The Effect of Wal-Mart Supercenters on Grocery Prices in New England

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Abstract

This study analyzes the effect of the presence of Wal-Mart Supercenters on the prices at conventional supermarkets in Massachusetts, Connecticut, and Rhode Island. Using price indexes constructed from primary price data on a basket of 54 goods and holding several demographics and market conditions constant, we determine that Supercenters result in a 7.79% average price reduction in national brand goods and a 6.38% average price reduction in private label goods. Wal-Mart Supercenters also price their groceries on average 15.65% lower than supermarkets competing with Supercenters and 22.28% lower than supermarkets geographically distant from Supercenters.

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I. Introduction

The discount retailer Wal-Mart has been a popular topic for discussion and debate for more than a decade. Its meteoric rise in the department store industry is well documented. In early 1981, Wal-Mart's sales constituted less than 12% of Sears', then the largest retailer in the United States. Less than ten years later, Wal-Mart officially became the largest retailer in the country (Vance and Scott, 1994). By 1997, Wal-Mart was the single largest employer with over 680,000 associates. Wal-Mart has grown so large that lawmakers take Wal-Mart into consideration when labor regulations and reforms are brought before Congress (Strope, 2004).

In 2003, Wal-Mart also became the largest food retailer in the United States (Jones, 2004) and is currently the leading grocer worldwide (Progressive Grocer, 2005). The company achieved this position in the United States largely due to the rapid expansion of Supercenters over the past decade. Supercenters are Wal-Mart stores that offer entire lines of groceries in addition to all of the usual wares found at conventional Wal-Mart locations. Supercenters are spreading across the nation quickly with 1,376 outlets recorded in 2003 and a projection for 1,000 more by 2008 (Business Week, 2003).

Supercenters are the subjects of as much, if not more, controversy than conventional Wal-Mart stores. For example, in 2003 Wal-Mart proposed the construction of a dozen Supercenters throughout the entire state of California by the end of 2007. Citing low wages and inadequate health care for employees as the top reasons, the voters of Los Angeles County successfully rejected Wal-Mart's attempts to construct a Supercenter in a Los Angeles suburb in the spring of 2005 (Joyce, 2005). Further, in anticipation of Wal-

Mart's entry, conventional supermarkets attempt to reduce union wages and benefits in regions of California targeted for proposed Supercenters (Zwiebach, 2004).

While Wal-Mart has been a prominent and regular topic in the popular press, the literature on Wal-Mart, and more specifically on Supercenters and their effects on the food industry, is relatively scarce. One reason for the lack of empirical evidence on the effect of Supercenters is the absence of a data source; Wal-Mart does not participate in any of the public data collection services.

Among the few studies examining Supercenters, Franklin (2001) found no significant impact of Supercenters on supermarket concentration in metropolitan areas. It is important to note however that the supermarket industry was already concentrated at the time of research due to the large wave of mergers and acquisitions in the mid to late 1990's.[2] According to Franklin (2001), the market share achieved by Wal-Mart Supercenters is inversely proportional to the income of local consumers amongst metropolitan areas. Moreover, he observed that Supercenters are more likely to enter low-income areas, which is consistent with the literature on conventional Wal-Mart stores.

There is no evidence in the literature that Supercenters are responsible for supermarkets' closing. However, Capps and Griffin (1998) determined that Wal-Mart Supercenters were directly responsible for a 21% reduction in sales for a regional chain of supermarkets in the Dallas/Fort Worth area of Texas. The combined effect of Supercenters and Wal-Mart's wholesale outlet, Sam's Club Stores, on supermarkets

[2] Preliminary concentration figures from the 2002 U.S. Economic Census (NAICS code 445110) indicate that the four-firm concentration ratio (CR4) was 32.5 percent, up from 20.8 percent in 1997. Note that this national measure of concentration understates the level of concentration in the industry, which is local in nature.

resulted in a loss of $15 to $17 billion in sales from supermarkets nationwide in 2001 (*USA Today* as cited by Jones, 2004).

Wal-Mart Supercenters follow a different pricing strategy than most supermarkets. All Wal-Mart stores price their products using Everyday Low Pricing (EDLP), meaning that all products are marked up by the same percentage regardless the price at which they were acquired (Vance and Scott, 1994). Sales, promotions, and advertising play a minor role in the practice of EDLP. Most supermarkets, by contrast, employ High-Low Pricing (HLP), whereby most products are given a high markup. However, a certain percentage of goods, changing on a regular basis, are discounted. In many cases promotional items are sold at a loss to the store (Jones, 2004). In the face of competition with conventional supermarkets, the EDLP strategy is profitable for Supercenters because it creates a stark price contrast with the higher priced supermarkets. Jones used a game theoretical approach to show that supermarkets would have higher sales if they all employed EDLP when competing with discount stores, but the incentive for a supermarket to deviate and employ HLP in order to attract customers with unique sale prices is very strong.

According to a 2002 UBS Warburg study, Wal-Mart Supercenters' prices are on average 14% lower than competing supermarkets (Bianco and Zellner, 2003). The question of how Wal-Mart's prices affect the prices at conventional supermarkets has gone largely unanswered in the literature.

An exception is the work of Woo, Huang, Epperson, and Cude (2002), who monitored prices at conventional supermarkets before and after the entry of a Wal-Mart Supercenter in the low-income area surrounding Athens, Georgia. They found that supermarkets lowered their prices significantly prior to the Supercenter's entry, but that

prices gradually rose back to their original levels following the entry. The only supermarkets showing lasting effects from the Supercenter entry were those with the highest prices at the beginning of the study.

The objective of this study is to examine the impact of Wal-Mart Supercenters on conventional stores' prices in three New England states (Connecticut, Massachusetts, and Rhode Island). We also examine how Wal-Mart Supercenters set their grocery prices in relation to conventional supermarkets. For these purposes, we use a unique data set on the price of a basket of goods sold in 18 stores comprising both Supercenters and supermarkets,

In addition to the unique data set, this article contributes to the literature and differs from prior studies in many respects. The majority of the existing empirical work on Wal-Mart has been conducted in rural areas southern and the midwestern states of the United States, where Wal-Mart originated and where it is still prominent among chain retailers (e.g., McGee and Rubach, 1996; Stone, 1997; Capps and Griffin, 1998; Hicks and Wilburn, 2001; Woo, Huang, Epperson, and Cude, 2001). The New England region is both wealthier and more densely populated than the regions generally sampled for Wal-Mart studies.[3] The six Supercenters examined in this article are located in areas where median household income ranges between $30,115 and $60,449. There are neighborhoods of households with annual incomes greater than $60,000 within five miles of most of the Supercenters. Given that Wal-Mart achieves the greatest profits and market share in rural regions of low income (McGee and Rubach, 1997; Franklin, 2001), the

[3] According to the U.S. Census Bureau, the median household income for the United States in 2003 was $43,527, whereas it was $55,004 for Connecticut, $52,084 for Massachusetts, and $42,205 for Rhode Island.

demographic distinction marked by the New England location will shed light on the impact of Wal-Mart stores in a more affluent region.

In addition to examining the impact of Supercenters in a more affluent region, we also include in the market basket examined for this study both national brand and private label goods. Supermarkets and Supercenters alike offer lines of both national brand and private label goods. National brand goods are obtained from national distributors and manufacturers while private labels are acquired through a form of vertical integration (Mills, 1995). An example of this distinction is seen between Coca-Cola and Stop n' Shop brand cola.

The benefits of including both types of goods in our research are two fold. First, it enables us to provide a better understanding on the nature of the competition between Supercenters and supermarkets given that supermarkets have greater control over private label than national brand prices (Ward, Shimshack, Perloff, and Harris, 2002). Moreover, Wal-Mart's effect on the national brand/private label price margin can be determined for the affected supermarkets.[4] Second, given that private labels are most popular among consumers of low income classes (Dhar and Hoch, 1997), whereas national brands are favored by affluent consumers, we are able to comment on the effect of Supercenters on prices paid by consumers of different levels of income. In order to get the clearest picture of Wal-Mart's effect on grocery prices and to better understand how supermarkets choose to compete with Wal-Mart, both the national brand and private label market baskets are

[4] The margin between branded and unbranded goods has been dynamic over the past decade due to factors such as the sharp increase in supermarket concentration and the drive by supermarkets to produce higher quality private label products (Ward, Shimshack, Perloff, and Harris, 2003). The main determinants of the national brand/private label margin are supermarket concentration (Wills and Mueller, 1989), advertising intensity (Connor and Peterson, 1992), and private label sales as a percentage of total sales for any given good (Mills, 1995). Bergès-Sennou, Bontems, and Réquillart (2004) provide a review of the literature on private label and national brand goods as well as the incentives for retailers to offer private labels.

composed of goods from the six major departments found in a supermarket.[5]

The remainder of this article is organized as follows. The next section describes the data and how they were acquired for the purposes of this study. This is followed by a description of the empirical model as well as theoretical predictions based on the existing literature. Empirical results and discussion follow and we conclude with suggestions for future research.

II. The Data

Because Wal-Mart does not participate in any public data collection service, it was necessary to gather primary price data. The data were gathered from 18 stores throughout the states of Massachusetts, Connecticut, and Rhode Island. The selection of the 18 stores was made by the following criteria: six of the stores are Wal-Mart Supercenters. Another six represent the largest supermarket, in terms of floor size, found within five miles of each of the Supercenters. These supermarkets are defined as "competing" supermarkets for the purpose of this study. According to Cotterill (1986), consumers rarely travel more then five miles from their homes to shop for groceries. Finally, for each supermarket competing with a Supercenter, another New England supermarket located further away was chosen. Using data from the 2000 Census as well as the 2004 *Trade Dimensions* Retail Data Directory, stores were selected on the basis of their similarity with the six competing supermarkets in terms parent company, size, market conditions, and demographics. Those final six stores are used as "comparison" stores to the six supermarkets competing with Wal-Mart Supercenters. Appendix A details the location of all 18 stores as well as the bases for selection of the comparison stores.

[5] According to Cotterill (1999a), the six departments with the largest shares of supermarket sales are the grocery, dairy, frozen food, health and beauty aids (HBA), meat, and produce departments.

The 54 products sampled in this study were selected from a larger list compiled by Cotterill (1999a) and span the six major supermarket departments: grocery, dairy, frozen food, health and beauty aids (HBAs), meat, and produce. The products were selected in proportion to departmental shares of sales calculated by Cotterill (1999a) to represent a typical consumer's market basket. This explains, for example, why more goods were sampled from the grocery department than from the dairy department. In every department the selection of products was divided evenly between national brand and private label goods, with the exception of the produce department, in which only national brand goods were available. Taking into account the fact that private label products are not identical among different supermarket chains, we used data from *Consumer Reports* to select products that do not vary a lot in quality among manufacturers. Quality variation among private label products is a potential source of price variation, because stores with higher quality private labels have higher private label prices (Bergès-Sennou, Bontems, and Réquillart, 2003). The data from *Consumer Reports* are intended to control for changes in price resulting from quality variation among different lines of private label products. A list of the products and their average price across the 18 stores can be found in Appendix B.

The prices were recorded directly off the shelves of the 18 stores within a span of three weeks in October 2004. Gathering the data within one calendar month minimizes the presence of time-series trends. Woo, Huang, Epperson, and Cude (2001), who used time series price analyses, showed food markups to shift on a monthly basis in response to market conditions. Only the non-promotional prices were recorded when a sampled

product was on promotion. Figure 1 reports the average price of the entire market basket at each of the store categories.

[*Insert Figure 1 here*]

Examining the prices of the goods on an aggregate basis, the order from least expensive to most expensive is Wal-Mart Supercenters, competing supermarkets, and comparison supermarkets. For both national brand and private label goods, the most pronounced average price difference is between the Wal-Mart Supercenters and their nearby competitors. Regarding the price difference between supermarkets that compete with Wal-Mart and those that do not, competing supermarkets charge an average of $6.90 less for the entire basket of national brand goods. For the private label goods the difference is $4.26.

III. The Model

Empirically, the test focuses on estimating the price differences between the different types of stores (Supercenters, competing and comparison supermarkets) as well as across the different supermarket departments and brands, while controlling for store characteristics, towns' demographics and market conditions. We pooled price data from competing supermarkets, comparison supermarkets, and the six Supercenters. The value of a basket of good of brand i (i=national brand (N), private label (P)) consisting of products in department j (j=dairy, frozen food, health and beauty aids (HBA), meat, produce, grocery) at store k can be expressed as:

$$(1) \quad V_{ijk} = \beta_{i0} + \beta_{i1} DAIRY + \beta_{i2} FROZEN + \beta_{i3} HBA + \beta_{i4} MEAT + \beta_{i5} PRODUCE + \beta_{i6} COMPETE + \beta_{i7} COMPARE + \beta_{i8} COMPETEDAIRY + \beta_{i9} COMPETEFROZ + \beta_{i10} COMPETEHBA + \beta_{i11} COMPETEMEAT + \beta_{i12} COMPETEPROD + \beta_{i13} COMPDAIRY + \beta_{i14} COMPFROZ + \beta_{i15} COMPHBA + \beta_{i16} COMPMEAT + \beta_{i17} COMPPROD + \boldsymbol{\delta_i X_k} + u_i$$

where *DAIRY*, *FROZEN*, *HBA*, *MEAT*, and *PRODUCE* are binary variables intended to capture price variations resulting from different price differences across departments. For example, *DAIRY* takes the value of one if the basket is composed of goods that are part of the dairy department and zero otherwise. The reference category is the grocery department. *COMPETE* and *COMPARE* are binary variables taking the value of one if the market basket belongs to a competing or comparison supermarket respectively and zero otherwise. The reference category is Wal-Mart Supercenter. These variables are also interacted with the departmental dummies (e.g., *COMPETEDAIRY*, *COMPETEFROZ*, etc.).

$\boldsymbol{X_k}$ is a vector of variables describing store characteristics, towns' demographics, and market conditions associated to store *k*. The variables included in this vector are described next. *RICH* is a binary variable equal to one if the city or town in which the department was found had a median household income greater than $45,725, i.e., within the upper half of the data set.[6] Given that consumers become less price sensitive as income increases (Hoch, Kim, Montgomery, and Rossi, 1995) and that consumers with annual incomes greater than $60,000 are likely to choose conventional supermarkets over discount or warehouse stores (Palma, Emerson, and House, 2003), *RICH* is expected to be positive for both brands of goods. Data on median household incomes were obtained from the 2000 census.

POPDENSITY is the population density, measured as the population of the city or town where the store is located, divided by the land area in square miles. The results of Palma, Emerson, and House (2003) show that proximity is an important determinant of

[6] According to the U.S. Census Bureau, the median household income for the United States was $43,527 in 2003, thus the upper portion of the dataset represents towns and cities that are wealthier relative to the U.S. average.

decisions made by consumers and retailers may have an incentive to compete when consumers are able to travel among stores easily. The coefficient on this variable is expected to be negative. Data on population and land areas were obtained from the 2000 census.

DTLC is the distance to the largest competitor within five miles. All data on store size and location were obtained from *Trade Dimensions*, a retail data directory. This variable is similar in nature to *POPDENSITY* and is expected to be positive for both brands. In other words, as the distance from the largest competitor increases, price competition is expected to decrease and thus the prices to rise. Capps and Griffin (1998) found that population density has greater explanatory power in price regression than simply population size.

The variable *SSIZE* represents the size of the store measured in square feet. Large supermarkets generally offer lower prices than smaller supermarkets (Binkley and Connor, 1996; MacDonald and Nelson, 1991). Additionally, Supercenters are the largest stores sampled in this study and they are expected to have the lowest prices due to the EDLP policy of Wal-Mart. Therefore, the coefficient on SSIZE is expected to be negative for both brands.

CONCENTRATED is a binary variable equal to one if the store is in a market with less than four competing stores. The market, for the purposes of this study, is defined by five-mile radius surrounding the largest store sampled in a city or town. Except for the studies of Kaufman and Handy (1989) and Newmark (1990), which have been criticized for their methodology, prior literature shows that there is a positive relationship between concentration and food prices (Hall, Schmitz, and Cothern, 1979; Lamn, 1981; Cotterill,

1986; Binkley and Connor, 1998; Cotterill, 1999b; Yu and Connor, 2002). Thus, we expect that the coefficient on this variable will have a positive sign.[7]

BH is the percentage of Blacks and Hispanics living in the town of interest at the time of the 2000 census. According to Hoch, Kim, Montgomery, and Rossi (1995) Blacks and hispanics are more sensitive to grocery prices. Therefore, the effect of this variable on price is expected to be positive. Equation (1) is estimated for each brand *i*, i.e., for national brands and private labels, for ease of interpretation and readability. However, there are no private label produce goods, thus there are no dummies or interaction terms related to produce goods in the private label equation, i.e., the coefficients β_{P5}, β_{P12}, and β_{P17} are zero.

By construction, β_{i0} is the average value of a market basket composed of goods of brand *i* from the grocery department at Wal-Mart Supercenters located in towns or cities with median household income of less than $45,725 and with four or more competing stores. Thus, β_{i6} is the average increment to this price charged for buying at a competing store and β_{i7} is the average increment for buying at a comparison store. If Wal-Mart Supercenters cause a decrease in prices at conventional supermarkets as found by Woo, Huang, Epperson, and Cude (2001) in Athens, GA, and Wal-Mart's food prices are lower than those of their competitors (Bianco and Zellner, 2004), than the coefficients on the variables *COMPETE* and *COMPARE* should be positive and the coefficient for *COMPARE* should be higher in magnitude than the one for compete. That is, the prices at

[7] Income and concentration are qualitative, rather than quantitative, due to their lack of statistical significance as quantitative predictors. A prior study in food retailing (Palma, Emerson, and House, 2003) found that a significant change in consumers' decisions occurs at a particular income threshold. Likewise, Bresnahan (1991) found that prices typically cease to change significantly after the entry of the 3rd competing firm.

Wal-Mart Supercenters should be lower than those at competing stores, which in turn should be lower than those at comparison stores.

The comparison stores are expected to have higher prices in the other departments as well, but the coefficients must be properly mapped to calculate the average expected values of market baskets by department and store category. Tables 1 and 2 report the mapping of coefficients for the national brand and private label models.

[*Tables 1 and 2 here*]

Table 3 summarizes the variables used in the models and their predicted signs. The only prediction regarding the interaction terms is that those involving the dummy *COMPARE* have greater coefficients than those involving *COMPETE*. The signs of the effects cannot be predicted.

[*Table 3 here*]

Equation (1) was estimated using the dependent variable V_{ijk} constructed as an index of the weighted average price of the goods in the market basket by department. Prior authors have constructed price indexes for an entire basket (Cotterill, 1986; Macdonald and Nelson, 1991; Cotterill, 1999a; Woo, Huang, Epperson, and Cude, 2001; Yu and Connor, 2002) or use relative prices of products as a dependent variable (Wills and Mueller, 1989). However, Binkley and Connor (1998) have shown that fresh goods (fresh red meats, milk, and produce) are priced differently than packaged goods (products in the "dry grocery" and "health and beauty" departments). Thus, we chose to construct departmental price indexes to examine whether the price response to the presence of a Wal-Mart Supercenter differs by department. The indexes by department, store type, and brand, were constructed by weighting prices within a market basket by estimated annual average consumer expenditure on each good. Doing so allows for proper accounting of

the different nature of the market baskets as well as respects the patterns of consumption in the United States.

Departmental price indexes are given by:

$$V_{ijk} = \frac{\sum_{m=1}^{M_j} W_{mj} P_{mijk}}{\sum_{m=1}^{M_j} W_{mj} P_{mij1}} \cdot 100$$

where V_{ijk} is the weighted price index for the market basket composed of goods of brand i in department j of store k. It is constructed as the weighted average price of the M_j goods of brand i in department j of store k, divided by the same thing for store 1 (the reference store) and multiplied by 100. W_{mj} is the weight assigned to good m in department j and P_{mijk} is the price of good m of brand i in department j at store k. The weights for the various goods were determined by the following formula:

$$W_{mj} = \frac{\overline{P}_{mj} C_{mj}}{\sum_{m=1}^{M_j} \overline{P}_{mj} C_{mj}}$$

where $\overline{P}_{mj}$ is the average price of good m in department j across all 18 stores sampled for this study and C_{mj} is the estimated per capita annual consumption of good m in department j in the United States in the year 2003 as measured by the Economic Research Service of the USDA.[8] Thus, the weight W_{mj} is the expenditure on good m, which is part of the market basket of department j, relative to the total expenditure on all goods sampled in department j. The reference store is Wal-Mart Supercenter in Raynham, MA,

[8] Some products, such as pasta sauce and chocolate chip cookies, were too specific in nature and were not included in the ERS database. In those cases, data for broader product categories, such as tomatoes for processing and confectionary chocolate, were used. Other products, particularly those of the HBA department, were not available at all from the ERS. Approximate values of annual consumption obtained from the manufacturers' websites for these products were used.

for the national brand indexes and Wal-Mart Supercenter in Jewett City, CT, for the private label indexes. These stores were chosen because across departments they have the lowest average prices. Tables 4 and 5 provide descriptive statistics for the price indexes, by department, store type, and brand.

[Insert Tables 4 and 5 here]

Tables 4 and 5 show that across all departments Wal-Mart Supercenters have on average the lowest price index, followed by competing supermarkets and finally comparison supermarkets. The only exception to this pattern is the national brand meat department, where the competing supermarkets have a slightly higher price index on average.

The CV statistics also reveal another trend in the data.[9] For all of the departments, except for national brand frozen foods, the Supercenters exhibit the lowest relative variability in the price indexes. This is expected, given that Wal-Mart's EDLP pricing strategy is defined by applying the same markup to all products regardless of the price at which they were acquired (Vance and Scott, 1994). Moreover, the competing stores have the greatest relative variability in price indexes except for only two departments-national brand meat and private label groceries. This finding suggests that the presence of Wal-Mart Supercenters results in greater price variability among conventional competitors. Marion, Heimforth, and Bailey (1993) determined that large warehouse and discount stores would result in a reduction in the ability of conventional supermarkets to coordinate pricing strategies. Additionally, the empirical work of Khanna and Tice (2000) found that depending on various store characteristics, such as corporate debt,

[9] The coefficient of variation, also known as the relative variability, is calculated by dividing the standard deviation by the mean.

internal ownership, store size, and chain size, different stores choose to compete with Wal-Mart through different means. Stores choose to compete in price, in quality or service, or they choose not to change the manner in which they do business.

The ideal scenario for weighting prices would include data on store level expenditure patterns. Given the lack of publicly available data, the above calculation of these price indexes implies a number of assumptions. The ERS data is calculated on a national basis and thus these indexes assume that New England consumption patterns follow those of the United States as a whole. Additionally, these indexes assume that consumers shop equally at Supercenters, conventional competing and comparison supermarkets, and that the consumption pattern is the same across store type. Finally, the same consumption data are used for both national brand and private label goods, implying that consumers purchase national brands and private labels in equal amounts. This is a strong assumption based on previous findings that national brand goods exceed private labels in both sales and total quantity across all product categories (Raju and Dhar, 1991; Ward, Shimshack, Perloff, and Harris, 2002). In future work, other weighting schemes will be explored to examine the robustness of the results. Table 6 reports the descriptive statistics for the quantitative variables used in the regression models, pooled across all departments and store categories. The higher average value for the private label price indexes does not imply that the private label goods have higher average prices. This result reflects the fact that the private label indexes were standardized to lower values than the national brand indexes.

[Insert table 6 here]

The private label indexes have a higher CV than the national brand indexes. This may be a reflection of the heterogeneity of private label products across chains and the pricing strategies associated with them. This finding also supports the notion that stores have, on average, a greater influence on private label prices than on national brand prices (Bergès-Sennou, Bontems, and Réquillart, 2004).

IV. Results and Discussion

Equation (1) was estimated for market baskets composed of national brands and market baskets composed of private labels using ordinary least squares (OLS) regression. Each equation was also estimated with the dependent variable expressed as an index and in absolute value. The results are shown in table 7. All four models have high explanatory power, as seen by the model F-statistics and the adjusted R^2 values. Diagnostic tests revealed no multicollinearity or heteroskedastic errors.[10,11]

[*Insert table 7*]

The coefficients in the demographic and market condition variables all have their expected signs, with the exception of BH for national brand price indexes, which is not statistically significant. In terms of statistical significance, the demographic and market condition variables perform better for private label products than for the national brand products. All of the demographic and market condition variables are statistically significant in the private label model, while only income (*RICH*), store size (*SSIZE)* and concentration (*CONCENTRATED)* are significant for national brand goods. This pattern

[10] The variance inflation factors (VIFS) for each of the independent variables were below the collinear benchmark of 10.

[11] White's test was performed with homoskedasticity as the null hypothesis. For all four models we failed to reject the null hypothesis.

supports the findings that supermarkets have greater control over private label prices than over the national brand prices, which are largely set by manufacturers (Mills, 1995).

The departmental dummy variables are all statistically insignificant. This suggests that Wal-Mart Supercenters do not set prices in the departments included in the models different from the grocery department. This finding is supported by both the research on Wal-Mart's policy of applying the same price markups to all of its products (Vance and Scott, 1994) and the CV pattern of the data, which showed very little variation in prices among all Supercenter locations and all departments.

The coefficients on *COMPETE* and *COMPARE* are both positive and highly significant, meaning that both the competing and comparison stores set prices for products in the grocery department higher than do the Wal-Mart Supercenters. Recalling the mapping techniques presented in tables 1 and 2, the average expected values for the competing and comparison grocery department price indexes are given by $\beta_{N0}+\beta_{N6}$ and $\beta_{N0}+\beta_{N7}$ respectively for national brand products and $\beta_{P0}+\beta_{P6}$ and $\beta_{P0}+\beta_{P7}$ respectively for private label products. Therefore, the coefficients for *COMPETE* and *COMPARE* are the percentages by which the conventional store prices, on average, exceed Supercenter prices in the grocery department. For national brand goods, the competing stores price their goods 20.43% higher than Supercenters. The comparison stores' prices are 38.55% higher than Supercenters on average. Similarly, the prices of private label goods at competing stores are 21.30% higher than at Supercenters and they are 35.11% higher at comparison stores than at Supercenters.

The coefficients on *COMPARE* is smaller than the coefficients on *COMPETE* in both regression, which suggests that the prices of goods in the grocery department are lower,

on average in competing stores than comparison stores, holding all else constant. This indicates that the presence of Wal-Mart Supercenters decreases grocery prices. However, an F-test must be performed to assess the statistical significance of these differences for each department. We compute this test for all departments later on in this section.

Some of the interaction terms between the comparison store type and departments are statistically significant. The interaction terms are interpreted as differences in margins between store types. For example, in the national brand regression, the coefficient for *COMPAREMEAT* reveals that the margin between grocery price indexes and meat prices indexes for comparison stores is 24.9 index points smaller, on average, than the margin between grocery indexes and meat indexes for Supercenters. The coefficients for *COMPAREDAIRY* and *COMPAREHBA* are also statistically significant in the national brand model. Binkley and Connor (1998) found that conventional supermarkets price their perishables, such as meat and dairy products, differently from dry goods, which supports this finding. The fact that the HBA department is the only non-food department may account for the difference in pricing between comparison stores and Supercenters among HBA products.

COMPAREMEAT is the only significant interaction term in the private label model. In other words, it is only for the meat department that we find a statistically significant difference between Supercenters and conventional supermarkets in the pricing of goods by department, relative to the grocery department. The smaller number of significant interaction terms in the private label model, relative to the national brand model, suggests that the pricing among store categories is more constant for private label goods. The pricing strategy of the manufacturers and distributors that supply national brand goods to

supermarkets may be responsible for the greater number of differences among national brand departments for comparison supermarkets.

The interaction terms involving competing stores are insignificant in both models. This finding shows that the differences among departmental price indexes for competing supermarkets are not statistically different from the differences among departmental price indexes for Supercenters. Therefore, the results show that while comparison stores do not price all of their departments similarly, the competing stores do.

Using the mapping technique demonstrated in tables 1 and 2, tables 8 and 9 report the expected price index for each department and store type, holding all demographics and market conditions constant. Column (6) in the tables reports the estimated difference in the price indexes for the comparison supermarkets and those of the competing supermarkets. This estimated difference in supermarket prices is interpreted as the impact of Wal-Mart Supercenters on prices at conventional supermarkets. F-tests were performed to test for the statistical significance of Wal-Mart's estimated impact. For example, the test of significance for the impact of Wal-Mart on national brand dairy products had the null hypothesis H_0: $\beta_{N6}+\beta_{N8} = \beta_{N7}+\beta_{N13.}$

[*Insert tables 8 and 9 here*]

The estimated Wal-Mart effect is negative for all departments, except for the meat department, for both national brand and private labels. Supercenters result in decreased prices at nearby supermarkets, which is in accordance with our predictions. The statistically significant effects range from a 7% (national brand frozen food) to 16% (national brand dairy) decrease in price on average. While the effect of Supercenters is positive for the meat department, it is not statistically significant.

Looking at the estimated impact of Wal-Mart Supercenters on prices, we see that Supercenters have a significant effect on the grocery, dairy, and frozen food departments for both national brand and private label goods. Supercenters have no significant effect on the HBA, meat, and produce departments. For both brands, the greatest estimated impact of Supercenters is found in the dairy department, with competing price indexes being 15.83% lower on average for national brand goods and 11.11% lower on average for private label goods, relative to comparison stores. For national brand and private label, the estimated reduction in price indexes for grocery products is 13.10% and 10.20% respectively and 6.99% and 8.01% respectively for frozen food products. Woo, Huang, Epperson and Cude (2001) found that dairy was affected more strongly than most other departments by the entry of a Supercenter, which coincides with our results. However, our finding that Supercenters have no effect on meat prices is in contrast to their study.

Tables 8 and 9 show that for all departments and for both brand types, Wal-Mart Supercenters set prices significantly lower than both competing supermarkets and comparison supermarkets. Column (5) of the tables shows how the price indexes at Supercenters compare to those at supermarkets that do not compete directly with Wal-Mart.

For national brand goods, the greatest price index differences between Supercenters and comparison conventional stores are in the dairy, frozen food, and grocery departments on average. The smallest margin between Supercenters and conventional supermarkets is in the meat department. The margin of difference between Supercenter

prices and conventional stores ranges between 11% lower than produce at competing stores to 35% lower than dairy products at comparison stores.

For private label goods, the margin between Supercenters and conventional stores is high for all departments except for, again, the meat department. The price difference between Supercenters and conventional stores ranges from 13.23% lower for dairy products at competing stores to 25.94% lower for grocery products at comparison stores. The greatest price differences between Supercenters and conventional stores for private label goods are found in the grocery and HBA departments.

Table 10 lists departmental shares of sales as determined by (1999a). Using these values, we calculated the overall effect of Wal-Mart Supercenters on prices at conventional supermarkets. For both models, the effect was calculated using only statistically significant effects. The results are shown in table 11.

[*Insert table 10 and 11here*]

Wal-Mart Supercenters result in a statistically significant 7.79% overall reduction in price indexes for national brand goods and a 6.38% reduction in private label price indexes. Therefore the presence of Wal-Mart Supercenters results in a decrease in the national brand/private label margin in competing supermarkets. This effect may be due to the fact that Wal-Mart Supercenters practice the EDLP strategy. This pricing has been found to increase private label proliferation within all supermarket product categories (Dhar and Hoch, 1997). Prior work on the national brand/private label margin has found that as private label proliferation increases, the private label prices increase relative to national brand prices, thereby narrowing the margin between brands (Mills, 1995; Ward, Shimshack, Perloff and Harris, 2002).

This study also seeks to determine the relationship between Supercenter and conventional supermarket prices. Using the departmental shares of sales as weights, we calculated the overall price difference between Wal-Mart Supercenters and both competing and comparison supermarkets. The results are compiled in table 12.

[*Insert table 12 here*]

The weighted mean of the price indexes at Wal-Mart Supercenters is significantly lower than the equivalent measure at both types of conventional supermarkets and for both brands. The percentage difference between conventional store prices and Supercenter prices ranges from 14.37% for private label products at competing stores to 25.19% for national brand comparison stores. Both types of conventional supermarkets set their private label prices, on average, closer to the prices of Wal-Mart Supercenters.

The Effect of Wal-Mart Supercenters on Consumers

Before the widespread expansion of Wal-Mart Supercenters across the United States, Marion, Heimforth, and Bailey (1993) predicted that depot stores would greatly reduce the prices paid by consumers in two ways. Depot stores, more commonly referred to in the literature as warehouse stores, are minimal service, low-cost grocery retailing outlets. According to the authors, warehouse stores would be able to offer grocery products at prices substantially lower than those found at incumbent supermarkets. Additionally, the authors predicted that supermarkets would likely reduce their prices in order to compete with warehouse stores. MacDonald and Nelson (1991) determined that supermarkets in cities without warehouse stores have grocery prices that are 4.5% higher, on average, than prices found at supermarkets within five miles of warehouse stores. Cotterill (1999b) found that supermarkets competing with warehouse stores price their groceries 2.66%

lower, on average, than supermarkets not competing with warehouse stores. He also determined that warehouse store prices are on average 8.8% lower than supermarket prices.

Our findings demonstrate both a greater impact on conventional supermarket prices and a greater margin between Supercenters and supermarket prices in New England. After holding constant the most important factors in determining supermarket prices as discussed by a wide survey of the literature: concentration, population density, and the quality of the goods sampled, we found that Supercenters result in a 7.79% overall price decrease for national brand goods. The equivalent price decrease for private label goods is 6.38%. The warehouse store category includes wholesale outlets, which require club memberships, as well as warehouse efforts by conventional grocery chains such as A&P and hyperstores such Wal-Mart Supercenters, which combine food and nonfood stores under the same roof (Marion, Heimforth, and Bailey, 1993). While the aforementioned studies examined the impact of the entire category of warehouse stores, our work focuses on a single variety of warehouse store. Our findings show that the presence of Wal-Mart Supercenters yields a greater reduction in food prices at conventional supermarkets than does the presence of other varieties of warehouse stores. Given that no membership is required to shop at Supercenters, the greater reduction in prices than found in other studies makes sense. Membership would have for effect to limit the impact of a warehouse on its supermarket competitors.

The consumer who is able to choose between shopping at supermarkets within five miles of a Supercenter or supermarkets more than five miles from the nearest Supercenter will save money by choosing the supermarket in competition with a Supercenter. This is

particularly true if the consumer is shopping in the grocery, dairy, and frozen food departments, which together comprise over 61% of the purchases made by consumers (Cotterill 1999a).

Far greater than the price margin between competing and comparison stores as a result of the presence of a Supercenter is the margin between the Supercenters themselves and conventional food retailers. Holding everything constant, Supercenters' prices are nearly 17% less than the prices of their nearby competitors for national brand goods and more than 14% less for private label goods. When compared to supermarkets geographically distant, this margin grows even wider. While there are many factors that consumers consider when choosing a supermarket (Palma, Emerson, and House, 2003), price sensitive consumers have a significant incentive to choose Wal-Mart Supercenters over conventional stores.

The Effect of Wal-Mart Supercenters on Competitors

The CV pattern in the price indexes suggests that Wal-Mart results in greater price variation among supermarkets with which it competes. Due to the cross-sectional nature of the data it is not possible to know with certainty if Supercenters reduce the ability of supermarkets to coordinate prices and promotional activities, as suggested by Marion, Heimforth, and Bailey (1993). However, the increased price index variation among competing supermarkets supports the notion that not all incumbent stores choose the same strategy in competition with Wal-Mart. Cotterill (1999b) determined that some supermarkets compete with large warehouse and discount stores by differentiating their product line rather than lowering prices, which is a possible explanation for increased price index variation.

Additionally, several of the supermarkets sampled for this study that were competing with Supercenters were recently renovated, with features such as gasoline stations, coffee shops, and bookstores. The Stop n' Shop supermarkets competing with Supercenters advertised "Everyday Low Prices" despite the fact that the chain still utilizes HLP (Jones, 2004). These observations support the findings of Khanna and Tice (2000), stating that some incumbent stores choose to compete with Wal-Mart by improving service, image, or variety rather than attempting to lower prices to match the discount giant. If conventional supermarkets chose to compete with Supercenters solely in price, we would expect the prices at competing stores to exhibit a CV pattern that more closely resembles that of the comparison stores. Moreover, the regression results would show a greater impact of the Supercenters on prices at conventional supermarkets.

Mills (1995) argues that a major reason supermarkets offer private labels is because of their profitability. Supermarkets obtain higher markups on private labels than on national brand goods, even though they are sold at lower prices than national brands. Given that we found a 7.79% percentage decrease in national brand prices and a 6.38% decrease in private label prices at competing supermarkets, it follows that supermarkets competing with Wal-Mart Supercenters rely on private labels for a greater share of their profit than do comparison supermarkets.

V. Conclusion

The primary objective of this study was to examine the effect of Wal-Mart Supercenters on the prices at conventional supermarkets in New England. This effect was examined with regards to the six major supermarket departments as well as both national brand and

private label goods. The secondary goals of this study included the examination of Wal-Mart's food prices in comparison to conventional supermarket prices.

This paper provides insight into questions regarding Wal-Mart Supercenters that are being asked more and more frequently in the United States as the firm continually announces its plans to erect more stores. It also provides several implications for further research.

The primary findings of this study are as follows:

1) Wal-Mart Supercenters result in a price decrease 7.79% for national brand goods at conventional supermarkets competing within a radius of five miles. The corresponding decrease in private label goods is 6.38%. Given that national brand goods are more expensive, Supercenters result in a decrease in the national brand/private label price margin.

2) Wal-Mart Supercenters result in the greatest price decreases in the grocery and dairy departments in conventional stores. There is also a smaller and statistically significant effect on frozen food prices. Supercenters have no significant effect on the HBA, meat, or produce departments.

3) Holding constant the market concentration, as measured by the number of large competitors within five miles and the distance among competitors, Wal-Mart Supercenters price their national brand and private label products significantly lower than conventional supermarkets. However, there is a greater difference between supermarkets and Supercenters in national brand prices than in private label prices.

In terms of further research, the observed CV pattern in the data calls for an exploration of the strategic efforts in areas other than pricing employed by supermarkets

to compete with Wal-Mart Supercenters as well as the effectiveness of each strategy. Capps and Griffin (1998) found that Supercenters result in the loss of sales among competing supermarkets and this study found significant reductions in prices among competitors. These findings do not bode well for U.S. supermarkets operating in areas soon to be inhabited by new Supercenters. More research is needed on the short-run and long-run price and non-price response of supermarkets to the entry of Wal-Mart Supercenters. Such research would enable a better understanding of the profitability and viability of the supermarket industry in the face of the rapid proliferation of Wal-Mart Supercenters.

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Appendix A: The Selection Criteria for the Supermarkets

In this appendix we present the 12 cities and towns visited in order to gather the price data, as well as the food retailers within each city. The cities are listed in pairs, with each pair consisting of a city containing a Wal-Mart Supercenter and a city geographically distant from any Supercenters. Each pair is followed by a brief explanation for the choices made.

Pair 1	
A) North Windham CT Population: 38,680 Median Household Income: $30,155	
Stores	Store Size
Wal-Mart Supercenter 474 Boston Rd. Months in operation: 84	55,000
Super Stop n' Shop 1391 Main St. Hwy 32	41,000
Other Store not Chosen	
Shaw's Supermarket	36,000
B) Vernon-Rockville CT Population: 35,771 Median Household Income: $44,510	
Store	Store Size
Super Stop n' Shop 10 Pitkin Rd.	37,000
Other store not chosen	
Shaw's Supermarket	60,000

Vernon-Rockville has a higher population and median household income than North Windham/Willimantic in both population and median household income. However, the other viable comparison in this case was Manchester, CT, which has higher population and median income than does Vernon Rockville as well as five large competing supermarkets. The Stop n' Shop stores were chosen for comparison because they are much closer to each other in size than the stores of Shaw's chain. The Stop n'

Shop store in Vernon featured a newly constructed gas station in the parking lot and was under renovation both inside and outside of the store.

Pair 2	
A) Westerly, RI Population: 22,966 Median Household Income: $44,613	
Stores	Store Size (sq. ft.)
Wal-Mart Supercenter 258 Post Rd. Months in operation: 20	57,000
Super Stop n' Shop 2 Post Rd.	47,000
Other stores not chosen	
Shaw's Supermarket McQuade's Marketplace	39,000 23,000
B) Seekonk, MA Population: 13,425 Median Household Income: $56,364	
Store	Store Size
Super Stop n' Shop 125 Highland Ave.	51,000
Other stores not chosen	
Price Rite Ro Jack's Foodstore	24,000 21,000

A city or town containing a Super Stop n' Shop was required to compare with the Westerly, RI Super Stop n' Shop. There was no location in Rhode Island that was comparable to Westerly in terms of demographics or the number of competing supermarkets. Therefore, we chose the town of Seekonk, which is located just across the border of Rhode Island in Massachusetts and has both large and small supermarkets, as does Westerly. The Stop n' Shop store in Westerly advertised "Everyday Low Prices".

Pair 3	
A) Jewett City, CT Population: 3,053 Median Household Income: $45,826	
Stores	Store Size
Wal-Mart Supercenter 180 River Rd. Months in operation: 45	63,000
Better Valu IGA 99 River Rd.	22,000
B) Plainfield, CT Population: 14,619 Median Household Income: $42,851	
Store	Store Size
Better Valu IGA 657 Norwich Rd. and Hwy 12	15,000
Other stores not chosen	
Big Y Supermarket	45,000

Because a Better Valu IGA store was necessary for comparison and because duplicating cities used for comparison is not ideal, only two options were available. Both were problematic. Plainfield is within 10 miles of the Jewett City Supercenter and the Better Valu IGA of Voluntown has a geographic monopoly. Plainfield was chosen because like Jewett City, this town has a Better Valu IGA competing with a much larger store. Moreover, the Better Valu IGA of Voluntown is only 6,000 square feet in size, making it too small to be considered a supermarket. The IGA store in Jewett City is considerably larger and newer than the Plainfield store.

Pair 4	
A) Ware, MA Population: 9,707 Median Household Income: $36,875	
Stores	Store Size
Wal-Mart Supercenter 352 Palmer Rd. Months in operation: 103	55,000
Big Y Supermarket 140 West St.	29,000
B) Stafford Springs, CT Population: 11,307 Median Household Income: $52,699	
Store	Store Size
Big Y Supermarket 87 W. Stafford Rd. Hwy 190	35,000
Other store not chosen	
Stafford Food Center	17,000

The town of Belchertown, MA, was the most attractive choice for comparison with Ware due to its similar demographics. However, the town does not have a Big Y Supermarket and it lies only five miles away from Ware. We settled on Stafford Springs, which is fairly similar to Ware in terms of market conditions and population size but differs greatly in terms of income. Stafford Springs, Connecticut is located near the southern border of Massachusetts.

Pair 5	
A) Waterford, CT Population: 19, 152 Median Household Income: $56,047	
Stores	Store Size
Wal-Mart Supercenter 155 Waterford Pkwy N. Months in operation: 20	66,000
Super Stop n' Shop 117 Boston Post Rd. Hwy 1	50,000
Other store not chosen	
Big Y Supermarket	52,000
B) Fairhaven, MA Population: 16,159 Median Household Income: $41,696	
Store	Store Size
Super Stop n' Shop 221 Huttleson Ave.	60,000
Other store not chosen	
Shaw's Supermarket	42,000

Despite the geographic distance of 90 miles between the two cities, Fairhaven appears to be the best choice for comparison. Norwich, CT, was considered as an alternate location. However, its population doubles that of Waterford and there are too many supermarkets in Norwich to make for a reasonable comparison. Fairhaven shares several characteristics with Waterford. Both towns have small populations with relatively higher median incomes and both are located near the coast. The coastal location may attract tourists in addition to residents as customers. Additionally, both are located within 10 miles of much larger cities. Waterford lies next to New London, CT, while Fairhaven borders New Bedford, MA. Neither New London nor New Bedford has a Supercenter. The Waterford Stop n' Shop featured a newly constructed Office Depot as a part of the

store and advertised its new renovations and improvements throughout the exterior windows.

Pair 6	
A) Raynham, MA Population: 11,739 Median Household Income: $64,464	
Stores	Store Size
Wal-Mart Supercenter 36 Paramount Dr. Months in operation: 35	67,000
Super Stop n' Shop 36 New St. Hwy	67,000
Other stores not chosen	
Market Basket Shaw's Supermarket	54,000 34,000
B) Attleboro, MA Population: 42,068 Median Household Income: $50,807	
Store	Store Size
Stop n' Shop 469 Perry and Pleasant St.	60,000
Other stores not chosen	
Ro Jack's (a) Ro Jack's (b) Shaw's Supermarket	30,000 23,000 36,000

The population disparity between Raynham and Attleboro makes this comparison appear dubious. However, the four large supermarkets of Raynham may also serve several surrounding towns such as Prattville that have no supermarkets. The Raynham Supercenter probably also draws customers from the neighboring city of Taunton, which does not have a Supercenter. Thus, the actual population serviced by the Raynham Supercenter is larger than 11,739. While the Shaw's supermarkets of these areas were closer in size than the Stop n' Shop stores, decided to use the Stop n' Shops because they are closer in size to the Wal-Mart stores and because Stop n' Shop has largest market

share in New England among supermarkets. The work of Woo, Huang, Epperson and Cude (2001) showed that stores with the highest markets share changed their prices by the greatest margins following the entry of a Wal-Mart Supercenter.

Appendix B: The basket of goods selected

Product	*Department*	*Average Price ($)*
Coca-Cola 2-Liter	Grocery	1.38
PL Cola 2-Liter	Grocery	0.66
Maxwell House Coffee (13 oz.)	Grocery	2.49
PL Coffee (13 oz.)	Grocery	2.03
Bumble Bee Tuna (6 oz.)	Grocery	1.38
PL Tuna (6 oz.)	Grocery	1.17
Cheerios (15 oz.)	Grocery	3.15
PL O-Shaped Cereal (15 oz.)	Grocery	2.02
Lays Potato Chips (12 oz.)	Grocery	2.66
PL Potato Chips (12 oz.)	Grocery	1.77
Kraft Mac n' Cheese (7.25 oz.)	Grocery	0.97
PL Mac n' Cheese (7.25 oz.)	Grocery	0.44
Prego Pasta Sauce (26 oz.)	Grocery	2.00
PL Pasta Sauce (26 oz.)	Grocery	1.29
Jif Creamy Peanut Butter (28 oz.)	Grocery	3.11
PL Creamy Peanut Butter (28 oz.)	Grocery	2.49
Del Monte Sliced Peaches (15.25 oz.)	Grocery	1.25
PL Sliced Peaches (15.25 oz.)	Grocery	0.99
Nabisco Chips Ahoy (16 oz.)	Grocery	3.21
PL Chocolate Chip Cookies (16 oz.)	Grocery	1.92
Heinz Ketchup (24 oz.)	Grocery	1.65
PL Ketchup (24 oz.)	Grocery	1.07
Bisquik Pancake Mix (40 oz.)	Grocery	2.72
PL Pancake Mix (40 oz.)	Grocery	1.79
Hood Milk 1% Milk (gallon)	Dairy	3.51
PL 1% Milk (gallon)	Dairy	2.94
Kraft American Singles (16 ct.)	Dairy	2.87
PL American Singles (16 ct.)	Dairy	2.47
Land o' Lakes Butter (1 lb.)	Dairy	4.03
PL Butter (1 lb.)	Dairy	3.08
Breyers Vanilla Ice Cream (1/2 gal.)	Frozen Food	4.70
PL Vanilla Ice Cream (1/2 gal.)	Frozen Food	3.41
Eggo Homestyle Waffles (10 ct.)	Frozen Food	1.85
PL Homestyle Waffles (10 ct.)	Frozen Food	1.28
Birdseye Frozen Broccoli (10 oz.)	Frozen Food	1.14
PL Frozen Broccoli (10 oz.)	Frozen Food	0.89
Q-Tips Cotton Swabs (500 ct.)	HBA	3.57
PL Cotton Swabs (500 ct.)	HBA	2.73
Dial Anti-Bacterial Soap (3 ct.)	HBA	2.06
PL Anti-Bacterial Soap (3 ct.)	HBA	1.58
Edge Shaving Gel (7 oz.)	HBA	2.65
PL Shaving Gel (7 oz.)	HBA	1.92

Appendix B: The basket of goods, continued.

Purdue Chicken Drumsticks (1 lb.)	Meat	1.62
PL Chicken Drumsticks (1 lb.)	Meat	1.29
Perri Italian Sausage (1 lb.)	Meat	3.40
PL Italian Sausage (1 lb.)	Meat	2.96
Oscar Meyer Bacon (1 lb.)	Meat	4.98
PL Bacon (1 lb.)	Meat	3.29
Red Delicious Apples (1 lb.)	Produce	3.38
Red Potatoes (1 lb.)	Produce	1.24
Carrots (1 lb.)	Produce	0.83
Lettuce Head (head)	Produce	1.30
Bananas (1 lb.)	Produce	0.55
Celery (1 lb.)	Produce	1.57

Note: PL = private label

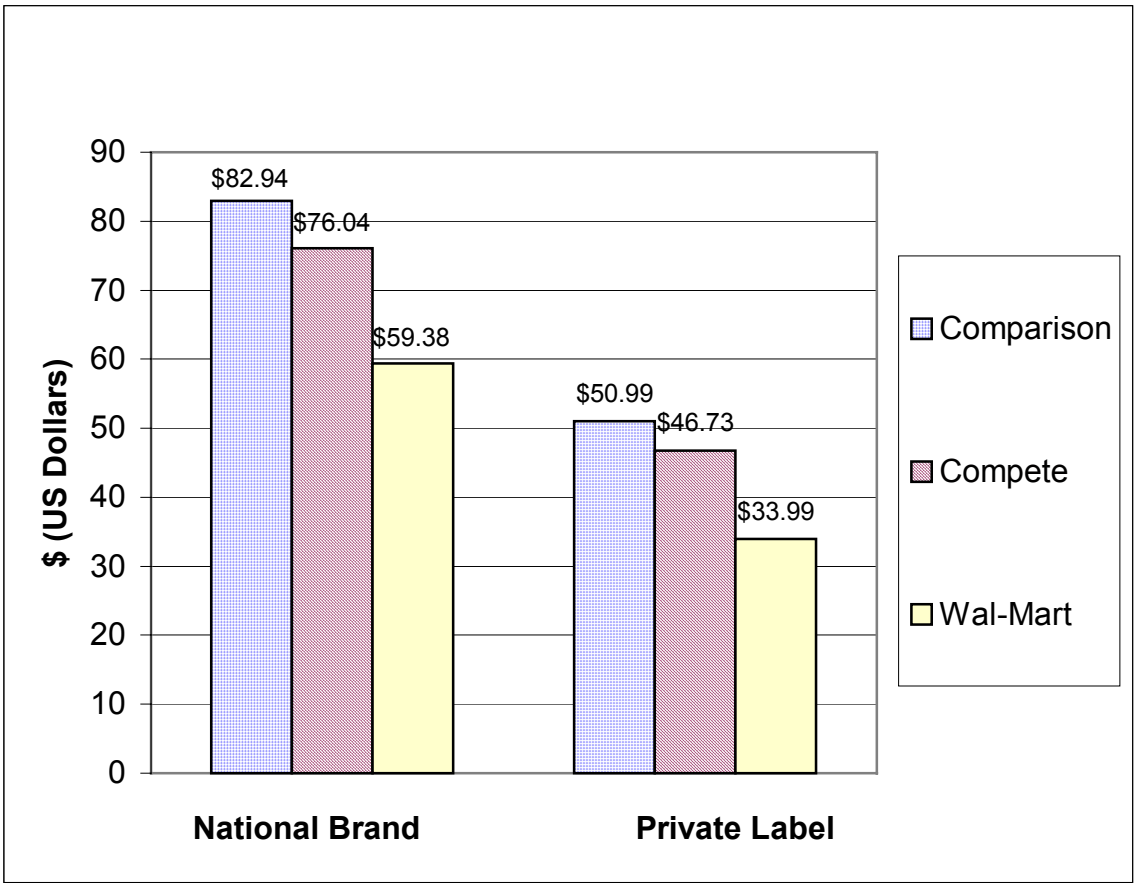

Figure 1: Average price of the market basket (54 goods), by store category**Table 1: Mapping of coefficients to obtain the average expected values of market baskets by department and store category for national brand goods**

	Wal-Mart	*Competing Stores*	*Comparison Stores*
Grocery	β_{N0}	$\beta_{N0} + \beta_{N6}$	$\beta_{N0} + \beta_{N7}$
Dairy	$\beta_{N0} + \beta_{N1}$	$\beta_{N0} + \beta_{N1} + \beta_{N6} + \beta_{N8}$	$\beta_{N0} + \beta_{N1} + \beta_{N7} + \beta_{N13}$
Frozen	$\beta_{N0} + \beta_{N2}$	$\beta_{N0} + \beta_{N2} + \beta_{N6} + \beta_{N9}$	$\beta_{N0} + \beta_{N2} + \beta_{N7} + \beta_{N14}$
HBA	$\beta_{N0} + \beta_{N3}$	$\beta_{N0} + \beta_{N3} + \beta_{N6} + \beta_{N10}$	$\beta_{N0} + \beta_{N3} + \beta_{N7} + \beta_{N15}$
Meat	$\beta_{N0} + \beta_{N4}$	$\beta_{N0} + \beta_{N4} + \beta_{N6} + \beta_{N11}$	$\beta_{N0} + \beta_{N4} + \beta_{N7} + \beta_{N16}$
Produce	$\beta_{N0} + \beta_{N5}$	$\beta_{N0} + \beta_{N5} + \beta_{N6} + \beta_{N12}$	$\beta_{N0} + \beta_{N5} + \beta_{N7} + \beta_{N17}$

Table 2: Mapping of the coefficients to obtain the average expected values of market baskets by department and store category for private label goods

	Wal-Mart	*Competing Stores*	*Comparison Stores*
Grocery	β_{P0}	$\beta_{P0} + \beta_{P6}$	$\beta_{P0} + \beta_{P7}$
Dairy	$\beta_{P0} + \beta_{P1}$	$\beta_{P0} + \beta_{P1} + \beta_{P6} + \beta_{P8}$	$\beta_{P0} + \beta_{P1} + \beta_{P7} + \beta_{P13}$
Frozen	$\beta_{P0} + \beta_{P2}$	$\beta_{P0} + \beta_{P2} + \beta_{P6} + \beta_{P9}$	$\beta_{P0} + \beta_{P2} + \beta_{P7} + \beta_{P14}$
HBA	$\beta_{P0} + \beta_{P3}$	$\beta_{P0} + \beta_{P3} + \beta_{P6} + \beta_{P10}$	$\beta_{P0} + \beta_{P3} + \beta_{P7} + \beta_{P15}$
Meat	$\beta_{P0} + \beta_{P4}$	$\beta_{P0} + \beta_{P4} + \beta_{P6} + \beta_{P11}$	$\beta_{P0} + \beta_{P4} + \beta_{P7} + \beta_{P16}$

Table 3: Variables used in the models

Variable	*Description*	*Expected Sign*
DAIRY	Dummy equal to 1 for the dairy department.	-
FROZEN	Dummy equal to 1 for the frozen food department.	-
HBA	Dummy equal to 1 for the health and beauty aids department.	-
MEAT	Dummy equal to 1 for the dairy department.	-
PRODUCE	Dummy equal to 1 for the dairy department.	-
COMPETE	Dummy equal to 1 for stores within 5 miles of a Supercenter	+
COMPARE	Dummy equal to 1 for stores more than 5 miles from a Supercenter	+
COMPETEDAIRY	Interaction term equal to 1 for competing stores and the dairy department	+/-
COMPETEFROZ	Interaction term equal to 1 for competing stores and the frozen food department	+/-
COMPETEHBA	Interaction term equal to 1 for competing stores and the HBA department	+/-
COMPETEMEAT	Interaction term equal to 1 for competing stores and the meat department	+/-
COMPETEPROD	Interaction term equal to 1 for competing stores and the produce department	+/-
COMPDAIRY	Interaction term equal to 1 for comparison stores and the dairy department	> COMPETEDAIRY
COMPFROZ	Interaction term equal to 1 for comparison stores and the frozen food department	> COMPETEFROZ
COMPHBA	Interaction term equal to 1 for comparison stores and the HBA department	> COMPETEHBA
COMPMEAT	Interaction term equal to 1 for comparison stores and the meat department	> COMPETEMEAT
COMPPROD	Interaction term equal to 1 for comparison stores and the produce department	> COMPETEPROD
RICH	Dummy variable equal to one if the town of the department has a median household income greater that $45,575.	+
POPDENSITY	The population density, equal to the population of the city or town divided by the land area in square miles.	_
DTLC	Distance in miles to the nearest competitor with over 45,000 sq. ft. of floor space.	+
SSIZE	Store size, in thousands of square feet.	-
CONCENTRATED	Dummy variable equal to one if there are more than three supermarkets competing within a five-mile radius.	-
BH	The percentage of black and hispanic people living in the city or town of the department.	-

Table 4: Summary statistics for national brand price indexes.

		Grocery	*Dairy*	*Frozen Food*	*HBA*	*Meat*	*Produce*
Mean	Supercenters	102.69	99.95	108.68	98.00	100.49	98.91
	Compete	128.60	135.06	146.39	122.11	127.28	127.62
	Compare	151.41	164.12	160.69	128.56	124.35	138.77
Standard Deviation	Supercenters	1.60	0.03	13.47	5.60	0.75	5.44
	Compete	14.96	19.70	18,64	10.37	0.93	20.77
	Compare	5.17	5.43	14.07	9.89	6.48	13.06
CV	Supercenters	1.56%	0.03%	12.39%	5.72%	0.75%	5.50%
	Compete	11.63%	14.59%	12.74%	8.49%	0.73%	16.27%
	Compare	3.41%	3.31%	8.75%	7.69%	5.21%	9.41%

Table 5: Summary statistics for private label price indexes

		Grocery	*Dairy*	*Frozen Food*	*HBA*	*Meat*
Mean	Supercenters	100.79	99.76	98.93	100.00	98.98
	Compete	140.41	131.46	136.20	152.38	132.55
	Compare	163.87	155.58	155.10	158.94	133.29
Standard Deviation	Supercenters	0.40	0.33	1.73	0.00	6.62
	Compete	11.47	20.56	34.30	18.74	16.64
	Compare	17.22	14.19	27.00	17.59	15.06
CV	Supercenters	0.40%	0.33%	1.74%	0.00%	6.75%
	Compete	8.17%	15.64%	25.198%	12.30%	12.55%
	Compare	10.51%	9.12%	17.42%	11.07%	11.30%

Table 6: Summary statistics for the quantitative variable of the regression models

		V	*SSize*	*DTLC*	*PopDens*	*BH*
Mean	Model (1)	125.75	48.72	2.59	1875	6.56
	Model (2)	130.48	48.72	2.59	1875	6.56
Standard Deviation	Model (1)	23.23	15.37	2.20	2989	9.17
	Model (2)	28.53	15.37	2.20	2989	9.17
Coefficient of Variation	Model (1)	18.51%	31.56%	85.24%	159.42%	139.91%
	Model (2)	21.86%	31.56%	85.24%	159.42%	139.91%

Table 7: Regression results, standard errors are in parentheses

	(1) *National Brand Price Indexes*	(2) *Private Label Price Indexes*
Intercept	109.113***	129.109***
	(7.258)	(9.268)
DAIRY	-2.920	-1.032
	(6.134)	(7.374)
FROZEN	5.989	-1.863
	(6.134)	(7.374)
HBA	-4.689	-0.792
	(6.134)	(7.374)
MEAT	-2.205	-2.816
	(6.134)	(7.374)
PRODUCE	-3.785	
	(6.134)	
COMPETE	22.294***	27.503***
	(6.414)	(7.776)
COMPARE	42.074***	45.330***
	(6.455)	(7.834)
COMPETEDAIRY	9.385	-7.919
	(8.675)	(10.428)
COMPETEFROZ	11.802	-2.338
	(8.675)	(10.428)
COMPETEHBA	-1.804	12.761
	(8.675)	(10.428)
COMPETEMEAT	0.888	-5.043
	(8.675)	(10.428)
COMPETEPROD	2.810	
	(8.675)	
COMPAREDAIRY	15.541*	-7.261
	(8.675)	(10.428)
COMPAREFROZ	3.245	-6.877
	(8.675)	(10.428)
COMPAREHBA	-18.207**	-4.142
	(8.675)	(10.428)
COMPAREMEAT	-24.900***	-27.771***
	(8.675)	(10.428)
COMPAREPROD	-8.894	
	(8.675)	
RICH	5.880**	14.458***
	(2.778)	(3.658)
POPDENS	-0.458	-1.196**
	(0.475)	(0.626)
DTLC	0.605	2.227***
	(0.642)	(0.732)
SSIZE	-0.202*	-0.891***
	(0.1)	(0.200)
CONCENTRATED	7.357**	10.623**
	(3.407)	(4.487)
BH	0.005	-0.113
	(0.148)	(0.194)
F	18.58	18.75
Adjusted R^2	.791	.800

***: Significant at the .01 level **: Significant at the .05 level *: Significant at the .10 level

Table 8: Expected Price Indexes for Departments, National Brand goods, model (1)

	(1): Wal-Mart Supercenters	*(2):Compete Stores*	*(3): Comparison Stores*	*(4): (1) – (2) % difference*	*(5):(1) – (3) % difference*	*(6):(2) – (3) % difference*
Grocery	109.11	131.25	151.03	-16.98***	-27.86***	-13.10***
Dairy	106.04	137.75	163.65	-23.02***	-35.20***	-15.83***
Frozen Food	114.95	149.04	160.25	-22.87***	-28.27***	-6.99*
HBA	104.27	124.76	128.14	-16.42***	-18.63***	-2.64
Meat	106.76	129.93	123.93	-17.83***	-13.86***	4.84
Produce	105.16	118.58	138.36	-11.32***	-23.99***	-14.29

***: Difference is significant at the .01 level **: Significant at the .05 level *: Significant at the .10 level

Table 9: Expected Price Indexes for Departments, Private Label goods, model (2)

	(1): Wal-Mart Supercenters	*(2):Compete Stores*	*(3): Comparison Stores*	*(4): (1) – (2) % difference*	*(6):(1) – (3) % difference*	*(5):(2) – (3) % difference*
Grocery	129.11	156.93	174.76	-17.52***	-25.94***	-10.20**
Dairy	128.40	147.98	166.47	-13.23***	-22.87***	-11.11**
Frozen Food	127.57	152.73	166.02	-16.47***	-23.16***	-8.01*
HBA	128.64	168.90	169.83	-23.84***	-25.54***	-0.55
Meat	126.61	149.07	144.17	-15.07***	-12.18***	3.40

***: Difference is significant at the .01 level **: Significant at the .05 level *: Significant at the .10 level

Table 10: Departmental shares of sales

Department	*Share of Sales*
Grocery	46.07%
Dairy	7.99%
Frozen Food	7.05%
HBA	5.77%
Meat	14.52%
Produce	18.61%

Source: Cotterill (1999a)

Table 11: The overall effect of Wal-Mart on supermarket products

Method	*(1) National Brand Price Indexes*	*(2) Private Label Price Indexes*
Using only statistically significant effects	-7.79%**	-6.38%**

***: Effect is significant at the .01 level. **: Effect is significant at the .05 level.

Table 12: The estimate overall price difference between Supercenters and supermarkets

Supermarket Category	*(1) National Brand Price Indexes*	*(2) Private Label Price Indexes*
Compete	-16.92%***	-14.37%***
Comparison	-25.19%***	-19.36%***

***: Difference is significant at the .01 level.