

These descriptive statistics suggest some interesting patterns: new Big Box stores generally open outside the market area of their own firm, but within the market area of at least one competitor firm. Location patterns appear to vary by retail sector.

Section 3: Methodology and data description

This paper examines location choices of newly opening Big Box stores, focusing especially on the proximity to existing retailers. Four main hypotheses about site selection are tested. First, new Big Box stores are unlikely to open in a market area that already has an

establishment belonging to the same firm.[9] Second, Big Box firms may avoid proximity to direct competitors, notably other Big Box firms in the same product space. Third, new Big Box firms may open near existing retailers that sell complementary products, and thus potentially could offer agglomeration benefits. A corollary of this hypothesis is that new Big Box stores may locate near existing retail clusters because of uncertainty about the productivity of untried locations. The main challenge to determining whether observed Big Box locations reflect preferences over existing stores is that a variety of other factors could drive firms to co-locate. Big Box firms (and other retailers offering similar products) will choose locations with higher potential productivity for retail activity; for instance, with access to a larger number of consumers, more desirable consumer characteristics, or better access to transportation infrastructure. Further, Big Box firms are likely to face political and institutional constraints that limit the set of feasible locations. Zoning generally limits retail and other commercial uses in many areas, and Big Box firms typically face more constraints – formal and informal – than smaller-scale retailers. The empirical strategy outlined below includes measures to distinguish firms' preferences over other stores from underlying site productivity and location constraints.

3.1 Empirical strategy

In order to understand what market area characteristics appeal to Big Box firms, and thus might lead to co-location, the analysis begins by estimating aggregate retail employment as a function of local area economic and demographic variables. The analysis is estimated for all existing retail firms, then separately by firm type (Big Box, chain and mom-and-pop), and just for newly opened Big Box stores. The regression equation is shown below:

[9] As discussed in the data description, all establishments under the same parent firm are linked together, even if they operate under different divisions of the firm. For instance, Walmart and Sam's Club stores are considered to belong to the same firm.

$$(Eq.\ 1)\ Retail_{it} = \beta_0 + \beta_1 Pop_{it} + \beta_2 Emp_{it} + \beta_3 DistCBD_{it} + \varepsilon_{it}$$

in which *i* indexes the PUMA and *t* indexes the year. *Retail* is total retail employees per square mile. *Pop* is a vector of population characteristics (density, income, educational attainment, race and ethnicity). *Emp* is non-retail employees per square mile, and *DistCBD* is the linear distance from each PUMA to the Central Business District (CBD).[10] Previous studies have found that the quantity, type and size of retail establishments in local markets, as well as the firm structure, vary with income, educational attainment, racial and ethnic composition of the neighborhood (Alwitt and Donley 1997; Meltzer and Schuetz 2012; Powell 2007; Schuetz et al 2012; Sloane et al 2005; Zenk 2005; Waldfogel 2008). Comparing the results across firm types allows for a better understanding of whether Big Box stores represent a fundamentally different location model than smaller retailers. Regressions also include county-year fixed effects, to control for time and place-specific economic conditions or institutional factors, such as labor market conditions, sales taxes, or business regulations. Standard errors are clustered by PUMA. Full definitions and data sources for all variables are shown in Table 4, summary statistics are shown in Table 5.

To explore how new Big Box stores' location choices reflect the proximity to own-firm, competitor and complementary stores, I adapt the analytical framework from Haltiwanger et al (2010). The general form of the regression to be estimated is shown below:

$$(Eq.\ 1)\ NewBigBox_{ijt+1,t+3} = \beta_0 + \beta_1 OwnFirm_{ijt} + \beta_2 InSector_{ijt} + \beta_3 OutSector_{ijt} + \beta_4 X_{it} + \varepsilon_{ijt}$$

where *i, j* and *t* index the Big Box firm, PUMA and year, respectively. *NewBigBox* is employees per square mile in newly opened Big Box stores, per firm-PUMA-time period (1993-

[10] Some specifications included measures of access to transit infrastructure, such as the density of highways or distance to rail transit stations. These variables are highly positively correlated with distance to CBD, and did not yield significant coefficients in any specifications.

1995, 2001-2003, 2007-2009). About 10 percent of observations have values greater than zero, with relatively large variation in number of employees for those observations, leading to a highly skewed distribution. Therefore the preferred specifications is a Tobit model, adjusting for left-censoring at zero.[11]

OwnFirm is a binary indicator of whether at least one establishment belonging to the same Big Box firm existed in the PUMA at the beginning of the period (1992, 2000 or 2006). *InSector* is employment density in Big Box stores within the same retail sector. *OutSector* is the employment density in Big Box stores for all other retail sectors combined. *X* is a vector of variables measuring the inherent retail productivity of the tract, as described in the previous equation, as well as political metrics that proxy for local opposition to Big Box stores. Regressions also include the baseline number of own-firm stores operating in the PMSA and the employment density in chain stores for the same and other retail sectors. Regressions are estimated first for all firms combined, then by retail sector, to assess whether responses to own-firm, competitor and complementary retailers vary across sector. All regressions include Big Box firm fixed effects, to control for unobservable firm characteristics that affect location strategy, as well as county-year fixed effects. Standard errors are clustered by PUMA.

3.2 Additional data description

Data on retail employment, by firm type and retail sector, come from the California NETS, as described in Section 2. The dependent variable is constructed as total employment density in new stores, for each of the 56 Big Box firms, aggregated to firm-PUMA-time period.

[11] Another approach to modeling the functional form is to treat the dependent variable as a binary outcome for any new Big Box store opening, per firm-PUMA-year. It is not possible to estimate probit or logit models on a binary outcome while including the full set of firm and city-year fixed effects (many fixed effects perfectly predict failure), so a binary dependent variable requires estimation of a linear probability model using OLS. These coefficients are similarly biased towards zero, as are the OLS estimates using log of employment density. Appendix Table 1 compares coefficient estimates across the three approaches.

The key independent variables are the employment density among other-firm Big Box stores in the same retail sector, and among other retail sectors. Own-firm indicators and in-sector employment densities vary for each firm-PUMA-year, while out-of-sector employment densities are the same per PUMA-year for all Big Box firms in the same sector. NETS data are also used to calculate the employment density for all non-retail firms; PUMAs with higher non-retail employment density may draw new retail stores, because non-retail workers nearby are potential consumers.

Demographic and economic characteristics for each PUMA-year are aggregated from tract-level data from the decennial Census and American Community Survey. For 1990 and 2000, variables are drawn from the Neighborhood Change Database (NCDB), which reports decennial census data for all years standardized to 2000 census tract boundaries. The most recent tract-level census data use the American Community Survey five-year estimates from 2005-2009, also using the 2000 census tract boundaries. Key variables include population density, household income and educational attainment, ethnic composition and age. In addition, I calculate the distance from each PUMA centroid (using latitude-longitude coordinates) to the Central Business District (CBD). The CBD is defined as the tract within each PMSA with the highest overall employment density (calculated with the NETS data).

3.3 Challenges to identification

An important concern in determining whether new Big Box locations reflect underlying firm strategy with regard to other stores is that Big Box stores likely face political or institutional constraints on where they can operate. If Big Box stores have a restricted choice set because of zoning or similar institutional mechanisms, we are likely to observe more clustering near competitors than firms would prefer. Zoning rules that limit Big Box stores can take many

forms, from outright bans on all retail activity to upper limits on the square footage of individual stores. Some cities have tried to selectively impose higher minimum wages on Big Box firms (DeBonis 2013). Even when retail is permitted under existing zoning and business regulation, Big Box firms often face political opposition from nearby residents, small business owners, and unions (Pristin 2009, Healy 2012).[12] Anecdotal evidence suggests that neighborhood opposition can effectively limit access to areas with ostensibly friendly zoning, while localities seeking to court commercial activity can issue variances. The 194 PUMAs included in this study fall under 127 different city and county governments responsible for zoning and business regulations; these laws can vary by neighborhood within jurisdiction, and over time. Therefore it is not feasible to collect data directly on local regulations affecting Big Box stores, nor to observe the informal political opposition. Instead, I rely on four proxy approaches to indicate the probable friendliness of each PUMA to Big Box firms.

First, to indicate the extent of monopoly power over zoning in the PUMA, I calculate a Herfindahl index for concentration of land shares by local government.[13] Values of this index range from zero to one with higher values indicating that land use regulatory authority in the PUMA is more highly concentrated. Prior studies have examined the hypothesis that local governments with greater monopoly power are better able to restrict undesirable activities (see Thorson 1996; Hamilton 1978). Second, I include fixed effects for each local government (city or county) with primary zoning authority over the PUMA. Third, I use partisan political affiliation as an indicator of political or informal opposition to Big Box stores. Labor unions

[12] For example, in 2012 Walmart proposed opening a Neighborhood Market in Los Angeles' Chinatown neighborhood. The targeted site had been built for a traditional supermarket and so was zoned for the proposed use, yet a coalition of opponents held up the store opening for nearly a year (see Healey 2012).

[13] The Herfindahl index is the sum of squared land shares across all local governments with some zoning authority in the PUMA. About half of the 194 PUMAs fall entirely within a single city or town, or in an unincorporated area within a single county, so have only one government responsible for zoning in the PUMA. The remaining PUMAs are split across two or more zoning authorities, and have Herfindahl index values ranging from 0.17 to 0.95.

have frequently opposed Big Box firms, over their use of non-union workforces and concerns about wages and benefits. Because unions have traditionally supported Democratic candidates, it seems likely that heavily Democratic areas may be less friendly to Big Box entry. Democratic vote shares for three statewide elections (Governor and U.S. Senate) are aggregated from tract-level data, taken from the Statewide Database at UC-Berkeley. Finally, I exclude from the analysis nine PUMAs in which no Big Box stores operated in the baseline year of the analysis; PUMAs in which at least one Big Box store currently operates are more likely to have zoning and other regulations than would allow additional Big Box stores.

Another challenge to identifying Big Box stores' location preferences with regard to other stores is the inability to determine which firms are truly competitors and which are complements. As discussed in the introduction, retailers that on the surface appear to be highly similar may in fact differentiate themselves from other firms through product range, quality, firm branding, shopping environment, or other means that are difficult to measure. This analysis assumes that Big Box firms within the same 3-digit retail sector offer a similar range of products, at comparable prices, in similar shopping environments, and therefore are direct competitors. However, even firms with substantial overlap in products may vary at the margin, or may use marketing techniques to appeal to slightly different consumer groups. For instance, Basker (2011) finds a negative income elasticity for Wal-Mart but a positive income elasticity for Target. If within-sector firms have enough differentiation in product offerings or firm reputation, these stores may actually serve some complementary role for what are apparently competitor firms. Similarly, I assume that stores in all other retail sectors are likely to be complementary, with the potential to draw additional consumers, but this assumption may be more valid for certain firms within retail sectors.

Section 4) Results

The results provide consistent evidence that new Big Box stores tend not to open near existing stores of the same parent firm, and cluster near potentially complementary retailers. However, there is little evidence that new Big Box stores seek to avoid existing stores operated by competitor firms; in fact new Big Box employment is positively correlated with existing competitor employment in most specifications. Proxies for underlying site product productivity explain relatively little of the observed clustering, while political and institutional constraints do not appear to drive co-location.

4.1 Descriptive statistics

The descriptive statistics shown in Table 3 suggest that new Big Box stores open outside the market area of existing own-firm stores, but that they may infringe on the market area of other-firm competitors in the same retail sector. These results come from measuring pairwise distances between establishments, while the regression analysis uses PUMAs as a proxy for market areas. Therefore before introducing regression results, I conduct simple difference-in-means analysis, comparing the baseline presence of own-firm stores, competitor and complementary stores, for PUMAs with and without new Big Box stores (Table 6). The top panel, combining all Big Box firms, shows that PUMAs with at least one new Big Box store are on average more likely to have an existing store of the same firm (0.38 to 0.17). This runs counter to the expectation that firms will avoid encroaching on their own establishments. PUMAs with a new Big Box also have higher average employment density from out-of-sector retailers (26 to 22 employees per square mile), consistent with the hypothesis of agglomeration economies from complementary firms. PUMAs with and without new Big Box stores have

essentially the same employment density of in-sector competitors. These patterns vary somewhat by individual retail sector, however. Three sectors – clothing, hobbies and general merchandise – show clustering of new Big Box stores with respect to all three types of establishments (own-firm stores, competitors and complements). New Big Box stores in electronics are more likely to open in PUMAs with more competitor and more complementary Big Box employment. Miscellaneous Big Box stores also show greater likelihood of opening near complementary retailers. The only evidence consistent with new Big Box stores avoiding in-sector competitors is found in building materials (a sector with only two Big Box firms).

4.2 Regression results: Market area characteristics of Big Box locations

To determine what economic and demographic factors are correlated with Big Box retail, and whether these differ from other retail firms, I estimate cross-sectional regressions of employment density on contemporaneous PUMA characteristics. Results suggest that the economic fundamentals behind location choice for Big Box stores are mostly similar to those for non-Big Box chains and mom-and-pop retailers, but a few notable differences (Table 7). The first column shows determinants of employment density for all retail stores combined. Consistent with prior literature, retail employment is positively associated with population density and non-retail employment density: households and other workers are the two main sources of potential retail consumers. These two variables together explain over 90 percent of the variation in retail employment density. Conditional on other factors, retail employment density increases with distance to CBD, perhaps because of lower land values or ease of developing shopping centers in suburban areas. Retail employment is negatively associated with black and Hispanic population shares, as suggested by prior studies of "retail deserts".

The regression on Big Box employment density reveals a few differences from the all-retail model (Column 2). Although the coefficient on population density is still positive, it is no longer statistically significant and less than half the magnitude. The coefficient on distance to CBD is roughly twice the magnitude, significant at the ten percent level. Together, these results are consistent with Big Box stores being more likely to operate in low-density suburban or exurban fringes, relative to non-Big Box retailers. In addition, the coefficient on income is positive and statistically significant, compared to negative and insignificant in the all-retail estimation (Column 1), or negative and significant for mom-and-pop retailers (Column 4). This is consistent with prior research from Schuetz et al (2012), who find a greater prevalence of small, independent retailers in low-income neighborhoods with large chain stores more frequent in middle-and high-income neighborhoods.

The last column in Table 3 estimates the determinants of employment density among newly opening Big Box stores, combining all firms. Notable differences with the general retail density models are: new Big Box employment is negatively associated with population density, again consistent with stores seeking relatively undeveloped locations (or at least, non-residential areas) in which to build large-footprint stores. The coefficient on income is positive and significant, as with baseline Big Box employment (column 2). Big Box stores may offer discount prices, but they apparently prefer to open in relatively more affluent areas.

4.3 Regression results: New Big Box location and existing stores

The analysis now shifts to examine the relationship between new Big Box locations and proximity to existing own-firm, competitor and complementary stores (Table 8). Regressions begin with only own-firm stores, then progressively add in competitors, complementary stores, controls for local market characteristics, and proxies for zoning and political constraints on

location. Looking first at the relationship with existing own-firm stores, the results of the simplest model match that of the difference-in-means comparison in Table 6: employment in new Big Box stores is positively correlated with presence of an own-firm store in the PUMA, controlling only for firm and county-year fixed effects (Column 1). However, the magnitude of the coefficient on own-firm stores drops and becomes insignificant once employment density in competitor and complementary Big Box firms are added (Column 3). Adding controls for market-area economic and demographic characteristics yields a coefficient on own-firm stores that is negative and statistically significant. This is consistent with new Big Box stores seeking to avoid encroaching on business of their own firm, conditional on underlying site productivity and proximity to other Big Box firms. The final column adds proxy variables for zoning and political opposition to Big Box retail (concentration of land use authority, fixed effects for local governments, Democratic vote share) and excludes nine PUMAs that had no initial Big Box retailers. The coefficient on own-firm stores increases in absolute value, suggesting that political or institutional constraints may somewhat hinder new Big Box stores' ability to avoid prior own-firm stores, presumably by limiting the available sites for development.[14]

The results on in-sector Big Box employment are not consistent with the hypothesis that new Big Box stores will avoid competitors, and the results are quite robust across specifications. New Big Box employment is positively associated with baseline in-sector employment in all models. The estimated magnitude drops when out-of-sector employment is added (comparing Column 2 to Column 4), but does not change much with the addition of market-area characteristics or political/institutional controls (Columns 5-6). This suggests that the tendency

[14] The coefficient on Democratic vote share is negative, as expected, but not significant. The coefficient on land concentration is negative and significant, indicating that new Big Box stores are less likely to open in PUMAs where control over land is more concentrated among fewer local governments, consistent with the monopoly zoning hypothesis. Coefficients on all right-hand side variables are shown in Appendix Table 2, column 4.

of new Big Box stores to open near rival firms is not merely a function of co-location near potential consumers or favorable locations, and is relatively little affected by institutional constraints on available sites.

There is further evidence of clustering among new and existing Big Box stores from the results on out-of-sector employment: new Big Box employment is positively associated with employment density among complementary Big Box firms. The coefficient on out-of-sector employment is significant in all specifications, with relatively small variations in magnitude. That is, the propensity of new Big Box stores to open near out-of-sector Big Box firms is also not explained by shared preferences over market fundamentals or zoning constraints.

The final set of analyses estimate new Big Box location choice separately for each of the seven retail sectors. Due to differences in market size, competitiveness of the retail sector (number of retail firms), or unobservable differences in substitutability between firms, we might expect to see different relationships between new store location and competitor or complementary store locations. Table 9 shows the coefficients on the variables of interest -- own-firm store, in-sector and out-of-sector Big Box employment – for each retail sector. With one exception, new Big Box employment is negatively associated with presence of an existing own-firm store in the PUMA. Only clothing firms have more new employees in PUMAs with prior stores of the same firm (Column 4). Big Box firms collectively represent less than one percent of employment among clothing retailers, so perhaps these firms perceive enough potential for growth that they do not worry about infringing on their own stores. There is also consistent evidence that new Big Box employment is positively associated with complementary Big Box employment; the coefficient on out-of-sector employment is positive and significant in

all retail sectors, although the magnitude varies considerably (smallest for clothing retailers, largest for electronics).

Results on in-sector employment are somewhat mixed, but still provide little evidence that new Big Box stores avoid competitors. In one sector, furniture, the in-sector coefficient is negative and significant. This is somewhat surprising, because it would seem that furniture stores offer more product differentiation (style or range) than among some other retail sectors. The in-sector coefficient is also negative among building materials but insignificant, and is essentially zero among Miscellaneous retailers (one of the more heterogeneous sectors). But among the remaining four sectors – electronics, clothing, hobbies, and general merchandise - new Big Box employment is positively and significantly associated with in-sector employment. From these results, it is not possible to conclude that prior Big Box stores in similar product space systematically deter entry by new Big Box stores.

Section 5) Discussion and next steps

The rapid growth of Big Box retail chains over the past twenty-five years has drawn considerable attention – much of it negative – from the retail industry, local policymakers and the media. Academic research has examined the impacts of Big Box stores on various outcomes, but little research to date has studied the reasons behind Big Box store location choices. In this paper, I explore some of the motivations that may be driving Big Box stores' site selection, focusing particularly on the interaction with existing stores that may be competitors or complements.

Results on economic and demographic determinants on Big Box location are generally consistent with the traditional retail business model. New Big Box stores are more likely to

choose market areas (PUMAs) with lower population density but higher employment density, farther from the CBD, and with more affluent residents. Results on two of the three measures of existing firm presence are consistent with prior hypotheses: new Big Box employment is negatively correlated with presence of own-firm stores, and positively correlated with employment in out-of-sector (and therefore potentially complementary) retail. However, there is very little evidence that new Big Box stores avoid existing in-sector Big Box stores, although these are likely to be their direct competitors. Economic and demographic fundamentals, politics and zoning play some role in Big Box site selection, but they do not explain the degree of observed clustering with either competitor or complementary stores.

Why might Target and Walmart, Home Depot and Lowe's, Staples and Office Depot, locate in close proximity to their direct competitors? Do the agglomeration benefits from locating near an established retail center – beyond what is measured by the current estimation -- outweigh the potential harm from proximity to competitors? Two possible explanations are consistent with the empirical results. First, it is possible that Big Box firms are not quite substitutes for one another, therefore may experience some benefits from co-location. Despite considerable overlap in product offerings, Target and Walmart have cultivated different corporate images among the public; Target markets itself to somewhat younger, more affluent consumers in urban and suburban areas.[15] Even without differences in firm reputation, marginal differences in product offerings could increase the benefit to firm clustering. For instance, a consumer seeking to purchase highly specialized office equipment might browse Staples, Office Max and Office Depot to find precisely the right item. A second possibility is that Big Box firms prefer to share market areas with a competitor, rather than cede large numbers of consumers.

[15] http://www.cbsnews.com/news/walmart-and-target-a-tale-of-two-discount-chains/

This is particularly likely for prime locations, such as regional power centers that draw large volumes of consumers. The current empirical estimation cannot distinguish these large retail centers, or other possible omitted variables for underlying site productivity or regulatory environment.

The analysis suggests some policy implications for both opponents of Big Box stores and economic development advocates. Local governments, unions, and mom-and-pop stores have expressed concern over the impact of Big Box entry into new markets, including recent expansions of Wal-Mart and Target into urban neighborhoods. However, if Big Box stores generally move into areas with existing large-scale retailers, they are less likely to portend radical changes in the built environment that planners have feared. For economic development advocates hoping to court Big Box stores, especially in "retail deserts", the results suggest that Big Box stores are unlikely to be first-movers into these markets. Whether the tendency to follow existing stores stems from an information failure or the need for a critical mass of stores to provide agglomeration benefits is an important question to understand the potential of Big Box stores to address the retail deserts problem.

References

Alwitt, L. and T. Donley. 1997. Retail Stores in Poor Neighborhoods. Journal of Consumer Affairs 31: 139-164.

Andersson, Ake, David Emanuel Andersson, Zara Daghbashyan and Bjorn Harsman. 2013. Location and spatial clustering of artists. Regional Science and Urban Economics 47: 128-137.

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

Basker, Emek. 2007. The Causes and Consequences of Wal-Mart's Growth. Journal of Economic Perspectives: 21(3): 177-198.

Basker, Emek. 2011. Does Wal-Mart Sell Inferior Goods? Economic Inquiry, 49(4): 973-981.

Basker, Emek, Shawn Klimek, and Pham Hoang Van. 2012. Supersize It: The Growth of Retail Chains and the Rise of the "Big Box" Retail Format. Journal of Economics and Management Strategy 21(3): 541-582.

Basker, Emek and Michael Noel. 2009. The Evolving Food Chain: Competitive Effects of Wal-Mart's Entry into the Supermarket Industry. Journal of Economics and Management Strategy 18(4): 977-1009.

Benjamin, J., G. Boyle, and C.F. Sirmans. 1992. Price Discrimination in Shopping Center Leases. Journal of Urban Economics 32: 299-317.

Berry, B. 1967. Geography of Market Centers and Retail Distribution. Englewood Cliffs, NJ, Prentice Hall.

Brueckner, Jan. 1993. Inter Store Externalities and Space Allocation in Shopping Centers. Journal of Real Estate Finance and Economics 7(1): 5-17.

Caplin, Andrew, and John Leahy. 1998. Miracle on Sixth Avenue: information externalities and search. The Economic Journal 108: 60-74.

Capozza, Dennis and Robert Van Order. 1978. A Generalized Model of Spatial Competition. American Economic Review 68: 896-908.

Carden, A., and C. Courtemanche. 2011. Supersizing supercenters? The Impact of Walmart Supercenters on Body Mass Index and Obesity. Journal of Urban Economics, 69:165-181.

Clapp, John, Stephen Ross and Tingyu Zhou. 2014. Retail Agglomeration and Competition Externalities: Evidence from U.S. Multiline Department Stores. Working paper.

DeBonis, Mike. 2013. D.C. Council approves "living wage" bill over Wal-Mart ultimatum. The Washington Post July 10 2013.

Eaton, B. and Richard Lipsey. 1975. The Principle of Minimum Differentiation Reconsidered: Some New Developments in the Theory of Spatial Competition. Review of Economic Studies 42: 27-49.

Elizalde, Javier. 2013. Competition in multiple characteristics: An empirical test of location equilibrium. Regional Science and Urban Economics 43(6): 938-950.

Ellickson, P. B. and P.L.E. Grieco. 2013. Wal-Mart and the Geography of Grocery Retailing. Journal of Urban Economics, 7(1): 1-14.

Fischer, Jeffrey and Joseph Harrington. 1996. Product Variety and Firm Agglomeration. RAND Journal of Economics 27(2): 281-309.

Haltiwanger, John, Ron Jarmin and C.J. Krizan. 2010. Mom-and-Pop Meet Big Box: Complements or Substitutes? Journal of Urban Economics 67(1): 116-134.

Hamilton, Bruce. 1978. Zoning and the Exercise of Monopoly Power. Journal of Urban Economics 5: 116-130.

Hausman, Jerry and Ephraim Leibtag. 2005. Consumer Benefits from Increased Competition in Shopping Outlets: Measuring the Effect of Wal-Mart. NBER Working Paper 11809.

Healey, Jon. August 13 2012. Wal-Mart and Chinatown: Who speaks for the community? Los Angeles Times.

Holmes, T. J. 2011. The Diffusion of Wal-Mart and the Economies of Density. Econometrica 79(1): 253-302.

Hotelling, Harold. 1929. Stability in Competition. Economic Journal 39: 41-57.

Irmen, A. and Jean-Francois Thisse. 1998. Competition in multi-characteristics spaces: Hotelling was almost right. Journal of Economic Theory 78: 76-102.

Klier, Thomas and Daniel McMillen. 2008a. Evolving Agglomeration in the U.S. Auto Supplier Industry. Journal of Regional Science 48(1): 245-267.

Klier, Thomas and Daniel McMillen. 2008b. Clustering of Auto Supplier Plants in the United States. Journal of Business Economics and Statistics 26(4): 460-471.

Lösch, August. 1954. The Economics of Location. New York: Wiley.

Matsa, D. A. 2011. Competition and Product Quality in the Supermarket Industry. Quarterly Journal of Economics, 126: 1539-1591.

Netz, Janet and Beck Taylor. 2002. Maximum or Minimum Differentiation? Location Patterns of Retail Outlets. Review of Economics and Statistics 84(1): 162-175.

Meltzer, Rachel and Jenny Schuetz. 2012. Bodegas or Bagel Shops? Neighborhood differences in retail and household services. Economic Development Quarterly 26(1): 73-94.

Pennington-Cross, Anthony and Sergio Garate. 2014. Entry and Co-Location: Evidence from Chilean Retailers. Working paper.

Picone, Gabriel A., David B. Ridley and Paul Zandbergen. 2009. Distance Decreases with Differentiation: Strategic Agglomeration by Retailers. International Journal of Industrial Organization 27(3): 463-473.

Pope, Devin and Jaren C. Pope. 2013. When Walmart Comes to Town: Always Low Housing Prices? Always? Working paper.

Pristin, Terry. 2009. A Difficult Birth for East Harlem Mall. The New York Times.

Schuetz, Jenny and Richard K. Green. 2014. Is the Art Market More Bourgeois Than Bohemian? Journal of Regional Science.

Schuetz, Jenny, Jed Kolko and Rachel Meltzer. 2012. Are Poor Neighborhoods "Retail Deserts?" Regional Science and Urban Economics 42(1): 269-285.

Sloane, D.C., L.B. Lewis, L.M. Nascimento. 2005. Assessing Healthy Food Options in South Los Angeles Restaurants. American Journal of Public Health 95(4): 668-673.

Stern, N. 1972. The Optimal Size of Market Areas. Journal of Economic Theory.

Thorson, James. 1996. An Examination of the Monopoly Zoning Hypothesis. Land Economics 72(1): 43-55.

Waldfogel, Joel. 2008. The Median Voter and the Median Consumer: Local private goods and population composition. Journal of Urban Economics 63(2): 567-582.

Zenk, S., et. al. 2005. Neighborhood Racial Composition, Neighborhood Poverty, and the Spatial Accessibility of Supermarkets in Metropolitan Detroit. American Journal of Public Health 95: 660-667.

Table 1: Big Box firms by retail sector

Retail sector (NAICS)	
Furniture & home furnishings stores (442)	ASHLEY, COST PLUS, LAZBOY, BED BATH & BEYOND, CONTAINER STORE, HOME GOODS, PIER ONE
Electronics & appliance stores (443)	BEST BUY, CIRCUIT CITY, FRYS
Building material & garden equipment dealers (444)	HOME DEPOT, LOWES
Clothing, shoes and accessories stores (448)	BABIES R US, BURLINGTON COAT, DRESS BARN, PUMA, DSW, VALUE CITY
Sporting goods, hobbies, book and music stores (451)	BASS, DICKS SPORTING, GUITAR CENTER, MICHAELS, SPORTS AUTHORITY, TOYS R US, BARNES NOBLE, BOOKS A MILLION, BORDERS, CROWN BOOKS
General merchandise: Discount department stores & warehouse stores (452)	ASSET MAXIMIZERS, CENTURY 21, CURACAO, DOLLAR JOES, DOLLAR WAREHOUSE, EL PROGRESO, INTL DISCOUNT, JC PENNEY, KMART, KOHLS, LUCKY BUY, MARMAXX, MARUKAI, MERVYNS, ROSS, SEARS, TARGET, WALMART, BARGAIN WHOLESALERS, BIG LOTS, COSTCO, DOLLAR TREE, PRICE CLUB, XTRA
Miscellaneous store retailers (453)	OFFICE DEPOT, OFFICE MAX, STAPLES, PETCO, PETSMART

Notes: The list of firm names was compiled from Columbia University Graduate School of Architecture, National Federation of Retailers, and Wikipedia. Trade names and NAICS codes taken from NETS 1992-2009.

Table 2: Retail employment, by sector and firm type

Retail sector	Employment	% Big Box	% Chain	% Mom-pop
Furniture & home furnishings	341	3.98	8.46	87.56
Electronics & appliances	432	7.66	10.78	81.56
Building material & garden equipment	420	23.22	9.63	67.15
Clothing, shoes and accessories	837	0.50	26.19	73.30
Sporting goods, hobbies, books & music	539	12.79	12.46	74.76
General merchandise	1093	64.26	20.95	14.79
Miscellaneous store retailers	826	6.71	4.44	88.85
All retail	7691	13.40	23.43	63.12

Notes: Employment numbers are PUMA-level averages for 1992, 2000 and 2006. All retail includes only sectors shown separately.

Table 3: New Big Box stores' proximity to own-firm stores and competitors

			Distance from new stores	
Sector	Big Box firms	New stores	Own firm	Competitor
Furniture & home furnishings	7	154	34.24	4.36
Electronics & appliances	3	118	17.65	9.83
Building material & garden equipment	2	171	25.09	53.31
Clothing, shoes and accessories	6	119	18.80	15.50
Sporting goods, hobbies, books & music	10	414	7.79	1.90
General merchandise	24	906	12.96	0.85
Miscellaneous store retailers	5	410	9.33	3.39
All sectors	**56**	**2250**	**14.29**	**6.37**

Notes: Distances are linear distance from new stores (1993-95, 2001-03, 2007-09) to nearest existing stores (1992, 2000, 2006). Competitor stores are other Big Box firms in same retail sector.

Table 4: Variable sources and definitions

Variable name	Definition	Source
Retail employment		
New Big Box	employees/sq mi, new Big Box	NETS (1992-2009)
Big Box	employees/sq mi, existing Big Box	
any own-firm	= 1 if any own-firm Big Box, = 0 ow	
in sector	employees/sq mi, same-sector Big Box	
out sector	employees/sq mi, out-of-sector Big Box	
retail	employees/sq mi, all retail	
mom-pop	employees/sq mi, mom-and-pop retail	
chain	employees/sq mi, large chain retail	
own-firm PMSA	existing own-firm Big Box stores in PMSA	
Other tract characteristics		
pop density	population/sq mi	Census (1990, 2000), ACS (2005-2009)
emp density	non-retail employees/sq mi	NETS (1992-2009)
distance CBD	distance (miles) to CBD	Calculated from NETS, Census
income	Median household income	Census (1990, 2000), ACS (2005-2009)
baplus	% pop w/ BA, grad or professional degree	
black	% pop African-American	
hispanic	% pop Hispanic	
kids	% pop < 18 years	
Political/institutional metrics		
democrat	% Democratic votes, Governor/Senate races	Statewide Database, UC-Berkeley
land index	Herfindahl index, land by local govt	Census 1990, 2000, ACS 2005-2009

Table 5: Variable summary statistics

Variable name	Mean	Std. Dev.	Min	Max	N
Retail employment					
New Big Box	0.11	0.94	0.00	41.49	32,592
Big Box	0.56	2.58	0.00	73.41	32,592
any own-firm	0.18	0.39	0.00	1.00	32,592
in sector	9.23	16.85	0.00	117.06	32,592
out sector	27.62	30.84	0.00	249.28	4,074
retail	299	384	0	4,199	582
chain	72	110	0	1,451	582
mom-pop	196	269	0	2,533	582
own-firm PMSA	0.87	1.07	0.00	4.42	2,106
Other tract characteristics					
pop density	5,646	5,566	8	42,744	582
emp density	2,689	5,130	2	66,280	582
distance CBD	13.25	10.39	0.08	71.19	582
income	80,072	25,839	26,446	185,559	582
baplus	27.20	14.46	2.25	70.82	582
black	7.68	9.91	0.17	67.40	582
hispanic	31.04	20.70	3.48	98.11	582
kids	23.95	5.73	8.01	40.39	582
Political/institutional metrics					
democrat	58.64	17.08	19.55	98.13	582
land index	0.70	0.31	0.17	1.00	582

Table 6: New Big Box location by prior store density

		New Big Box	No new Big Box	New - none
All Big Box firms	any own-firm	0.38	0.17	0.21 ***
	in sector	9.29	9.23	0.06
	out sector	26.34	22.03	4.31 ***
	n =	2060	30532	
Home furnishings	any own-firm	0.17	0.08	0.09
	in sector	0.59	0.53	0.06
	out sector	33.83	31.39	2.43
	n =	147.00	3927.00	
Electronics	any own-firm	0.86	0.52	0.35
	in sector	2.18	1.00	1.18 ***
	out sector	43.38	29.66	13.72 ***
	n =	105.00	1641.00	
Building materials	any own-firm	2.08	1.87	0.20
	in sector	1.24	2.01	-0.77 **
	out sector	26.80	28.54	-1.73
	n =	166.00	998.00	
Clothing	any own-firm	0.10	0.03	0.07 **
	in sector	0.38	0.13	0.25 ***
	out sector	40.59	31.65	8.95 ***
	n =	110.00	3382.00	
Hobbies	any own-firm	0.43	0.27	0.16 ***
	in sector	2.63	2.23	0.40 **
	out sector	33.69	29.24	4.45 ***
	n =	369.00	4869.00	
Gen merchandise	any own-firm	1.81	0.81	1.00 ***
	in sector	21.50	19.81	1.69 **
	out sector	12.77	11.24	1.53 ***
	n =	791.00	13177.00	
Miscellaneous	any own-firm	0.42	0.36	0.06
	in sector	1.59	1.46	0.13
	out sector	35.73	29.45	6.27 ***
	n =	372	2538	

Notes: Numbers are firm-PUMA-year averages. New Big Box/No new Big Box indicates at least one new Big Box store opened per PUMA-year (1993-95, 2001-03, 2007-09). Own-firm store is binary indicator of any Big Box store of the same parent firm operated in that PUMA in baseline years (1992, 2000, 2006). In-sector emp is baseline year employees per square mile, combining other Big Box firms in the same retail sector. Out-of-sector emp is baseline year employees per square mile, combining Big Box firms in different retail sectors. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 7: Retail location model, by firm type

Dependent var:	ln(retail)	ln(Big Box)	ln(chain)	ln(mom-pop)	ln(new Big Box)
	(1)	(2)	(3)	(4)	(5)
ln(pop density)	0.506***	0.211	0.453***	0.436***	-0.523**
	(0.049)	(0.129)	(0.092)	(0.042)	(0.243)
ln(emp density)	0.511***	0.689***	0.467***	0.499***	0.784***
	(0.045)	(0.124)	(0.088)	(0.037)	(0.227)
ln(dist CBD)	0.0903**	0.207*	0.059	0.0642*	0.219
	(0.040)	(0.116)	(0.078)	(0.036)	(0.258)
ln(income)	-0.104	1.366***	-0.077	-0.467***	1.658**
	(0.168)	(0.505)	(0.314)	(0.171)	(0.810)
baplus	-0.005	-0.0534***	-0.0125*	0.005	-0.0618***
	(0.003)	(0.011)	(0.007)	(0.003)	(0.018)
black	-0.00827***	-0.0151**	-0.0117**	-0.00539***	-0.021
	(0.002)	(0.008)	(0.005)	(0.002)	(0.015)
hispanic	-0.00644***	-0.0252***	-0.0162***	-0.001	-0.0379***
	(0.002)	(0.006)	(0.004)	(0.002)	(0.010)
kids	-0.0120***	0.006	-0.0242***	-0.0174***	-0.032
	(0.005)	(0.013)	(0.009)	(0.004)	(0.028)
County-yr FE	Y	Y	Y	Y	Y
Observations	582	582	582	582	582
R-squared	0.968	0.668	0.858	0.975	0.312

Coefficients from OLS estimates. Robust standard errors, clustered by PUMA, in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 8: New Big Box stores and existing retail locations

Dependent var:	ln(new Big Box)					
	(1)	(2)	(3)	(4)	(5)	(6)
any own-firm	0.135**			0.049	-0.174***	-0.256***
	(0.058)			(0.053)	(0.056)	(0.056)
ln(in sector)		0.200***		0.113***	0.111***	0.109***
		(0.032)		(0.028)	(0.029)	(0.034)
ln(out sector)			0.202***	0.154***	0.193***	0.152***
			(0.032)	(0.030)	(0.036)	(0.047)
Big Box firm FEs	Y	Y	Y	Y	Y	Y
Time-place fixed effects	County-yr	County-yr	County-yr	County-yr	County-yr	City-yr
Econ/demographic controls	N	N	N	N	Y	Y
Political/institutional controls	N	N	N	N	N	Y
Observations	31,428	31,428	31,428	31,428	31,428	30,942
R-squared	0.14	0.1453	0.1476	0.1493	0.1586	0.1913

All coefficients are estimated from Tobit models, adjusting for left-censoring at zero. Robust standard errors, clustered by PUMA, in parentheses. Column 5 excludes PUMAs with zero Big Box stores in the baseline year.

*** p<0.01, ** p<0.05, * p<0.1

Table 9: New Big Box location, competitor and complementary stores, by retail sector

Dependent var:	ln(new Big Box)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Sector:	Furniture	Electronics	Bldg stuff	Clothing	Hobbies	Genl merch	Misc
any own firm	-0.526***	-0.278***	-0.619**	0.0987***	-0.135***	-0.210***	-0.418***
	(0.014)	(0.029)	(0.302)	(0.012)	(0.009)	(0.013)	(0.011)
ln(in sector)	-0.0856***	0.209***	-0.136	0.385***	0.0207***	0.151***	0.008
	(0.014)	(0.018)	(0.187)	(0.009)	(0.008)	(0.006)	(0.011)
ln(out sector)	0.233***	0.778***	0.494**	0.0773***	0.195***	0.276***	0.242***
	(0.005)	(0.011)	(0.248)	(0.004)	(0.004)	(0.007)	(0.004)
Big Box firm FE	Y	Y	Y	Y	Y	Y	Y
City-year FE	Y	Y	Y	Y	Y	Y	Y
Other controls	Y	Y	Y	Y	Y	Y	Y
Observations	4,011	1,719	1,146	2,865	4,584	13,752	2,865
Pseudo R-squared	0.4975	0.4381	0.3985	0.5912	0.2801	0.2575	0.3053

All columns show results from Tobit estimates, adjusted for left-censoring at zero. Robust standard errors, clustered by PUMA, in parentheses. Excludes PUMAs with no large chain retailers in baseline year. *** p<0.01, ** p<0.05, * p<0.1

Appendix Table 1: Robustness checks on new Big Box functional form

Dependent var:	ln(new Big Box)		Any new Big Box
Estimation	OLS	Tobit	OLS
	(1)	(2)	(3)
any own-firm	-0.016**	-0.256***	-0.008
	(0.007)	(0.056)	(0.007)
ln(in sector)	0.010***	0.109***	0.004**
	(0.002)	(0.034)	(0.002)
ln(out sector)	0.012***	0.152***	0.008***
	(0.003)	(0.047)	(0.003)
Big Box firm FE	Y	Y	Y
City-year FE	Y	Y	Y
Other controls	Y	Y	Y
Observations	30,942	30,942	30,942
Pseudo R-squared	0.087	0.1913	0.107

Columns 1 and 3 are OLS estimates, Column 2 shows Tobit estimates, adjusted for left-censoring at zero. Robust standard errors, clustered by PUMA, in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Appendix Table 2: Coefficients on all control variables

Dependent var:	ln(new Big Box)			
	(1)	(2)	(3)	(4)
any own-firm	0.000	-0.0124*	-0.0158**	-0.256***
	(0.006)	(0.007)	(0.007)	(0.056)
ln(in sector)	0.0112***	0.010***	0.010***	0.109***
	(0.002)	(0.002)	(0.002)	(0.034)
ln(out sector)	0.0164***	0.0141***	0.0124***	0.152***
	(0.002)	(0.002)	(0.003)	(0.047)
ln(own-firm PMSA)		0.0198***	0.0212***	0.298***
		(0.003)	(0.003)	(0.032)
ln(in-sector chain)		-0.004*	-0.006**	-0.049
		(0.002)	(0.002)	(0.030)
ln(out-sector chain)		0.0165***	0.0128**	0.186*
		(0.004)	(0.006)	(0.106)
ln(pop density)		-0.0131**	-0.0238***	-0.436***
		(0.005)	(0.008)	(0.110)
ln(emp density)		0.002	0.0160**	0.286***
		(0.004)	(0.007)	(0.094)
ln(distance CBD)		-0.002	-0.005	-0.157
		(0.004)	(0.008)	(0.112)
ln(income)		0.013	0.009	0.500
		(0.014)	(0.024)	(0.392)
baplus		-0.001***	-0.001***	-0.023***
		(0.000)	(0.000)	(0.009)
black		0.000	0.000	-0.002
		(0.000)	(0.000)	(0.006)
hispanic		0.000	-0.001**	-0.014**
		(0.000)	(0.000)	(0.006)
kids		-0.001	0.000	-0.012
		(0.001)	(0.001)	(0.015)
democrat			0.001	-0.005
			(0.001)	(0.010)
land index			-0.026	-0.608**
			(0.018)	(0.273)
Big Box firm FEs	Y	Y	Y	Y
City-year FE	Y	Y	Y	Y
Observations	32,592	31,428	30,942	30,942
R-squared	0.069	0.072	0.087	0.1913

Columns 1-3 are OLS estimates, Column 4 shows Tobit estimates, adjusted for left-censoring at zero. Robust standard errors, clustered by PUMA, in parentheses. *** p<0.01, ** p<0.05, * p<0.1