The Effect of Entry by Wal-Mart Supercenters on Retail Grocery Concentration

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The U.S. retail grocery industry shifted from an industry dominated by small grocers serving local markets to one characterized by large retailers present in international markets. Average retail grocery concentration as measured by CR4 increased from 19.9 in 1997 to 31.0 in 2002 (U.S. Department of Commerce, Bureau of the Census, 2000; 2005). Wal-Mart's tremendous growth is the catalyst to this change, but little is known about Wal-Mart's effect on market concentration. This analysis evaluates the effects of *de novo* entry by Wal-Mart Supercenters on retail grocery concentration. The effect of Wal-Mart Supercenters on changes in retail grocery concentration is estimated using econometric modeling. The results show that existing Wal-Mart Supercenter operations and entry by Wal-Mart Supercenters significantly increase the rate of change in retail grocery concentration.

During the past two decades the U.S. retail grocery industry has seen a contraction of small "Mom and Pop" retailers, large chain retailers created via mergers and acquisitions, and the *de novo* entry of supercenters stores by Wal-Mart and Target (Kaufman 2002). The average retail grocery concentration, as measured by the sum of market share of the top four firms (CR4), increased by 56 percent in just five years, rising from 19.9 in 1997 to 31.0 in 2002 (U.S. Department of Commerce, Bureau of the Census 2000; 2005).[1] Grocery has rapidly shifted from an industry dominated by small grocers serving local markets to one characterized by large retailers present in international markets.

Wal-Mart is often at the heart of the media's reporting of the grocery industry's changes; due in part to its rapid growth and size (e.g., Smith 2004; Cleeland and Goldman 2003). In 1987 Wal-Mart did not sell a full line of groceries. By 2002, the company had surpassed Kroger Foods to become the largest grocery retailer in the United States. This rapid growth is expected to continue, with one prediction that Wal-Mart will control 35 percent of the U.S. retail grocery sales for many consumer products by 2010 (Clarke 2005).

This has triggered a wave of mergers, further increasing concentration (Cotterill 2001). The Schumpeterian economic tradition would suggest that "creative destruction" introduced by an entrant with new technology or processes (i.e., Wal-Mart's efficient supply-chain-management practices) drives economic progress. However, concerns have emerged that the largest grocers are using their low cost structure, along with advantages in marketing, store design, and shelf space allocations, to harm consumers. In fact, Wal-Mart's retail grocery sales have been shown to have "substantial impacts" on regional economies (Boarnet et al. 2005).

This paper evaluates the effects of *de novo* entry by Wal-Mart Supercenters on retail grocery concentration (CR4). Understanding Wal-Mart's influence on market concentration is important to support or discredit critics who charge that large grocers use their market position to reduce consumer access to groceries (Blanchard and Lyson 2002), increase retailer market power (Foer 1999), and discourage competition (Federal Trade Commission 2001). Such practices might be possible for firms with a strong influence on market concentration. In addition, an extensive literature shows a pattern linking retail grocery market concentration to increases in retail grocery prices.

Yu and Connor (2002) note that only the banking and airline industries have received more empirical price-concentration analysis than the retail grocery industry. Of the many grocery price-concentration studies (Marion et al. 1979; Cotterill 1986; Binkley and Connor 1998; Cotterill 1999), only two (Kaufman and Handy 1989; Newmark 1990) did not find a positive relationship between market concentration and price. Moreover, the findings in both of those studies have been refuted by Cotterill (1993) and Yu and Connor (2002).

Contrary to the findings of traditional retail

[1] NAICS code 4451 (Grocery stores) was used to calculate CR4. This does not include grocery sales from supercenter and warehouse stores.

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grocery concentration-price literature, Wal-Mart entry is associated with lower, not higher, retail grocery prices (Leibtag 2005). Higher mark-ups resulting from increased market concentration in the retail grocery industry are offset by discounts arising from greater efficiency (Dobson and Waterson 1997). Dobson and Waterson conclude that the effects from changes in market structure depend on the relationship between market power and scale economies. Aalto-Setala (2002) found "there is no need to constrain directly the growth of larger stores (in Finland) from an anti-trust perspective as long as there is sufficient competition." Thus while cost efficiencies from scale economies appear to temper at least part of the mark-up resulting from increased market concentration, competition still remains important.

Literature

Location and market-concentration theories are studied in field of industrial economics. These two related theories will be used to specify a model to determine Wal-Mart's effects on retail grocery concentration. First, an empirical study evaluating Wal-Mart's effects on retail grocery concentration will be reviewed.

Empirical Retail Grocery Concentration Study

Franklin (2001) is the only study found in a literature search evaluating Wal-Mart's effects on retail grocery concentration. His work examined the largest 100 metropolitan statistical areas (MSAs) using Trade Dimension's *Market Scope* data. Based on descriptive statistics, Franklin concluded that "Wal-Mart Supercenter entry had little impact on food seller concentration in 19 major metropolitan areas between 1993 and 1998." Franklin estimated univariate and multivariate ordinary least squares models to determine whether Wal-Mart entry and CR4 are related to income, population, or time since Wal-Mart entered a MSA. He found a negative relationship between median household income and Wal-Mart's market share and a positive relationship between the time since entering an MSA and Wal-Mart's market share.

Franklin's analysis only evaluated the effects of Wal-Mart Supercenters on retail grocery concentration in large metropolitan areas. At the time of Franklin's study, only 188 of the 721 (26 percent) Wal-Mart Supercenters operated in the largest 100 metropolitan areas, suggesting that Wal-Mart's focus is not on metropolitan areas. In 2006 nearly 500 of the 1,980 Wal-Mart Supercenters were located in counties with a largest city of fewer than 20,000 people (Artz and Stone 2006).

While Wal-Mart Supercenters may not be penetrating metropolitan markets, the effect of Wal-Mart Supercenters on retail grocery concentration in lesser populated areas may be substantial. Several researchers have found that Wal-Mart significantly affects a host town or trade area (Singh, Hansen, and Blattberg 2004; Woo et al. 2001; Capps and Griffin 1998; Stone 1997). Two recent articles model the effects of supercenter and warehouse stores on retail grocery sales. First, Artz and Stone (2006) found that a Wal-Mart Supercenter in a non-metropolitan county captures 17 percent of the existing grocery market within two years. Second, entry by a supercenter into low-population-density counties increased growth in sales by over 49 percent but did not lead to a growth in sales in metropolitan counties (Martens, Florax, and Dooley 2005).

This paper refines the pioneering analysis by Franklin (2001) in three ways. First, given differences in population density, Franklin's data are expanded from the 100 MSAs focused on urban areas to contiguous grocery marketing areas (GMAs) containing both metropolitan and non-metropolitan areas. Second, the regression-model explanatory variables are based on location and market-concentration theories. Finally, the empirical model considers the existing operation of and new entry by Wal-Mart Supercenters along with the reaction by the chief competitors in terms of entry and exit. A discussion of the variables gleaned from location theory and previous concentration studies follows. These variables will be used to specify the change in retail market concentration model.

Theory and Independent Variables

In general, early concentration studies typically examined the determinants of concentration levels, while more recent studies considered the drivers of change in market concentration (Curry and George 1983). The goal of this study is not to explain why a market is concentrated, but to explain why market concentration is changing. Therefore, change in

concentration (ΔCR4) will be the dependent variable. In the retail grocery industry, ΔCR4 is positive for most GMAs, consistent with increasing concentration experienced in the grocery industry.

The independent variables were defined using both location and market-concentration theories. Location theory seeks to explain the geographical concentration of firms on the basis of competition and economic efficiency (Brulhart 1998; Sutton 1998). Similarly, market-concentration theory seeks to explain why markets become concentrated (Curry and George 1983). Table 1 lists variables important to location theory and market concentration theory (Brulhart 1998; Sutton 1998; Curry and George 1983; Hannan and Freeman 1977).

Research coming from these theories suggests the most important explanatory variable of change in market concentration is initial concentration. As industries become more concentrated a firm's ability to gain market share at the expense of others becomes more difficult (Connor, Rogers, and Bhagavan 1996). In this study the initial level of grocery-industry concentration, as measured by the sum of the top four firms' market shares (CR4), will be used to express market concentration. CR4 is expected to have a negative relationship with ΔCR4.

Market size and market growth are also common to location theory and market concentration (Table 1). These market variables are expected to have negative relationships with change in market concentration for three reasons. First, large markets may allow room for fringe firms to serve individual consumers with similar preferences. Second, in fast-growing markets incumbents may struggle to take advantage of growth opportunities, allowing new firms to gain market share. Third, growth may attract new firms, further decreasing concentration.

For this study, initial population density and initial retail grocery sales are proxies for market size, while change in population density is a proxy for market growth. As discussed in the proceeding paragraph, higher population density and increasing population density are expected to decrease ΔCR4, so negative signs are expected. Higher levels of initial retail grocery sales also are expected to decrease future changes in concentration (i.e., negative sign), but at a decreasing rate. Therefore the log of initial grocery sales was used in this model.

From Table 1, a fourth set of variables is technology and economies of scale. Technology allows existing firms to be more productive, forcing out less-competitive firms and increasing market concentration. Similarly, economies of scale encourage firms to grow, also increasing market concentration. The retail grocery industry experiences the effects of technology and economies of scale as large grocers such as Wal-Mart Supercenters enter markets.

For this study, four variables are used to proxy economies of scale and technology. First is the percentage of retailers classified as independent. Groceries are sold by both independent retailers and retail chains. Over time, independent retailers have been exiting while large retail chains use technology and economies of size to capture additional market share. GMAs with a higher percentage of independent retailers are likely to have less technology and a smaller average size, so a positive relationship between initial percentage of independent stores and change in concentration is expected. Markets with a high percentage of independent retailers are likely the next battle grounds for market share between Wal-Mart and other large retail grocers.

The count of and changes in the number of Wal-

Table1. Key Independent Variables from Location and Concentration Theory.

Variable	Location theory	Concentration theory
Initial concentration	X	X
Initial market size	X	X
Industry (market) growth	X	X
Innovation / economies of scale	X	X
Trade costs / entry barriers	X	X
Resource endowments	X	

Mart Supercenters and stores operated by the top two competitors are the remaining variables used to describe the initial level of technology and economies of scale in local grocery markets. Positive signs are expected on these incumbent and entrant store variables because concentration is expected to increase as additional large stores compete for market share.

Finally, resource endowments, important in location literature, draw additional competitors into a market and increases competition, lowering concentration (Brulhart 1998). In the retail grocery industry, the number of local distribution centers is used as a proxy for proximity to resources. Stores in GMAs with more distribution centers are less likely to exit a market because the local market structure offers the stores more resources to remain competitive, resulting in a negative relationship between the count of distribution centers and change in concentration.

Specification and Data

Based upon the literature, the following model was specified:

$$(1)\quad \begin{aligned}\Delta CR4_{i,(t+1)-t} &= \beta_0 + \beta_1(CR4_{i,t}) + \beta_2(CP_{i,t}) + \\ &\beta_3(\Delta CP_{i,(t+1)-t}) + \beta_4(Year_t) + \beta_5(PInd) + \beta_6(DC_{i,t}) \\ &+ \beta_7(Pdn_{i,t}) + \beta_8(\Delta Pdn_{i,(t+1)-t}) + \beta_9(\ln Sales) + \\ &\beta_{10}(WM_{i,t}) + \beta_{11}(\Delta WM_{i,(t+1)-t}) + \varepsilon_{i,t},\end{aligned}$$

where $\Delta CR4_{i,(t+1)-t}$ is the change in four-firm concentration (CR4) in GMA i from year t to $t+1$; $CR4_{i,t}$ is the concentration level in GMA i in year t; $CP_{i,t}$ is the count of stores operated by the top two firms (not including Wal-Mart) in GMA i in year t; $\Delta CP_{i,,(t+1)-t}$ is the change in the count of stores operated by the top two firms (not including Wal-Mart) in GMA i, from year t to $t+1$; $Year_t$ is a dummy variable for each year t = 1999, 2000, 2001; $Pind_{i,t}$ is the percentage of total grocery stores classified as independent in GMA i in year t; $DC_{i,t}$ is the total number of grocery distribution centers in GMA i in year t; $Pdn_{i,t}$ is the initial population density in GMA i in year t; $\Delta Pdn_{i,,(t+1)-t}$ is the change in population density in GMA i from year t to $t+1$; $Log(Sales_{i,t})$ is the log of total grocery sales in GMA i in year t; $\Delta WM_{i,,(t+1)-t}$ is the change in number of Wal-Mart Supercenters in GMA i, from year t to $t+1$; and $WM_{i,t}$ is the count of Wal-Mart Supercenter stores in GMA i in year t.

As in Franklin (2001), data were obtained from the Trade Dimensions *Marketing Guidebook* and *Market Scope* (2000–2004). Instead of taking data for MSAs, here the spatial unit was defined as a grocery marketing area (GMA). A GMA is defined and monitored by Trade Dimensions on the basis of distribution center locations, transportation flows, and physical boundaries. As such, they can be viewed as 50 distinct geographical regions, with differing competitors. The geographical size of each of the 50 GMAs varies, but most are approximately the size of an average U.S. state. All contain metropolitan and non-metropolitan counties. While GMAs follow county boundaries, they do not follow state boundaries.

Unfortunately, GMA boundaries change over time because grocery retailing evolves, and Trade Dimensions adjusts their market boundary definitions accordingly. Of the 50 total GMAs, 17 underwent some type of boundary change between 1999 and 2003. In addition, the "Fargo GMA" data contained inconsistencies, so it was excluded from the data set. Therefore, only 32 of the 50 GMAs had usable data for the years 1999 through 2003 (Figure 1). Earlier data were not available because Trade Dimensions *Marketing Guidebook* did not publish GMA level market share data for all retailers before 1999. After annual changes were calculated, four years of observations remained for each of the 32 GMAs, or 128 observations. While discarding observations is always regrettable, the omission of the East and West Coast markets is not critical to this analysis because Wal-Mart only had a limited presence in these markets between 1999 and 2003.

It is important to note that Trade Dimensions states that they only use sales from grocery and grocery-related products when defining market share. Therefore, even though Wal-Mart sells a full line of general merchandise, the sales used to compute market share and market concentration are only those for products sold in a typical retail grocer store. Therefore, entry by a Wal-Mart Supercenter does not overstate typical retail sales.

Descriptive statistics are found in Table 2. The sample of 32 GMAs had a mean CR4 of 59.8, which is much higher than the 2002 national CR4 level of 31 for two reasons. First, the national CR4 is not an average, while our mean CR4 is an average of multiple GMAs. Our average CR4 captures the large

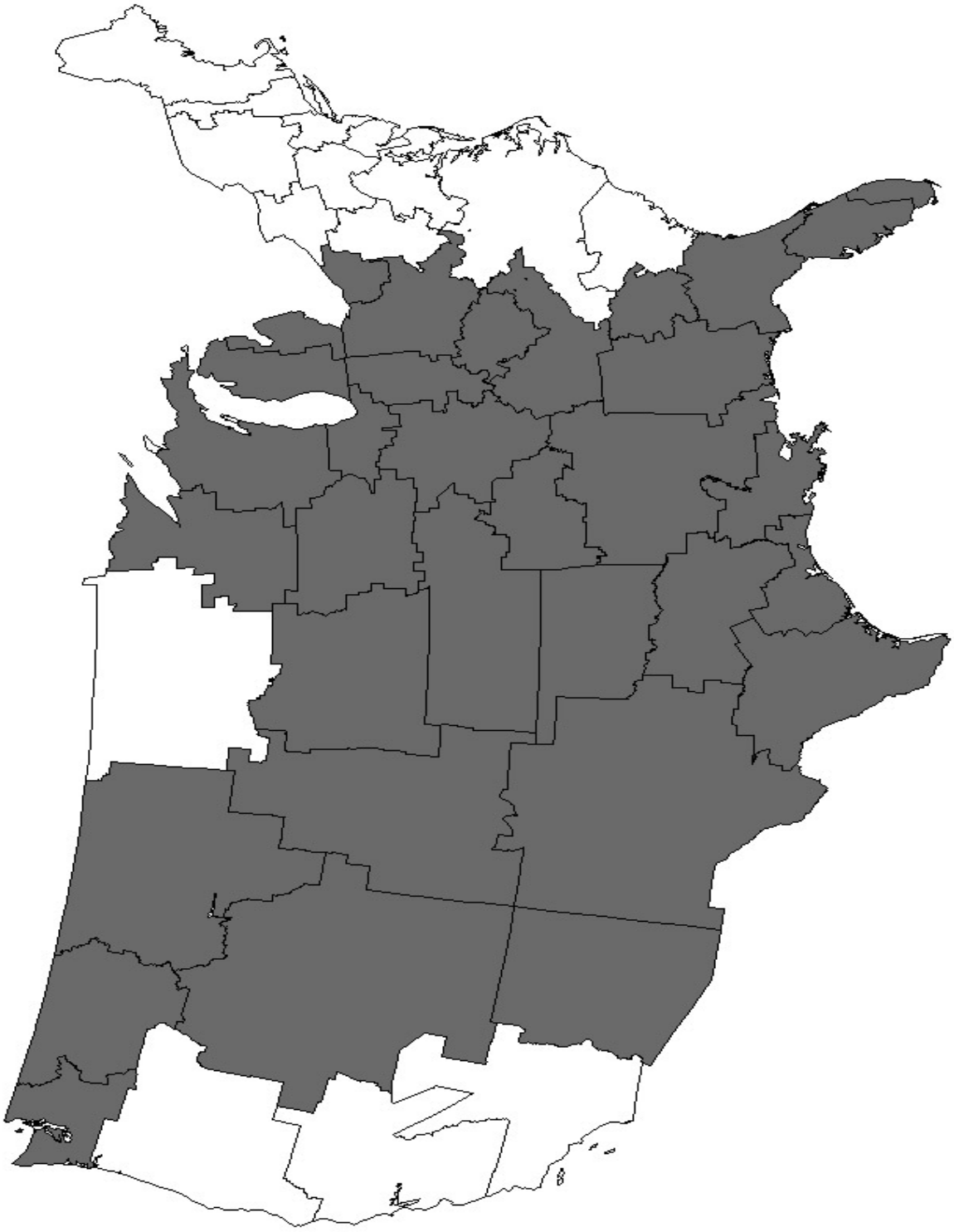

Figure 1. GMAs Included in the Dataset.

ranges in retail grocery concentration resulting from differences in metropolitan and non-metropolitan areas (Table 2). Such variations in concentration are consistent with claims that food is purchased in local markets, meaning local conditions heavily influence local CR4 (Cotterill 1986). Second, data were not available for the east and west coasts of the United States, areas with relatively lower retail grocery concentration.

The sample had an average annual change in CR4 of 1.1 from 1999 to 2003, but change in CR4 ranged from −6.3 in the Milwaukee GMA to 8.3 in the Springfield GMA (Table 2). The GMAs had an average of 18.8 initial Wal-Mart Supercenters, ranging from zero in the Detroit GMA to 83 in the Memphis GMA. On average, 4.3 new Wal-Mart Supercenters were added to each GMA each of the four years, but 18 new stores entered the Memphis GMA. The standard deviation of the change in Wal-Mart Supercenters was high: 3.9. Finally, the percentage of retail grocery stores classified as independent ranged from 9.4 percent in the Tampa GMA to 68.1 percent in the Milwaukee GMA.

When Wal-Mart Supercenters enter, competitors can respond by opening new stores to compete, by exiting and closing stores, or by doing nothing. Annually, the top two competitors in each GMA open 2.3 new stores on average (Table 2). The range of change in competitors was as low as 54 competitors exiting the New Orleans GMA and as high as 56 competitor stores entering the Dallas GMA. This suggests that some competitors in some GMAs are opening new stores or merging as a reaction to Wal-Mart's entry while competitors in other GMAs are exiting. Table 3 lists the top two competitors in each GMAs during 1999.

Figure 2 shows the GMAs with the 50th to 90th percentile level of concentration in gray and 90th to 100th percentile of concentration in black. Visually, one can see that GMAs in parts of Florida, Texas, and Arizona are in the top decile of concentrated GMAs, while concentration levels are mixed through the rest of the study area. Similarly, Figure 3 shows the change in concentration for the GMAs by percentile. Note that many of the white GMAs in Figure 2 (<50th percentile of CR4) are gray or black in Figure 3, showing that lesser-concentrated GMAs are experiencing the greatest increases in concentration, which is consistent with results from previous concentration studies.

Diagnostics

The four years of data for the 32 GMAs were stacked to form a panel (a cross-section of observations over time) of 128 total observations. The panel has both a spatial dimension (GMAs) and a temporal (time in years) dimension. Two types of models used to evaluate panel data are fixed and random effects models, which Greene (2000) de-

Table 2. Descriptive Statistics for Grocery Industry, 1999 to 2003.

Variable	Mean	Std. dev.	Range	
CR4	59.8	13.1	24.0	89.1
ΔCR4	1.1	2.8	-6.3	8.3
Sales	$9,028,095	3,570,478	$1,618,636	$16,560,859
Pop. density	151.2	168.3	4.8	748.7
ΔPop. density	2	8	−43	41
# Wal-Marts	18.8	17.1	0	83
Δ # Wal-Marts	4.3	3.9	−7	18
Competitors	172.6	90.9	38	464
ΔCompetitors	2.3	13.7	−54	56
% Independent	37.7%	15.8%	9.4%	68.1%

Source: Trade Dimensions Marketing Guidebook and Market Scope (1999–2000, 2002–2003).

Table 3. Top Two Competitors by GMA in 1999.

GMA	1st competitor	2nd competitor
Atlanta	Kroger	Publix Super Markets
Billings	Albertson's	SuperValu
Chicago	Jewel Food Stores	Dominicks Finer Foods
Cincinnati	Kroger	Roundy's
Cleveland	Giant Eagle	Tops Markets
Dallas	Albertson's	Tom Thumb
Denver	King Soopers	Safeway Inc.
Des Moines	HyVee Food Stores	Fareway Stores, Inc
Detroit	Farmer Jack	Kroger
Grand Rapids	Spartan Stores	Meijer
Houston	Kroger	H E Butt Grocery
Indianapolis	Kroger	SuperValu
Jacksonville	Winn-Dixie Stores	Publix Super Markets
Kansas City	Associated Wholesale	Dillon Food Stores
Louisville	Kroger	Winn-Dixie Stores
Memphis	Kroger	Jitney Jungle Stores
Miami	Publix Super Markets	Winn-Dixie Stores
Milwaukee	Sentry	Shultz Sav O Stores
Minneapolis	Cub Foods	Rainbow Food Stores
Nashville	Kroger	Food Lion
New Orleans	Winn-Dixie	Jitney Jungle Stores
Oklahoma City	Homeland Stores, Inc	Albertsons Inc.
Omaha	HyVee Food Stores	Bakers Supermarkets
Phoenix	Frys Food Stores	Bashas Markets
Salt Lake City	Albertson's	Smith's Food
San Antonio	H E Butt Grocery	Albertsons Inc.
Seattle	Safeway Inc.	Quality Food Centers, Inc
Spokane	Safeway Inc.	Albertsons Inc.
Springfield	Woods Supermarkets, Inc	Ramey/Price Cutter Supermarkets
St. Louis	Schnuck Markets	Kroger
Tampa	Publix Super Markets	Winn-Dixie

Source: Trade Dimensions Marketing Guidebook (2000).

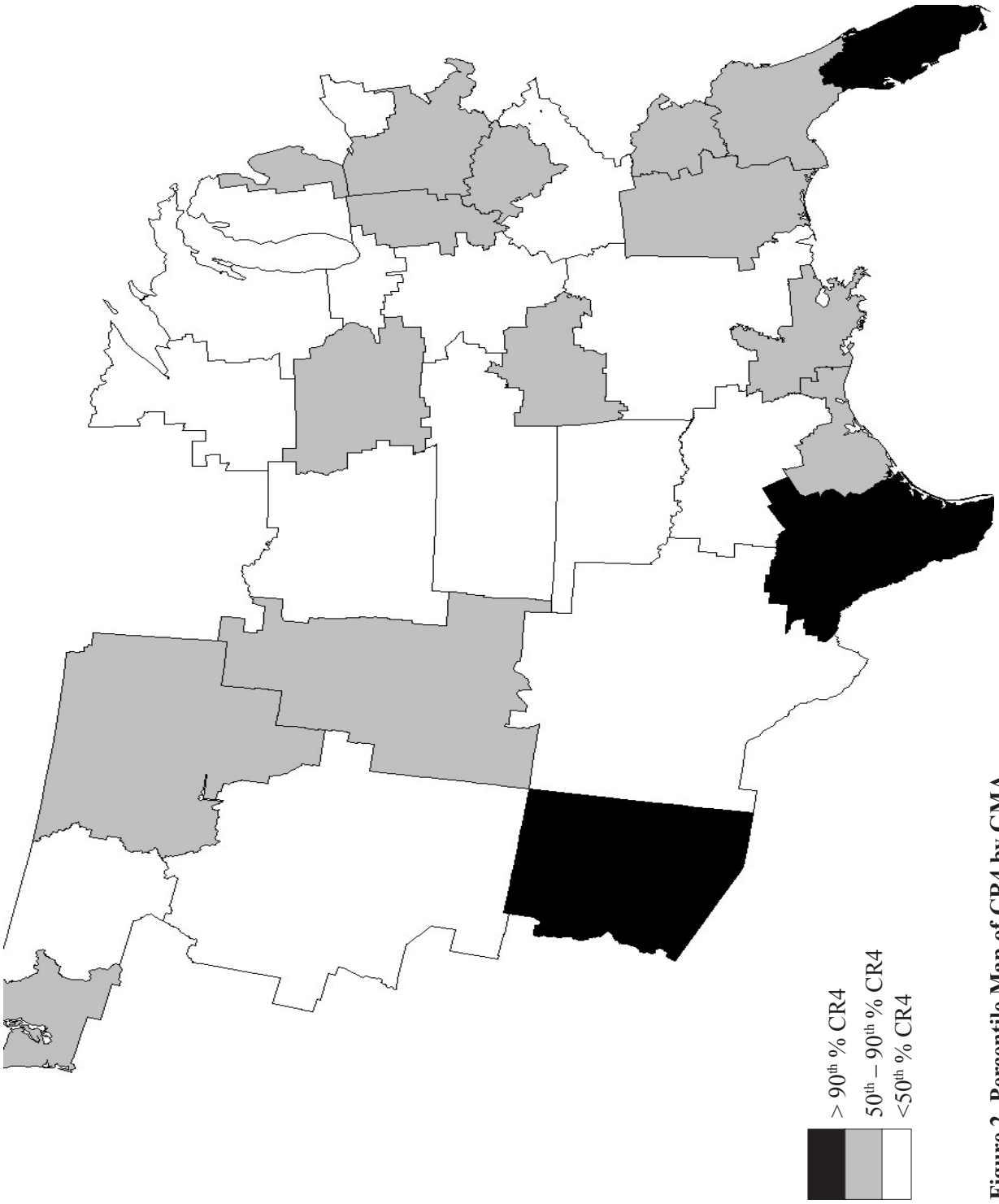

Figure 2. Percentile Map of CR4 by GMA.

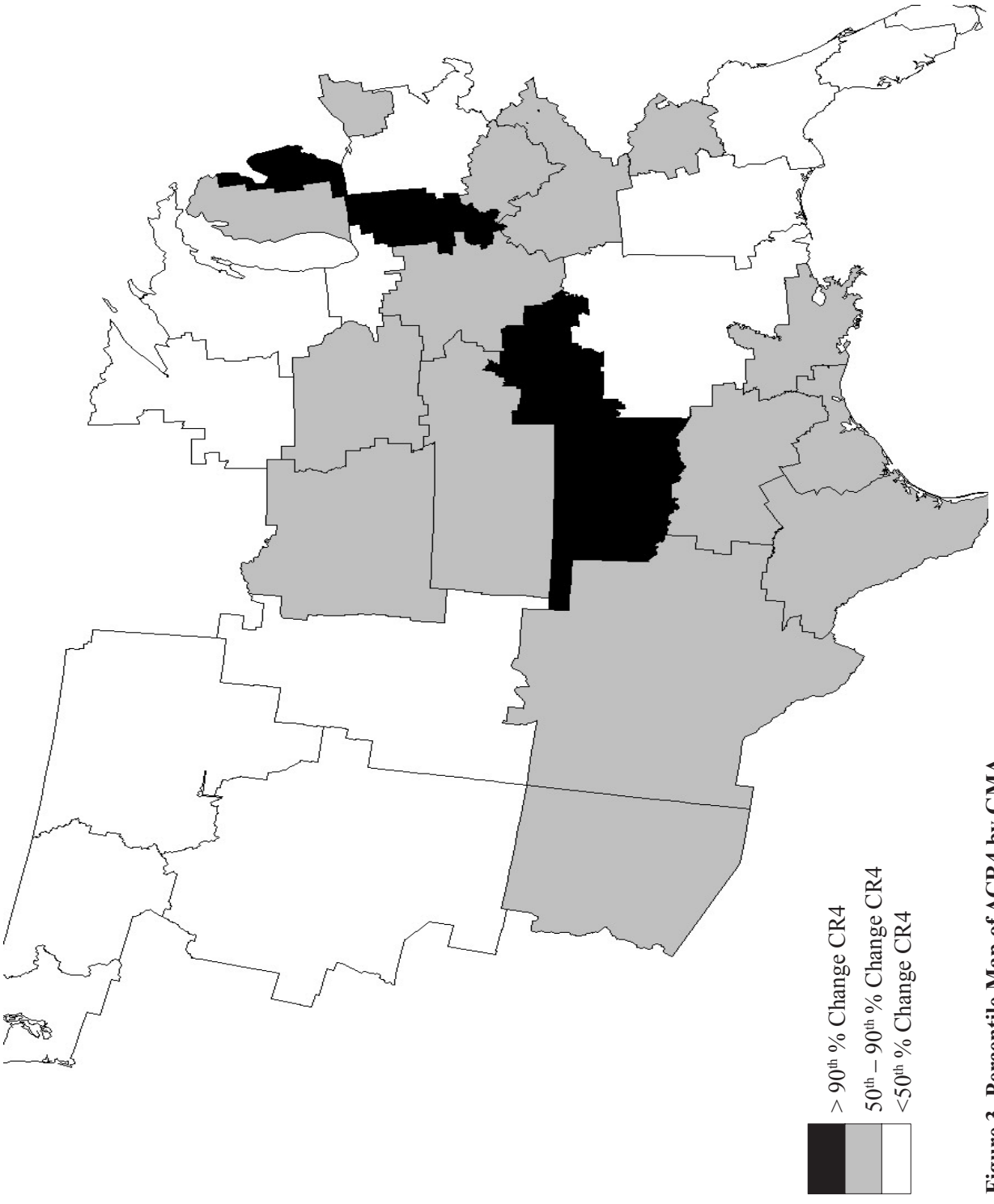

Figure 3. Percentile Map of ΔCR4 by GMA.

scribes in detail. Ordinary Least Squares (OLS) is inappropriate because it assumes identical coefficients across every GMA in the sample. In the fixed effects model, slopes are constant and intercepts vary either by the cross-section (GMA), time, or both. To determine whether statistically significant differences exist across groups (e.g., GMAs), an *F* test is used to test for R^2 change. A random effects model is a regression with a random constant term or a mean value plus a random error. In a random effects model, some omitted variables may be constant over time and vary among GMAs, while others are fixed between cases but vary over time.

The Hausman specification test is used to determine whether the fixed or random effects model is most appropriate. If there is significant correlation between unobserved random effects and the regressors, the fixed effects model will be best because it allows for correlation between the independent variables and unobserved effect. If, however, there is no significant correlation between unobserved random effects and the regressors, the random effects model would be more powerful because time-constant factors can be included. In addition, the models will be tested for heteroskedasticity and autocorrelation using the Breusch-Pagan test (Breusch and Pagan 1979) and a test developed by Woolridge (2002), respectively.

The panel data were run in both fixed and random effect models, and the Hausman test resulted in a P-value of 0.000. Therefore the fixed effects model, which allows for correlation between the independent variables and unobserved effects, was used for the results shown in Table 4. The Breusch-Pagan and Woodridge tests found no causes of inefficiency from heteroskedasticity or autocorrelation. The F test rejects the null hypothesis that all GMAs are alike (i.e., u_i = 0), so the fixed effects are the result of significant statistical differences across GMAs.

As expected, a high rho value of 0.97 suggests

Table 4. Econometric Results for Change in Concentration Model.

Group variable (i): GMA				No. of observations =	128	
R^2 Within =	0.4314			Number of groups =	32	
R^2 Between =	0.0404			sigma_u =	13.53	
R^2 Overall =	0.0282			sigma_e =	2.19	
Prob > F =	0.000			Rho (var. due to u_i)	0.97	
	Coeff.	Std. err.	t	P > |t|	[95% conf.	interval]
CR4	−0.5554	0.0958	−5.80	0.000	−0.746	−0.365
CP	0.0261	0.0250	1.04	0.301	−0.024	0.076
ΔCP	0.0431	0.0216	2.00	0.049	0.000	0.086
Y99	0.4477	1.1238	0.40	0.691	−1.788	2.683
Y00	−0.0082	0.8389	−0.01	0.992	−1.677	1.660
Y01	−0.9314	0.6500	−1.43	0.156	−2.224	0.361
PInd	−9.5768	6.5008	−1.47	0.144	−22.507	3.353
DC	0.0228	0.4088	0.06	0.956	−0.790	0.836
Pdn	−0.0689	0.0453	−1.52	0.132	−0.159	0.021
ΔPdn	−0.0080	0.0527	−0.15	0.880	−0.113	0.097
lnSales	4.5939	4.6311	0.99	0.324	−4.617	13.805
WM	0.1343	0.0616	2.18	0.032	0.012	0.257
ΔWM	0.1621	0.0899	1.80	0.075	−0.017	0.341
F(13,83) = 4.84 that all u_i=0; Prob > F = 0.000						

that most of the model's variation comes from the fixed effects (GMAs), meaning the model accounts for the major differences across the GMAs as well as changes over time. It follows that the highest R^2 is from within the groups (GMAs) (Table 4). Considering the many unknown factors that might affect retail grocery market concentration, this R^2 is believed to be quite good. The R^2 between GMAs and the overall R^2 are much lower, a common outcome for fixed effects models (Bjorklund 1989; Baltagi 1995).

Results and Discussion

Four variables (*CR4, WM, ΔWM,* and *ΔCP*) had statistically significant relationships with the change in CR4. Although the remaining variables were not significant at the ten-percent level, there were theoretically sound reasons for including the variables. Therefore, the variables were left in the model to control for variation associated with these important location and market concentration theory factors.

The result from *CR4* (the beginning level of CR4) was significant at the one-percent level with a negative sign, as expected. In this study and in past manufacturing market concentration studies, higher initial market concentration results in smaller future changes in market concentration. This describes how the market is converging to a new, higher level of concentration.

Wal-Mart has a significant positive affect on the change in CR4, with the initial number of Wal-Mart supercenter stores (*WM*) variable significant at the five-percent level. The *WM* coefficient was 0.1343, which, by itself, shows that the existing operation of an individual Wal-Mart Supercenter has a relatively small effect on the rate of market concentration change. However, Wal-Mart operates multiple stores in geographical areas which, combined, have a significant affect on the rate of market concentration change. For example, on average about 19 Wal-Mart Supercenters operated in each GMA, meaning the typical GMA would expect an increase in the change in CR4 of about 2.5 points annually due to the presence of Wal-Mart Supercenters.

The coefficient for the change in the number of Wal-Mart Supercenters (*ΔWM*) is 0.1621 and is significant at the ten-percent level. Annually, about four new Wal-Mart Supercenters entered the typical GMA. Therefore, the average GMA experienced an increase in change in concentration of about 0.69 points due to Wal-Mart Supercenter expansion. Individual GMAs experienced a greater expansion of Wal-Mart Supercenters. For example, in the Memphis GMA, the average annual effect of entry by Wal-Mart Supercenters was 2.19 points, a high number considering that the mean change in concentration was only 1.11 points.

Finally, the change in the count of stores operated by the top two firms in each GMA (*ΔCP*) was positive and significant at the five-percent level. Whether the top two competitors are expanding and merging due to Wal-Mart or not, their expansion and mergers are increasing the annual change in CR4 by 0.10 points, on average. The Atlanta GMA experienced the greatest average annual change in concentration due to *ΔCP* (0.86 points), while the average annual change in concentration in New Orleans fell by 0.58 points due to changes in the count of stores operated by the top competitors (*ΔCP*).

Discussion

The effects of *de novo* entry by Wal-Mart supercenters on retail grocery concentration were evaluated for 32 relatively large GMAs, covering most of the United States. The results support the hypothesis that Wal-Mart is increasing retail grocery concentration. Existing Wal-Mart stores increased the change in concentration by 0.13 points per store and entry by new Wal-Mart Supercenters further increased the change in concentration by 0.16 points per store. The average four-year combined effects of existing Wal-Mart Supercenters and entry by Wal-Mart Supercenters increased concentration annually in a range from 0.16 points in the Seattle GMA to 10.95 points in the Memphis GMA (Table 5).

Although the effect of entry by Wal-Mart Supercenters on change in concentration is four times greater per store than the effect of entry by one of the top two competitors (0.04), consideration of the effect of entry by a top competitor remains important. The average annual change in the number of top two competitors (*ΔCP*) was positive for 22 of the 32 GMAs, with the New Orleans GMA losing an average of 54 competitors annually and the Atlanta GMA gaining an average of 20 competitors annually. Frequent mergers, consolidations, divestures, and buyouts account for some of the changes in top competitors. The regression results show the effect

Table 5. Average Annual Statistics and Effects of ΔCP, WM, and ΔWM on ΔCR4.

GMA	ΔCR4	ΔCP	ΔCP Effect	WM	WM effect	ΔWM	**ΔWM effect on ΔCR4**	**Total WM effect on ΔCR4**
Albuquerque	1.2	−8	−0.34	25	3.32	3	0.53	3.85
Atlanta	2.0	20	0.86	20	2.65	5	0.73	3.38
Billings	−0.2	−3	−0.11	3	0.40	2	0.32	0.73
Chicago	−1.8	1	0.02	9	1.18	1	0.16	1.34
Cincinnati	0.8	0	−0.01	15	2.05	5	0.77	2.82
Cleveland	2.4	−6	−0.26	7	0.97	1	0.16	1.14
Dallas	1.4	17	0.71	57	7.66	11	1.70	9.36
Denver	0.6	8	0.32	17	2.25	6	0.97	3.22
Des Moines	1.2	1	0.05	13	1.78	5	0.85	2.63
Detroit	3.2	1	0.03	1	0.10	1	0.08	0.18
Grand Rapids	2.8	2	0.08	2	0.20	3	0.45	0.65
Houston	1.3	7	0.29	21	2.75	9	1.46	4.21
Indianapolis	3.2	8	0.33	21	2.85	5	0.81	3.66
Jacksonville	−0.1	6	0.25	19	2.59	3	0.49	3.07
Kansas	2.1	2	0.10	28	3.73	5	0.81	4.54
Louisville	1.7	1	0.05	18	2.42	4	0.65	3.07
Memphis	0.2	−4	−0.16	65	8.76	14	2.19	10.95
Miami	−0.6	3	0.13	4	0.57	2	0.24	0.81
Milwaukee	−0.8	2	0.09	7	0.87	4	0.69	1.56
Minneapolis	−0.6	3	0.13	2	0.20	2	0.28	0.49
Nashville	2.0	−4	−0.16	44	5.88	5	0.85	6.73
New Orleans	2.4	−14	−0.58	29	3.89	3	0.45	4.34
Oklahoma	3.0	−6	−0.25	34	4.53	7	1.05	5.59
Omaha	1.5	5	0.19	7	0.94	2	0.32	1.26
Phoenix	2.9	9	0.40	7	0.91	4	0.61	1.51
Salt Lake City	−0.3	0	0.00	7	0.97	7	1.09	2.07
San Antonio	1.5	3	0.14	24	3.19	5	0.77	3.96
Seattle	−0.6	10	0.44	0	0.03	1	0.12	0.16
Spokane	−1.5	3	0.12	1	0.13	1	0.20	0.34
Springfield	3.7	1	0.05	32	4.30	4	0.57	4.86
St. Louis	1.3	−2	−0.09	35	4.73	5	0.73	5.46
Tampa	−0.1	8	0.33	31	4.13	7	1.09	5.22

of competitors on change in concentration ranged from negative 0.58 points to positive 0.86 points for the New Orleans and Atlanta GMAs, respectively (Table 5).

With Wal-Mart Supercenters increasing the change in market concentration in all 32 GMAs, understanding whether and where Wal-Mart Supercenters face strong market competition becomes important to guide policy makers, those involved in the retail grocery industry, and consumers. The data were evaluated several ways, and two groups or regimes of GMAs emerged—one regime with a strong Wal-Mart presence and another regime with a weaker Wal-Mart presence. Regime 1 consisted of 13 GMAs, each with more than 20 Wal-Mart Supercenters operating annually, while Regime 2 consisted of the remaining 19 GMAs, each with fewer than 20 Wal-Mart Supercenters operating annually (Table 6).

The Regimes helped draw two important generalized conclusions about the level of competition between Wal-Mart's and the top two competitors. First, on average the top two competitors (ΔCP) are entering Regime 2, but not Regime 1 where Wal-Mart's market presence is stronger. Average ΔCP is 3.4 in Regime 2 compared 0.7 in Regime 1, and only two of the nine GMAs with negative ΔCP were in Regime 2 (Table 6).[2] Second, on average Wal-Mart opens more than twice as many Supercenters in Regime 1, where their presence is already strong. The average change in Wal-Mart Supercenters was 6.2 in Regime 1, compared to only 3.0 in Regime 2 (Table 6). Furthermore, the correlation between the count of Wal-Mart Supercenters and entry by Wal-Mart Supercenters was 0.78.

The descriptive statistics based on regimes suggest that Wal-Mart is meeting less resistance in markets where their market presence is established, and thus Wal-Mart is responsible for increasing market concentration at a faster rate. In this case, Wal-Mart Supercenters may be taking more of their market share from other large competitors who are choosing not to expand or even to exit the market. In regimes where Wal-Mart is less established, competitors are entering with additional stores, suggesting that Regime 2's large competitors are more willing to fight for market share. In Regime 2 GMAs, Wal-Mart likely faces stronger competition, so smaller supermarkets will probably be forced give up more market share as Wal-Mart and the top competitors fight for market share.

[2] If the Dallas GMA was removed from the sample, an average of 1.4 top competitors would have exited the market. A large acquisition occurred in the Dallas GMA during the sample period.

Implications and Research Suggestions

This research should help those involved in the retail grocery industry understand changes in market concentration and market conditions due to Wal-Mart entry. This research shows that Wal-Mart Supercenters are increasing market concentration everywhere, but primarily where they have an established presence. In areas where Wal-Mart's presence is large, they are likely taking market share from larger competitors. Small grocery retailers should look for opportunities to capitalize on market-share increases when one of Wal-Mart's larger competitors exits. This may also suggest that Wal-Mart is able to capitalize on additional economies of scale where their market presence is stronger.

Policy makers and those involved in the retail grocery industry might also note that Wal-Mart's top two competitors are expanding where Wal-Mart's presence is relatively small. By doing so, these top competitors may be positioning themselves to fight for market share when Wal-Mart enters or expands in their markets. Clearly, Wal-Mart's top retail grocery competitors believe they can position themselves to compete for market share. Finally, those in the retail grocery industry and consumers should be aware that Wal-Mart entry means higher levels of retail concentration. Even though Wal-Mart is associated with lower prices, increased retail grocery concentration has traditionally resulted in higher prices.

Data availability limits this study in two ways. First, in this study the effects of Wal-Mart Supercenters on concentration are considered at the GMA level, a level for which data is available. However, retail grocery markets are much smaller than Trade Dimension's GMAs. Within certain local markets, the effects of Wal-Mart Supercenters on grocery concentration could be much greater; especially in small, rural towns. To understand the effects of entry by Wal-Mart Supercenters on grocery markets, the spatial scale of this study would need to be reduced from the GMA level to a county or zip-code level. This would more clearly show the effects of Wal-

Table 6. Average Annual Descriptive Statistics by Regime.

Regime 1 – Large Wal-Mart presence								
GMA	ΔCR4	CR4	CP	ΔCP	WM	ΔWM	ΔCP effect on ΔCR4	Total WM effect on ΔCR4
Albuquerque	1.2	50.2	102.0	−8.0	24.8	3.3	−0.34	3.85
Dallas	1.4	56.2	214.5	16.5	57.0	10.5	0.71	9.36
Houston	1.3	61.8	188.0	6.8	20.5	9.0	0.29	4.21
Indianapolis	3.2	61.7	171.0	7.8	21.3	5.0	0.33	3.66
Kansas	2.1	49.8	104.5	2.3	27.8	5.0	0.10	4.54
Memphis	0.2	55.6	184.0	−3.8	65.3	13.5	−0.16	10.95
Nashville	2.0	56.9	190.8	−3.8	43.8	5.3	−0.16	6.73
New Orleans	2.4	58.9	126.8	−13.5	29.0	2.8	−0.58	4.34
Oklahoma	3.0	48.4	85.8	−5.8	33.8	6.5	−0.25	5.59
San Antonio	1.5	82.6	218.8	3.3	23.8	4.8	0.14	3.96
Springfield	3.7	51.6	47.3	1.3	32.0	3.5	0.05	4.86
St. Louis	1.3	51.9	136.3	−2.0	35.3	4.5	−0.09	5.46
Tampa	−0.1	84.5	445.8	7.8	30.8	6.8	0.33	5.22
Average	1.8	59.2	170.4	0.7	34.2	6.2	0.0	5.6
Std. Deviation	1.1	11.6	98.1	8.0	13.6	3.1	0.3	2.2

Mart Supercenters on retail grocery concentration for specific, less-aggregated markets. Reducing the spatial scale of the study would also give insight into whether Wal-Mart Supercenters affect retail grocery concentration differently between urban and rural areas.

Second, this study is limited by temporal data constraints. Additional years of data would allow analysis of whether Wal-Mart is beginning to saturate markets or whether lag effects exist between Wal-Mart Supercenter entry and market concentration changes. Also, additional years of data could be used to better understand the effects of entry by Wal-Mart on competitors. Due to changes in GMA definitions by Trade Dimensions, it was not possible to extend the time dimension of the dataset.

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Table 6. Average Annual Descriptive Statistics by Regime.

Regime 2 – Small Wal-Mart presence								
GMA	ΔCR4	CR4	CP	ΔCP	WM	ΔWM	ΔCP Effect on ΔCR4	Total WM Effect on ΔCR4
Atlanta	2.0	66.1	225.3	20.0	19.8	4.5	0.86	3.38
Billings	−0.2	60.9	42.8	−2.5	3.0	2.0	−0.11	0.73
Chicago	−1.8	60.7	290.8	0.5	8.8	1.0	0.02	1.34
Cincinnati	0.8	60.1	306.5	−0.3	15.3	4.8	−0.01	2.82
Cleveland	2.4	47.4	205.8	−6.0	7.3	1.0	−0.26	1.14
Denver	0.6	76.3	198.0	7.5	16.8	6.0	0.32	3.22
Des Moines	1.2	70.5	179.8	1.3	13.3	5.3	0.05	2.63
Detroit	3.2	57.0	231.3	0.8	0.8	0.5	0.03	0.18
Grand Rapids	2.8	44.2	251.8	1.8	1.5	2.8	0.08	0.65
Jacksonville	−0.1	74.8	181.8	5.8	19.3	3.0	0.25	3.07
Louisville	1.7	69.5	113.0	1.3	18.0	4.0	0.05	3.07
Miami	−0.6	88.2	305.8	3.0	4.3	1.5	0.13	0.81
Milwaukee	−0.8	29.5	63.5	2.0	6.5	4.3	0.09	1.56
Minneapolis	−0.6	45.2	64.5	3.0	1.5	1.8	0.13	0.49
Omaha	1.5	43.4	45.3	4.5	7.0	2.0	0.19	1.26
Phoenix	2.9	73.7	205.0	9.3	6.8	3.8	0.40	1.51
Salt Lake City	−0.3	56.8	137.5	0.0	7.3	6.8	0.00	2.07
Seattle	−0.6	64.7	208.5	10.3	0.3	0.8	0.44	0.16
Spokane	−1.5	56.1	50.0	2.8	1.0	1.3	0.12	0.34
Average	0.7	60.3	174.0	3.4	8.3	3.0	0.1	1.6
Std. Deviation	1.5	14.1	89.1	5.6	6.7	1.9	0.2	1.1

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