Have Wal-Mart Supercenters Slowed the Rate of "Inflation"? The Effect of Wal-Mart Entry into Local Grocery Markets on the Consumer Price Index

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Abstract:

This paper analyzes the price-index effect caused by the entrance of a well-known big box retailer into urban grocery retailing markets. We investigate the impact of entry by Wal-Mart Supercenters on the food-at-home component of the consumer price index (FAH-CPI) in urban grocery markets. The first Wal-Mart Supercenter opened in 1988 in Washington, Missouri, marking the entry of Wal-Mart into food retailing. Wal-Mart's initial expansion into grocery was slow at first, with only 30 Supercenters by 1993. But it quickly rose to become the leading food retailer in the U.S., overtaking the Kroger Co. in 2003.

The impact of Wal-Mart's entry into grocery markets can be easily seen. Taking the food-at-home component of the CPI across urban markets for the year of Wal-Mart Supercenter entry, 1988, and the end of the time period studied, 2005, one can calculate average price increases in markets where Wal-Mart has entered and not entered, and then compare the changes to get a "snap-shot" of the Wal-Mart Supercenter effect on prices. In markets where Wal-Mart has more than 5% share, more than 10% share, more than 15% share, and more than 20% share the percentage price increase is 5.4% less, 7% less, 10.4% less, and 15.6% less than markets where Wal-Mart Supercenters have not entered.

In addition to estimating long-run market responses to Wal-Mart entry, we take advantage of the sampling procedure used to construct the food-at-home component of the CPI to test for a short-run price response from incumbent firms when a Supercenter enters a food retailing market. When a Supercenter opens in a new retail grocery market, then only as expenditures at that store increase does it begin to be included in the store sample rotation and the CPI begin to reflect price changes of Wal-Mart Supercenters. So, initially CPI prices in food retailing markets where Wal-Mart Supercenters enter represent incumbent price responses only. Over time, the CPI price index will reflect both the incumbent price response and the lower prices offered at Wal-Mart Supercenters.

We were able to download Supercenter opening dates originally from Wal-Mart's website, however, Wal-Mart removed the file from their website. The original file lists every Wal-Mart store opening date up to January of 2006 as well as individual store number, street address, city, state, zip code, and store type. Given the nature of our data on MSAs over time, panel-data techniques can be employed to estimate the effect that Wal-Mart Supercenters have on the food-at-home component of the CPI. This allows us to utilize both the variation of Wal-Mart supercenter growth over time within an MSA and the variation of Wal-Mart supercenter growth across MSAs to estimate the effects on price of Wal-Mart entry into retail grocery markets.

Results found using both a baseline empirical model that does not include lagged values of the FAH-CPI and a dynamic panel model that does include lagged values of the FAH-CPI provide strong evidence that Wal-Mart Supercenter entry and growth has a negative effect on the annual food-at-home price index for the twenty-four MSAs and CMSAs collected by the BLS. The marginal impact of a new Wal-Mart Supercenter is a reduction in the annual FAH-CPI in the range of -0.13% to -0.27% across all model specifications and estimation techniques used. Twenty-three of the twenty-four MSAs and CMSAs experienced Wal-Mart Supercenter entry and all of these markets experienced an increase in the number of Supercenters during the 1988-2005 sample period. The total number of Supercenters that entered these markets was 279 stores, which represents an average increase of 12.13 stores per market. Multiplying this average increase by the marginal effect of an additional Supercenter yields a FAH-CPI reduction of anywhere from 1.58% to 3.28% for the average market over the post-entry period, depending on the model specification and estimation technique used.

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INTRODUCTION

The main player in the restructuring of grocery retailing over the last two decades has been Wal-Mart Supercenters, which offer a full line of grocery products as well as the products offered in their discount stores. This "one-stop-shopping" experience has provided a new choice regarding grocery shopping that has appealed to consumers looking to reduce their retail search costs and reduce the price they pay for groceries. The effect that Wal-Mart Supercenters has had on the structure of grocery retailing is astonishing, both in terms of incumbent firms exiting certain markets and the growth of the "national-chain" food retailing firm format.

Anecdotal evidence that supports the exit claim on a national market level scale is Winn-Dixie filing bankruptcy in 2005, and on the local market level scale are "mom and pop" stores going out of business (Jia, 2008). The last decade or so has seen an increase in the rise of supermarkets filing bankruptcies, and Wal-Mart is thought to have been *the cause* of many of these bankruptcies (Callahan and Zimmerman, 2003). Decline in Winn-Dixie's urban market share over the time period 1988 – 2005 supports this claim. In 1988, Winn-Dixie held 2.5% urban market share across the urban markets studied, while in 2005, Winn-Dixie held only 0.006% market share. The Atlantic and Pacific Tea Company held 3.8% urban market share in 1988 and this number declined to 0.06% in 2005. Evidence of the growth of the "national chain" format is supported by Kroger's urban market share rising from 3.8% in 1988 to 11.5% in 2005, Albertson's urban market share rising from 1.3% to 8.5%, and Safeway's urban market share rising from 5.7% to 8.1%.

Wal-Mart has been slow to enter urban markets to date, but with the rise to dominance in rural environments, it can be argued that this led some incumbent firms to react to urban market entry by making substantial investments via mergers and/or acquisitions in markets across the U.S. in order to compete with the scale and efficiency of Wal-Mart's distribution technology. For example, the late nineties saw considerable activity in merger and acquisitions by most of the largest supermarket chains. In 1998 the top three supermarket chains, Kroger, Albertson's and Safeway, all made significant investments to acquire a larger firm size; Albertson's acquired American stores in August of 1998, Safeway acquired Dominick's in October of 1998, and Kroger acquired Fred

Meyer in October of 1998 after Fred Meyer had acquired Ralphs Grocery and Quality Food Centers in November of 1997 (*Progressive Grocer*, 1999).

It is natural to ask whether Wal-Mart Supercenters have had a competitive effect on prices since their entry into food retailing markets. There has been a significant amount of recent research regarding the dynamics of market structure determinants of the retail sector in the U.S. We add to this growing literature by analyzing the price-index effects that are caused by the entrance of Wal-Mart supercenters into urban grocery retailing markets. Grocery markets provide a natural starting place to study price-index impacts of entry because of the relatively fast growth of the big-box grocery retailing format attributed to WM supercenters and of the relative ease of finding price index data for food at home consumption. The main empirical exercise is the investigation of Wal-Mart supercenter's effect on the food at home component of the consumer price index in urban grocery retailing environments.

HISTORY OF THE GROCERY INDUSTRY

Over the past century, grocery retailing on a regional and national scale has evolved from a fragmented, competitive industry prior to the introduction of chain stores, to a monopolistically competitive industry during the chain store era, and finally, to an oligopolistic industry during the present day Wal-Mart supercenter era. All the while, as the industry became more and more concentrated, the degree of competition amongst rival firms became more and more intense. The net profit rate in the grocery industry over the last twenty years has remained relatively flat at 1%, while the number of stores has steadily declined. Industry structure is always easier to analyze at some snapshot in time compared to the more realistic dynamic nature of markets. With that in mind, the following discussion attempts only to informally describe, in a more qualitative fashion, the evolution of market structure in grocery retailing over the last 100 years, documenting the significant market shock of Wal-Mart entry and discussing the strategic response of rival firms.

In the late 1800s, prior to the chain store era, grocery retailing was comprised of public markets, general grocery stores, and specialty stores. Most of these food sellers were small, privately owned businesses that were not very efficient. On a regional and

national scale the industry was highly fragmented due to high transportation costs, but this fragmentation provided some degree of local monopoly power for these early types of grocery retailers. However, within any given local market, concentration remained low due to the small scale upon which each retailer was operating. Ellickson (2011) reports that the number of small retailers in the country totaled more than half a million during this time but notes that this does not represent an accurate count of the total number of stores. Either way, the regional and national market structure of grocery retailing prior to the chain store era represented a workably competitive retail market. The local market structure, however, resembled a more monopolistically competitive market, where product differentiation existed on the dimension of food quality and service levels.

The prevalence of public markets and small independently owned grocery stores and specialty stores started to wane during the early 1900s. As summarized by Mayo (1993), food manufacturers had already started to realize the benefits of mass production through the development of more advanced transportation and communication systems. It was time for these same benefits to accrue toward the area of retail food distribution networks. In order to capture the benefits from increased economies of scale in distribution, retail grocery firms needed standardized stores operating at many locations. The answer was found with the introduction of the chain store.

During the early 1900s, the food retailing industry witnessed the emergence of the chain grocery store, led by A&P. These chain stores were virtually identical to their independently owned grocery store counterparts in store size and product offerings. The main difference was that A&P vertically integrated into both wholesaling and manufacturing, saving costs, and passing those cost savings on to consumers. The small independently owned grocery stores could not compete on the basis of price and many of them exited the industry. Tedlow (1990) reports that prices offered by chain stores were 4.5% – 14% lower than the small independent grocery stores. Lebhar (1963) reports the share of the top 5 grocery stores in the U.S. increased sharply from 4.2% to 28.8% of total industry sales from 1919 to 1932. The small independents attempted to pool their buying resources together by creating wholesaling cooperatives so they could receive quantity discounts from manufactures that matched the discounts that the chains were

receiving. An example of this was the formation of the Independent Grocer Alliance (IGA) by a collection of independently owned grocery stores in New England in 1926 (McTaggart, 2012). By the end of the 1930s, the price differences were converging, but the introduction of the supermarket format and the adoption of the supermarket format by the existing chains squashed any hope for the independents to compete at such a large scale. (Ellickson, 2007).

Independents needed a way to differentiate themselves in product space and in strategic behavior from the national chains. Cullen decided to do this by offering national brands and by heavily investing in advertising, taking advantage of the increasing magazine and radio trade. In order to do this efficiently at the store level, larger store layouts were needed in order to increase the volume of sales per store and thereby reduce marginal costs, and lower building costs were needed to offset the investment in advertising. This competitive strategic behavior was intended to lower food prices in order to effectively compete with the national chains on price. That was one half of the equation. The other half of the equation relied upon an increase in demand for shopping at supermarkets to match the increase in sales volume. Advertising of the national food brands had its effect on consumer tastes, shifting their preferences from the chains' own manufactured food brands toward the national brands. A competitive consequence of this shift was the elimination of the benefits accrued from vertical integration into manufacturing by the national chains. So, consumer tastes were dictating a level of product differentiation in food items that had not been realized at such a large scale before. Cullen had effectively differentiated the supermarket format, both in product space and strategic behavior, from the economy store format that had become so popular during the chain store era. The net effect allowed Cullen to realize economies of scale and scope at the store level. Once the chains caught on to this new way of conducting food trade and started building supermarkets of their own, economies of scale and scope began to be fully utilized at both the distribution level and the store level. By the end of the supermarket era there was a new realization and conceptualization about how minimum efficient scale could be reached in grocery retailing, and that it could occur at a more local and regional level.

Table 1 shows the percentage distribution of total grocery sales in the U.S. by type of store during the supermarket era. This presents a clear picture of how the supermarket format evolved into a dominant force over this 50 year period, taking away business from all the other store types except convenience stores. By the end of the supermarket era, market share for the supermarket format increased to 65.7 %, making it the new dominant format. Other grocery, the dominant store type at the beginning of the supermarket era, still captured 18.1% of the market, but this declining trend would continue. While the total number of stores was declining, the average size of a grocery store was increasing. During the chain store era, the average size of a grocery store was around 500 – 600 sq. ft. By 1956, the average size of only supermarkets was around 18,000 sq. ft., by 1970, 30,000 sq. ft.[1]

By the end of the supermarket era, the market structure of grocery retailing was oligopolistic in nature. The decline of national chains during the supermarket era gave rise to more regional and local chains during the supermarket era. Also, most all of the innovations were occurring in and around major cities as suburban expansion became prevalent. Economies of scale and scope were being utilized in these major metropolitan areas as well as smaller cities that were close enough to previously defined distribution patterns. In any major metropolitan area, there was a relatively small mixture of local, regional, and national supermarkets competing against each other. In the more densely metropolitan areas, such as New York, Boston, Chicago, and L.A., among others, large wholesale cooperatives had developed that helped smaller independent grocery stores to survive. Kaufman, Newton, and Handy (1993) and Franklin and Cotterill (1993) show 4-firm concentration ratios for the largest metropolitan areas in the U.S. as defined by the Bureau of Labor Statistics from 1954 to 1987. These large metropolitan areas are comprised of the primary city center in addition to the surrounding suburbs. In general, these areas have witnessed increased concentration of the top 4 grocery firms over this time period. In 1954, the average 4-firm concentration ratio across these areas was around 45% and by 1987, this value increased to 63%.

Sam Walton, founder of Wal-Mart, summarized the generalized growth strategy that Wal-Mart followed over the years (as quoted in Neumark et al. (2008)).

[1] See Mayo (1993) and Ellickson (2011).

> We figured we had to build our stores so that our distribution centers, or warehouses, could take care of them, but also so those stores could be controlled. We wanted them within reach of our distribution managers, and of ourselves here in Bentonville, so we could get out there and look after them. Each store had to be within a day's drive of a distribution center. So we would go as far as we could form a warehouse and put in a store. Then we would fill in the map of that territory, state by state, county seat by county seat, until we had saturated that market area. … So for the most part, we just started repeating what worked, stamping out stores cookie-cutter style (Walton 1992, pp. 110-111).

This hub-and-spoke style of growth was evident as Wal-Mart discount stores started to open throughout the south close to the headquarters in Bentonville, Arkansas in the 1960s. Wal-Mart began to realize large scale entry in the discount retailing industry that encompassed most of the southern and mid-western regions of the U.S. As a result Wal-Mart already had a large network of discount stores and distribution centers which provided a firm foundation for entry into the grocery retailing industry. The choice that Wal-Mart had was either to build a new supercenter or convert a discount store into one. Given the infrastructure already laid out, commitment to enter the grocery retailing industry was credible because investments in growth were already taking place.

Wal-Mart entered grocery retailing in 1988 in Washington, Missouri by introducing their supercenter format. By 2009, only two decades later, Wal-Mart had become the largest grocery retailer in the U.S., operating 2,612 Wal-Mart supercenters in 48 states. The primary reason Wal-Mart was able to grow so quickly was their store conversion strategy. Bonanno (2010) reports that during the period from 1988 to 2002, more than 90% of the supercenter openings throughout the U.S. involved converting discount stores into supercenters. After 2002, the percentage of supercenter openings that were store conversions decreased, but the percentage stayed well above 50% through 2006. A consequence of this store conversion strategy was a net decrease in the number of Wal-Mart discount stores. An interesting fact to note is that the number of Wal-Mart discount stores reached its peak in 1996 with 2,218 stores and by 2009 there were 891 stores, a reduction of just over 1,300 stores. Graff (2006) and Holmes (2008) show that the geographic expansion pattern of supercenters followed the same expansion pattern as discount stores, focusing on rural environments in the south and mid-west.

PRICE EFFECTS OF WAL-MART ENTRY

Price impacts resulting from Wal-Mart supercenter entry into grocery retailing have been well documented in Basker (2005), Basker and Noel (2009), Courtemanche and Carden (2011), Hausman and Leibtag (2007, 2009), and Volpe III and Lavoie (2008). Also closely related to our topic is a paper by Marion (1998) that analyzes the effect of entry by a new strategic group, i.e. "warehouse stores," into 25 MSAs defined by the BLS covering the period 1977-1992. The results indicate that MSAs with considerable market shares of warehouse stores had lower food-at-home price increases during the period analyzed. The study also divided up the time period into subsets to analyze differential responses throughout the period. This led to the finding that the negative impact was driven largely by the price response from firms during the first half of the period analyzed, 1977-1985. Stiegert and Sharkey (2007) use a very similar approach to Marion (1998). They basically replace "warehouse stores" with "supercenters," which include Wal-Mart, Kmart, and Target supercenters, and conduct entry analysis as summarized above across the same 25 MSAs covering the period 1993-2003. They find that the emergence of the supercenter format had no significant impact on the BLS food-at-home index. They also found a positive relationship between price changes and concentration changes.

Another closely related paper is Basker (2005), which looks at retail prices that *do not* include any grocery prices. Basker analyzed the Wal-Mart entry effect on *average* city prices across 165 cities covering the time period 1982-2002. The results of the paper indicate that average city level prices on 10 specific products decrease by 1.5-3% in the short run and four times as much in the long run when Wal-Mart entry occurs. Basker and Noel (2009) investigate the price reactions of incumbent firms to Wal-Mart entry into the food retailing markets. They use ACCRA price data on 24 specific food-at-home items across 175 local markets and find that 1) Wal-Mart's prices over these specific food-at-home items are on average, 10% lower than their competitors and 2) competitors' reaction to Wal-Mart entry is to lower prices on average, by 1-1.2%. A significant contribution to the literature includes the isolation of what Basker and Noel call the "big three supermarket chains," which include Albertson's, Safeway, and Kroger. The reaction of these big three chains is in some sense a more relevant comparison than

including both supermarkets and grocery "fringe" stores. They find that the price response of the big three supermarket chains to be around 0.5%, although this result is insignificant. However, this is the first study to provide some evidence that the price response from Wal-Mart competitors is mostly coming from the smaller grocery stores. It is also worthy to note that the absolute price difference from Wal-Mart and the big three supermarket chains is around 2-3%, considerably lower than the absolute price difference when including all competitors.[2]

Volpe III and Lavoie (2008) use "hand-collected" price data and form an expenditure weighted price basket from one market in New England to investigate the competitive price effect (indirect price effect) across both national and private brand grocery items. They collect data from six Wal-Mart Supercenters as well as 6 "competing stores" and 6 "distant stores." The distant stores are compared to competing stores to quantify any price differences that result because of Wal-Mart presence. They find that competing stores' response to Wal-Mart Supercenter entry is a 6-7% price reduction for national brand grocery items and a 3-7% price reduction for private brand grocery items. Hausman and Leibtag (2007) use home scanner panel data representing prices paid by consumers to test for both the direct price effect and the indirect price effect from superstore (includes supercenters, warehouse club stores, and mass merchandisers) entrance over 20 specific grocery items across 8 US cities covering the time period 1998-2001. The direct price effect is Wal-Mart offering lower prices than competitors do, thus causing consumers to substitute away from traditional groceries to lower priced "non-traditional" retail outlets. The indirect price effect is competitors' lowering their prices due to increased competition. The results indicate a negative direct

[2] A critique of Basker and Noel (2009) is that they only use annual data from 2001 to 2004. This raises an interesting empirical question; what if competitors have already learned how to react to Wal-Mart entry by 2001, referring to the strategic learning evidence found in Marion (1998). That is, maybe competitors, especially the big three supermarket chains, have already learned how to respond to Wal-Mart entry from previous "encounters" by 2001. If this is the case, then the instantaneous response to Wal-Mart entry prior to 2001, say in 1997, could be larger than just 0.5% and significant. This would signal that other supermarket chains learned quickly how to respond to Wal-Mart entry, became more efficient in terms of investment in distribution systems, and started lowering their prices prior to 2001. Given that the above logic holds, the price response that Basker and Noel (2009) find could in fact be the price response after stiff price competition already took place prior to 2001, and therefore, what they are reporting would be 1) either a lower bound regarding the price response, or 2) the yearly price response to keep up with the Wal-Mart "mission" to lower prices continuously every year, representing some form of soft price competition.

price effect (compensating variation is 20.2% of average food expenditure) and a negative indirect price effect (compensating variation is 4.8% of average food expenditure) as consumer expenditures increased at supercenters.

DATA

In order to investigate the price effects of Wal-Mart supercenter entry and growth into more densely populated urban grocery retailing environments, data from the Bureau of Labor Statistics (BLS) are collected that represent the Food-at-Home component of the Consumer Price Index (FAH-CPI). The data are easy obtainable from the BLS website. The advantage to using the FAH-CPI is that it includes a much broader set of grocery items compared to what previous studies have used. The disadvantage of using a price index is that individual prices of the items that make up the index are unobservable. By investigating Wal-Mart's impact from entry into large urban grocery markets over a large set of grocery items, this study complements the current literature by providing evidence regarding price impacts of supercenter entry and expansion at a much broader scale. The following baseline empirical model is used to estimate Wal-Mart supercenter's effects on the FAH-CPI:

$$Ln\ (FAH\text{-}CPI) = B_0 + B_1(income) + B_2(population) + B_3(supplier\ hhi) + B_4(residential\ rent\ index) + B_5(fuels\ index) + B_6(trend) + B_7(quadratic\ trend) + B_8(wal\text{-}mart\ sc) + e$$

Dependent Variable: FAH-CPI

The FAH-CPI data were collected from the BLS's website for the years spanning 1984 to 2005 for 24 metropolitan statistical areas (MSAs) and consolidated metropolitan statistical areas (CMSAs) that are defined by the BLS as having a population of 1.5 million people or more. Table 2 lists the MSAs and CMSAs used in this study. The base period for the FAH-CPI is 1982-1984 = 100 and the FAH-CPI for each MSA and CMSA is not seasonally adjusted.

Hausman and Leibtag (2009) summarize the most up-to-date BLS framework for sampling food at home prices to construct the FAH-CPI. The BLS takes into consideration two types of updates in order to produce the most accurate reflection of food at home price changes over time. First, stores where actual consumer spending

takes place are updated based on reported total expenditures from a particular store, and second, products that make up the price basket are updated based on expenditure shares for a particular food item. The Telephone Point-of-Purchase Survey (TPOPS) is the latest method that the BLS employs to construct a sampling procedure. Food items in the market basket can certainly change, but the BLS does not update the expenditure shares across food items very frequently. When the BLS goes to a particular store to collect price data, total expenditures are recorded across food item categories, but the expenditure shares are not used to update the expenditure weighted price basket; they are used to define the probability of store selection. The stores that have a larger expenditure share are the ones that have a probability of being sampled more frequently. Note that because TPOPS follows a store rotation schema, only a 20-25% subset of stores is sampled in a given year.

Following the above logic, as Wal-Mart supercenters get shopped at more frequently in a given MSA, the probability that a particular Wal-Mart supercenter gets included in the construction of the price basket increases. So, when a new Wal-Mart supercenter is included and prices of food items at this store are recorded, the BLS actually links out the lower Wal-Mart prices to the old store higher prices. The consequence of this sampling procedure does not take into account the lower price that Wal-Mart supercenters offer. Thus, outlet substitution bias is created in the construction of the food-at-home CPI. The assumption that the BLS makes in this situation is that the quality of shopping experience at a Wal-Mart supercenter is lower than the quality of shopping experience at the old higher priced store. The overall quality of shopping experience is based on the amount of customer service that is offered at a particular store as well the extra amenities offered at a particular store. So, the BLS assumes that higher customer service and extra amenities that are not offered at Wal-Mart supercenters is the reason that Wal-Mart supercenters offer lower priced food items (AWP, 2002). This is referred to as a quality adjusted price regarding the quality of the overall shopping experience at a Wal-Mart Supercenter. However, evidence found in Hausman and Leibtag (2007) that expenditures increase rapidly at Wal-Mart supercenters when they enter a given MSA and that incumbent food retailing firms lower their prices in response provides a rational for questioning the current BLS procedure.

Given that the BLS constructs the food-at-home CPI in the above manner, it only captures the incumbent price responses to Wal-Mart supercenter entry (Hausman and Leibtag, 2007, 2009). We take advantage of this sampling procedure to test for a short-run price response from incumbent firms when a Wal-Mart supercenter enters a food retailing market. It should be realized that as expenditures at Wal-Mart supercenters increase and thus are included in the store sample rotation, the CPI will take into account price changes of Wal-Mart supercenters. So, CPI prices in food retailing markets where Wal-Mart supercenters enter only capture incumbent price responses in the early years after Wal-Mart has entered a market, but over time, the CPI prices reflect both the incumbent price responses and the lower prices offered at Wal-Mart supercenters. Micro data from the BLS would have to be available in order to disentangle the two types of price changes, which is not publicly available.

Independent Variables

The Wal-Mart supercenter opening dates were originally downloaded from Wal-Mart's website. Since then, Wal-Mart has removed the file from their website. The original file lists every Wal-Mart store opening date up to January of 2006 as well as individual store number, street address, city, state, zip code, and store type. However, the original file failed to account for conversion dates where Wal-Mart converted a discount store into a supercenter. Thomas Holmes provides an updated version of the original file that does account for supercenter conversion dates on his website. With the conversion dates and new construction entry dates for Wal-Mart supercenters we are able to locate every supercenter in the MSAs and CMSAs that are considered city class size A by the BLS. This way we are able to match up the correct geographic region to the food at home CPI over the 24 MSAs and CMSAs used.

A list of the relevant counties within the MSAs and CMSAs are provided in Chapter 17: The Consumer Price Index of the BLS Handbook of Methods. The latest revision of the Handbook is June of 2007. We are able to get a list of the zip codes within each county from the website www.zip-codes.com, which is a licensed distributor of the U.S. Postal zip code data. We use the zip codes within the MSAs and CMSAs to merge with the Wal-Mart store opening data to identify how many supercenters are located in a particular geographic region over time. This allows us to create a variable

that represents how many Wal-Mart supercenters are operating in a particular MSA or CMSA in each time period from 1984 to 2005.

The Wal-Mart supercenter market share data come from annual publications of Trade Dimensions Market Scope for the years of 1984 – 2005. Trade Dimensions publishes market share data for a few different geographic definitions of markets. We chose the geographic markets that match the closest to the geographic regions defined by the BLS. The Market Scope data list the counties that make up the definition of the relevant geographic markets, so we matched the counties in order to get the closest match. In some cases, Market Scope MSAs were combined to match BLS MSAs and CMSAs. In those cases, the Wal-Mart supercenter market share is a population weighted average across markets.

Market concentration is represented by the *supplier hhi* variable, which was constructed using individual market shares of suppliers, or wholesalers, in a market. The market share data used also come from annual publications of Trade Dimensions Market Scope for the years 1984 – 2005. The supplier HHI is the sum of the each wholesaler's squared market share across all wholesalers in a market.

Data for the *income* and *population* variables for each MSA and CMSA were collected from the Bureau of Economic Analysis's website. *Income* represents total personal income in a market and *population* represents total population in a market. The geographic definitions of these two variables do not exactly match the geographic definitions of the FAH-CPI, but it is a close approximation. Finally, data for the *residential rent index* and *fuels index* variables were collected from the BLS website. Descriptive statistics of the baseline model are presented in Table 3.

EMPIRICAL MODELS AND RESULTS

Difference-in-difference Analysis

It is a natural question to ask whether or not Wal-Mart Supercenters have had a competitive effect regarding prices since their entry into food retailing markets. Taking the food-at-home component of the Consumer Price Index (CPI) produced by the Bureau of Labor Statistics (BLS) across urban markets for the year of Wal-Mart Supercenter entry, 1988, and the end of the time period studied, 2005, one can construct an easy

comparison of average percentage point price increases in markets where Wal-Mart has entered and not entered, and then compare the increases to get a "snap-shot" of the Wal-Mart Supercenter effect in terms of prices. Table 4 summarizes these results.

This is a simple difference-in-difference (DID) exercise where the first difference represents the percentage change in the food-at-home price index across the urban markets studied for the years 1998 -2005. The second difference represents the difference in the average percentage change increase in markets where Wal-Mart has entered and the average percentage change increase in markets where Wal-Mart has not entered. Just comparing over the simple "presence" indicator, we find that the percentage increase in markets where Wal-Mart has entered is 8% less than the percentage increase in markets where Wal-Mart has not entered across the entire time period. When conditioning this simple DID upon Wal-Mart Supercenter market share across the urban markets studies, a striking result emerges. In markets where Wal-Mart Supercenters have more than 5% market share, more than 10% market share, more than 15% market share, and more than 20% market share the percentage price increase is 5.4% less, 7% less, 10.4% less, and 15.6% less than markets where Wal-Mart Supercenters have not entered. It is clear from this simple exercise that price increases regarding the food-at-home component of the CPI are less in markets where Wal-Mart has a presence. In addition, as Wal-Mart gains market share, the price increase gets smaller and smaller over the time period 1988-2005. By analyzing these simple DID results that do not control for any market observables, it appears that Wal-Mart Supercenters have contributed to a lower food-at-home price basket over time.

Annual Food at Home Consumer Price Index Model and Results

The following empirical model is used to investigate the relationship between Wal-Mart supercenter entry and growth and the annual food at home component of the consumer price index (FAH-CPI) produced by the Bureau of Labor Statistics while controlling for market characteristics. The baseline specification of the annual empirical model is:

(1) $Ln\ (FAH\text{-}CPI) = B_0 + B_1(income) + B_2(population) + B_3(supplier\ hhi) + B_4(residential\ rent\ index) + B_5(fuels\ index) + B_6(trend) + B_7(quadratic\ trend) + B_8(wal\text{-}mart\ sc) + e$

The unit of observation is a densely populated urban market represented by a metropolitan statistical area (MSA) or a combined metropolitan statistical area (CMSA) in a given year. In total, there are twenty-four MSAs and CMSAs in the sample. The time period spans twenty-two years for twenty-two of the MSAs and CMSAs. The beginning year is 1984 and the ending year is 2005 for these twenty-two MSAs and CMSAs, with the two exceptions being Tampa-St. Petersburg-Clearwater and Washington-Baltimore. The BLS started collecting food at home price data for the Tampa-St. Petersburg-Clearwater CMSA in 1987 and for the Washington-Baltimore CMSA in 1998. Therefore, the panel is unbalanced.

There are number of independent variables in the model that are intended to control for market characteristics. The first set attempts to control for demand shifters that would affect the FAH-CPI. Included in the model are the variables *income* and *population*. *Income* is the total income in a market in a given year, measured in billions of dollars. Total income in a market is expected to have a positive effect on the annual FAH-CPI. Cotterill (1986) and Marion (1998) suggest that demand for food at home becomes more inelastic in markets as total income in a market increases because expenditures on food at home items represent a smaller share of overall expenditures. More inelastic demand should lead to higher food at home prices which would lead to a higher FAH-CPI. Also, as total income in a market increases, it is expected that consumers would start to shop at stores that offer higher quality food at home items as well as a better shopping experience, which would also lead to higher priced food at home items which would lead to a higher FAH-CPI (Cotterill, 1986; Marion, 1998).

Population is the total population in a market in a given year, measured in millions of residents. Total population in a market is expected to have a positive effect on the annual FAH-CPI. More populated markets should lead to a higher demand for food at home items and, assuming that the rate of growth in demand for food at home items is outpacing the rate of growth in supply for food at home items, higher demand would lead to higher food at home prices and therefore a higher FAH-CPI (Cotterill, 1986; Marion, 1998).

Supply shifters that would affect the FAH-CPI are also included in the model. *Supplier hhi* is the level of wholesale food market concentration in a market in a given

year. It is expected that more concentrated wholesale food markets are associated with food wholesalers that have a higher a degree of market power. Assuming that food wholesalers with a higher degree of market power charge higher prices for wholesale food to downstream food retailers that are not vertically integrated into wholesaling, it is expected that these particular food retailers would pass on these higher costs to consumers in the form of higher food retail prices. Including a measure for wholesale food market concentration captures this positive effect on a market's FAH-CPI. *Residential rent index* and *fuels index* are included in the model as proxies to control for input costs. *Residential rent index* is the price index for residential rent in a market in a given year collected by the BLS. It is intended to proxy for commercial land costs in a market in a given year. Markets that experience higher land costs would also experience a higher FAH-CPI. *Fuels index* is the price index for utility prices in a market in a given year collected by the BLS. It is intended to proxy for utility operating costs in a market in a given year. Markets that experience higher utility costs would also experience a higher FAH-CPI.

To control for the tendency of food prices to rise over time, a linear and quadratic time trend is included in the model to de-trend the FAH-CPI. These trends would also capture any time variant unobservable market characteristics that affect the FAH-CPI. *Trend* captures the linear time trend of the FAH-CPI and *quadratic trend* captures any potential curvature in the trend of the FAH-CPI. Common time trends, instead of market-specific time trends, across markets are assumed. This assumption is conditional on the market characteristics that are included in the model. If no observable market characteristics are included in the model, then a market-specific time trend would capture any differing trends across markets that would affect the FAH-CPI. Differing trends across markets are captured in the model by the inclusion of total market income, total market population, and the proxies for operating costs in a market combined with a common quadratic time trend.

The variable of interest is the *wal-mart sc* variable. It is intended to capture Wal-Mart supercenter entrance and growth into a market over time. *Wal-mart sc* is measured three different ways and three separate regression results are reported for each specification. The first measure, *sc mktshare*, is the level of Wal-Mart supercenter

market share in a market in a given year. The second measure, *sc stores*, is the number of Wal-Mart supercenters in a market in a given year. The third measure, *sc presence*, is a binary variable representing Wal-Mart supercenter presence in a market in a given year. *Sc presence* = 1 if at least one Wal-Mart supercenter exists in a market in a given year and *sc presence* = 0 if no Wal-Mart supercenters exist in a market in a given year.

Table 5.1 summarizes the annual OLS results with MSA fixed effects and White standard errors. This is a baseline regression assuming no presence of serial correlation in the error. Column 1 shows the effect that Wal-Mart supercenter market share has on the annual FAH-CPI for the twenty-four MSAs and CMSAs considered to be of city class size A by the BLS. The coefficient estimate for the variable *sc mktshare* shows that as Wal-Mart supercenter market share increases by 1% point, the annual FAH-CPI decreases by 0.17%. This is estimate is significantly different from zero at the 1% level. Column 2 shows the effect that the number of Wal-Mart supercenters in a market has on the annual FAH-CPI. This estimate shows that as the number of Wal-Mart supercenters increases by 1 store, the annual FAH-CPI decreases by 0.17% as well, and this estimate is significantly different from zero at the 1% level. Column 3 shows the effect of Wal-Mart supercenter presence in a MSA. This estimate shows that the annual FAH-CPI is 0.89% lower in MSAs where there is a Wal-Mart supercenter presence and this estimate is significantly different from zero at the 5% level. Overall, Table 5.1 shows that Wal-Mart supercenter entrance and growth in a market has a negative effect on the annual FAH-CPI.

Table 5.1 also reports the coefficient estimates for the market characteristic control variables. The coefficient estimate for *income* represents the marginal effect that total income in a market has on the annual FAH-CPI. In the market share regression, as total income increases by $1 billion, the annual FAH-CPI decreases by 0.1%. This estimate is significantly different from zero at the 5% level. In the number of supercenter stores regression, as total income increases by $1 billion, the annual FAH-CPI deceases by 0.13%. This estimate is significantly different from zero at the 1% level. In the supercenter presence regression, as total income increases by $1 billion, the annual FAH-CPI decreases by 0.07%, but this estimate is insignificant. Overall, Table 5.1 shows that total income in a market has a small negative effect on the annual FAH-CPI. This result

is unexpected, but it may provide evidence that food at home consumption is an inferior good relative to food away from home consumption, which is a normal good. If it is the case that as total income in a market increases and consumers substitute away from food-at-home consumption toward eating out at restaurants more, then it is possible that demand for food-at-home items could decrease, leading to lower food-at-home prices, all else constant.

The coefficient estimate for *population* represents the marginal effect that total population in a market has on the annual FAH-CPI. In the market share regression, as total population increases by 1 million residents, the annual FAH-CPI increases by 2.8%. In the number of supercenter stores regression, as total population increases by 1 million residents, the annual FAH-CPI increases by 3.6%. In the supercenter presence regression, as total population increases by 1 million residents, the annual FAH-CPI increases by 2.4%. All three estimates are significantly different from zero at the 1% level. Overall, Table 5.1 shows that total population in a market has a positive effect on the annual FAH-CPI.

The coefficient estimate for *supplier hhi* represents the marginal effect that wholesale-food market concentration in a market has on the annual FAH-CPI. In the market share regression, as the HHI for wholesale-food market concentration increases by 1,000 points, the annual FAH-CPI increases by 0.77%. In the number of supercenter stores regression, as the HHI increases by 1,000 points, the annual FAH-CPI increases by 0.72%. In the supercenter presence regression, as the HHI increases by 1,000 points, the annual FAH-CPI increases by 0.88%. All three estimates are significantly different from zero at the 5% level. Overall, Table 5.1 shows that wholesale-food market concentration in a market has a positive effect on the annual FAH-CPI.

The coefficient estimate for *residential rent index* represents the marginal effect that the BLS's residential rent index in a market has on the annual FAH-CPI. In the market share regression, as the residential rent index increases by one, the annual FAH-CPI increases by 0.08%. In the number of supercenter stores regression, as the residential rent index increases by one, the annual FAH-CPI increases by 0.07%. In the supercenter presence regression, as the residential rent index increases by one, the annual FAH-CPI increases by 0.09%. All three of these estimates are significantly different

from zero at the 1% level. Overall, Table 5.1 shows that the residential rent index in a market has a small positive effect on the annual FAH-CPI.

The coefficient estimate for *fuels index* represents the marginal effect that the BLS's fuels and utilities index in a market has on the annual FAH-CPI. In the market share regression, as the fuels index increases by one, the annual FAH-CPI increases by 0.06%. In the number of supercenter stores regression, as the fuels index increases by one, the annual FAH-CPI increases by 0.06%. In the supercenter presence regression, as the fuels index increases by one, the annual FAH-CPI increases by 0.05%. All three of these estimates are significantly different from zero at the 1% level. Overall, Table 5.1 shows that the fuels index in a market has a small positive effect on the annual FAH-CPI.

The estimation results reported in Table 5.1 should be interpreted with caution. There is no attempt to control for serial correlation in the error. One way to do this is to cluster the errors by market, which controls for arbitrary serial correlation within a market. Table 5.2 summarizes the annual OLS results with MSA fixed effects and cluster-robust standard errors. Note that the coefficient estimates in Table 5.3 are identical to the coefficient estimates in Table 5.1. Cluster-robust standard errors only affect the estimated standard errors. The results from Table 5.2 are summarized in the next paragraph.

The *sc mktshare* variable remains significantly different from zero, but is now only significant at the 10% level as opposed to the 1% level. *Sc stores* remains significantly different from zero at the 1% level and *sc presence* becomes insignificant. For all three of the Wal-Mart supercenter variables the standard errors are roughly double in size when taking into account arbitrary serial correlation within a market. As for the market characteristic variables, *income* and *supplier hhi* become insignificant. *Population* and *fuels index* remain significant in the market share regression and the number of supercenter stores regression, but become insignificant in the supercenter presence regression. Finally, *residential rent index* remains significant in all three regressions. Table 5.2 results suggest that there is serial correlation present in the error and clustering errors by market provides more precise estimates than the results reported in Table 5.1, where there is no attempt to control for serial correlation.

Clustering errors by market accounts for arbitrary serial correlation within a market and the standard errors are adjusted accordingly. There are some drawbacks using the clustered errors. One drawback is that clustered errors assume no correlation in the error across markets. For example, if it is the case that unobservable market characteristics are correlated with each other across markets, then the standard errors reported using clustered errors are incorrect. Another drawback is that clustered errors do not provide a specific serial correlation structure. In order to experiment with a more specified serial correlation structure and to allow for correlation in the errors between markets, regression results using standard errors developed by Driscoll and Kraay (1998) are reported in Table 5.3.

The annual OLS results are calculated with MSA fixed effects and Driscoll-Kraay standard errors assuming a MA(2) error process.[3] The results in Table 5.3 resemble the results in Table 5.1, where only White standard errors were assumed. All of the coefficient estimates are identical to the ones reported in Table 5.1 and Table 5.2. The standard error estimates are more in line with the White standard errors than with the clustered standard errors. All of the market characteristic variables are significantly different from zero except *income* in the supercenter presence regression. The coefficient of *Sc mktshare* is significantly different from zero at the 5% level and the coefficient of *sc stores* is significantly different than zero at the 1% level. The coefficient of *Sc presence* remains insignificant when compared to the *sc presence* result using clustered errors.

In order to experiment with a more restrictive serial correlation structure, Table 5.4 reports annual OLS results with MSA fixed effects and panel corrected standard errors (PCSE) assuming an AR(1) error process. The PCSE method was developed by Beck and Katz (1995) which produces standard errors that are robust to heteroskedasticity, contemporaneous correlation between markets, and serial correlation restricted to an AR(1) process. The coefficient estimates reported in Table 5.4 are

[3]Hoechle (2007) describes how the optimal lag length of residuals in an autocorrelated moving average process is calculated regarding estimation of the standard errors developed by Driscoll and Kraay (1998). The rule of thumb that is given in Hoechle (2007) uses the concept of "plug-in" estimators developed by Andrews (1991), Newey and West (1994), and others. Specifically, the lag length was calculated using $m(T) = floor[4(T/100)^{2/9}]$, where T = the number of time periods in the sample. There are 22 years in the sample so the lag length is calculated as $m(22) = floor[4(22/100)^{2/9}]=floor[2.86]=2$.

different from those reported in the first three tables, where the coefficient estimates are identical. Column 1 shows the effect that Wal-Mart supercenter market share has on the annual FAH-CPI. The coefficient estimate for *sc mktshare* now shows that as Wal-Mart supercenter market share increases by 1% point in a market, the annual FAH-CPI decreases by 0.05%. This estimate is now insignificant and closer to zero compared to the previous estimates. The previous estimates showed a significant 0.17% marginal reduction in the annual FAH-CPI. Column 2 shows the effect that the number of Wal-Mart supercenters in a market has on the annual FAH-CPI. The coefficient estimate for *sc stores* now represents a 0.13% reduction in the annual FAH-CPI for each additional supercenter that enters a market compared to a 0.17% reduction previously. This estimate remains significantly different from zero at the 1% level. Column 3 shows the effect of Wal-Mart supercenter presence in a market. The coefficient estimate for *sc presence* now shows that markets with at least one Wal-Mart supercenter are associated with an annual FAH-CPI that is 0.17% lower than markets where there are no Wal-Mart supercenters. This estimate is also insignificant and closer to zero than the previous insignificant results reported in Tables 5.2 and 5.3. When restricting the serial correlation process to an AR(1) structure, all of the Wal-Mart supercenter variable estimates get closer to zero and the variables *sc mktshare* and *sc presence* become insignificant. Overall, Table 5.4 shows that Wal-Mart supercenter entrance and growth in a market has a smaller negative effect on the annual FAH-CPI compared to previous estimates.

Table 5.4 also reports the coefficient estimates for the market characteristic control variables when using PCSE and an AR(1) error structure. Some interesting results occur when compared to the previously reported market characteristic coefficient estimates in Tables 5.1 – 5.3. As was the case with the Wal-Mart supercenter variables, all market characteristic coefficient estimates get closer to zero. The coefficient estimates for *population*, *residential rent index*, and *fuels index* remain significant and positive. One interesting result is the coefficient estimate for *supplier hhi* becomes negative, but is insignificant. Another interesting result is the coefficient estimate for *income* becomes positive in the supercenter market share and number of stores regressions and remains negative in the supercenter presence regression, but is also insignificant.

Overall, the annual regression results using the baseline empirical model show that Wal-Mart supercenter entry and growth into large densely populated markets has a negative impact on the FAH-CPI. Consistent identification of the Wal-Mart supercenter effect is coming from the impact that the number of Wal-Mart supercenter stores in a market has on the annual FAH-CPI. The results reported thus far control for any non-random locational choice made by Wal-Mart by including both unobservable market characteristics that are time invariant (MSA fixed effects) and observable market characteristics that change over time. There still remains the possibility that timing of entry by Wal-Mart is also important to consider. Basker and Noel (2009) and Courtemanche and Carden (2011) discuss the possibility of positive demand shocks that are positively correlated with a market's food at home prices and positively correlated with Wal-Mart entrance. There could also be negative supply shocks that increase food at home prices while also making Wal-Mart entry more attractive. If there is no attempt to control for this added source of endogeneity bias, then the results reported thus far are both biased and inconsistent.

Following Courtemanche and Carden (2011), interactions of each year with income and of each year with population are added separately to the baseline empirical model to attempt to control for the potential endogeneity bias due to the timing of Wal-Mart entry into a market. The interaction of each year with population attempts to control for the possibility that Wal-Mart entrance may be correlated with varying population trends over time within a market that have differential effects on the FAH-CPI. The interaction of each year with income attempts to control for the possibility that Wal-Mart entrance may be correlated with varying income trends over time within a market that have differential effects on the FAH-CPI. These regression results are summarized in Table 5.5 and Table 5.6.

Table 5.5 summarizes the annual OLS results with MSA fixed effects including the interaction term of each year with market population. Results using both clustered standard errors and Driscoll-Kraay standard errors are reported. Column 1 reports the effect that Wal-Mart supercenter market share has on the annual FAH-CPI using Driscoll-Kraay standard errors assuming a MA (2) error structure. The coefficient estimate for *sc mktshare* now shows that as Wal-Mart supercenter market share increases

by 1% point in a market, the annual FAH-CPI decreases by 0.27%. This estimate is significantly different than zero at the 1% level. Column 2 reports the effect that the number of Wal-Mart stores has on the annual FAH-CPI using Driscoll-Kraay errors and MA(2) error. This estimate represents a 0.21% reduction in the FAH-CPI for each additional Wal-Mart supercenter that enters a market and is significantly different from zero at the 1% level. Column 3 reports the effect that Wal-Mart supercenter presence has on the annual FAH-CPI using Driscoll-Kraay errors and MA(2) error. This estimate shows that markets with at least one Wal-Mart supercenter are associated with an annual FAH-CPI that is 1.1% lower than markets where there are no Wal-Mart supercenters. This effect is significantly different from zero at the 10% level. Columns 4,5, and 6 use clustered errors and the results are similar with the exception that the *sc presence* variable becomes insignificant.

Table 5.5 also reports the coefficient estimates for the market characteristic variables using both clustered errors and Driscoll-Kraay errors. The coefficient estimate for *income* remains negative, but is only significant in the supercenter presence regressions. The coefficient estimate for *supplier hhi* is positive and significant using Driscoll-Kraay errors but is insignificant using clustered errors. *Residential Rent* continues to show a positive effect on the annual FAH-CPI and is significant in five out of the six regression results. *Fuels index* now shows a negative effect on the annual FAH-CPI, but is only significant in the supercenter presence regressions. Finally, the interaction terms of each year with market population are all significant in the supercenter market share regressions and the number of stores regressions. In the supercenter presence regressions, earlier years (1984 – 1988) interacted with population are insignificant.

Table 5.6 summarizes the annual OLS results with MSA fixed effects including the interaction term of each year with total market income. As in Table 5.6 results using both clustered standard errors and Driscoll-Kraay standard errors are reported. Column 1 reports the effect that Wal-Mart supercenter market share has on the annual FAH-CPI using Driscoll-Kraay standard errors assuming a MA (2) error structure. The coefficient estimate for *sc mktshare* now shows that as Wal-Mart supercenter market share increases by 1% point in a market, the annual FAH-CPI decreases by 0.28%. This estimate is

significantly different than zero at the 1% level. Column 2 reports the effect that the number of Wal-Mart stores has on the annual FAH-CPI using Driscoll-Kraay errors and MA(2) error. This estimate represents a 0.22% reduction in the FAH-CPI for each additional Wal-Mart supercenter that enters a market and is significantly different from zero at the 1% level. Column 3 reports the effect that Wal-Mart supercenter presence has on the annual FAH-CPI using Driscoll-Kraay errors and MA(2) error. This estimate shows that markets with at least one Wal-Mart supercenter are associated with an annual FAH-CPI that is 1.0% lower than markets where there are no Wal-Mart supercenters. This effect is significantly different from zero at the 10% level. Columns 4, 5, and 6 use clustered errors and the results are similar with the exception that the *sc presence* variable becomes insignificant.

Table 5.6 also reports the coefficient estimates for the market characteristic variables using both clustered errors and Driscoll-Kraay errors. The coefficient estimate for *population* remains positive and is significant at the 1% level for all regressions. The coefficient estimate for *supplier hhi* is positive and significant using Driscoll-Kraay errors but is insignificant using clustered errors. *Residential Rent* continues to show a positive effect on the annual FAH-CPI and is, again, significant in five out of the six regression results. *Fuels index* continues to show a negative effect on the annual FAH-CPI, but is only significant in the supercenter presence regressions. Finally, the interaction terms of each year with total market income are predominantly insignificant.

The results thus far provide evidence that Wal-Mart supercenter entry and growth has a negative effect on the annual food at home price index for the twenty-four MSAs and CMSAs collected by the BLS. The marginal impact of a new Wal-Mart supercenter is a fall in the FAH-CPI in the range of -0.13% up to -0.22%. Following Basker and Noel (2009), the marginal impact of a new supercenter understates the total effect that all supercenters stores have on the FAH-CPI over the sample period once entrance has occurred. There are 23 MSAs and CMSAs that experienced Wal-Mart supercenter entrance and all of these markets experienced an increase in the number of supercenters over the sample period. The total number of supercenters that entered these markets totaled 279 stores. That represents an average increase of 279/23 = 12.13 stores in a particular market. Multiplying this average increase in the number of supercenters by the

marginal effect of a new Wal-Mart supercenter yields a FAH-CPI reduction in the range of 1.58% to 2.67% for the average market over the post-entry period, depending on the model specification and estimation technique used.

There is still a concern that the results thus far do not accurately take into account the timing of Wal-Mart entrance. If Wal-Mart is making their entrance decisions based off prior price trends in a market then the previous regressions suffer from omitted variable bias by not including lagged values of the FAH-CPI. Including lagged values of the FAH-CPI also has the advantage that both short-run and long-run effects of Wal-Mart supercenter entrance and growth can be analyzed (Basker 2005, Courtemanche and Carden (2011). The next section develops an empirical model that includes lagged values of the FAH-CPI and the results of this dynamic panel model are discussed.

Dynamic Panel Model and Results

The following regression represents the dynamic panel model by including FAH-CPI, lagged one year, in the baseline empirical model:

(2) $Ln\ (FAH\text{-}CPI)_{it} = B_0 + B_1(income_{it}) + B_2(population_{it}) + B_3(supplier\ hhi_{it}) + B_4(residential\ rent\ index_{it}) + B_5(fuels\ index_{it}) + B_6(trend_t) + B_7(quadratic\ trend_t) + B_8(ln\ FAH\text{-}CPI_{i,t-1}) + B_9(wal\text{-}mart\ sc_{it}) + e_{it}$

Basker (2005b) explains the motivation behind including lagged price in the regression model. A similar model was also used in Courtemanche and Carden (2011). Both papers provide evidence that price stickiness does exist over time in a market. This would be represented by $0 < B_8 < 1$, indicating that deviations from the annual FAH-CPI's long-run time trend are persistent over time, but fade away as the time horizon increases.

Including lagged FAH-CPI also has the advantage that both short-run and long-run effects of Wal-Mart entrance and growth into a market can be estimated. The short-run effect of Wal-Mart entrance is given by the estimated coefficient for the variable *wal-mart sc*, B_9. So, when a Wal-Mart supercenter enters a market, the effect during the first year of entrance on the annual FAH-CPI is measured by B_9. The effect during the second year of entrance is measured by B_9B_8 and during the third year is measured by $B_9(B_8)^2$, and so on. The long-run effect of this geometric series can be shown to be $B_9/(1-B_8)$. It is important to highlight that the coefficient estimate for *wal-mart sc* in the baseline

empirical model in the previous section represents both the short-run and long-run effects of Wal-Mart entrance and growth because the regression cannot separate the two effects without including lagged FAH-CPI. Therefore, a comparison of the following long-run regression results of Wal-Mart entry with the results reported in the previous section will be highlighted. This section represents a robustness check against the previous results to investigate the sensitivity of the results reported thus far.

All of the following regression results using lagged FAH-CPI follow the estimation techniques used in Basker (2005), Basker and Noel (2009), and Courtemanche and Carden (2011) by clustering standard errors by market to account for arbitrary serial correlation over time within a market.

Table 6.1 summarizes the dynamic panel model results with MSA fixed effects and FAH-CPI lagged one year. The coefficient estimates for the *wal-mart* sc variables represent short-run entry effects and the long-run effects of entry can be calculated using the coefficient estimate for $ln\ FAH\text{-}CPI_{t-1}$ as discussed above. Column 1 shows the short-run effect that Wal-Mart supercenter market share has on the annual FAH-CPI in a particular market. The coefficient estimate for *sc mktshare* shows that as Wal-Mart supercenter market share increases by 1% point in a market, the annual FAH-CPI decreases by 0.03% in the short run and decreases by 0.0003/(1-0.8289)%, or 0.18%, in the long-run. This estimate is not statistically different from zero. Column 2 shows the short-run effect that the number of Wal-Mart supercenter stores in a market has on the annual FAH-CPI. The coefficient estimate for *sc stores* shows that the marginal impact of a new Wal-Mart supercenter is a reduction in the annual FAH-CPI of 0.005% in the short-run and 0.0005/(1-0.8134)%, or 0.27%, in the long-run. This estimate is significantly different from zero at the 1% level. Column 3 reports the effect that Wal-Mart supercenter presence has on the annual FAH-CPI. This estimate shows that markets with at least one Wal-Mart supercenter are associated with an annual FAH-CPI that is 0.15% lower than markets where there are no Wal-Mart supercenters in the short run and 0.0015/(1-0.8341)%, or 0.9%, lower than markets where there is no supercenter presence in the long-run. This effect is not significantly different from zero.

Following Courtemanche and Carden (2011), the next set of regression results includes longer FAH-CPI lags of 2, 3, and 4 years in place of the one year FAH-CPI lag.

The motivation behind this is to check to see if there are any major changes in the estimated long-run effect of Wal-Mart supercenter entrance and growth when different lag lengths are used. Unbiased estimates of the Wal-Mart supercenter effect require that there is no correlation between the error term, e_{it}, and the FAH-CPI lagged one year, $ln\ FAH\text{-}CPI_{i,t-1}$. However, if serial correlation exists in the error term, then the error in any current period is correlated with the error in previous periods, thus introducing correlation between the error term and lagged FAH-CPI, resulting in biased estimates of the Wal-Mart supercenter effect. So, the concern is the potential endogeneity of lagged values of the FAH-CPI. If the estimated long-run impact of Supercenter entrance and growth in a market does not change too much when longer lag lengths are included, then this provides some evidence that the endogeneity of lagged FAH-CPI is not seriously biasing the Wal-Mart supercenter effects. It is also expected that the coefficient estimates for lagged values of the FAH-CPI should decline as longer lag lengths are used representing the persistent decay of FAH-CPI deviations over time from its long-run average trend, which should cause the coefficient estimates of the short-run and long-run Wal-Mart effects to get closer together.

The dynamic panel model results with MSA fixed effects and FAH-CPI lagged two years are summarized in Table 6.2. Column 1 reports the marginal impact of an increase in supercenter market share in a market to be a 0.13% reduction in the annual FAH-CPI in the short-run and a 0.28% reduction in the long-run. This estimate becomes significant at the 5% level compared to the insignificant 0.18% long-run reduction result using FAH-CPI lagged one year. Column 2 shows that the marginal impact of a new Wal-Mart supercenter in a market to be a 0.13% reduction in the annual FAH-CPI in the short-run and a 0.26% reduction in the long-run, decreasing slightly from the previous result long-run effect of 0.27% This estimate remains significantly different from zero at the 1% level. Column 3 reports the coefficient estimate representing Wal-Mart supercenter presence in a market and this result remains insignificant. The first two regression results using lagged FAH-CPI provide evidence of the expected result that the coefficient estimates for lagged values of the FAH-CPI should decline as longer lag lengths are used, representing the persistent decay of FAH-CPI deviations over time from its long-run average trend. The coefficient estimate for $ln\ FAH\text{-}CPI_{t-1}$ is 0.8289 and the

coefficient estimate for *ln FAH-CPI*$_{t-2}$ decreases to 0.5417. Both of these estimates are significantly different from zero at the 1% level. The expectation that this should cause the coefficient estimates of the short-run effects to approach the long-run effects as longer lag lengths are used is also confirmed. This trend is expected to continue as lag lengths of three and four years are included separately in the model.

Table 6.3 reports the dynamic panel model results with MSA fixed effects and FAH-CPI lagged three years. As in the first two results, standard errors are clustered at the market level. Column 1 reports the marginal impact of an increase in supercenter market share in a market to be a 0.21% reduction in the annual FAH-CPI in the short-run and a 0.31% reduction in the long-run. This estimate becomes significant at the 1% level compared to the significant 0.28% long-run reduction result using FAH-CPI lagged two years. Column 2 shows that the marginal impact of a new Wal-Mart supercenter in a market to be a 0.19% reduction in the annual FAH-CPI in the short-run and a 0.26% reduction in the long-run, which is the same estimated effect as using FAH-CPI lagged two years. This estimate remains significantly different from zero at the 1% level. Column 3 reports the coefficient estimate representing Wal-Mart supercenter presence in a market and this result continues to remain insignificant.

Table 6.4 reports the dynamic panel model results with MSA fixed effects and FAH-CPI lagged four years. Column 1 reports the marginal impact of an increase in supercenter market share in a market to be a 0.22% reduction in the annual FAH-CPI in the short-run and a 0.27% reduction in the long-run. This estimate remains significant at the 1% level compared to the significant 0.31% long-run reduction result using FAH-CPI lagged three years. Column 2 shows that the marginal impact of a new Wal-Mart supercenter in a market to be a 0.21% reduction in the annual FAH-CPI in the short-run and a 0.24% reduction in the long-run, decreasing slightly from the estimated effect using FAH-CPI lagged three years. This estimate remains significantly different from zero at the 1% level. Once again, the effect of the binary variable *sc presence* is insignificant. The coefficient estimates for the lagged values of the FAH-CPI continue to decline. The estimate for *ln FAH-CPI*$_{t-3}$ is 0.2776 and the coefficient estimate for *ln FAH-CPI*$_{t-4}$ decreases to 0.1398. Both of these estimates are significantly different from zero at the 1% level.

Overall, the results show that as longer FAH-CPI lag lengths are used the coefficient estimates for the short-run and long-run Wal-Mart supercenter effects do get closer together, providing some evidence that the endogeneity of lagged FAH-CPI is not seriously affecting the estimated long-run impact of Wal-Mart supercenter entrance and growth into a market. Comparing the regression results in the previous section, where lagged values of the FAH-CPI were not included in the model, to the long-run results in this section show that the estimated impact of a new Wal-Mart supercenter to be somewhat robust to the inclusion of lagged values of the FAH-CPI. The marginal impact of a new Wal-Mart supercenter is a fall in the FAH-CPI in the range of -0.13% up to -0.22% when lagged values of FAH-CPI are not included in the model and -0.24% up to -0.27% when lagged values are included in the model. The results in this section are similar to the results in the previous section where the interaction terms of each year with population and of each year with income are included in the baseline model. Those results represented the marginal impact to be in the range of -0.21% to -0.22% per supercenter. Out of the three Wal-Mart supercenter variables, it is the number of Wal-Mart supercenters in a market that provides the most robust results. The Wal-Mart supercenter presence variable is the most sensitive both to the choice of model specification and the choice of estimation technique.

Tables 6.1 – 6.4 also report the dynamic panel model coefficient estimates for the market characteristic variables. Both short-run and long-run effects of these controls can also be estimated by including lagged values of the FAH-CPI in the model using the same procedure as discussed above. The results of these coefficients estimates are summarized below, focusing on the results obtained in the number of Wal-Mart supercenter stores regressions.

The coefficient estimate for *income* represents the short-run marginal effect that total income in a market has on the annual FAH-CPI. In the dynamic panel model regression including FAH-CPI lagged one year, as total income increases by $1 billion, the annual FAH-CPI decreases by 0.07% in the short-run and 0.38% in the long-run. This estimate is significantly different from zero at the 5% level. In the regression including FAH-CPI lagged two years, as total income increases by $1 billion, the annual FAH-CPI deceases by 0.18% in the short-run and 0.37% in the long-run. This estimate is

significantly different from zero at the 1% level. The regression results using FAH-CPI lagged three years show a short-run marginal effect of an increase in income to be a 0.29% reduction in the annual FAH-CPI in the short run and a 0.43% reduction in the long-run, which is a significant effect at the 1% level. Finally, the regression results using FAH-CPI lagged four years reports a 0.37% reduction in the short-run and a 0.46% reduction in the long-run, which is also a significant effect at the 1% level. As longer lags lengths of the FAH-CPI are used the short-run and long-run marginal impacts of income get closer together, which is the expected result. Overall, Tables 6.1 – 6.4 continue to show that total income in a market has a small negative effect on the annual FAH-CPI.

The coefficient estimate for *population* represents the short-run marginal effect that total population in a market has on the annual FAH-CPI. In the regression using FAH-CPI lagged one year, as total population increases by 1 million residents, the annual FAH-CPI increases by 1.1% in the short-run and 5.6% in the long-run This estimate is significant at the 5% level. Using FAH-CPI lagged two years, as total population increases by 1 million residents, the annual FAH-CPI increases by 2.9% in the short-run and 5.8% in the long-run. Using FAH-CPI lagged three years, the marginal effect of an increase in population on the annual FAH-CPI is 4.8% in the short-run and 7% in the long-run, and using FAH-CPI lagged four years, the estimated short-run effect is 6% in the short-run and 7.3% in the long-run. All of these three estimates are significantly different from zero at the 1% level. Once again, convergence between the short-run and long-run effects is occurring as the lag length of the FAH-CPI increases. Overall, Tables 6.1 – 6.4 continue to show that total population in a market has a positive effect on the annual FAH-CPI.

The coefficient estimate for *supplier hhi* represents the short-run marginal effect that wholesale-food market concentration in a market has on the annual FAH-CPI All four estimates using lagged values of the FAH-CPI are not statistically different than zero. There is evidence that the short-run and long-run effects do get closer together as longer lengths are used. Overall, Tables 6.1 – 6.4 report that wholesale-food market concentration in a market has a positive insignificant effect on the annual FAH-CPI. The coefficient estimate for *residential rent index* represents the short-run marginal effect that

the BLS's residential rent index in a market has on the annual FAH-CPI. The coefficient estimate for *fuels index* represents the short-run marginal effect that the BLS's fuels and utilities index in a market has on the annual FAH-CPI. Both *residential rent index* and *fuels index* are insignificant in all of the regressions using lagged FAH-CPI. The short-run and long-run effects, once again, get closer together for both variables. Overall, Tables 6.1 – 6.4 show that the residential rent index in a market and the fuels index in a market have virtually no effect on the annual FAH-CPI.

In summary, the results found using both the baseline empirical model that does not include lagged values of the FAH-CPI and dynamic panel model that does include lagged values of the FAH-CPI thus provide strong evidence that Wal-Mart supercenter entry and growth has a negative effect on the annual food at home price index for the twenty-four MSAs and CMSAs collected by the BLS. The marginal impact of a new Wal-Mart supercenter is a fall in the annual FAH-CPI in the range of -0.13% to -0.27% across all model specifications and estimation techniques used. Once again referring to Basker and Noel (2009), the marginal impact of a new supercenter understates the total effect that all supercenters stores have on the FAH-CPI over the sample period once entrance has occurred. Out of the 24 MSAs and CMSAs, 23 MSAs and CMSAs experienced Wal-Mart supercenter entrance and all of these markets experienced an increase in the number of supercenters over the sample period. The total number of supercenters that entered these markets totaled 279 stores. That represents an average increase of 279/23 = 12.13 supercenters in a particular market. Multiplying this average increase in the number of supercenters by the marginal effect of a new Wal-Mart supercenter yields a FAH-CPI reduction of anywhere from 1.58% to 3.28% for the average market over the post-entry period, depending on the model specification and estimation technique used.

SUMMARY AND CONCLUSIONS

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Table 1: Percentage Distribution of Grocery Sales by Type of Store

Supermarket Era: 1930-1980

Year	Supermarkets	Convenience Stores	Other Grocery	Specialty Food Stores	Warehouse Clubs Supercenters	Mass Merchandisers	Other Stores	Home Deliv Mail Ord
1929	0	0	48	17	0	0	13.3	13.8
1939	5.8	0	52.4	14.1	0	0	7.7	14.9
1948	14.9	0	51.1	14.6	0	0	5.1	11.2
1954	28.1	0	42.9	11.8	0	0	4.5	8.9
1958	36.5	0.1	37	11.2	0	-	4.7	7.3
1963	45.4	0.7	31.1	8.4	0	-	5.9	5.3
1967	52.2	1.2	25.8	8.3	0	-	5.6	4.2
1972	58.1	3.3	24.4	6.8	0*	-	3.5	2.2
1977	65.7	3.3	18.1	5.9	0*	-	4.1	1.3

Supercenter Era: 1980-2005

Year	Supermarkets	Convenience Stores	Other Grocery	Specialty Food Stores	Warehouse Clubs Supercenters	Mass Merchandisers	Other Stores	Home Deliv Mail Ord
1982	65.2	3.2	19.6	5.3	0*	0.9	3.2	1
1987	64.8	2.9	13.3	3	0.8	1	6.5	1
1992	73.9	2.7	1.9	2.3	2.4	1	8.3	1.3
1993	76.3	2.8	1.7	2.4	2.5	1.2	5	1.8
1994	75.9	2.7	1.6	2.3	3	1.2	5	1.8
1995	75.4	2.7	1.5	2.2	3.2	1.5	5.1	1.8
1996	75	2.7	1.3	2.2	3.3	1.6	5.3	2.1
1997	73.9	2.7	1.2	2.2	3.4	1.7	4.6	3.8
1998	73.3	2.6	1.1	2.2	4.5	1.8	4.6	3.6
1999	72.7	2.5	1.1	2	5.8	1.8	4.7	3.6
2000	70.9	2.5	1.4	2	7.2	1.7	4.9	3.4

Supermarket Era: 1980-2005 contined

2001	70.1	2.6	1.2	2	8.9	1.7	4.8	3.1
2002	67.4	2.6	1.3	2	11.7	1.6	4.8	3
2003	66.8	2.6	1.3	2.1	12.6	1.4	4.9	3
2004	66.3	2.7	0.8	2.3	13.4	1.2	4.9	2.8
2005	65.8	2.6	0.7	2.3	14.1	1	4.9	2.8

Source: FDA Economic Research Service; calculated data from the U.S. Census Bureau and the Bureau of Labor Statistics.
* Indicates less than 0.05%.

Table 2: Metropolitan Statistical Areas (MSA) and Consolidated Metropolitan Statistical Areas (CMSA)

Atlanta, GA (MSA)
Boston-Brockton-Nashua, MA-NH-ME-CT (CMSA)
Chicago-Gary-Kenosha, IL-IN-WI (CMSA)
Cincinnati-Hamilton, OH-KY-IN (CMSA)
Cleveland-Akron, OH (CMSA)
Dallas-Fort Worth, TX (CMSA)
Denver-Boulder-Greeley, CO (CMSA)
Detroit-Ann Arbor-Flint, MI (CMSA)
Houston-Galveston-Brazoria, TX (CMSA)
Kansas City, MO-KS (MSA)
Los Angeles-Riverside-Orange County, CA (CMSA)
Miami-Fort Lauderdale, FL (CMSA)
Milwaukee-Racine, WI (CMSA)
Minneapolis-St. Paul, MN-WI (MSA)
New York-Northern New Jersey-Long Island, NY-NJ-CT-PA (CMSA)
Philadelphia-Wilmington-Atlantic City, PA-NJ-DE-MD (CMSA)
Pittsburg, PA (MSA)
Portland-Salem, OR-WA (CMSA)
St. Louis, MO-IL (MSA)
San Diego, CA (MSA)
San Francisco-Oakland-San Jose, CA (CMSA)
Seattle-Tacoma-Bremerton, WA (CMSA)
Tampa-St. Petersburg-Clearwater, FL (CMSA)
Washington-Baltimore, DC-MD-VA-WV (CMSA)

Table 3: Summary Statistics

Variable	Definition	Obs	Mean	Std. Dev.	Min	Max
FAH-CPI	food at home CPI (1982-1984 = 100)	511	144.24	27.54	99.20	206.40
income	total personal income, in billions of dollars	511	14.26	14.90	1.97	101.44
population	population, in millions of people	511	5.11	4.47	1.38	21.89
supplier hhi	wholesale HHI, in thousands of units	511	2.26	0.80	0.76	5.20
residential rent index	residential rent index CPI (1982-1984 = 100)	511	154.03	35.56	92.20	263.00
fuels index	fuels index CPI (1982-1984 = 100)	511	125.47	23.98	88.90	214.10
sc mktshare	Wal-Mart supercenter market share	511	1.27	3.67	0.00	26.90
sc stores	number of Wal-Mart supercenters	511	2.65	6.88	0.00	58.00
sc presence	binary variable representing supercenter presence	511	0.35	0.48	0.00	1.00

Table 4: Simple Average DID for CPI Food-At-Home conditional upon Wal-Mart Supercenter entry: 1988-2005

Supercenter Market Share	# of Markets	Average % Change	DID (%)
0%	4	68	
>0%	19	60	-8
>5%	9	63	-5
>10%	8	61	-7
>15%	5	58	-10
>20%	3	53	-15

Table 5.1: Annual OLS Results with MSA Fixed Effects and White Standard Errors

Ln (FAH-CPI)	(1) Market Share	(2) SC Stores	(3) SC Presence
income	-0.0010**	-0.0013***	-0.0007
	(0.0005)	(0.0005)	(0.0005)
population	0.0280***	0.0359***	0.0241***
	(0.0056)	(0.0056)	(0.0056)
supplier hhi	0.0077**	0.0072**	0.0088**
	(0.0035)	(0.0035)	(0.0035)
residential rent index	0.0008***	0.0007***	0.0009***
	(0.0002)	(0.0002)	(0.0002)
fuels index	0.0006***	0.0006***	0.0005***
	(0.0002)	(0.0002)	(0.0002)
trend	0.0368***	0.0365***	0.0370***
	(0.0011)	(0.0011)	(0.0011)
quadratic trend	-0.0006***	-0.0006***	-0.0006***
	(0.0001)	(0.0001)	(0.0001)
sc mktshare	-0.0017***		
	(0.0005)		
sc stores		-0.0017***	
		(0.0003)	
sc presence			-0.0089**
			(0.0043)
Constant	4.3188***	4.3086***	4.3248***
	(0.0304)	(0.0311)	(0.0315)
Observations	511	511	511
R-squared	0.981	0.981	0.980

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Table 5.2 Annual OLS Results with MSA Fixed Effects and Cluster-Robust Standard Errors

Ln (FAH-CPI)	(1) SC Market Share	(2) SC Stores	(3) SC Presence
income	-0.0010	-0.0013	-0.0007
	(0.0008)	(0.0008)	(0.0009)
population	0.0280**	0.0359***	0.0241
	(0.0122)	(0.0102)	(0.0142)
supplier hhi	0.0077	0.0072	0.0088
	(0.0087)	(0.0087)	(0.0082)
residential rent index	0.0008**	0.0007**	0.0009**
	(0.0003)	(0.0003)	(0.0004)
fuels index	0.0006*	0.0006*	0.0005
	(0.0003)	(0.0003)	(0.0004)
trend	0.0368***	0.0365***	0.0370***
	(0.0024)	(0.0024)	(0.0023)
quadratic trend	-0.0006***	-0.0006***	-0.0006***
	(0.0001)	(0.0001)	(0.0001)
sc mktshare	-0.0017*		
	(0.0010)		
sc stores		-0.0017***	
		(0.0006)	
sc presence			-0.0089
			(0.0083)
Constant	4.3188***	4.3086***	4.3248***
	(0.0584)	(0.0615)	(0.0610)
Observations	511	511	511
R-squared	0.981	0.981	0.980

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Table 5.3: Annual OLS Results with MSA Fixed Effects and Driscoll-Kraay Standard Errors Assuming MA(2) Error

Ln (FAH-CPI)	(1) SC Market Share	(2) SC Stores	(3) SC Presence
income	-0.0010*	-0.0013*	-0.0007
	(0.0006)	(0.0007)	(0.0005)
population	0.0280***	0.0359***	0.0241***
	(0.0044)	(0.0064)	(0.0038)
supplier hhi	0.0077**	0.0072***	0.0088***
	(0.0028)	(0.0025)	(0.0026)
residential rent	0.0008***	0.0007***	0.0009***
	(0.0002)	(0.0002)	(0.0002)
fuels index	0.0006***	0.0006***	0.0005**
	(0.0002)	(0.0002)	(0.0002)
trend	0.0368***	0.0365***	0.0370***
	(0.0015)	(0.0015)	(0.0016)
quadratic trend	-0.0006***	-0.0006***	-0.0006***
	(0.0001)	(0.0001)	(0.0001)
sc mktshare	-0.0017**		
	(0.0006)		
sc stores		-0.0017***	
		(0.0003)	
sc presence			-0.0089
			(0.0059)
Constant	4.3188***	4.3086***	4.3248***
	(0.0410)	(0.0459)	(0.0359)
Observations	511	511	511
R-squared	0.981	0.981	0.980
Number of groups	24	24	24

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Table 5.4: Annual OLS Results with MSA Fixed Effects and PCSE Assuming AR(1) Error and Correlated Panels

Ln (FAH-CPI)	(1) SC Market Share	(2) SC Stores	(3) SC Presence
income	0.0002	-0.0001	0.0003
	(0.0006)	(0.0006)	(0.0006)
population	0.0125*	0.0206***	0.0110*
	(0.0070)	(0.0070)	(0.0065)
supplier hhi	-0.0009	-0.0007	-0.0006
	(0.0031)	(0.0031)	(0.0030)
residential rent	0.0005***	0.0004**	0.0006***
	(0.0002)	(0.0002)	(0.0002)
fuels index	0.0004**	0.0004**	0.0003**
	(0.0002)	(0.0002)	(0.0001)
trend	0.0357***	0.0354***	0.0357***
	(0.0018)	(0.0018)	(0.0018)
quadratic trend	-0.0005***	-0.0004***	-0.0005***
	(0.0001)	(0.0001)	(0.0001)
sc mktshare	-0.0005		
	(0.0006)		
sc stores		-0.0013***	
		(0.0003)	
sc presence			-0.0017
			(0.0029)
Constant	4.4563***	4.4474***	4.4576***
	(0.0399)	(0.0394)	(0.0403)
Observations	511	511	511
R-squared	0.998	0.998	0.998
Number of city	24	24	24

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Table 5.5: Annual OLS Results with MSA Fixed Effects and Interaction between Market Population and Each Year

Ln (FAH-CPI)	(1) SC Market Share DK MA(2)	(2) SC Stores DK MA(2)	(3) SC Presence DK MA(2)	(4) SC Market Share Cluster	(5) SC Stores Cluster	(6) SC Presence Cluster
Income	-0.0042	-0.0024	-0.0061**	-0.0042	-0.0024	-0.0061*
	(0.0026)	(0.0031)	(0.0023)	(0.0031)	(0.0027)	(0.0035)
supplier hhi	0.0098***	0.0094***	0.0114***	0.0098	0.0094	0.0114
	(0.0028)	(0.0026)	(0.0029)	(0.0085)	(0.0086)	(0.0077)
residential rent index	0.0008***	0.0007**	0.0012***	0.0008*	0.0007	0.0012**
	(0.0003)	(0.0003)	(0.0002)	(0.0004)	(0.0004)	(0.0005)
fuels index	-0.0002	-0.0002	-0.0005*	-0.0002	-0.0002	-0.0005*
	(0.0002)	(0.0003)	(0.0002)	(0.0003)	(0.0003)	(0.0003)
Trend	0.0253***	0.0259***	0.0243***	0.0253***	0.0259***	0.0243***
	(0.0015)	(0.0015)	(0.0015)	(0.0024)	(0.0024)	(0.0025)
quadratic trend	-0.0000	-0.0000	-0.0000	-0.0000***	-0.0000**	-0.0000*
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
sc mktshare	-0.0027***			-0.0027***		
	(0.0009)			(0.0009)		
sc stores		-0.0021***			-0.0021***	
		(0.0004)			(0.0006)	
sc presence			-0.0105*			-0.0105
			(0.0060)			(0.0091)
Constant	4.4457***	4.4154***	4.4722***	4.4457***	4.4154***	4.4722***
	(0.0333)	(0.0390)	(0.0334)	(0.0856)	(0.0885)	(0.0872)
Observations	511	511	511	511	511	511
R-squared	0.984	0.984	0.983	0.984	0.984	0.983
Number of groups	24	24	24			

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Table 5.6: Annual OLS Results with MSA Fixed Effects and Interaction between Total Market Income and Each Year

	(1) SC Market Share	(2) SC Stores	(3) SC Presence	(4) SC Market Share	(5) SC Stores	(6) SC Presence
Ln (FAH-CPI)	DK MA(2)	DK MA(2)	DK MA(2)	Clustered	Clustered	Clustered
Population	0.0431***	0.0469***	0.0428***	0.0431***	0.0469***	0.0428***
	(0.0083)	(0.0099)	(0.0070)	(0.0113)	(0.0125)	(0.0115)
supplier hhi	0.0096***	0.0096***	0.0108***	0.0096	0.0096	0.0108
	(0.0029)	(0.0027)	(0.0031)	(0.0085)	(0.0087)	(0.0077)
residential rent index	0.0008***	0.0006*	0.0012***	0.0008*	0.0006	0.0012**
	(0.0003)	(0.0003)	(0.0002)	(0.0004)	(0.0004)	(0.0005)
fuels index	-0.0002	-0.0002	-0.0005**	-0.0002	-0.0002	-0.0005**
	(0.0002)	(0.0003)	(0.0002)	(0.0003)	(0.0003)	(0.0002)
Trend	0.0256***	0.0263***	0.0248***	0.0256***	0.0263***	0.0248***
	(0.0015)	(0.0015)	(0.0015)	(0.0023)	(0.0023)	(0.0025)
quadratic trend	-0.0000	-0.0000	-0.0000	-0.0000***	-0.0000***	-0.0000*
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
sc mktshare	-0.0028***			-0.0028***		
	(0.0009)			(0.0009)		
sc stores		-0.0022***			-0.0022***	
		(0.0005)			(0.0006)	
sc presence			-0.0104*			-0.0104
			(0.0058)			(0.0091)
Constant	4.4474***	4.4154***	4.4731***	4.4474***	4.4154***	4.4731***
	(0.0352)	(0.0388)	(0.0343)	(0.0804)	(0.0820)	(0.0820)
Observations	511	511	511	511	511	511
R-squared	0.983	0.984	0.982	0.983	0.984	0.982
Number of groups	24	24	24			

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Table 6.1: Dynamic Panel Model OLS Results with MSA Fixed Effects and FAH-CPI Lagged One Year

Ln (FAH-CPI)	(1) SC Market Share	(2) SC Stores	(3) SC Presence
income	-0.0006**	-0.0007**	-0.0006*
	(0.0003)	(0.0003)	(0.0003)
population	0.0073	0.0105**	0.0063
	(0.0050)	(0.0043)	(0.0052)
supplier hhi	0.0009	0.0008	0.0011
	(0.0022)	(0.0021)	(0.0021)
residential rent index	0.0001	0.0001	0.0001
	(0.0001)	(0.0001)	(0.0001)
fuels index	-0.0001	-0.0001	-0.0001
	(0.0001)	(0.0001)	(0.0001)
Trend	0.0043***	0.0049***	0.0042***
	(0.0009)	(0.0009)	(0.0009)
quadratic trend	-0.0000	-0.0000	-0.0000
	(0.0000)	(0.0000)	(0.0000)
ln FAH_CPI$_{t-1}$	0.8289***	0.8134***	0.8341***
	(0.0202)	(0.0202)	(0.0205)
sc mktshare	-0.0003		
	(0.0002)		
sc stores		-0.0005***	
		(0.0001)	
sc presence			-0.0015
			(0.0027)
Constant	0.7985***	0.8602***	0.7779***
	(0.0889)	(0.0906)	(0.0903)
Observations	487	487	487
R-squared	0.991	0.991	0.991

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Table 6.2: Dynamic Panel Model OLS Results with MSA Fixed Effects and FAH-CPI Lagged Two Years

Ln (FAH-CPI)	(1) SC Market Share	(2) SC Stores	(3) SC Presence
income	-0.0014**	-0.0018***	-0.0011*
	(0.0006)	(0.0006)	(0.0006)
population	0.0199*	0.0287***	0.0150
	(0.0105)	(0.0091)	(0.0116)
supplier hhi	0.0007	0.0008	0.0014
	(0.0048)	(0.0049)	(0.0044)
residential rent index	0.0002	0.0002	0.0003
	(0.0002)	(0.0002)	(0.0002)
fuels index	-0.0000	0.0000	-0.0001
	(0.0002)	(0.0002)	(0.0002)
Trend	0.0115***	0.0125***	0.0106***
	(0.0020)	(0.0021)	(0.0021)
quadratic trend	0.0000	0.0000	0.0000**
	(0.0000)	(0.0000)	(0.0000)
ln FAH-CPI$_{t-2}$	0.5417***	0.5086***	0.5686***
	(0.0445)	(0.0480)	(0.0474)
sc mktshare	-0.0013**		
	(0.0005)		
sc stores		-0.0013***	
		(0.0003)	
sc presence			-0.0055
			(0.0055)
Constant	2.0863***	2.2090***	1.9798***
	(0.1935)	(0.2124)	(0.2069)
Observations	463	463	463
R-squared	0.979	0.979	0.978

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Table 6.3: Dynamic Panel Model OLS Results with MSA Fixed Effects and FAH-CPI Lagged Three Years

Ln (FAH-CPI)	(1) SC Market Share	(2) SC Stores	(3) SC Presence
income	-0.0024***	-0.0029***	-0.0019**
	(0.0008)	(0.0008)	(0.0008)
population	0.0333**	0.0476***	0.0245
	(0.0138)	(0.0123)	(0.0159)
supplier hhi	0.0031	0.0035	0.0042
	(0.0061)	(0.0062)	(0.0056)
residential rent index	0.0003	0.0003	0.0005
	(0.0003)	(0.0003)	(0.0003)
fuels index	0.0001	0.0002	-0.0000
	(0.0002)	(0.0002)	(0.0002)
Trend	0.0162***	0.0175***	0.0142***
	(0.0024)	(0.0026)	(0.0029)
quadratic trend	0.0000	0.0000	0.0000**
	(0.0000)	(0.0000)	(0.0000)
ln FAH-CPI$_{t-3}$	0.3223***	0.2776***	0.3737***
	(0.0518)	(0.0581)	(0.0620)
sc mktshare	-0.0021***		
	(0.0007)		
sc stores		-0.0019***	
		(0.0004)	
sc presence			-0.0062
			(0.0068)
Constant	3.0358***	3.1926***	2.8329***
	(0.2202)	(0.2519)	(0.2661)
Observations	439	439	439
R-squared	0.973	0.974	0.972

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Table 6.4: Dynamic Panel Model OLS Results with MSA Fixed Effects and FAH-CPI Lagged Four Years

VARIABLES	(1) SC Market Share	(2) SC Stores	(3) SC Presence
income	-0.0031***	-0.0037***	-0.0025**
	(0.0009)	(0.0009)	(0.0009)
population	0.0416**	0.0595***	0.0308
	(0.0157)	(0.0129)	(0.0188)
supplier hhi	0.0046	0.0049	0.0057
	(0.0065)	(0.0066)	(0.0061)
residential rent index	0.0004	0.0004	0.0006
	(0.0003)	(0.0003)	(0.0003)
fuels index	0.0002	0.0003	0.0000
	(0.0002)	(0.0002)	(0.0002)
trend	0.0186***	0.0201***	0.0160***
	(0.0024)	(0.0027)	(0.0030)
quadratic trend	0.0000	0.0000	0.0000***
	(0.0000)	(0.0000)	(0.0000)
ln FAH-CPI$_{t-4}$	0.1887***	0.1398***	0.2513***
	(0.0422)	(0.0477)	(0.0610)
sc mktshare	-0.0022***		
	(0.0008)		
sc stores		-0.0021***	
		(0.0004)	
sc presence			-0.0046
			(0.0067)
Constant	3.6135***	3.7753***	3.3686***
	(0.1818)	(0.2182)	(0.2569)
Observations	415	415	415
R-squared	0.971	0.973	0.970

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10