

## Big Boxes and Smaller Waistlines? Wal-Mart, Warehouse Clubs, and Obesity

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### **Abstract**

We estimate the impacts of Wal-Mart and warehouse club retailers on height-adjusted body weight and overweight and obesity status, finding robust evidence that non-grocery selling Wal-Marts reduce weight while grocery-selling Wal-Marts and warehouse clubs either reduce weight or have no effect. The effects appear strongest for women, minorities, urban residents, and the poor. We then examine the effects of these retailers on exercise, food and alcohol consumption, smoking, and eating out at restaurants in order to explain the results for weight. Most notably, the evidence suggests that all three types of stores increase consumption of fruits and vegetables while reducing consumption of foods high in fat. This is consistent with the thesis that Wal-Mart increases real incomes through its policy of “Every Day Low Prices,” making healthy food more affordable, as opposed to the thesis that cheap food prices make us eat more.

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# 1. Introduction

Has cheap food from Wal-Mart's expansion expanded shoppers' waistlines, or are Every Day Low Prices helping people afford healthier foods? Wal-Mart built itself into the world's largest retailer by aggressively pursuing a policy of "Every Day Low Prices." It has recently adopted the slogan "Save More. Live Better." Being healthy is an important part of living better, and according to the conventional wisdom obesity is an oftenly-avoidable impediment to healthy living. We estimate the impact of Big Box retail – as measured by the number of Wal-Mart discount stores, Super Wal-Marts, and warehouse clubs (Sam's Club, Costco, and BJ's Wholesale Club) in a county – on body weight, overweight, and obesity. We find robust evidence that more Wal-Mart discount stores (which do not sell groceries) relative to population lead to a modest reduction in body mass index (BMI), overweight, and obesity, while grocery-selling Wal-Marts and warehouse clubs reduce weight in some specifications but have a statistically insignificant effect in others.<sup>1</sup> The largest effects are for the poor, minorities, women, and urban populations. All three types of stores seem to cause people to substitute toward healthier diets, as healthy food consumption rises while fat consumption falls. These results support the theory that increased real incomes lead to a substitution from cheap unhealthy foods to more expensive healthy foods, as opposed to the conventional wisdom that cheaper food makes us eat more. We also explore the relationship between Big Boxes and exercise, smoking, drinking, and eating out, and find that some of the health gains from improved eating habits may be offset by less exercise and more smoking and alcohol consumption.<sup>2</sup>

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<sup>1</sup> BMI=weight in kilograms/height in meters squared is more commonly used in empirical studies than weight because it is adjusted for height. A person is classified as overweight if her BMI $\geq$ 25 and obese if her BMI $\geq$ 30.

<sup>2</sup> Since Wal-Mart is so large relative to other retailers and since the company itself is controversial *as such*, we will sometimes use "Wal-Mart" and "Big Box" interchangeably while acknowledging that our measures of warehouse clubs also includes Costco and BJ's Wholesale Clubs.

Obesity has increased dramatically in the last fifty years, making it a major public health concern and the subject of a growing body of literature.<sup>3</sup> In 1960, approximately 43.3% of the population was considered overweight, while almost two-thirds of the population (66.3%) was considered overweight in 2004. In 1960, only 12.8% of the population was considered obese; by 2004, almost one-third of the population was obese (32.2%).<sup>4</sup> Obesity has been linked to higher disease prevalence. Strum (2002) reports a relationship between obesity and various coronary and pulmonary diseases like high blood pressure, diabetes and heart disease; moreover, Strum reports that the obese are more likely to suffer strokes.<sup>5</sup>

Obesity is particularly amenable to economic analysis because it is the direct result of individual choices in the face of changing incentives (Philipson and Posner, 2003:S87-S88). Obesity is caused by an imbalance between “calories in” and calories out”: the consensus view is that an increasingly sedentary lifestyle and lower prices of calories are responsible for the upward trend.

Wal-Mart and other “Big Box” retailers embody a series of changes in the ways that late twentieth century Americans lived, worked, and shopped. Food got cheaper, and the consumption technology became more automobile-oriented. At the height of the Cold War, the supermarket was an international example of American prosperity (Levenstein 1993). These changes, particularly the Big Box revolution of the 1960s and 1970s, also coincide with growth in obesity since the late 1970s and early 1980s (Figure 1). Wal-Mart has attracted attention in the scholarly literature and in the popular press. The most obvious manifestation of what Fishman (2006) calls *The Wal-Mart Effect* is the company’s policy of Every Day Low Prices.

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<sup>3</sup> See Rosin (2008) for a survey of the literature on the economics of obesity.

<sup>4</sup> Estimates are from Flegal et al. (1998) and Ogden et al. (2006), as discussed by Courtemanche (2008b). Someone is considered “overweight” when he or she has a Body Mass Index (BMI, calculated as weight in kilograms divided by height in meters squared) between 25.5 and 29. One is considered “obese” when he or she has a BMI over 30.

<sup>5</sup> This assessment is drawn from Courtemanche (2008b).

These include lower prices of food—prices so much lower, in fact, that Hausman and Leibtag (2004, 2005) suggest we are mis-measuring the Consumer Price Index because the effect of Wal-Mart and other Big Box retailers is not sufficiently accounted for. Lower prices, especially if the lower prices are disproportionately for products of questionable nutritional value, may lead to a higher incidence of obesity.

Wal-Mart has been at the forefront of changes in the ways people live, shop, and eat in the late twentieth century.<sup>6</sup> When Wal-Mart enters a market, it brings with it the company's policy of Every Day Low Prices. Wal-Mart's possible effects on body weight might work through different channels depending on the type of store. The first Wal-Mart discount stores (what we will call "regular Wal-Mart") dealt primarily in consumer goods, which would have lowered the price of these goods, increasing the relative price of food.

Next, the introduction of the Wal-Mart Supercenter might increase obesity by lowering the price of store-bought food. On the other hand, this raises the relative price of eating in restaurants, which would presumably reduce obesity since restaurant meals are generally considered less healthy than home-cooked meals.<sup>7</sup> Wal-Mart's effect on the relative price of healthy versus unhealthy foods is ambiguous, although healthy foods may become relatively cheaper because distribution networks have also improved retailers' ability to move fresh fruits and vegetables. Further, Wal-Mart may lower the prices of cigarettes and alcohol, which may impact weight.

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<sup>6</sup> See the essays in Lichtenstein (2006) for critical perspectives on Wal-Mart's role in twentieth-century retail and labor history.

<sup>7</sup> Satia et al (2004), Young and Nestle (2002), Chou et al (2004), Zoumas-Morse et al (2001), Dunn (2008), and others find evidence to support this argument. However, Anderson and Matsa (2007) find evidence that restaurant prevalence is not causally related to obesity because as people eat in restaurants, they crowd out eating other meals and snacks throughout the day.

Similar effects occur when a Sam's Club or other discount warehouse enters, but with a twist. Sam's Club is oriented toward bulk buying, and the amenability of different categories of goods to bulk buying could differ across product categories. Preservative-laden foods have longer shelf lives, so Sam's Club and other Big Boxes could lead to substitution away from healthy fresh foods and toward unhealthy processed foods.

Income effects may also affect weight for all three types of stores. Wal-Mart's low prices increase real incomes, although if Wal-Mart hurts small businesses or reduces employment the net change in real incomes could potentially be negative.<sup>8</sup> Numerous studies observe that low-income individuals have poorer diet quality and a higher incidence of obesity than others.<sup>9</sup> One possible explanation is that higher incomes induce a substitution away from unhealthy but inexpensive processed foods and toward more healthy but more expensive foods such as fresh produce (Basiotis and Lino, 2002; Ranney and McNamara, 2002; Drewnowski and Specter, 2004). If unhealthy foods are inferior goods and Wal-Mart increases real incomes, Wal-Mart entry should increase consumption of healthy food at the expense of unhealthy food.<sup>10</sup>

We combine county-level data on Wal-Mart discount stores, Super Wal-Marts, and warehouse clubs with individual survey responses from the Behavioral Risk Factor Surveillance System (BRFSS) to explore the relationship between Wal-Mart's presence and BMI, overweight, and obesity. The data suggest that access to regular Wal-Marts lowers weight, with Super Wal-Marts and warehouse clubs either reducing weight or having no effect. Stratifying the sample reveals that the effects are strongest for minorities, the poor, and the urban population. While

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<sup>8</sup> Hereafter, we assume that the net effect of Wal-Mart on disposable income is positive. However, we acknowledge that this is not a theoretical certainty.

<sup>9</sup> See, for example, Shahar et al (2005), Basiotis and Lino (2002), and Drewnowski and Specter (2004).

<sup>10</sup> We are grateful to Van Pham for this point. Basker (2008) argues that the income elasticity of Wal-Mart revenue is negative while the income elasticity of Target revenue is positive, suggesting that the goods available at Wal-Mart are inferior.

Wal-Mart appears to reduce exercise, possibly by fostering dependence on the automobile as the means of transportation for shopping trips, Wal-Mart also appears to reduce the consumption of unhealthy foods and increase the consumption of healthy foods. These results support the hypothesis that Wal-Mart's low prices make healthy fresh foods more affordable, inducing a substitution from unhealthy to healthy foods. Further, Super Wal-Marts are associated with an increase in drinking while warehouse clubs are associated with more smoking and less eating out.

Wal-Mart is a political football, so any findings that relate to the social effects of the company will necessarily have policy implications. Wal-Mart is taxed in some cases and subsidized in others. Some states and municipalities have gone out of their way to lure Wal-Mart projects, and others have gone out of their way to make it hard for Wal-Mart to do business. The public policy question concerns the types of externalities that are (or are not) produced by Wal-Mart's entry. While a complete accounting for Wal-Mart's social effect is not possible at this stage, our findings reveal information about some of the factors that government officials should consider when evaluating proposed Big Box retail projects.

## **2. Literature on Obesity and Wal-Mart**

Much research (and public debate) on Wal-Mart focuses on jobs and wages. Basker (2005a) finds that Wal-Mart entry leads to net job creation in the short run. Neumark et al (2006) dispute her finding, but Basker (2006a) argues that the instrumental variable used by Neumark et al (distance from Bentonville, Arkansas, the location of Wal-Mart's headquarters) presents problems of its own and maintains the reliability of the estimates in (Basker 2005a). Using a sample of eight Pennsylvania counties and newly-available Quarterly Workforce Indicators from the US Census, Hicks (2007) finds a net positive increase in jobs and a net

reduction in retail job turnover after Wal-Mart entry. Goetz and Rupasingha (2007) argue that Wal-Mart reduces county-level social capital; however, Carden et al. (2008a) show that this result does not hold when broader data are used and a longitudinal perspective is taken.

One recent polemic has also argued that Wal-Mart is a “conservative cultural gatekeeper” that is in a position to mold American values in the form of those consistent with a “rural, conservative” agenda (Dicker, 2005), but conservative leaders threatened a boycott over Wal-Mart’s decision to join the National Gay and Lesbian Chamber of Commerce.<sup>11</sup> Carden et al. (2008a) use data from Putnam (2000) and Basker (2005a, 2005b) to show that Wal-Mart does not make communities “more liberal” or “more conservative.” More extensive reviews of the literature on Wal-Mart can be found in Basker (2006b), Hicks (2007), and Carden et al. (2008a).

Wal-Mart has trademarked two phrases that capture the philosophy that has made them into the world’s largest retailer: “Every Day Low Prices” and “Always Low Prices.” Wal-Mart entry has led to reductions in the prices of a number of goods (Hausman and Leibtag, 2004, 2005; Basker 2005b; Basker and Noel 2007). Most recently, Basker and Noel (2007) have estimated a statistically significant 1-1.2% reduction in competitors’ grocery prices driven largely by reductions in prices by smaller competitors. They find smaller reductions for larger competitors such as Kroger, Safeway, and Albertson’s.

Hausman and Leibtag (2004) cite data from studies showing that even after accounting for discount cards and sales, Wal-Mart maintains a price advantage of 8-27%. They argue that Wal-Mart has a price advantage of 15-25% over its competitors, but Basker and Noel (2007) suggest that the advantage is more on the order of 10%. Hausman and Leibtag point out a clear problem with the way the Consumer Price Index is calculated given these findings, noting that

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<sup>11</sup> Progressive critics claimed NGLCC membership was a cynical ploy on Wal-Mart’s part. See also Featherstone (2002) for a critique of Wal-Mart’s values agenda.

since the CPI does not adequately control for the shifting structure of retail, the CPI is biased upward—quoting their abstract, “the BLS CPI-U food at home inflation is too high by about 0.32 to 0.42 percentage points, which leads to an upward bias in the estimated inflation rate of about 15% per year.” Moreover, they find large increases in well-being from the opportunity to shop at Supercenters, suggesting that the foregone benefits attributable to anti-Wal-Mart campaigns are substantial, especially for the poor (Hausman and Leibtag, 2005).

The economics literature on causes of obesity is extensive. We survey here the obesity research that most directly pertains to Wal-Mart. Several studies suggest that lower food prices mean more obesity. For example, Philipson and Posner (2003) and Lakdawalla et al. (2005) suggest that rising obesity in the United States is the result of falling real food prices due to increased agricultural productivity and a movement from jobs requiring physical activity to more sedentary employment. Additionally, Chou et al. (2002), Chou, Grossman, and Saffer (2004), and Rashad (2006) find evidence that prices at fast-food and full-service restaurants appear to be correlated with obesity.

Increased urbanization and suburbanization have reduced the amount of exercise that people get.<sup>12</sup> In addition, we have moved into increasingly sedentary occupations. As Philipson and Posner (2003) note, work—manual labor—was formerly a paid form of exercise. Today, they argue, our choices manifest a preference for sedentary labor and sedentary leisure.

Recent studies have also attempted to link obesity to urban sprawl, or the spreading out of a city to suburban areas where walking and public transportation are less viable transportation options. Ewing et al. (2003), Giles-Corti et al. (2003), and Frank et al. (2003) show that increases in automobile-oriented infrastructure are associated with higher obesity, while Plantinga and Bernell (2005) find that suburbs do not make people heavier, heavier people move

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<sup>12</sup> Brueckner and Largey (2006) show that suburbanites tend to exhibit greater social connectedness.

to the suburbs. It might be argued that “Sprawl-Mart” increases obesity, but using longitudinal data, Eid et al (2006) argue that sprawl does not matter. In related work, Courtemanche (2008) finds that lower gasoline prices increase weight by causing a substitution from walking to driving and by increasing eating out.

We also explore Wal-Mart’s impact on two other risky health behaviors, smoking and drinking. These results are of interest by themselves, but also because smoking and drinking may affect body weight as nicotine is an appetite suppressant and metabolic stimulant while alcohol contains empty calories.<sup>13</sup> Wal-Mart driven price changes should also lead to changes in cigarette prices. The demand curve for cigarettes is highly inelastic, but it is downward sloping: Chaloupka (1999) notes that most estimates of the price elasticity of demand for cigarettes are between -0.3% and -0.5%. A review of studies of the price elasticity of alcohol concludes that the price elasticities of beer, wine, and distilled spirits are -0.3, -1.0, and -1.5 (Leung and Phelps, 1993). While “Always Low Prices” will reduce the prices of risky behaviors, the net effect may be more complex if risky behaviors are not independently determined. Moreover, public health accounting for Wal-Mart is complicated by the fact that all aspects (public health care utilization, for example, and drug prices) are not considered.

### **3. Theory and History<sup>14</sup>**

Weight is determined by the balance between calories in and calories out, and the technologies and habits that have produced both “calories in” and “calories out” have changed dramatically in the last three centuries. Since 1700, the industrial world has seen a dramatic and daring *Escape From Hunger and Premature Death*, to borrow the title of Fogel (2003). The

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<sup>13</sup> The causal relationship between cigarette prices and weight has been the subject of debate in the literature; see Chou et al (2004), Gruber and Frakes (2006), Baum (2008), and Courtemanche (2008).

<sup>14</sup> This section draws heavily on Levenstein (1988). We thank Tyler Cowen for directing us to Levenstein’s work.

central problem for most of history consisted of producing enough calories to avoid death. Even after basic bodily needs—the number of calories needed to sustain the body in a state of total rest—were met very little was left over for productive work. Americans in colonial Virginia in 1700 had an estimated 2,313 surplus calories per day for work; this compared very favorably to the 720 calories available in England and Wales and the 439 calories available in France (Fogel 2000:76). This has changed, and today the problem appears to be an excessive calorie balance rather than an insufficient calorie balance. Risk of mortality as a function of body mass index is U-shaped (Fogel 2000:147), and it appears that in the modern western world we are moving along the upward-sloping portion of the curve.

Wal-Mart has been part of this seismic shift. Eating habits were very conservative in the late nineteenth century. Food preparation in the early nineteenth century was characterized by “an overwhelming heaviness” with meals often consisting of boiled vegetables “mashed into paste.” Greens were considered food for animals, and people behaved accordingly even though an 1879 cookbook exhorted people to eat them in greater quantity (Levenstein 1988:5). For the poor especially, diets consisted largely of salted meats and heavy boiled vegetables like potatoes and cabbage (Levenstein 1988:23-24). Apples were among the earliest “superfoods” as they were valued for their supposed medicinal qualities (Levenstein 1988:5).

Several changes altered nineteenth-century American diets up and down the income distribution. First, stoves and ranges replaced open hearths in the 1880s and allowed for greater culinary precision and variety (Levenstein 1988:18-19). Second, changes in the technology of commercial canning in the 1870s “made fish, fruit, vegetables, and milk available to [well-off workers] all year round in this high-status form” (Levenstein 1988:26). Finally, advances in transportation integrated markets across the continent and increased dietary variety by making it

easier to carry fresh vegetables over long distances. People also became more health-conscious as they got richer. Levenstein cites the breakfast cereal revolution, which started in Battle Creek, Michigan near John Henry Kellogg's sanitarium, as an example (Levenstein 1988:33-34).

Food technology changed further over the course of the twentieth century. As Cutler et al. (2003:94) write, innovations such as vacuum packing, improved preservatives, deep freezing, artificial flavors, and microwaves have dramatically reduced the time cost associated with eating. As an illustration, they ask us to consider the humble potato, which was at the beginning of the twentieth century eaten in "massive amounts," "largely baked, boiled, or mashed," and "generally consumed at home." Since French fries took a lot of time and energy to prepare, potatoes were rarely consumed in this form. Technological changes that made French fry production much more capital-intensive allowed for fries to be produced and distributed at a much lower cost. "Today, the French fry is the dominant form of potato and America's favorite vegetable" (Cutler et al. 2003:94).

Cutler et al. (2003:101) argue that the increase in obesity can be attributed to an increase in the number of calories consumed while snacking between meals, which is consistent with their thesis that technological change is at the root of the increase in obesity. The aforementioned technological developments that ushered in the era of prepared food in the late twentieth century reduced the time-cost of snacking. It is easier to open a pack of Twinkies than it is to bake cookies, and as a result people have gained weight by snacking more often. Cutler et al. (2003:102) attribute the increase in snacking to "snacks consumed at home and, to a lesser extent, in snacks purchased in stores and at restaurants."

Enter Wal-Mart. The Wal-Mart revolution is fundamentally a revolution in retail logistics; as Karjanen (2006:152) characterizes it, "Wal-Mart does not manufacture or source

locally, but merely acts as a global commodity supply chain, distributing globally sourced goods to local markets.” The company’s major innovations have been in its distribution channels, with store locations, warehouse locations, and logistics practices planned in such a way as to minimize wasted motion. The company’s information-processing capacity also allows it to conduct its operations and target its products with greater precision. Wal-Mart’s databases are a premier source of information about consumer behavior, and they give Wal-Mart and its suppliers an edge with respect to forecasting consumer demand. This translates into even lower costs.

The advent and diffusion of large-scale, “Big Box” retailing in the 1960s and 1970s have introduced productivity improvements along the supply chain that have substantially reduced the costs of food delivery. Where seasonal fruits were once the norm, fresh fruits of all varieties (bananas, for example) are now available year-round in places where they do not grow naturally. Moreover, advances in food processing technology have led to store shelves filled with canned and processed foods with “use by” dates that are often years from when they are first distributed.

Time is money, especially when one is distributing rapidly-depreciating perishables like fresh fruit. Wal-Mart’s advances in transportation logistics and forecasting may have made it profitable for retailers to stock more fresh fruits and vegetables as well as lightly-processed items like bagged salad, baby spinach, and other vegetables. Mid-twentieth century innovations in food processing led to highly-processed foods of questionable nutritional value (TV dinners, for example). During the Big Box retail revolution of the late twentieth century, innovations reduced the cost of delivering fresh fruits and vegetables, possibly reducing the relative price of healthy foods in terms of unhealthy foods.

Wal-Marts come in three sizes, and each type might have a different effect.<sup>15</sup> The first is the discount store, which was the company's original business model. The discount store focuses primarily on consumer goods like clothing, electronics, and so on. The second is the Supercenter, colorfully called "Super Wal-Mart," which adds a full-service grocery store in addition to the discount store, creating "one-stop shopping." The third is the membership-only warehouse club in which members can buy discounted, brand-name goods in wholesale quantities. Here we elaborate on the discussion in Section 1 about the theoretical mechanisms by which the different stores might affect obesity. The effects are ambiguous *a priori*.

The Wal-Mart discount store primarily provides consumer goods, reducing the absolute price of consumer goods and increasing real income. It also reduces the price of consumer goods in terms of food. The substitution effect implies that people will substitute away from food and toward consumer goods, resulting in weight loss. Wal-Mart could also affect exercise because these cheaper consumer goods include exercise equipment, which will fall in absolute price as well as relative price in terms of food. The income effect is ambiguous, but it is reasonable to expect that exercise equipment is a normal good. The net effect is ambiguous because there are many substitutes for exercise, as well. It is also possible that Wal-Mart reduces calorie expenditure because one-stop shopping might require that shoppers expend fewer calories in shopping. Also, if Wal-Mart makes shopping more automobile-oriented, people might burn fewer calories as a result. Next, Wal-Marts sells cigarettes, potentially affecting obesity by increasing smoking. Finally, the income effect for exercise is ambiguous; however, if nutritious foods are normal goods and junk foods are inferior goods, we would expect people to consume more nutritious foods as a result.

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<sup>15</sup> We ignore Wal-Mart Neighborhood Markets for now because they are more like traditional supermarkets and do not fit under the "Big Box" rubric.

The effect of Super Wal-Mart may be different because Super Wal-Mart also sells food (and generally in greater variety than incumbent retailers). Given its core competencies in managing a global supply chain, Super Wal-Mart may introduce a greater variety of fresh fruits and vegetables and lean meats than would be available prior to Super Wal-Mart's entry. It also reduces the prices of prepared, processed foods, but the relative prices of foods that were previously unavailable locally necessarily falls. For example, one might be able to get preservative-laden TV Dinners for \$1.99 at Incumbent's Grocery, but Incumbent's might not carry artichokes, avocados, or bagged spinach. After Wal-Mart enters, the price of TV Dinners might fall to \$1.49 but artichokes, avocados, and bagged spinach are introduced into a market where they were unavailable previously. The costs of acquiring some of these goods might have previously required a trip to a specialty retailer (or to California), but Super Wal-Mart shoppers can now get these goods with less marginal effort. Wal-Mart's supply chain competencies also encourage processing innovations like bagged salads and greens. This also reduces the preparation time needed to prepare a healthy meal. Another relative price worth considering is the price of home-cooked meals relative to restaurant meals. If Super Wal-Marts reduce the price of the former but not the latter, people may lose weight by eating at home more and eating out less. Super Wal-Marts sell both cigarettes and alcohol (except for dry counties or towns). As discussed previously, cheap cigarettes may lead to weight loss while cheap alcohol may lead to weight gain. The income effect attributable to increased Super Wal-Mart penetration suggests that people will purchase more fresh fruits and vegetables and less junk food.

While the discussion for Super Wal-Marts applies to warehouse clubs like Sam's Club, B.J.'s Wholesale Club, and Costco as well, they are different in several ways. They require membership payments and then allow shoppers to buy food and other wares in bulk at discount

prices. They cater both to small businesses and to regular shoppers; in addition to bulk items marked for resale and other goods like office supplies, stores like Sam's Club also offer electronics, automotive services, prepared foods, processed foods, frozen foods, and fresh fruits and vegetables. Warehouse clubs may therefore increase eating out by reducing the operating costs of restaurants. Additionally, if reductions in the price of gasoline increase weight, the cheap gas sold by some warehouse clubs could conceivably increase obesity.

The emerging literature in behavioral economics suggests that self-control problems contribute to obesity (see Whitman 2006 and Glaeser 2007 for critical summaries). Glaeser (2007) criticizes the psychological basis for paternalism, arguing that the psychological case for paternalism is also a psychological case against paternalism. Information and error lead to updating. Whitman (2006) offers a Coasean case "against the new paternalism." Wal-Mart could improve the stochastic abilities of hyperbolic discounters to credibly commit to different types of stuff. One-stop, stock-up shopping might help mitigate self-control problems by allowing people to constrain their own future choices. Whitman (2006:5) argues that people can constrain their own future choices. Even if shopping at Wal-Mart increased obesity, people with self-control problems could avoid Wal-Mart and thereby reduce their exposure to self-control difficulties.

## 4. Data

Data on Big Box retailer locations are available from several places. We use Wal-Mart and Super Wal-Mart data generously made available online by Thomas J. Holmes.<sup>16</sup> Data on Sam's Club, Costco, and BJ's Wholesale Club locations through 2003 were collected by Austan

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<sup>16</sup> <http://www.econ.umn.edu/~holmes/data/WalMart/index.html>. The data were used in the preparation of Holmes (2008).

Goolsbee and Chad Syverson and were generously provided by Chad Syverson via email. Our main source of individual-level data is the Behavioral Risk Factor Surveillance System (BRFSS), a telephone survey of health conditions and risky health behaviors conducted by state health departments and the Center for Disease Control.<sup>17</sup> The BRFSS consists of repeated annual cross sections of randomly-selected individuals starting in 1984. In 1984, only 15 states participated, but this number grew rapidly and all states were participating by 1996. The number of respondents also grew rapidly, from 12,258 in the 1984 wave to 355,710 in the 2006 wave. The BRFSS includes self-reported height and weight, which allows us to estimate BMI and construct indicator variables for whether or not the respondent is overweight ( $BMI \geq 25$ ), obese ( $BMI \geq 30$ ), and severely obese ( $BMI \geq 35$ ).<sup>18</sup> These are the dependent variables in our primary analysis.

In our secondary analysis, we use BRFSS data on food consumption, exercise, smoking, and drinking as dependent variables in order to identify the channels through which Wal-Mart affects obesity while examining its broader effect on health behaviors. The 1990 to 1994 surveys contain self-reported estimates of the frequency with which the respondents consume a wide variety of foods. The BRFSS uses this information to calculate an index of fat consumption, which takes a value of 0 if the respondent is below the 25<sup>th</sup> percentile in fat intake, 1 if fat intake is between the 25<sup>th</sup> and 75<sup>th</sup> percentiles, and 2 if fat intake is above the 75<sup>th</sup> percentile. We use this index as a proxy for unhealthy food consumption.

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<sup>17</sup> Since the BRFSS is a telephone survey, low-income individuals or people who only use cellular phones may be under-sampled. However, it seems unlikely that this would systematically bias the results in this paper.

<sup>18</sup> Self-reported weight and height may be problematic since people tend to underreport their weight and, to a lesser extent, exaggerate their height. Some economists have employed a correction for self-reported BMI developed by Cawley (1999). This correction the National Health and Nutrition Examination Survey, which includes both actual and self-reported weight and height, to estimate actual BMI as a function of self-reported BMI and a variety of demographic characteristics. Researchers have generally found that the correlation between actual and self-reported BMI is very high, and that correcting for measurement error does not substantially alter the coefficient estimates in regressions (Cawley, 1999 and Lakdawalla and Philipson, 2002). We therefore elect not to employ the correction in this paper.

The 1990 to 2003 surveys also report the frequency with which the respondents consume a narrower range of healthy foods. The BRFSS uses this information to construct the number of servings of fruits and vegetables the respondents consume per day, which we use as a proxy for healthy food consumption.

For exercise, the surveys up to 2000 ask the respondents a variety of questions regarding physical activity. Based on their answers, the BRFSS constructs a variable indicating whether or not they exercise regularly. The waves up to 2000 also report the number of alcoholic beverages consumed in the past 30 days. We use this variable, as well as an indicator variable for whether or not the respondents drink at all, as our measures of alcohol consumption. In all waves, the BRFSS asks respondents whether they currently smoke, while in all waves up to 2000 it asks smokers the number of cigarettes they smoke per day. We use both variables as measures of smoking.

We also utilize demographic variables from the BRFSS as controls in both the main and secondary analyses. The data include household income categories; we calculate real incomes (in 2003 dollars) by assigning individuals incomes equal to the midpoint of their category and then adjusting for inflation using the consumer price index for all urban consumers from the Bureau of Labor Statistics. The BRFSS data also allow us to construct indicator variables for whether or not the individual is married, female, black, and a race other than black or white. Finally, we include age plus a set of indicator variables for highest level of educational attainment: some high school, high school graduate, some college, and college graduate.

Because the BRFSS does not contain information on the frequency with which people eat at restaurants, we also use the DDB Needham Life Style Surveys. This is one of the data sources

used by Robert Putnam in *Bowling Alone*, and the data are available on his website.<sup>19</sup> These data contain detailed information on leisure time activities, beliefs, and values. Self-reported frequencies of going out to breakfast, lunch, and dinner in the past year are available from 1988-1998. The survey questions group responses into the following categories: none, 1-4 times, 5-8 times, 9-11 times, 12-24 times, 25-51 times, and 52+ times. We construct continuous variables by assigning them the midpoint of the chosen category, or 52 if “52+ times” is chosen. We then add these three frequencies to construct the total number of times the respondents go out to eat per year. The DDB data also include demographic information, allowing us to create the same set of controls that we use with the BRFSS.

We match these individual-level data to the number of Wal-Mart discount stores, Super Wal-Marts, Sam’s Clubs, Costcos, and BJ’s Wholesale Clubs in the county in the month before the respondent’s interview. We adjust for market size by calculating the number of stores per 100,000 residents in the county, using population data from the U.S. Census Bureau.

We are restricted in some cases by data limitations. The BRFSS only includes county identifiers starting in 1994, and our warehouse club data are only available through 2003. Our matched sample for most regressions therefore only includes 1,306,947 observations from 1994-2003. We report variable names, sources, descriptions, and summary statistics in Table 1. The average individual in the BRFSS sample has a BMI of 26.4, while 56% of the sample is overweight, 20% is obese, and 7% is severely obese. The average respondent lives in a county with 0.8 regular Wal-Marts per 100,000 residents, 0.4 Super Wal-Marts per 100,000 residents, and 0.3 warehouse clubs per 100,000 residents (reflecting the sum of Sam’s Clubs, Costcos, and BJ’s Warehouses).

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<sup>19</sup> The data are available at <http://www.bowlingalone.com/data.htm>.

Figure 1 shows changes in the obesity rate in the BRFSS sample over the period 1984-2003, along with changes in Wal-Mart Discount Stores, Super Wal-Marts, warehouse clubs, and the total combined number of Big Box retailers. The graph provides some preliminary support for the theory that Big Box retailers increase obesity. Both obesity and big box retail are trending upward during the period, with the number of Wal-Mart Discount Stores beginning to decline after 1994 as they were converted to Super Wal-Marts. Further, both obesity and total Big Box retail appear to exhibit slightly quadratic growth until 1993, flatter growth from 1993 to 1997, and more steep growth after 1997. More specifically, the reduction in the growth rate of warehouse clubs after 1994 coincides with a reduction in the growth rate in obesity, but also the conversion of Wal-Marts to Super Wal-Marts. To further disentangle correlation from causality, we next turn to regression analysis.

## 5. Empirical Analysis

The number of Wal-Marts ( $WM$ ), Super Wal-Marts ( $SWM$ ), and warehouse clubs ( $WC$ ) may affect body mass index ( $BMI$ ) through several mechanisms: healthy food consumption ( $HF$ ), unhealthy food consumption ( $UF$ ), exercise ( $E$ ), smoking ( $S$ ), drinking ( $D$ ), and frequency of eating at restaurants ( $R$ ). The relationship between these variables can be modeled by the following set of equations:

$$BMI = f(HF, UF, E, S, A, R, X) \quad (1)$$

$$HF = g(WM, SWM, WC, X) \quad (2)$$

$$UF = g(WM, SWM, WC, X) \quad (3)$$

$$E = g(WM, SWM, WC, X) \quad (4)$$

$$S = g(WM, SWM, WC, X) \quad (5)$$

$$A = g(WM, SWM, WC, X) \quad (6)$$

$$R = g(WM, SWM, WC, X) \quad (7)$$

where  $X$  is a set of demographic characteristics. Combining these equations yields the following reduced-form model:

$$BMI = f(WM, SWM, WC, X). \quad (8)$$

Because of the limited overlap between available data for the different mechanisms we have discussed and the fact that estimating a complete structural model would require six instruments, we restrict our attention to the reduced-form model given by equation (8). In Section 5.5, we also estimate equations (2) through (7) in an effort to explain the reasons for the reduced-form results. Research suggests that commonly-used price measures such as the consumer price index do not accurately reflect the impact of Wal-Mart on prices. Previous studies of the effect of Wal-Mart on prices have used the Homescan data discussed in Hausman and Leibtag (2004, 2005), Basker (2005b), and Basker and Noel (2007). We therefore do not include prices in the structural analysis, although accurately estimating the effect of Wal-Marts and warehouse stores on healthy food, unhealthy food, cigarette, and alcohol prices represents an interesting direction for further research.

## 5.1 Regressions

We begin by assuming a linear functional form for (8) and estimating

$$BMI_{icmy} = \beta_0 + \beta_1 WM_{icmy} + \beta_2 SWM_{icmy} + \beta_3 WC_{icmy} + \beta_4 X_{icmy} \cdot (9)$$

where  $i$ ,  $c$ ,  $m$ , and  $y$  are indexes for individual, county, month, and year;  $X$  includes the variables for education, race, gender, income, marital status, and age described in Section 4 plus the square of income and age; and  $\alpha$ ,  $\tau$ , and  $\mu$  are county, year, and month fixed effects.<sup>20</sup> Our Wal-Mart,

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<sup>20</sup> Results are similar using log-linear, log-log or quadratic specifications. We include month fixed effects because our data allow the number of stores to change every month. In unreported regressions, we include a separate binary variable for each month-year combination; results are almost identical. Following CGS's (2006) argument that controlling so extensively for time may lead to misspecified models in regressions with body weight as the dependent variable, we elect not to report the results from regressions that include separate fixed effects for all 120 months in the sample. These results are available upon request.

Super Wal-Mart, and warehouse club variables reflect the number of stores in the county per 100,000 residents, following Goetz and Rupasingha (2006), Carden et al. (2008a, 2008b) and Carden and Courtemanche (2008).<sup>21</sup> Our standard errors are heteroskedasticity-robust and clustered by county. The year effects account for national trends, while the month effects account for seasonal variations in body weight. Since the variables of interest are county-level, the county effects should account for time-invariant sources of omitted variable bias in  $\beta_1, \beta_2,$  and  $\beta_3$ . Our identification assumption is therefore that changes over time in unobservable county characteristics are uncorrelated with changes over time in body weight and Wal-Mart, Super Wal-Mart, or Warehouse Club presence.

We next conduct a variety of robustness checks to examine the validity of this assumption. First, we add a set of county-level controls that includes the number of grocery stores, the number of restaurants, a price index for food consumed away from home, and the unemployment rate. We include grocery stores to address the concern that Wal-Marts and warehouse clubs simply proxy for food availability and overall levels of economic development. We add the number of restaurants and the prices of food consumed away from home since areas with easy access to restaurant food may both have high body weights and fewer discount grocers since demand for food prepared at home may be lower.<sup>22</sup> We include county unemployment rate because Ruhm (2000, 2005) found that body weight falls as unemployment rates rise, and local economic conditions may also affect Wal-Mart and warehouse club entry and exit.

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<sup>21</sup> For all years, we scale by county population in 1997 obtained from the U.S. Census Bureau. We fix county population so that the variation over time comes entirely from variation in the number of stores. Allowing population to vary over time would allow the possibility that the results are driven by changes in population instead of changes in stores. Nonetheless, our results are very similar using county population from the survey year. We combine Sam's Clubs, Costcos, and BJ's Warehouses into one "warehouse club" variable because their stores are similar and, accordingly, their effects are statistically indistinguishable if they are included in the model separately. Combining them improves the precision of the estimates.

<sup>22</sup> We do not include prices of food at home, prices of cigarettes, or gas prices because Wal-Mart, Super Wal-Mart, and warehouse clubs may affect those, and we aim to encompass all possible mechanisms with our coefficient estimates.

Another concern is that Wal-Marts and Sam's Clubs tend to locate disproportionately in rural areas or small towns, while Costco has had more success entering larger metropolitan areas. Since trends in BMI over time may differ between heavily populated and lightly populated areas, our fixed effects estimates may be biased. In another robustness check, we therefore interact county population with the set of year dummies in order to capture these differential trends.

A similar concern is that Wal-Mart and Sam's Club expansion occurred fastest in the areas surrounding Wal-Mart's birthplace of Bentonville, Arkansas, such as the South and Midwest, while Costco expansion occurred most rapidly in the West. Neumark et al. (2005) use distance from Bentonville as an instrument for Wal-Mart location in a critique of Emek Basker's findings about Wal-Mart and employment. Basker (2007) responds to these criticisms, and Carden et al. (2008a) use distance from Bentonville as an instrument for Wal-Mart location in a study of Wal-Mart's effect on social capital. If trends in BMI are different in different parts of the county, our fixed effects again may be biased. We therefore add census division-by-year effects to the model, created by interacting dummy variables for each of the nine U.S. census divisions with the year fixed effects. We also account for differential trends between more narrowly-defined geographical areas by including state-by-year interactions.

We next include linear county-specific time trends in equation (9). These are created by interacting the county fixed effects with the year effects, and they help determine whether slow-moving trends in unobservable county characteristics are biasing our estimates. The census-division-by-year and state-by-year interactions should account for some county trends as unobservable county characteristics are likely correlated across states and regions, but the linear county trends will account for these trends more directly. However, our sample consists of

29692 county-year combinations spanning 3102 counties, so adding 3102 new variables may lead to a considerable loss in efficiency.

We next estimate the baseline fixed effects model using indicator variables for whether or not the individual is overweight, obese, and severely obese as alternative dependent variables. While converting a continuous variable to discrete may reduce efficiency, seeing if effects on BMI translate to effects on overweight and obesity is necessary to determine their impact on health. For example, if Wal-Marts or warehouse clubs increase BMI but the entire effect occurs at the lower end of the distribution, then health will not worsen and may actually improve if underweight people gain weight. In this case, we would obtain positive coefficient estimates in the BMI regressions but not in the regressions using overweight, obesity status, and severe obesity status.

## 5.2 Results

Table 2 reports the key results from these regressions.<sup>23</sup> Column (1) displays the estimates from the baseline fixed effects estimation of equation (9). One additional regular Wal-Mart per 100,000 residents is associated with a statistically significant but modest reduction in average BMI of 0.071 units, or 0.46 pounds at the sample mean height. Since regular Wal-Marts do not sell groceries, the slight weight reduction could either reflect income effects as Wal-Mart increases real incomes or substitution effects as Wal-Mart reduces the relative price of non-food goods. An additional Super Wal-Mart per 100,000 residents, which sells cheap groceries, is also associated with a small and statistically significant reduction in BMI of 0.027 units, or 0.18 pounds. Warehouse clubs have a similar negative effect, with an additional Super Wal-Mart per 100,000 residents shaving off -0.035 units of BMI, or 0.23 pounds, although the coefficient estimate is less precise and therefore statistically insignificant at conventional levels. For

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<sup>23</sup> Coefficient estimates for the control variables are available from the authors upon request.

purposes of comparison, there are four Sam's Clubs and two Costcos in Shelby County, Tennessee according to the online store locators at [www.samsclub.com](http://www.samsclub.com) and [www.costco.com](http://www.costco.com). The US Census Bureau's estimate of the county's population in 2006 was 911,438, meaning that there were approximately 0.66 warehouse stores per 100,000 residents of Shelby County.<sup>24</sup> An increase of one additional Sam's Club per 100,000 residents would more than double warehouse store presence in Shelby County.

All three coefficient estimates remain virtually unchanged when we add the county-level controls or population-year interactions. Including census division-by-year interactions reduces the magnitude of the three effects slightly, but the baseline estimates remain well inside the 95% confidence intervals, so we are unable to conclude that these reductions in magnitude reflect anything other than sampling error. Using state-by-year instead of census division-by-year interactions makes almost no difference in the point estimates. Including county trends increases the standard errors considerably while slightly reducing the magnitudes for Wal-Mart and Super Wal-Mart and causing the sign of the coefficient on warehouse clubs to become positive. In these estimates, all coefficients are statistically insignificant. Note that county trends explain 58%, 57%, and 54% of the variation in Wal-Marts, Super Wal-Marts, and warehouse clubs remaining after controlling for county fixed effects and the other regressors in the baseline model. Moreover, county effects and trends, along with the other regressors, explain 95%, 88%, and 96% of the total variation in per capita Wal-Marts, Super Wal-Marts, and warehouse clubs. Therefore, we suspect that the inclusion of county trends eliminates too much of the meaningful variation in the variables of interest to accurately identify their effects in these models.<sup>25</sup> In any

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<sup>24</sup> <http://quickfacts.census.gov/qfd/states/47/47157.html>, accessed August 25, 2008.

<sup>25</sup> Ruhm (2003), encountered a similar situation in his study examining the effect of state unemployment rate on weight and smoking when adding state trends. Citing Chou et al (2002), he argues in favor of the baseline fixed effects models instead of the models including state trends.

case, for all three types of stores the baseline estimates are well within the 95% confidence intervals of the estimated coefficients from regressions that include county trends. We therefore cannot conclude that the baseline fixed effects estimators are inconsistent. Because we find no evidence that our baseline estimates are inaccurate, we employ the county fixed effects estimation strategy throughout the rest of the paper.

The coefficient on Wal-Mart is again negative and statistically significant when we estimate the impact of Wal-Mart's presence on a survey respondent's probability of being overweight. The coefficient magnitude of 0.005 corresponds to a 0.9% decrease in  $P(\text{Overweight})$  relative to the sample mean. An additional Wal-Mart discount store per 100,000 capita would reduce by approximately 1% the probability that someone is obese. The effect of an additional Super Wal-Mart on  $P(\text{Overweight})$  is negative but small and statistically insignificant, while the effect of an additional warehouse club is positive and statistically insignificant.

An additional Wal-Mart decreases the probability of obesity by 0.4 percentage points, or 2.0% of the sample obesity rate. This implies that a 2% reduction in obesity would save 2,240 lives and \$2.34 billion in medical expenditures per year. These calculations are admittedly crude, but they suggest that the estimated changes in weight attributable to increased Wal-Mart and Big Box penetration may translate to meaningful effects on public health. Our coefficient estimates for Super Wal-Marts and warehouse clubs are both negative, but they are small and statistically insignificant.

Increases in all three types of stores are associated with reductions in  $P(\text{Severely Obese})$ , although all three coefficient estimates are statistically insignificant. The magnitudes are sizeable, however. Relative to the sample mean severe obesity rate of 6.5%, an additional Wal-

Mart, Super Wal-Mart, and warehouse club decrease P(Severely Obese) by 1.4%, 0.5%, and 2.8%, respectively. The large standard errors of the coefficient estimates may be caused by the lack of variation in the dependent variable.

In the interests of conserving space, we do not report the results for regressions combining two or more robustness checks; for example, including the county-level controls plus state-year interactions, or using obesity status as the dependent variable while including the population-year interactions and census division-year interactions. However, the coefficient estimates remain similar using the various combinations. These estimates are available from the authors upon request.<sup>26</sup>

### **5.3 Stratification by Gender, Income, Race, and Population Density**

Wal-Mart affects different groups of people different ways. In this section, we explore possible heterogeneity by stratifying the sample on the basis of gender, income, race, and population density. For gender, we estimate equation (9) separately for men and women. For income, we divide the sample into individuals with a household income of up to \$25,000 (approximately the 25<sup>th</sup> percentile), between \$25,000 and \$70,000 (approximately the 75<sup>th</sup> percentile), and above \$70,000. For race, we run separate regressions for whites, blacks, and people of another primary race. For population density, we split the sample into groups of people who live in a county with up to 50 (approximately the 25<sup>th</sup> percentile), between 50 and 200 (approximately the 75<sup>th</sup> percentile), and more than 200 people per square mile.

Stratifications by gender, income, and race are common in the obesity literature. We stratify according to population density for two reasons. First, Wal-Mart's effect may be stronger or

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<sup>26</sup> Including census division- or state-by-year interactions as well as county trends, however, substantially reduces the precision of the estimates.

weaker depending on the thickness of the market and the density of the customer base. Second, Wal-Mart has encountered resistance as it has tried to move into urban areas.

Table 3 reports the results of these estimations. For gender, the most striking difference is that warehouse stores have a negative effect on weight for women and a slight positive effect on weight for men, and the difference is statistically significant. People with low incomes seem to lose the most weight when Wal-Marts and Super Wal-Marts enter. This is not surprising since low-income consumers would presumably be the most sensitive to modest changes in prices and purchasing power. People with high incomes have the strongest responses to warehouse club entry; however, because of the large standard error we cannot rule out the possibility that this is the result of sampling error. Racial differences are evident in the data. Blacks respond most strongly to Wal-Mart entry, while people of a race other than white or black respond most strongly to warehouse club entry. The warehouse club result may be driven by Costco's presence in Arizona and California, which have large Latino populations. The data suggest that people in the least dense areas are almost completely unaffected by Wal-Mart, Super Wal-Mart, or warehouse club entry. The strongest response to warehouse club entry occurs in densely populated areas. Finally, note that we do not obtain a positive and statistically significant estimate in any of the 33 cells in Table 3, which suggests that these store sub-types do not increase weight for any of the populations in question.

#### **5.4 Lags**

Weight is a capital stock that responds gradually to changes in caloric intake or expenditure. For example, if someone begins consuming 1,000 extra calories per day every day, he or she will slowly gain weight over a period of time, eventually reaching a new steady state

months or maybe even years into the future.<sup>27</sup> Additionally, some evidence suggests that food consumption patterns fit addiction models, in which case the long-run response to price changes would be stronger than the short-run response (Cawley, 1999; Barnes, 2008). We therefore next estimate equation (9) including one, three, and five annual lags of *WM*, *SWM*, and *WC* to examine the sensitivity of our baseline results to an attempt to differentiate between short-run and longer-run effects.

We report the results of these estimations in Table 4. Of particular interest are the “total effects,” or sum of the coefficients on the contemporaneous and lagged variables, which we report at the bottom of the table. Adding lags makes essentially no difference for regular Wal-Marts, as the total effects are almost identical to the estimates in Table 2, and the coefficients on each lag are small and statistically insignificant. Wal-Mart’s total effect on weight therefore manifests itself very quickly. The slight negative effects of Super Wal-Marts that are reported in Table 2 seem to slowly disappear as lags are added, although the baseline estimate is still within the 95% confidence interval of the total effect estimated with five lags, and the coefficients on each lag are statistically insignificant. The effect of warehouse clubs, however, becomes somewhat more strongly negative over time. In column (1), the coefficient on the lag is significant at the 10% level, while in columns (2) and (3) the sum of the coefficients on the first and second lags is negative and significant at the 5% level. The delayed effect may reflect a temporary reluctance to shop at warehouse clubs because of the need to purchase a membership. Nonetheless, the total effects of warehouse clubs are outside the boundaries of conventional statistical significance, so our results provide only weak evidence that warehouse clubs reduce weight in the long run.

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<sup>27</sup> See Cutler et al (2003) for a model that depicts this phenomenon, and Anderson, Butcher, and Levine (2003) and Courtemanche (2008) for further discussion.

To summarize, Tables 2, 3, and 4 present a total of 69 estimates of the effects of Wal-Mart, Super Wal-Mart, or warehouse club penetration, and not a single estimated coefficient is positive and statistically significant. It therefore seems highly unlikely that any of the three types of stores increase weight. Moreover, we find evidence that increased penetration by Wal-Mart discount stores is associated with a modest reduction in weight. Our results for Super Wal-Marts and warehouse clubs are less conclusive, but the weight of the evidence suggests that both kinds of stores either decrease weight slightly or have no measureable effect.

### 5.5 Examining the Mechanisms

The estimated effects of Super Wal-Mart and warehouse clubs contradict the conventional wisdom that cheap food leads to weight gain. In this section, we attempt to explain our reduced-form results by examining the effects of Wal-Marts, Super Wal-Marts, and warehouse clubs on the various mechanisms discussed in Section 3. We estimate variations of equations (2) through (7) assuming a linear functional form. Since the evidence suggests that our baseline fixed effects reduced-form estimators are not biased, we use this methodology throughout this section. Our regression equation is:

$$Y_{icmy} = \beta_0 + \beta_1 WM_{cmy} + \beta_2 SWM_{cmy} + \beta_3 WC_{cmy} + \beta_4 X_{icmy} + \alpha_c + \tau_y + \mu_m + \varepsilon_{icmy} \quad (10)$$

where  $Y$  is one of eight dependent variables: number of fruits and vegetables consumed per day, index of fat consumption, whether or not the respondent exercises regularly, whether or not the respondent drank any alcoholic beverages in the past month, the number of alcoholic beverages consumed during in the past month (with the sample restricted to people who drink), whether or not the respondent currently smokes, number of cigarettes smoked per day (with the sample restricted to people who smoke), and the number of times the subject went out to eat in the past year. We estimate both OLS and ordered probit models for specifications in which the BRFSS

index of fat consumption is the dependent variable. Since the BRFSS does not include information on the frequency with which people visited restaurants, we use the considerably smaller DDB data to evaluate Wal-Mart's impact on restaurant visits. Also, the BRFSS variables for fat consumption, exercise, and number of cigarettes smoked are not available in all survey waves, limiting our sample size in these regressions.

Limited data is of particular concern for the fat consumption index, which is available in only 1990-1994. Since the BRFSS contains county identifiers starting in 1994, we can only match county-level store data to fat consumption for a single cross-section. This would prevent the inclusion of county fixed effects, limiting the information that can be gleaned from the results. We therefore use state-level Wal-Mart, Super Wal-Mart, and warehouse club data in the fat consumption regressions, which allows us to use the entire 1990-1994 period. We estimate models with state instead of county fixed effects. If we use state- instead of county-level store data in the reduced-form regressions, the coefficient estimates are similar but the standard errors are considerably larger. We therefore expect that using state-level data in the fat consumption regressions will not systematically bias our estimates, but it will reduce their precision. The use of 1990-1994 data creates another problem, however: the average county contained only 0.005 Super Wal-Mart stores per 100,000 residents during this period. Because of this especially low number of stores, our estimated effects of Super Wal-Mart on fat consumption should be interpreted with caution.

We begin by investigating healthy and unhealthy food consumption. If regular Wal-Marts decrease consumption of all foods, this would be consistent with the hypothesis that regular Wal-Marts increase the relative price of food by decreasing the absolute price of non-food goods, leading to a net substitution away from food. Alternatively, if regular Wal-Marts

increase consumption of healthy foods but decrease fat consumption, this would support the hypothesis that Wal-Marts increase real incomes, inducing a substitution from cheap but unhealthy food to more expensive but healthier food. For Super Wal-Marts and warehouse clubs, an increase in consumption of both kinds of food would support the conventional wisdom that cheap food leads people to eat more while suggesting that the other mechanisms must be driving the reduced-form results. On the other hand, if Super Wal-Marts and warehouse stores increase healthy food consumption while decreasing fat consumption, this would be consistent with the “income effect” hypothesis.

We report the results in Table 5. All three types of stores are associated with a statistically significant increase in fruit and vegetable consumption. Relative to the sample mean of 3.9 servings of fruits and vegetables per day, an additional regular Wal-Mart per 100,000 residents increases consumption by 1.9%, an additional Super Wal-Mart increases consumption by 0.8%, and an additional warehouse club increases consumption by 2.9%.

We display the results for estimates of Wal-Mart’s impact on fat consumption in the right half of Table 5. For the ordered probit regressions, we report the marginal effects on the probability of being in each of the three categories. In the OLS regression, all three types of stores lead to a statistically significant (at the 10% level or higher) reduction in fat consumption. In the ordered probit regression, all three stores are again associated with less fat intake, although the warehouse club estimate is now slightly insignificant. The coefficient estimate for Super Wal-Mart is extremely large. We suspect that this is because of the small number of Super Wal-Marts during the 1990-1994 sample period. Indeed, an additional store per 100,000 residents represents almost a 22,000% increase in Super Wal-Mart presence relative to the sample mean. The elasticities implied by our estimates may therefore be more meaningful; using our OLS

estimates, 10% increases in regular Wal-Marts, Super Wal-Marts, and warehouse clubs are associated with 0.8%, 0.2%, and 0.2% reductions, respectively, in the mean value of “fat index.” To summarize, the fact that all three types of stores are associated with increases in fruit and vegetable consumption but decreases in fat intake provide support for our hypothesis that discount stores increase real incomes, causing substitution away from cheap and unhealthy processed foods and toward healthier but more expensive foods, such as fresh produce.

In Table 6, we present the results for estimates of the impact of Wal-Mart stores and warehouse clubs on other health behaviors: exercise, drinking, smoking, and eating at restaurants. We also look at other risky behaviors that should be affected by Wal-Mart’s policy of “Every Day Low Prices”: smoking and alcohol consumption. It has been estimated that obesity leads to 112,000 deaths and \$117 billion in avoidable medical costs every year (Flegal et al 2005, US Department of Health and Human Services, 2001). Smoking has been linked to 438,000 avoidable deaths at a cost of \$167 billion (Amour et al, 2005). Alcohol related-deaths have been estimated at about 100,000 per year (“Substance Abuse ...”, 2001) and alcohol-related costs have been estimated at almost \$185 billion in 1998 (Harwood, 2000).<sup>28</sup>

Regular Wal-Marts and warehouse clubs per 100,000 people are associated with 2.9% and 2.3% reductions in the probability of obtaining regular exercise, suggesting that these stores may in fact reduce functional exercise by causing a shift from walking-intensive downtown shopping to driving-intensive suburban shopping. Alternatively, if people are losing weight due to reduced fat intake, they may feel less of a need to exercise. This may explain why the sizeable

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<sup>28</sup> The recommended citation for the economic cost of alcohol estimates reported by Harwood (2000) suggests that the figure is “(b)ased on estimates, analyses, and data reported in Harwood, H.; Fountain, D.; and Livermore, G. *The Economic Costs of Alcohol and Drug Abuse in the United States 1992*. Report prepared for the National Institute on Drug Abuse and the National Institute on Alcohol Abuse and Alcoholism, National Institutes of Health, Department of Health and Human Services. NIH Publication No. 98-4327. Rockville, MD: National Institutes of Health, 1998.” Online: <http://pubs.niaaa.gov/publications/economic-2000/#updated>, accessed August 8, 2007.

changes in eating habits do not lead to more dramatic weight losses. The results are not conclusive, though, as the coefficient on warehouse clubs is imprecisely estimated while we observe no measurable effect for Super Wal-Marts.

None of the three types of stores affect whether or not an individual drinks, but Super Wal-Marts are associated with a statistically significant increase in drinking intensity among drinkers. An additional Super Wal-Mart per 100,000 residents increases alcohol consumption by 2.3% among drinkers, which translates to a 1.2% increase for the entire population. Using commonly accepted estimates of the costs of drinking, such an increase would lead to 1,200 additional deaths and \$2.2 billion in additional medical expenditures per year.<sup>29</sup> Therefore, even if Super Wal-Marts do not lead to more obesity, they still have the potential to hurt public health. We do not observe a similar effect on alcohol consumption for warehouse clubs. It is important to note, however, that the relationship between alcohol consumption and social cost is likely to be non-linear. Moderate amounts of alcohol have positive benefits, and the negative effects are likely to increase more rapidly as the number of drinks consumed at a single time increases.

Wal-Mart, Super Wal-Mart, and warehouse clubs do not appear to affect whether an individual smokes. However, warehouse clubs appear to increase smoking intensity among smokers, as one might expect as it gets easier and cheaper to buy cigarettes in bulk. The imprecision of the estimate makes it slightly insignificant. An additional warehouse club per 100,000 residents is associated with a 2.6% increase in cigarettes smoked per day among smokers, or a 0.6% increase in smoking among the entire population. Such an increase would lead to 2,628 deaths and \$1.0 billion in medical expenses per year using commonly accepted

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<sup>29</sup> Alcohol related-deaths have been estimated at about 100,000 per year (“Substance Abuse ...”, 2001) and alcohol-related costs have been estimated at almost \$185 billion in 1998 (Harwood, 2000).

estimates of the costs of smoking.<sup>30</sup> We do not find that Wal-Marts or Super Wal-Marts affect smoking intensity, even though both types of stores sell cigarettes. We suspect that the effect for warehouse clubs therefore reflects the combination of bulk purchasing and the addictive nature of cigarettes: people may smoke more simply because they have more cigarettes in the house.

The estimates for eating at restaurants are imprecise because of the smaller size of the DDB dataset. However, we find that an additional warehouse club per 100,000 residents decreases eating out by a statistically significant (at the 10% level) 2.2 times per year, or 4.8% of the sample mean. While this supports our hypothesis that discount grocers raise the relative price of eating at restaurants by decreasing the absolute price of eating at home, the fact that we do not observe a similar effect for Super Wal-Marts is surprising. This suggests that the warehouse club effect may reflect bulk purchasing rather than price. If people have large quantities of food in the house, they may be less inclined to go out to a restaurant. Also, the fact that warehouse clubs charge a membership fee may enhance people's desire to shop at them once they are members, as opposed to eating out, in order to "get their money's worth." While membership fees are sunk costs and therefore should not affect marginal decisions, evidence from behavioral economics suggests that loss aversion leads people to not treat sunk costs as sunk (see, for example, Thaler and Johnson, 1990).

Together, the results from Tables 5 and 6 help to explain why people do not gain weight after Wal-Mart, Super Wal-Mart, and warehouse club become more prevalent. Regular Wal-Marts lead to healthier food choices, which should decrease weight, but less exercise, which should increase weight. The net effect appears to be modest weight loss. Super Wal-Marts are associated with healthier food choices, which should decrease weight, but more drinking, which should increase weight. The net effect either appears to be zero or slight weight loss.

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<sup>30</sup> Smoking has been linked to 438,000 avoidable deaths at a cost of \$167 billion (Amour et al, 2005).

Warehouse clubs lead to healthier food choices, more smoking, and less eating out, which should decrease weight, and less exercise, which should increase weight. The net effect is again either zero or slight weight loss.

Another useful aspect of the estimates in Table 6 is that they enhance the credibility of the reduced-form results and the results for food consumption. Our findings that the three types of stores are associated with slight weight loss and healthier eating habits could be the result of omitted variable bias if counties that become healthier over time (leading to slower weight growth than other counties) also tend to experience more Wal-Mart and warehouse club entry, possibly because of increased demand for home cooking. If this were the case, however, we should have found that Wal-Marts and warehouse stores were associated with more exercise, less smoking, and less drinking, and we found none of these.

## **6. Conclusion**

We examine the relationship between Big Box retail and obesity, which illustrates the complexity of the relationship between obesity and economic change. Contrary to conventional wisdom, Super Wal-Marts and warehouse clubs do not appear to increase body weight or the prevalence of overweight, obesity, or severe obesity. If anything, they may lead to a small weight loss. Moreover, we find strong evidence that the entry of regular Wal-Marts – which do not sell groceries – leads to modest weight loss. The results from our secondary analysis are consistent with our theory that discount stores increase real incomes, inducing a substitution from unhealthy but cheap food to healthy but more expensive food. We also find some evidence that regular Wal-Marts and warehouse clubs decrease exercise, Super Wal-Marts increase drinking intensity among drinkers, and warehouse clubs increase smoking intensity among smokers and decrease frequency of eating at restaurants.

The most obvious policy implication of our results is that local governments should not resist Wal-Mart or warehouse club entry, or deny tax breaks to these stores, out of fear that their effect on food prices would increase obesity. The possible effects on drinking and smoking, however, should be considered, especially considering the numerous negative externalities – such as drunk driving accidents, second-hand smoke, and Medicare and Medicaid expenses – associated with these activities. Perhaps alcohol or cigarette taxes could help mitigate these effects in states with a large discount store presence.

Another possible policy implication of our results is that the weight loss associated with regular Wal-Marts suggests that transfer payments for non-food goods could potentially be an alternative to widely-proposed taxes on unhealthy food. This could achieve modest reductions in obesity while being more politically popular. We leave a welfare analysis of these policies to future research.

Further work should disentangle the theoretical backdrop against which Wal-Mart operates. “Always Low Prices” can mean uniformly low prices or changes in *relative* prices such that, in a world with strong substitution effects, people move relatively away from the good that is growing cheaper, slower. This presents a paradox in light of Lakdawalla et al.’s finding (2005) that the relative price of food has fallen by approximately 0.2% per year since 1950.

Our results also suggest that the conventional wisdom that cheap food leads to weight gain may be incorrect. Relative prices – of food to non-food goods, healthy food to unhealthy food, and food at home to food away from home – may matter more than absolute food prices. Also, our theory that additional real income induces a substitution from unhealthy to healthy food provides a possible explanation for the negative correlation between income and weight (Rosin 2008). Future research should continue to examine this hypothesis more generally.

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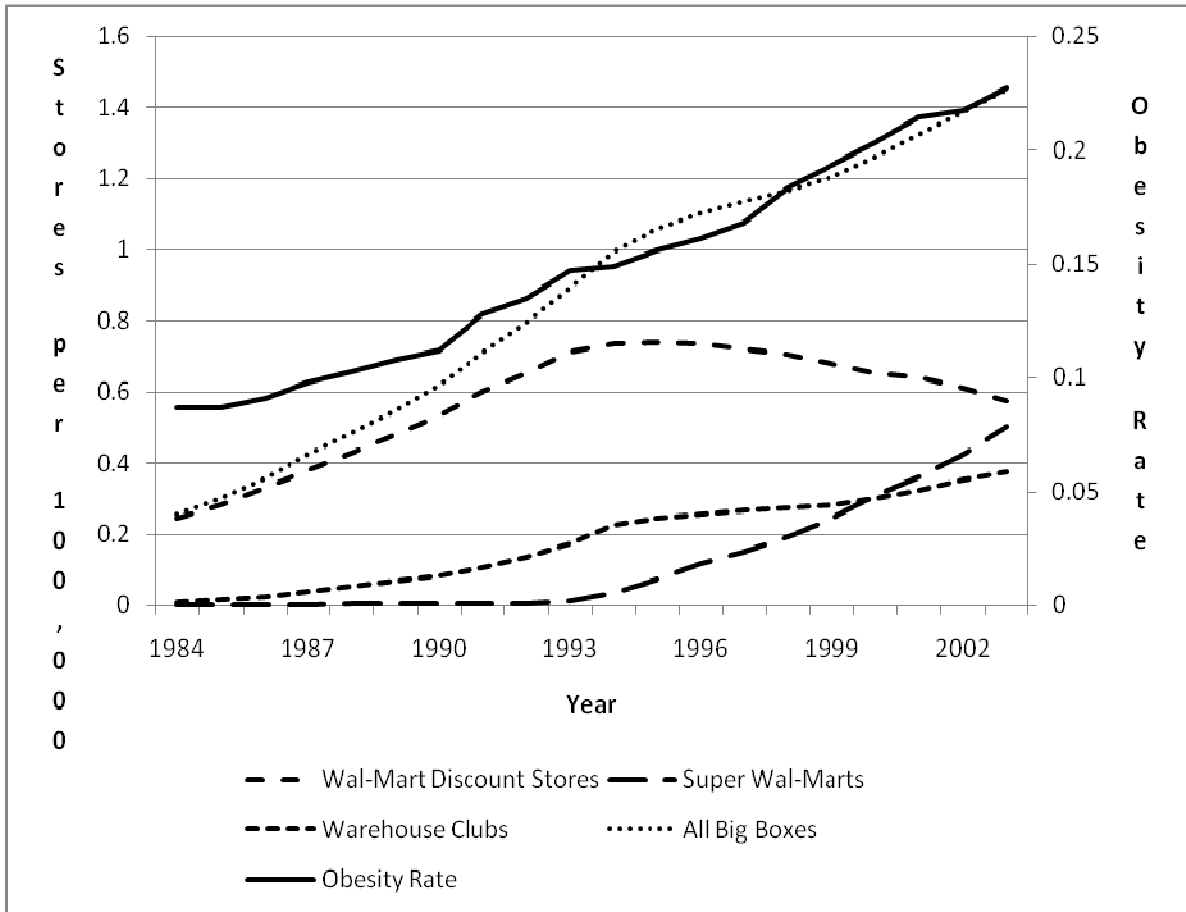
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**Figure 1 – Changes over Time in Number of Wal-Mart Discount Stores, Super Wal-Marts, and Warehouse Clubs per 100,000 Residents and the Obesity Rate**



Notes: Obesity rates are weighted means from the BRFSS data. Numbers of stores are county-level and weighted by population.

**Table 1 – Summary Statistics**

Variable Name	Source*	Description	Mean (Std. Dev.)**
Wal-Mart		Wal-Marts, not counting Super Wal-Marts, per 100,000 residents in the county	0.804 (1.243)
Super Wal-Mart		Super Wal-Marts per 100,000 residents in the county	0.352 (0.881)
Sams Clubs		Sams Clubs per 100,000 residents in the county	0.181 (0.304)
Costcos		Costcos per 100,000 residents in the county	0.066 (0.203)
BJ's		BJ's Warehouses per 100,000 residents in the county	0.040 (0.146)
BMI	BRFSS	Respondent's body mass index	26.403 (5.317)
Overweight	BRFSS	1 if BMI $\geq$ 25; 0 otherwise	0.558 (0.500)
Obese	BRFSS	1 if BMI $\geq$ 30; 0 otherwise	0.199 (0.399)
Severely Obese	BRFSS	1 if BMI $\geq$ 35; 0 otherwise	0.065 (0.247)
Fruits/Vegetables	BRFSS	Servings of fruits and vegetables consumed per day	3.909 (2.871)
Fat Index	BRFSS 1990-1994	0 if fat intake below 25 <sup>th</sup> percentile, 1 if between 25 <sup>th</sup> and 75 <sup>th</sup> , 2 if above 75 <sup>th</sup>	1.021 (0.707)
Exercise	BRFSS 1994-2000	1 if obtains regular exercise, 0 otherwise	0.526 (0.499)
Drinker	BRFSS	1 if drank any alcohol in the last month; 0 otherwise	0.532 (0.499)
Drinks	BRFSS	Number of alcoholic beverages drank in the past month; drinkers only	20.086 (35.083)
Smoker	BRFSS	1 if smoked any cigarettes in the last month; 0 otherwise	0.234 (0.423)
Cigarettes	BRFSS 1994-2000	Number of cigarettes smoked per day 0; smokers only	18.472 (10.478)
Ate Out	DDB 1988-1998	Number of times ate out at a restaurant in the past year	45.620 (33.280)
Grocery	Economic Census	Grocery stores per 100,000 residents in the county	
Restaurants	Economic Census	Restaurants per 100,000 residents in the county	
Restaurant Price	BLS	Real price index in nearest metropolitan area of food consumed outside the home	0.980 (0.079)
Unemployment	BLS	Unemployment rate in the county	4.941 (2.028)
Married	BRFSS	1 if married; 0 otherwise	0.550 (0.498)
Some High School	BRFSS	1 if attended some high school but did not graduate; 0 otherwise	0.072 (0.258)
High School	BRFSS	1 if graduated high school but obtained no further education; 0 otherwise	0.316 (0.465)
Some College	BRFSS	1 if attended some college but did not graduate; 0 otherwise	0.278 (0.448)
College	BRFSS	1 if graduated from college; 0 otherwise	0.298 (0.457)
Female	BRFSS	1 if female; 0 if male	0.572 (0.495)
Race: Black	BRFSS	1 if race is black; 0 otherwise	0.080 (0.271)
Race: Other	BRFSS	1 if race is neither white nor black; 0 otherwise	0.092 (0.289)
Real Income	BRFSS***	Household income in 2003 dollars	45494.58 (25521.15)
Age	BRFSS	Age in years	46.606 (16.820)

Notes: \* all variables exist from 1994-2003 unless otherwise indicated; \*\* means and standard deviations for aggregate variables are recorded after being matched to the BRFSS; \*\*\* income is adjusted for inflation using CPI data from the BLS. Store data are from Holmes (2008) as well as Syverson and Goolsbee.

**Table 2 – Effects of Wal-Mart, Super Wal-Mart, and Warehouse Clubs on BMI, P(Overweight), and P(Obese)**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Wal-Marts	-0.071 (0.014) <sup>***</sup>	-0.068 (0.014) <sup>***</sup>	-0.070 (0.014) <sup>***</sup>	-0.053 (0.015) <sup>***</sup>	-0.050 (0.016) <sup>***</sup>	-0.035 (0.026)	-0.083 (0.039) <sup>**</sup>	-0.023 (0.010) <sup>**</sup>	-0.005 (0.001) <sup>***</sup>	-0.004 (0.001) <sup>***</sup>	-0.0009 (0.0008)
Super Wal-Marts	-0.027 (0.014) <sup>**</sup>	-0.027 (0.014) <sup>*</sup>	-0.029 (0.014) <sup>**</sup>	-0.022 (0.014)	-0.024 (0.015)	-0.014 (0.024)	0.037 (0.038)	0.012 (0.010)	-0.0012 (0.0013)	-0.0013 (0.0011)	-0.0003 (0.0007)
Warehouse Clubs	-0.035 (0.042)	-0.024 (0.042)	-0.032 (0.043)	-0.020 (0.041)	-0.020 (0.041)	0.037 (0.057)	-0.100 (0.050) <sup>**</sup>	-0.001 (0.014)	0.004 (0.004)	-0.0002 (0.003)	-0.0018 (0.0019)
County Controls	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO
Population* Year	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO
Census Division*Year	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO
State*Year	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO
County Time Trends	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO
Scaled By	Pop.	Pop.	Pop.	Pop.	Pop.	Pop.	Land	None	Pop.	Pop.	Pop.
Dependent Variable	BMI	BMI	BMI	BMI	BMI	BMI	BMI	BMI	Over- weight	Obese	Severely Obese
Number of Observations	1306947	1306947	1306947	1306947	1306947	1306947	1306947	1306947	1306947	1306947	1306947
R <sup>2</sup>	0.080	0.081	0.081	0.081	0.081	0.083	0.081	0.080	0.085	0.043	0.029

Notes: \*\*\* statistically significant at the 1% level; \*\* 5% level; \* 10% level. Standard errors are in parentheses; standard errors are heteroskedasticity-robust and clustered by county. All regressions include county, year, and month fixed effects, as well as the individual-level control variables.

**Table 3 – Effects of Wal-Mart, Super Wal-Mart, and Warehouse Clubs on BMI: Stratifications by Gender, Income, Race, and Population Density**

	Gender		Income			Race			Population Density		
	Female	Male	Below \$25,000	\$25,000 to \$70,000	Above \$70,000	White	Black	Other	Below 50/sq. mile	50 to 200/sq. mile	Above 200/sq. mile
Wal-Marts	-0.08 (0.02) <sup>***</sup>	-0.05 (0.02) <sup>***</sup>	-0.10 (0.03) <sup>***</sup>	-0.04 (0.02) <sup>*</sup>	-0.07 (0.04) <sup>*</sup>	-0.07 (0.02) <sup>***</sup>	-0.15 (0.08) <sup>*</sup>	-0.02 (0.06)	-0.03 (0.02)	-0.08 (0.02) <sup>***</sup>	-0.07 (0.04)
Super Wal-Marts	-0.02 (0.02)	-0.03 (0.02) <sup>*</sup>	-0.06 (0.03) <sup>**</sup>	-0.02 (0.02)	-0.03 (0.04)	-0.03 (0.01) <sup>*</sup>	-0.03 (0.06)	-0.05 (0.06)	-0.01 (0.02)	-0.05 (0.02) <sup>**</sup>	-0.05 (0.04)
Warehouse Clubs	-0.09 (0.06)	0.03 (0.05)	-0.02 (0.08)	0.07 (0.05)	-0.11 (0.07)	-0.03 (0.04)	0.12 (0.20)	-0.24 (0.14) <sup>*</sup>	0.01 (0.07)	0.00 (0.06)	-0.10 (0.08)
Number of Observations	747654	559293	349163	646838	310946	1082460	104423	120064	344942	584183	377822
R <sup>2</sup>	0.097	0.064	0.085	0.075	0.130	0.075	0.080	0.114	0.075	0.078	0.088

Notes: \*\*\* statistically significant at the 1% level; \*\* 5% level; \* 10% level. Standard errors are in parentheses; standard errors are heteroskedasticity-robust and clustered by county. All regressions include county, year, and month fixed effects, as well as the individual-level control variables.

**Table 4 – Lagged Effects of Wal-Mart, Super Wal-Mart, and Warehouse Clubs on BMI**

	(1)	(2)	(3)
Wal-Marts	-0.066 (0.022)***	-0.067 (0.022)***	-0.067 (0.022)***
Wal-Marts in t-1	-0.006 (0.022)	0.015 (0.028)	0.015 (0.028)
Wal-Marts in t-2	-	-0.034 (0.027)	-0.034 (0.027)
Wal-Marts in t-3	-	0.013 (0.020)	0.004 (0.025)
Wal-Marts in t-4	-	-	0.023 (0.020)
Wal-Marts in t-5	-	-	-0.011 (0.015)
Super Wal-Marts	-0.039 (0.020)*	-0.039 (0.020)*	-0.039 (0.020)*
Super Wal-Marts in t-1	0.018 (0.022)	0.038 (0.028)	0.038 (0.028)
Super Wal-Marts in t-2	-	-0.044 (0.028)	-0.043 (0.028)
Super Wal-Marts in t-3	-	0.029 (0.024)	-0.011 (0.029)
Super Wal-Marts in t-4	-	-	0.013 (0.026)
Super Wal-Marts in t-5	-	-	0.029 (0.024)
Warehouse Clubs	0.032 (0.057)	0.029 (0.058)	0.029 (0.059)
Warehouse Clubs in t-1	-0.099 (0.052)*	-0.066 (0.063)	-0.066 (0.062)
Warehouse Clubs in t-2	-	-0.065 (0.056)	-0.066 (0.056)
Warehouse Clubs in t-3	-	0.028 (0.044)	0.024 (0.059)
Warehouse Clubs in t-4	-	-	0.035 (0.052)
Warehouse Clubs in t-5	-	-	-0.037 (0.044)
<b>Total Wal-Mart Effect</b>	<b>-0.072 (0.015)***</b>	<b>-0.074 (0.018)***</b>	<b>-0.070 (0.019)***</b>
<b>Total Super Wal-Mart Effect</b>	<b>-0.021 (0.015)</b>	<b>-0.017 (0.020)</b>	<b>0.009 (0.024)</b>
<b>Total Warehouse Club Effect</b>	<b>-0.068 (0.047)</b>	<b>-0.073 (0.050)</b>	<b>-0.082 (0.054)</b>
Number of Observations	1306947	1306947	1306947
R <sup>2</sup>	0.081	0.081	0.081

Notes: \*\*\* statistically significant at the 1% level; \*\* 5% level; \* 10% level. Standard errors are in parentheses; standard errors are heteroskedasticity-robust and clustered by county. All regressions include county, year, and month fixed effects, as well as the individual-level control variables.

**Table 5 -- Effects of Wal-Mart, Super Wal-Mart, and Warehouse Clubs on Healthy and Unhealthy Food Consumption**

	Fruits/ Vegetables	OLS	Fat Index		
			P(Below 25 <sup>th</sup> Percentile)	P(25 <sup>th</sup> -75 <sup>th</sup> Percentile)	P(Above 75 <sup>th</sup> Percentile)
	(1)	(2)	(3)	(4)	(5)
Wal-Marts	0.075 (0.020) <sup>***</sup>	-0.124 (0.050) <sup>**</sup>	0.062 (0.025) <sup>**</sup>	0.003 (0.001) <sup>**</sup>	-0.065 (0.027) <sup>**</sup>
Super Wal-Marts	0.031 (0.014) <sup>**</sup>	-4.144 (1.498) <sup>***</sup>	2.080 (0.757) <sup>***</sup>	0.116 (0.044) <sup>***</sup>	-2.195 (0.800) <sup>***</sup>
Warehouse Clubs	0.112 (0.044) <sup>**</sup>	-0.204 (0.123) <sup>*</sup>	0.100 (0.062)	0.006 (0.004)	-0.106 (0.066)
Number of Observations	1004895	67584	67584	67584	67584
R <sup>2</sup>	0.334	0.115	0.058	0.058	0.058

**Table 6 – Effects of Wal-Mart, Super Wal-Mart, and Warehouse Clubs on Exercise, Smoking, Drinking, and Eating Out**

	Exercise	Drinker	Drinks	Smoker	Cigarettes	Eating Out
Wal-Marts	-0.015 (0.003) <sup>***</sup>	0.001 (0.002)	0.177 (0.191)	-0.0003 (0.001)	0.051 (0.095)	-0.730 (0.611)
Super Wal- Marts	0.001 (0.003)	-0.001 (0.002)	0.459 (0.209) <sup>**</sup>	0.0003 (0.001)	0.014 (0.090)	-0.162 (1.150)
Warehouse Clubs	-0.012 (0.011)	-0.000 (0.006)	-0.300 (0.413)	-0.005 (0.003)	0.482 (0.360)	-2.210 (1.334) <sup>*</sup>
Number of Observations	508912	923109	498784	1345336	155515	31440
R <sup>2</sup>	0.342	0.153	0.072	0.091	0.083	0.098

Notes: \*\*\* statistically significant at the 1% level; \*\* 5% level; \* 10% level. Standard errors are in parentheses; standard errors are heteroskedasticity-robust and clustered by county. All regressions include county, year, and month fixed effects, as well as the individual-level control variables.