NBER WORKING PAPER SERIES

MOM-AND-POP MEET BIG-BOX: COMPLEMENTS OR SUBSTITUTES?

John C. Haltiwanger
Ron S. Jarmin
C. J. Krizan

Working Paper 15348
http://www.nber.org/papers/w15348

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
September 2009

We thank Paul Bailey for excellent research assistance as well as Emek Basker, Randy Becker, Dan Driscoll, Lucia Foster, Kristin McCue, David Neumark, Javier Miranda, and Jim Rebitzer and participants at the NBER Conference on Entrepreneurship and Cities for helpful comments. We thank the Kauffman Foundation for financial support. Any opinions and conclusions expressed herein are those of the author(s) and do not necessarily represent the views of the U.S. Census Bureau. All results have been reviewed to ensure that no confidential information is disclosed. The views expressed herein are those of the author(s) and do not necessarily reflect the views of the National Bureau of Economic Research.

Mom-and-Pop Meet Big-Box: Complements or Substitutes?
John C. Haltiwanger, Ron S. Jarmin, and C. J. Krizan
NBER Working Paper No. 15348
September 2009
JEL No. L26,L81,R11,R3

ABSTRACT

In part due to the popular perception that Big-Boxes displace smaller, often family owned (a.k.a. Mom-and-Pop) retail establishments, several empirical studies have examined the evidence on how Big-Boxes' impact local retail employment but no clear consensus has emerged. To help shed light on this debate, we exploit establishment-level data with detailed location information from a single metropolitan area to quantify the impact of Big-Box store entry and growth on nearby single unit and local chain stores. We incorporate a rich set of controls for local retail market conditions as well as whether or not the Big-Boxes are in the same sector as the smaller stores. We find a substantial negative impact of Big-Box entry and growth on the employment growth at both single unit and especially smaller chain stores – but only when the Big-Box activity is both in the immediate area and in the same detailed industry.

John C. Haltiwanger
Department of Economics
University of Maryland
College Park, MD 20742
and NBER
haltiwan@econ.umd.edu

Ron S. Jarmin
Center for Economic Studies
U.S. Census Bureau
4600 Silver Hill Road
Washington, DC 20233
ron.s.jarmin@census.gov

C. J. Krizan
Center for Economic Studies
U.S. Census Bureau
4600 Silver Hill Road
Washington, DC 20233
Cornell.J.Krizan@census.gov

I. Introduction

The rise of Big-Box retailing has spurred considerable debate. Big-Boxes, large retail stores operated by national or multinational chains, have been criticized for their labor market practices, their contribution to the trade deficit and many other things. On the other hand, they are popular shopping venues and have been a boon to consumers because they offer expansive product lines at low prices. In addition, recent empirical evidence shows that the restructuring in the retail trade sector towards large national chains has been at the core of productivity growth in the retail trade sector. The higher productivity of large national chains has also been linked to large national chains advantages in exploiting information technology. [5]

Even with the benefits to consumers and gains in productivity, the shift towards large national chains has not been without costs. Perhaps the most relevant criticism of the Big-Box retail format along these lines is that it displaces smaller, often family owned (a.k.a. Mom-and-Pop) retail establishments and contributes to the decline of traditional retail districts such as the main streets of small towns and the downtown shopping districts of large cities.[6] While much of the public debate surrounding Big-Box retailers concerns their impact on already existing stores, a related interesting question concerns the impact Big-Boxes have on entrepreneurship in the retail sector. Does the presence of Big-Boxes in local retail markets preclude entrepreneurial retailers from entering or expanding their presence in the market?

Implicit in the contention that Big-Boxes displace smaller retailers is that Big-Boxes and smaller stores are substitutes in the provision of retail services within local retail markets. However, since Big-Box stores may attract shoppers to a location, it is possible that they may actually benefit smaller neighboring stores. That is, the ultimate impact of Big-Boxes on other retail outlets depends on the degree to which they are substitutes or complements in the provision of retail services within their local market.

Community leaders and policymakers alike are interested in knowing whether or not Big-Box retailers displace more retail employment than they create and how they affect the level of entrepreneurial activity in retail markets. Although economists have attempted to measure the overall local retail employment effect from the entry of a Big-Box store into the community, they have failed to reach a consensus. Recent papers focusing on the impact of Big-Box (particularly Wal-Mart) entry on retail employment at the county level

[5] The work of Hausman and Leibtag (2005) highlights the consumer welfare gains from lower prices and greater product variety. The work of Foster, Haltiwanger and Krizan (2006a) shows that much of the productivity growth in the retail trade sector in the 1990s is due to more productive entering stores from large national chains displacing less productive single unit stores that exit. We discuss the recent literature on IT, large chains and productivity in detail in section II. The higher productivity and lower prices of large national chains are arguably connected since it is the higher productivity that (at least in part) enables the large national chains to charge lower prices.

[6] We often refer to the single unit stores as Mom-and-Pop stores in this analysis for labeling purposes. This is not meant to indicate that all single unit establishments are family-owned businesses but rather simply that they are single unit stores. Single unit stores are typically small (fewer than 10 employees) and often are sole proprietorships.

find both a positive and negative impact. Basker (2005) finds that, while it's likely that employment at other retailers shrinks, on average Wal-Mart entry leads to an overall increase in county level retail employment of about 50 jobs. Neumark, Zhang and Ciccarella (2008) highlight potential endogeneity problems with Basker's empirical methodology and use an alternative instrumental variable estimation approach that yields results showing that Wal-Mart entry reduces county retail employment.

In related work, Jarmin, Klimek and Miranda (2009) document the changes in the structure of county-level retail markets. They note that the trend away from single unit stores to those operated by chains has been underway for many decades. This trend has been influenced by changes in technology, transportation and land-use patterns. Despite this trend, however, they document that substantial entry (as well as exit) of single unit retailers persists. That is, despite seeing their share of overall retail activity decline steadily over decades (not just since the advent of the Big-Box, discount format), single unit retailers still perceive a niche and enter retail markets at high rates. This suggests that chain stores are not perfect substitutes for single unit retailers.

These county-level studies are reasonably informative about the changing structure of the retail sector. However, they offer few insights about the mechanics of the adjustments that occur when Big-Boxes enter and expand in retail markets. To gain a richer understanding of these adjustment mechanisms, we utilize retail establishment data from the Census Bureau's Longitudinal Business Database (LBD) that allow us to measure the impact of changes in Big-Box activity on the activity of nearby single unit and smaller chain stores within local geographic areas.[7]

The establishment records on the LBD provide information on firm structure (e.g., whether a retail establishment is part of a chain) and physical location. We use this rich information to measure the effects of Big-Box entry and growth within a few miles of smaller retailers, controlling for local retail market conditions. We also focus on just one metro region – the area including and surrounding Washington, D.C – and thus are exploiting within metro area variation rather than between county variation as in the recent literature.[8] We quantify the impact of Big-Box store entry and growth on single unit and smaller chain stores, operating in both the same and other retail sectors, by detailed location controlling for local retail market conditions including demographic (shopper) characteristics such as income, education and population growth. We also control for access to transportation infrastructure such as interstate highway exits and subway stops.

[7] We note that our empirical approach and design is much better suited to quantify the adjustment process within a metro area than to answer directly the question posed by the county-level studies regarding the overall employment effect. It would in principle be possible to integrate across all the often overlapping detailed areas at different distances to generate an estimate of the overall effect. However, our focus is on quantifying the local adjustment process.

[8] We use only a single metro region because of the substantial time and computer resources needed to generate our highly detailed analytic database that includes distance measures between all retail stores in the D.C. area along with information on local retail conditions for narrowly defined geographic areas. The resulting analytical database richly describes the changes in a rapidly expanding metro region but it would clearly be of interest to extend the data and analysis to additional metro areas in subsequent analyses.

Our main finding is that there is a substantial negative impact of Big-Box entry and growth on employment growth at both single unit and especially smaller chain stores - but only if the Big-Box activity is in the immediate area *and* in the same detailed industry. This negative same-sector effect attenuates with distance. That is, the impact tends to be the largest if the Big-Box activity is within 1 mile or 1 to 5 miles as opposed to 5 to 10 miles of the store in question. The impact of increased big-box activity manifests itself through a substantial reduction in net employment growth at smaller retailers, which is mostly accounted for by an increase in job destruction from store exit. We find more complex relationships between the growth and entry of Big-Box activity in *other* sectors on single unit and smaller retail chain stores. The greater complexity reflects heterogeneous responses depending on the nature of the Big-Box and the single-unit and smaller chain store in question. One particularly interesting part of this story is that for smaller chain restaurants, we find a positive other sector Big-Box effect in the immediate area regardless of whether the Big-Box is in General Merchandise or not.

The paper proceeds as follows. Section II provides a discussion of the recent literature studying the changing structure of retail trade that helps provide background and motivation for our analysis. Section III discusses the data sources and measurement methodology used in this paper. In section IV, we discuss our empirical strategy for estimating the impact of Big-Box entry and growth on single unit and smaller chain stores. Concluding remarks are in section V.

II. Background

In this section, we review the recent literature on the dynamics of the retail trade industry with a focus on the key findings and facts that both motivate and provide perspective for our analysis. A number of studies have documented the large transformation undergoing in the U.S. retail sector since the early 20th century (and before). Today's retail customers patronize significantly larger establishments that are much more likely to be operated by large national chains than their parents and grandparents did several decades ago. Changes in technology, transportation costs, suburbanization and consumer preferences both influenced and have been influenced by the structural change in retail markets.

Jarmin, Klimek and Miranda (2009 – hereafter JKM) show that the share of retail trade employment in the U.S. accounted for by single units declined from 53 percent in 1976 to 39 percent in 2000. In this work and the work of Foster, Haltiwanger and Krizan (2006a, 2006b – hereafter FHK), it is clear that this transformation is closely linked to the entry and exit of establishments. That is, adjustment on the extensive margin (i.e., entry and exit of individual stores) is a primary means by which adjustment occurs in the retail trade industry.

JKM document other important trends in retail trade. For example, retail establishments have been getting larger (as measured by employment) - even Mom-and-Pops - over time and across local retail markets of varying sizes. They also find that the rate of churning

for both single unit and chain retail stores is higher in large metropolitan area like Washington D.C. than it is in smaller urban or rural areas. They find large metro areas have fewer retail stores and firms per capita than do smaller areas and that rural areas have fewer retail employees per capita than larger areas. That is, retail stores in metro areas are larger than those in smaller areas.

There are two primary strands in the literature that seek to explain the increased scale and scope of retail outlets. First, studies such as Bresnahan and Reiss (1991) and Dinerlsoz (2004) focus on market size to explain the scale and scope of retail trade stores. Schiff (2009) pushes in a related direction for restaurants showing that larger and denser cities not only have more cuisines but there is a clear hierarchy in how less common cuisines appear across cities of increasing size. The other main strand of research focuses on technological change to explain the evolution of the scale and scope of retail trade businesses. For example, Holmes (2001) shows how barcodes lead to more frequent deliveries and larger store sizes. In related work, Doms, Jarmin and Klimek (2004) show that IT investments are related to productivity improvement only for large retail chains. Basker, Klimek and Van (2008) show retail technology changes are complementary to consumer preferences for one-stop shopping which leads to more products in larger stores operated by larger chains. These findings help explain the FHK (2006a) findings on the large fraction of productivity growth in retail trade being accounted for by the restructuring towards large national chains.

Just as scale and scope have evolved, so has retail location. Modern large-scale retailing emerged in the 1870s and 80s as city-based Department stores were formed to serve urban customers and catalog houses, which focused largely on rural areas, grew enormously in size and sophistication (Chandler 1977). By contrast, suburban regions were relatively underserved by retailers as recently as the mid 1960s (American Society of Planning Officials (1963)). All that changed however by the 1990s. While two-thirds of retail employment was located in central cities in the 1950s, by 1990 the number had dropped to less than one-half (Wassmer (2002)).

Most explanations for the large-scale post-World War II movement of the U.S. population to the suburbs focus on the pent-up demand for housing following the Second World War and the Great Depression, the provision of FHA and VA mortgages for returning soldiers, and the abundance of cheap land (Jackson (1985)). However, the biggest factors may have been widespread automobile ownership together and substantial government investments in highway infrastructure that combined to substantially lower transportation costs (Brueckner, 2000 and Glaeser and Kahn, 2005). Although there is some debate in the literature over the nature of the causality (Wassmer (2002)), in can be argued that lower transportation costs and cheap land led to workers moving to suburbs and commuting further to jobs located near older transport infrastructure (e.g., rail and water). The move towards a service economy and the flexibility of cars and trucks allowed jobs to move closer to the suburban workers.

Big-Box retailing can be seen in this context as an efficient response to population shifts, lower transportation costs and improvements in information technology. Nevertheless,

there is often spirited public debate surrounding the entry of Wal-Mart and other "Big-Box" stores into local retail markets. This aspect of the transformation of retail has been the subject of several academic studies.[9] In particular, Basker (2005) looks at retail employment at the county level after the entry of a Wal-Mart. She finds that, while it's likely that employment at other retailers shrinks, on average Wal-Mart entry leads to an overall increase in county level retail employment of about 50 jobs. Neumark, Zhang and Ciccarella (2008) criticize Basker's IV strategy and use an alternative that show Wal-Mart entry has a negative impact on county employment.[10]

This brief review helps both motivate and distinguish the approach we take in this paper. We focus on detailed location effects within a metro area rather than the national between-county variation used in the recent literature. Our starting point is to view different classes of retailers operating within a metro area as inputs to the provision of retail services. Our view, motivated by the recent literature, is that ongoing changes within a metro area are driven by changing technology, demographic shifts, consumer preferences, transportation networks, and regulations. These induce adjustments in the ways that retail services are provided to consumers. Put differently, we argue that the changes in the structure of local retail markets reflect retailers' attempts to find the most efficient way to provide retail services given technology, market size, and preferences. With this conceptual framework in the background, we are interested in investigating the adjustment process that occurs when single unit and small chain stores are faced with the entry or growth of a Big-Box store in their market area.

This approach has some parallels with the literature on localized spillovers (e.g, Rosenthal and Strange, 2003 and 2008, and Arzaghi and Henderson, 2005) if one views Big-Boxes as a focal point of localized retail agglomeration, or at least as responding to similar market cues (access to customers or transportation networks) as nearby smaller stores. Alternatively, it could be that the popular perception is correct and Big-Boxes dominate whatever local markets they enter (perhaps given the productivity and cost advantages discussed above) and drive competing stores out of business. Whether Big-Boxes are complements or substitutes for other retailers, our approach allows us to measure the intensity of the effect and how it changes with distance. Because of this our results can help inform those interested in the role the changing structure of local retail markets plays in the physical structure of metro areas.

Finally, before proceeding to the empirical analysis, it is important to acknowledge the limitations of our analysis. Our calculation of the employment effects of the entry and growth of Big-Boxes helps to illuminate the mechanisms and costs of adjustments as local retail markets like Washington DC's have evolved over our study period. By using detailed establishment and demographic data and explicitly considering the spatial context in which these adjustments occur we are able to more precisely measure the impact of Big-Box stores on local labor market than prior studies. However, we do not quantify the welfare consequences of the changing structure of retail markets. For this,

[9] Additional studies of the impact of Big-Box retailing include Davidson and Rummel (2000) and Lorch (2005, 2006).
[10] This debate continues (see, Basker (2006)).

we would need to quantify the relevant consumer and producer surplus effects, a task well beyond the intent and scope of this study.

III. Data and Measurement Issues

While we obtain data from several sources, our core data that allow us to track retail trade establishments and firms come from the Longitudinal Business Database (LBD) developed by Jarmin and Miranda (2002). The LBD covers all establishments and firms in the non-farm business sector from 1976 to 2005 and includes information about payroll, employment, detailed location, detailed industry and ownership structure. The data appendix explains the specifics of how we use the information from the LBD to construct our measures but we provide an overview here. Our basic approach is to use the LBD to assemble a set of the retail trade establishments operating in our target counties during the 1976 to 2005 period and use the longitudinal nature of the data to minimize spurious entry and exit due to missing geographic or industry information. The LBD's firm identifiers allow us to label establishments according to whether they were part of a single or multiunit firm and classify the multiunits according to how many states they operate in. For the remainder of the paper we refer to "small" chains that have establishments in 1 to 14 states and "large" chains operating in 15 or more states.[11]

Since there is no "official" definition of what a Big-Box is, we use information from a variety of outside data sources to identify them for our analysis. Due to the confidential nature of the Census Bureau micro data used in our study, we can't list the names of the well-known retailers that make up our list of Big-Boxes but in the appendix we describe the sources and criteria for classifying stores as Big-Boxes. While we don't list the names, we use the lists and criteria of Big-Boxes that have been developed by analysts of the retail trade industry. In general we consider an establishment to be a Big-Box if it is: a large structure with a substantial number of employees, offers either a broad spectrum of goods or great depth within a specialized line of goods, and is (usually) operated by a nation-wide chain that earns very high revenue levels.[12]

Not every national chain of retail establishments meets our definition of a Big-Box. Indeed, most do not. On the other hand virtually all of our Big-Boxes are part of nation-wide firms. Therefore we define the large chain category to be the stores of multi-unit firms which operate in 15 or more states – but are not Big-Boxes. At the end we use four mutually exclusive categories of firms: single units (a.k.a. Mom-and-Pops), small retail chains, large retail chains and Big-Boxes.

Another critical part of our analysis is to assign a detailed location to all our establishments. As described in the data appendix, we assign a latitude and longitude

[11] In the recent literature some have used the number of states and some the number of stores to classify establishments into chain types (see, e.g., FHK (2006b) and Basker, Klimek, Van (2008)). Our method follows FHK (2006b) and a large chain in our case by construction has at least 15 stores operating in at least 15 states. Results on the changing composition of retail trade towards larger chains are not sensitive to the precise cutoff for large chains.

[12] We note that traditional Department Stores (often part of a large, national chain) are not classified as Big-Boxes.

measure to the retail trade establishments in the D.C. metro area (where again this is defined in a consistent manner as described in the appendix). We use the latitude and longitude information to construct distance measures between the retail trade establishments and all the Big-Boxes in the D.C. region. As described below, by using the distance measure we can construct activity rings of various sorts (Big-Box, demographic, etc.) with 1 mile, 1 to 5 mile and 5 to 10 mile radii.[13]

Our demographic data come from the 1980, 1990, and 2000 Decennial Censuses. We use these microdata files to construct measures of population characteristics, income, and population growth in local areas. These methodologies are also described in detail in the data appendix.

Much of our analysis is based on analyzing employment growth at the establishment level and the decomposition of employment growth into components such as job destruction from exit. In the remainder of this section, we provide details about our measures of employment and growth. Let E_{it} be employment in year *t* for establishment *i*. In practice, this is a point-in-time measure reflecting the number of workers on the payroll for the payroll period that includes 12 March. We measure establishment-level employment growth as follows:

$$g_{it} = (E_{it} - E_{it-1}) / X_{it},$$

where

$$X_{it} = .5*(E_{it} + E_{it-1}).$$

This growth rate measure has become standard in analysis of establishment and firm dynamics, because it shares some useful properties of log differences but also accommodates entry and exit. (See Davis et al 1996, and Tornqvist, Vartia, and Vartia 1985).[14] In what follows, we refer to this as the DHS growth rate measure. Note that the DHS growth rate measure can be defined at any level of aggregation (establishment, local area, industry, etc.)

Measures of job creation and destruction at the establishment level are given by:

$$JC_{it} = \max(g_{it}, 0)$$
$$JD_{it} = \max(-g_{it}, 0)$$

Job creation from entry at the establishment level is given by:

[13] We recognize that this simple measure of 'nearness' ignores natural barriers such as rivers, lakes, and other obstacles.

[14] The DHS growth rate like the log first difference is a symmetric growth rate measure but has the added advantage that it accommodates entry and exit. It is a second order approximation of the log difference for growth rates around zero.

$$JC_{it} = \max(g_{it},0) * I\{g_{it} = 2\}$$

where I is an indicator variable equal to one if expression in brackets hold, zero otherwise, and $g_{it} = 2$ denotes an entrant.

Similarly job destruction from exit at the establishment level is given by:

$$JD_{it} = \max(-g_{it},0) * I\{-g_{it} = 2\}$$

where $g_{it} = -2$ denotes an exit. Using these measures it is straightforward to generate aggregate measures of job creation and destruction as well as job creation and destruction from entry and exit, respectively, at any level of aggregation by taking the employment (X_{it}) weighted average of these establishment level measures.[15] In the regression analysis that follows, we use these establishment-level measures of net growth and the components of growth on an employment-weighted basis. The employment-weighted regressions by construction yield that the mean of the dependent variable is equal to the appropriate employment weighted mean.

IV. Results

A. Basic facts about the evolution of the retail sector in the D.C. area.

We find that the retail establishments in our set of D.C. metro counties largely mirror national trends in retail trade. Figure 1 shows the employment growth for the four types of retail establishments over the 1976 to 2005 period. The rapid employment growth for the large chains and Big-Box beginning in the early nineties is striking. Interestingly, judging solely from Figure 1, it does not appear that single unit Mom-and-Pop stores bore the brunt of the displacement effects of the larger chains' growth. Instead, the smaller chains retreated in the face of increased competition from the Big-Boxes and other large chains.

The patterns in Figure 1 reflect the overall growth patterns for the D.C. metro area. The D.C. area grew substantially over this period, so we expect to see all types of retail establishments grow as well. To get a sense of the restructuring that occurred over this period, Figure 2 presents the shares of employment by establishment type by year. Figure 2 highlights the substitution away from smaller chain store employment towards Big-Box and large chain employment. There is a modest overall downward trend in the share of single unit employment especially through 1996 but interestingly single unit establishments recovered some of their share in the 1996-2005 period.

In the empirical analysis that follows, we exploit establishment-level employment growth rates and the components of establishment-level employment growth such as the job creation from entry and job destruction from exit. Figures 3-5 provide perspective on the trends in these measures for the DC metro area by establishment type. Figure 3 depicts

[15] See the appendix for details.

the net employment growth rates for the four retail establishment types. The rapid growth of Big-Box stores in the 1990's is clearly evident from the figure. Until 1990, the time series patterns for the four types moved in sync. Starting in 1990, however, the pattern for Big-Box stores begins to deviate. To a smaller degree the cycle for large chain stores runs counter to smaller chain chains and single location stores. Also of note is that during the 1999-2000 trough in large chain employment growth, single location stores show their strongest growth since the mid-80s when all store types exhibited robust growth. The figure shows that employment growth at single unit retailers remained on par with that at larger chain establishment, at least for the D.C. metro area.

Underlying the net employment growth rate patterns are large rates of gross job creation and destruction. For example, the average annual net growth rate of single unit establishments is 3.5 percent per year which is the difference between an average gross job creation rate of 22 percent and an average gross job destruction rate of 19.5 percent. Much, although not all, of the gross job creation and destruction is along the extensive margin through establishment entry and exit. FHK emphasized the importance of extensive margin as a critical margin of adjustment in retail trade. For single units, establishment entry accounts for about 52 percent of job creation and 46 percent of job destruction on an annual basis.[16] These patterns make sense as once a store is created it becomes relatively more difficult to change its size and scope.

Given the importance of the extensive margin in retail trade, Figures 4 and 5 provide detail on the contribution of store openings and closings to job creation and destruction (computed as described above) respectively. In each case we see that for most years both job creation from new store openings and job destruction is highest for single location stores and lowest for Big-Box. This hierarchy has been noted by JKM and FHK. The obvious exception to this is the large spike in the job creation from the entry of new Big-Box stores in the 90's.

In the regressions below, we exploit spatial, industry and temporal variation in employment growth of retail establishments in the D.C. area. A key component of our identification strategy are the differences across the single unit and small chain retail stores in their proximity to Big-Boxes stores from different detailed retail industries and with different entry dates and growth patterns. Our D.C. metro dataset contains about 1200 Big-Box stores. Table 1 provides information about which major retail sub-sectors in the D.C. area have Big-Box activity[17] for two sub-periods. We report only through 2000 in Table 1 because we are using an SIC-based definition. In the analysis that follows, however, we use much more detailed industry (e.g., 6-digit SIC and 8-digit NAICS).[18] However, Table 1 is useful to provide a broad overview. It is clear that in

[16] Appropriate caution is required in comparing the shares of job creation from entry and job destruction from exit on an annual basis and over a five-year horizon as in FHK.

[17] To avoid disclosing respondent information, we simply report information about existence of activity in the cell and whether employment in the cell grew over time.

[18] Using the industry detail is quite important given the coarseness of 4-digit SIC industry classifications in retail for at least some industries. Note that in many cases there is no additional detail in the 6-digit SIC relative to the 4-digit SIC (e.g., Hardware stores (SIC 525100), Retail Nurseries (SIC 526100) and Misc. Home furnishings Stores (SIC 579100)) but in cases where there is detail there is often considerable

terms of major industry groups, Big-Box activity is concentrated in a relatively small number of major industry groups – building materials, hardware and garden supply; general merchandise; and home furnishings, furniture and equipment. There is also substantial growth of Big-Box activity in each of these broad categories (quantitative information about growth suppressed for disclosure reasons).

B. Empirical Specifications: Focusing on the Role of Distance within the D.C. Metro Area.

As discussed above, existing evidence on the impact of Big-Box stores on retail employment comes from analyses using county-level data to examine changes in payroll and/or employment in the wake of entry of a particular chain such as Wal-Mart. Prominent papers in this literature use Wal-Mart's geographically based expansion strategy to construct instruments (planned opening dates in the case of Basker (2005) and distance from Bentonville, AR interacted with time in the case of Neumark, Zhang and Ciccarella (2008) and related distance measures used by Dube, Eidlin and Lester (2005)).

Rather than focusing on Wal-Mart per se or on between county variation across the nation, our approach focuses on the proximity of single unit and small chain stores to Big-Box retailers. We utilize detailed longitudinal store level micro data geocoded to permit distance to play an explicit role and to permit more precise control for local retail market conditions. Much of our identification strategy is driven by the assumption that given transportation costs faced by shoppers, the impact – positive or negative – of entry by a Big-Box store within in a large metro area should be localized. For example, in the D.C. area the entry of a Big-Box store in Prince George's County, MD shouldn't be expected to impact retail employment in Loudon County, VA (on the opposite side of the D.C. area) as much as retail trade activity in the immediate area in Prince George's County.[19]

Physical distance is clearly not the only factor that determines whether Big-Boxes are substitutes or complements for single unit and small retail chain stores. Distance in product space is also a critical factor. To explore the role of product space, we use

---

heterogeneity. Examples that help illustrate this heterogeneity include Sporting Goods – Retail (SIC 594110), Fishing Tackle (SIC 594170), Toys-Retail (SIC 594510), Craft Supplies (SIC 594520), Gun Shops (SIC 594550), Book Stores (SIC 594210), and College Book Stores (SIC 594230). We have found, however, that the general pattern of our results is robust to using coarser industry definitions but not surprisingly with less precision. In what follows, we also explore the role of specific types of Big-box stores (e.g., General Merchandise) and impacted single units and small chains (e.g., restaurants). As we discuss further below, General Merchandise is important to explore separately both because of the possible spillover effects of General Merchandise stores but also the potential overlap of SIC categories within General Merchandise. That is, we think using the narrow industry definitions works best outside of General Merchandise so it is useful to treat the latter differently.

[19] The role of distance likely varies by type of product and sector. For example, retail customers might be more likely to travel extensive distances for certain types of durable goods (e.g., autos). As we discuss in the conclusion, an area for future research is to explore additional variation in the patterns by product and sector. We leave this for future research since this approach would be facilitated by constructing a database for multiple metropolitan areas.

information about the detailed industry that the single unit and small retail chain stores are operating in relative to the industry of the Big-Box store that may have entered their neighborhood. Our primary approach is to focus on same sector and other sector effects. In some extensions of the basic specification, we further control for whether the other sector Big-Box store is a General Merchandiser – and likely to intersect the product space of many types of stores – and whether the single unit or small chain store is a restaurant.

We focus on the impact of Big-Box stores on the dynamics of retail establishments operated by single location Mom-and-Pops and smaller chain stores. Our primary regressions estimate the impact of changes in Big-Box employment along both the intensive and extensive margins on single unit and smaller chain store activity in the immediate area, controlling for common factors that impact retail trade activity in the immediate area. In the remainder of this section, we provide an overview of our estimation approach. Note that while we primarily discuss the regression strategy for single units, our approach for smaller chain stores is the same. The main regression specification is given by:

$$Y_{it} = \alpha_1 BB\_1\_mile\_same_{it-1} + \alpha_{15} BB\_1\_to\_5mile\_same_{it-1} + \alpha_{5to10} BB\_5\_to\_10mile\_same_{it-1}$$
$$+ \beta_1 BB\_1\_mile\_other_{it-1} + \alpha_{15} BB\_1\_to\_5mile\_other_{it-1} + \alpha_{5to10} BB\_5\_to\_10mile\_other_{it-1}$$
$$+ X_{it}^{'}\delta + \lambda Year_t + \varepsilon_{it}$$

where Y_{it} is the outcome variable of interest (either the employment growth rate of the establishment or a component of the single unit establishment growth rate such as the job destruction from exit), X_{it} is a vector of controls and $Year_t$ represents year effects. We describe the main variables of interest (e.g., $BB\_1\_mile\_same_{it-1}$) as well as the controls below.

We use the DHS growth rate measure described in the previous section for both LHS and RHS variables that accommodates including entering, exiting and continuing establishments. The primary explanatory variables of interest are measures of the (one year) lagged Big-Box activity in various concentric rings around each single unit store.

First, we consider specifications where the Big-Box activity is a dummy variable indicating the lagged initial entry of Big-Box activity in the same sector and other sectors for concentric rings of less than 1 mile, 1 to 5 mile and 5 to 10 miles (so in the above expression we distinguish lagged Big-Box activity by distance and same/other sector). These specifications measure the adjustment along both the extensive and intensive margins of single unit and small chain store employment to the first entry of Big-Box into a given ring. That is, we only exploit variation across single units in the change in Big-Box activity along the extensive margin.

Next, we consider specifications with the lagged growth rates of employment of Big-Boxes in the same sector and in other sectors as explanatory variables. Our measure of the growth rate of Big-Box activity is the overall growth of Big-Box activity in the

respective ring on an employment-weighted basis. In practice, it is the DHS growth rate of Big-Box activity in the respective rings.

An example will aid interpretation of these measures. Consider a single unit hardware store in operation in both years t and t-1 that is located within 1 mile of general merchandise Big-Box with employment in years t, t-1 and t-2 of 100, 90 and 80, respectively, and is also located within 1 mile of a Big-Box home improvement store that entered in year t-1 with 100 employees. In year t, our single unit hardware store will have a lagged "same sector Big-Box within 1 mile" DHS growth rate of (100-0)/((100+0)/2)=2 (the value for entrants) and the lagged dummy for "same sector Big-Box entry within 1 mile" will be equal to 1. Similarly, it will have a lagged "other sector Big-Box within 1 mile" DHS growth rate of (100-90)/((110+90)/2)=.10 and a lagged dummy for "other sector Big-Box entry within 1 mile" equal to 0.

We use the one year lagged measures for Big-Box entry and growth for two related reasons. We are interested in the response of single unit and smaller chain stores to changes in Big-Box activity and such a response likely takes some time. In addition, the time precedence potentially helps in the identification of the response. By focusing on the lagged response, we are intentionally omitting the effect of the displacement of any single unit or smaller chain store activity at the physical site of the Big-Box store. It might be of interest to explore the precise nature of the sites that Big-Boxes locate and the impact of this site selection on that physical site. In a related way, it would be of interest to explore the dynamics of Big-Box entry in richer ways. That is, the announcement of the intention of a Big-Box entry may yield effects as retailers in the area anticipate the arrival of the Big-Box. We leave the analysis of a richer dynamic characterization of the impact of Big-Box activity for future work.

We estimate the regression specifications using OLS with a rich set of controls for local retail conditions including year effects, local demographic, population and income characteristics and measures of the proximity of retail establishments to transportation infrastructure (i.e., the X matrix in the above equation includes all of these controls). We also include controls as discussed below for relevant establishment characteristics. As such, the results should be interpreted as providing quantitative information about how single unit (and in turn smaller chain) establishment growth and survival responds to changes in Big-Box activity in their local area, holding constant the observable controls.

The observable controls are intended to, as fully as possible, soak up retail market conditions at the local level. Interpreting the estimated effects of Big-Box same sector and other sector activity as causal is appropriate only to the extent that our controls account for all factors that jointly influence retail store location and growth decisions of Big-Boxes and other stores. While we have a rich set of controls, there may remain unobserved factors influencing local retail conditions that influence single unit, small chain store and Big-Box activity. Even in the presence of such unobserved factors, our results still provide a quantitative description of the relationship between Big-Box activity in the prior year and single unit (or small chain store) activity in the current year, holding constant observable local retail trade conditions.

Given potential concerns about unobserved factors influencing local retail conditions, one can think about the other sector Big-Box variables as additional controls for the retail conditions at the local level. In other words, we think our identification of the impact of same sector effects of Big-Box activity is on stronger grounds than the other sector effects. For the latter, the effect we may be identifying is the combination of the effect of other sector Big-Box effects and effects of local retail conditions not captured by our other controls.

The detailed construction of our controls is described in the data appendix. We include the following to capture local demographic and income characteristics: quartiles of household income in the 10-mile concentric ring, shares of the local population (10 mile ring) by education class, age class, and gender.[20] We also include the growth rate of the population within a 5-mile ring. The population growth is intended to capture fast growing areas and the demographic effects to capture the characteristics and resources of local consumers. To measure proximity to transportation infrastructure, we compute the number of highway exits within 1, 5 and 10 miles for each single location and smaller chain store. This is included not only as a proxy for ease of access of shoppers, but to capture the location preferences of Big-Box stores that require many truck deliveries. We also compute the number of Metro (subway) stops within 1 mile. We assume shoppers traveling on Metro will not patronize establishments located far from a station.

A basic empirical pattern that highlights the likely importance of these controls is that compared to Big-Box stores single unit and smaller chain stores tend to be in more densely populated areas, are closer to metro stops, further away from highway exits, and have a local population that has a higher fraction of adults with less than a high school degree and has lower income. These patterns suggest, not surprisingly, that these controls are important for the outcomes of interest and we find below that the controls play an important role in the results.

We also include establishment-specific controls for establishment age. While many factors impact growth, we have found that establishment age is one of the most robust. We have found, for example, that young establishments exhibit a very high exit rate (and thus a very high job destruction rate from exit -- see, Haltiwanger, Jarmin and Miranda (2008)). Therefore we include a dummy variable indicating whether the establishment is less than five years old. We also include a dummy variable indicating whether the establishment has a left censored age (was in existence in 1976).

For both single unit and smaller chain stores, we analyze two sets of stores in our descriptive regressions. Recall the dependent variable is the DHS growth rate, g_{it}, which is computed as the growth between period t-1 and t, or a component of the DHS growth

[20] For the demographic and income variables we use a 10 mile ring both because we think this it is a reasonable area for measuring local population characteristics but also, as described in the appendix, using smaller areas (e.g., 5 mile rings) to construct these measures introduces additional measurement error. We use a 5 mile ring for population growth since we have more reliable and robust measures of overall population in smaller concentric rings.

rate such as job destruction from exit. This can be computed for stores active in period t-1, which we refer to here as incumbents, and births, stores not active in period t-1 but active in period t. Since much of the debate about the impact of Big-Box stores focuses on those retail businesses that existed in an area before a Big-Box enters, we run regressions that focus only on the incumbent single unit and smaller chain stores in addition to more general regressions that allow period t single unit and smaller chain entry. The incumbent only samples are also the relevant sample when we explore exit since it is only the incumbents that are at risk for exit.[21]

Before proceeding to the empirical analysis, it is useful to emphasize that there is considerable variation across single unit (and smaller chain) stores in terms of their exposure to Big-Box stores. Table 2 presents the standard deviations of the key Big-Box employment growth measures for the within 1, 1 to 5 mile and 5 to 10 mile rings for both the incumbent only sample and the sample with incumbents and entrants. The unit of observation in Table 2 is single unit establishments in a given year in the respective samples. Consider, for example, the 1 to 5 mile ring. The standard deviation in same sector Big-Box employment growth rate in this concentric ring is 0.117 for the incumbent sample and the 0.115 in the incumbent plus birth sample. The standard deviation in other sector Big-Box employment growth rates in the respective rings is even larger. We also note that there is substantial variation across population growth rates in the regions surrounding the single unit establishments. The latter is obviously one important factor to control for in the analysis.

One potential limitation of the main specification is that other sector Big-Box activity measures are too coarse if the other sector Big-Box store's product space or other characteristics interact significantly in opposing or complementary ways with those of the single unit or small chain stores located near it. Two cases in particular are of concern. First, Big-Box activity in General Merchandise arguably has different "other sector" effects than Big-Box activity in alternative sectors such as Bookstores. The argument is that since General Merchandise Big-Boxes carry a wide range of goods, they have the potential to crowd out single unit activity in a range of sectors. Second, the impact of proximity to a Big-Box on restaurants is plausibly different. That is, it may be that Big-Box activity in a neighborhood has a positive other sector effect for restaurants more than for other sectors since the Big-Box attract many hungry customers who like the convenience of eating near where they shop.[22] Below we estimate specifications that test the sensitivity of our main results to this type of heterogeneity.

[21] We don't consider analyses of entry of single unit or smaller chain stores separately since analysis of entry per se requires a different approach. That is, the at-risk group for entrants is potential entrants, which is difficult to measure (although see Dunne, Roberts and Klimek (2007) for an interesting way to measure potential entrants). Even though estimating the probability of entry by itself is not so straightforward; we do include analyses of the patterns of employment growth that include entering establishments. We regard these as asking the reasonable question: which establishments have more rapid growth (including the contribution of entry) given the presence of Big-Boxes?

[22] We also note there are no Big-Boxes in the restaurant industry, although they may have small convenience food servers on-premises.

C. *Results for Single Unit "Mom-and-Pop" Stores*

Our main results for single units are in Tables 3 and 4. Table 3 shows the results of regressions measuring the relationship between the first entry of a Big-Box store and employment growth as well as job destruction from exit for single unit (Mom-and-Pop) retailers. All of the results reported are employment-weighted since this makes the results interpretable in terms of the employment impact in the designated local area.[23] Columns 1 and 2 of Table 3 have as the dependent variable the net growth rate of the establishment using the incumbents only and the incumbents plus births sample respectively. Column 3 has job destruction from exit at the establishment level as the dependent variable using the incumbent only sample. It is useful to note in interpreting the results that job destruction from exit tends to move in the opposite direction from net growth – that is, higher job destruction from exit, holding other things equal, implies lower net growth. We are interested in exit since at least part of the policy interest is on whether Big-Box entry and growth induces the exit of single units.

We report the main coefficients of interest as well as the impact of the controls that are especially important. For the latter, we find in virtually all of our specifications that local population growth is an important determinant of growth and survival of single units. We also find that establishment age is important as we suggested above. That is, we tend to find that young incumbents have a high job destruction rate from exit that contributes to young incumbents on average having negative net employment growth. We find that when births are added to the sample, the coefficient on establishment age becomes positive reflecting the contribution of births (who are by construction less than five years old) to the average growth of young establishments. For the other non-reported controls, we find sensible patterns with, for example, higher income areas experiencing greater growth and survival.

The main coefficients of interest in Table 3 are those measuring the impact of the first entry of same and other sector Big-Box stores broken out by distance. In interpreting the estimated effects in Table 3, recall that the key RHS variables are dummy variables equal to 1 if this is the year after first entry into the indicated ring by a Big-Box. We find large, negative effects of same sector Big-Box entry if the entry is in the immediate proximity. Using the incumbent only sample, the first entry of a Big-Box store in the 1 mile ring yields a 27 percentage point decline in net employment growth for single units in the same sector. We see that this is associated with a 31 point increase in job destruction from exit. Combining the two estimates implies that adjustment for single units to the initial entry of a Big-Box nearby is all along the extensive margin. In the 1-5 mile ring, the impact is also negative on growth (and positive on job destruction from exit) and large, but still substantially smaller in magnitude than in the 1 mile ring. For the 5-10 mile ring, the estimated effects become insignificant for net growth but we still obtain a positive and significant impact on job destruction from exit. The increase in job destruction from exit is 5 percentage points in this outer ring which is non-trivial but much smaller than in the inner rings.

[23] In an earlier draft, we explored unweighted results and obtained similar patterns. We omit here since they are of less interest and also for brevity.

Using the full sample of single units that includes the entrants yields similar patterns. In the immediate 1-mile area, the estimated impact is a 32 percentage point decline in net growth. Since this is slightly larger in magnitude relative to the first column implies that entrants are also reduced in the immediate area of a Big-Box entry. We also find a negative and larger in magnitude effect in the 1 to 5 mile ring.

For the "other sector" Big-Box entry we find mixed results on single unit employment growth and survival. For the 1 mile and the 5 to 10 mile rings, the estimated effects are small and insignificant. We find some evidence of a positive effect on net employment growth from other sector entry in the 1 to 5 mile ring. As will become clear, refinements of this specification below will help us understand this result. But the important point to take away for now is that we find no evidence of a negative impact of other sector Big-Box employment growth. As discussed above, the "other sector" results may be masking very heterogeneous outcomes depending on the nature of the other Big-Box entry as well as the nature of the single unit in question. We explore such issues below.

In interpreting these results, we think the demographic, income and population variables control for key differences in local retail market conditions. If there remain omitted factors in the residual that jointly influence single unit growth and Big-Box growth in the local area, such factors should bias the estimated effect upwards. Thus, if anything, our negative estimated same sector effects underestimate the true effect. In addition, as we discussed in section IV.B, the other sector Big-Box activity acts as a further control in interpreting the impact of same sector Big-Box activity.

Table 3 focuses on the first entry of Big-Boxes in the neighborhood. Table 4 considers the role of Big-Box employment growth in the neighborhood (which nests the impact of first entry but also captures subsequent growth of Big-Box activity in the neighborhood). Interestingly, the qualitative patterns of Table 3 hold in Table 4. That is, growth of Big-Box employment yields a negative impact on single unit employment growth if the Big-Box employment growth is in the same sector and in the immediate area. Here again we find the impact declines with distance. We also find the same mixed evidence in terms of other sector activity with some evidence of a positive effect in the 1-5 mile ring.

Caution needs to be used in comparing the magnitudes of the coefficients in Tables 3 and 4. In Table 3, the key RHS variables are dummy variables equal to one if the indicated category has a first entry of a Big-Box. In contrast, in Table 4 the key Big-Box RHS variables are continuous variables – namely lagged growth rates in the indicated category. For example, using the estimates for the second column of Table 2, a 10 percentage point in increase in the lagged same sector Big-Box growth rate within 1 mile yields about a 1.1 percent reduction in the growth rate of the single unit stores. Of course, much of the action here is on the extensive margin especially in the immediate area. The estimated impact of a Big-Box entrant in Table 4 can be calculated as the estimated coefficient times the employment growth rate of Big-Boxes when there is entry (which has a DHS growth rate equal to 2). Using the second column of Table 4, this yields an estimated negative impact of –0.218 in the 1 mile ring. This estimate can be

compared to Table 3 where the corresponding estimate is –0.320 The finding that it is smaller in magnitude in Table 4 implies that first entry has the largest impact relative to subsequent growth of Big-Boxes.

To further explore the patterns we have shown in this section, in Table 5 we report results where we use the specification from Table 4 but permit the effects of Big-Box employment growth on job destruction to vary over time. In particular, as illustrated in Figures 1 and 2 Big-Box employment growth accelerated in the 1990s. Table 5 shows the results when we permit the impact of lagged Big-Box employment growth to impact single units differently pre- and post-1992 (where post-1992 includes 1992).[24] The findings in Table 5 show that much of the impact of Big-Box employment growth on single unit employment growth is a post-1992 phenomenon. These findings may reflect evolution in the nature of the adjustment process. Early on, Big-Box market penetration was relatively low and this was a relatively new way to deliver retail trade services. As familiarity with Big-Box stores grew, both market penetration as well as the impact of Big-Box entry and growth increased.

Recall that one potential limitation of the other sector Big-Box effects is that the estimated effects mask heterogeneous responses depending on the nature of the Big-Box or the single unit in question. We explore these issues in Table 6. First, we decompose the other sector Big-Box growth into two types of other sector Big-Box growth.[25] Specifically, for each distance ring, other sector Big-Box growth is decomposed into growth from Big-Boxes that are in General Merchandise (denoted by GEN MER in the table) and Big-Boxes that are *not* in General Merchandise. The first column of Table 6 uses this decomposition to extend the results from Table 4. We find that this decomposition shows that the modest positive other sector effect in the 1-5 mile ring found in Table 4 is accounted for by the Big-Box activity not in General Merchandise.

Column 2 extends the decomposition by an additional step. That is, column 2 includes an interaction of these other sector Big-Box measures with a dummy variable indicating whether the single unit in question (the establishment that is the unit of observation for the dependent variable) is a restaurant or not.[26] The variable "SU Restaurant" takes on a value of 1 if the single unit is a restaurant and zero otherwise. Here we find that the modest positive effect in the 1-5 mile ring for other sector activity that is not in General Merchandise is accounted for by restaurants. The inference is Big-Box activity not from General Merchandise appears to have a modest positive effect on single unit restaurants in the surrounding (but not immediate area). We find a non-trivial negative other sector effect in the 5 to 10 mile ring for other sector activity that is in General Merchandise (about a 2 percent negative effect) for restaurants. Overall, these findings suggest that

[24] Note that the 1992 growth rate is the growth rate from 1991 to 1992 and the lagged growth rate for Big-Boxes in 1992 is the 1990 to 1991 growth rate so we are essentially breaking the sample into the pre and post 1990 growth patterns for Big-Boxes.

[25] For this purpose, we focus on lagged Big-Box growth rather than first entry since the former nests the latter and captures subsequent growth of Big-Boxes after first entry in the ring.

[26] We don't interact the restaurant dummy with the same sector Big-Box activity since there are no Big-Boxes in the restaurant industry.

General Merchandise Big-Box activity does not have much of an impact on other sector single units.

As a related robustness check, in unreported regressions we re-estimated the specifications in Tables 3 and 4 but excluding single units that are in General Merchandise. This explores the extent to which the estimated same sector estimates in Tables 3 and 4 are driven by same sector General Merchandise effects for those single unit stores (e.g., variety stores) classified in General Merchandise. We find that the estimates in Tables 3 and 4 are very similar when we exclude these single units, so our main findings on same sector effects are robust to the exclusion of single unit General Merchandise stores.

Our specifications as reflected in the reported results in Table 3-6 could be expanded in a number of different directions. As we have already discussed, exploring the role of product space to a greater degree than analyzed in Table 6 is of interest. In addition, the impact of Big-Box activity on single units may vary depending on the characteristics of the neighborhood. A thorough investigation of the latter is beyond the scope of this paper but some exploratory analysis that shows the potential of such analysis is reported in Figure 6. Figure 6 is based on an extension of the core specification reported in column 1 of Table 4. For each of the Big-Box effects in this specification, we interact the effects based upon the population density and income distribution of the area. Specifically, we classify neighborhoods into four groupings of the area around each store: high population density, high income; high population density, low income; low population density, high income; low population, low income. The method for constructing these classifications is discussed in the data appendix.

Since this interacted specification yields a large number of estimated coefficients, we focus on the estimated results for same sector effects in Figure 6. We note that the unreported interactions with the other sector effects tended to small and insignificant. For the same sector effects, these results suggest that the negative impact of Big-Box growth is largest in magnitude in high population density, low income areas. The effects are actually reversed in low population density, high income areas. For the other categories of areas, the effects remain negative but are muted. The results reported are point estimates and we note that the differences between the high population density, low income and low population density, high income area results are statistically significant at the 1 percent level. These interesting patterns may be driven by a number of factors (see, e.g., Porter (1995) and Alwitt and Donley (1997)). For example, they may reflect the type of Big-Box activity that enters high population density/low income relative to low population density/high income areas. Alternatively, these patterns may reflect the type and propensity of single unit stores that serve these different types of areas. We regard these suggestive results as highlighting an interesting area for future work.

D. *Results for Smaller Chain Stores*

We now turn our attention to establishments that are part of smaller chain firms. We are interested in the impact of Big-Box employment on these types of establishments to

compare and contrast with the single unit establishment results. In addition, recall that Figures 1-5 showed that establishments from smaller chain stores exhibited substantial employment loss and associated declines in their share of total retail employment. In some ways, the aggregate patterns suggest Big-Box activity is a more direct substitute for the type of retail trade activity offered by the establishments from smaller chain chains as opposed to Mom-and-Pop single unit establishments. Here we use the micro variation in the local area to investigate these relationships.

For this analysis, we focus on the analogues of Tables 3, 4 and 6.[27] In Table 7, we present results showing the impact of same and other sector Big-Box first entry on employment growth and survival for establishments from smaller chain stores that are analogous to those for single units in Table 3. Again, for employment growth we present results for both an incumbent sample and a sample with incumbents plus births. The third column of Table 7 presents the results for job destruction from exit for the incumbent sample. In turn, Table 8 presents results on the impact of the growth of Big-Box employment on employment growth and survival of smaller chain establishments.

Before discussing the main results, it is useful to note that for the most part the other controls have similar qualitative effects in this setting but the estimates for some key controls tend to be smaller in magnitude and less significant. This can be seen by observing that local population growth is often not significant in Tables 7 and 8. This may be because establishments for smaller chain stores are more likely serving a larger market than single unit establishments that have found a niche in the local market.

In Table 7, we find a large, negative impact on growth and survival of same sector Big-Box entry in the 1-mile and 5 to 10 mile rings. We think the absence of much of an effect in the 1 to 5 mile ring likely reflects the spatial pattern of activity of such establishments, although verifying this would involve additional analysis. The largest impact by far is in the 1-mile ring. For example, using the incumbent sample, the entry of a same sector Big-Box yields a 34 percentage point decline in net growth and an accompanying 35 percentage point increase in job destruction from exit. These are large effects in absolute terms and even larger than the analogous estimates for single units reported in Table 3. Table 8 shows that these same qualitative patterns hold from same sector Big-Box Growth.[28]

In terms of other sector Big-Box entry and growth, we find even less of a relationship between other sector Big-Box activity and the employment growth of establishments from smaller chain stores. For example, we no longer find even the modest positive effect in the 1-5 mile ring. However, as will become clear, these modest overall other sector effects mask rich heterogeneous responses to which we turn to now.

---

[27] One complicating but interesting issue that we do not consider for smaller chain stores is the extent to which the entry or growth of Big-Boxes (or the effects of other controls) has an impact on the propensity to yield adjustments of stores that are part of the same smaller chain. That is, to consider the unit of observation as the local firm rather than the establishment.

[28] In unreported results, we also estimated the specifications in Tables 7 and 8 excluding smaller chain stores that are in General Merchandise and obtained very similar results. Thus, our same sector estimates in Tables 7 and 8 are robust to excluding same sector effects from General Merchandise.

Table 9 returns to exploring the decompositions of other sector effects as in Table 6. Here we find more striking patterns in terms of differences between other sector Big-Box activity depending on whether the Big-Box activity is in General Merchandise. Specifically, in column 1 of Table 9, we find a negative impact of other sector Big-Box activity that is in General Merchandise on smaller chain growth in the 1-mile, 1 to 5 mile and 5 to 10 mile rings. The estimated impact of other sector General Merchandise growth is largest (and also statistically significant) in the 1 mile and the 5 to 10 mile rings. This qualitative pattern is roughly similar to same sector Big-Box pattern in that the largest negative effects are in the 1 mile and 5 to 10 mile rings. However, the quantitative effects are much smaller than the estimated same sector effects.

In column 2, we find these patterns interact in interesting ways with whether the smaller chain is a restaurant. That is, we find that the negative impact in the immediate (1 mile) area of other sector General Merchandise Big Activity is entirely associated with smaller chains that are not restaurants. For small chain restaurants, we find that the growth of other sector Big-Box activity has a positive effect whether the Big-Box is from General Merchandise or not. So the "eating near where you shop" hypothesis yields a positive effect for smaller chain restaurants that we did not detect for single unit restaurants.

The results in Table 9 support the hypotheses that General Merchandise have different other sector effects than other Big-Boxes and also that restaurants respond differently than other stores. More generally, Table 9 suggests that understanding other sector effects likely requires permitting heterogeneous responses depending on the nature of the Big-Box as well as the potentially impacted store in question. The results in Table 9 (and the analogous Table 6) are only a small step in this direction.

V. Concluding Remarks

Our main findings are summarized as follows:

1. Within the D.C. metro area, the share of employment accounted for by Big-Box stores and larger chain stores has risen substantially at the expense of both single unit and especially smaller chain stores.
2. Much of the margin of adjustment of retail trade at the establishment level is via establishment entry or exit rather than changes in the scale of operations at the establishment level. This pattern is especially true for single unit and small chain stores.
3. The entry and growth of Big-Box stores has a substantial negative impact on employment growth and survival of single unit and smaller chain stores that operate in the same detailed industry as the Big-Box. This negative impact attenuates with distance from the Big-Box. That is, the impact is largest if the single unit or smaller chain store is within 1 mile or 1 to 5 miles of the Big-Box store relative to being 5 to 10 miles from the Big-Box. These patterns are

observed in regressions controlling for local retail conditions in the immediate area.

4. We find much, if not all, of the negative impact is accounted for by increased exit. In some ways, this is not surprising since, as prior studies have shown, the extensive margin of employment adjustment is critically important for retail establishments.
5. We find more complex relationships between the entry and growth of Big-Box stores and the growth and survival of single unit and smaller chain stores that operate in a different detailed industry from the Big-Box. When we group all other sector effects together, we find little systematic relationship. However, when we permit heterogeneous responses depending on the nature of the Big-Box as well as the single unit or smaller chain store at risk we find some interesting patterns. In particular, General Merchandise Big-Boxes have a negative other sector effect on smaller chain stores in the immediate and surrounding areas especially if the smaller chain store is not a restaurant. For smaller chain restaurants, we find a positive other sector Big-Box effect in the immediate area regardless of whether the Big-Box is in General Merchandise or not.

This paper is a natural extension to the recent literature in that we are exploring the impact of Big-Box entry and growth on employment growth at neighboring retail establishments with rich controls for physical distance, cruder controls for distance in product space and rich controls for local retail market conditions. A core message of our findings is that distance and sector both matter. Single unit and smaller chain stores in the same sector and close by location as recent Big-Box entry and growth take the biggest hit in terms of growth and survival.

While we think the findings are novel and interesting, the analysis here is very much a first step. For one, we look at only one metro area. Exploring additional metro areas is of interest not only to consider how robust our findings are to other areas but would permit richer investigation into the nature and mechanisms underlying the results. Additional areas would permit us, for example, to explore heterogeneous other sector effects in a much richer manner than our relatively coarse General Merchandise and not General Merchandise decomposition. We note however that constructing the data infrastructure that permits the type of analysis using detailed location information for many metro areas requires substantial work. While the LBD has the source information that permits detailed geocoding (i.e., latitude and longitude), the LBD has not yet been geocoded on a national basis. In addition, constructing all of the distance and controls in detailed geographic areas requires considerable time and computing resources as well. Beyond the basic measurement issues, further conceptual and empirical analysis is also needed to explore richer characterizations of what it means to be close not only in geographic space but also in product space. Hopefully, this paper is a step towards showing the payoff of exploiting such variation on such a detailed location basis.

Our findings are primarily about quantifying the adjustment process within a metro area of Big-Box entry and growth. More generally, our paper's contribution is more about the "what" and the "how" aspects of the impact of Big-Boxes and not about the "why".

Developing and then ultimately estimating the underlying model that helps us understand and provide structure for characterizing how retail services in local communities evolves in response to changes in technology, costs and demand is obviously needed.[29] Our novel findings should help provide basic facts to guide the development of such models.

[29] See, e.g., the recent paper by Jia (2009) modeling the impact of discount stores on Mom-and-Pop stores.

References

Alwitt, Linda and Thomas Donley (1997). "Retail Stores in Poor Urban Neighborhoods." *Journal of Consumer Affairs*, 31(1), 139-164.

American Society of Planning Officials (1963), "Discount Stores", Planning Advisory Service, Chicago, Illinois, March.

Arzaghi, Muhammad and J.V. Henderson, (2005) "Networking off Madison Avenue," Review of Economic Studies, Center for Economic Studies Working Paper, WP-05-15, U.S. Census Bureau.

Basker, Emek (2005), "Job Creation or Destruction? Labor Market Effects of Wal-Mart Expansion," *The Review of Economics and Statistics*, 87(1), 174-83.

Basker, Emek (2006), "When Good Instruments Go Bad: A Reply to Neumark, Zhang, and Ciccarella," working paper, University of Missouri.

Basker, Emek, Shawn Klimek, and Pham Hoang Van (2008), "Supersize It: The Growth of Retail Chains and the Rise of the "Big-Box" Retail Format", working paper.

Bresnahan, Timothy F & Reiss, Peter C, (1991). "Entry and Competition in Concentrated Markets," *Journal of Political Economy*, University of Chicago Press, vol. 99(5), pages 977-1009, October.

Brueckner, Jan K. (2000). "Urban Sprawl: Diagnosis and Remedies". *International Regional Science Review* 23(2): 160-171.

Chamberlain, Robert G. (2001), "What Is The Best Way To Calculate The Great Circle Distance (Which Deliberately Ignores Elevation Differences) Between Two Points?" http://www.census.gov/cgi-bin/geo/gisfaq?Q5.1. and http://www.cs.nyu.edu/visual/home/proj/tiger/gisfaq.html

Chandler, Alfred D. Jr.,(1997) *The Visible Hand: The Managerial Revolution in American Business*. Cambridge, MA: Harvard Belknap.

Davidson, Sharon M., and Amy Rummel. (2000). "Retail Changes Associated with Wal-Mart's Entry into Maine." *International Journal of Retail & Distribution Management* 28(4/5), 162-9.

Davis, Steven, John Haltiwanger, and Scott Schuh (1996) *Job Creation and Destruction*. Cambridge MA: MIT Press.

Dinlersoz, Emin M. (2004) "Firm Organization and the Structure of Retail Markets" *Journal of Economics and Management Strategy*, Summer, vol. *13*(2), pp. 207-240.

Doms, Mark E.; Jarmin, Ron S. and Klimek, Shawn D. (2004) "Information technology investment and firm performance in US retail trade." *Economics of Innovation and New Technology,* October, vol. *13*(7), pp. 595-613.

Dube, Arindrajit, and Ken Jacobs. (2004). "Hidden Cost of Wal-Mart Jobs: Use of Safety Net Programs by Wal-Mart Workers in California." Briefing Paper Series, UC Berkeley Labor Center, August.

Dube, Arindrajit, Barry Eidlin, and Bill Lester. (2005). "Impact of Wal-Mart Growth on Earnings throughout the Retail Sector in Urban and Rural Counties." Unpublished paper, University of California, Berkeley.

Dunne, Timothy, Shawn Klimek, Mark Roberts, and Xu. (2007). "The Dynamics of Market Structure and Market Size in Two Health Services Industries," Center of Economic Studies Working Paper CES 07-26.

Foster, Lucia, John Haltiwanger, and C.J. Krizan (2006a), "Market Selection, Reallocation and Restructuring in the U.S. Retail Trade Sector in the 1990s," *The Review of Economics and Statistics*.

Foster, Lucia, John Haltiwanger, and C.J. Krizan (2006b), "The Evolution of National Retail Chains: How We Got Here", working paper.

Glaeser, Edward L. & Kahn, Matthew E., (2004). "Sprawl and urban growth," Handbook of Regional and Urban Economics, in: J. V. Henderson & J. F. Thisse (ed.), *Handbook of Regional and Urban Economics*, edition 1, volume 4, chapter 56, pages 2481-2527 Elsevier.

Haskel, Jonathan and Raffaella Sadun (2005), "Entry, Exit and Labour Productivity in U.K.Retailing: Evidence from Micro Data," March.

Hausman, Jerry and Ephraim Leibtag (2005), "Consumer Benefits from Increased Competition in Shopping Outlets: Measuring the Effect of Wal-Mart", NBER Working Paper No. 11809.

Haltiwanger, John, Ron S. Jarmin, and Javier Miranda (2008), "Business Formation and Dynamics by Business Age: Results from the New Business Demography Statistics", working paper.

Holmes, Thomas J. (2001) "Bar Codes Lead to Frequent Deliveries and Superstores." *RAND Journal of Economics*, Winter, vol. *34*(4), pp. 708-725.

Holmes, Thomas J. (2008), "The Diffusion of Wal-Mart and Economies of Density," NBER Working Paper No. 13783.

Jackson, Kenneth T. (1985), *Crabgrass Frontier: The Suburbanization of the United*

States, Oxford University Press, New York.

Jarmin, Ron S. and Javier Miranda (2002), "The Longitudinal Business Database," Center for Economic Studies Working Paper No. 02-17.

Jarmin, Ron S., Shawn Klimek, and Javier Miranda (2009), "The Role of Retail Chains: National, Regional, and Industry Results," in *Producer Dynamics* (eds. Dunne, Jensen and Roberts), Chicago, NBER/University of Chicago Press, pp. 237-270.

Jarmin, Ron S., Shawn Klimek, and Javier Miranda (2004), "Firm Entry and Exit in the U.S. Retail Sector, 1977-1997," Center for Economic Studies Working Paper No. 04-17.

Jia, Panle (2009), "What Happens When Wal-Mart Comes to Town: An Empirical Analysis of the Discount Retail Retailing Industry," *Econometrica* (forthcoming).

Lorch, B. (2006) "The evolution of a big-box landscape: a case study of the Winnipeg market" *Canadian Journal of Regional Science* 29 (3), 375 - 392

Lorch, B. (2005) "Auto-dependent Induced Shopping: Exploring the Relationship between Power Centre Morphology and Consumer Spatial Behaviour" *Canadian Journal of Urban Research* 14 (2), 364-383

Neumark, D., J. Zhang, and S. Ciccarella (2008), "The Effects of Wal-Mart on Local Labor Markets" *Journal of Urban Economics*, 405-30.

Porter, Michael E. **(**1995**),** "The Competitive Advantage of the Inner City," *Harvard Business Review***,** 73(May-June): 55-71**.**

Rosenthal, Stuart, and William Strange (2008) "The Attenuation of Human Capital Spillovers," Journal of Urban Economics, 64(2), 373-389.

Rosenthal, Stuart and William Strange, (2003), "Geography, Industrial Organization, and Agglomeration," The Review of Economics and Statistics, 85 (2): 377-393.

Schiff, Nathan (2009), "Cities and Product Variety in the Restaurant Industry," working paper.

Sinnott, W. (1984) "Virtues of the Haversine", Sky and Telescope, vol. 68, no. 2, p. 159

Tornqvist, L., P. Vartia, and Y. Vartia (1985), "How Should Relative Change Be Measured?", *American Statistician* 39 (February), 43-46.

Wassmer, Robert W. (2002), "Fiscalisation of Land Use, Urban Growth Boundaries and Non-central Retail Sprawl in the Western United States", *Urban Studies* Vol 39, No. 8, p. 1307-1327.

Data and Measurement Appendix

A. Big-Box Definitions:

Our first task in assembling our data was to determine which stores are Big-Boxes. There is not a standard definition but there are a variety of lists and sources that we used to develop our list. A good starting point is the Colombia University Graduate School of Architecture, Preservation and Planning's Web Site.[30] It identifies several key elements of Big-Boxes including size (50-200 thousand square feet), often rectangular (hence Big-Box label), with ample parking to facilitate access by shoppers who travel to the site by car.

We located several institutional studies of big-box stores effects on local communities that proved very useful in developing our working definition. For example, the Public Law Research Institute of the University of California's Hastings College of Law surveys studies performed by the states of California, Hawaii, and Maryland as well as the city of Los Angeles and the differences in their definitions prove to be as useful as the similarities.[31] For example, the state of California defines a Big-Box as any store measuring over 75,000 square feet in area. By contrast, the Maryland Department of Planning and the city of Los Angeles use 20-200,000 and of 60-130,000 square feet respectively. A Hawaii Legislative Reference Bureau study points out that using a measure of size alone is misleading because what constitutes a "big" store depends partly on what is being sold in it. That is, a 25,000 square foot bookstore seems small compared to a 120,000 sq ft Costco but it is very large compared to other bookstores. For this reason the University of California study recommends using a combination of factors to identify Big-Boxes. They are: size, industry, design, and stock diversity/depth.
Our work follows the spirit of this definition and uses information from Wikipedia and the National Retailer's Federation list of the top 100 U.S. retail firms as well. Wikipedia describe a Big-Box as a large, freestanding, rectangular, generally single-floor structure built on a concrete slab with floor space several times greater than traditional retailers in the sector. They also note that store sizes vary across geography and industry[32] and provide a link to a list of "Superstores" – another common term for Big-Boxes.[33] This list is our starting point, though we eliminated some of the firms and added others from the National Retail Federation's list of top 100 retailers that meet our working definition of a Big-Box. [34] Finally, we made a couple of additions to the list based on our knowledge in the D.C. retail market. While the sources we use for our list are in the public domain, we have not included our actual list of Big-Boxes to avoid any potential complementary disclosure issues. But suffice it to say that the Big-Box list we use are the well-known set of stores commonly thought of as Big-Boxes. Note in this regard that the lists of Big-Boxes from these above noted sources as well as our final sample specifically do not include traditional Department Stores.

30 http://www.columbia.edu/itc/architecture/bass/newrochelle/extra/big_box.html
31 http://www.uchastings.edu/centers/state-local-gov/docs/plri_big_box_paper_04.pdf
32 http://en.wikipedia.org/wiki/Big-box_store
33 http://en.wikipedia.org/wiki/List_of_superstores
34 http://www.stores.org/pdf/08TOP100.pdf

B. MSA Definition:

A second fundamental concept we had to define is what counties we should include in our definition of the Washington D.C. metro area. Since our data span three decades and the official definition of the Washington MSA (and even what an MSA is) changed significantly over that time, we had to settle on a reasonable approximation of the region. We began by looking at how the list of counties in the MSA has changed during our timeframe in Table A.1

Table A.1

Component Name	When Present in Definition				
	2003	**1993**	**1983**	**1973**	**Working Definition**
District of Columbia	X	X	X	X	X
Calvert County, MD	X	X	X		(removed)
Charles County, MD	X	X	X	X	X
Frederick County, MD	X	X	X		X
Montgomery County, MD	X	X	X	X	X
Prince George's County, MD	X	X	X	X	X
Arlington County, VA	X	X	X	X	X
Clarke County, VA	X	X			
Culpeper County, VA		X			
Fairfax County, VA	X	X	X	X	X
Fauquier County, VA	X	X			
King George County, VA		X			
Loudoun County, VA	X	X	X	X	X
Prince William County, VA	X	X	X	X	X
Spotsylvania County, VA	X	X			
Stafford County, VA	X	X	X		X
Warren County, VA	X	X			
Alexandria city, VA	X	X	X	X	X
Fairfax city, VA	X	X	X	X	X
Falls Church city, VA	X	X	X	X	X
Fredericksburg city, VA	X	X			
Manassas city, VA	X	X	X		X
Manassas Park city, VA	X	X	X		X
Berkeley County, WV		X			
Jefferson County, WV	X	X			

Table A.1 shows us that there have been additions and subtractions to the list of counties in the D.C. MSA over time (for example Culpeper County VA and Berkeley County WV). Because of this we decided to choose the counties most consistently present but

that also were not too far away from the District of Colombia. Our final set of counties is noted in the column titled "working definition". As will be discussed later, we dropped Calvert County MD because it was not covered by Census Tracts in 1980.

C. Establishment and Firm Data:

Having identified Big-Box firms and narrowed our geographic focus to a few counties, we selected our establishment data from the Longitudinal Business Database (LBD). The LBD is a research dataset constructed at the Center for Economic Studies containing the universe of all U.S. Business establishments with paid employees from 1976 to 2005 (Jarmin and Miranda (2002)). It is based on the administrative data in the Census Bureau's Business Register (BR) but improves those data in several key ways. For example, it contains a time-invariant establishment numeric identifier that allows us to link stores in the D.C. area over time. Also, it provides information on the establishments' most consistent industry code. Finally, it re-times establishment births to avoid clustering caused by administrative processing. From the LBD we selected all establishments with a "best" industry code within retail trade.[35] We also selected all those establishments in our target counties. We used the longitudinal nature of the LBD to fill-in missing industry and geographic information as necessary to avoid spurious entry and exit from our sample. The resulting sample of retail trade establishments yields roughly the same counts of employment and establishments as for County Business Patterns.

Although the LBD has been used extensively in other research projects and is relatively free of outliers, since our study focuses on a narrow industry in a small geography, we did some additional checking for outliers. We edited the employment patterns of a very small number of observations that had unusually erratic employment growth and loss. For those few cases where employment changed by several orders of magnitude for a single year and then returned to earlier levels (or disappeared), we replaced the large (small) number in the series with the nearest adjacent value that had the same magnitude as the rest of the series.

We also used the BR for our analysis. The BR contains information on establishment name and address that we needed to geocode the establishments and to flag our Big-boxes. We assigned a latitude and longitude to each establishment in our sample by first selecting its address from the BR and then using an algorithm in ARCGIS that first attempts to geocode the stores exact address. If the address cannot be found, we instructed ARCGIS to assign the latitude and longitude of the centroid of the establishment's zip code.

Both the BR and the LBD contain a numeric firm identifier but we used the business name information in the BR to flag Big-Box firms. We identified the Big-Box firms by choosing the identification number associated with the largest firm with the Big-Box name (or key parts of the name) in the Big-Boxes' specific industry. Once we had the

[35] Prior to 2002, we selected establishments with SIC codes from 52 to 59. From 2002 forward we chose those with NAICS codes between 44 and 45 as well as 722 (restaurants).

Big-box firm ids and the establishment geocodes from the BR, we linked the information back into the sample from the LBD.

Because previous studies on the retail trade industry have shown that the extent of the firms' geographic coverage is correlated with important aspects of firm behavior (see Foster, Haltiwanger and Krizan (2006b), Jarmin, Klimek and Miranda (2009)) we created similar categories of firm types. Single Unit firms (SUs) are those firms that have only one establishment. Small chain retail firms are those firms operating multiple establishments in 1 to 14 states and "Large" chain firms are those businesses operating in 15 or more states. All of the categories are mutually exclusive with the large chains, for example, those stores part of large chains that are not classified as Big-Boxes.

D. Demographic Data:

We use a wide range of demographic controls in our analysis. The data underlying these variables come from the 1980, 1990 and 2000 Decennial Census microdata (sample) files. Our basic data on population, education, age, and gender, etc. were constructed by tabulating the weighted person-level observations in the files to the Census Tract level and assigning the tract's latitude and longitude as the cells' location. Income was measured by calculating the quartiles of the region's income distribution each year and then totaling the number of households in the tract that fell in each quartile.

Once we had the tract-level data for 1980, 1990, and 2000 we calculated the distance between each tract and each establishment (see below for details) and summed the data into 1, 5, and 10 mile rings around each store. Next we imputed the levels for each variable in the non-censual years by calculating an annual inter-censual growth rate, counting the number of years since the last census and multiplying the number of years by the annual rate. For example, 1-mile population in 1984 was imputed as follows:

$$POP^1_{1984} = POP^1_{1980} + \left(\left(\frac{POP^1_{1990} - POP^1_{1980}}{\frac{POP^1_{1980} + POP^1_{1990}}{2}} \right) / 10 \right) * 4$$

Although conceptually simple, this was a somewhat difficult algorithm to apply because of a couple of the characteristics of census tracts. For example, census tracts not only change over time, they did not cover the entire country until 1990. Until then only a few metropolitan areas had tracts assigned to them and while coverage in the D.C. are was fairly complete by 1980, we dropped Calvert County MD from our analysis because it was not yet tracted. Another complication is that there are many tracts with a radius greater than 1 – or even 5 – miles. The result is that a non-trivial number of our establishments had missing 1 or 5 mile values for many of the demographic characteristics, particularly in 1980. Observations with missing values for the 1-mile 1980 population also had missing 1-mile population growth rates for the 1980-1990 period. We addressed these problems by imputing backwards from the 1990 value using

the 10-mile growth rate of the variable being imputed. This problem with missing 1 and 5 mile distance characteristics files made these characteristics files less robust than the 10 mile distance files. We use the latter in the analysis for demographic and income characteristics of the local area.

For the analysis reported in Figure 6, we use this demographic information to classify neighborhoods into high and low density population density based on whether the population density in the five mile ring around the store is above or below the median for five mile rings. In turn, we classify neighborhoods into high and low income areas based on the whether the share of the population in the top income quartile in the 10 mile ring is above or below the median for the top income quartile in 10 mile rings. As noted above, we use the 10 mile ring for demographic characteristics since this yields more robust annual measures of the local demographic characteristics. Using these two classifications, we construct four groupings of the area around each store: high population density, high income; high population density, low income; low population density, high income; low population, low income. Note that for the analysis in Figure 6, we have considered alternative related measures for classifying an area based on income (e.g., using the share in the top 2 quartiles or the share in the bottom quartile) as the indicator for income and obtained similar results.

E. Highway Exits and Metro Stations:

The highway exit data was created by using the search feature on latlon.com which allows a user to point and click a particular point on a map to find the latitude and longitude of the point on the map. This allowed us to create a database of the location of current exits for the limited access highways in our target counties. The more difficult part of the exercise was to search through a series of highway maps from the 1970s and 1980s to assign opening years to the exits.

We obtained a dataset of Metro station latitude and longitudes from Matthew Graham (affiliation). As in the highway exits, we also researched their opening dates and include only those stations currently open in our ring totals.[36]

F. Measuring Distances:

Having geocoded our establishment, demographic, highway and Metro Station data, we compute the distances between elements using a variant of the Haversine formula (Sinnott (1984)).[37] Starting with the following terms:

dlon = longitude2 - longitude1
dlat = lattitude2 - lattude1

[36] See http://www.wmata.com/about_metro/docs/history.pdf for and excellent concise history of the history of the D.C. region's Metro transit system.
[37] See http://www.census.gov/cgi-bin/geo/gisfaq?Q5.1 and http://www.cs.nyu.edu/visual/home/proj/tiger/gisfaq.html

$a = (\sin(dlat/2))^2 + \cos(lat1) * \cos(lat2) * (\sin(dlon/2))^2$
$c = 2 * \arcsin(\min(1,\sqrt{a}))$

the distance between any two points on the earth is given by:

$d = R * c$

where R is the radius of the earth (3963 miles according to Chamberlin (1996)).[38]

G. Measures of Job Creation and Destruction

Measures of job creation and destruction (at any level of aggregation) are given by:

$$JC_t = \sum_i (X_{it} / X_t) \max\{g_{it}, 0\}$$
$$JD_t = \sum_i (X_{it} / X_t) \max\{-g_{it}, 0\}$$
$$JC\_Entry_t = \sum_i (X_{it} / X_t) I\{g_{it} = 2\}.$$
$$JD\_Exit_t = \sum_i (X_{it} / X_t) I\{g_{it} = -2\}$$

Given these definitions, the following simple relationships hold:

$$g_t = JC_t - JD_t,\ JC_t = JC\_Cont_t + JC\_Entry_t \text{ and } JD_t = JD\_Cont_t + JD\_Exit_t$$

where JC_Cont and JD_Cont are job creation and job destruction for continuing establishments respectively.

[38] We checked the results of this formula by assuming a flat earth, using the Pythagorean Theorem and a correction for the distance between a degree of latitude or longitude at the D.C. region's latitude provided by the National Geospatial-Intelligence Agency's Web Site: http://www.nga.mil/MSISiteContent/StaticFiles/Calculators/degree.html . We found a difference of only 10 feet on average.

Figure 1: Retail Employment in D.C. Metro Counties

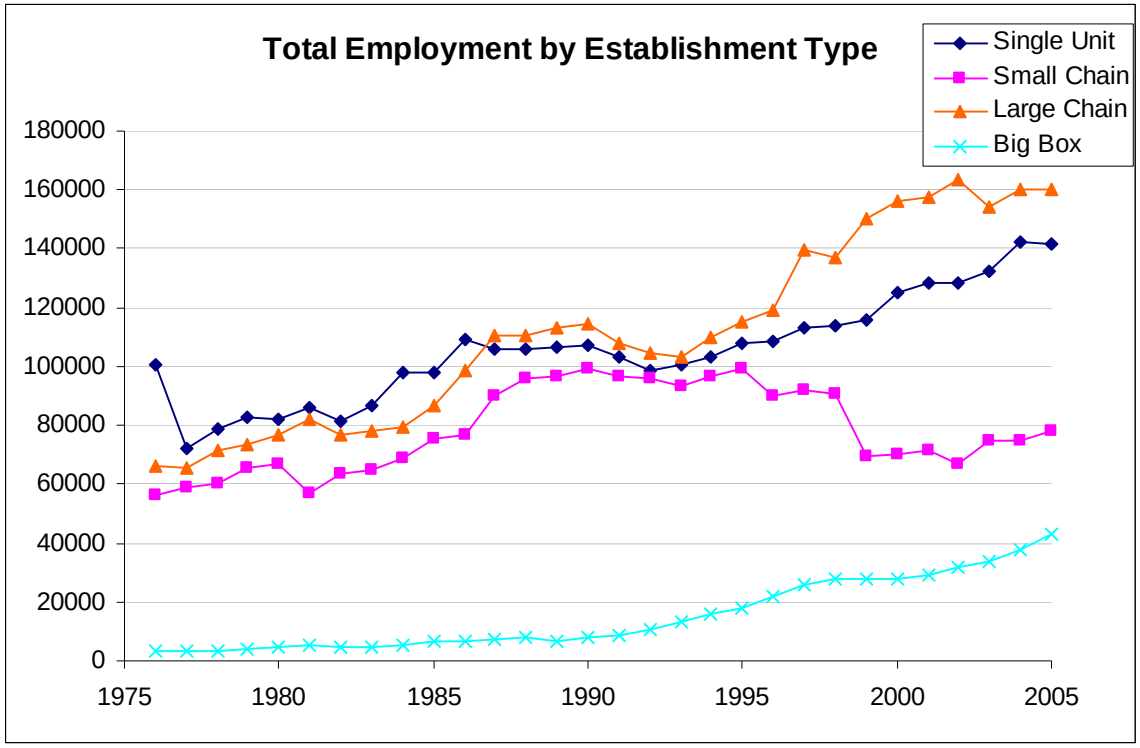

Figure 2: Shares of Retail Employment in D.C. Metro Counties

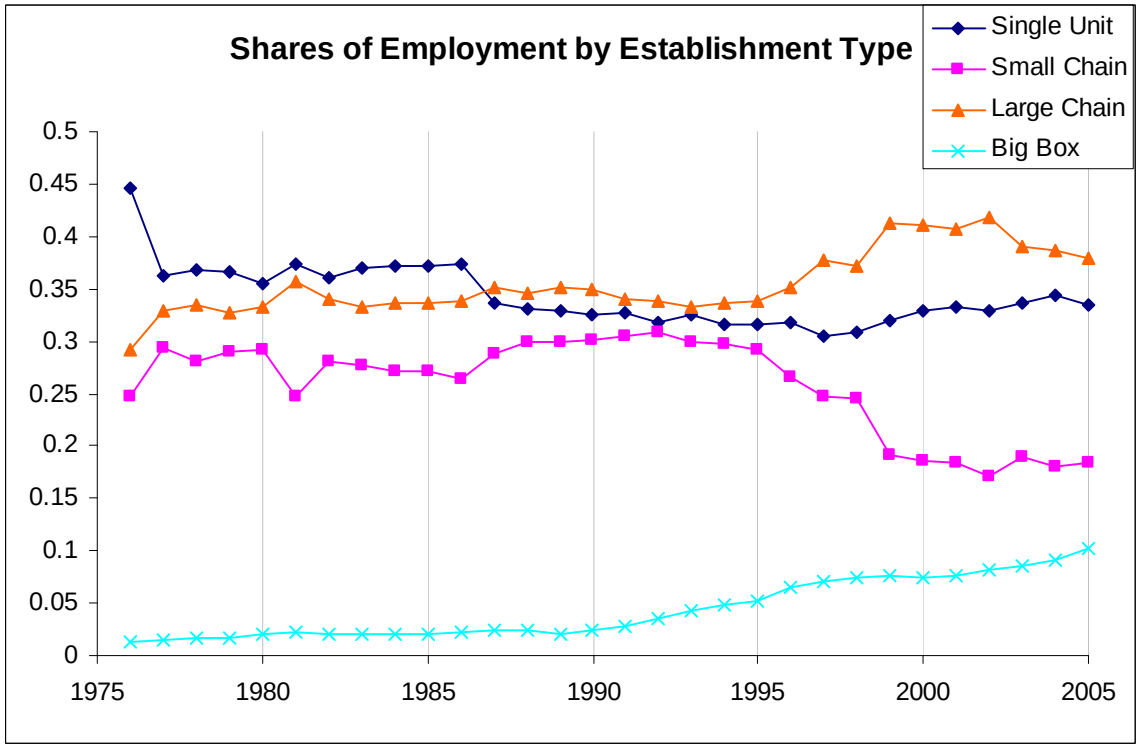

Figure 3: Net Employment Growth by Type

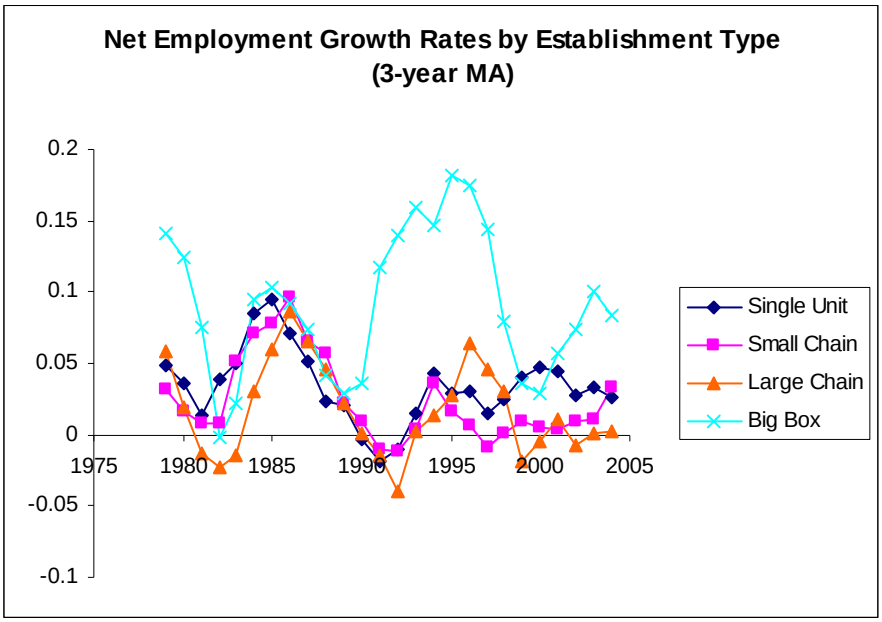

Figure 4: Job Creation from New Retail Stores by Type

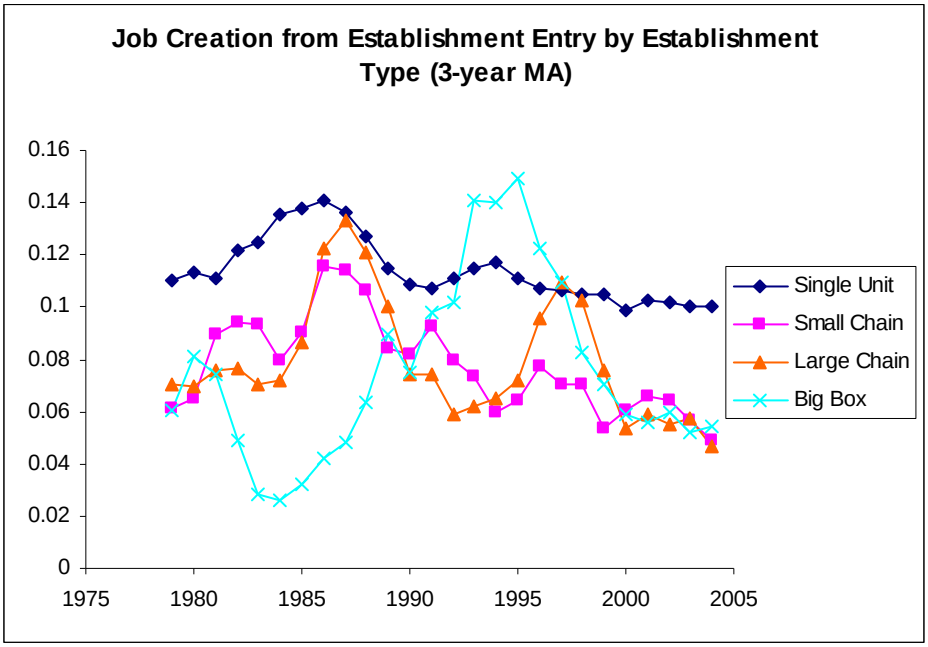

Figure 5: Job Destruction from Store Closings by Type

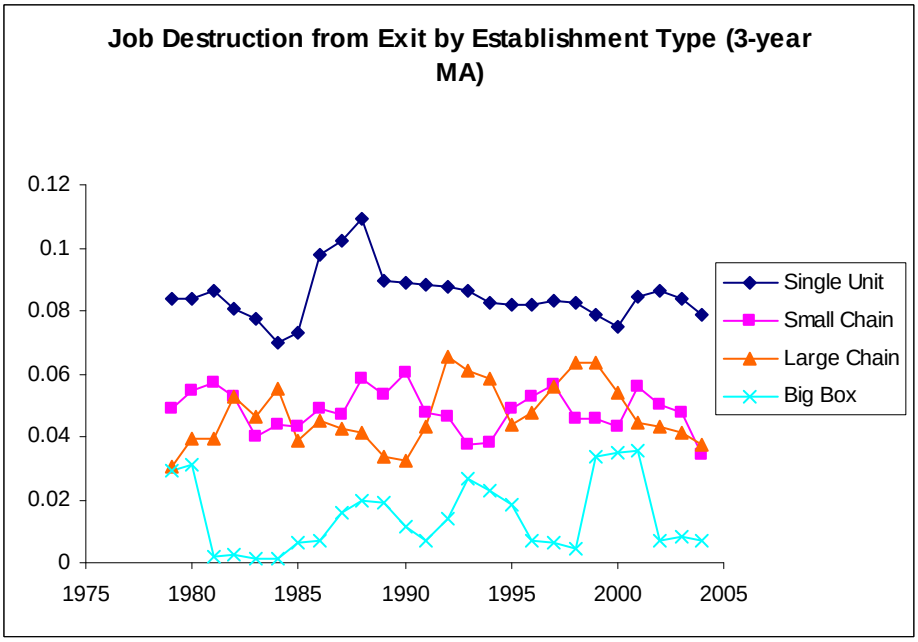

Figure 6 Big-Box Impact Across Different Areas

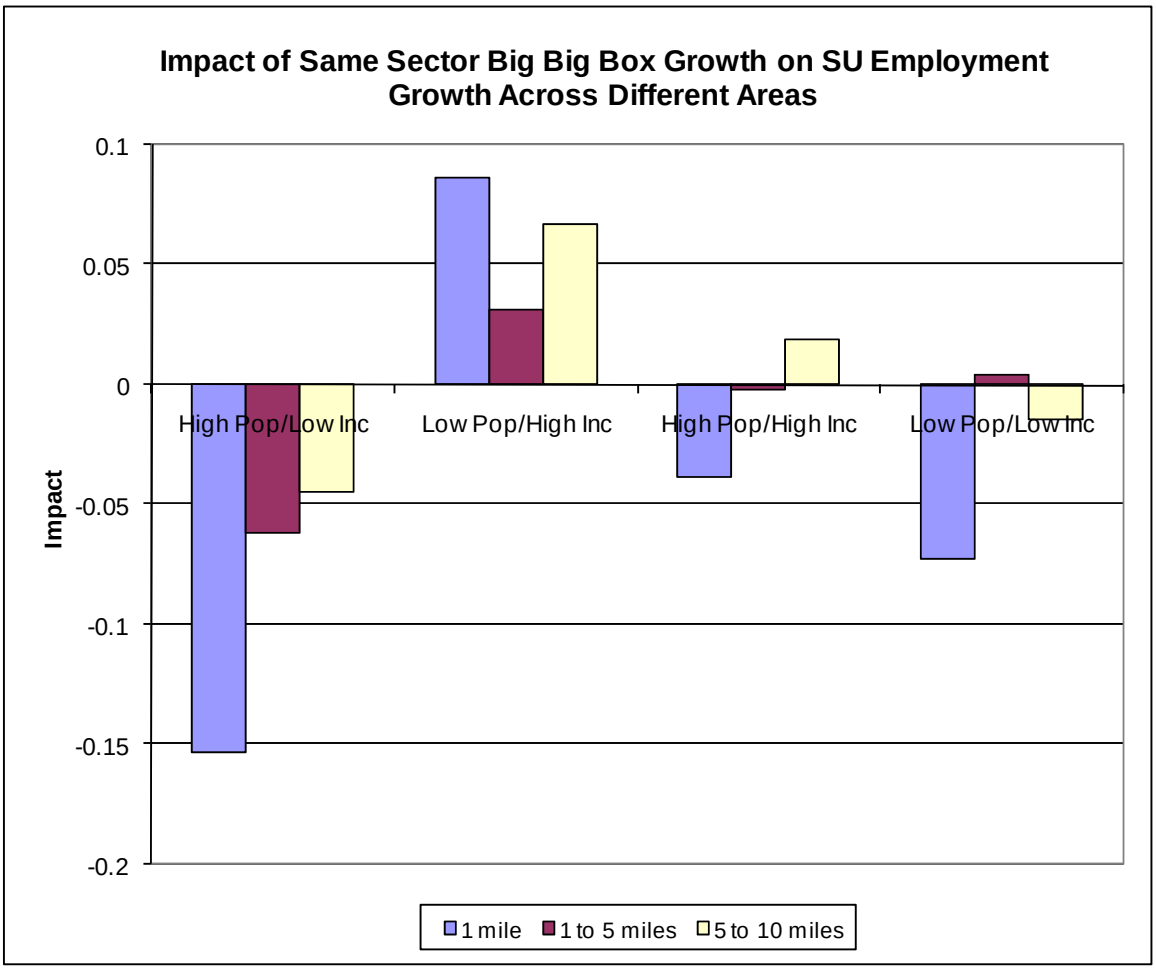

Table 1: Presence and Growth of Big-Box Activity by Broad Industry (2-digit SIC) in D.C. Metro Area

Broad SIC	1978-1991	1992-2000
Building Materials, Hardware, Garden Supply	Yes	Yes (+)
General Merchandise	Yes	Yes (+)
Food Stores	No	No
Automotive Dealers, Service Stations	Yes	Yes (+)
Apparel and Accessory	No	No
Home Furnishings, Furniture and Equipment	Yes	Yes (+)
Eating and Drinking	No	No
Miscellaneous	Yes	Yes (+)

Notes: A "Yes" in a column indicates the presence of Big-Box activity. A "+" or "-" in the second column indicates that Big-Box activity in that sector has expanded (contracted).

Table 2: Standard deviations of Selected Explanatory Variables

	Single Unit Incumbents in t-1	Single Unit Estabs with Emp>0 in t-1 or t
Lagged Growth in:		
Same Sector Big-Box Emp (1 mile)	0.049	0.049
Other Sector Big-Box Emp (1 mile)	0.482	0.483
Same Sector Big-Box Employment (1 to 5 mile)	0.117	0.115
Other Sector Big-Box Employment (1 to 5 mile)	0.253	0.254
Same Sector Big-Box Employment (5 to 10 mile)	0.136	0.134
Other Sector Big-Box Employment (5 to 10 mile)	0.210	0.212
Population Growth in 5 mile ring	0.032	0.032

Table 3: Relationship Between Entry of Big-Box Employment, SU Employment Growth and SU Job Destruction from Exit

Dependent Variable	Net	Net	JD Exit
Sample	Incumbents	Incumbents+Births	Incumbents
Explanatory Variables:			
First entry of Big-Box in:			
Same sector within 1 mile (last year)	-0.269	-0.320	0.312
	(0.052)	*(0.063)*	*(0.040)*
Same sector in 1 to 5 mile ring (last year)	-0.084	-0.117	0.101
	(0.031)	*(0.037)*	*(0.023)*
Same sector in 5-10 mile ring (last year)	-0.016	-0.006	0.051
	(0.028)	*(0.034)*	*(0.022)*
Other sector within 1 mile (last year)	-0.007	-0.001	0.000
	(0.006)	*(0.007)*	*(0.005)*
Other sector in 1 to 5 mile ring (last year)	0.056	0.033	-0.008
	(0.016)	*(0.019)*	*(0.012)*
Other sector in 5-10 mile ring (last year)	-0.021	-0.005	-0.015
	(0.017)	*(0.021)*	*(0.013)*
Population Growth in 5 mile ring	0.070	0.130	-0.099
	(0.043)	*(0.052)*	*(0.033)*
Young Establishment Indicator (<5 years old)	-0.046	0.296	0.081
	(0.002)	*(0.003)*	*(0.002)*
R-squared	0.01	0.04	0.01
Number of Observations	251949	290930	251949
Mean of Dependent Variable	-0.09	0.04	0.09

Notes: All Specifications include year effects, local demographic and income controls, controls for the number of highway exits within 1, 5 and 10 miles and the number of metro stops within 1 mile. Standard errors in italics. All regressions are employment weighted.

Table 4: Relationship Between Growth of Big-Box Employment, SU Employment Growth and SU Job Destruction from Exit

Dependent Variable	Net	Net	JD Exit
Sample	Incumbents	Incumbents+Births	Incumbents
Explanatory Variables:			
Lagged Growth in			
Same Sector Big-Box Emp (1 mile)	-0.094	-0.109	0.110
	(0.021)	*(0.025)*	*(0.016)*
Same Sector Big-Box Emp (1 to 5 mile)	-0.021	-0.027	0.027
	(0.012)	*(0.015)*	*(0.009)*
Same Sector Big-Box Emp (5 to 10 mile)	0.006	-0.002	-0.003
	(0.011)	*(0.013)*	*(0.008)*
Other Sector Big-Box Emp (1 mile)	-0.002	-0.002	0.001
	(0.002)	*(0.003)*	*(0.002)*
Other Sector Big-Box Emp (1 to 5 mile)	0.017	0.009	-0.008
	(0.005)	*(0.005)*	*(0.003)*
Other Sector Big-Box Emp (5 to 10 mile)	-0.001	0.000	-0.011
	(0.006)	*(0.007)*	*(0.004)*
Population Growth in 5 mile ring	0.072	0.130	-0.100
	(0.043)	*(0.052)*	*(0.033)*
Establishment less than 5 years old	-0.046	0.295	0.081
	(0.002)	*(0.003)*	*(0.002)*
R-squared	0.01	0.04	0.01
Number of Observations	251949	290930	251949
Mean of Dependent Variable	-0.09	0.03	0.09

Notes: All Specifications include year effects, local demographic and income controls, controls for the number of highway exits within 1, 5 and 10 miles and the number of metro stops within 1 mile. Standard errors in italics. All specifications are employment weighted.

Table 5: Relationship Between Growth in Big-Box Employment and SU Employment Growth (Pre and Post 1992)

Dependent Variable: Net Growth	Sample Incumbents	Incumbents+ Births
Explanatory variables:		
Lagged Growth in:		
Same Sector Big-Box Emp (1 mile)	0.018	-0.005
	(0.045)	*(0.054)*
Same Sector Big-Box Emp (1 mile) X POST 1992 dummy	-0.143	-0.136
	(0.051)	*(0.062)*
Same Sector Big-Box Employment (1 to 5 mile)	0.056	0.053
	(0.022)	*(0.027)*
Same Sector Big-Box Employment (1 to 5 mile) X POST 1992 dummy	-0.113	-0.117
	(0.026)	*(0.032)*
Same Sector Big-Box Employment (5 to 10 mile)	0.039	0.019
	(0.017)	*(0.020)*
Same Sector Big-Box Emp (1 mile) X POST 1992 dummy	-0.068	-0.046
	(0.022)	*(0.026)*
Other Sector Big-Box Emp (1 mile)	-0.009	-0.006
	(0.004)	*(0.005)*
Other Sector Big-Box Emp (1 mile) X POST 1992 dummy	0.009	0.006
	(0.005)	*(0.006)*
Other Sector Big-Box Employment (1 to 5 mile)	0.015	0.010
	(0.006)	*(0.008)*
Other Sector Big-Box Employment (1 to 5 mile) x Post 1992 dummy	0.003	-0.004
	(0.009)	*(0.011)*
Other Sector Big-Box Employment (5 to 10 mile)	-0.017	-0.003
	(0.009)	*(0.011)*
Other Sector Big-Box Employment (5 to 10 mile) x Post 1992 dummy	0.026	0.005
	(0.012)	*(0.014)*
R-squared	0.01	0.04
Number of Observations	251949	290930
Mean of Dependent Variable	-0.09	0.03

Notes: All Specifications include year effects, local demographic and income controls, and controls for the number of highway exits within 1, 5 and 10 miles and the number of metro stops within 1 mile. These specifications also include the population and establishment age effects but are not reported in this table for brevity. The patterns for the latter are similar to those reported in prior tables. All regressions are employment weighted.

Table 6: Heterogeneous Responses to Other Sector Big-Box Activity for Single Units

Sample	Incumbents	
Dependent Variable: Establishment net employment growth		
Explanatory Variables:		
Lagged Growth in		
Same Sector Big-Box Emp (1 mile)	-0.094	-0.095
	(0.021)	*(0.021)*
Same Sector Big-Box Emp (1 to 5 mile)	-0.021	-0.023
	(0.012)	*(0.012)*
Same Sector Big-Box Emp (5 to 10 mile)	0.006	0.002
	(0.011)	*(0.011)*
Other Sector Big-Box Emp Not GEN MER (1 mile)	0.000	0.002
	(0.002)	*(0.003)*
Other Sector Big-Box Emp Not GEN MER (1 to 5 mile)	0.017	0.006
	(0.004)	*(0.005)*
Other Sector Big-Box Emp Not GEN MER (5 to 10 mile)	0.005	0.003
	(0.005)	*(0.006)*
Other Sector Big-Box Emp GEN MER (1 mile)	-0.006	-0.002
	(0.004)	*(0.005)*
Other Sector Big-Box Emp GEN MER (1 to 5 mile)	0.003	0.002
	(0.003)	*(0.004)*
Other Sector Big-Box Emp GEN MER (5 to 10 mile)	-0.004	0.002
	(0.004)	*(0.005)*
Other Sector Big-Box Emp Not GEN MER (1 mile)*SU Restaurant		-0.006
		(0.005)
Other Sector Big-Box Emp Not GEN MER (1 to 5 mile)*SU Restaurant		0.031
		(0.008)
Other Sector Big-Box Emp Not GEN MER (5 to 10 mile)*SU Restaurant		0.008
		(0.010)
Other Sector Big-Box Emp GEN MER (1 mile)*SU Restaurant		-0.010
		(0.009)
Other Sector Big-Box Emp GEN MER (1 to 5 mile)*SU Restaurant		0.004
		(0.007)
Other Sector Big-Box Emp GEN MER (5 to 10 mile)*SU Restaurant		-0.019
		(0.008)
R-squared		
Number of Observations	251949	251949
Mean of Dependent Variable		

Notes: All Specifications include year effects, local demographic and income controls, controls for the number of highway exits within 1, 5 and 10 miles and the number of metro stops within 1 mile. Standard errors in italics. These specifications also include the population and establishment age effects but are not reported in this table for brevity. The patterns for the latter are similar to those reported in prior tables. All specifications are employment weighted.

Table 7: Relationship Between Entry of Big-Box Employment, Small Chain Employment Growth and Small Chain Job Destruction from Exit

Dependent Variable	Net	Net	JD Exit
Sample	Incumbents	Incumbents+Births	Incumbents
Explanatory Variables:			
First entry of Big-Box in:			
Same sector within 1 mile (last year)	-0.342	-0.401	0.352
	(0.068)	*(0.083)*	*(0.046)*
Same sector in 1 to 5 mile ring (last year)	0.034	0.033	-0.017
	(0.036)	*(0.044)*	*(0.024)*
Same sector in 5-10 mile ring (last year)	-0.072	-0.043	0.070
	(0.032)	*(0.038)*	*(0.022)*
Other sector within 1 mile (last year)	0.004	-0.009	0.001
	(0.009)	*(0.011)*	*(0.006)*
Other sector in 1 to 5 mile ring (last year)	-0.006	-0.016	0.020
	(0.023)	*(0.027)*	*(0.016)*
Other sector in 5-10 mile ring (last year)	-0.060	-0.010	-0.008
	(0.023)	*(0.028)*	*(0.016)*
Population Growth in 5 mile ring	0.112	0.102	-0.023
	(0.068)	*(0.076)*	*(0.046)*
Young Establishment Indicator (<5 years old)	0.011	0.285	0.013
	(0.004)	*(0.005)*	*(0.003)*
R-squared	0.01	0.05	0.009
Number of Observations	251949	290930	251949
Mean of Dependent Variable	-0.06	0.02	0.05

Notes: All Specifications include year effects, local demographic and income controls, controls for the number of highway exits within 1, 5 and 10 miles and the number of metro stops within 1 mile. Standard errors in italics. All specifications are employment-weighted.

Table 8: Relationship Between Growth of Big-Box Employment, Small Chain Employment Growth and Small Chain Job Destruction from Exit

Dependent Variable	Net	Net	JD Exit
Sample	Incumbents	Incumbents+Births	Incumbents
Explanatory Variables:			
Lagged Growth in			
Same Sector Big-Box Emp (1 mile)	-0.118	-0.123	0.099
	(0.026)	*(0.032)*	*(0.018)*
Same Sector Big-Box Emp (1 to 5 mile)	0.025	0.019	-0.012
	(0.014)	*(0.017)*	*(0.010)*
Same Sector Big-Box Emp (5 to 10 mile)	-0.026	-0.016	0.013
	(0.012)	*(0.014)*	*(0.008)*
Other Sector Big-Box Emp (1 mile)	-0.004	-0.005	0.002
	(0.003)	*(0.004)*	*(0.002)*
Other Sector Big-Box Emp (1 to 5 mile)	0.004	-0.002	0.002
	(0.007)	*(0.008)*	*(0.004)*
Other Sector Big-Box Emp (5 to 10 mile)	-0.013	-0.001	0.000
	(0.008)	*(0.009)*	*(0.005)*
Population Growth in 5 mile ring	0.110	0.101	-0.022
	(0.068)	*(0.076)*	*(0.046)*
Establishment less than 5 years old	0.011	0.285	0.013
	(0.004)	*(0.005)*	*(0.003)*
R-squared	0.01	0.05	0.01
Number of Observations	251949	290930	251949
Mean of Dependent Variable	-0.06	0.02	0.05

Notes: All Specifications include year effects, local demographic and income controls, controls for the number of highway exits within 1, 5 and 10 miles and the number of metro stops within 1 mile. Standard errors in italics. All specifications are employment weighted.

Table 9: Heterogeneous Responses to Other Sector Big-Box Activity for Small Chain (SC) Stores

Sample	Incumbents	
Dependent Variable: Establishment net employment growth		
Explanatory Variables:		
Lagged Growth in		
Same Sector Big-Box Emp (1 mile)	-0.117	-0.118
	(0.026)	*(0.026)*
Same Sector Big-Box Emp (1 to 5 mile)	0.026	0.025
	(0.014)	*(0.014)*
Same Sector Big-Box Emp (5 to 10 mile)	-0.026	-0.026
	(0.012)	*(0.012)*
Other Sector Big-Box Emp Not GEN MER (1 mile)	0.000	-0.006
	(0.003)	*(0.004)*
Other Sector Big-Box Emp Not GEN MER (1 to 5 mile)	0.005	0.001
	(0.005)	*(0.006)*
Other Sector Big-Box Emp Not GEN MER (5 to 10 mile)	0.010	0.012
	(0.007)	*(0.009)*
Other Sector Big-Box Emp GEN MER (1 mile)	-0.010	-0.019
	(0.006)	*(0.007)*
Other Sector Big-Box Emp GEN MER (1 to 5 mile)	-0.006	-0.005
	(0.005)	*(0.005)*
Other Sector Big-Box Emp GEN MER (5 to 10 mile)	-0.019	-0.011
	(0.006)	*(0.007)*
Other Sector Big-Box Emp Not GEN MER (1 mile)*SC Restaurant		0.019
		(0.007)
Other Sector Big-Box Emp Not GEN MER (1 to 5 mile)*SC Restaurant		0.018
		(0.012)
Other Sector Big-Box Emp Not GEN MER (5 to 10 mile)*SC Restaurant		-0.003
		(0.015)
Other Sector Big-Box Emp GEN MER (1 mile)*SC Restaurant		0.026
		(0.012)
Other Sector Big-Box Emp GEN MER (1 to 5 mile)*SC Restaurant		-0.007
		(0.010)
Other Sector Big-Box Emp GEN MER (5 to 10 mile)* SC Restaurant		-0.034
		(0.012)
R-squared	0.01	0.01
Number of Observations	251949	251949
Mean of Dependent Variable	-0.06	-0.06

Notes: All Specifications include year effects, local demographic and income controls, controls for the number of highway exits within 1, 5 and 10 miles and the number of metro stops within 1 mile. Standard errors in italics. These specifications also include the population and establishment age effects but are not reported in this table for brevity. The patterns for the latter are similar to those reported in prior tables. All specifications are employment weighted.