Wal-Mart and the Geography of Grocery Retailing[☆]

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Abstract

This paper empirically examines the impact of entry by Wal-Mart on competition in the supermarket industry. Using a detailed panel dataset spanning 1994 to 2006, we estimate the impact of Wal-Mart on firm outcomes and market structure, controlling for persistent local trends and systematic differences across markets by exploiting the detailed spatial structure of our store-level census. We find that Wal-Mart's impact is highly localized, affecting firms only within a tight, two-mile radius of its location. Within this radius, the bulk of the impact falls on declining firms and mostly on the intensive margin. Entry of new firms is essentially unaffected. Moreover, the stores most damaged by Wal-Mart's entry are the outlets of larger chains. This suggests that Wal-Mart's expansion into groceries is quite distinct from its earlier experience in the discount industry, where the primary casualties were small chains and sole proprietorships that were forced to exit the market. This contrast sheds light on the role density economies play in shaping both equilibrium market structure and economic geography. In the case of grocery competition, high travel costs and the perishable nature of groceries appear to impart horizontal differentiation between firms. This differentiation in demand appears to reduce impact of scale economies advantages that Wal-Mart exploited to the detriment of far-flung competitors in the discount store industry.

Keywords: Economic Geography, Spatial Competition, Retail Trade, Supermarkets
JEL: R12, C23, L11, L50, M31, L81

1. Introduction

Over the past 40 years, Wal-Mart has transformed the geographic structure of retailing, forging a lasting impact on the structure of both urban and rural markets. Due to its intensive investment in information technology and relentless pursuit of cost-cutting innovation, Wal-Mart is viewed by some as the primary driver of the significant aggregate productivity gains

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realized over the past quarter century (McKinsey Global Institute, 2001). An early precursor of the "big box" format, Wal-Mart is part of a movement toward fewer but larger outlets, thereby shifting the burden of transport from firm to consumer and creating "economies of density" by funneling previously diffuse demand to a central location. In the United States, the resulting shakeout among single store mom-and-pop firms was striking, leading to much debate over the demise of the sole proprietorship and decline of main street shopping districts. Does Wal-Mart's more recent entry into grocery retailing, now well underway, foretell a similar shift in market structure?

The big box concept turns on the willingness of consumers to travel farther for lower prices and greater selection, ultimately yielding a market structure with fewer, but larger, outlets. Given that very low-income families must frequently rely on public transportation, which has been linked both to poor labor outcomes arising from mismatch (Baum, 2009; Gautier and Zenou, 2010) and the clustering of poor families in city centers (Glaeser et al., 2008; Rosenthal, 2008; Brueckner and Rosenthal, 2009), there is increasing concern that low income families may face fewer shopping options or be foreclosed entirely. This is especially relevant within the grocery segment. Grocery markets have historically been served by two types of firms: large chain stores, which tend to locate in more suburban settings, and smaller fringe or mom-and-pop stores, which focus more on either center city or remote rural locations. The increasing dominance of large chains, and Wal-Mart in particular, raises the possibility of the increasing spread of so-called "food deserts", areas in which consumers have little to no access to fresh or healthy foods (Bitler and Haider, 2011).

However, it is not obvious ex ante how Wal-Mart's entry will impact the geography of grocery retailing since, in many ways, Wal-Mart does not represent a sharp departure from the existing chain-supermarket model. Most major supermarket firms already operate large stores, and have invested heavily in information and distribution technologies for the past quarter century. To have a transformative impact and increase the spread of food deserts, Wal-Mart would need to leverage consumers' desire for one-stop shopping to sharply expand the catchment area of a grocery store, traditionally thought to be only a few miles, to a much wider area.[1] This requires inducing consumers to travel farther by offering low enough prices (or high enough quality) to offset the increased travel costs. Because travel costs in grocery retail are higher than dry goods (due to the perishable nature of grocery products and frequency of store visits) it is unclear how effective the strategy could be.[2] Moreover, in dense urban settings with transportation constrained consumers, the Wal-Mart model might simply be infeasible.

[1]Using a structural model of strategic store location choice, Zhu and Singh (2009) find that a Wal-Mart supercenter's impact on rival discount stores, while strongest (and fairly uniform) within the first 10 miles, remains significant beyond even 10 miles. In contrast, Orhun (2012) finds that a supermarket's impact on its rival supermarkets drops dramatically outside the first mile, becoming insignificant beyond 5 miles.

[2]Travel costs are just one example of how retail customers may be heterogeneous, making it difficult to draw them to a single location. If small stores are able to exploit this heterogeneity by differentiating themselves from Wal-Mart (by location or other characteristics), they may be able to maintain a viable customer base and partially offset Wal-Mart's density strategy.

Wal-Mart's venture into groceries is increasingly attracting the attention of academics as well. Researchers have found that on average grocery stores reduce prices (Basker and Noel, 2009) and raise quality (Matsa, 2011) in reaction to entry by Wal-Mart. Wal-Mart has also been shown to increase consumer-surplus (Hausman and Leibtag, 2007), but also lead to higher rates of obesity (Carden and Courtemanche, 2011). However, somewhat surprisingly, little is known about Wal-Mart's overall impact on market structure, or even the particular types of stores most vulnerable to their competition. In addition, existing research focuses on the impact on incumbent stores only, ignoring Wal-Mart's impact on potential entrants surrounding the entry site. These features of Wal-Mart's impact have important implications for merger policy, as well as our broader understanding of spatial competition in dynamically evolving industries. The goal of this paper is to fill this void. To measure the Wal-Mart effect, we employ a full census of the supermarket industry that spans every year from 1994 to 2006. We exploit the fine spatial structure and time-series variation in our data to econometrically control for persistent local trends and systematic differences across markets that might influence Wal-Mart's strategic decision to enter a local market and/or the endogenous responses of its rivals.

We find that Wal-Mart's impact on the grocery industry differs sharply from its earlier experience as a discount retailer. First, its impact is highly localized. The entry of a new Wal-Mart supercenter significantly impacts only those rival supermarket firms that operate within a tight two mile radius of the new Wal-Mart outlet. This result is robust to three alternative measures of this "impact": number of employees, square feet of selling space, and overall sales volume. The first two are primary inputs (i.e. capital and labor), while the last is a key outcome variable.[3] Across all three measures, rival stores outside a two mile radius are not significantly affected by the entry of Wal-Mart, indicating that consumers are not willing to drive further to shop for groceries at a supercenter, even in more rural locations. Second, within the local "impact zone", Wal-Mart accelerates decline but does not dampen growth. In particular, the primary local effect of Wal-Mart's entry is to increase the decline in employment (and sales) amongst declining firms and, to a lesser extent, induce exit. Even within the impact zone, expansion by *de novo* entry is not significantly affected by Wal-Mart's entry, implying that Wal-Mart does not significantly constrain entrepreneurial activity in even the most proximate locations. Both results are robust to the type of market (urban or rural) and a tighter definition of geographic proximity. We find the strongest and longest-lasting effects for stores that Wal-Mart converted from existing discount stores (as opposed to greenfield construction), suggesting that Wal-Mart may benefit from (and competitors may be harmed by) the increased consumer awareness of an existing location as well as the lower fixed costs associated with not having to duplicate construction and zoning expenditures.

Despite its larger scale and the potential appeal of one-stop shopping, Wal-Mart is still constrained by the high degree of horizontal differentiation that characterizes grocery compe-

[3]For brevity and because of measurement issues we discuss later, we focus our presentation on the employment measure. Results for the two alternative measures are reported in an online appendix.

tition. This manifests itself most clearly along the spatial dimension: Wal-Mart's catchment area is no larger than the typical supermarket. To further explore this issue, we decompose Wal-Mart's impact by the type of firm it competes with, either a small or a large chain. We find that Wal-Mart's impact falls almost exclusively on the larger chains, having essentially no impact on the small players. This is in sharp contrast to what has been documented in other industries, where the burden fell almost entirely on small chains and local mom-and-pops (Haltiwanger et al., 2010; Jia, 2008). To further illustrate the heterogeneity in response, we compare Wal-Mart with two rival supermarket firms: Kroger (the national chain closest in size to Wal-Mart) and Save-A-Lot (a chain that targets a niche of low-income shoppers). We find that the impact of Kroger largely mirrors that of Wal-Mart: a two-mile impact radius that primarily falls on the intensive margin. The magnitude of the effect is comparable to that of the greenfield Wal-Mart outlets. Save-A-Lot, on the other hand, has no measurable impact on overall industry employment at all.

We also investigate the differential impact of Wal-Mart on low income communities. Grocery retail in low-income areas is characterized by fewer available stores and a higher proportion of small stores versus large vertically integrated chains. One explanation for this phenomena is that low-income areas contain a substantial fraction of consumers with very high travel costs, who are unwilling or unable to frequent the larger chain grocers. We find some evidence that Wal-Mart's impact on these communities is larger than on higher income areas, although it is again focused exclusively on large chains, leaving the small stores essentially unaffected. This suggests that the same features that insulate small stores from chain supermarkets in poor areas also protect them from competition with Wal-Mart. Meanwhile competition between major grocery chains and Wal-Mart appears to be more intense in low-income areas, where they are closer substitutes.

The full set of results can be rationalized with a relatively simple conceptual framework, based on Ellickson's (2006) model of retail competition with endogenous fixed investments, which we discuss in Section 4. In this framework, which adapts John Sutton's (1991) model of natural oligopoly to the retail setting, firms make large investments in IT to provide a wide range of products at low cost. To cover these sunk investments, firms must serve a large fraction of the market, effectively trading off specialization for economies of scale. The resulting oligopoly leaves a handful of dominant firms earning economic profits (due to the indivisibility of these fixed investments). Drawing on the insights of Sutton (1998), there is also scope for a horizontal differentiation by a second tier of low-quality firms (e.g. Aldi, Save-A-Lot and many mom-and-pops) who choose not to compete with the dominant firms, instead targeting an independent (but smaller) submarket of value-conscious consumers. Meanwhile the relative lack of price-insensitive consumers in low-income areas implies that chain grocers face harsher competition from the low-cost, limited variety supercenter format. This competitive structure explains why 1) Wal-Mart's impact is concentrated on larger chains (they serve the same consumer segment) and is larger in low-income areas (where consumers view chain supermarkets and supercenters as closer substitutes), 2) the impact falls mostly on the intensive margin (the naturally oligopolistic structure implies that additional entry can primarily erode economic profits), 3) Save-A-Lot is entirely distinct (they are serving a

separate submarket), and 4) the impact is larger for Wal-Mart conversions than greenfield entry (having already sunk the cost of building the outlet, conversions are viable in markets with thinner margins - so rivals experience more pressure on their operations following Wal-Mart's entry - but new builds require more opportunity for growth and entry, so rival response is more muted).

Overall, our results suggest that Wal-Mart's impact on groceries is distinct from its (earlier) impact on the discount store industry. Rather than fundamentally transforming the nature of competition, Wal-Mart may simply represent the entry of a typical (albeit very efficient) vertically integrated supermarket chain. Not only have several firms continued to thrive in its presence, Wal-Mart itself is now planning to introduce smaller formats to better compete for urban consumers (both in groceries and traditional dry goods).[4]

The paper is organized as follows. Section 2 provides a brief historical overview of both Wal-Mart and the grocery industry. Section 3 presents the data and details our estimation strategy for measuring Wal-Mart's impact. Section 4 presents our main results, employing the endogenous fixed cost model of retailing to interpret the findings. Section 5 concludes by summarizing our main contributions.

2. Wal-Mart, Big Box retail, and the Grocery Industry

2.1. Wal-Mart and the Economics of Density

Wal-Mart began as a rural department store with a simple business model: bring the wider selection and lower prices available to urban consumers to those who live in more rural environs. Much of Wal-Mart's initial success can be attributed to two factors: the creation and exploitation of density economies and aggressive investment in information technology, both of which led to huge cost advantages over competing firms (Holmes, 2011). By drawing consumers from a much wider catchment area than a typical small town retailer, they were able to create economies of *density* in markets that lacked the *population* density to support a rich diversity of specialized outlets. In essence, Wal-Mart created the shopping density of a city in places where the population itself was more diffuse. Moreover, Wal-Mart was quick to embrace advanced computerized logistic systems and bar code scanners (Holmes, 2001), forging a critical connection between outlet and firm and adding a dimension of scope economies at the level of the chain. As they grew in scale, their leverage with suppliers increased, adding buying power to their expanding list of advantages. Predictably, Wal-Mart's rise led to the closure of many smaller shops that lacked the scale to compete at this level.

By the late 1980s, Wal-Mart was poised to take on another segment of the retail market: groceries. Capitalizing on their large existing network of discount stores, extensive experience in distribution, and well-earned reputation for cutting costs, they began rolling out supercenters (combination discount and grocery stores) in 1988. By 2003, they were the single largest grocery chain by sales volume in the United States.

[4] *Wall Street Journal*, February 22, 2011, "Wal-Mart Tries to Recapture Mr. Sam's Winning Formula".

Not surprisingly, the rise of the big box format in general, and Wal-Mart in particular, has ignited a firestorm of debate as pundits decry the demise of the "mom-and-pop" retailer and the shift from labor- to capital-intensive retail formats. Several studies have documented the impact of big box retailers in general and Wal-Mart in particular, focusing on the changing scale of operation and the demise of the sole proprietorship. The impact of Wal-Mart on the grocery industry is less well-understood. Many observers believed that Wal-Mart would have the same transformative impact on food stores that it did on consumer dry goods which, given the concerns noted earlier about the urban poor, are even more salient in the context of food supply. However, the supermarket industry poses several distinct challenges for the Wal-Mart business model. First, groceries are perishable, requiring consumers to make more frequent visits to the store than with house-wares, clothing or other dry goods. Thus, there is a natural limit to the catchment area from which a given outlet can pull demand and the degree to which additional economies of density can be wrung from the existing structure. Our empirical results suggest that Wal-Mart has not changed this constraint. Second, as we discuss in the following section, the types of innovations that Wal-Mart pioneered in the discount industry had already been adopted by the dominant supermarket chains (Messinger and Narasimhan, 1995). At the same time, a substantial fringe of mom-and-pop grocery stores remained active in the industry. Our analysis will show that Wal-Mart's impact falls mostly on supermarket chains, while mom-and-pops, having differentiated themselves from the major supermarket chains, were far less impacted by Wal-Mart's arrival.

2.2. The Retail Grocery Landscape

Perhaps the most salient feature of grocery retailing is that, despite the dominance of several large national and regional chains, many single store enterprises and small chains continue to thrive. The rise of chain grocery stores began in the 1930s, when nascent supermarket entrepreneurs began building "food warehouses" in suburban locations. These stores were exploiting the same density economies in suburban settings that Wal-Mart would eventually bring to rural towns. Indeed, the earliest supermarkets sold dry goods as well as groceries, anticipating the rise of the supercenter by a half century. By the 1950s, the major supermarket chains had developed large-scale, hub-and-spoke distribution networks, and, by the 1980s, were heavily investing in cost reducing information technology. The computerization of the supply chain fueled a dramatic increase in assortments: the number of products carried per store tripled from 1970 to 1990 and average store size increased by about 1000 square feet per year (both trends have tapered off in the last 10 years).

Turning to more recent experience, Table 1 provides descriptive statistics for our fourteen year panel. The total number of stores increased from 29,827 in 1994 to 33,823 in 2006, only slightly outpacing population growth. In fact, the number of stores per capita remained relatively stable, at about 1.14 stores per 10,000 people, ending a long-term downward trend (see Figure 1). The industry is also subject to a fair amount of churn. An average of 1,323 stores exit each year, implying a mean store lifespan of roughly 23 years. About 1,656 stores open each year, with the largest numbers of openings occurring in 1995 and 1996.

During our panel, Wal-Mart alone accounted for an extraordinary 54 percent of the net increase in stores (they opened 2,168 supercenters between 1994 and 2006). They are

clearly a major factor. However, during this time the overall market share of chain stores (which includes Wal-Mart) was essentially stable, despite Wal-Mart's significant growth. This suggests that non-chain stores may have been better insulated from Wal-Mart's impact. Our local analysis will corroborate that Wal-Mart's impact was felt primarily by large chains.

Table 2 provides the names and store counts of the Top 10 firms (by total stores) in 1994 and again in 2006. Wal-Mart's explosive growth is the most dramatic feature (they operated just 97 supercenters in 1994), but the expansion (via a mix of acquisition and greenfield expansion) of Kroger, Safeway, Delhaize (Food Lion), and Supervalu are also noteworthy, as is the (purely greenfield) expansion of Aldi, a German-based firm that caters to low income consumers. Thus, Wal-Mart was not the only firm making substantial investments in this era. At the other end of the spectrum, the demise of A&P and American Stores (along with Kroger and Safeway, four of the five earliest entrants into the U.S. grocery business) are striking as well. Overall, between 1994 and 2006, the market share of stores operated by the top 10 firms increased from 26.5 percent to 38.6 percent, mostly the result of cross-market acquisitions.[5] At the same time, non-chain firms experienced net entry of about 700 stores.

Several themes emerge from this coarse analysis. First, the expansion of Wal-Mart is dramatic. However, several other firms expanded their presence as well, including firms at both the high-end of the quality spectrum (Publix, Whole Foods, Stop & Shop) and the extreme low-end (Aldi, Save-A-Lot). What is unclear is the extent to which these trends were a response to Wal-Mart's entry, or simply coincidental. The fact that the average number of stores per capita remained quite stable (ending a long term historical decline) suggests that Wal-Mart's growth may have represented an expansion in the equilibrium number of stores per capita. Second, the share of small players also remained relatively stable, suggesting that, even in the aggregate, this was not the segment of the market that Wal-Mart displaced. Third, while many of the firms that closed the most stores are lower-end southern chains (e.g., Winn-Dixie, Piggly-Wiggly) that compete directly with Wal-Mart, the major high-end southern chain (Publix) expanded over this period.

While there is much to be learned from national statistics, competition in retail groceries is fundamentally local in nature. To compare the role of Wal-Mart's density strategy versus that of other grocery store formats, Table 3 presents demographic statistics on the regions surrounding Wal-Mart supercenter and other store locations.[6] To construct these statistics, we take each store location in our dataset and compute (using data from the 2000 Census) the density, per-capita income, and poverty rate for the surrounding region by including all census tracts centered within five miles of the given location.[7] We can then compare

[5]This increase does not appear to have come at the expense of the smallest players: recall that the overall market share of chain stores (those operating over 10 stores per firm) held relatively steady at about 75 percent.

[6]For this table and the remainder of the paper, we focus on Wal-Mart supercenters, which constitute the vast majority of Wal-Mart's grocery revenue and the focus of their density strategy. Wal-Mart operates a few smaller stores, Neighborhood Markets, that sell groceries exclusively and are much closer to traditional grocery stores.

[7]In some instances, no centroids are within 5 miles of the store location, in which case we use the tract

the distributions of the demographic variables in locations surrounding each Wal-Mart with those of specific rivals (Kroger and Save-a-Lot), as well as the overall set of large chains (those with more than 25 outlets) and the smaller fringe players.

The first thing to note is the large degree of heterogeneity across store locations, even within specific chains. In almost all cases, the standard deviation of density is larger than its mean, even when we condition on being located inside an MSA (or its complement). This highlights the importance of controlling for unobserved heterogeneity when trying to assess Wal-Mart's impact. Still, some clear patterns can be discerned. Wal-Mart supercenters tend to locate in more remote locations than other large supermarket chains. They are more likely to locate outside a designated MSA while, within MSAs, they choose locations that are far less dense. This is consistent with a strategy that shifts the burden of transportation onto the consumer. In contrast, Kroger outlets tend to be located in dense, higher income locations. While Wal-Marts do locate in lower income areas, the per-capita income surrounding a Wal-Mart is higher than for Save-A-Lot and comparable to small firms, suggesting that Wal-Mart is not exclusively targeting the poorest consumers. Given the relative immobility of low income consumers (Baum, 2009; Gautier and Zenou, 2010), focusing on the lowest income markets would undermine Wal-Mart's density strategy (particularly in MSAs).

Another interesting feature of the data arises when we compare Wal-Mart to small chain and mom-and-pop stores. Our analysis will show that the growth rates in small firm employment are largely unaffected by Wal-Mart entry. This may seem surprising since Wal-Marts and small stores locate in areas with similar mean income and poverty levels. However, large differences arise when we condition on MSA. Within MSA's, small firms are located in extremely dense areas, whereas Wal-Mart's locations have more diffuse populations. The ordering is reversed outside MSAs, where small firms locate in less dense areas than Wal-Mart. One explanation for this may be that, while Wal-Mart focuses on customers who drive to their stores, small firms use location to cater to those customers with higher mobility constraints. In MSAs, immobile consumers are best reached by locating in dense urban areas, while Wal-Mart chooses to locate in less dense areas that are conveniently reached by vehicle. Outside of MSAs, Wal-Mart's locate in relatively dense—but car convenient—areas near major roads and towns. On the other hand, the small stores choose relatively less dense locations to cater to customers who do not wish to drive to towns.

Although these relationships are suggestive of horizontal differentiation within the grocery industry, the role that Wal-Mart played in the fortunes of these chains and local stores cannot be discerned from aggregate trends. While Wal-Mart clearly became a major player in the industry, we note that, apart from combining a supermarket with *their own* existing discount outlets (and an obviously daunting scale of operation), Wal-Mart did not represent something fundamentally new for the grocery industry. Their primary advantages were the aforementioned scale (no other potential entrant could roll out so many stores in so short a time) and their installed base of large outlets (allowing them to forgo some of the entry costs associated with pure greenfield entry). Adding to the confusion, their growth was focused

demographics of the nearest centroid.

primarily in the South, which experienced strong population growth over this period. It is crucial to account for these contemporaneous trends in assessing Wal-Mart's impact.

The challenge of our empirical work is to disentangle the direct impact of Wal-Mart from the other contemporaneous trends affecting the supermarket industry to understand whether Wal-Mart represents a fundamental shift in industrial structure, or simply the entry of another, well-run supermarket chain. To do so, we exploit the rich spatial structure of the data to identify the impact of Wal-Mart via the spatial pattern of its influence within a local market. In this way, we are able to control for both local trends and varying initial conditions, and isolate the causal effect of Wal-Mart's entry. We turn to this exercise next.

3. Determining Wal-Mart's Impact

3.1. Data Sources

The goal of our empirical analysis is to quantify the impact of Wal-Mart on the fortunes and decisions of its rivals in the grocery industry. To do so, we require detailed data for the entire industry and suitable measures of both outcomes and choices. Our data on the supermarket industry are drawn from the Trade Dimension's (TD) TDLinx panel dataset, which includes the full census of supermarkets (including Wal-Mart supercenters) operating throughout the United States. Trade Dimensions defines a supermarket as "any full-line, self-service food store with an annual sales volume of $2 million or more." This definition, which is applied at the establishment level regardless of the overall sales volume of the firm, is the government and industry standard. The TD data is the industry's leading source of store level information, has been used in numerous academic studies, consulted in merger analysis by the Federal Trade Commission, and is frequently cited in the trade press for information on relative performance. Using a mixture of store level surveys, register-level scanner data, and direct store visits, Trade Dimensions collects information on store features (e.g. size, number of checkouts, number of employees, store format) and store level gross revenue. Key to our spatial analysis, we know the exact physical location (geocode) of each store, as well as which chain it ultimately belongs to, which allows us to differentiate stores by size of chain.[8]

While the most natural measure of store performance is profitability, we do not have access to data on prices, quantities or costs, nor are we aware of any entity that systematically collects them for the full census of firms.[9] Instead, we will present three alternative proxies and discuss their relative merits. The most direct measure of performance in the TD dataset is store level revenue. However, because the majority of the revenue data is imputed using a proprietary scheme that we do not observe, we focus primarily on employment and store size, along with the discrete outcome of whether an outlet remains in operation. Employment and store size allow us to track the interplay between labor and capital, and also capture

[8]The name on the front of the store is often a poor indicator of the ultimate owner, as stores acquired in a merger or acquisition will often retain their old store name (presumably for reasons related to local brand capital).

[9]A large fraction of the firms in question are privately held, so stock market data is of little use as well.

two key dimensions on which firms compete, namely service and assortment. Moreover, both measures are directly observable, relatively stable, and subject to fairly little measurement error. In the interest of brevity, we will focus on employment in the main text, saving the corresponding results for revenue and store size for the online appendix.

3.2. Growth Indices

To capture Wal-Mart's impact on rival firms, we utilize the growth measures developed by Davis et al. (1996, DHS) for their analysis of job creation and destruction, creating separate growth indices for employment, store size, and revenue. There are two key advantages to using the DHS methodology. First, it seamlessly incorporates both entry and exit, which are important discrete components of the relevant response set. Second, it allows changes in the relevant growth rates to be further decomposed into four distinct components: decreases due to exits, decreases due to negative adjustments by continuing firms, increases due to positive adjustments by continuing firms, and increases due to de novo entry. We are therefore able to distinguish, for example, Wal-Mart's direct impact on the exit rate from its impact on incumbent firms that remain in operation, as well as how its presence changes the rate and scale at which new firms enter. The ability to capture changes along both the intensive and extensive margin, and gauge the relative importance of each, is key to understanding exactly how Wal-Mart impacts market structure.

While we will construct growth rates for each of three outcomes (sales, store size, and employment), we focus on employment in describing the framework. Following DHS and Haltiwanger et al. (2010), we define employment growth at the store level as,

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

where

$$X_{it} = \frac{(E_{it} + E_{it-1})}{2}.$$

X_{it} is simply the average level of employment (E) across two consecutive periods and g_{it} the magnitude of the change in employment relative to this average. Note that when firm i is operating in both periods, g_{it} is similar to a log growth rate. However, it's key advantage is that it also accommodates firm entry and exit. If firm i enter's the market in period t, $g_{it} = 2$. Similarly, $g_{it} = -2$ for an exiting firm.

We then construct the growth index for region k as,

$$G_{kt} = \frac{\sum_{i \in \mathcal{R}_k} X_{it} g_{it}}{\sum_{i \in \mathcal{R}_k} X_{it}} = \frac{\sum_{i \in \mathcal{R}_k} (E_{it} - E_{it-1})}{\sum_{i \in \mathcal{R}_k} X_{it}}$$

where $\mathcal{R}_k$ is the set of stores within region k, for example, the set of firms within two miles of a given Wal-Mart supercenter. G_{kt} is then simply a measure of regional employment growth. Note that the middle expression would be redundant except that it allows for a convenient decomposition of regional employment growth into "job creation" and "job destruction",

and then even further into four distinct components,

$$G_{kt} = JCC_{kt} + JCE_{kt} - JDC_{kt} - JDE_{kt}. \tag{1}$$

Respectively, these components represent the contribution to net job growth (creation) due to an increase in employment at continuing firms (JCC), job creation from the entry of new firms (JCE), job destruction due to a decrease in employment at continuing firms (JDC), and job destruction due to firm exits (JDE).

For example, the contribution of job creation at continuing firms is,

$$JCC_{kt} = \frac{\sum_{i \in \mathcal{R}_k} X_{it} \max\{g_{it}, 0\} \mathbf{1}[g_{it} < 2]}{\sum_{i \in \mathcal{R}_k} X_{it}},$$

which counts employment growth changes for firms with positive job growth ($g_{it} > 0$) that are not new entrants ($g_{it} < 2$), weighted by their size with respect to the employment of all firms across the region.

The contribution of entering firms—which must be positive by definition—is calculated similarly,

$$JCE_{kt} = \frac{\sum_{i \in \mathcal{R}_k} X_{it} \mathbf{1}[g_{it} = 2]}{\sum_{i \in \mathcal{R}_k} X_{it}}.$$

The statistics for destruction at continuing and exiting firms are analogous to those for creation,

$$JDC_{kt} = \frac{\sum_{i \in \mathcal{R}_k} X_{it} \max\{-g_{it}, 0\} \mathbf{1}[g_{it} > -2]}{\sum_{i \in \mathcal{R}_k} X_{it}},$$
$$JDE_{kt} = \frac{\sum_{i \in \mathcal{R}_k} X_{it} \mathbf{1}[g_{it} = -2]}{\sum_{i \in \mathcal{R}_k} X_{it}}.$$

We will use each of these components as dependent variables to capture the impact of Wal-Mart's entry along each distinct margin.

3.3. Estimating Wal-Mart's Impact

Wal-Mart is clearly selective in where it chooses to locate stores, balancing the distance from its distribution centers and installed base of discount stores against each market's relative potential for sales growth, demographic features (presumably low to middle income consumers), and strength of competition. Moreover, there are clear demographic trends to account for as well, including the continued migration from the Midwest "rust belt" to the South and from urban centers to suburban enclaves. As a historically southern chain that typically eschews urban locations, Wal-Mart likely benefitted from these shifts. Cleanly identifying the impact of Wal-Mart on rival grocers requires accounting for these confounding factors econometrically. It also requires focusing on the empirically relevant treatment effect.

Our identification strategy exploits the detailed spatial and panel structure of the data to rely on intra- as opposed to inter-market variation to tease out a clear "Wal-Mart effect",

zeroing in on the changes in the growth rates before and after Wal-Mart chooses to enter. Taking the unit of observation to be a local site that experienced entry by a Wal-Mart supercenter during the sample period, we calculate growth (sales, size, and employment) indices for concentric rings surrounding each new supercenter entry. We assume that stores in the furthest ring from the Wal-Mart are unaffected by its entry, so that the difference in the relevant growth rate (relative to that furthest ring) captures the causal effect of Wal-Mart competition. We then use the indices to conduct a difference-in-difference estimation to determine the difference in the impact of Wal-Mart's entry across the rings, relying on the time series variation to pin down the causal effect of this entry.

We construct a set of employment (as well as size and revenue) indices surrounding each Wal-Mart that opened between 1996 and 2005 for the eleven year span centered at the year that Wal-Mart entered (or all years that are available when our data does not cover the entire span). For each Wal-Mart location w, we divide the area within $\bar{r}$ miles of the Wal-Mart site into concentric rings and compute $(Y_{wr^1t}, Y_{wr^2t}, \ldots, Y_{w\bar{r}t})$. Y_{r^1t} is the index of interest for all stores within r^1 miles of the Wal-Mart, Y_{r^2t} is the index for all stores between r^1 and r^2 miles away from the Wal-Mart, and so forth. In the specification we present below, we use the set of bands, $r \in \{2, 4, 6, 8, 10\}$, i.e., we construct indices separately for stores within 2 miles of each Wal-Mart location, 2-4 miles away, 4-6 miles away, 6-8 miles away and 10-12 miles away. We have experimented with specifications that vary both the width and the extent of the bands (with the outer ring as far as 25 miles away), all yielding qualitatively similar results. Let Y_{wrt} be the index relating to the region at most r miles away from Wal-Mart location w in year t, and define τ_w as the year of Wal-Mart outlet w's entry. Our estimating equation is then,

$$Y_{wrt} = \alpha_{wt} + \beta_r + \gamma_{r,t-\tau_w} + \epsilon_{wrt}. \tag{2}$$

In this equation, the parameters of interest are $\gamma_{r,t-\tau_w}$, which capture the impact of Wal-Mart's entry on the index of ring r, $t - \tau_w$ years after Wal-Mart's entry. The time-varying nature of these treatment effect parameters allows us to capture the full dynamic response to Wal-Mart's entry, which may naturally taper off with time. To control for unobservable shocks to local demand, α_{wt} is a region-wide, time-varying shock to demand or costs that affects the index in every ring. A ring-specific dummy β_r captures systematic (non-time-varying) differences in growth rates across ring-types. Finally, ϵ_{wrt} is a mean-zero iid shock that we assume to be uncorrelated with the year of Wal-Mart's entry into location w. To allow for correlation among localized shocks, we cluster standard errors at the region level.

Since we use growth rates rather than levels, first-differencing controls for such difficult to proxy factors as proximity to a (pre-existing) highway interchange or popular shopping district. Furthermore, because we have a balanced panel of rings surrounding each Wal-Mart site, we are able to use site-year fixed effects (α_{wt}) to control for area-wide unobserved shocks to growth across all rings. This is our most critical control as it allows for a freely time-varying, site-specific unobservable at the level of each Wal-Mart location. This will control for area-wide demand shocks such as factory openings or closings that cause large movements in the local labor market, the construction of a new housing development or strip

mall, as well as the accelerated migration to the south and the western "sand states". In particular, through these site-specific time effects, we can control for the fact that the vast majority of Wal-Mart supercenters were opened in southern markets that were experiencing sharp net population growth over this period.

Furthermore, by including additional ring-specific (non-time-varying) fixed effects (β_r), we can also accommodate differences in the average growth rates across the rings. This allows for the possibility of Wal-Mart systematically choosing locations in the pockets of highest-growth within a city or suburb or in areas with persistently weak or under-performing firms. Our parameter estimates are then consistent under the assumption that any shocks to grocery demand at the ring-level (ϵ_{wrt}) that are not captured by the included site-time fixed effects (α_{wt}) are uncorrelated with the timing of Wal-Mart's entry decision. In other words, we are assuming that Wal-Mart cannot (or does not) time its entry to coincide with highly localized (ring level) shocks to demand. This assumption seems relatively mild for the stores which were opened as conversions from existing Wal-Mart discount stores (since their locations were already determined), but somewhat stronger for greenfield entries.

Note that because we only see the locations that Wal-Mart chose to enter, the relevant *treatment effect* that we are estimating is the average treatment effect on the treated (ATET). Wal-Mart's locations were clearly chosen by design, not by random assignment. We are controlling for this selection problem by exploiting the quasi-randomization of *when* Wal-Mart chose to enter, not *where* they entered (by also controlling for site-specific fixed effects, this means we are assuming only that Wal-Mart's entry timing is unrelated to ϵ_{wrt}). Thus, we are able to consistently estimate the causal effect of Wal-Mart's entry on the types of markets that Wal-Mart tends to enter (i.e. the treated). Without modeling (as opposed to controlling for) the selection of locations, we cannot predict the impact of Wal-Mart's entry in locations that are vastly different from the ones it has entered so far (e.g. a Wal-Mart in downtown Manhattan or San Francisco proper). However, for the purposes of this study, namely identifying Wal-Mart's impact on the observed structure of the grocery industry, the ATET is the appropriate object of interest. A structural model of site-selection that can tackle large counterfactuals is the focus of future research.

Returning to the mechanics of estimation, equation (2) can be estimated as a standard fixed effects regression in which we difference across rings to remove α_{wt}. To normalize reference groups, we assume that Wal-Mart's impact on the outermost ring is negligible, and impose the restriction $\gamma_{\bar{r},t-\tau_w} = 0$; we validate this assumption by changing the specification to include more distant rings. We must also include a reference group for the year of Wal-Mart entry; we assume that Wal-Mart has no effect on firms five years prior to its entry, i.e., $\gamma_{r,-5} = 0$ for all rings. As a falsification test, we report estimates of $\gamma_{r,-4}$ and $\gamma_{r,-3}$, which should be zero if our identification assumptions hold and grocery stores do not react to Wal-Mart's anticipated entry more than two years in advance of its arrival. We view $\gamma_{r,-2}$ and $\gamma_{r,-1}$ as tests of an anticipatory effect of Wal-Mart on other grocers, as Wal-Mart often announces its intentions to open a store in advance of its actual opening date and this might change the opportunity cost of continuing to operate a rival supermarket instead of re-purposing the location for an alternative use (e.g. a chain restaurant). This is an additional

benefit of our flexible approach, which traces out the full dynamic impact of Wal-Mart's entry.

4. Results: Wal-Mart's Impact on Grocery Retailers

We use information from 2,072 Wal-Mart supercenter entry sites to estimate (2), resulting in 87,565 site-ring-year observations. Before we turn to the main regression results, we first provide a sense of the grocery industry activity surrounding Wal-Mart entry locations in Table 4. The key advantage of our ring specification is that by aggregating our data into geographic regions, we can consider the impact of entry on a region rather than focus only on existing stores. This allows us to assess Wal-Mart's impact on entry of new stores and properly account for the possible re-allocation of labor across stores as a result of Wal-Mart's entry into the region. On average, there are 2.9 stores within two miles of a Wal-Mart entry site, employing roughly 200 full time equivalent employees, so our inner-most two-mile ring can be considered a relatively tight commercial area. The typical Wal-Mart supercenter employs 300 full-time equivalent employees (only some of which are employed in grocery retail), so Wal-Mart's entry is a significant shock to the local market. While the number of stores increases steadily as we consider rings further removed from the Wal-Mart entry site, the density of stores falls precipitously (note the increased area of the outer rings).[10] Not surprisingly, the variance in the number of stores and employees increases as we consider more remote rings. The high density in areas where Wal-Mart chooses to enter is evidence of Wal-Mart's strategic choice of entry locations from its national choice set. As noted earlier, while our methodology is useful in uncovering the average treatment on the treated, we are unable to consider how an area outside the treatment group of entry locations would react to Wal-Mart's entry.

To further understand the economic geography surrounding each Wal-Mart location, Table 5 breaks down stores and grocery employment within 4 miles of every Wal-Mart outlet by store type and local income level. We define an entry location as low income if the surrounding area's per capita income is less than double the 2000 census individual poverty level.[11] While there is a large degree of heterogeneity, low income areas typically have fewer competing stores around a given Wal-Mart than the corresponding higher income areas. Interestingly, the decline in both the number of stores and the number of employees mainly comes from large chains (chains with 25 or more stores), while the number of small chain and mom-and-pop stores, as well as their employment levels, are relatively constant across income levels. This suggests that large chains are more sensitive to consumer income levels than these smaller fringe players, who may be better able to customize their offerings to target different consumer types.

[10] This is one reason we believe that controling for a ring-level differences in growth rate is an important feature of our framework.

[11] The area's per capita income is calculated using the 2000 census in the same manner as for Table 3. The individual poverty line in the 2000 US Census was $8,794.

4.1. Wal-Mart's Geographic Footprint

Most empirical studies of Wal-Mart's impact on general merchandise retailing assume that a given Wal-Mart outlet's market area is roughly equivalent to the county of entry (Basker, 2005; Jia, 2008; Holmes, 2011). This reflects the fact that conventional Wal-Mart's tend to draw customers of their more durable "dry goods" from a wide area (Zhu and Singh, 2009). Matsa (2011) adopts the county-level market-area in his analysis of quality competition between grocery stores and Wal-Mart. In contrast, marketing researchers have estimated the relevant trading area of a grocery store to be a tight 3-5 mile radius surrounding the store.[12] If Wal-Mart does attract grocery customers from across an entire county, this represents a substantial geographical expansion of the catchment area, and implies that Wal-Mart supercenters may be fundamentally different from traditional supermarkets. Our analysis is well-suited to empirically establishing the geographic scope of Wal-Mart's impact on the grocery industry. In particular, we are able to determine whether Wal-Mart competes most closely with stores in its immediate vicinity (similar to traditional grocery retailers) or if its impact extends to a wider area (similar to the impact of Wal-Mart on general merchandise retailing).

Table 6 examines the impact of Wal-Mart entry on employment growth in the geographic region surrounding each Wal-Mart supercenter. The table displays our estimates of the Wal-Mart effect, captured by the parameter vector $\gamma_{r,t-\tau_w}$. Each column corresponds to a ring distance from the Wal-Mart site, while each row corresponds to the number of years relative to Wal-Mart's entry. Negative rows correspond to an anticipatory effect of Wal-Mart, allowing for the early announcement of opening dates to trigger a preemptive response. Focusing on the full set of parameter estimates, the first result that jumps out is the extremely localized nature of Wal-Mart's impact. Outside of a tight, two mile radius, there is no measurable impact at all. With the exception of two (likely spurious) positive coefficients in the 2-4 mile ring, all coefficients are both economically and statistically insignificant.

To highlight this result, Figure 2 plots the coefficients and their standard errors for the 0-2 and 6-8 mile ring. The impact of Wal-Mart's entry on the inner most ring is apparent; upon entry employment growth falls by 5 percent and remains depressed in every year following entry. Meanwhile, there is no measurable effect at all 6-8 miles away.

The same pattern holds for the two alternative measures of the competitive impact (sales and size),[13] which are reported in an online appendix. Moreover, the highly localized impact of Wal-Mart on all three measures is robust to extending the furthest distance ring as far out as 25 miles.[14] Wal-Mart's entry has a sharp and persistent negative impact on employment

[12]Singh et al. (2006) examine members of a frequent shopper program of a grocery store and find that the mean distance to the store is 3.5 miles, and that 78 percent of customers live within 5 miles of the store.

[13]We view floor size as a proxy for the degree of product variety at a store. The effect we find is due to both size adjustments in continuing stores and the entry and exit of stores within the ring.

[14]Focusing on competition in small rural markets, Grieco (2011) has found a similar result that the competition effect between a grocery store and a distant supercenter outside its immediate zip-code but within 25 miles is much smaller than the competition effect between two small grocery stores in the same zip-code.

growth close to its entry site. Within two miles of its location, the results indicate that Wal-Mart causes a 5-7 percent decline in employment in the first four years following entry and a 4 percent decline over the next two years. Similar results hold for the two alternative impact measures (see online appendix). Traditional retailers appear to accommodate Wal-Mart's entry by contracting to reduce operating costs. Interestingly, there is little evidence of an anticipatory effect - with the exception of year -3 (likely spurious), the coefficients corresponding to the four years preceding Wal-Mart's actual entry are both economically and statistically insignificant.

Robustness of the Local Geographic Footprint

To assess the robustness of Wal-Mart's deep but localized impact, we examined a variety of alternative regression specifications, two of which are discussed here. First, we looked at whether the impact was *even more localized* than the two mile footprint. To do so, we shrank the relevant distance increment to a single mile, focusing on a finer set of bands, corresponding to $r \in \{1, 2, 3, 4, 5\}$. Note that this moves the reference group to be 4-5 miles from the Wal-Mart entry site, a defensible choice given the results from the two-mile specification reported above. Table 7 presents the results of this exercise. As above, there is no measurable effect outside of two miles. Within the two-mile impact zone, the effect is somewhat higher in magnitude and more consistently significant within the first mile, but there are clearly measurable effects in the second mile, suggesting that the impact tapers off (pretty sharply) with distance, but does extend beyond a single mile.

Next, we examined whether the relevant geographic footprint differs across urban and rural markets. Arguably, consumers might be willing to travel farther in less dense or congested places, with the impact zones adjusting accordingly. Surprisingly, we find little evidence that this is so. In the analysis presented in Table 8, we allow the magnitude of Wal-Mart's impact to vary based on whether the entry site was located within a designated MSA or not. In both types of areas, there is no measurable impact outside of the tight two mile radius (beyond this inner ring, the table shows only the 2-4 mile coefficients, as the remaining parameter estimates were all insignificant). Within the measurable impact radius, the results for rural and urban areas are strikingly similar. The timing of the effects coincides perfectly, with the more rural (non-MSA) markets showing a slightly deeper effect, but not a wider one.

4.2. The Mechanism of Impact

Having established that Wal-Mart's impact is contained to a two mile radius, we now focus on this area alone to further unpack the components of the competitive reaction. In particular, we use the decomposition proposed above in equation (1) to distinguish reactions along the intensive and extensive margins. Focusing on the two mile zone, Table 9 breaks the aggregate employment effect (Column 1 here, which is the same as Column 1 of Table 6) into its four distinct components: decreased job creation from continuing firms, decreased job creation due to fewer entering firms, increased job destruction due to continuing firms, and increased job destruction from exits. This allows us to identify the types of firms that Wal-Mart affects and the mechanism by which they react. We find that the biggest component of the realized decreases is due to contraction by continuing firms. This reaction along

the intensive margin accounts for about half of the overall effect. Another quarter of the effect comes from decreased job creation at continuing firms, while the remaining quarter is due to exit. Thus, roughly three quarters of the overall impact falls on the intensive margin. Somewhat surprisingly, new entry is essentially unaffected, suggesting that Wal-Mart does not depress entrepreneurial activity by new entrants, a frequent concern in the popular press. Once again, the online appendix presents complementary results for the two alternative measures (sales and size), which mirror the employment findings closely.

The fact that three-quarters of the effect is due to exit or contraction by declining firms suggests that Wal-Mart mainly affects firms in decline, hastening their exit or forcing them to contract.[15] However, within these firms, the impact is primarily on the intensive margin. This suggests that firms are able to accommodate Wal-Mart's entry by reducing employment and store size (product selection), perhaps shifting "up-market" to exploit an element of vertical differentiation (Matsa, 2011). This stands in sharp contrast to Wal-Mart's earlier experience in pure discounting, where the impact fell mainly on the extensive margin and largely on the smaller chains and single-store outlets. At that time, the modal response was simply to exit.

The sharp contrast to Wal-Mart's earlier experience in discounting invites a closer look at the specific types of firms that are in play here. There are many different types of grocery stores, from single-outlet mom-and-pops to regional and national chains like Kroger and Safeway. While one might expect Wal-Mart's technological advantage to be greatest relative to small firms, it is clearly less horizontally differentiated from the larger firms. Which store type is more adversely affected by Wal-Mart's expansion is an empirical question. In order to investigate how Wal-Mart's impact differs by store type, we split the sample into firms with less than 25 stores (small firms) and chains with more than 25 stores (large firms). Within the small firm class, almost half the stores are single-unit operations. As can be seen from Table 5, small firms tend to operate much smaller stores in addition to operating fewer outlets. The 'large chain' subsample, on the other hand, is dominated by the vertically integrated supermarket chains listed in Table 2 and regional supermarket chains that also operate sophisticated, vertically integrated distribution networks. We repeat the analysis using these two subsamples. In the interest of brevity, we focus on only the composite effect (net growth).

Table 10 shows the impact of Wal-Mart on net employment growth within two miles of the entry sites (once again, there was no measurable impact outside of the two mile radius). The earlier (pooled) results are shown in Column 1, with the two (firm type) subsamples presented in columns 2 and 3. Surprisingly, the measurable impact falls entirely on the larger chains - small chains and mom-and-pops show no significant reaction to Wal-Mart's entry. Within the larger chains, the decomposition (not shown here, but available upon request) follows

[15] While we cannot tell if the increase in contraction among continuing firms is due to an increase in the proportion of declining firms, or larger average declines among declining firms, the fact that the we do not see a decline in the growth from growing firms suggests that the share effect is not likely to be driving the result.

those of Table 9. For the small chains and single operator sample, there is no measurable impact across the board.[16] The fact that small firms are better able to withstand Wal-Mart's entry despite technological disadvantages relative to vertically integrated firms suggests that horizontal differentiation is an important feature of grocery retailing. Wal-Mart is most similar to a large chain retailer and appears to compete mostly with that type of store. Stores that have developed strategies to differentiate themselves from chain supermarkets are also well differentiated from Wal-Mart supercenters. This could be because the target demographic of the smaller stores, namely less mobile consumer types, is less likely to switch to a Wal-Mart than a chain grocery customer.

The impact of Wal-Mart on low-income communities is an area of particular concern for public policy-makers. Several activists have suggested that Wal-Mart entry is likely to adversely affect local businesses in low income communities which are vital to the local economy.[17] While a full assessment of Wal-Mart's community impact is beyond the scope of this paper, we can use our methodology to investigate Wal-Mart's impact on grocery stores in low-income communities by allowing $\gamma_{i,t}$ to vary based on whether or not the given Wal-Mart is entering a low-income area.[18] The results of this analysis are presented in Table 11. Again, we find that Wal-Mart's measurable impact is confined to be within two miles of its entry location so we focus on these coefficients alone. Wal-Mart's impact on low-income communities does appear to be larger than for higher income communities, although we cannot statistically reject the hypothesis of a purely homogeneous impact for any of these specifications. In any case, even in low income communities, Wal-Mart's impact falls primarily on large chain stores, and not on the small chains and mom-and-pops who are more likely to be locally owned. The effect on large chain stores in low income communities is substantial: they experience a decline in their employment growth rate of roughly 10 percentage points for the first four years following Wal-Mart entry, nearly twice as high as that of higher income communitites. This is particularly noteworthy given that large chains already comprise a smaller proportion of employment in low income communities. The intensity of Wal-Mart's impact in low income communities, coupled with the negligible impact on small stores, suggests that these large chain stores are even less well differentiated from Wal-Mart in low income communities, while small stores remain well insulated from Wal-Mart. We expand on these themes in the following subsection.

4.3. An Endogenous Fixed Cost Model of Retailing

Retail competition is characterized by a complex interplay of scale economies, spatial competition, and both horizontal and vertical product differentiation. Ellickson (2006) provides a formal model of retail oligopoly, based on John Sutton's (1991) endogenous fixed cost

[16] Again, the employment and sales floor size estimates closely track net sales, and are omitted for brevity.

[17] See, for example, `http://makingchangeatwalmart.org/`, accessed August 15, 2012.

[18] We caution again that these results represent the average treatment effect on the treated. Since the majority of low-income areas where Wal-Mart has entered are low density, they should not be extrapolated to predict the impact of Wal-Mart in high density areas such as inner city Washington, DC; Chicago, IL or Los Angeles, CA where proposed Wal-Mart entry is a subject of intense debate.

framework, in which large, regional and sometimes national chains make firm-level investments in distribution technology that allow them to stock an ever increasing array of branded goods at low prices. Focusing on the grocery industry, Ellickson shows that as market size expands, firms increase the intensity of this investment, leading roughly the same number of dominant chains to serve both small markets and large. This naturally oligopolistic structure is a strong empirical regularity that extends from the local neighborhood up to the regional distribution area.

Key to the current analysis, because the number of players remains small in equilibrium, an integer constraint binds and firms can continue to earn significant economic profits (even in a setting with free entry). This feature can help explain why Wal-Mart's impact appears to fall mostly on the intensive margin – the incumbent firms were not forced up against a zero profit condition. Moreover, the fact that Wal-Mart had already sunk many of these distribution related expenses in its parallel dry goods business is also germane, as it explains why the market was able to absorb so many additional outlets (i.e. the realized growth was primarily market expansion, rather than business stealing). In particular, although the exit rate increases by 1-2 percent each year following Wal-Mart's entry, the number of shopping *outlets* (other than Wal-Mart) only declines by about 0.15 in the innermost ring. Coupled with the fact that Wal-Mart is also *adding* an outlet to each of these locations, the equilibrium number of grocery outlets actually *expands* with Wal-Mart's entry. In this sense, Wal-Mart's impact appears unambiguously positive from the consumer's perspective since it demonstrably increases the choice set and presumably raises the intensity of price competition.

Note that product differentiation can enter the model in two ways. First, the fact that consumers must travel (repeatedly) to a physical store requires firms to balance the cost of driving distance against the scale economies associated with larger outlet sizes. For durable goods, consumers may be willing to tolerate a longer commute time given the relative infrequency of their store visits. However, the highly perishable nature of grocery products puts a sharp constraint on consumer's willingness to travel. It appears that Wal-Mart has not relaxed this constraint. Second, firms can differentiate themselves in product space, either horizontally or vertically, and focus on niche consumer types.

In Ellickson's (2006) framework, the dominant chains function by aggregating several consumer types together, offering a variety of products wide enough to serve a large fraction of the market (this is the reason for building large stores and investing in advanced distribution technology). As a consequence, some consumers will be relatively under-served, creating an opportunity for a second tier of vertically differentiated firms that do not engage in the endogenous investment game.[19] In the grocery industry, consumers with high travel costs, perhaps due to the lack of an automobile, poor storage facilities, or simply personal

[19]This extension is formalized in Ellickson (2006), building on the framework of Sutton (1998).

preferences,[20] are hardest to serve from a centralized location. This creates a niche that is occupied by the small chains and sole proprietorships who use location to make themselves attractive to travel averse consumers. Wal-Mart's entrance with even larger stores in a more centralized format is not appealing to consumers in this niche market, so there is little impact of Wal-Mart on firms in this segment.

A similar story may explain why Wal-Mart's impact on large chains appears to be more severe in low income communities. These communities are likely to have a large proportion of price-sensitive consumers, even amongst the sub-population that is relatively mobile. Wal-Mart's focus on low prices and limited variety is particularly appealing to these customers. In contrast, in higher income areas, consumers are more likely to be less price-sensitive and more interested in quality, variety, and other amenities that are a poor fit for Wal-Mart's business model. As a result, a smaller proportion of consumers are likely to switch from chain groceries to Wal-Mart outside of low income communities. Moreover, higher income areas offer large grocers a better opportunity to differentiate themselves from Wal-Mart on the basis of variety and ammenities.

4.4. Is Wal-Mart Really Different?

To further explore the implications of this framework, we repeated our baseline analysis for two additional grocery firms. The first was Kroger, the conventional supermarket chain most similar to Wal-Mart in terms of chain size and national presence. The second firm we considered was Save-A-Lot, a collection of licensee and corporate owned stores with an express focus on "extreme value" and price-conscious consumers. We expect Kroger to appear most like Wal-Mart, but Save-A-Lot to be quite distinct. The results are presented in Table 12. The first column simply repeats the baseline net growth results for Wal-Mart, while the second and third columns contain the parameter estimates for Kroger and Save-A-Lot. As before, there were no measurable effects outside the two mile radius, so these coefficients are omitted for brevity.

Focusing on Column 2, we see that Kroger has a similar initial impact to Wal-Mart, but its effect is felt earlier (prior to its entry) and dies out faster. The overall magnitudes are similar, but most are statistically insignificant. The tendency of rival firms to react in anticipation of Kroger's entry might reflect the fact that these openings are announced far in advance, since, unlike with Wal-Mart, they are exclusively greenfield entries. Moreover, Kroger tends to enter markets that are much denser in economic activity than Wal-Mart, so the incumbent stores in these markets may be more easily re-purposed to another use. However, we should caution the reader that because the treatment effects that we are estimating here are for the "treatment on the treated", it is somewhat complicated to compare results across "experiments" since the relevant treatment groups are quite different. Kroger tends to enter more urbanized markets than Wal-Mart and is far less focused on the south. They also did not benefit from an existing set of discount stores that they could easily convert to

[20] In the same vein, it is also possible that a single consumer type may prefer different types of stores for different needs. For example, a shopper may travel to a large store for a weekly grocery trip while utilizing a closer store to pick up single items.

supercenters. Therefore, they are likely forced to target new opportunities more intensely than the more built-out areas.

Turning our attention to Column 3, Save-A-Lot has no measurable impact at all. We believe that this reflects their focus on a distinct niche of consumers who are not served by the mainstream grocers, further illustrating the importance of horizontal differentiation. Save-A-Lot's core business model involves targeting low-income consumers, a distinct and independent submarket from that of the major national chains. Once again, the relevant treatment group is quite different, but it does suggest a pattern quite distinct from those of Wal-Mart and Kroger.

Finally, returning to the contrast between Wal-Mart and Kroger, we further examined the potential advantage Wal-Mart enjoyed from its existing base of pure discount stores. Note that roughly two-thirds of the Wal-Mart openings were "conversions" from existing conventional discount stores (i.e. pre-existing Wal-Marts) and the remaining openings were greenfield supercenters. Since we observe the type of store (conversion or *de novo* build), we once again allow for heterogeneous impact of Wal-Mart, this time by entry type, rather than location, and repeat the baseline analysis. The results are presented in Table 13, with the results from our original homogeneous effects specification in Column 1 and the heterogeneous effects specfication in Columns 2 and 3. Note that the results for the converted stores are both larger in magnitude and more consistently significant, while the greenfield stores mirror the results we found for Kroger (although their is still no anticipatory impact for Wal-Mart). These results seem consistent with the notion that Wal-Mart targeted quite different markets for its greenfield entries than its conversion. The converted stores were already zoned commercial, and in many cases the structure already built, so Wal-Mart would not have to incur the sunk costs associated with a pure de novo entry. Therefore, they were likely able to "enter" markets that were ex ante more competitive. Moreover, they likely also benefitted from an installed base of existing discount store customers who were easy to attract. For their greenfield sites, they were probably forced to look for the same types of new opportunities as Kroger, where the existing set of firms would be more sparse and operating with higher margins.

5. Conclusion

Since the early 1990s, Wal-Mart has become a major force in the grocery industry. While the extent to which Wal-Mart affects other grocers is of practical importance for merger analysis, it can also be used to inform researchers of the importance of differentiation in blunting the impact of an efficient firm seeking to exploit density economies in a retail environment. This paper exploits spatial panel data on grocery store sales, size and employment to measure Wal-Mart's impact on the surrounding grocery stores using a difference-in-difference approach. The results indicate that several sources of differentiation serve to insulate grocery stores from competition with Wal-Mart. Most importantly, Wal-Mart's entry does not negatively affect revenue or employment at grocery stores more than two miles away from the Wal-Mart site. This seems to indicate that Wal-Mart's strategy of exploiting density economies by convincing consumers to travel farther for goods has not translated from dry

goods to groceries. Within two miles, we find evidence of significant heterogeneity in the effect of Wal-Mart. While Wal-Mart appears to intensify declines in sales due to contraction and exit, it has little effect on new entry. Moreover, its effect falls mostly on large chains, which target the same consumer types as Wal-Mart supercenters. In contrast to the experience of discount stores, differentiation from Wal-Mart, either in location or in store characteristics, appears to soften competition in the grocery industry.

The contrast of Wal-Mart's experience in the discount industry with that in groceries highlights important differences in the nature of density economies across the two markets. First, the strategy of creating shopping density by aggregating consumers over large distances may simply be less effective with perishable, frequently purchased goods. The nature of the product itself may limit the returns to scale in both distribution and retail store size. Although supermarkets themselves have been scaling up for many years, it is likely that this process has reached a natural limit. These reduced scale economies make it difficult for Wal-Mart to offer low enough prices to induce consumers to travel. Second, it could also be the case that, due to more frequent store visits, consumer travel costs are higher in the grocery sector. Even if there are similar scale economies between the two industries, consumers who are willing to travel 20 miles to buy a television may be unwilling to make the same trip to repeatedly purchase groceries. Third, heterogeneity in consumer tastes make it more difficult to leverage density economies. The original Wal-Mart business model was about mass standardization. This appears to be less salient for food products. In particular, if consumers preferences are more discerning for grocery products than dry goods, it may be difficult to gather a sufficient mass of grocery shoppers under a single roof to generate the requisite scale. While our results on the differing impact of Wal-Mart on large and small firms provides some evidence for heterogeneity, future work is needed to fully understand the mechanism by which density economies impact market structure.

Finally, it is important to keep in mind that, even though we do not find that Wal-Mart has reshaped the economic geography of grocery retailing as it did for dry goods, this does not mean that Wal-Mart's entry into groceries was a mistake. There are reasons apart from density motives that could make grocery retailing profitable for Wal-Mart. For example, groceries could serve to bring in more customers or accelerate trip frequency for regular customers, increasing the chance that they purchase high-margin offerings. Second, even though Wal-Mart may not draw customers from far afield, it may still be profitable when operating grocery outlets with a smaller catchment area. That Wal-Mart has begun opening smaller stores, which specialize in groceries ("Neighborhood Markets"), suggests that this may be the case.[21] Wal-Mart's interest in smaller grocery stores is also an indication that the company which built itself on a density strategy believes smaller grocery stores remain profitable, despite the daunting scale of supercenters.

[21] *Supermarket News*, September 20, 2010, `http://www.supermarketnews.com/retail_financial/wal-marts-president-returns-edlp-0920/index.html`

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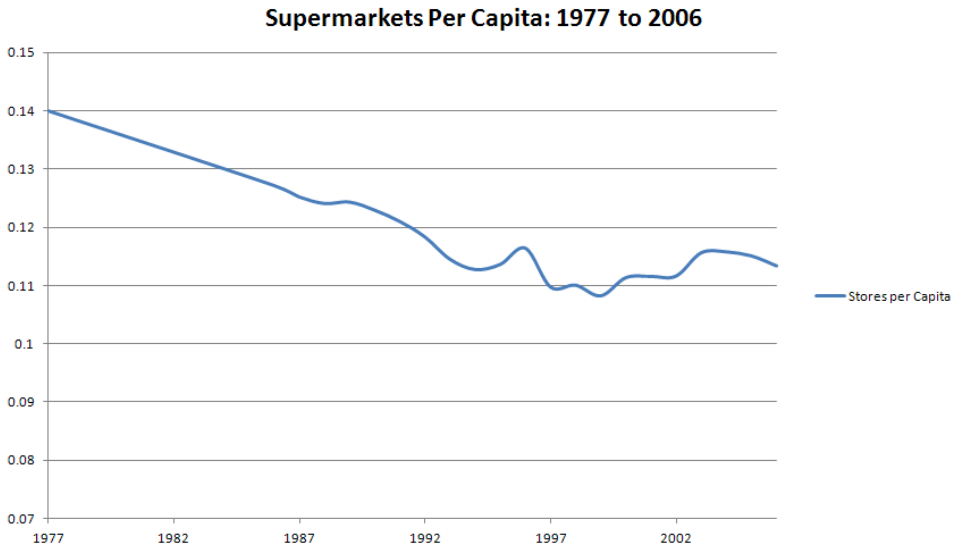

Figure 1: Supermarket Stores Per Capita: 1977-2006 (Progressive Grocer)

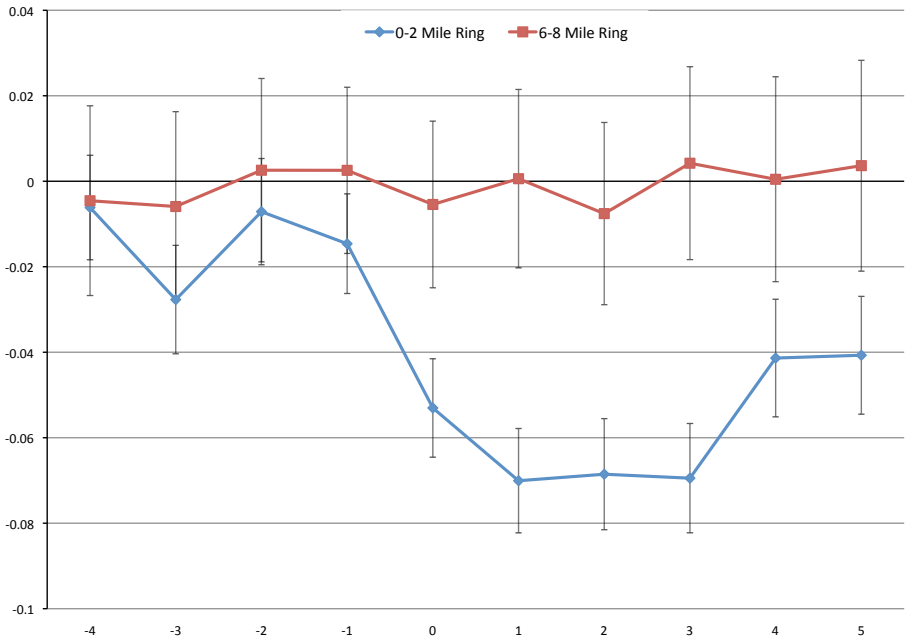

Figure 2: Effect of Wal-Mart Entry On Net Employment Growth Rate

Table 1: National Statistics on Grocery Industry, 1994-2006.

Year	Stores	Wal-Marts[a]	Closings	Openings	Stores per capita	Avg Size (000 sqft)	Avg Sales (million $)	Avg FTE	% Chain[b]
1994	29,827	97	2,201		1.146	26.0	9.9	56.2	0.774
1995	30,287	237	1,471	2,955	1.152	27.7	10.4	59.2	0.723
1996	31,389	340	1,335	2,714	1.183	26.2	10.6	60.7	0.718
1997	29,948	410	992	931	1.118	27.5	11.4	64.0	0.744
1998	30,368	487	1,498	1,321	1.124	27.9	11.5	65.5	0.745
1999	30,226	650	1,133	1,576	1.108	28.6	12.0	67.3	0.762
2000	31,446	833	1,054	1,777	1.114	28.5	12.2	67.3	0.747
2001	31,856	1,046	1,000	1,464	1.117	28.0	12.5	68.8	0.745
2002	32,212	1,226	1,079	1,405	1.119	28.9	12.8	70.0	0.746
2003	33,555	1,449	1,238	1,958	1.154	30.3	13.2	67.2	0.744
2004	33,909	1,700	1,167	1,383	1.155	30.3	13.8	68.5	0.745
2005	34,012	1,960	1,713	1,119	1.147	30.3	14.5	70.6	0.749
2006	33,823	2,225		1,274	1.130	30.0	16.0	73.2	0.75

[a] Includes all Wal-Mart formats (e.g., Supermarkets and Neighborhood Markets).
[b] Chain stores are those with at least two outlets.

Table 2: Top ten firms by number of outlets and outlet concentration ratio for the top ten firms, 1994 and 2006.

	1994		2006	
Rank	Name	# Stores	Name	# Stores
1	Kroger	1,295	Kroger	2,474
2	Winn-Dixie	1,138	Wal-Mart	2,225
3	Delhaize (Food Lion)	1,016	Supervalu	1,714
4	Amer Stores	901	Delhaize (Food Lion)	1,551
5	A&P	882	Safeway	1,535
6	Safeway	840	Publix	884
7	Albertsons	691	Ahold (Stop & Shop)	815
8	Publix	450	Aldi	803
9	Vons	344	Albertsons	544
10	Penn Traffic	338	Winn-Dixie	527
CR10		0.265		0.386

Table 3: Demographic statistics for area surrounding store locations.

	N	Density	Income	Poverty Rate
All Stores				
Wal-Mart[a]	2155	839.3	19020	13.2
		(931.9)	(4463)	(9.3)
Kroger	3125	2276.5	22063	12.1
		(2514.8)	(6321)	(7.6)
Save-A-Lot	1466	1572.3	17893	15.7
		(2703.2)	(3163)	(7.5)
Small Firms[b]	23667	3367.1	20080	13.8
		(7320.2)	(6215)	(9.2)
Large Chains	23882	2329.9	22083	12.0
		(3826.4)	(6498)	(8.5)
Stores in MSAs				
Wal-Mart[a]	1302	1175.4	20546	11.5
		(1031.0)	(4771)	(8.6)
Kroger	2581	2682.1	22969	11.6
		(2585.4)	(6398)	(7.0)
Save-A-Lot	895	2427.6	19055	14.5
		(3171.9)	(3105)	(6.8)
Small Firms[b]	15921	4872.7	21716	13.1
		(8512.4)	(6577)	(9.1)
Large Firms	19368	2762.4	23165	11.2
		(4100.7)	(6541)	(7.9)
Stores outside MSAs				
Wal-Mart[a]	853	326.3	16692	15.9
		(369.2)	(2570)	(9.7)
Kroger	544	351.7	17763	14.6
		(364.3)	(3602)	(9.7)
Save-A-Lot	571	231.6	16072	17.5
		(227.6)	(2270)	(8.3)
Small Firms[b]	7746	272.6	16716	15.3
		(744.6)	(3506)	(9.1)
Large Firms	4514	474.1	17438	15.4
		(1032.3)	(3637)	(9.8)

Standard deviations in parenthesis. N is number of stores ever open, 1994-2006. Density, income, and poverty rate are weighted average of 2000 census tracts whose centroids are within five miles of store location.

[a] Supercenter locations only.

[b] Includes all firms with fewer than 25 stores, including mom-and-pops.

Table 4: Ring Level Average Number of Stores and Employees surrounding Wal-Mart Locations.

	0-2 Miles	2-4 Miles	4-6 Miles	6-8 Miles	8-10 Miles
Stores	2.857	3.486	3.905	4.473	5.05
	(1.856)	(4.290)	(5.865)	(6.920)	(7.796)
Employees (thousands)	200.6	250.1	295.3	330.2	368.7
	(181.2)	(365.1)	(503.1)	(576.8)	(650.8)
Area of Ring (square miles)	12.6	37.7	62.8	88.0	113.1

Note: Standard deviations in parenthesis. Pooled across all years.

Table 5: Ring Level Average Number of Stores and Employees, by Store Type and Area Income

	0-2 Miles			2-4 Miles		
	All Stores	Small Firms	Large Firms	All Stores	Small Firms	Large Firms
Stores						
All Entry Sites	2.86	0.77	2.09	3.49	0.96	2.52
	(1.86)	(1.02)	(1.66)	(4.29)	(1.55)	(3.53)
Low Income	2.57	0.92	1.65	2.09	0.81	1.28
	(1.74)	(1.12)	(1.41)	(3.29)	(1.44)	(2.39)
Not Low Income	3.06	0.66	2.40	4.47	1.07	3.40
	(1.91)	(0.93)	(1.75)	(4.63)	(1.61)	(3.91)
Employees (thousands)						
All Entry Sites	200.6	32.8	167.8	250.1	41.1	208.9
	(181.2)	(56.0)	(176.0)	(365.1)	(86.7)	(332.1)
Low Income	141.3	34.8	106.5	124.5	33.0	91.4
	(130.0)	(54.9)	(117.9)	(241.4)	(79.8)	(200.0)
Not Low Income	242.4	31.4	211.0	338.7	46.9	291.9
	(199.6)	(56.7)	(196.3)	(409.0)	(90.8)	(378.5)

Note: Standard deviations in parenthesis. Pooled across all years. An entry location is defined as low income if the population weighted average per-capita income of census tracts centered within 5 miles of Wal-Mart's location is less than double the individual poverty line in 2000.

Table 6: Impact of Wal-Mart Entry On Net Employment Growth Rate

Years to Wal-Mart Entry	0-2 mile	2-4 miles	4-6 miles	6-8 miles
-4	-0.006	0.025*	0.006	-0.005
	(0.012)	(0.012)	(0.011)	(0.011)
-3	-0.028*	0.020	0.014	-0.006
	(0.013)	(0.011)	(0.011)	(0.011)
-2	-0.007	0.033*	0.011	0.003
	(0.012)	(0.011)	(0.011)	(0.011)
-1	-0.015	0.017	0.011	0.003
	(0.012)	(0.011)	(0.010)	(0.010)
0	-0.053*	0.011	-0.000	-0.005
	(0.011)	(0.011)	(0.010)	(0.010)
1	-0.070*	0.006	-0.004	0.001
	(0.012)	(0.011)	(0.011)	(0.011)
2	-0.069*	0.004	0.014	-0.008
	(0.013)	(0.011)	(0.011)	(0.011)
3	-0.069*	0.014	0.005	0.004
	(0.013)	(0.012)	(0.011)	(0.012)
4	-0.041*	0.013	0.003	0.000
	(0.014)	(0.013)	(0.013)	(0.012)
5	-0.041*	0.022	0.010	0.004
	(0.014)	(0.014)	(0.012)	(0.013)

Note: Standard errors in parenthesis; * signifies significance at .05 level.

Table 7: Impact of Wal-Mart Entry Net Employment Growth Rate: Tight Rings

Years to Wal-Mart Entry	0-1 mile	1-2 miles	2-3 miles	3-4 miles
-4	0.006	-0.006	0.010	0.018
	(0.013)	(0.013)	(0.012)	(0.012)
-3	-0.013	-0.035*	0.009	-0.001
	(0.013)	(0.014)	(0.012)	(0.012)
-2	0.011	-0.001	0.021	0.023*
	(0.012)	(0.013)	(0.012)	(0.011)
-1	-0.012	-0.004	0.015	0.006
	(0.012)	(0.013)	(0.011)	(0.011)
0	-0.025*	-0.020	0.008	0.009
	(0.012)	(0.012)	(0.011)	(0.011)
1	-0.044*	-0.027*	0.008	0.015
	(0.013)	(0.013)	(0.012)	(0.011)
2	-0.057*	-0.031*	-0.015	0.003
	(0.013)	(0.013)	(0.012)	(0.012)
3	-0.044*	-0.043*	0.005	0.015
	(0.013)	(0.013)	(0.012)	(0.012)
4	-0.035*	-0.023	0.016	0.004
	(0.015)	(0.015)	(0.015)	(0.013)
5	-0.036*	-0.021	0.018	0.006
	(0.015)	(0.014)	(0.013)	(0.013)

Note: Standard errors in parenthesis; * signifies significance at .05 level.

Table 8: Impact of Wal-Mart Entry on Net Employment growth rates, heterogeneity by MSA

	0 - 2 Miles		2 - 4 Miles	
Years to Wal-Mart Entry	in MSA	outside MSA	in MSA	outside MSA
-4	-0.008	-0.003	0.018	0.037
	(0.017)	(0.017)	(0.016)	(0.017)
-3	-0.031	-0.022	0.015	0.029
	(0.018)	(0.016)	(0.016)	(0.014)
-2	-0.007	-0.007	0.036*	0.028
	(0.017)	(0.017)	(0.015)	(0.015)
-1	-0.023	-0.000	0.019	0.014
	(0.016)	(0.016)	(0.014)	(0.016)
0	-0.053*	-0.052*	0.003	0.025
	(0.016)	(0.016)	(0.015)	(0.016)
1	-0.049*	-0.102*	0.015	-0.007
	(0.016)	(0.018)	(0.015)	(0.017)
2	-0.062*	-0.078*	-0.001	0.014
	(0.017)	(0.020)	(0.015)	(0.017)
3	-0.068*	-0.071*	0.013	0.017
	(0.017)	(0.018)	(0.016)	(0.018)
4	-0.038	-0.046	0.005	0.026
	(0.018)	(0.021)	(0.016)	(0.022)
5	-0.040	-0.040	0.036	0.003
	(0.019)	(0.018)	(0.019)	(0.019)

Note: Standard errors in parenthesis; * signifies significance at .05 level.

Table 9: Impact of Wal-Mart entry on employment growth for grocery retailers within 2 miles of Wal-Mart decomposed into components.

Years to Wal-Mart Entry	Overall	Creation Continuting	Creation Entry	Destruction Continuing	Destruction Exit
-4	-0.006	-0.004	-0.001	0.003	-0.001
	(0.012)	(0.006)	(0.005)	(0.005)	(0.003)
-3	-0.028*	-0.001	-0.003	0.017*	0.007*
	(0.013)	(0.006)	(0.005)	(0.005)	(0.003)
-2	-0.007	-0.002	0.001	0.006	-0.000
	(0.012)	(0.006)	(0.005)	(0.005)	(0.003)
-1	-0.015	-0.003	-0.003	0.005	0.004
	(0.012)	(0.006)	(0.004)	(0.005)	(0.003)
0	-0.053*	-0.012*	-0.008	0.024*	0.009*
	(0.011)	(0.005)	(0.004)	(0.005)	(0.003)
1	-0.070*	-0.013*	-0.008	0.030*	0.019*
	(0.012)	(0.006)	(0.004)	(0.005)	(0.004)
2	-0.069*	-0.015*	-0.008	0.028*	0.018*
	(0.013)	(0.006)	(0.005)	(0.005)	(0.004)
3	-0.069*	-0.019*	-0.011*	0.026*	0.013*
	(0.013)	(0.006)	(0.004)	(0.006)	(0.004)
4	-0.041*	-0.009	-0.005	0.019*	0.008*
	(0.014)	(0.006)	(0.005)	(0.006)	(0.004)
5	-0.041*	-0.016*	-0.007	0.013*	0.005
	(0.014)	(0.006)	(0.005)	(0.006)	(0.004)

Note: Standard errors in parenthesis; * signifies significance at .05 level.

Table 10: Impact of Wal-Mart entry on net employment growth by store type. Dependent variable is net employment growth among specified sample of stores, small firms have 25 stores or fewer.

Years to Wal-Mart Entry	All Stores	Small Firms	Large Firms
-4	-0.006	0.003	-0.003
	(0.012)	(0.021)	(0.015)
-3	-0.028*	0.013	-0.040*
	(0.013)	(0.019)	(0.015)
-2	-0.007	0.030	-0.018
	(0.012)	(0.020)	(0.015)
-1	-0.015	0.011	-0.020
	(0.012)	(0.019)	(0.014)
0	-0.053*	-0.020	-0.048*
	(0.011)	(0.020)	(0.014)
1	-0.070*	-0.023	-0.071*
	(0.012)	(0.019)	(0.014)
2	-0.069*	-0.011	-0.062*
	(0.013)	(0.020)	(0.015)
3	-0.069*	0.014	-0.087*
	(0.013)	(0.021)	(0.015)
4	-0.041*	0.008	-0.068*
	(0.014)	(0.022)	(0.015)
5	-0.041*	-0.027	-0.029
	(0.014)	(0.022)	(0.015)

Note: Standard errors in parenthesis; * signifies significance at .05 level.

Table 11: Impact of Wal-Mart Entry on net employment growth rates, heterogeneity by local income and store type, area within 2 miles of Wal-Mart.

Years to	All Stores		Small Firms		Large Firms	
Wal-Mart Entry	Not Low Income	Low Income	Not Low Income	Low Income	Not Low Income	Low Income
-4	-0.001	-0.014	0.004	0.001	0.014	-0.029
	(0.017)	(0.018)	(0.029)	(0.030)	(0.020)	(0.021)
-3	-0.013	-0.049*	0.033	-0.016	-0.027	-0.058*
	(0.017)	(0.019)	(0.027)	(0.026)	(0.020)	(0.024)
-2	-0.008	-0.006	0.012	0.056*	-0.008	-0.032
	(0.017)	(0.018)	(0.028)	(0.027)	(0.020)	(0.022)
-1	0.002	-0.039*	0.004	0.020	0.005	-0.057*
	(0.016)	(0.017)	(0.026)	(0.026)	(0.018)	(0.020)
0	-0.039*	-0.073*	-0.010	-0.035	-0.033	-0.070*
	(0.015)	(0.017)	(0.027)	(0.028)	(0.018)	(0.021)
1	-0.050*	-0.099*	0.000	-0.056*	-0.047*	-0.104*
	(0.017)	(0.018)	(0.026)	(0.027)	(0.019)	(0.022)
2	-0.056*	-0.086*	-0.013	-0.007	-0.042*	-0.091*
	(0.017)	(0.020)	(0.027)	(0.028)	(0.019)	(0.023)
3	-0.060*	-0.083*	0.020	0.005	-0.070*	-0.111*
	(0.017)	(0.019)	(0.030)	(0.029)	(0.020)	(0.023)
4	-0.026	-0.063*	0.011	0.003	-0.058*	-0.084*
	(0.018)	(0.021)	(0.030)	(0.031)	(0.020)	(0.023)
5	-0.024	-0.063*	-0.029	-0.026	-0.008	-0.059*
	(0.019)	(0.020)	(0.030)	(0.030)	(0.021)	(0.023)

Note: Standard errors in parenthesis; * signifies significance at .05 level. An entry location is defined as low income if the population weighted average per-capita income of census tracts centered within 5 miles of Wal-Mart's location is less than 200 percent of the individual poverty line.

Table 12: Comparison of Impact from Wal-Mart to other Chains, 0-2 miles.

Years to Entry	Wal-Mart	Kroger	Save-A-Lot
-4	-0.006	-0.028	-0.005
	(0.012)	(0.026)	(0.018)
-3	-0.028*	-0.022	0.015
	(0.013)	(0.027)	(0.017)
-2	-0.007	-0.063*	-0.008
	(0.012)	(0.025)	(0.018)
-1	-0.015	-0.063*	0.004
	(0.012)	(0.026)	(0.017)
0	-0.053*	-0.021	-0.013
	(0.011)	(0.025)	(0.016)
1	-0.070*	-0.036	0.004
	(0.012)	(0.025)	(0.017)
2	-0.069*	-0.026	0.018
	(0.013)	(0.025)	(0.017)
3	-0.069*	-0.045	-0.006
	(0.013)	(0.026)	(0.017)
4	-0.041*	-0.034	0.004
	(0.014)	(0.026)	(0.017)
5	-0.041*	-0.001	-0.018
	(0.014)	(0.028)	(0.020)

Standard errors in parenthesis; * signifies significance at .05 level.

Table 13: Impact of Wal-Mart Entry on Net Employment growth rates, heterogeneity by entry method, effect in 0-2 mile range.

	Homogeneous	Heterogeneous Effects	
Years to Wal-Mart Entry	Effects	Greenfield	Conversion
-4	-0.006	0.019	-0.022
	(0.012)	(0.022)	(0.014)
-3	-0.028*	-0.003	-0.043*
	(0.013)	(0.021)	(0.016)
-2	-0.007	0.016	-0.021
	(0.012)	(0.022)	(0.015)
-1	-0.015	-0.005	-0.021
	(0.012)	(0.020)	(0.014)
0	-0.053*	-0.017	-0.073*
	(0.011)	(0.019)	(0.014)
1	-0.070*	-0.050*	-0.081*
	(0.012)	(0.022)	(0.015)
2	-0.069*	-0.032	-0.087*
	(0.013)	(0.023)	(0.016)
3	-0.069*	-0.049*	-0.080*
	(0.013)	(0.020)	(0.016)
4	-0.041*	-0.027	-0.050*
	(0.014)	(0.022)	(0.017)
5	-0.041*	-0.011	-0.055*
	(0.014)	(0.026)	(0.016)

Note: Standard errors in parenthesis; * signifies significance at .05 level.