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Essays In Applied Economics

by

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Professor Sofia Villas-Boas, Chair
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Abstract

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In this dissertation, I investigate the relationship between unemployment and grocery purchasing patterns with a particular focus on the health impacts of recession. The first chapter, I analyze food items and in the second chapter, I turn the focus on beer and cigarettes. Both of these chapters investigate possible mechanisms behind the documented phenomenon of decreased morbidity and mortality during recessions.

To conduct the analysis presented in Chapter 1, I supplement five years of multi-market, multi-chain grocery scanner data with additional information on the positive health attributes of food products to create a unique dataset. First, I find no evidence that products with positive health attributes are systematically more expensive or promoted systematically less. They are, however, purchased on promotion less. Second, I match the scanner data with unemployment rate by market in order to conduct a reduced form analysis of changes in pricing, promotion and quantities sold given a macroeconomic shock. For overall grocery categories, prices go down, promotions weakly increase and overall quantities sold decline; results vary for products with health attributes. While shares for healthy products within category are unaffected by recession in some categories, in other categories I see a marked shift toward higher fat options within category.

In Chapter 2, I again use retail scanner data to track price and quantity changes for beer and cigarettes subject to changes in unemployment rate. First, I find prices paid do not change significantly as a function of unemployment rate. Next, I find that the percentage of beer and cigarettes purchased on promotion is not significantly related to unemployment rate per se; that said, there is evidence of a period of experimentation with in-store cigarette promotions following the Tobacco Master Agreement that coincided with the 2001 recession and led to more cigarettes being purchased on promotion overall during that period. However, this period of strong in-store promotions gave way to fewer overall purchases made on promotion as states strengthened tobacco regulations in the early 2000's. The quantity of beer sold in supermarkets, which accounts for about 40 percent of total beer sales, and drug stores seems mostly unchanged by recessionary conditions; however, cigarette quantity sold has a modest negative relationship with unemployment.

Taken as a whole, this work suggests that average grocery purchasing patterns do

not change greatly due to increases in average unemployment rate. While not entirely inconsistent with the hypothesis that decreased morbidity and mortality during recessions may be due to decreased smoking rates or better eating habits, the small magnitude of the overall effect suggests other mechanisms or heterogeneous effects might be at play.

To my husband and children, with gratitude.

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Chapter 1

Eating Healthy In Lean Times: The Relationship Between Unemployment and Grocery Purchasing Patterns[1]

[1]This project was supported by the Agriculture and Food Research Initiative Competitive Grant #2012-67011-19964 from the USDA National Institute of Food and Agriculture.

"Are recessions good for your health? Surprisingly, the answer appears to be yes." Christopher Ruhm, writing in the Quarterly Journal of Economics in 2000

"[T]he quest for a healthful and cost-conscious diet suggests Americans will be eating more meals cooked at home, upping their produce and whole-grain intake and eschewing sodium. 'It's the back-to-basics bailout diet,' says Shelley McGuire, professor of nutrition at Washington State University in Pullman."[2]

1.1 Introduction

In this paper, I focus on two essential research questions: first, are foods with positive health at- tributes (e.g. low fat, low sodium, or low sugar products), more expensive on average than their regular within category counterparts and second, is there evidence consistent with a shift toward or away from items with positive health attributes during recessions? Along the way to answering these two basic questions, I also examine the shifts in pricing and promotion uptake during recessions as well. My analysis makes use of five years (2001-2006) of grocery scanner purchase data for nine grocery categories; the data are from 49 markets (metropolitan areas) in the US, covering many chains, thousands of stores and tens of thousands of individual products. The data include limited information on product attributes, which I supplemented with primary data gathering. By coding an additional 20,000 product characteristics into the data, I created a data set that will allow me to tackle the above research questions, while also bringing to the literature a unique dataset that will serve as the basis for future work. In this paper, the data on product characteristics enable me to classify individual products into 16 sub-categories defined by product health attributes. Because this is the first data set to combine scanner data with product health attributes, I am able to conduct a novel analysis of the differences in price paid (transaction price), promotion (i.e. retailer product discounts $\geq$5%) and promotion uptake (percentage of products sold on promotion) for each grocery category and sub-category. By then matching the data with unemployment and demographic data by market, I am able to conduct a reduced form analysis of how quantities change with un- employment; in particular, I analyze the relationship between unemployment rate and the within category share of products sold with positive health attributes. Similarly, I am able to analyze changes in prices paid and promotion as a function of unemployment rate.

I find significant differences between price paid for goods with positive health characteristics and those without; that said, there is no evidence that, on average, sub-categories defined by posi- tive health characteristics tend to have systematically higher per unit transaction prices than their regular counterparts within category. In some cases, the healthier alternatives within category are more expensive on average; in other cases, the

[2]From the article "Americans may eat healthier during recession: Going back to the basics of cost-saving, basic foods that are cooked at home would improve the country's diet, experts say." in the LA Times, January 19, 2009.

healthier options are, on average, less expensive. The share of products sold with positive health characteristics is unaffected by unemployment in most categories; however, in the margarine, mayonnaise, yogurt and milk categories, I find a significant shift toward higher fat products as unemployment increases. The outcome I observe that is most consistent with healthier eating during recession is simply less consumption overall as unemployment increases: quantities sold decline in most categories when unemployment goes up. A reduced form analysis of pricing and promotion as a function of unemployment fails to produce a clarifying explanation for these quantity shifts in terms of price changes or systematic differences in promotion uptake; rather, the heterogeneity of the impact of unemployment across and within categories suggests that consumers may simply value health attributes variably in different categories.

This work contributes to several strands of economic literature: the literature on the cost of healthy eating, the effect of recessions on health, food demand and, more tangentially, the literature on promotions. Because I observe health characteristics, price paid and promotions (discounts) for tens of thousands of products sold at thousands of stores over time, I am able to test whether or not foods with positive health attributes are indeed more expensive on average than their regular counterparts. Unlike previous studies, I am able to make an apples to apples comparison of close substitutes within category. This removes differences in convenience or time cost of preparation and places the focus primarily on health attributes. Beliefs about the costs of healthy foods can impact purchase decisions [18] and the notion that "healthier is more expensive" is often repeated in the popular press. My work shows that this is not necessarily the case. This work contributes to the discussion in the public health and nutrition liter- ature as to whether healthy food is more expensive than unhealthy, "junk" food ([11, 9, 10, 8]). Most recently, Binkley and Golub [2] find that on average, higher fat milk is slightly more expensive, but then point out that the reverse is true in about half of the markets studied. USDA economists Carlson and Frazão [6] recently released a study finding that while junk food is cheaper on a per calorie basis, healthier foods such as fruits, vegetables, whole grains and proteins such as beans and eggs are cheaper on a per serving basis.

Understanding the health impacts of recessions is important in formulating policy responses designed to assist people during tough economic times. I find evidence consistent with overall lower food consumption during recessions and little shift in the proportion of foods with positive health attributes; there is a small but significant shift toward higher fat dairy, mayonnaise and margarine products, but given overall lower quantities sold, the effect on total calories purchased in these categories is ambiguous. This finding fits into the literature on the health impacts of recession, and in particular in sheds light on why average Body Mass Index (BMI) decreases as unemployment increases. Two works by Ruhm [31] [30] show total mortality[3] declines during recessions, BMI is negatively correlated with unemployment and self-reported risky behaviors (smoking, drinking, driving)

[3]Ruhm analyzes total mortality and mortality for the 10 leading causes of death. He matches this with unemployment rate at the state, and where appropriate, city level.

decline while healthy behaviors (exercise, eating fruits and vegetables, lowering fat intake) increase. If the self-reported lifestyle changes are true, we would expect to see the changes in people's eating habits reflected in grocery purchase data. I am able to shed light on this particular mechanism with data less prone to error than food intake diaries; the results from my analysis suggest that, rather than a shift toward consuming healthier foods, lower consumption overall is a more likely potential explanation for lower BMI during recessions.

Whereas nutrient Engel curves are typically constructed using broad category averages, I focus on within category shifts vis-a-vis various health characteristics using detailed product data. While I do not observe detailed macronutrient data, the data on health related product attributes do shed light on whether consumers substitute toward or away from healthier alternatives within category subject to a negative macroeconomic shock. In particular, I can examine whether or not the percentage of healthy items sold within a given category increases or decreases with unemployment; I generally find little shift in proportion of items with positive health attributes purchased but total quantities decline. This suggests calories are income normal. As noted above, there is a small but significant shift toward higher fat dairy, margarine and mayonnaise despite lower quantities overall; while the effect on total calories is ambiguous (total fat and calories may still decline). This fits into and is consistent with the general literature on food demand. Studies show that most foods are income normal and nutrients (fat, calories, protein, etc.) are also income normal ([20, 21, 1]). As incomes decline, we expect people to consume less food and fewer nutrients; indeed, while lower income households do spend a greater percentage of their income on food, fewer dollars are spent on food the poorer the household. Moreover, Gicheva et al [16] find that consumers substitute away from eating out toward eating at home when faced with small income shocks in the form of higher gas prices; eating out less should result in fewer calories, less fat and overall improved nutrient profile for the average adult ([35]). On the other hand, overweight and obesity are more prevalent among low income groups than high income groups and food insecurity is positively associated with obesity in the US ([36, 37]). In a recent study making use of food diary data from National Health and Nutrition Examination Survey (NHANES) and the Continuing Survey of Food Intakes by Individuals (CSFII), Chen and Liu [7] find a negative relationship between income and the consumption of higher calorie varieties of soda and milk (soda and milk are notable for the clean distinction between low and high calorie varieties with little to no difference in price between lower calorie alternatives versus their regular counterparts). Similarly, Binkley and Golub [2] assess expenditures on milk, soda, bread and cereal using cross-sectional household data and find wealthier households are more likely to make healthy choices within category. My work is consistent with these findings, though the lack of household data makes it difficult to assess heterogenous effects in this paper.

I am also able to discern whether more items are purchased on discount as unemployment increases. The richness of the data allow me to test these findings across multiple chains and investigate heterogeneity across different types of products. I find that items with health attributes are purchased on promotion far less often than their regular within

category counterparts, and even where promotion uptake increases with unemployment, it is still far lower for items with positive health claims than for those without. That said, promotion uptake generally increases with unemployment for most products. This is consistent with findings in the literature on promotions. Gicheva et al [16] show that even small income shocks cause people to substitute away from eating out and toward eating at home; moreover, households are more likely to purchase products on promotion when experiencing an income shock. Meanwhile, Ehrenherg [12] finds that grocery promotions generally do not affect long-term sales because the short-term spike in sales is attributable to increased sales to people who would have purchased the product anyway.

My findings are consistent with recent work showing that healthier alternatives are not necessarily more expensive than less healthy options and that higher incomes are associated with healthier choices. Based on positive health characteristics for a variety of packaged foods, I find no evidence that recessions lead people to make healthier choices; however, I confirm that higher unemployment simply leads to lower consumption overall. This finding, combined with a substitution away from eating out ([16]) is possibly a more likely mechanism for the inverse relationship between obesity and unemployment found by Ruhm (2000) than a substitution toward healthier foods per se. Moreover, the heterogeneity across categories is consistent with a recent study using Danish panel data ([33]) suggesting differences in valuation of certain tastes for different categories is responsible for the apparent differences in health characteristics across categories; with expanded data, this represents a fruitful area for future research.

The rest of the paper proceeds as follows: in section 2, I provide a detailed description of the retail scanner data, including how product attributes were coded into the data, as well as demographic summary statistics. In section 3, I outline the reduced form analysis. In particular, section 3.1 describes the analysis of differences in means in pricing and promotions for products with and without health attributes and section 3.2. details the variation in unemployment; sections 3.3. and 3.4 give results from a reduced form analysis of the relationship between unemployment and the pricing, promotion, quantities sold and share of sales for products with and without health attributes. I offer a summary of the results and concluding remarks in section 4.

1.2 Data Sources Description

I use the Information Resources, Inc. (IRI) Marketing data set made available to researchers in 2008 ([5]). The data comprise five years of sales, price and promotion data for 49 US markets from multiple store formats. IRI Markets are selected to give wide geographic coverage and to enable analysis of competitive grocery markets. Figure 2.1 in the Appendix is a map of the markets included in this data set. IRI masks any data that might identify a particular chain or store; store type is provided, but no name. To further protect confidentiality, IRI does not include any markets where the dominant grocery chain has more than 50% of the market. The data come from all drug, grocery and mass

market stores within the defined market area; Table 2.1 lists the markets and the number of chains in each market as well as the total number of chains included in the data overall. The data cover 30 product categories, both food and non-food, selected to enable analysis of diverse questions in consumer choice.

I focus on a subset of 9 food categories for which some nutritional product feature is included in the data (e.g. low fat, reduced sodium, etc.)[4]. The categories are: carbonated beverages, cold cereal, hot dogs, margarine, mayonnaise, milk, peanut butter, salty snacks, and yogurt. Table 2.2 lists these categories and the number of products in each while Table1.3 lists the product features in each category. I coded these product features (text fields in the original dataset) into the data as product characteristic dummy variables. Note that these nutritional product features vary from product to product (e.g. milk products are normally classified in terms of fat, carbonated beverages are classified in terms of sugar content, etc.). In some cases, they are clear descriptive labels (e.g. 0% fat milk vs. 2% fat milk) and in other categories, the precise meaning of the feature or claim is less obvious (e.g. "reduced fat" snacks or "lower sodium" soups). Most product claims are regulated and, depending on the product, terms like "reduced fat" or "lower sodium" do have precise definitions. In most cases, I opted to aggregate products with similar characteristics (e.g. low fat and fat-free) into the same product feature sub-category to ensure sufficient data for analysis in each sub-category in each market in each month. I supplement the nutritional product features included in the data with original data gathered on products with missing data. I collected nutritional features from text product descriptions included in the data, manufacturer's websites and, when possible, product labels[5]. In total, with the assistance of the undergraduate data team, I added over 20,000 product nutrition characteristics to the product database of 50,000 UPCs (see Table 1.4 for a breakdown of how many characteristics were coded into each category)[6]. This

[4]I limited the initial analysis based on the categories for which nutritional information is already included in the IRI Data. Several categories included in the IRI data set (e.g., frozen dinners), don't have 'low fat' or 'low sodium' identifiers included. To the extent these categories are systematically different from the categories I include here, this represents a potential source of bias in my results– for example, people may gravitate toward 'lower fat' products in categories where those claims are common (e.g. yogurt) but gravitate toward more high fat, high calorie products in categories where nutrition is less of a selling point (e.g. frozen pizza). Collecting nutritional data on a product-by-product basis requires a massive data gathering effort for each category; that said, this analysis could be extended to additional categories once UPC level nutritional data is matched with the IRI purchase data.

[5]Executives from the nutrition information web site Shopwell gave permission for their site to be used as a nutrition reference for products in this study. Shopwell has an on-line, searchable database of grocery products which it classifies and scores according to nutrition characteristics; information provided includes the basic nutrition data from the food label. Importantly, Shopwell is not a user populated database as many other on-line nutrition databases are; rather, they purchase their nutrition by UPC data from proprietary vendors, who provide regular updating.

[6]For example, of 513 unique peanut butter products, 206 products initially lacked information regarding sugar content. I reviewed each of the products with missing product characteristics. I (and/or one of a team of undergraduate research assistants) searched for information regarding the product in the product description or from a restricted set of reputable on-line resources. Through this process we classified 118

data gathering and entry effort reduced the number of missing product characteristics by nearly two-thirds. Thus, this data set contains both comprehensive sales data and health attributes; this level of detail enables novel analyses along the health attribute dimension.

Almost all of the data entered confirmed that products without a product claim/attribute in the original data set was indeed a regular product. In general, if a product makes a health related claim on the package or specifically lists an attribute in the description, it is included in the data. Generally, the products that remain unclassified for a particular product characteristic are store brands, discontinued products or less well known regional or kosher brands with limited information availability. If these generic, discontinued, regional and specialty products differ systematically vis-a-vis the relevant product characteristics from the remaining data, this represents a potential source of bias; for example, if private label or kosher products tend to be higher in fat or higher in sodium and people substitute toward those products when unemployment is high, that behavior will not be captured in the analysis.

Census demographic data are matched to the broad market data by metropolitan statistical area (MSA) and/or state or region in the case of larger geographical markets. Based on the Census data, the IRI markets taken as a whole are demographically similar to the United States; that said, the sample is more urban, slightly more educated and slightly more wealthy than the national average. Within the sample are diverse markets with a range of demographic compositions, as shown in the "Max" and "Min" columns of 2.5. The market data are matched with unemployment data at the market level; the available variation in unemployment is analyzed in detail below.

1.3 Reduced Form Analysis

1.3.1 Differences in Mean Pricing and Promotion Across and Within Categories

To better understand the relative prices of products with and without positive health attributes, I first conduct a simple difference in means test on quantity weighted average price paid, percent of UPCs on promotion and percent of total units purchased on promotion for all categories and sub-categories. The difference in means tests for price paid and promotion take the following form:

$$QuantityWtdAveragePricePaid_{ijkt} = \alpha + \beta ProductCharacteristic_i + \epsilon_{ijkt} \qquad (1.1)$$

peanut butter products as reduced-sugar or sugar free, bringing the total number of unclassified products down to 88. We repeated this process in each category. Where strict nutritional definitions for product claims applied, I used those to classify the product; in other cases, I used product claims on the package to classify products (e.g. "light" or "baked" potato chips).

Quantity weighted average price paid is calculated using revenue and quantity. All dollar amounts are deflated using the Consumer Price Index for Food At Home. The subscripts are defined as follows: i denotes a specific UPC, j denotes a specific market, k denotes a specific chain, and t is a month index. The product characteristic is a dummy variable that takes the value of 0 if the product does not possess the characteristic in question and 1 if it does. The coefficient on the constant term α will thus give the average quantity weighted average price paid for products without the characteristic in question, and the coefficient on the product characteristic dummy will give the difference in price paid for items with the characteristic. The results give an average for products with or without the characteristic with no adjustment for product size; to the extent that sizes differ systematically across attributes, this is a source of potential source of bias.

I find no evidence that products with positive health attributes are systematically more or less expensive than their regular counterparts. The results are presented in Table 1.6 and in Figure 1.2. Each column of Table 1.6 represents the regression of price paid on one product characteristic; the constant, given at the top of each column, represents the average price paid for products that do not possess the given product characteristic.[7] The coefficient on the product characteristic dummy represents the average difference in price for products possessing the characteristic in question.Prices for products with positive health attributes are significantly higher in 9 categories and significantly lower in 6 categories; high fat milk products also show significantly lower price paid[8]. The large difference in price for whole grain cereals is likely spurious; in the first pass of data gathering, I was not able to categorize cereals that did not make a positive whole grain claim as regular when in fact, most cereals not making a direct whole grain claim are likely not whole grain and should be used as a basis for comparison.[9] Therefore, the comparison group for whole grain cereals is quite small. Moreover, high fat milk products ($\geq$6%) shows significantly lower price paid; however, this sub-category contains mostly products typically bought in smaller sizes than regular milk products (e.g. egg nog, kefir, and custard beverages); this is one category where size adjustment is likely to change the result significantly. Ignoring whole grain cereals and high fat milk products, there are 8 categories in which positive health attributes are associated with a higher product price and 6 where positive health characteristics are associated with a lower product price. This disproves the general notion that "healthier is more expensive" and is consistent with recent USDA findings ([6]). That said, there are significant difference in prices within each category and the differences in price seem to be greater when the item with positive health attributes is the more expensive item.

Next, I conduct a difference in means test for promotion using the same form specified above:

[7]Products with missing data are dropped and their average price is not reflected in the constant.

[8]The omitted category for milk is whole milk; product characteristics coded for are low fat milk ($\leq$2%) and high fat milk products ($\geq$6%).

[9]I expect to correct this in subsequent versions of this paper.

$$Promotion_{ijkt} = \alpha + \beta ProductCharacteristic_i + \epsilon_{ijkt} \quad (1.2)$$

The promotion dummy equals 1 if an item is offered at a discount of 5% or greater at a given chain in a given week; only store promotions specific to the product are included, not manufacturers discounts or discounts applied to the entire purchase. Averaged up to the month-chain level, it gives the average percentage of time the given product was promoted during the month. For example, if $Promotion_{ijkt}$=.25, it indicates that product i was on promotion one week during month t in market j and chain k. Thus, the estimate of the constant term gives the average percent time on promotion for products not possessing a given product characteristic, while the estimates of the coefficient β gives the difference in promotion for products with the given characteristic.

Again, I find no evidence that products with positive healthy attributes are systematically promoted more or less than their regular counterparts. The results can be seen in Tables 1.7 and 1.8 and in Figure 1.4. Seven sub-categories defined by positive health attributes are promoted less and seven are promoted more than their regular within category counterparts. There is no significant difference for whole wheat cereals versus regular and high fat milk products are promoted significantly less. These results are consistent with the mixed results for prices given above and inconsistent with retailers systematically favoring or not favoring products with positive health attributes.

One where I do find a systematic difference is promotion uptake: despite similar promotion rates, items with positive health characteristics are purchased far less on promotion than their regular counterparts. I conduct a t-test on percentage of items sold on promotion for each category and sub-category defined by health attributes. Results are presented in Table 1.9 and graphically in Figure 1.4. Although low-sugar and diet soda, for example, are on promotion just as much if not more than their regular counterparts, they are purchased on promotion far less. This is true for all products with positive health attributes– regardless of promotion rates, they are consistently purchased on promotion less. This suggests consumers who buy these products are not necessarily doing so because of promotions and are less likely to take advantage of them.

1.3.2 Sources of Unemployment Variation

I seek to determine how much of the unexplained variation in grocery purchasing patterns is attributable to local unemployment rate. I therefore begin with an analysis of the variation in unemployment. The data cover 2001 to 2006, including the 2001 recession as well as a long period general macroeconomic strength and relatively low national unemployment. That being said, there is still variation in unemployment after controlling for geographic and time effects. Figure 2.6 shows residuals from a regression of unemployment on state and quarterly fixed effects as well as a time trend. The regression equation is as follows:

$$UnemploymentRate_{jt} = u_j + v_t + \tau_t + \epsilon_{jt} \tag{1.3}$$

Where unemployment is at the monthly, metropolitan statistical area (MSA) level, u_j is a state fixed effect, v_t is a quarterly fixed effect and τ_t is a time trend. Robust standard errors are calculated using the Huber-White Sandwich estimator, under the assumption that observations are independent across states and time periods, but not within states. Note that the high value residual points in Figure 2.6 coinciding with the end of 2005 are due to temporary high unemployment in New Orleans, one of the IRI markets, after hurricane Katrina. I drop New Orleans from the sample and re-run the regressions; Figure 2.7 shows the residual plot without the New Orleans data. Table 2.4 shows results for the regressions both with and without New Orleans included in the sample. The difference in R-squared between the regression of unemployment on time trend, quarterly and fixed effects shows about 4% of the unemployment variation is explained by New Orleans alone. That said, with or without New Orleans included in the sample, approximately half of variation in unemployment from 2001 to 2006 is unexplained by time trend, quarterly and state effects. Moreover, during the sample period unemployment rate changes by 100% (i.e. is doubled or halved over the course of the sampling period) in 21 of 49 markets. This suggests that there is significant variation in unemployment remaining for me to use in identifying shifts in grocery purchasing patterns that cannot be explained by region and time factors.

1.3.3 The Relationship Between Prices, Promotion and Unemployment

Next, I check the effect that unemployment has on prices and promotions. I regress quantity weighted average price on unemployment for all categories; I include time trend, quarterly effects, geographic fixed effects and market level demographic controls. All prices are first deflated using the Consumer Price Index for Food At Home. The reduced form specification has the following form:

$$ln(p_{ijt}) = \alpha_{ijt} + \beta ln(unemployment_{jt}) + \eta' \boldsymbol{X}_{jt} + u_j + v_t + \tau_t + \epsilon_{ijt} \tag{1.4}$$

Here, p_{ijt} is quantity weighted average price for product i in market j at month t; this is regressed on a constant, log unemployment, demographic controls quarter and state fixed effects and a time trend. Errors are clustered at the market level. I run similar regressions on the percent of products sold each month on promotion each major category as well as each sub category (e.g. percent of total mayonnaise sold on promotion and percent low fat mayonnaise sold on promotion). [10] The specification is similar, but on

[10]The data include a dummy variable indicating whether total price reduction was 5% or greater; as described in section 3.1., I use this dummy to calculate percent sold on promotion.

the left hand side is log percent of total quantity sold on promotion in market j at time t. Additionally, because price paid is related to unemployment, as shown above, I add quantity weighted average price paid as a control:

$$ln(PercentPromo_{jt}) = \alpha_{jt} + \beta ln(unemployment_{jt}) + \gamma ln(\widehat{Price_{jt}}) + \eta' \boldsymbol{X}_{jt} + u_j + v_t + \tau_t + \epsilon_{jt} \tag{1.5}$$

Due to the endogeneity of prices, I instrument for price paid directly using lagged quantity weighted average price paid.[11] I use a generalized two-stage least squares (G2SLS) procedure to estimate the coefficients with standard errors clustered at the market level. Inspection of residual verses predicted value plots showed severe heteroskedasticity. The plots show that for higher predicted values of percent sold on promotion, variance is lower. In order to correct for this, I redefine the panel at the Market-Chain-Product level and cluster standard errors at the Market level; thus, I allow for intra-market correlation between chains and products. This corrects the heterogeneity problem suggesting chains promote differently and may respond differentially to unemployment and this must be taken into account.[12] The redefined price and promotion regressions have the form:

$$ln(p_{ijkt}) = \alpha_{ijkt} + \beta ln(unemployment_{jt}) + \eta' \boldsymbol{X}_j + u_j + v_t + \tau_t + \epsilon_{ijkt} \tag{1.6}$$

$$ln(PercentPromo_{jkt}) = \alpha_{jt} + \beta ln(unemployment_{jt}) + \gamma ln(\widehat{Price_{jkt}}) + \eta' \boldsymbol{X}_j + u_j + v_t + \tau_t + \epsilon_{jkt} \tag{1.7}$$

Again using a G2SLS procedure, I instrument for price directly[13] with a one month lagged quantity weighted average price and calculate the percentage of products sold on promotion at the market-chain-month level. The subscript 'k' indicates the re-definition

[11] While there is likely a two way relationship between prices paid and percent purchased on promotion in the current period, it seems unlikely that price paid in the previous period could be determined by percent sold on promotion in the current period.

[12] One potential explanation for this is that some chains simply promote a lot all the time, regardless of unemployment rate or other macroeconomic conditions, because they target bargain shoppers. Higher variation in promotion levels of chains that promote less, on average, may indicate that these chains only promote during certain times or under certain conditions. Alternatively, chains that promote a lot may be consistently responsive to macroeconomic conditions, thereby lowering variance vis-a-vis unemployment. This provides a potentially fruitful avenue for further exploration in subsequent papers.

[13] The first stage is very strong for all products; the coefficient on log lagged price is typically between .9 and .98 and all coefficients are significant at the .01 level. This is to be expected as grocery retail prices, particularly for value added processed foods, tend to be sticky, changing at most quarterly and less frequently for some goods. One month lagged price paid is a strong predictor of current month price paid without being endogenously determined by quantities and discounts in the current period.

of the panel to include the chain (k) level[14] . In Equation 1.6, p_{ijkt} is quantity weighted average price for a given product in a given market at a given chain in a given month; in Equation 1.7 prices are averaged for a given category or sub-category overall in market j, chain k and month t. Tables 1.13 through 1.18 display the results of the price and promotion regressions. The log-log specification allows the coefficient on unemployment to be interpreted as the percentage increase (decrease) in price or share sold on promotion given a 1% increase (decrease) in unemployment rate; because all of the coefficients are less than one, in the discussion that follows I will refer to the percentage increase given a doubling (100% increase) in unemployment rate. As noted above, unemployment rate does change by 100% or more in 21 of 49 markets, so this is not an out of sample interpretation.

One hypothesis is that we might expect that macroeconomic shocks would prompt people to hunt for bargains and buy more items on sale, i.e. that average price paid would decrease and the percentage of items purchased on promotion would increase. In Tables 1.11, 1.12, 1.13, and 1.14 I present the results that are consistent with this hypothesis. For instance, in Table 1.11, the coefficients in the first and fourth regression columns demonstrate an average 2.2% decline in overall hot dog price paid and an increase of nearly 40% in the quantity of low-fat hot dogs sold on promotion given a doubling of the unemployment rate. The share of low fat hot dogs sold on promotion is low to begin (see Table 1.9) with, so an increase of 40% would result in about 9% of all low fat hot dogs being sold on promotion. In the salty snack category, shown in Table 1.12, average price paid declines slightly for the category as a whole when unemployment rises. A doubling of the unemployment rate is associated with the share of items sold on promotion increasing a little under 10% for the category as a whole and a little over 10% for low fat salty snacks, as shown in the fourth and fifth columns of Table 1.12. Again, referring to Table 1.12, nearly 40% of salty snacks are sold on promotion to begin with; thus, a doubling of the unemployment rate would increase that to about 44%. For low fat salty snacks, the share sold on promotion is relatively small (5%), so a 10% increase given a doubling of the unemployment rate would still mean that nearly 95% of all salty snacks are not sold on promotion. Moving on to carbonated beverages, the first three regression columns of Table 1.13 indicate that a doubling of the unemployment rate correlates with a 3.6% decrease in average price paid for all carbonated beverages, a 3.4% increase in price paid for low sugar carbonated beverages and a 5.2% decrease in price paid for diet (calorie free) products. Controlling for these price shifts in the promotion regressions (the third through sixth regression columns), only low sugar carbonated beverages sell more on promotion (36% more as unemployment doubles); however, given that the percent of total low sugar carbonated beverages sold on promotion is already very low (.1%, as seen in Table 1.9) this does not represent a high volume of promotional sales for the overall category. Finally, Table 1.14 demonstrates that there is a significant decline in price paid for all milk products, low fat milk products and high fat milk products as unemployment

[14]Because this variable is calculated at the chain level, i.e. all major chains in a metropolitan area are included, I do not observe an zeros, i.e. there is always some positive percentage of products in promotion in a given category.

rises, while the share of quantity sold on promotion increases for the category as a whole and low fat milk; quantity sold on promotion does not change significantly for high fat products. For milk, given that a significant share of items are already sold on promotion, the increases associated with unemployment imply a rather large shift to promotion milk buying associated with unemployment. For example, just over 23% of all milk products and around 17% of low fat milks are sold on promotion (Table 1.12). A doubling of unemployment correlates with an increase to 31% of all milk products sold on promotion and an increase of about 5 percentage points for low fat milk as well.

On the flip side, price paid may also increase during a recession. This may happen for several reasons; one might be a contraction of supply for certain products during a recession. Another might be increased demand for food at home (as opposed to food away from home) or substitution toward foods perceived as cheaper alternatives to begin with (e.g. peanut butter and margarine as substitutes for meat and butter). Finally, stores may change their promotional strategies as well. Tables 1.15 through 1.18 present results for categories where either price paid increases, share sold on promotion declines or both. The only significant coefficient on unemployment for the margarine category (Table 1.15) is in the second column, which presents results for a regression of price paid for low calorie and "healthy fat" (e.g. omega-3, olive oil, etc.) type margarines; in this case an increase in unemployment is associated with an increase in price paid for these products, but no change in promotional sales for the category as a whole or the sub-category of low calorie margarine. Results for mayonnaise can be seen in Table 1.16; none of the regressions of log average price paid yield a significant coefficient on unemployment. However, there seems to be a shift away from promotional sales of low fat mayonnaise toward regular mayonnaise; in the fourth regression column of Table 1.16, the positive coefficient on unemployment signifies an increase in promotional sales with unemployment, while the negative coefficient in the low fat column represents a decline in sales of these items on promotion when unemployment increases. Multiplying these predicted changes by average share of total units sold on promotion (show in Table 1.9), this implies that a doubling of unemployment correlates with an increase of total mayonnaise sales on promotion from 31.8% to over 36% while promotional sales of low fat mayonnaise correlates with a decline from about 11.5% to under 10%. While more peanut butter products in general are sold on promotion when unemployment increases, price paid for low sugar and low sodium peanut butters increase slightly but significantly, as seen in Table 1.17. Likewise, Table 1.18 shows that transaction prices for low fat and low calorie products actually increase despite increased purchases on promotion for the category as a whole and for low fat products.

Finally, cold cereal pricing and promotion are not significantly correlated with unemployment; none of the coefficients on unemployment are significant for either the category as a whole or for low-sugar or whole grain products (see Table 1.19). The lack of any changes in the cereal category are likely due to the relatively inelastic supply and strong demand given that cold cereal is more or less a staple product for most American households, recession or no. To summarize, price paid generally declines or stays neutral during

recession, but not always for healthier products within category. Proportion of items purchased on promotion generally increases. I summarize these effects graphically in Figures 1.7 and 1.8. In these figures, the black line represents the point estimate and blue bar the 95% confidence interval. As unemployment increases, the percentage of products sold on promotion increases significantly for hot dogs overall, low-fat hot dogs, mayonnaise overall, milk overall, low fat milk, low sugar peanut butter, salty snacks overall, low fat salty snacks, yogurt overall and low fat yogurt. Low fat mayonnaise shows a decline in the percentage of products sold on promotion as unemployment increases. In particular, when unemployment increases:

- Transaction prices decline for 3 of 9 overall categories; the remaining 6 categories have no significant difference in average prices paid associated with recession conditions
- Price paid declines for 2 of 15 healthier sub-categories and for 1 less healthy category (high fat milk products)
- Price paid increases for 6 of 15 healthier sub-categories; 7 of 16 total sub-categories show no significant shift in price paid associated with recession conditions.
- The proportion of items purchased on promotion increases for 6 of 9 overall categories and for 5 of 15 healthier sub-categories; share of purchases made on promotions declines for one healthier sub-category (low fat mayonnaise) and one less healthy category (high fat milk products).

These pricing and promotion results inform the next stage of my reduced form analysis; namely, that it is important to control for pricing and promotions in analyzing quantity changes, that chain level behavior (especially vis-a-vis promotions) may be important, and that the results may go in any direction depending on whether demand side income effects, substitution effects or supply side effects dominate.

1.3.4 The Relationship Between Category Quantities Sold and Unemployment

Moving forward to investigate the relationship between quantities sold and unemployment, I specify a regression equation for which the dependent variable is the natural log of units sold for a given UPC in a given market at a given chain in a given month (q_{ijkt} is quantity sold of a product i in market j at chain k in month t; i.e., I define a market-chain-month-product panel)[15] . I estimate the following regression both for the category as a whole and separately for each product characteristic sub-category:

[15]Because this variable is calculated at the market-chain-month level, i.e. all major chains in a metropolitan area are included, I do not observe an zeros, i.e. there is always at least one unit of each product sold per month at a given chain. If a product is discontinued during the period, i.e. it is no longer on the market, it is dropped from the panel.

$$ln(q_{ijkt}) = \alpha_{jt} + \beta ln(unemployment_{jt}) + \gamma ln(\widehat{PricePaid}_{ijkt}) + \eta' \boldsymbol{X}_{jt} + u_j + v_t + \tau_t + \epsilon_{jt} \quad (1.8)$$

In addition to the constant term, the independent variables on the right hand side are: quantity weighted average price for products in the given market at a given chain in the previous month, monthly unemployment rate in the market, and a vector containing demographic characteristics of the market. I include region (u_j) and quarter (v_t) dummies, as well as a time trend (τ_t). A log-log specification is used so that the coefficient on unemployment can be interpreted as the percentage change in monthly quantity sold associated with a 1% increase in unemployment rate in the store neighborhood. Due to the endogeneity of price paid, I again instrument directly for price using lagged price. As above, I use generalized two-stage least squares (G2SLS) to estimate the coefficients. I cluster the standard errors at the market level to address any intra-market correlation. I also specify a similar equation for for percentage of products sold with a given percentage product characteristic:

$$ln(ShareProductChar_{jkt}) = \alpha_{jt} + \beta ln(unemployment_{jt}) + \gamma ln(\widehat{PricePaid}_{ijkt}) + \eta' \boldsymbol{X}_{jt} + u_j + v_t + \tau_t + \epsilon_{jt} \quad (1.9)$$

Again, I include the controls described above and instrument for price directly using the G2SLS technique with clustered standard errors. As noted above, not all products have information regarding product characteristics. Products with information missing regarding the product characteristics are simply dropped in the estimation of equation 1.9. To the extent that there is a systematic difference in missing data across product characteristics, this is a potential source of bias. [16] The log-log specification allows for a "% change in dependent variable for a 1% change in unemployment rate" interpretation. As before, in the discussion that follows, I will multiply the coefficients by 100 and refer to the "% change in dependent variable for a 100% change in unemployment rate". The results of this initial specification are shown in Tables 1.20 and 1.21. Quantity sold declines for 7 of the 9 overall grocery categories analyzed; the 95% confidence intervals for the percentage decline in sales given a doubling of the unemployment rate can be

[16] Most of the missing data is comprised of store-brands, for which there is no product characteristic data. We would expect sales of lower priced store brands to increase in general due to macroeconomic shocks. Moreover, kosher and regional specialty brands are less likely to have information available from the sources used in this study. Anecdotally, kosher products are higher in fat and salt and are less likely to be available in low fat or low sodium versions, so the missing data here represents a true limitation of this study.

seen graphically in Figure 1.9. In Table 1.21, I present the categories for which share of products sold with health characteristics does not change with unemployment. For each category, the first column is the result for the regression of log total quantity sold followed by the column(s) for the regression of log share of healthy products. The first category presented in the table is carbonated beverages; in the first column, the coefficient on log unemployment rate is significant and negative, implying a .189% decline in quantity sold for each 1% increase in unemployment rate, i.e. a 18.9% decline in sales given a doubling of unemployment. This number is consistent with the decline in soda sales during the last recession, when unemployment more than doubled nationally; the market research firm Mintel Group found soda sales declined 20% over the period 2005 through 2010 ([26]). That said, the share of purchases dedicated to low sugar and diet soda products does not significantly change with unemployment. A similar pattern is found in the sub-category results for hot dogs, peanut butter and salty snacks; cold cereal is split, with no change in the share for whole wheat products. The 95% confidence intervals for these estimates can be seen graphically in Figure 1.10. The fact that total quantities sold decline for carbonated beverages, peanut butter and salty snacks with no change in share for products with positive health attributes suggests that total calories purchased in these categories declines or at least weakly declines in these categories when unemployment rate increases.

Table 1.21 shows the quantity and share regression results for categories that do exhibit shifts as a function of unemployment. Again, quantities for the overall categories, shown in the first regression column for each category, decline or do not change significantly with unemployment increases. Low sugar cereal share declines with unemployment and for margarine, mayonnaise, milk and yogurt, the shares of low fat products also decline as unemployment increases. The share of sales dedicated to high fat milk products increases (though, it should be stated, high fat milk products like egg nog and kefir represent a very low percentage of total sales; more noteworthy is the decline in the share of low fat milk sold). This shift toward higher fat products can be seen graphically in Figure 1.11. These negative changes in the percentage of quantity sold dedicated to products with positive health attributes (and an increase for high fat milk) represent a small but significant proportion of total sales. For mayonnaise, total quantity sold does not change significantly (the coefficient on total sales is positive and not significant) and there is a marked shift toward higher fat products within category as unemployment increases; this suggests an increase in total mayonnaise calories purchased with unemployment. However, for the remaining categories where the composition shifts toward higher fat products, overall quantity sold declines so it is not possible to infer the direction of the change in total calories purchased.

In summary, the results suggest that the unemployment rate is negatively correlated with sales in 7 of 9 overall categories; this is consistent with a decrease in consumption due to negative macroeconomic shocks. Within category, share of sales dedicated to healthier items within category increases in one case (low sugar carbonated beverages) and remains unaffected by recession conditions in 8 additional sub-categories (diet/calorie

free carbonated beverages, whole grain cereal, low sugar mayonnaise, low sugar peanut butter, low sodium peanut butter, low fat salty snacks and lower sodium salty snacks). Shares decline for low sugar cereal, low fat mayonnaise, low fat milk, low fat yogurt and low calorie yogurt. High fat milk (>6%) share of sales increases with unemployment. I summarize the direction of the coefficients on unemployment for the regressions on price, share purchased on promotion, quantity sold, and sub-category share in Table 1.22.

Lower quantity demanded in categories such as carbonated beverages, hot dogs and salty snacks with shares of healthier alternatives within those categories remaining unaffected is evidence to support Chris Ruhm's argument that recessions are good for people's health because they lead to less spending on "vices", in this case junk food. That said, the shifts toward fattier dairy products in both the milk and yogurt categories, as well as the decline in the share of low fat mayonnaise sales suggests that prices and promotions can play a decisive factor in whether to make a healthy choice in hard times. The heterogeneity of effects across categories suggests that Ruhm's healthy eating hypothesis may be an artifact of self-reported data: individuals in the BRFSS survey may recall some healthier choices (buying less chips and soda) but not consider or report the switch to whole milk or regular mayonnaise. Moreover, the differences across categories also suggest different types of consumers; perhaps the person who choses reduced sugar peanut butter or low sodium chips is a wealthier consumer less likely to be affected by the impact of recession and more committed to their tastes than the average milk buyer. Understanding the underlying mechanism driving the choices of consumers in these various categories will require more detailed individual level purchase and demographic data.

Conclusion

Using a unique data set that combines rich scanner data with information on tens of thousands of product health attributes, I demonstrate that positive health attributes aren't necessarily associated with higher average transaction prices. I also show that many healthy alternatives are promoted just as much or more than their regular counterparts within category, although consumers who purchase products with positive health attributes seem to take advantage of promotional discounts far less often. Additionally, I demonstrate that recession is not necessarily associated with lower transaction prices for these products with positive health attributes. While most items are purchased more on promotion when unemployment increases, healthy items have much lower promotion uptake rates to begin with; increased promotion during a recession does not guarantee that a healthy sub-category's share of sales won't decline. Finally, I find that changes in market level unemployment are associated a significant decline in total quantities sold for 7 of 9 overall grocery categories. Changes in market level unemployment are also associated with significant changes in within category shares for items with health characteristics. Demand for healthier products within category is robust in carbonated beverages, hot dogs, peanut butter and salty snacks. On the other hand, there is a significant shift toward higher fat products in margarine, mayonnaise, milk and yogurt. The robustness of

demand for certain types of healthy products during recession, but not for others suggests that health related food labeling is valued more in some categories than others. Whether this is due to heterogeneity of taste preferences among consumers, availability of close substitutes or differences in retailer behavior is a fruitful area for future research.

The evidence presented in this paper is consistent with the idea that recessions are good for the average person's eating habits in one significant respect: overall lower consumption. This, combined with a decrease in eating in restaurants and fast-food outlets less, an income effect documented by [16], could likely be the mechanism responsible for the negative correlation between recession and obesity found in the literature. This is also consistent, for example, with the USDA's claim in recent work on food deserts that overconsumption in general is a more likely culprit for obesity among the poor than under-availability of healthy options ([29]).

The results in this paper show that health attributes clearly matter to consumers, but they matter in different ways depending on the category. This immediately suggest several areas for further research, in particular an hedonic price analysis of health claims for various grocery categories and a more structural analysis of consumer choice as a function of unemployment. This work would be helpful to firms marketing more healthful products, particularly in helping to understand how to design promotions and achieve better promotion uptake rates. A better understanding for the reasons for the mixed results vis-a-vis health attributes is also policy relevant, as it can inform the regulation of food product labels and claims and other programs aimed at getting consumers to make healthier choices, as well as informing how government nutrition programs respond to recession.

1.4 Tables and Figures

Figure 1.1: Map of Markets Included in the IRI Data

Table 1.1: MARKETS AND STORE CHAINS: The data are geographically diverse and represent competitive grocery markets.

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Total Unique Chains Across All Markets	131	130	127	124	123	117
	Number of Chains Present In Each Market					
Market	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
ATLANTA	13	10	8	8	8	7
BIRMINGHAM/MONTG.	11	9	9	7	6	6
BOSTON	11	12	10	10	9	10
BUFFALO/ROCHESTER	6	6	7	6	7	7
CHARLOTTE	8	8	8	8	8	7
CHICAGO	13	13	13	11	12	12
CLEVELAND	5	5	5	5	5	5
DALLAS, TX	11	13	11	9	10	10
DES MOINES	7	5	4	5	4	4
DETROIT	9	10	9	7	7	7
EAU CLAIRE	3	3	3	3	3	2
GRAND RAPIDS	6	6	6	6	4	4
GREEN BAY	5	5	5	5	4	4
HARRISBURG/SCRANT	15	15	12	10	9	10
HARTFORD	10	9	9	9	10	11
HOUSTON	9	10	8	8	8	8
INDIANAPOLIS	9	8	8	8	7	6
KANSAS CITY	6	6	6	6	6	6
KNOXVILLE	8	8	7	7	7	7
LOS ANGELES	14	15	15	15	13	13
MILWAUKEE	9	11	11	9	8	9
MINNEAPOLIS/ST. PAUL	6	7	7	4	7	7
MISSISSIPPI	9	7	7	7	7	6
NEW ENGLAND	10	10	7	8	7	8
NEW ORLEANS, LA	11	9	9	9	9	9
NEW YORK	17	17	17	17	18	18
OKLAHOMA CITY	3	3	3	3	3	3
OMAHA	7	7	6	7	6	5
PEORIA/SPRINGFLD.	10	11	11	9	10	10
PHILADELPHIA	14	16	16	13	13	13
PHOENIX, AZ	9	8	7	6	6	6
PITTSFIELD	5	5	5	5	5	5
PORTLAND,OR	5	6	6	8	8	7
PROVIDENCE,RI	4	4	3	3	5	6
RALEIGH/DURHAM	12	12	11	11	11	9
RICHMOND/NORFOLK	10	12	11	11	10	9
ROANOKE	12	11	11	11	10	8
SACRAMENTO	10	9	9	9	9	9
SALT LAKE CITY	4	4	4	4	3	3
SAN DIEGO	10	10	10	10	10	10
SAN FRANCISCO	9	9	9	10	10	10
SEATTLE/TACOMA	9	9	9	9	9	9
SOUTH CAROLINA	14	14	13	13	14	11
SPOKANE	5	4	6	6	6	5
ST. LOUIS	6	6	6	6	6	6
SYRACUSE	8	9	9	8	7	7
TOLEDO	8	9	8	7	8	7
TULSA,OK	4	5	4	4	4	4
WASHINGTON, DC	10	11	11	12	12	12

Table 1.2: PRODUCT STATISTICS: A variety of categories, vendors and brands are represented among thousands of products in the sample.

	Unique Parent Companies	**Unique Vendors**	**Unique Brands**	**Unique UPCs**
Carbonated Beverages	232	249	538	10331
Cold Cereal	135	139	671	4402
Hot Dogs/Franks/Wieners	207	233	367	1865
Margarine	53	60	113	533
Mayonnaise	124	129	166	744
Milk & Milk Products	280	357	636	8830
Peanut Butter	69	72	97	513
Salty Snacks	949	989	1762	18655
Soup	188	201	253	4899
Yogurt	126	146	331	4081

Table 1.3: PRODUCT FEATURES: Sub-categories are defined by health-related product characteristics for each category.

Category	Number of UPCs
Carbonated Beverages	
Total UPCs	10331
Lower Sugar/Lower Calorie	27
Diet/Calorie Free	2719
Cold Cereal	
Total UPCs	4402
No Sugar/Low Sugar	392
Fiber/Whole Grain Claim	3532
Hot Dogs/Franks/Wieners	
Total UPCs	1865
Lower or Reduced Fat/Fat Free	171
Margarine	
Total UPCs	533
Low-Cal/Low-Fat/Healthy Oil	206
Mayonnaise	
Total UPCs	744
Lower Sugar	13
Low-Fat/Fat-Free	276
Milk & Milk Products	
Total UPCs	8830
Low-fat/Skim Milk	5254
High Fat Milk UPCs (>6% milk fat)	1200
Peanut Butter	
Total UPCs	513
Lower Sugar	114
Reduced Sodium/Sodium Free	83
Salty Snacks	
Total UPCs	18655
Reduced-Fat/Fat-Free/Light	3370
Lower/Reduced Sodium	478
Yogurt	
Total UPCs	4081
Low-Fat/Fat-Free	3549
Reduced/Low-Calorie	518

Table 1.4: PRODUCT FEATURE DATA ENTRY: Over 20,000 product characteristics were coded into the data, greatly increasing the data available for analysis.

Category	Total UPCs	Original Missing Characteristics (Note: Products may have multiple characteristics.)	Product Characteristics Added	Missing Characteristics
Carbonated Beverages	10,331	386	360	26
Cold Cereal	4,402	2,880	0	2,880
Hot Dogs	1,865	1,246	570	676
Margarine	533	78	28	50
Mayonnaise	744	435	149	286
Milk	8,830	3,721	3,667	54
Peanut Butter	513	389	171	218
Salty Snacks	18,655	16,522	14,871	1,651
Yogurt	4,081	3,379	257	3,122
	49,954	**29,036**	**20,073**	**8,963**

Table 1.5: MARKET DEMOGRAPHICS: Sample population is more urban and slightly better educated, less diverse and more wealthy than national average.

Variable	Mean	Std. Dev.	Min	Max	US Population
General Charcteristics					
Total population: Total	3,265,176	4,242,407	84,708	21,200,000	281,421,906
Percent Urban	85.2	10.0	48.8	98.2	80.3
Percent Over 65 Y.O.	11.9	2.2	7.6	18.3	12.4
Percent Female	51.2	0.7	49.6	52.6	50.9
Percent Women With Children	31.4	2.3	26.1	38.0	12.4
Percent Women With Children Under 6	7.7	0.8	5.7	10.2	3.0
Race & Ethnicity					
Percent White	77.3	10.8	55.0	96.1	75.1
Percent Black	12.7	9.7	0.3	37.4	12.3
Percent Foreign Born	8.5	6.9	1.4	30.9	11.1
Percent Foreign Born: Latin America	3.6	4.1	0.2	19.2	5.7
Percent of Total Population Who Are Foreign Born Spanish Speakers	3.0	3.7	0.1	17.7	10.7
Education					
Percent of Males with HS Diploma	26.7	4.6	16.8	37.7	27.6
Percent of Males with Bachelor's	18.0	2.7	11.1	24.3	16.1
Percent of Males with Master's	6.4	1.6	3.5	11.4	6.0
Percent of Females with HS Diploma	28.9	4.4	18.4	41.0	29.6
Percent of Females with Bachelor's	16.5	3.0	11.0	24.8	15.0
Percent of Females with Master's	6.1	1.5	3.9	10.1	5.8
Income					
Households: Median household income in 1999	$44,993.55	$5,992.83	$31,330.00	$62,024.00	$41,994.00
Per capita income in 1999	$22,540.84	$2,726.16	$15,853.00	$30,769.00	$21,587.00
% Households: Less than $10,000	8.5	2.2	5.1	16.2	9.5
% Households: $10,000 to $14,999	5.8	1.2	3.6	8.8	6.3
% Households: $15,000 to $19,999	5.8	1.0	3.8	8.0	6.3
% Households: $20,000 to $24,999	6.2	0.9	4.1	7.7	6.6
% Households: $25,000 to $29,999	6.3	0.8	4.2	7.7	6.4
% Households: $30,000 to $34,999	6.3	0.6	4.5	7.3	6.4
% Households: $35,000 to $39,999	5.8	0.5	4.5	6.8	5.9
% Households: $40,000 to $44,999	5.7	0.4	4.6	6.6	5.7
% Households: $45,000 to $49,999	5.0	0.4	4.2	5.9	5.0
% Households: $50,000 to $59,999	9.4	0.7	7.9	11.0	9.0
% Households: $60,000 to $74,999	11.2	1.1	8.2	13.3	10.4
% Households: $75,000 to $99,999	11.1	1.8	6.8	14.6	10.2
% Households: $100,000 to $124,999	5.6	1.4	2.8	9.5	5.2
% Households: $125,000 to $149,999	2.7	0.9	1.1	5.6	2.5
% Households: $150,000 to $199,999	2.3	0.9	0.9	5.7	2.2
% Households: $200,000 or more	2.4	1.0	1.2	6.0	2.4

Table 1.6: REGRESSION OF QUANTITY WEIGHTED AVERAGE PRICE ON HEALTH CHARACTERISTICS

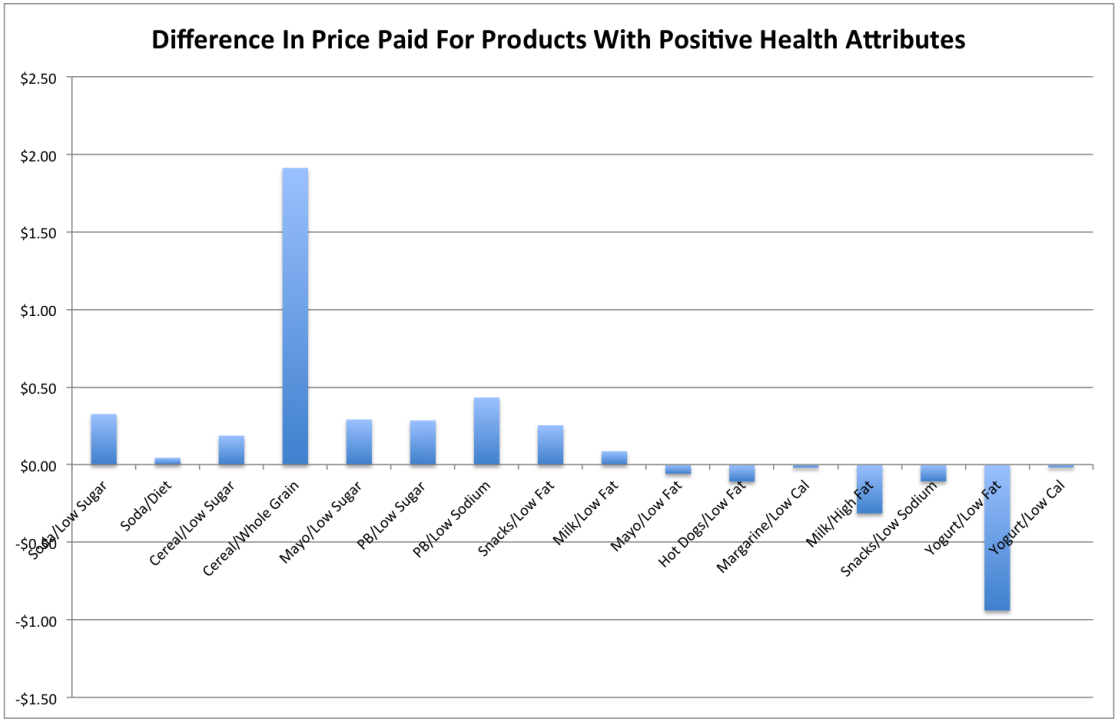
Dependent Variable:	Quantity Weighted Average Price Paid							
	Carbonated Beverages		Cold Cereal		Hot Dogs	Margarine	Mayonnaise	
Constant	1.876***	1.864***	2.657***	0.902***	2.859***	1.725***	2.352***	2.385***
	(0.000966)	(0.00125)	(0.00117)	(0.00312)	(0.00481)	(0.00314)	(0.00321)	(0.00443)
Low Sugar	0.326***							
	(0.00926)							
Diet/Calorie Free		0.0444***						
		(0.00195)						
Low Sugar			0.187***				0.291***	
			(0.00273)				(0.0233)	
Whole Grain				1.912***				
				(0.00323)				
Low Fat					-0.109***			-0.0587***
					(0.00650)			(0.00485)
Low Calorie						-0.0191***		
						(0.00389)		
Observations	32,117,724	32,117,724	12,537,347	19,751,402	3,913,540	5,524,792	3,515,866	4,027,441
Number of Panels	1,437,270	1,437,270	530,098	803,326	146,841	186,836	108,432	144,904

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Dependent Variable:	Quantity Weighted Average Price Paid							
	Milk		Peanut Butter		Salty Snacks		Yogurt	
Constant	2.137***	2.228***	2.695***	2.628***	1.884***	1.990***	2.159***	1.019***
	(0.00276)	(0.00165)	(0.00399)	(0.00395)	(0.000855)	(0.000752)	(0.00232)	(0.00211)
Low Fat	0.0866***				0.254***		-0.940***	
	(0.00333)				(0.00160)		(0.00259)	
High Fat (>6%)		-0.314***						
		(0.00465)						
Low Sugar			0.285***					
			(0.00773)					
Low Sodium				0.433***		-0.107***		
				(0.00955)		(0.00355)		
Low Calorie								-0.0174***
								(0.00300)
Observations	8,578,352	8,578,352	3,974,951	3,662,876	30,586,925	33,303,811	17,711,410	9,172,416
Number of Panels	359,655	359,655	133,831	116,979	1,806,904	1,972,634	771,709	343,445

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 1.2: NO SYSTEMATIC DIFFERENCE IN AVERAGE PRICE PAID: coefficients* on product characteristics from a regression of price on product characteristic.



*A blue bar extending above the zero line indicates that the product in question has a higher average transaction price by the dollar amount indicated on the y-axis than products without the given product characteristic (e.g. low sugar soda has a higher price paid than non-low sugar soda). A blue bar below the zero line indicates that the given product has an average price paid that is the indicated number of cents/dollars lower than its regular within category counterparts. All average transaction price estimates are significant at the .01 level and the standard errors are extremely small; 95% confidence intervals on the point estimates are within 1 cent or less.

Table 1.7: REGRESSION OF PROMOTION INDICATOR ON HEALTH CHARACTERISTICS: Carbonated Beverages through Mayonnaise

Dependent Variable:	Promotion Indicator							
	Carbonated Beverages		Cold Cereal		Hot Dogs	Margarine	Mayonnaise	
Constant	0.295***	0.286***	0.252***	0.318***	0.264***	0.188***	0.147***	0.131***
	(0.000214)	(0.000269)	(0.000315)	(0.0937)	(0.000529)	(0.000479)	(0.000524)	(0.000614)
Low Sugar	0.0143***							
	(0.00207)							
Diet/Calorie Free		0.0261***						
		(0.000438)						
Low Sugar			-0.0297***				-0.110***	
			(0.000666)				(0.00212)	
Whole Grain				-0.0896				
				(0.0937)				
Low Fat					-0.0324***			0.0609***
					(0.000989)			(0.000921)
Low Calorie						-0.0149***		
						(0.000639)		
Observations	32,118,314	32,118,314	12,537,347	19,751,402	3,913,540	5,524,792	3,515,866	4,027,441
Number of Panels	1,437,340	1,437,340	530,098	803,326	146,841	186,836	108,432	144,904

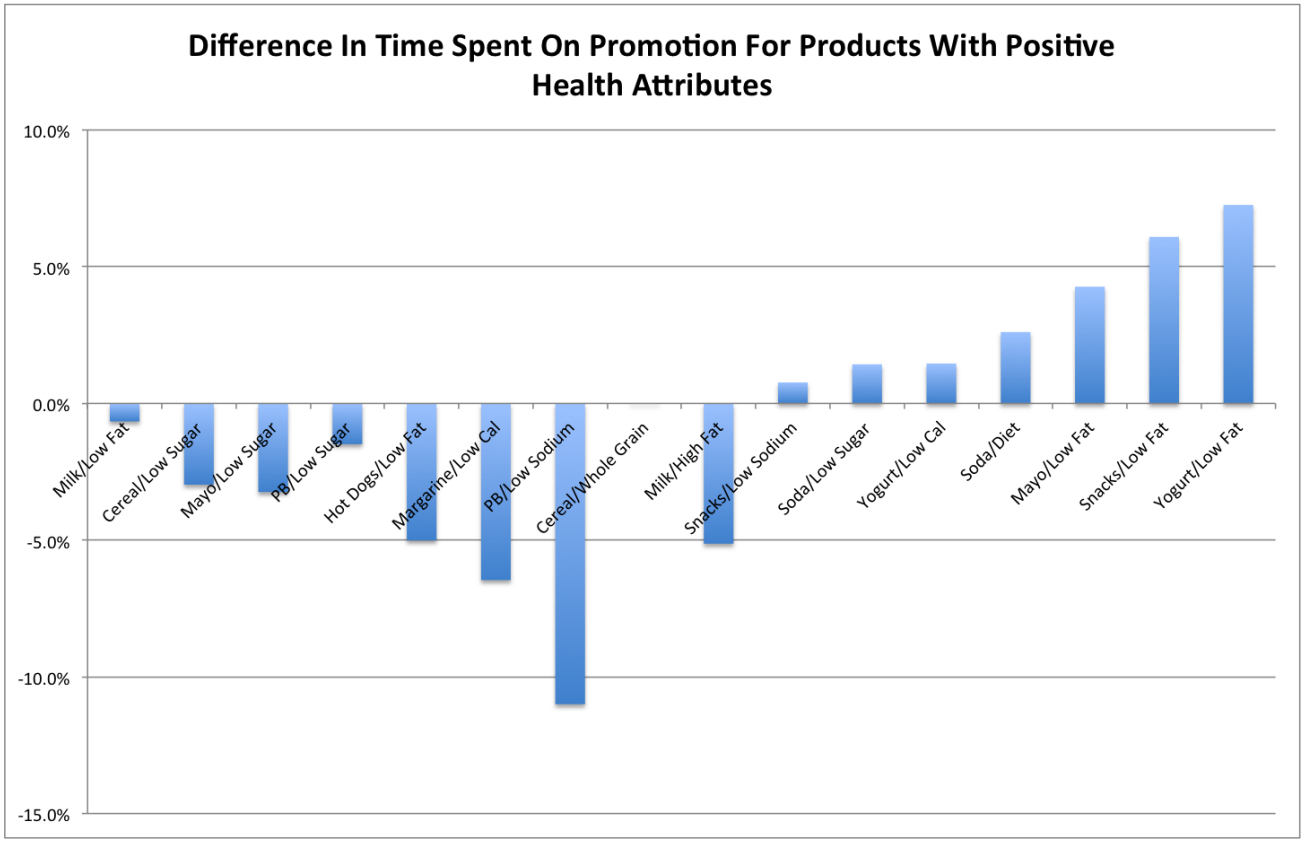
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 1.8: REGRESSION OF PROMOTION INDICATOR ON HEALTH CHARACTERISTICS: Milk through Yogurt

Dependent Variable:	Promotion Indicator							
	Milk		Peanut Butter		Salty Snacks		Yogurt	
Constant	0.148***	0.140***	0.170***	0.176***	0.241***	0.225***	0.165***	0.244***
	(0.000449)	(0.000271)	(0.000471)	(0.000490)	(0.000213)	(0.000172)	(0.000471)	(0.000377)
Low Fat	-0.00658***				-0.0513***		0.0726***	
	(0.000555)				(0.000375)		(0.000511)	
High Fat (>6%)		0.0427***						
		(0.00101)						
Low Sugar			-0.0501***					
			(0.00103)					
Low Sodium				-0.0646***		0.00768***		
				(0.00123)		(0.00104)		
Low Calorie								0.0146***
								(0.000545)
Observations	8,578,353	8,578,353	3,974,951	3,662,876	30,586,935	33,303,821	17,711,410	9,172,416
Number of Panels	359,655	359,655	133,831	116,979	1,806,904	1,972,634	771,709	343,445

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 1.3: NO SYSTEMATIC DIFFERENCE IN AVERAGE PRICE PAID: Coefficients* on product characteristics from a regression of price on product characteristic.

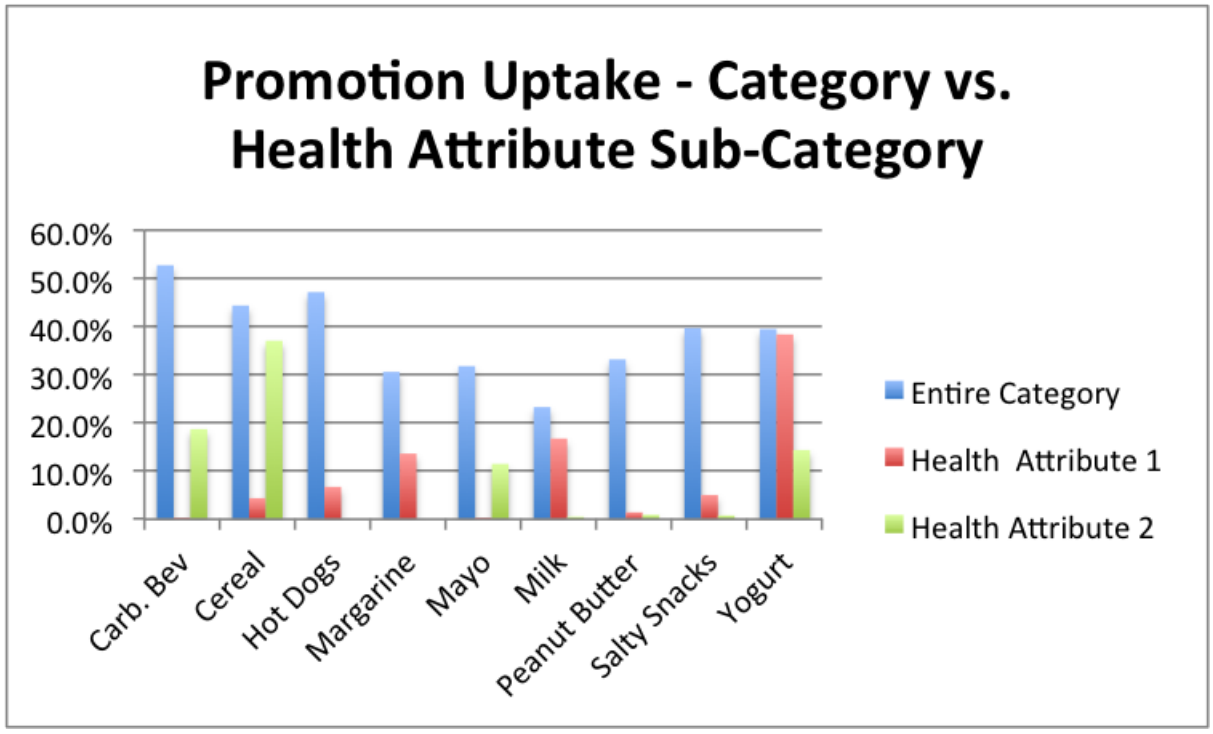


*A blue bar extending above the zero line indicates that the product in question spends more time on promotion in a given month by the percent amount indicated on the y-axis than products without the given product characteristic. A blue bar below the zero line indicates that the given product has an average time spent on promotion that is the indicated number of percentage points lower than its regular within category counterparts. All percent estimates are significant at the .01 level and the standard errors are extremely small; 95% confidence intervals on the point estimates are within 1 percent or less.

Table 1.9: T-TEST RESULTS FOR DIFFERENCE IN MEAN PERCENTAGE OF ITEMS SOLD ON PROMOTION

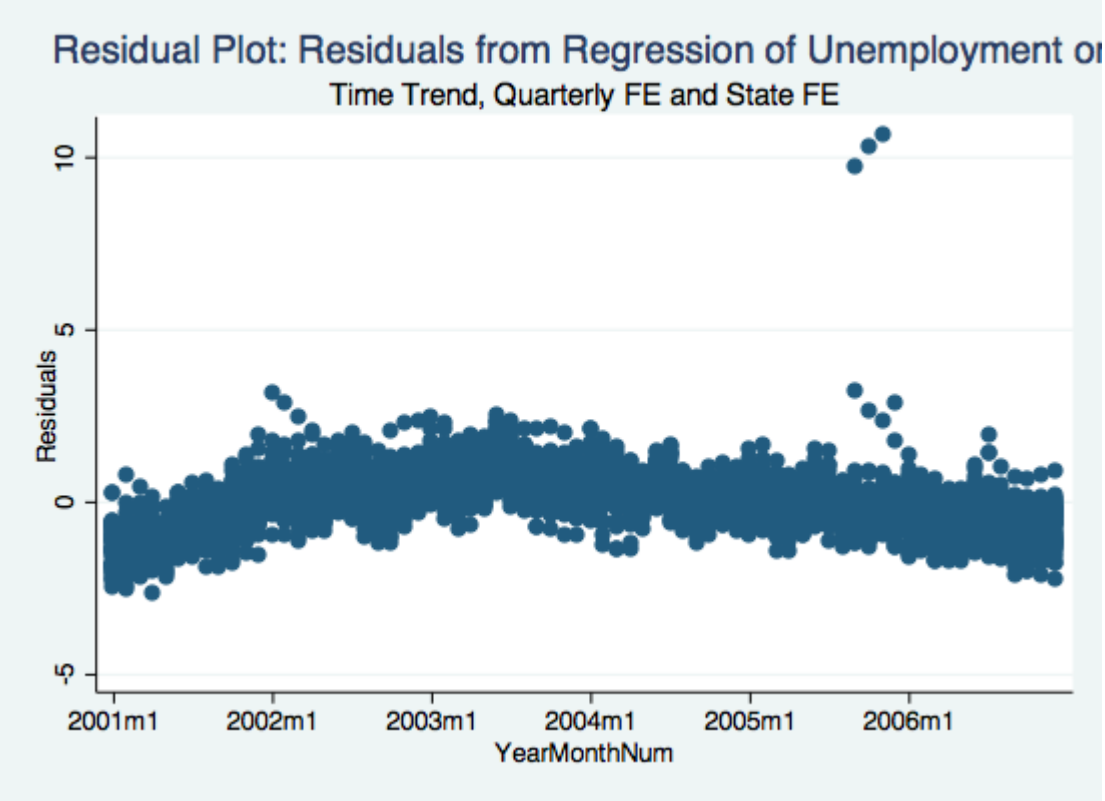
Difference in Mean Between Promotional Items Sold For All Products In Category vs. Sub-Categories		
	Percent of Total Units Sold on Promotion	p-value
Carbonated Bevg.		
All Products	52.7%	
Low Sugar	0.1%	<.01
Diet/Calorie Free	18.7%	<.01
Cold Cereal		
All Products	44.4%	
Low Sugar	4.4%	<.01
Whole Grain/Fiber	37.1%	<.01
Hot Dogs		
All Products	47.1%	
Low Fat Hot Dogs	6.7%	<.01
Margarine		
All Products	30.6%	
Calorie/Healthy Fat Claim	13.6%	<.01
Mayonnaise		
All Products	31.8%	
Low Sugar	0.0%	<.01
Low Fat	11.5%	<.01
Milk		
All Products	23.3%	
Low Fat	16.8%	<.01
High Fat (>6%)	0.5%	<.01
Peanut Butter		
All Products	33.2%	
Low Sugar	1.4%	<.01
Low Sodium	0.9%	<.01
Salty Snacks		
All Products	39.7%	
Low Fat	5.0%	<.01
Low Sodium	0.8%	<.01
Yogurt		
All Products	39.5%	
Low Fat	38.4%	<.01
Low Calorie	14.4%	<.01

Figure 1.4: PERCENTAGE SOLD ON PROMOTION BY CATEGORY: Difference In Means Test



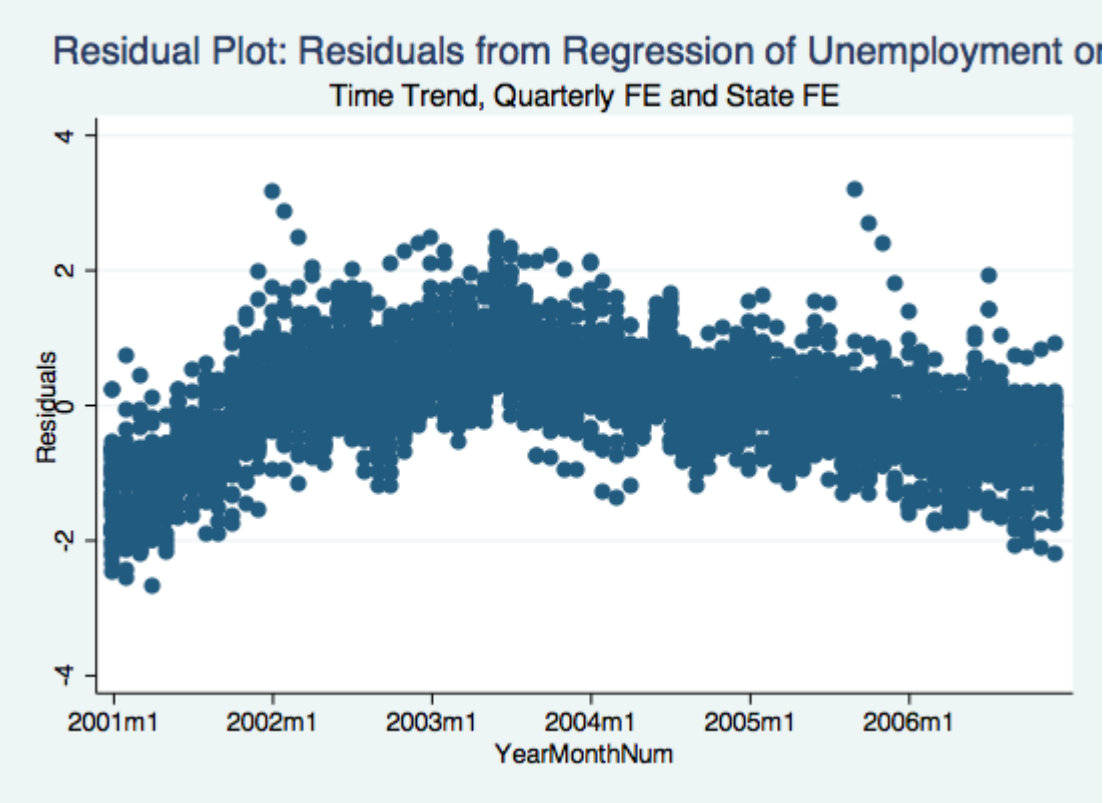
*Blue bars represent the proportion of items sold on promotion for each major category as a whole. Red and green bars represent the share of products sold on promotion in the sub-categories defined by health attributes (e.g. the first blue bar is all carbonated beverages, the green bar is all diet carbonated beverages.) All percent estimates are significant at the .01 level and the standard errors are extremely small; 95% confidence intervals on the point estimates are within 1 percent or less.

Figure 1.5: UNEMPLOYMENT RESIDUALS OVER TIME: All Markets



This figure depicts residuals sorted by time period of the original data resulting from a panel regression of unemployment rate over time and regions on regional and time trend.

Figure 1.6: UNEMPLOYMENT RESIDUALS OVER TIME: All Markets Except New Orleans



This figure depicts residuals sorted by time period of the original data resulting from a panel regression of unemployment rate over time and regions on regional and time trend, excluding the New Orleans market.

Table 1.10: OLS REGRESSION OF MARKET UNEMPLOYMENT ON TIME AND GEOGRAPHIC EFFECTS: 50% of variation left unexplained after taking account of geographic and time effects.

	Dependent Variable: Monthly Unemployment Rate				Regressions 1-4 with New Orleans Dropped			
	OLS 1	OLS 2	OLS 3	OLS 4	OLS 5	OLS 6	OLS 7	OLS 8
TimeTrend	-0.003			-0.002	-0.004			-0.002
	(0.001)**			(0.001)**	(0.001)**			(0.001)**
1st Quarter Dummy		0.505		0.486		0.538		0.517
		(0.055)**		(0.041)**		(0.054)**		(0.039)**
2nd Quarter Dummy		0.126		0.113		0.156		0.142
		(0.055)*		(0.041)**		(0.054)**		(0.038)**
3rd Quarter Dummy		0.173		0.166		0.188		0.181
		(0.055)**		(0.041)**		(0.054)**		(0.038)**
State Fixed Effects	No	No	Yes	Yes	No	No	Yes	Yes
Constant	5.19	4.867	4.664	4.551	5.194	4.839	4.664	4.54
	(0.040)**	(0.039)**	(0.103)**	(0.107)**	(0.039)**	(0.038)**	(0.097)**	(0.100)**
Observations	3528	3528	3528	3528	3456	3456	3456	3456
R-squared	0	0.03	0.45	0.48	0	0.03	0.49	0.52

Standard errors in parentheses
* significant at 5% level; ** significant at 1% level

Table 1.11: HOT DOGS: Prices and Promotion Regressed on Unemployment

HOT DOG/FRANKFURTERS				
Dependent Variable:	Ln(Quantity Weighted Average Price)	Ln(Quantity Weighted Average Price)	Ln(Percent Units Sold on Promotion)	Ln(Percent Units Sold on Promotion)
	All Products	Low Fat	All Products	Low Fat
Ln(Unemployment Rate)	-0.0221**	-0.00926	0.0624	0.387***
	(0.0108)	(0.00607)	(0.0523)	(0.101)
Ln(Price) [IV Lag Price Paid]			-0.245***	-0.0949***
			(0.0248)	(0.0308)
Constant	1.267***	1.060***	-4.870***	-1.573***
	(0.158)	(0.0737)	(0.607)	(0.334)
Observations	4,313,832	1,071,381	4,282,123	990,541
Number of Market-Chain-Product Panels	164,880	38,626	163,820	37,013

Demographic, geographic, time & trend controls included in all regressions.
Standard errors clustered at the market level in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 1.12: SALTY SNACKS: Prices and Promotion Regressed on Unemployment

SALTY SNACKS						
Dependent Variable:	Ln(Qty Wtd Avg Price)	Ln(Qty Wtd Avg Price)	Ln(Qty Wtd Avg Price)	Ln(Percent Units Sold on Promotion)	Ln(Percent Units Sold on Promotion)	Ln(Percent Units Sold on Promotion)
	All Products	Low Fat	Low Sodium	All Products	Low Fat	Low Sodium
Ln(Unemployment Rate)	-0.0207**	0.00963	-0.0111	0.0959**	0.109*	-0.0925
	(0.00979)	(0.00754)	(0.00866)	(0.0463)	(0.0630)	(0.119)
Ln(Price) [IV Lag Price Paid]				-0.0697***	-0.133***	-0.133***
				(0.0115)	(0.0222)	(0.0303)
Constant	0.534***	0.527***	0.425***	-1.483***	-3.535***	-4.729***
	(0.107)	(0.0476)	(0.106)	(0.205)	(0.380)	(0.799)
Observations	33,303,721	8,354,441	893,778	33,146,942	7,835,070	785,455
Number of Market-Chain-Product Panels	1,972,634	449,195	42,358	1,958,214	424,924	39,714

Demographic, geographic, time & trend controls included in all regressions.
Standard errors clustered at the market level in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 1.13: CARBONATED BEVERAGES: Prices and Promotion Regressed on Unemployment

CARBONATED BEVERAGES						
Dependent Variable:	Ln(Quantity Weighted Average Price)	Ln(Quantity Weighted Average Price)	Ln(Quantity Weighted Average Price)	Ln(Percent Units Sold on Promotion)	Ln(Percent Units Sold on Promotion)	Ln(Percent Units Sold on Promotion)
	All Carb. Bev. Products	Low Sugar	Diet/Calorie Free	All Carb. Bev. Products	Low Sugar	Diet/Calorie Free
Ln(Unemployment Rate)	-0.0366**	0.0339***	-0.0520***	0.0252	0.362**	0.0273
	(0.0146)	(0.0105)	(0.01000)	(0.0447)	(0.146)	(0.0491)
Ln(Price) [IV Lag Price Paid]				-0.0983***	-0.170***	-0.160***
				(0.0175)	(0.0204)	(0.0265)
Constant	0.416***	0.575***	0.470***	-0.960***	-5.867***	-2.077***
	(0.120)	(0.109)	(0.0905)	(0.203)	(0.542)	(0.279)
Observations	32,148,430	227,358	12,009,011	32,038,644	148,653	11,456,274
Number of Market-Chain-Product Panels	1,438,430	20,301	541,063	1,432,045	18,234	517,871

Standard errors clustered at the market level in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 1.14: MILK: Price and Promotion Regressions

MILK						
Dependent Variable:	Ln(Quantity Weighted Average Price)	Ln(Quantity Weighted Average Price)	Ln(Quantity Weighted Average Price)	Ln(Percent Units Sold on Promotion)	Ln(Percent Units Sold on Promotion)	Ln(Percent Units Sold on Promotion)
	All Products	Low Fat (≤2%)	High Fat (≥6%)	All Products	Low Fat (≤2%)	High Fat (≥6%)
Ln(Unemployment Rate)	-0.0336**	-0.0191**	-0.0525***	0.360***	0.320***	-0.138
	(0.0153)	(0.00840)	(0.0139)	(0.0901)	(0.0998)	(0.158)
Ln(Price) [IV Lag Price Paid]				-0.0505	0.116***	0.124***
				(0.0320)	(0.0369)	(0.0294)
Constant	0.704***	0.776***	1.000***	-4.059***	-4.450***	-4.619***
	(0.144)	(0.0802)	(0.0969)	(0.902)	(1.081)	(0.631)
Observations	8,638,622	5,647,459	537,426	8,402,248	5,230,718	357,322
Number of Market-Chain-Product Panels	363,735	230,548	40,815	359,988	217,436	36,154

Demographic, geographic, time & trend controls included in all regressions.
Standard errors clustered at the market level in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 1.15: MARGARINE: Prices and Promotion Regressed on Unemployment

MARGARINE				
Dependent Variable:	Ln(Quantity Weighted Average Price)	Ln(Quantity Weighted Average Price)	Ln(Percent Units Sold on Promotion)	Ln(Percent Units Sold on Promotion)
	All Products	Low Cal/Healthy Fat	All Products	Low Cal/Healthy Fat
Ln(Unemployment Rate)	-0.00687	0.0307***	0.122	0.0415
	(0.00947)	(0.00800)	(0.0748)	(0.0819)
Ln(Price) [IV Lag Price Paid]			-0.264***	0.0484*
			(0.0226)	(0.0253)
Constant	0.453***	0.646***	-1.268***	-2.749***
	(0.0873)	(0.105)	(0.314)	(0.390)
Observations	5,604,745	2,934,055	5,496,986	2,745,160
Number of Market-Chain-Product Panels	191,237	100,493	190,378	98,095

Demographic, geographic, time & trend controls included in all regressions.
Standard errors clustered at the market level in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 1.16: MAYONNAISE: Prices and Promotion Regressed on Unemployment

MAYONNAISE						
Dependent Variable:	Ln(Quantity Weighted Average Price)	Ln(Quantity Weighted Average Price)	Ln(Quantity Weighted Average Price)	Ln(Percent Units Sold on Promotion)	Ln(Percent Units Sold on Promotion)	Ln(Percent Units Sold on Promotion)
	All Products	Low Sugar	Low Fat	All Products	Low Sugar	Low Fat
Ln(Unemployment Rate)	-0.00859	0.00482	0.00224	0.134*	0.101	-0.194**
	(0.00798)	(0.0231)	(0.00949)	(0.0785)	(0.183)	(0.0839)
Ln(Price) [IV Lag Price Paid]				-0.363***	0.223**	0.0580*
				(0.0255)	(0.113)	(0.0331)
Constant	1.033***	1.011***	0.900***	-1.559***	-7.947***	-2.978***
	(0.0746)	(0.231)	(0.0706)	(0.333)	(2.351)	(0.435)
Observations	4,087,460	27,574	1,700,056	3,954,172	2,397	1,524,822
Number of Market-Chain-Product Panels	148,201	2,175	70,672	147,390	745	68,574

Demographic, geographic, time & trend controls included in all regressions.
Standard errors clustered at the market level in parentheses

Table 1.17: PEANUT BUTTER: Prices and Promotion Regressed on Unemployment

PEANUT BUTTER						
Dependent Variable:	Ln(Quantity Weighted Average Price)	Ln(Quantity Weighted Average Price)	Ln(Quantity Weighted Average Price)	Ln(Percent Units Sold on Promotion)	Ln(Percent Units Sold on Promotion)	Ln(Percent Units Sold on Promotion)
	All Products	Low Sugar	Low Sodium	All Products	Low Sugar	Low Sodium
Ln(Unemployment Rate)	-0.0158	0.0177**	0.0204**	0.232***	0.126	0.0167
	(0.00966)	(0.00897)	(0.0100)	(0.0880)	(0.0795)	(0.0866)
Ln(Price) [IV Lag Price Paid]				-0.283***	0.0560*	-0.0793***
				(0.0189)	(0.0327)	(0.0281)
Constant	0.908***	0.979***	1.033***	-1.898***	-4.359***	-4.088***
	(0.109)	(0.126)	(0.147)	(0.308)	(0.426)	(0.534)
Observations	4,027,645	595,677	346,735	3,846,696	394,220	185,280
Number of Market-Chain-Product Panels	136,574	21,470	12,583	135,717	20,024	11,394

Demographic, geographic, time & trend controls included in all regressions.
Standard errors clustered at the market level in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 1.18: YOGURT: Prices and Promotion Regressed on Unemployment

YOGURT						
Dependent Variable:	Ln(Quantity Weighted Average Price)	Ln(Quantity Weighted Average Price)	Ln(Quantity Weighted Average Price)	Ln(Percent Units Sold on Promotion)	Ln(Percent Units Sold on Promotion)	Ln(Percent Units Sold on Promotion)
	All Products	Low Fat	Low Calorie	All Products	Low Fat	Low Calorie
Ln(Unemployment Rate)	0.0109	0.0510***	0.0463***	0.194**	0.164**	0.126
	(0.0127)	(0.00971)	(0.0108)	(0.0837)	(0.0735)	(0.0994)
Ln(Price) [IV Lag Price Paid]				-0.300***	-0.00315	0.0844***
				(0.0197)	(0.0177)	(0.0161)
Constant	-0.143*	0.126	0.000804	-1.567***	-1.722***	-2.296***
	(0.0863)	(0.0774)	(0.0792)	(0.311)	(0.302)	(0.367)
Observations	17,521,535	14,980,554	4,115,783	17,521,535	14,980,554	4,115,783
Number of Market-Chain-Product Panels	771,285	662,462	165,877	771,285	662,462	165,877

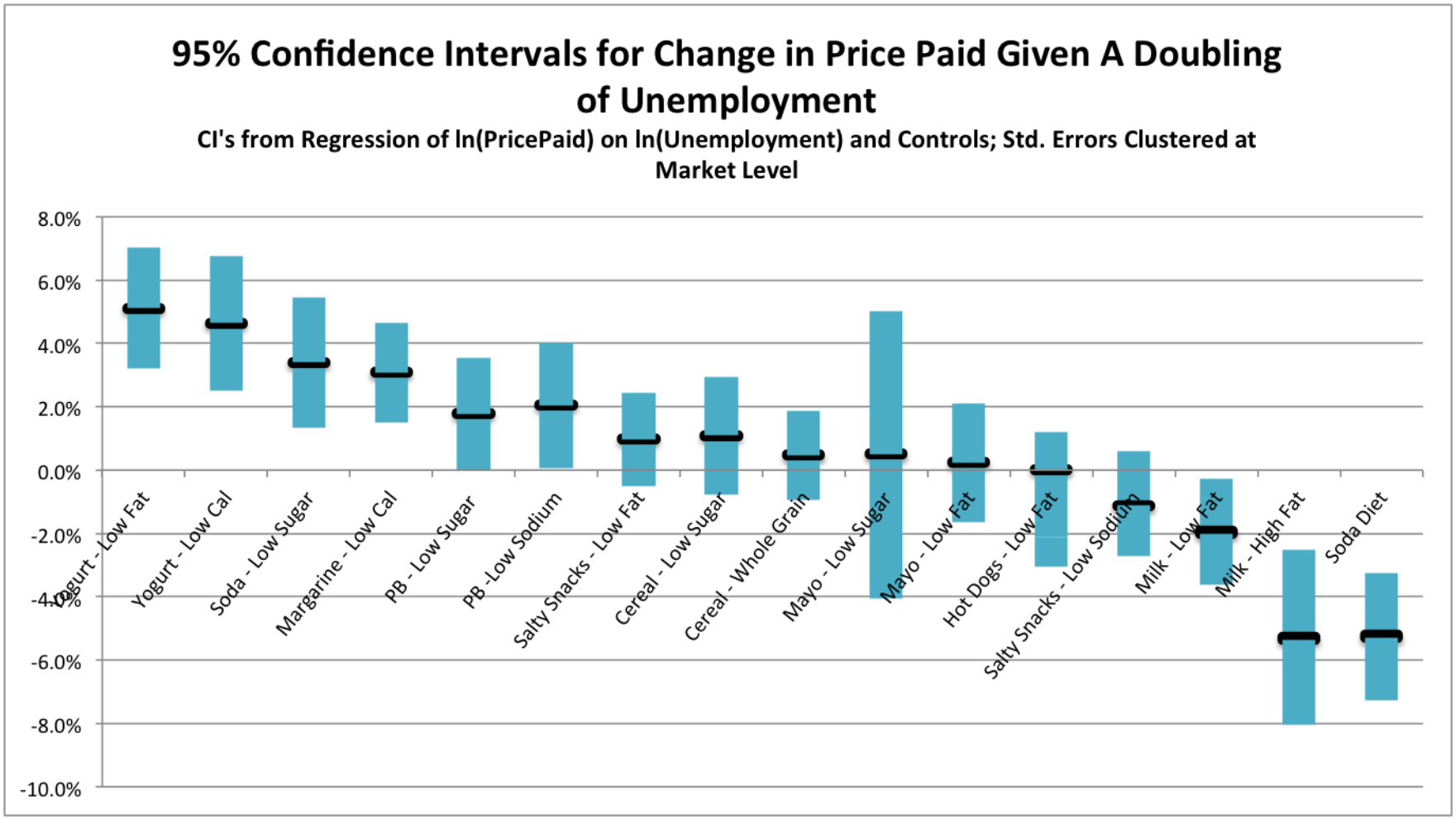
Demographic, geographic, time & trend controls included in all regressions.
Standard errors clustered at the market level in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 1.19: COLD CEREAL: Price and Promotion Regressions

COLD CEREAL						
Dependent Variable:	Ln(Quantity Weighted Average Price)	Ln(Quantity Weighted Average Price)	Ln(Quantity Weighted Average Price)	Ln(Percent Units Sold on Promotion)	Ln(Percent Units Sold on Promotion)	Ln(Percent Units Sold on Promotion)
	All Products	Low Sugar	Whole Grain/Fiber	All Products	Low Sugar	Whole Grain/Fiber
Ln(Unemployment Rate)	0.00276	0.0108	0.00458	0.00102	-0.0808	-0.00139
	(0.00950)	(0.00940)	(0.00718)	(0.0547)	(0.0764)	(0.0551)
Ln(Price) [IV Lag Price Paid]				-0.140***	-0.0296*	-0.159***
				(0.0162)	(0.0158)	(0.0260)
Constant	1.144***	1.163***	1.144***	-1.251***	-3.893***	-1.391***
	(0.0544)	(0.0533)	(0.0458)	(0.182)	(0.316)	(0.189)
Observations	23,021,042	2,444,210	19,751,257	22,950,017	2,284,474	18,934,601
Number of Market-Chain-Product Panels	942,029	105,518	803,304	938,001	101,156	771,460

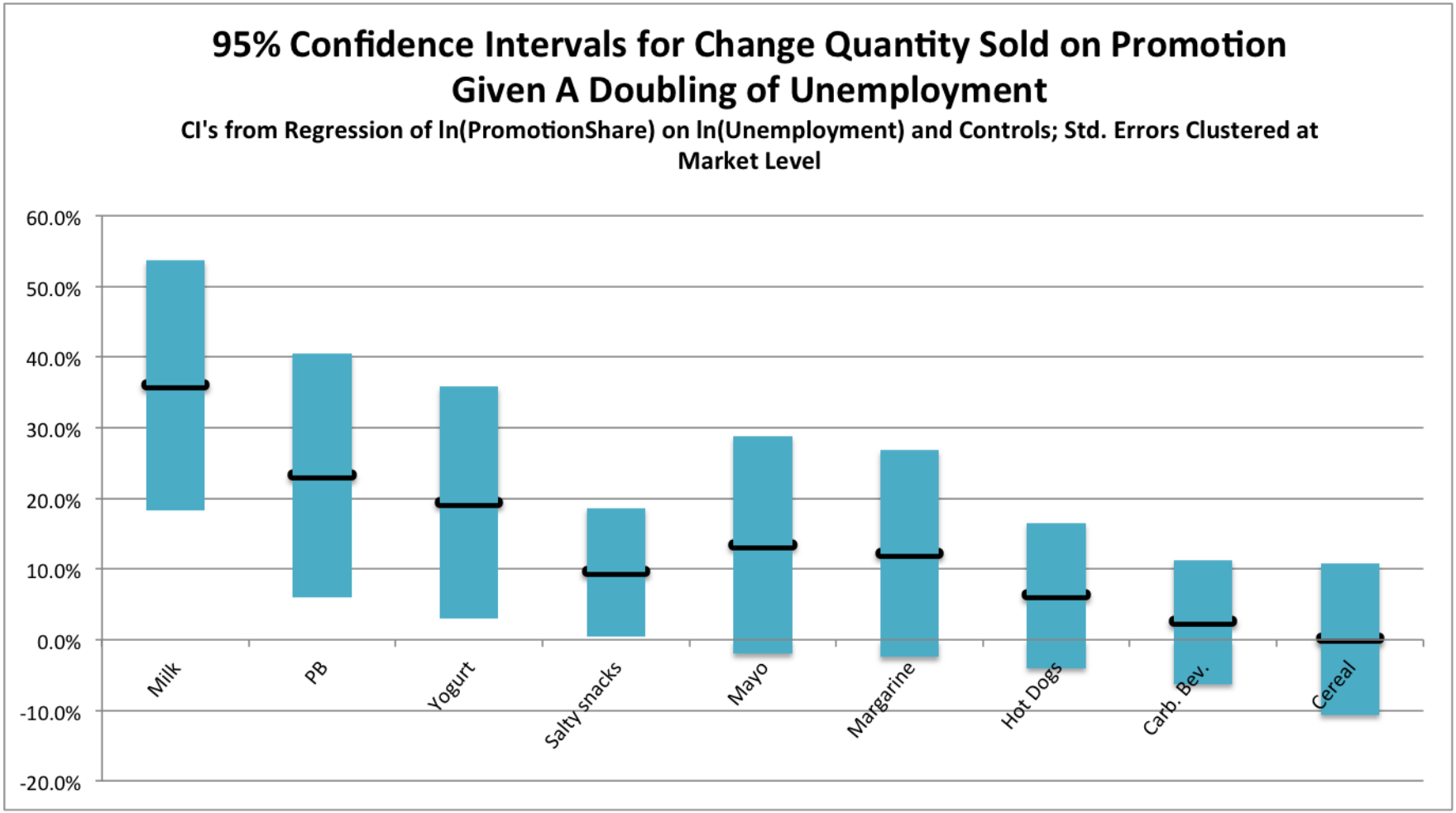
Demographic, geographic, time & trend controls included in all regressions.
Standard errors clustered at the market level in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 1.7: CHANGES IN PRICE PAID ASSOCIATED WITH A DOUBLING OF UNEMPLOYMENT



The black lines in this figure represent the point estimate multiplied by 100 (i.e. scaled up to represent a doubling of unemployment rather than a 1% increase in unemployment rate) for the regressions of log price paid on log unemployment presented in Tables 6-14; the bars represent the 95% confidence intervals calculated using the standard errors from those same regressions.

Figure 1.8: CHANGES IN SHARE SOLD ON PROMOTION ASSOCIATED WITH A DOUBLING OF UNEMPLOYMENT



The black lines in this figure represent the point estimate multiplied by 100 (i.e. scaled up to represent a doubling of unemployment rather than a 1% increase in unemployment rate) for the regressions of log percent sold on promotion on log unemployment presented in Tables 6-14; the bars represent the 95% confidence intervals calculated using the standard errors from those same regressions.

Table 1.20: RESULTS FROM REGRESSION OF QUANTITY AND SHARES ON UNEMPLOYMENT: Categories for Which Share of Healthy Products Does Not Change With Unemployment

	CARBONATED BEVERAGES			COLD CEREAL		HOT DOG	
Dependent Variable:	Ln(Total Units Sold Per Month)	Ln(Share of Total Units Sold Per Month)	Ln(Share of Total Units Sold Per Month)	Ln(Total Units Sold Per Month)	Ln(Share of Total Units Sold Per Month)	Ln(Total Units Sold Per Month)	Ln(Share of Total Units Sold Per Month)
	All Products	Low Sugar	Diet/Calorie Free	All Products	Whole Grain/Fiber	All Products	Low Fat
Ln(Unemployment Rate)	-0.189***	-0.00418	0.00117	-0.157***	-0.00455	-0.0230	-0.00568
	(0.0242)	(0.123)	(0.0261)	(0.0242)	(0.00537)	(0.0364)	(0.103)
Ln(Price) [IV Lag Price Paid]	-1.052***	-1.084***	0.115*	-1.578***	0.0571***	-1.578***	0.763***
	(0.0272)	(0.0639)	(0.0646)	(0.0300)	(0.0126)	(0.0239)	(0.201)
Constant	3.954***	-6.665***	-1.051***	4.771***	-0.261***	4.790***	-2.697***
	(0.222)	(0.466)	(0.145)	(0.258)	(0.0227)	(0.280)	(0.325)
Observations	32,020,729	87,635	122,113	22,962,578	119,973	4,302,138	94,483
Number of Market-Chain-Product Panels	1,431,496			938,723		164,147	
Number of Market-Chain Panels		83,905	115,482		111,311		81,284

	PEANUT BUTTER			SALTY SNACKS		
Dependent Variable:	Ln(Total Units Sold Per Month)	Ln(Share of Total Units Sold Per Month)	Ln(Share of Total Units Sold Per Month)	Ln(Total Units Sold Per Month)	Ln(Share of Total Units Sold Per Month)	Ln(Share of Total Units Sold Per Month)
	All Products	Low Sugar	Low Sodium	All Products	Low Fat	Low Sodium
Ln(Unemployment Rate)	-0.151***	0.0482	0.0239	-0.193***	0.00526	-0.0516
	(0.0250)	(0.0851)	(0.115)	(0.0237)	(0.0644)	(0.142)
Ln(Price) [IV Lag Price Paid]	-1.461***	0.564***	-0.0727	-0.941***	0.206***	0.665***
	(0.0323)	(0.165)	(0.168)	(0.0197)	(0.0644)	(0.113)
Constant	4.643***	-3.409***	-4.194***	3.476***	-1.520***	-3.750***
	(0.293)	(0.448)	(0.751)	(0.234)	(0.276)	(0.607)
Observations	4,020,698	96,317	91,992	33,162,027	121,424	106,604
Number of Market-Chain-Product Panels	136,359			1,959,392		
Number of Market-Chain Panels		76,574	74,284		117,281	103,255

Demographic, geographic, time & trend controls included in all regressions.
Standard errors clustered at the market level in parentheses
*** p<0.01, ** p<0.05, * p<0.1

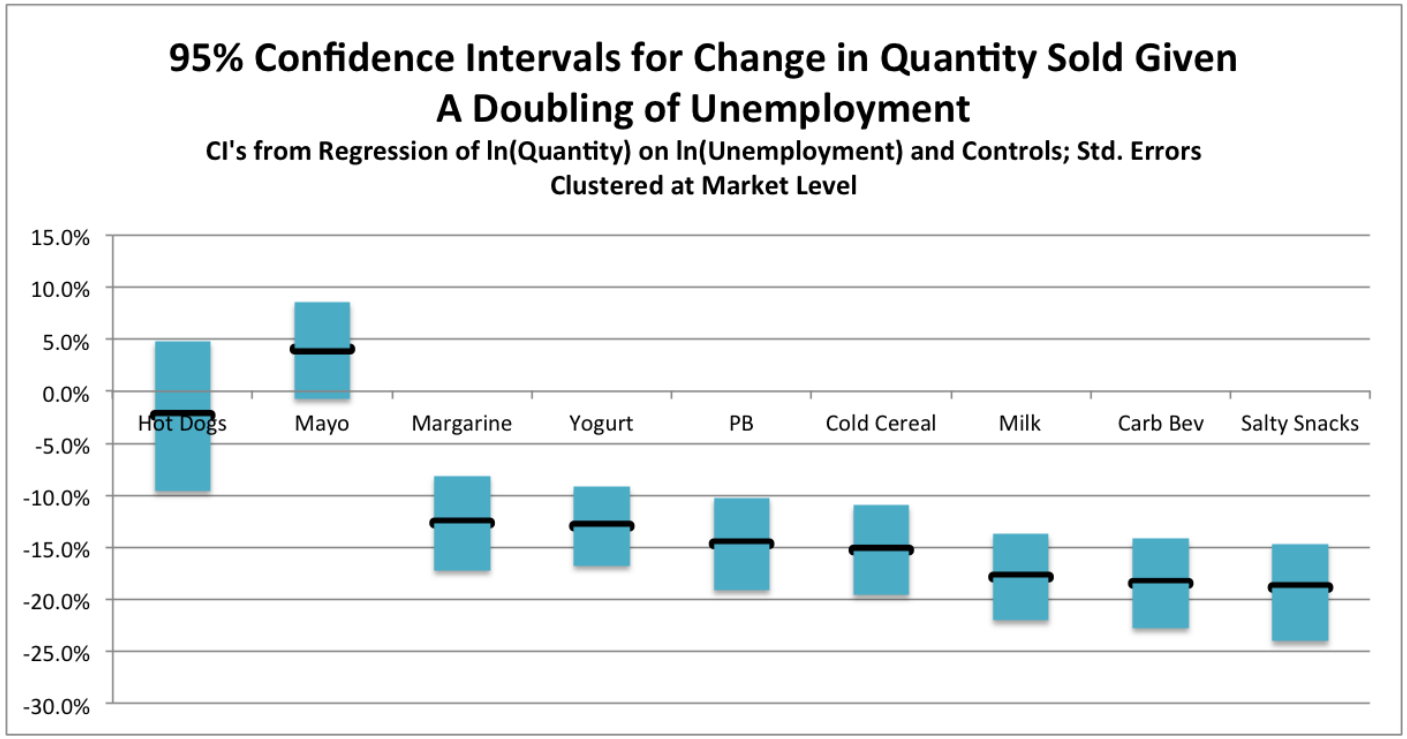
Table 1.21: RESULTS FROM REGRESSION OF QUANTITY AND SHARES ON UNEMPLOYMENT: Categories for Which Share of Healthy Products Changes With Unemployment

	COLD CEREAL		MARGARINE		MAYONNAISE		
Dependent Variable:	Ln(Total Units Sold Per Month)	Ln(Share of Total Units Sold Per Month)	Ln(Total Units Sold Per Month)	Ln(Share of Total Units Sold Per Month)	Ln(Total Units Sold Per Month)	Ln(Share of Total Units Sold Per Month)	Ln(Share of Total Units Sold Per Month)
	All Products	Low Sugar	All Products	Low Cal/Healthy Fat	All Products	Low Sugar	Low Fat
Ln(Unemployment Rate)	-0.157***	-0.174***	-0.131***	-0.116***	0.0405	-0.0134	-0.496***
	(0.0242)	(0.0338)	(0.0255)	(0.0274)	(0.0249)	(0.320)	(0.0844)
Ln(Price) [IV Lag Price Paid]	-1.578***	-0.198**	-1.279***	0.0143	-1.375***	-0.170	0.189***
	(0.0300)	(0.0913)	(0.0231)	(0.0630)	(0.0315)	(0.247)	(0.0676)
Constant	4.771***	-2.153***	5.102***	-0.753***	4.128***	-7.160***	-0.915***
	(0.258)	(0.130)	(0.304)	(0.127)	(0.272)	(1.410)	(0.352)
Observations	22,962,578	116,920	5,596,007	96,938	4,079,472	19,830	101,376
Number of Market-Chain-Product Panels	938,723		190,953		147,887		
Number of Market-Chain Panels		108,867		76,409		18,226	83,098

	MILK			YOGURT		
Dependent Variable:	Ln(Total Units Sold Per Month)	Ln(Share of Total Units Sold Per Month)	Ln(Share of Total Units Sold Per Month)	Ln(Total Units Sold Per Month)	Ln(Share of Total Units Sold Per Month)	Ln(Share of Total Units Sold Per Month)
	All Products	Low Fat (≤ 2%)	High Fat (≥6%)	All Products	Low Fat	Low Calorie
Ln(Unemployment Rate)	-0.183***	-0.0750**	0.234**	-0.134***	-0.00879***	-0.0907*
	(0.0235)	(0.0335)	(0.114)	(0.0217)	(0.00303)	(0.0544)
Ln(Price) [IV Lag Price Paid]	-0.860***	0.266***	-0.744***	-1.178***	-0.0375***	-0.00147
	(0.0387)	(0.0565)	(0.104)	(0.0302)	(0.00551)	(0.123)
Constant	4.283***	-0.395*	-3.613***	3.769***	0.00459	-0.738***
	(0.249)	(0.238)	(0.459)	(0.374)	(0.0147)	(0.177)
Observations	8,613,435	118,025	96,465	17,727,701	104,821	99,836
Number of Market-Chain-Product Panels	361,932			773,100		
Number of Market-Chain Panels		101,870	88,675		94,034	91,869

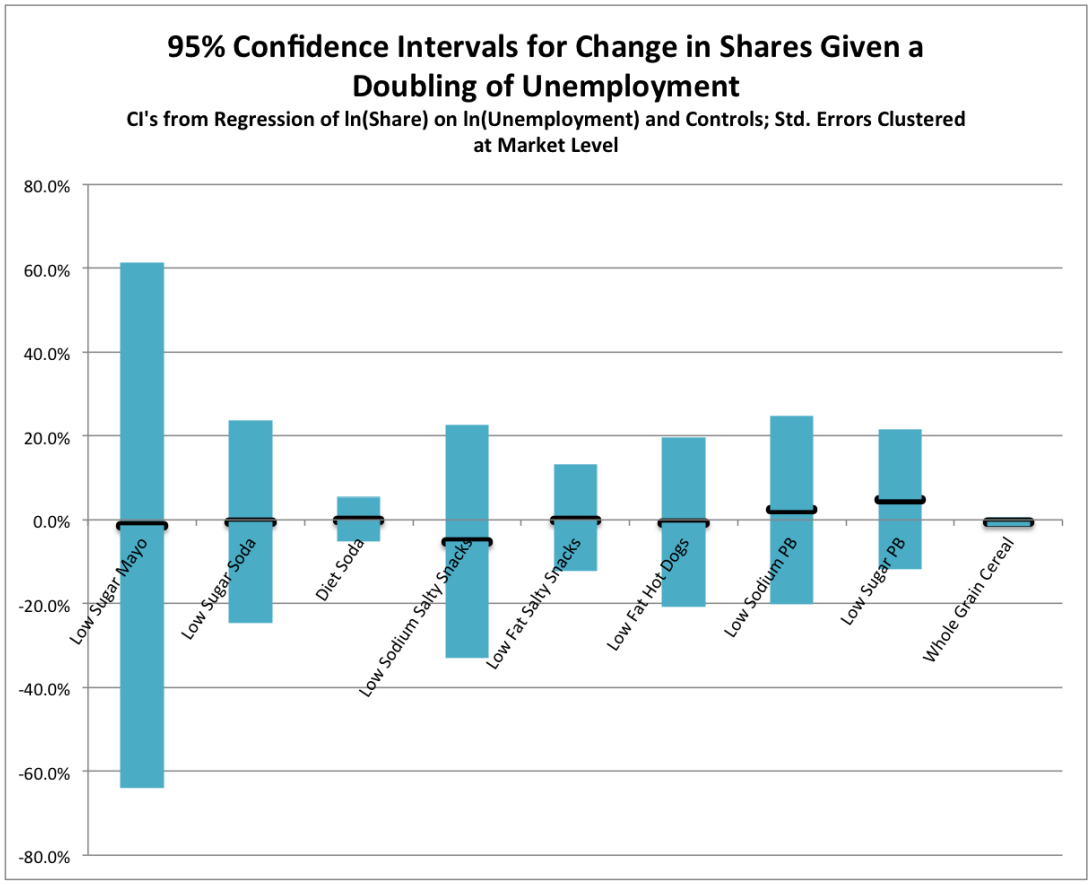
Demographic, geographic, time & trend controls included in all regressions.
Standard errors clustered at the market level in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 1.9: CHANGES IN TOTAL QUANTITY SOLD GIVEN A DOUBLING OF UNEMPLOYMENT: Overall Product Categories



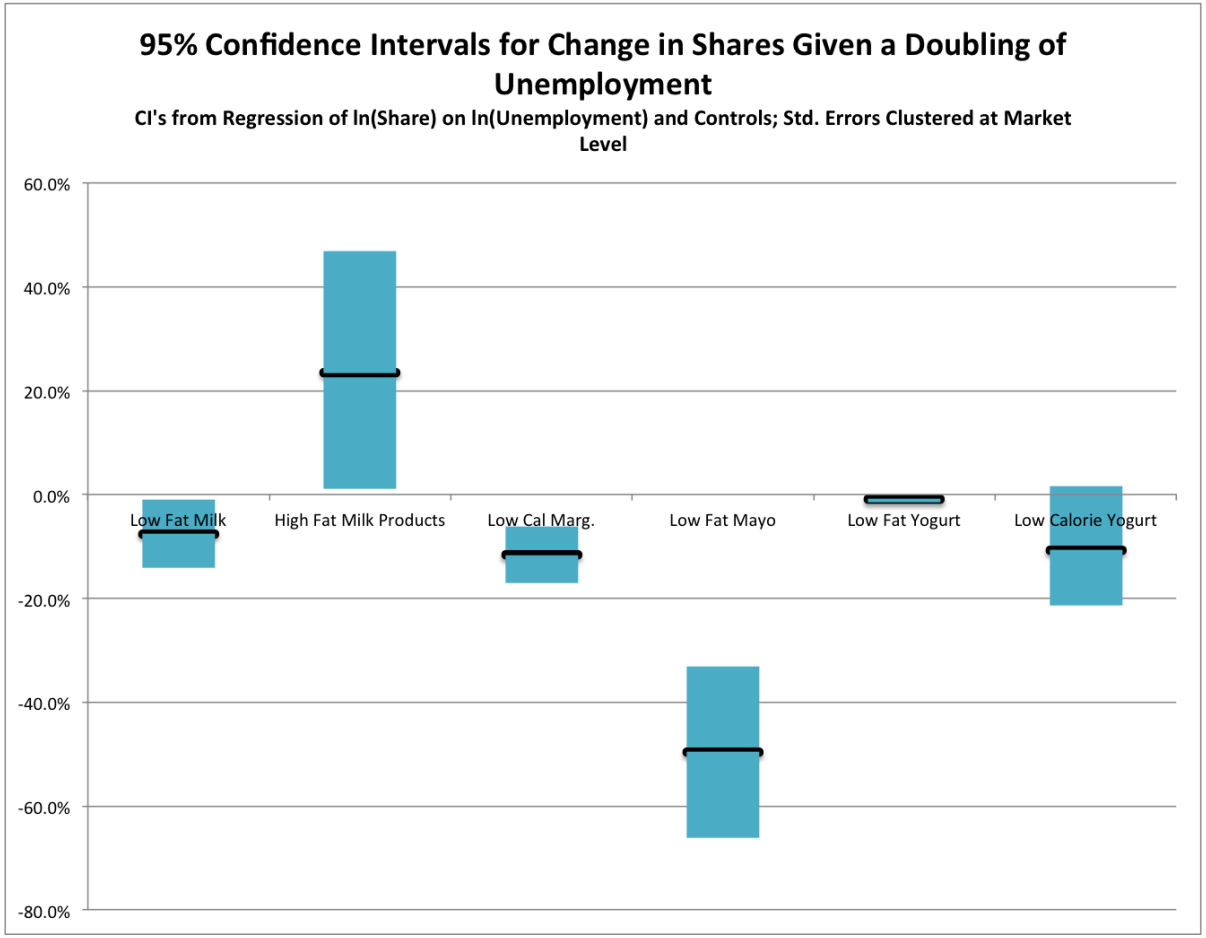
The black lines in this figure represent the point estimate multiplied by 100 (i.e. scaled up to represent a doubling of unemployment rather than a 1% increase in unemployment rate) for the regressions of log total quantity sold on log unemployment presented in Tables 15 and 16; the bars represent the 95% confidence intervals calculated using the standard errors from those same regressions.

Figure 1.10: CHANGES IN SHARE OF TOTAL QUANTITY SOLD GIVEN A DOUBLING OF UNEMPLOYMENT: Categories With No Significant Change



The black lines in this figure represent the point estimate multiplied by 100 (i.e. scaled up to represent a doubling of unemployment rather than a 1% increase in unemployment rate) for the regressions of log share of total quantity sold for products with positive health attributes on log unemployment rate presented in Tables 15 and 16; the bars represent the 95% confidence intervals calculated using the standard errors from those same regressions.

Figure 1.11: CHANGES IN SHARE OF TOTAL QUANTITY SOLD GIVEN A DOUBLING OF UNEMPLOYMENT: Categories With A Decline In Share of Positive Health Attributes



The black lines in this figure represent the point estimate multiplied by 100 (i.e. scaled up to represent a doubling of unemployment rather than a 1% increase in unemployment rate) for the regressions of log total quantity sold on log unemployment presented in Tables 15 and 16; the bars represent the 95% confidence intervals calculated using the standard errors from those same regressions.

Table 1.22: SUMMARY OF EFFECTS: Direction of unemployment coefficient (positive, negative or neutral) for all regressions of log price paid, share sold on promotion, quantity and share of sale on log unemployment rate.

Category	Price Paid	Promotion	Quantity	Share for Sub-Category
Carbonated Beverages				
Overall	↓	–	↓	
Lower Sugar/Lower Calorie	↑	↑		–
Diet/Calorie Free	↓	–		–
Cold Cereal				
Overall	–	–	↓	
No Sugar/Low Sugar	–	–		↓
Fiber/Whole Grain Claim	–	–		–
Hot Dogs/Franks/Wieners				
Overall	↓	↑	–	
Lower or Reduced Fat/Fat Free	–	↑		–
Margarine				
Overall	–	–	↓	
Low-Cal/Low-Fat/Healthy Oil	↑	–		↓
Mayonnaise				
Overall	–	↑	–	
Lower Sugar	–	–		–
Low-Fat/Fat-Free	–	↓		↓
Milk & Milk Products				
Overall	↓	↑	↓	
Low-fat/Skim Milk	↓	↑		↓
High Fat Milk UPCs (>6% milk fat)	↓	↓		↑
Peanut Butter				
Overall	–	–	↓	
Lower Sugar	↑	↑		–
Reduced Sodium/Sodium Free	↑	–		–
Salty Snacks				
Overall	↓	↑	↓	
Reduced-Fat/Fat-Free/Light	–	↑		–
Lower/Reduced Sodium	–	–		–
Yogurt				
Overall	–	↑	↓	
Low-Fat/Fat-Free	↑	↑		↓
Reduced/Low-Calorie	↑	–		↓

Chapter 2

Are Vices Pro-cyclical? Evidence from Beer and Cigarette Scanner Sales Data.

2.1 Introduction

This paper attempts to shed light on the purchase of cigarettes and beer during recession. Specifically, I use a reduced form specification to examine the impact of unemployment rate on the purchases, promotion and prices of cigarettes and beer in grocery, drug and mass retailers. This work makes use of five plus years of retail scanner data from 2001 through 2006 (including the 2001 recession); the data are comprised of 49 markets and thousands of individual stores. By matching these data with unemployment and Census information, I am able to track changes in overall sales, purchases of items on discount and average prices paid as a function of unemployment rate.

I find that overall, no statistically significant change in average prices paid are associated with unemployment for both cigarettes and beer. There is evidence of great variation in promotional purchases of cigarettes in the early 2000's in the wake of the Tobacco Master Settlement, and partially coinciding with the 2001 recession; on average, more cigarettes were purchased on promotion in the 2001 recession. However, the amount of overall promotional purchases of cigarettes declined in the early to mid-2000's as states strengthened tobacco regulation, and time and geographic factors bear a stronger relationship with cigarette promotional purchases than unemployment per se. There seems to be no statistically significant effect of unemployment rate on beer purchases made on promotion. In general, purchases of beer in grocery and drug retailers seem to be impacted very little by recession: there is no change in percentage of purchases made on promotion, no change in overall revenues and only a very slightly positive, but statistically significant, increase in total retail beer sales associated with unemployment. While the overall trend for cigarette purchases during the period of 2001-2006 was negative, the overall trend seems a stronger explanatory factor than unemployment. There is a small but negative and statistically significant relationship between total cigarette purchases in a given month and unemployment rate and more cigarettes are purchased in drug stores when unemployment is high. Taken together, these findings suggest that overall purchases of beer and cigarettes are not highly dependent on unemployment, but rather more likely to be impacted by general trends and government regulation of these products; that said, there is some evidence of outlet switching in the case of cigarettes. These findings help to flesh out the understanding of how consumers behave in response to recession, and in particular, some of the underlying mechanism behind documented health impacts of recessions.

This work contributes primarily to the literature on the health impacts of recession. Several hypotheses based on self-reported health behaviors have been suggested; I am able to bring actual purchase data to test the validity of conclusions based on self-reported data, and I make use of exogenous variation in unemployment, which has been lacking in many previous cohort studies. For example, British researchers find in large cohort studies that unemployed individuals report smoking and drinking more than others who are either employed or have had shorter duration of unemployment [25, 23]. If indeed true, this would imply a negative income elasticity for alcohol and cigarettes, which some

elasticity studies have found (the demand literature is discussed in greater detail below). On the other hand, Ruhm, writing in the Quarterly Journal of Economics and later in the Journal of Health Economics, [31, 30], matches state morbidity and mortality statistics with average state unemployment rate and finds that morbidity and mortality from most major causes decline during recessions. Ruhm then matches self reported health behavior information with average unemployment rate and finds that smoking rates are negatively associated with unemployment, as well as eating better and exercising more.[1] Using the same data, Ruhm finds a positive, but not statistically significant relationship between unemployment and drinking. In contrast to both of these veins of analysis, I use actual purchase data rather than self-reported data. Based on the data available for this study, I find no evidence consistent with major changes alcohol consumption associated with higher unemployment rates; results for cigarettes suggest a long term declining trend but not necessarily a relationship to unemployment and recession per se.

This paper also contributes more broadly to the literature on alcohol and cigarette demand. I bring a comprehensive, panel data set that includes thousands of stores, multiple chains in multiple metropolitan areas combined with demographics and am thus able to include spatial and demographic variation in my study. Most previous studies on cigarette and alcohol demand have relied upon mostly time series for aggregate national consumption and some cross sectional data [14, 15]. Furthermore, the question of how an income shock would impact consumers' purchases of cigarettes and beer has not been adequately answered by the demand literature simply because of the huge variation in both price and income elasticity estimates over time. A meta-analysis of cigarette elasticities found that, as one might assume, short run elasticity is smaller than long run estimates and that income elasticities are larger in more recent studies than in earlier studies. That said, many estimates of cigarette income elasticity are negative and those that are positive tend to be only slightly positive and less than .5 [15]. Gallet et al, also find that price and income elasticity estimates of beer have varied over time and that beer may have shifted to being an inferior good in the early 1980's [14]. Both price and elasticity estimates vary greatly across different studies, from negative to positive, for both cigarettes and beer; it is difficult to understand from existing work what impact a recession might have on consumption patterns. To my knowledge, this is the first paper to look specifically at the impact of variation in unemployment[2] on cigarette and beer purchases. My findings of decreased cigarette quantities sold during recession are consistent with cigarettes being a normal good; likewise, my finding of a zero to slightly positive change in beer sales

[1]Ruhm analyzes total mortality and mortality for the 10 leading causes of death. He matches this with average monthly or quarterly unemployment rate at the state level. Individual health behavior data on smoking and drinking are in the form of dichotomous variables such as smoker/non-smoker and drinker/non-drinker, as well as integer variables such as average cigarettes per day and drinks per day based on one month or three month recall. His specification uses fixed effects to unobserved determinants of lifestyle behaviors associated with the state, calendar month and survey year.

[2]One previous paper using average unemployment over a 10 year period, among other covariates, found that it was associated with a higher likelihood of promotional activity (Bray, 2007).

associated with unemployment is consistent with the most recent findings that beer is an inferior good.

2.2 Data

I use the Information Resources, Inc. (IRI) Marketing data set made available to researchers in 2008 [4]. The data comprise five years of sales, price and promotion data for 49 US markets from multiple store formats. IRI Markets are selected to give wide geographic coverage and to enable analysis of competitive grocery markets. Figure 2.1 shows a map of markets included in IRI Data. IRI masks any data that might identify a particular chain or store; store type is provided, but no name. To further protect confidentiality, IRI does not include any markets where the dominant grocery chain has more than 50% of the market. The data come from all drug, grocery and mass market stores within the defined market area; obviously, this leaves out convenience stores and liquor stores. The IRI data set includes only scanner purchase data and scanners have very limited penetration in convenience and liquor stores, particularly those that are owned independently. That said, the grocery market represents almost as much of total beer sales as liquor and convenience stores combined. According to market research, supermarkets sell about 40% of beer sold in the United States, while convenience stores and liquor stores account for 23% and 21%, respectively [28]. Table 2.1 lists the markets and the number of chains in each market as well as the total number of chains included in the data overall. The IRI data cover 30 product categories, both food and non-food; in this paper, I focus only on beer and cigarettes. These data include private label (generic) sales. Information for private labels is linked to a masked chain identifier, however, as noted above, it is not possible to identify which chain is which, so private labels can also not be specifically identified by store.

There are 10,417 unique UPCs represented in the beer data; these products are sold by 531 vendors under 2745 different brand names. Unsurprisingly, most beer is packaged in six, twelve or twenty-four packs of 12 oz. bottles or cans, although there are over 2000 UPCs for individual 12 oz. bottles for sale (see Table 2.2).

Sales of beer are highly seasonal; winter is a time of typically low beer sales, as well as a dip in seasonal unemployment. Figure 2.2 shows total unit sales of beer (left axis) plotted with average unemployment across all IRI markets (right axis); beer sales move in a predictable seasonal pattern with seemingly little relationship with unemployment. Beer is purchased more frequently on promotion (i.e. with a store discount of 5% or greater) in the summer as well. Figure 2.3 shows this pattern for total purchases on promotion and plots it against unemployment. Again, on the surface, there is little evidence that the purchase of alcohol is related to the macroeconomic indicator of unemployment rate. One obvious limitation of these data is that sales of alcohol in liquor stores and bars are not included; there seems to be little in the way of scholarly work on the topic of recessionary impacts on alcohol purchases in bars and restaurants. Articles in the popular

press suggest that individuals substitute away from drinking in bars and restaurants and toward drinking in at home: a 2010 Time Magazine article reports on a Gallup poll suggesting people substitute away from drinking in bars and restaurants and toward drinking at home during recessions [27], while an industry analyst's report released in 2012 suggests alcohol sales in bars and restaurants increased as the economy grew stronger [34]. Moreover, previous work has found that consumers substitute away from restaurants and toward food at home when faced with an income shock [16]; this phenomenon implies that if people eat less in restaurants under these circumstances, then the alcohol they might otherwise have consumed with their meals will also be shifted toward home consumption (or perhaps skipped entirely). To the extent that this is true, any analysis of grocery and drug store sales of beer would tend to underestimate a decline in total consumption.

Nearly 7000 different cigarette products are sold under 794 brand names by 119 vendors are observed in the IRI data set. The vast majority of these products are filtered cigarettes of either the full-flavor, light or ultra-light variety, although combinations of 17 flavors and 10 different sizes are also included (see Table 2.2).

Figure 2.4 shows that total units of cigarettes purchased tends to be peaky and display an overall downward trend during the time period observed. On the surface, there is no obvious correlation with unemployment. Cigarettes, like beer, are a highly regulated product. Unlike beer, cigarette regulations became increasingly stringent during the early 2000's. The Tobacco Master Settlement agreement restricted greatly tobacco companies' ability to advertise their products in the media [32]. As advertising became more restricted, tobacco companies began to spend the majority of their advertising budgets on in-store product placement and point-of-sale promotions (e.g. discounts, buy one get one free, etc.) [22]. Figure 2.3 shows total units purchased on promotion during plotted with unemployment across all IRI markets from 2001 to 2006. The same spikiness in promotional unit sales in the early 2000's has also been found in analysis of other retail scanner data sets, such as AC Nielson ScanTrak data [24]. In 2003, there was a sharp uptick in the stringency of state regulations on cigarette sales, including minimum price laws, excise taxes and promotion bans and possibly a change of strategy on the part of tobacco companies—in some markets, cigarettes continued to be heavily promoted through point of sale discounts (such as in New York [17]) while other markets saw a sharp drop-off in purchases made on promotion (as in Florida [3]). The price paid given in the IRI data includes tax; a recent analysis of the impact of cigarette taxes on prices and brand name sales using IRI data found that taxes are passed through 100%, i.e. a 1 cent increase in tax per pack leads to a 1 cent increase in retail price paid per pack [13].

Census demographic data are matched to the broad market data by metropolitan statistical area (MSA) and/or state or region in the case of larger geographical markets. Based on the Census data, the IRI markets taken as a whole are demographically similar to the United States; that said, the sample is more urban, slightly more educated and slightly more wealthy than the national average. Within the sample are diverse markets with a range of demographic compositions, as shown in the "Max" and "Min" columns of Table2.5. The market data are matched with unemployment data at the market level;

the available variation in unemployment is analyzed in detail below.

2.3 Reduced Form Analysis

2.3.1 Variation in Unemployment

I seek to determine how much of the unexplained variation in beer and cigarette purchasing patterns is attributable to local unemployment rate. I therefore seek to establish that sufficient variation exists in unemployment over the time period in question to carry out the primary analysis. The data cover 2001 to 2006, including the 2001 recession as well as a long period general macroeconomic strength and relatively low national unemployment. However, after controlling for time and geographic effects, there is still variation in unemployment. Figure 2.6 shows residuals from a regression of unemployment on state and quarterly fixed effects as well as a time trend. The regression equation is as follows:

$$UnemploymentRate_{jt} = \alpha_{jt} + u_j + \nu_t + \tau_t + \epsilon_{jt} \tag{2.1}$$

where unemployment is at the monthly, metropolitan statistical area (MSA) level, u_j controls for time invariant state characteristics, ν_t is a quarterly fixed effect and τ_t controls for trends over time. Robust standard errors are calculated using the Huber-White Sandwich estimator, under the assumption that observations are independent across states and time periods, but not within states. Note that the high value residual points in Figure 2.6 coinciding with the end of 2005 are due to temporary high unemployment in New Orleans, one of the IRI markets, after hurricane Katrina. I drop New Orleans from the sample and re-run the regressions; Figure 2.7 shows the residual plot without the New Orleans data.

Table 2.4shows results for the regressions both with and without New Orleans included in the sample. The difference in R-squared between the regression of unemployment on time trend, quarterly and fixed effects shows about 4% of the unemployment variation is explained by New Orleans alone. That said, with or without New Orleans included in the sample, approximately half of variation in unemployment from 2001 to 2006 is unexplained by time trend, quarterly and state effects. Moreover, during the sample period, unemployment rate changes by 100% (i.e. is doubled or halved over the course of the sampling period) in 21 of 49 markets. This suggests that there is significant variation in unemployment remaining for me to use in identifying shifts in beer and cigarette purchasing patterns that cannot be explained by region and time factors.

Finally, I create a graph overlaying the unemployment residuals with residuals from a regression of quantities sold on state, quarterly and fixed effects. The specification is identical to that for the above unemployment rate estimation equation, just with total quantity sold in a given month or total quantity sold on promotion in a given month on the left hand side. These overlay graphs, presented in Figure 2.8 through Figure 2.11 suggest from the outset that there is a great deal of unexplained variation in the quantities

sold of beer and cigarettes after controlling for time and geographic effects. Moreover, it is difficult to ascertain from the residual plots alone whether a potential relationship exists between quantities purchased and unemployment.

2.3.2 Price, Promotions and Unemployment

Before analyzing the relationship between quantities or cigarettes and beer purchased, I investigate the effect that unemployment has on prices and promotions. Using a log-log specification, I regress quantity weighted average price on unemployment including a time trend, quarterly effects, geographic fixed effects and market level demographic controls. All prices are first deflated using the Consumer Price Index for Food At Home. Inspection of residual verses predicted value plots showed evidence of heteroskedasticity. In order to correct for this, I redefine the panel at the Market-Chain-Product-Month level and cluster standard errors at the Market level; thus, I allow for time invariant intra-market correlation between chains and products. The redefined price and promotion regressions have the form:

$$ln(price_{ijkt}) = \alpha_{ijkt} + \beta ln(unemploymentrate_{jt}) + \eta \boldsymbol{X_j} + \nu_j + u_t + \tau_t + \epsilon_{ijkt} \qquad (2.2)$$

The variable $price_{ijkt}$ is quantity-weighted average price of a given product in a given market at a given chain in a given month; unemployment rate varies at the month-market level. The variable Xj represents a vector of market level demographics, including population, income, race/ethnicity and education measures. The variables u_j, ν_t, and τ_t are state and quarter fixed effects and a time trend, respectively. I estimate this equation first using standard OLS and then GLS in order to make better use of panel variation; I estimate the equation for both for all store types together and for drug stores separately. Finally, I also specify a version of the above equation without the time trend and quarter fixed effects, instead using a quarter-of-year fixed effect. Results for beer are shown in Table 2.5 and for cigarettes in Table 2.6. The OLS coefficient on unemployment is negative; the GLS results with a time trend suggest that a 1% increase in unemployment is associated with a .05% increase in beer prices; put differently, if unemployment were to double, we might expect to see beer price paid to rise by 5%. There is no significant effect for drug stores alone. For cigarettes, the result is similar, although the effect size is about half of that for beer. However, the inclusion of a time trend control can cause spurious correlation to arise– when I instead substitute a quarter-of-year fixed effect, the price effect of unemployment disappears while the R-squared increases slightly. These results suggest that unemployment has little impact on the price paid of cigarettes and beer.

One might guess that consumers purchase more or fewer products on promotion during recession or that retailers might promote differently when unemployment is increasing. I explore this by investigating the relationship between promotional purchases and unemployment. Specifically, I use a dummy variable for whether or not a particular item is on

promotion in a particular week to calculate the percentage of products sold on promotion in a given month. Promotion is defined narrowly as an in-store discount of 5% or greater (this excludes coupons or promotions not specifically related to the product). The specification is similar to the one for the price regression above, but on the left hand side is log percent of total quantity sold on promotion in market j at time t. Additionally, because price paid is related to unemployment, as shown above, I add quantity weighted average price paid as a control:

$$ln(PercentPromo_{jkt}) = \alpha_{jkt} + \beta ln(unemployment_{jt}) + \gamma ln(\widehat{Price_{jt}}) + \eta X_{jt} + u_j + \nu_t + \tau_t + \epsilon_{jkt} \tag{2.3}$$

Due to the endogeneity of prices, I instrument for price paid directly using lagged quantity weighted average price paid. I first estimate the equation using OLS as a baseline and then proceed to a generalized two-stage least squares (G2SLS) procedure to estimate the coefficients with standard errors clustered at the market level. As noted, I calculate the percentage of products sold on promotion at the market(j)-chain(k)-month(t) level. In the above equation, prices are averaged for a given category or sub-category overall in market j and month t. Table 2.7 shows the estimation results for the first and second stage of the GLS estimation of the above equation in column 3 and 4; unsurprisingly, one month lagged price is a very strong instrument for current period price. While the OLS estimation of the equation, shown in column 1, gives a positive and significant coefficient on unemployment, the GLS estimation that makes use of the full panel dimension of the data shows no relationship. I estimated the same equation for percentage of revenue from items sold on promotion; these results are shown in columns 2 and 6 respectively, and are very similar to the result for percentage of units sold on promotion. Finally, as a robustness check, I alter the specification slightly to drop the quarter control and time trend and use quarter-of-year instead; these results, for both percentage of units sold on promotion and percent of revenue from items sold on promotion, are show in columns 5 and 7. The R-squared is highest for this specification and again, there appears to be no significant relationship between unemployment and promotional purchases for beer.

Table 2.8 shows the results for cigarettes. Again, the first two columns represent the OLS baseline for both percent of units and percent of revenues from items purchased on promotion. The third column shows the first stage for the GLS estimation and demonstrates that lagged price for cigarettes is a very strong instrument for current price. The fourth and sixth columns show a positive and statistically significant coefficient on unemployment for percentage of cigarettes sold on promotion and percentage of revenues from cigarettes sold on promotion. Because inclusion of a time trend variable can potentially lead to spurious correlation, I again check the robustness of this finding by removing the time trend and quarter effect and substituting a quarter-of-year effect. The coefficient on unemployment declines in magnitude and is no longer significant. Going back to Table 2.5, promotional purchases in the early 2000's are quite spiky month to month with no evident relationship with unemployment trends; as noted above, this was a period of ex-

perimentation with promotional strategies in the wake of the Tobacco Master Settlement. As promotional schedules are often set quarterly, a quarter-of-year fixed effect is likely to capture this effect more strongly than average unemployment in a given city. The next best robustness check would be to include data from the 2008-2009 recession as it becomes available.

2.3.3 Quantities of Cigarettes and Beer Purchased and Unemployment

The specification I use to track changes in quantities purchased as a function of unemployment rate is quite similar to that for percentage sold on promotion in the previous section. The only difference is that, now, I run five versions of this specification for several left-hand side variables: total units of a given product purchased in a given month in a given market, total revenues for a given product purchased in a given month in a given market, percentage of units of a given product sold at drug stores, total units in a given category sold in a given market, and total units of a given product sold at a given chain in a given market in a given month. Specifically:

$$ln(Quantity_{ijkt}) = \alpha_{ijkt} + \beta ln(unemployment_{jt}) + \gamma ln(\widehat{Price_{jt}}) + \eta X_{jt} + u_j + \nu_t + \tau_t + \epsilon_{ijkt} \tag{2.4}$$

Here i denotes a specific product, j a specific chain, k a specific market and t a specific month. Again, I instrument for price directly using one-month lagged quantity weighted average price. The variable X_j represents a vector of market level demographics, including population, income, race/ethnicity and education measures. The variable u_j controls for time invariant regional effects, ν_t is a quarter fixed effect, and τ_t controls for time trend. I assume the error term ϵ_{ijkt} to be correlated between chains and products and correct for this by clustering the standard errors at the market level. Once again I use a generalized two-stage least squares procedure to estimate the equation. As a robustness check, I rerun the regression without the time trend and quarter fixed effect and substitute a quarter of year fixed effect instead.

Tables 2.9, 2.10 and 2.11 show the results for this set of regressions for the beer category. The first columns of each table shows the results using OLS as a baseline; the coefficient on unemployment using OLS is statistically significant for each set of regressions. However, applying the generalized least squares technique to make full use of the panel dimension of the data and instrumenting directly for price using lagged price paid leads to an increase in the estimated impact of price and a decrease in significance for the coefficient on unemployment rate. In other words, using the preferred specification and the fixed effects robustness check, there are almost no significant changes in beer quantity sold or revenues associated with unemployment. In the fourth and fifth columns of Table 2.11, the coefficient on unemployment for total beer sales in a given market in a given month is slightly positive and significantly positive—a doubling of unemployment would

be associated with a 1% increase in total beer quantity sold in a given market in a given month. This is somewhat consistent with Ruhm's analysis of self-reported health survey data that shows people self report drinking more during recessions, however, the order of magnitude is much smaller [31]. Overall, the regressions for beer paint a picture of little to no impact of recession on beer sales.

The results for cigarettes are shown in Tables 2.12, 2.13 and 2.14. Again, results using ordinary least squares to estimate Equation 2.4 are shown in the initial columns of each table. In the specifications that make use of a quarterly fixed effect and a time trend (referred to as Spec. 1 in the column headers), the coefficient on unemployment is negative and statistically significant (for example, in columns 4 and 6 of Table 2.12 and Table 2.14, respectively). However, when the time trend and quarterly fixed effect are removed and replaced with a quarter of year fixed effect, the coefficients on unemployment (in columns 5 and 7 of Table 2.12) are no longer statistically significant. This suggests that the time trend included in the initial specification may have been leading to spurious correlation [19]. Furthermore, as noted in the data description, cigarette purchases in the early 2000's, i.e. the time coinciding with the 2001 recession, were extremely spiky; quarter of year fixed effects likely absorb this variation, which was probably due to marketing adjustments on the part of firms and shifting regulations in the wake of the Tobacco Master Settlement. That said, both specifications, shown in the fourth and fifth column of Table 2.14, estimate a negative and statistically significant relationship between total units sold in a given market and a given month and unemployment rate. Interestingly, the initial specification estimates no statistically significant relationship between unemployment rate and drug store purchases, while the quarter of year fixed effects model does show a strongly positive relationship between unemployment rate and percentage of products purchased in drug stores. Overall the results are consistent with a slight decline in total unit purchases as unemployment increases and with potential outlet switching during recessions. The log-log specification allows us to lend the following interpretation to the coefficients on unemployment rate: a doubling of unemployment rate (100% increase) is associated with a decline of total cigarette sales of between 1% and 11% in any market in a month.

2.4 Conclusion

This paper provides a novel analysis of cigarette and beer sales as they relate to unemployment using a retail scanner data set. Previous studies in the health economics literature have suggested that individual unemployment increases smoking and drinking behaviors, while later studies have found a beneficial effect of higher unemployment levels on overall levels of morbidity and mortality and posited that lower self-reported rates of smoking might be the cause. The findings in this paper suggest that apart from the downward trend of smoking over time, an increased unemployment rate is indeed associated with lower purchases of cigarettes overall. Meanwhile, quantities sold of beer in supermarkets, which account for 40% of the total beer market, and drug stores seem to

be very slightly positively associated with unemployment rates. Given that this study does not cover alcohol sales in restaurants in bars and restaurants, it is possible that, as industry reports suggest, total consumption declines while purchases of beer for at home consumption remain relatively constant. Overall, these results are somewhat consistent with recent studies showing improved health during periods of recession; however, given the large improvements in morbidity in mortality found by Ruhm [31], it seems implausible that a 1% decline in the purchases of cigarettes coupled with a 1% increase in beer sales would have any net impact on overall health during recessions. These results naturally lead to the question of heterogeneous effects; while the data used in this study are at an aggregate level, individual level purchase and unemployment data is the key to true insight into the question of the recessionary impacts on consumer health behaviors. Unfortunately, at this time, there is no data set available that combines individual household variation in unemployment with purchase information. Finally, to the extent that a change in the unemployment rate is a proxy for household level income shocks, the coefficients on unemployment are consistent with the income normality of cigarettes in that cigarette purchases have a slightly negative relationship with unemployment. The coefficients presented for beer are mostly not statistically significant despite a very large sample size, except for one slightly positive coefficient on unemployment. This analysis of how retail sales actually shift during periods of recession lends clarity to the wide range of income elasticities found in previous studies and suggests that beer may be an inferior good.

2.5 Tables and Figures

Figure 2.1: Map of Markets Included in the IRI Data

Table 2.1: MARKETS AND STORE CHAINS: The data are geographically diverse and represent competitive grocery markets.

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Total Unique Chains Across All Markets	131	130	127	124	123	117
	Number of Chains Present In Each Market					
Market	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
ATLANTA	13	10	8	8	8	7
BIRMINGHAM/MONTG.	11	9	9	7	6	6
BOSTON	11	12	10	10	9	10
BUFFALO/ROCHESTER	6	6	7	6	7	7
CHARLOTTE	8	8	8	8	8	7
CHICAGO	13	13	13	11	12	12
CLEVELAND	5	5	5	5	5	5
DALLAS, TX	11	13	11	9	10	10
DES MOINES	7	5	4	5	4	4
DETROIT	9	10	9	7	7	7
EAU CLAIRE	3	3	3	3	3	2
GRAND RAPIDS	6	6	6	6	4	4
GREEN BAY	5	5	5	5	4	4
HARRISBURG/SCRANT	15	15	12	10	9	10
HARTFORD	10	9	9	9	10	11
HOUSTON	9	10	8	8	8	8
INDIANAPOLIS	9	8	8	8	7	6
KANSAS CITY	6	6	6	6	6	6
KNOXVILLE	8	8	7	7	7	7
LOS ANGELES	14	15	15	15	13	13
MILWAUKEE	9	11	11	9	8	9
MINNEAPOLIS/ST. PAUL	6	7	7	4	7	7
MISSISSIPPI	9	7	7	7	7	6
NEW ENGLAND	10	10	7	8	7	8
NEW ORLEANS, LA	11	9	9	9	9	9
NEW YORK	17	17	17	17	18	18
OKLAHOMA CITY	3	3	3	3	3	3
OMAHA	7	7	6	7	6	5
PEORIA/SPRINGFLD.	10	11	11	9	10	10
PHILADELPHIA	14	16	16	13	13	13
PHOENIX, AZ	9	8	7	6	6	6
PITTSFIELD	5	5	5	5	5	5
PORTLAND,OR	5	6	6	8	8	7
PROVIDENCE,RI	4	4	3	3	5	6
RALEIGH/DURHAM	12	12	11	11	11	9
RICHMOND/NORFOLK	10	12	11	11	10	9
ROANOKE	12	11	11	11	10	8
SACRAMENTO	10	9	9	9	9	9
SALT LAKE CITY	4	4	4	4	3	3
SAN DIEGO	10	10	10	10	10	10
SAN FRANCISCO	9	9	9	10	10	10
SEATTLE/TACOMA	9	9	9	9	9	9
SOUTH CAROLINA	14	14	13	13	14	11
SPOKANE	5	4	6	6	6	5
ST. LOUIS	6	6	6	6	6	6
SYRACUSE	8	9	9	8	7	7
TOLEDO	8	9	8	7	8	7
TULSA,OK	4	5	4	4	4	4
WASHINGTON, DC	10	11	11	12	12	12

Table 2.2: PRODUCT STATISTICS: A variety of categories, vendors and brands are represented among thousands of products in the sample.

BEER - Descriptive Statistics	
Unique UPCs	10417
Number of Vendors	531
Number of Brands	2745
Most common values for total ounces:	
Single 12 oz.	2,368
72 oz. (6 - pack)	2,493
144 oz. (12 - pack)	1,035
288 oz (24 - pack)	1,058

CIGARETTES- Descriptive Statistics	
Unique UPCs	6983
Number of Vendors	119
Number of Brands	794
Unique Flavors	17
Unique Sizes	11
Filtered	95.90%
Non-Filtered	3.06%

Table 2.3: MARKET DEMOGRAPHICS: Sample population is more urban and slightly better educated, less diverse and more wealthy than national average.

Variable	Mean	Std. Dev.	Min	Max	US Population
General Charcteristics					
Total population: Total	3,265,176	4,242,407	84,708	21,200,000	281,421,906
Percent Urban	85.2	10.0	48.8	98.2	80.3
Percent Over 65 Y.O.	11.9	2.2	7.6	18.3	12.4
Percent Female	51.2	0.7	49.6	52.6	50.9
Percent Women With Children	31.4	2.3	26.1	38.0	12.4
Percent Women With Children Under 6	7.7	0.8	5.7	10.2	3.0
Race & Ethnicity					
Percent White	77.3	10.8	55.0	96.1	75.1
Percent Black	12.7	9.7	0.3	37.4	12.3
Percent Foreign Born	8.5	6.9	1.4	30.9	11.1
Percent Foreign Born: Latin America	3.6	4.1	0.2	19.2	5.7
Percent of Total Population Who Are Foreign Born Spanish Speakers	3.0	3.7	0.1	17.7	10.7
Education					
Percent of Males with HS Diploma	26.7	4.6	16.8	37.7	27.6
Percent of Males with Bachelor's	18.0	2.7	11.1	24.3	16.1
Percent of Males with Master's	6.4	1.6	3.5	11.4	6.0
Percent of Females with HS Diploma	28.9	4.4	18.4	41.0	29.6
Percent of Females with Bachelor's	16.5	3.0	11.0	24.8	15.0
Percent of Females with Master's	6.1	1.5	3.9	10.1	5.8
Income					
Households: Median household income in 1999	$44,993.55	$5,992.83	$31,330.00	$62,024.00	$41,994.00
Per capita income in 1999	$22,540.84	$2,726.16	$15,853.00	$30,769.00	$21,587.00
% Households: Less than $10,000	8.5	2.2	5.1	16.2	9.5
% Households: $10,000 to $14,999	5.8	1.2	3.6	8.8	6.3
% Households: $15,000 to $19,999	5.8	1.0	3.8	8.0	6.3
% Households: $20,000 to $24,999	6.2	0.9	4.1	7.7	6.6
% Households: $25,000 to $29,999	6.3	0.8	4.2	7.7	6.4
% Households: $30,000 to $34,999	6.3	0.6	4.5	7.3	6.4
% Households: $35,000 to $39,999	5.8	0.5	4.5	6.8	5.9
% Households: $40,000 to $44,999	5.7	0.4	4.6	6.6	5.7
% Households: $45,000 to $49,999	5.0	0.4	4.2	5.9	5.0
% Households: $50,000 to $59,999	9.4	0.7	7.9	11.0	9.0
% Households: $60,000 to $74,999	11.2	1.1	8.2	13.3	10.4
% Households: $75,000 to $99,999	11.1	1.8	6.8	14.6	10.2
% Households: $100,000 to $124,999	5.6	1.4	2.8	9.5	5.2
% Households: $125,000 to $149,999	2.7	0.9	1.1	5.6	2.5
% Households: $150,000 to $199,999	2.3	0.9	0.9	5.7	2.2
% Households: $200,000 or more	2.4	1.0	1.2	6.0	2.4

Figure 2.2: BEER PURCHASES AND UNEMPLOYMENT: All Markets

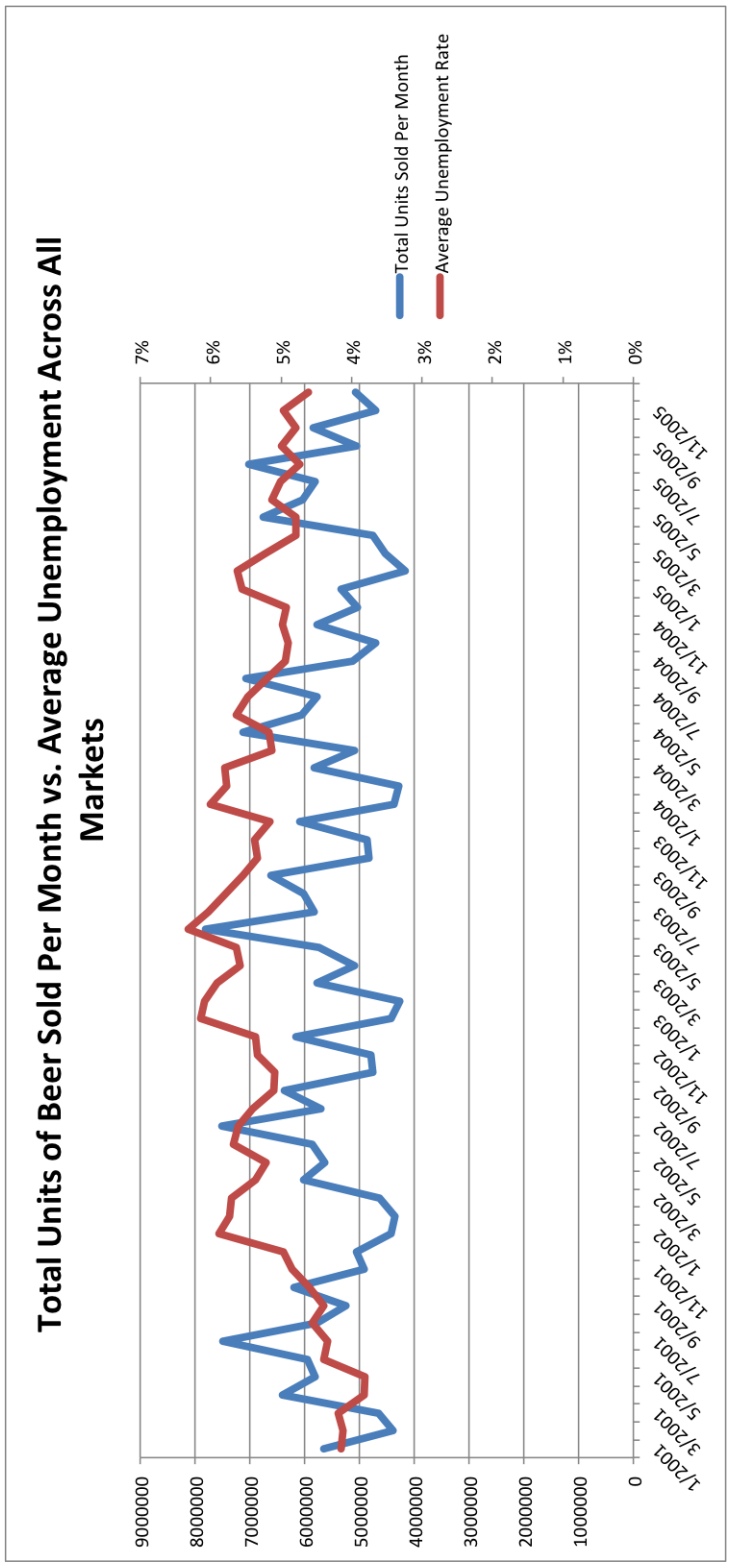
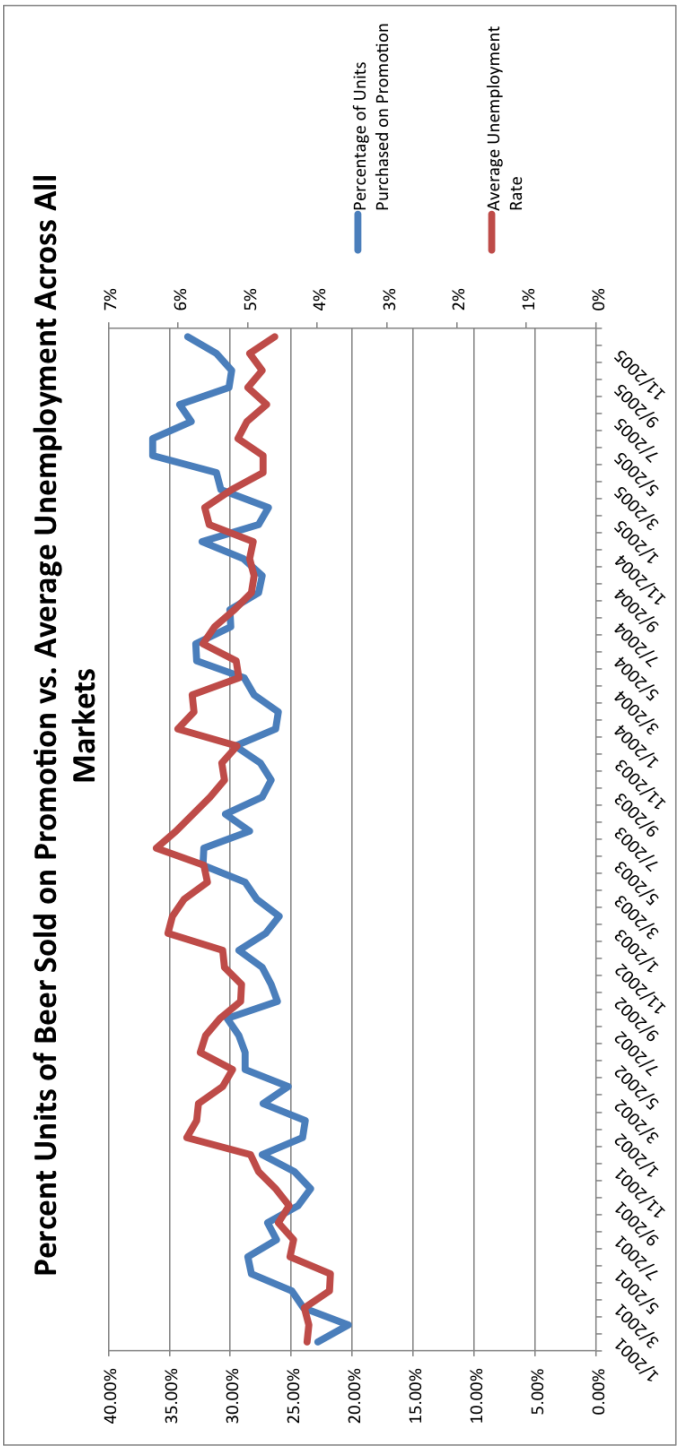


Figure 2.3: BEER PURCHASES ON PROMOTION VS. UNEMPLOYMENT: All Markets



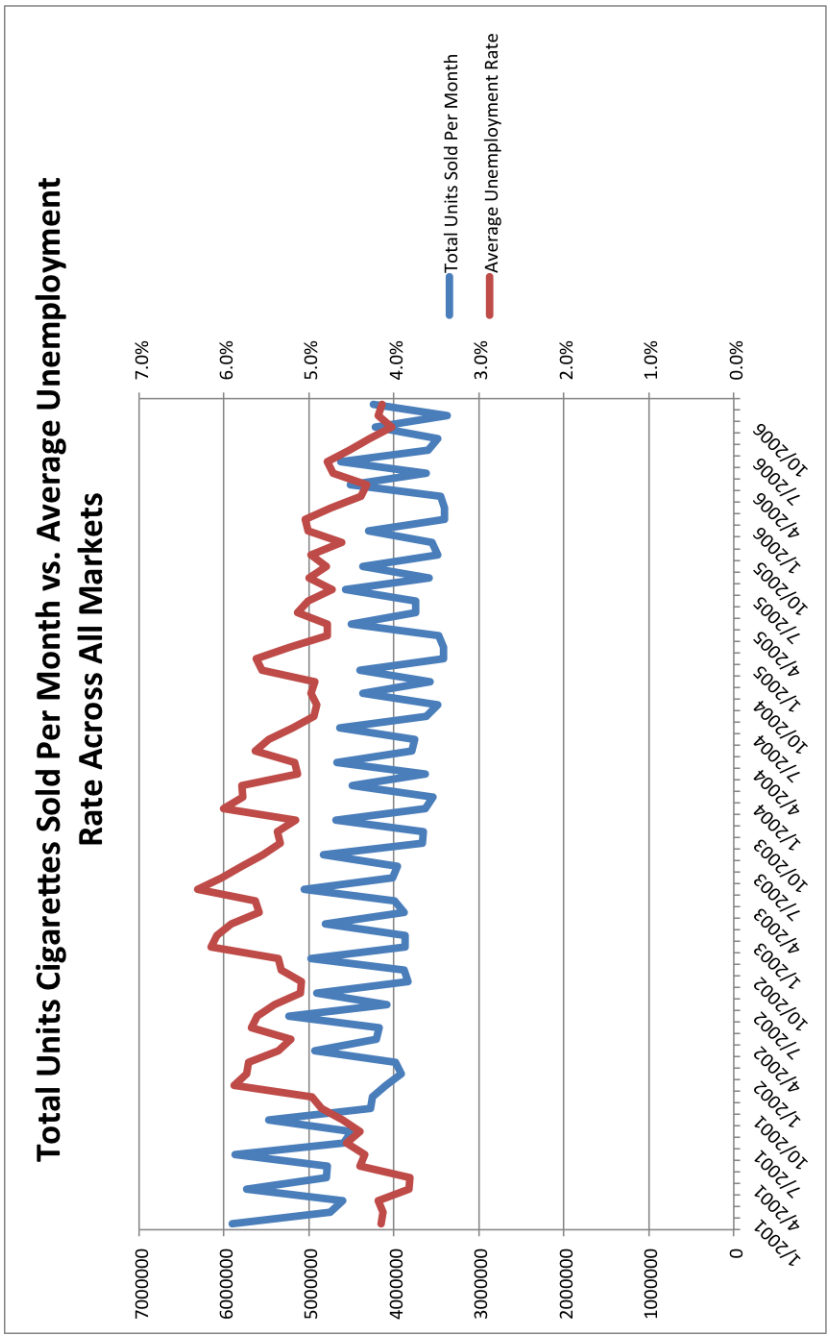


Figure 2.4: CIGARETTE PURCHASES AND UNEMPLOYMENT: All Markets

Figure 2.5: CIGARETTE PURCHASES ON PROMOTION AND UNEMPLOYMENT: All Markets

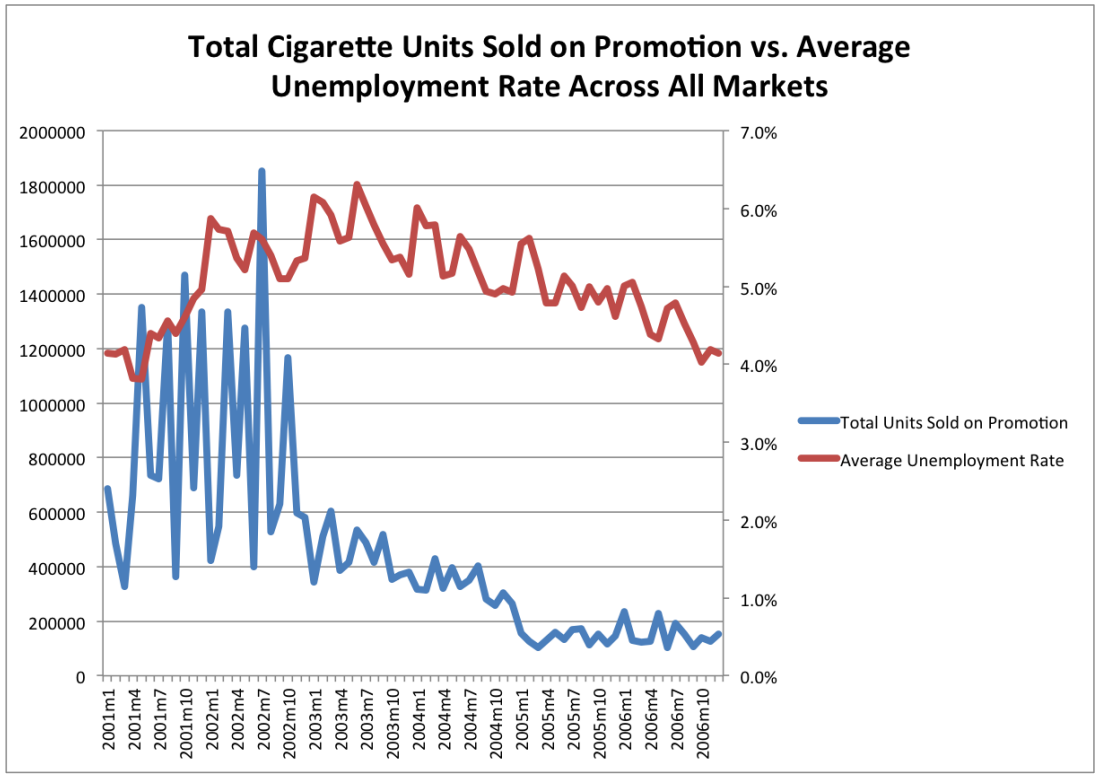
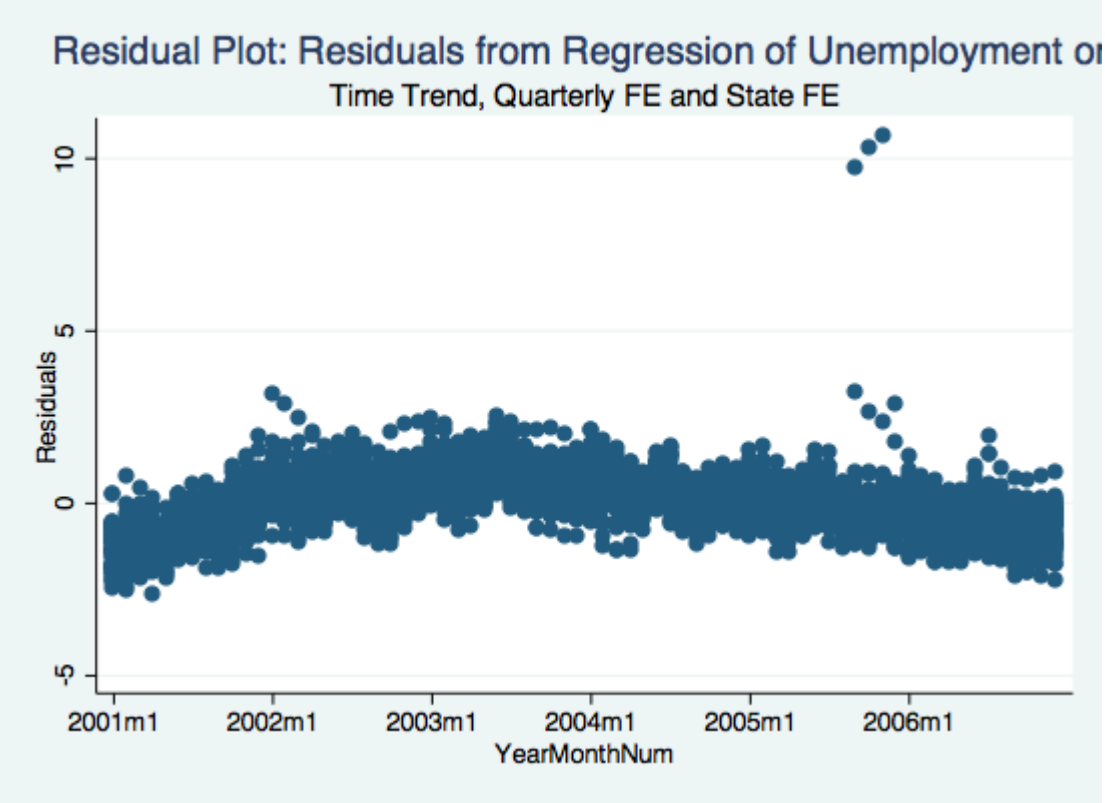
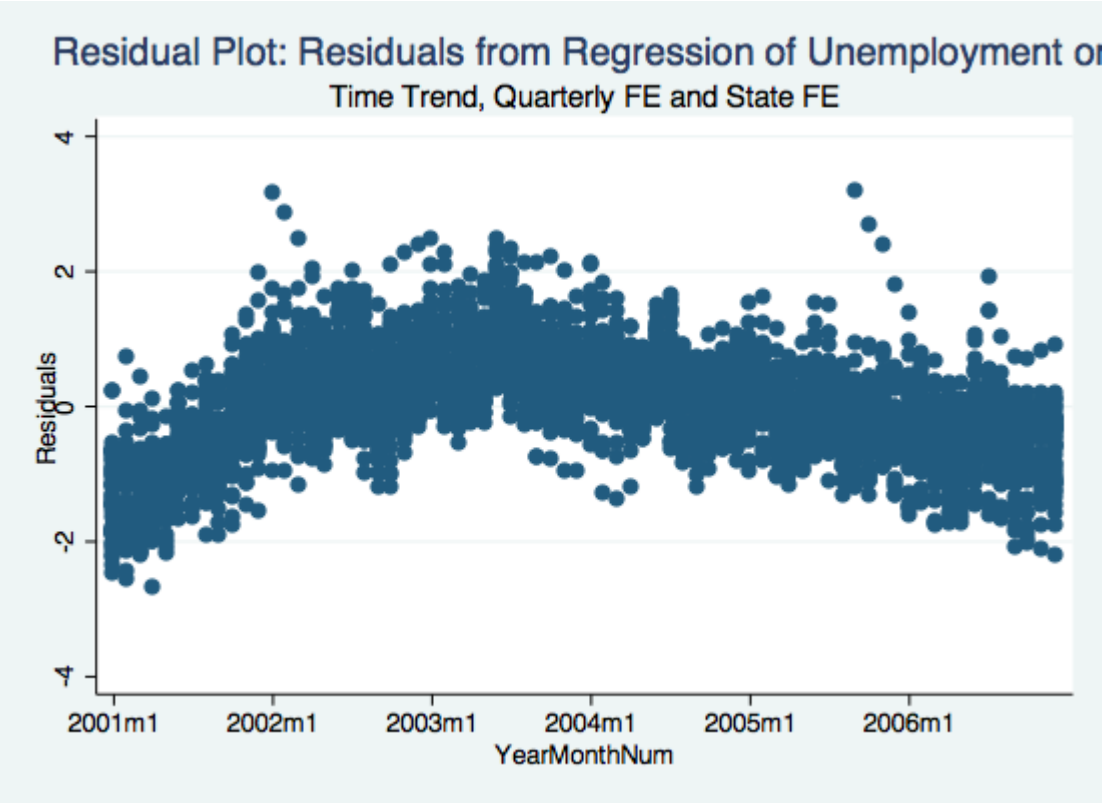


Figure 2.6: UNEMPLOYMENT RESIDUALS OVER TIME: All Markets



This figure depicts residuals sorted by time period of the original data resulting from a panel regression of unemployment rate over time and regions on regional and time trend.

Figure 2.7: UNEMPLOYMENT RESIDUALS OVER TIME: All Markets Except New Orleans



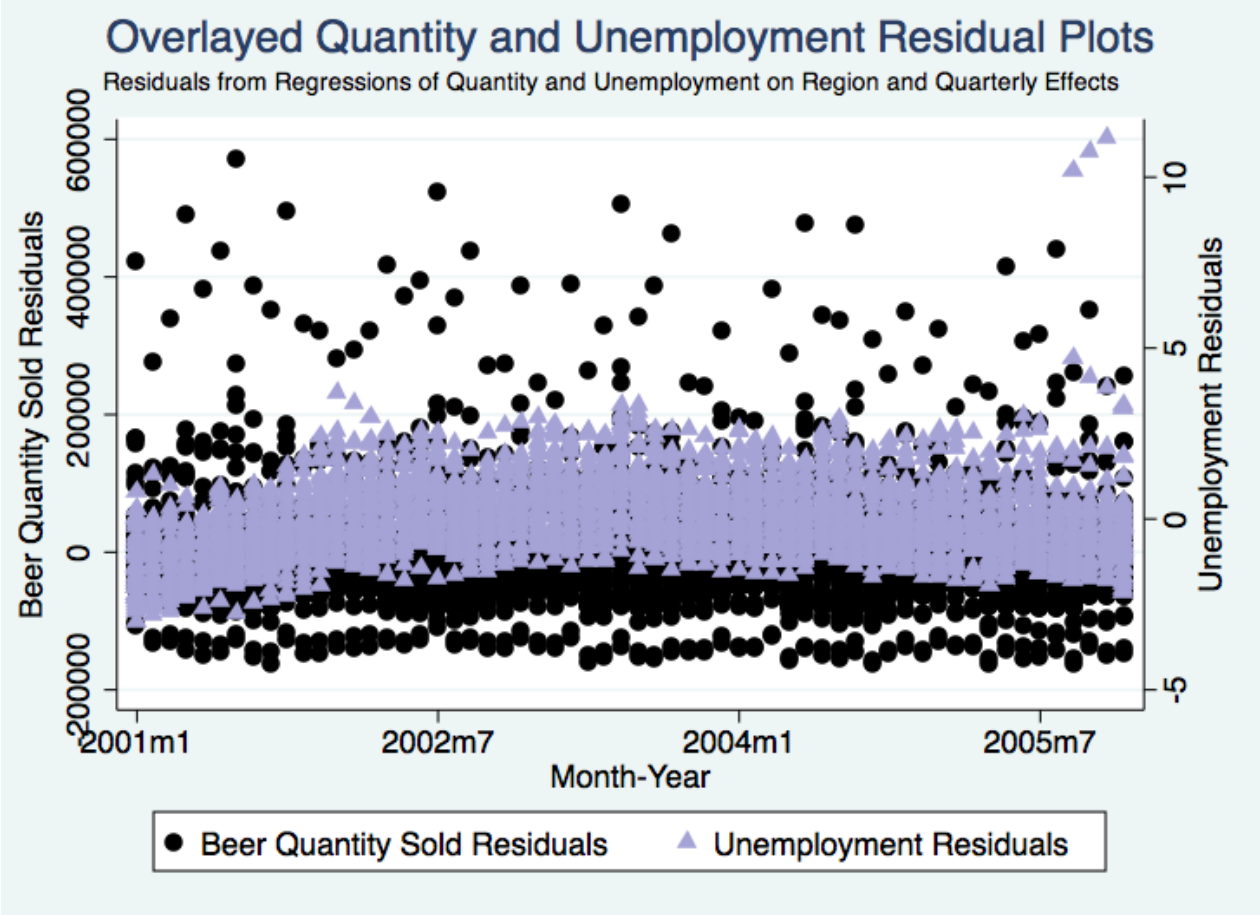
This figure depicts residuals sorted by time period of the original data resulting from a panel regression of unemployment rate over time and regions on regional and time trend, excluding the New Orleans market.

Table 2.4: OLS REGRESSION OF MARKET UNEMPLOYMENT ON TIME AND GEOGRAPHIC EFFECTS: 50% of variation left unexplained after taking account of geographic and time effects.

	Dependent Variable: Monthly Unemployment Rate				Regressions 1-4 with New Orleans Dropped			
	OLS 1	OLS 2	OLS 3	OLS 4	OLS 5	OLS 6	OLS 7	OLS 8
TimeTrend	-0.003			-0.002	-0.004			-0.002
	(0.001)**			(0.001)**	(0.001)**			(0.001)**
1st Quarter Dummy		0.505		0.486		0.538		0.517
		(0.055)**		(0.041)**		(0.054)**		(0.039)**
2nd Quarter Dummy		0.126		0.113		0.156		0.142
		(0.055)*		(0.041)**		(0.054)**		(0.038)**
3rd Quarter Dummy		0.173		0.166		0.188		0.181
		(0.055)**		(0.041)**		(0.054)**		(0.038)**
State Fixed Effects	No	No	Yes	Yes	No	No	Yes	Yes
Constant	5.19	4.867	4.664	4.551	5.194	4.839	4.664	4.54
	(0.040)**	(0.039)**	(0.103)**	(0.107)**	(0.039)**	(0.038)**	(0.097)**	(0.100)**
Observations	3528	3528	3528	3528	3456	3456	3456	3456
R-squared	0	0.03	0.45	0.48	0	0.03	0.49	0.52

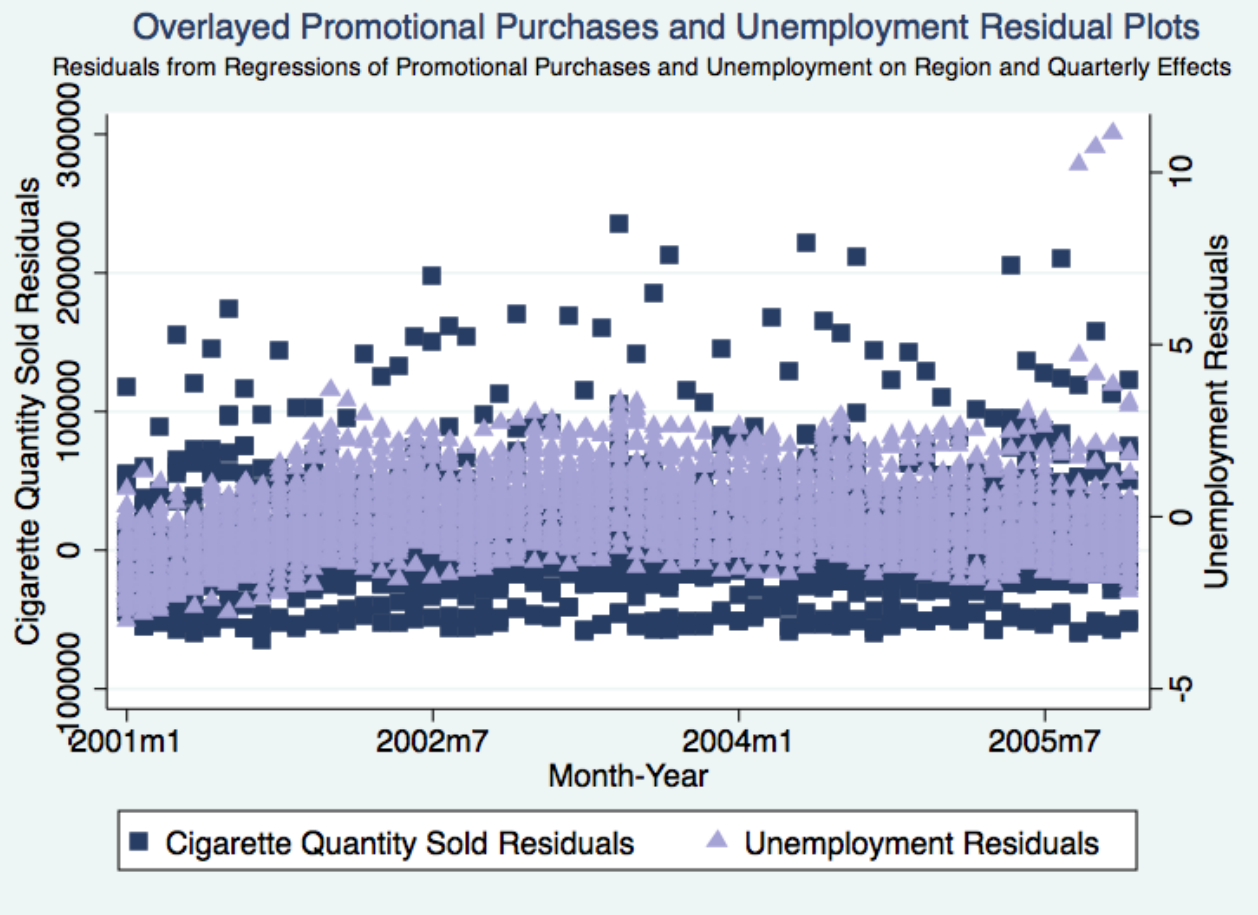
Standard errors in parentheses
* significant at 5% level; ** significant at 1% level

Figure 2.8: BEER QUANTITY AND UNEMPLOYMENT RESIDUALS OVER TIME



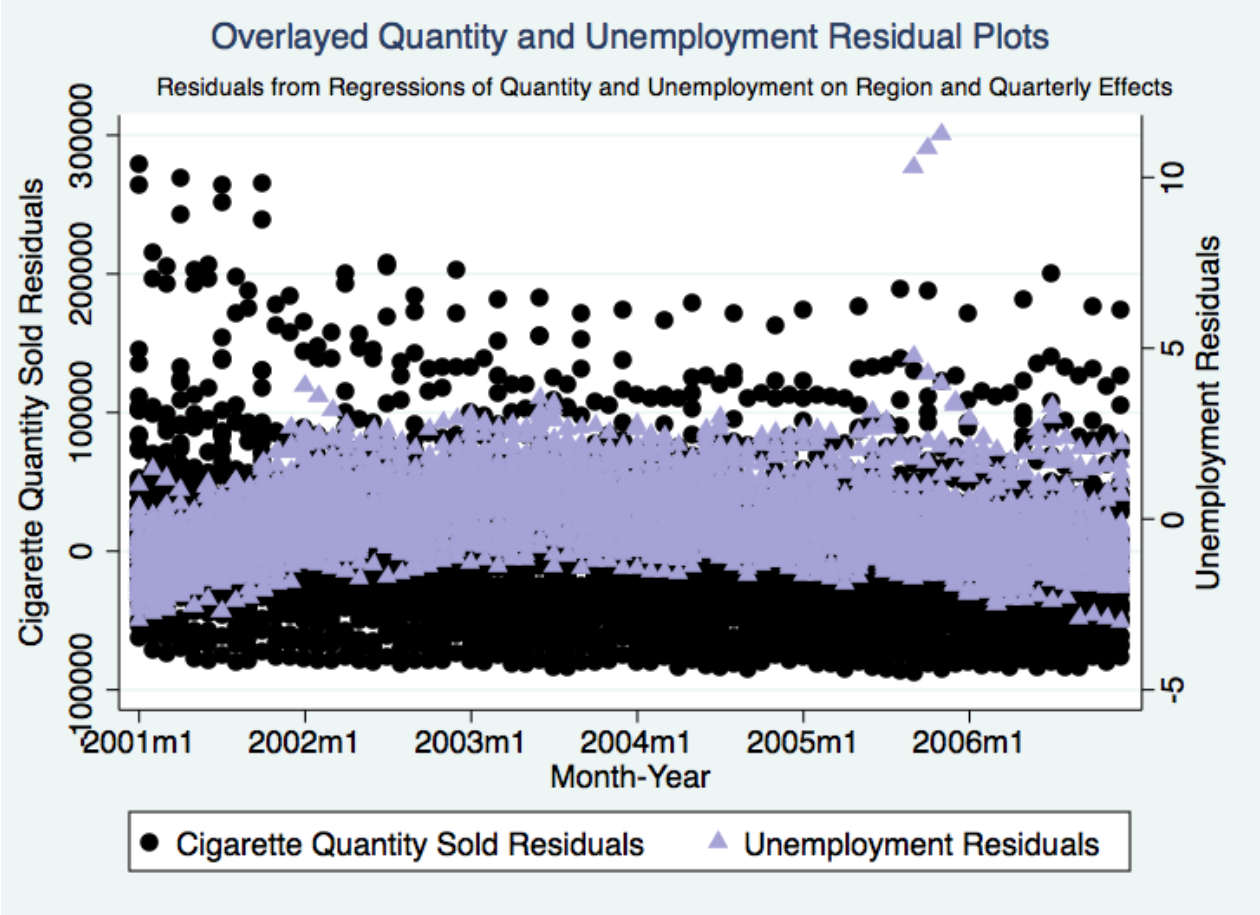
This figure depicts residuals sorted by time period of the original data resulting from a panel regression of unemployment rate over time and regions on a region fixed effect and time trend, overlaid with the residuals resulting from a panel regression of total beer units sold over time on a region fixed effect and time trend.

Figure 2.9: BEER QUANTITY SOLD ON PROMOTION AND UNEMPLOYMENT RESIDUALS OVER TIME



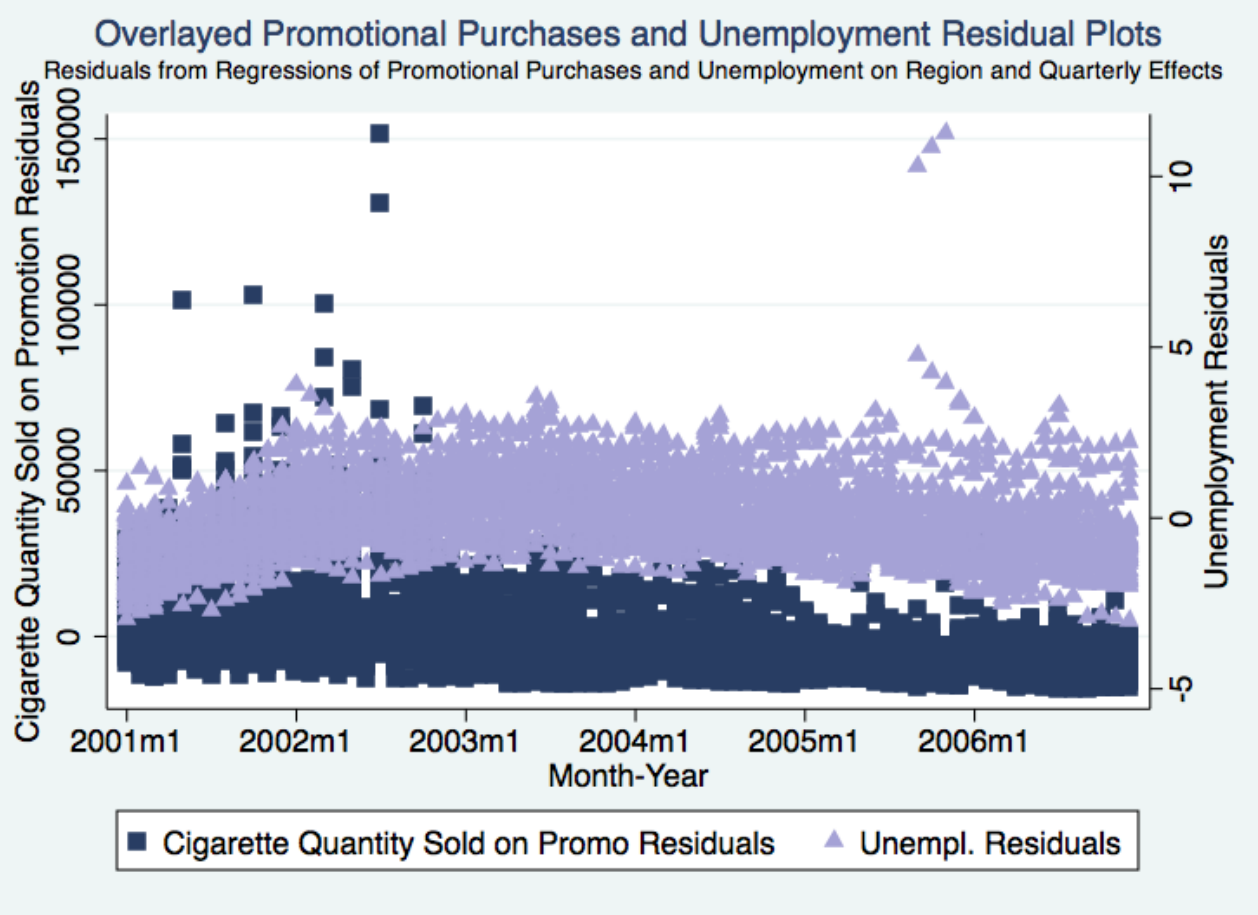
This figure depicts residuals sorted by time period of the original data resulting from a panel regression of unemployment rate over time and regions on a region fixed effect and time trend, overlaid with the residuals resulting from a panel regression of total beer units sold on promotion (discount of 5% or greater) on a region fixed effect and time trend.

Figure 2.10: CIGARETTE QUANTITY AND UNEMPLOYMENT RESIDUALS OVER TIME



This figure depicts residuals sorted by time period of the original data resulting from a panel regression of unemployment rate over time and regions on a region fixed effect and time trend, overlaid with the residuals resulting from a panel regression of total cigarette units sold over time on a region fixed effect and time trend.

Figure 2.11: CIGARETTE QUANTITY SOLD ON PROMOTION AND UNEMPLOYMENT RESIDUALS OVER TIME



This figure depicts residuals sorted by time period of the original data resulting from a panel regression of unemployment rate over time and regions on a region fixed effect and time trend, overlaid with the residuals resulting from a panel regression of total cigarette units sold on promotion (discount of 5% or greater) on a region fixed effect and time trend.

Table 2.5: BEER: Prices Regressed on Unemployment

BEER	(1) OLS	(2) GLS	(3) GLS	(4) OLS	(5) GLS	(6) GLS
Dependent Variables:	Ln(Chain Qty Weighted Avg Price)	Ln(Chain Qty Weighted Avg Price)	Ln(Chain Qty Weighted Avg Price)	Ln(Mkt Drug Store Qty Weighted Avg Price)	Ln(Mkt Drug Store Qty Weighted Avg Price)	Ln(Mkt Drug Store Qty Weighted Avg Price)
Ln(Unemployment Rate)	-0.047***	0.0578***	0.0075932	-0.0318***	0.0458	-0.047
	(0.000)	-0.006	(0.010)	(0.000)	-0.031	(0.047)
Demographic Controls	YES	YES	YES	YES	YES	YES
Region Controls	YES	YES	YES	YES	YES	YES
Quarterly Control	YES	YES	NO	YES	YES	NO
Quarter of Year	NO	NO	YES	NO	NO	YES
Time Trend	-0.0006282***	0.000521***		0.000166***	-0.0000325	
	(0.000)	(0.000)		(0.000)	(0.001)	
Constant	1.840969***	1.713***	1.770903***	1.766***	1.563***	1.660***
	(0.152)	(0.148)	(0.146)	(0.001)	(0.472)	(0.466)
Observations	14,158,605	14,158,605	14,158,605	12,728,181	12,728,181	12,728,181
R-squared	0.1679	0.1574	0.1678	0.123	0.0131	0.083
Number of Market-Chain-Product-Month Panels		613,972	613,972		568,156	568,156

Robust standard errors clustered at the market level in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2.6: CIGARETTES: Prices Regressed on Unemployment

CIGARETTES	(1) OLS	(2) GLS	(3) GLS	(4) OLS	(5) GLS	(6) GLS
Dependent Variables:	Ln(Chain Qty Weighted Avg Price)	Ln(Chain Qty Weighted Avg Price)	Ln(Chain Qty Weighted Avg Price)	Ln(Mkt Drug Store Qty Weighted Avg Price)	Ln(Mkt Drug Store Qty Weighted Avg Price)	Ln(Mkt Drug Store Qty Weighted Avg Price)
Ln(Unemployment Rate)	-0.008***	0.0284*	0.0176134	0.0489***	-0.0157	0.00172
	(0.000)	(0.015)	(0.029)	(0.000)	(0.03)	(0.058)
Demographic Controls	YES	YES	YES	YES	YES	YES
Region Controls	YES	YES	YES	YES	YES	YES
Quarterly Control	YES	YES	NO	YES	YES	NO
Quarter of Year	NO	NO	YES	NO	NO	YES
Time Trend	-0.001***	-0.00079**		-0.00182***	-0.00185***	
	(0.000)	(0.000)		(0.000)	(0.000)	
Constant	1.766***	1.636***	1.625***	1.922***	2.042***	1.988***
	(0.001)	(0.157)	(0.169)	(0.001)	-0.229	(0.231)
Observations	21,305,073	21,305,073	21,305,073	21,185,720	21185720	21,185,720
R-squared	0.1536	0.15	0.1571	0.397	0.3886	0.420
Number of Market-Chain-Product-Month Panels		1,092,387	1,092,387		1,091,154	1,091,154

Robust standard errors clustered at the market level in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2.7: BEER: Percent of Purchases Made on Promotion Regressed on Unemployment

BEER	(1) OLS	(2) OLS	(3) GLS - First Stage	(4) GLS -Second Stage	(5) GLS -Second Stage	(6) GLS -Second Stage	(7) GLS -Second Stage
Dependent Variable:		Ln(Percent Revenue from Items On Promotion)	Ln(Quant. Wt. Avg. Price Paid)	Ln(Percent Units Purchased On Promotion)	Ln(Percent Units Purchased On Promotion)	Ln(Percent Revenue from Items On Promotion)	Ln(Percent Revenue from Items On Promotion)
Ln(Unemployment)	0.115***	0.122***		0.000873	0.0134	-0.00921	-0.0097
	(0.001)	(0.001)		(0.0681)	(0.088)	(0.0661)	(0.092)
Ln(Qty Wtd. Avg. Price Paid)	0.0429***	0.0251***					
	(0.000)	(0.000)					
One month lagged Ln(Qty Wtd. Avg. Price Paid)			0.985***				
			(0.001)				
Ln(Qty Wtd. Avg. Price Paid) - I.V.				-0.0193	-0.0275**	-0.0265**	-0.0347***
				(0.0130)	(0.013)	(0.0127)	(0.012)
Demographic Controls	YES	YES	NO	YES	YES	YES	YES
Region Controls	YES	YES	NO	YES	YES	YES	YES
Quarterly Control	YES	YES	NO	YES	NO	YES	NO
Quarter of Month Control	NO	NO	NO	NO	YES	YES	YES
Time Trend	0.00637***	0.00625***		0.00609***		0.00611***	
	(0.000)	(0.000)		(0.000856)		(0.000938)	
Constant	-2.464***	-2.483***	0.0267***	-2.067***	-2.127***	-2.056***	-2.098***
	(0.003)	(0.003)	(0.002)	(0.522)	(0.531)	(0.548)	(0.574)
Observations	14082971	14083127	14111102	14,037,454	14,037,454	14,037,611	14037611
R-Squared	0.229	0.217	0.999	0.225	0.226	0.214	0.215
Number of Market-Chain-Product-Month Panels			609757	608,486	608486	608,486	608,486

Robust standard errors clustered at the market level in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2.8: CIGARETTES: Percent of Purchases Made on Promotion Regressed on Unemployment

CIGARETTES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	OLS	OLS	GLS - First Stage	GLS -Second Stage	GLS -Second Stage	GLS -Second Stage	GLS -Second Stage
Dependent Variable:		Ln(Percent Revenue from Items On Promotion)	Ln(Quant. Wt. Avg. Price Paid)	Ln(Percent Units Purchased On Promotion)	Ln(Percent Units Purchased On Promotion)	Ln(Percent Revenue from Items On Promotion)	Ln(Percent Revenue from Items On Promotion)
Ln(Unemployment)	0.151***	0.388***		0.525***	-0.319	0.755***	-0.134
	(0.002)	(0.002)		(0.191)	(0.201)	(0.201)	(0.184)
Ln(Qty Wtd. Avg. Price Paid)	-0.0186***	-0.0143***					
	(0.000)	(0.000)					
One month lagged Ln(Qty Wtd. Avg. Price Paid)			0.988***				
			(0.001)				
Ln(Qty Wtd. Avg. Price Paid) - I.V.				-0.0525***	-0.0955***	-0.0518***	-0.0910***
				(0.013)	(0.012)	(0.012)	(0.012)
Demographic Controls			NO	YES	YES	YES	YES
Region Controls			NO	YES	YES	YES	YES
Quarterly Control			NO	YES	NO	YES	NO
Quarter of Month Control			NO	NO	YES	YES	YES
Time Trend	-0.0343***	-0.0340***		-0.0356***		-0.0351***	
	(0.000)	(0.000)		(0.00197)		(0.00195)	
Constant	-3.895***	-4.271***	0.0252***	-4.551***	-4.261***	-4.929***	-4.414***
	(0.007)	(0.007)	(0.002)	(0.668)	(0.690)	(0.681)	(0.644)
Observations	18,661,579	18,661,579	21,249,226	18,613,198	18,613,198	18,613,198	18,613,198
R-Squared	0.186	0.209	0.999	0.183	0.218	0.206	0.235
Number of Market-Chain-Product-Month Panels			1,083,282			1,044,718	

Robust standard errors clustered at the market level in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2.9: BEER: Unit Purchases and Revenues of A Given Product In a Given Month and Market Regressed on Unemployment

BEER

Estimator	OLS	OLS	GLS - First Stage	GLS - Second Stage - (Spec. 1)	GLS - Second Stage - (Spec. 2)	GLS - Second Stage - (Spec. 1)	GLS - Second Stage - (Spec. 2)
Variables	Ln(Total Units Purchased Per Month Within Market)	Ln(Total Revenue Per Month Within Market)	LnQWAvPrice	Ln(Total Units Purchased Per Month Within Market)	Ln(Total Units Purchased Per Month Within Market)	Ln(Total Revenue Per Month Within Market)	Ln(Total Revenue Per Month Within Market)
Variable Level	UPC-Market-Month	UPC-Market-Month	UPC-Market-Month	UPC-Market-Month	UPC-Market-Month	UPC-Market-Month	UPC-Market-Month
LnUnempl	0.159***	0.106***		-0.00203	-0.0297	0.0639	-0.0146
	(0.000)	(0.002)		(0.004)	(0.073)	(0.0399)	(0.071)
LnQWAvPrice	-0.00996***	0.00934***					
	(0.000)	(0.001)					
Lag-LnQWAvPrice			0.926***				
			(0.00746)				
LnQWAvPrice - I.V.				-0.0884***	-0.103***	-0.0532***	-0.0756***
				(0.000)	(0.015)	(0.0137)	(0.014)
Demographic Controls	YES	YES		YES	YES	YES	NO
Region Controls	YES	YES		YES	YES	YES	YES
Quarter FE	YES	YES		YES	NO	YES	NO
Quarter of Year FE	NO	NO		NO	YES	NO	YES
TimeTrend	-0.000776***	4.83E-06		-0.000728		3.25e-06	
	(0.000)	(0.000)		(0.000)		(0.000617)	
Constant	11.55***	13.50***	0.133***	11.89***	11.86***	13.58***	13.62***
	(0.001)	(0.006)	(0.013)	(0.007)	(0.790)	(0.709)	(0.708)
Observations	14,157,260	14,157,260	14,111,102	14,111,462	14,111,462	14,111,462	14,111,462
Overall R- Squared	0.634	0.617	0.999	0.692	0.628	0.614	0.613
Number of Market-Chain-Product-Month Panels			609,757	609,820	609,820	609,820	609,820

Robust standard errors clustered at the market level in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2.10: BEER: Percent of Total Units Purchased At Drug Stores Regressed on Unemployment

BEER

Estimator	OLS	GLS - First Stage	GLS - Second Stage - (Spec. 1)	GLS - Second Stage - (Spec. 2)
Variables	Ln(Percentage Units Sold at Drug Stores)	LnQWAvPrice	Ln(Percentage Units Sold at Drug Stores)	Ln(Percentage Units Sold at Drug Stores)
Variable Level	UPC-Market-Month	UPC-Chain-Market-Month	UPC-Market-Month	UPC-Market-Month
Ln (Unempl. Rate)	-1.837***		0.0479	0.188
	(0.000)		(0.131)	(0.004)
Ln(Qty. Wt. Avg. Price Paid)	0.0471***			
	(0.000)			
1- Month Lagged Ln(Qty. Wt. Avg. Price Paid)		0.985***		
		(0.001)		
Ln(Qty. Wt. Avg. Price Paid) I.V.			0.145*	0.170**
			(0.080)	(0.000)
Demographic Controls	YES	NO	YES	YES
Region Controls	YES	NO	YES	YES
Quarter FE	YES	NO	YES	NO
Quarter of Year FE		NO	NO	YES
TimeTrend	0.000963***		0.001035	
	(0.000)		(0.003)	(0.000)
Constant	5.251***	0.0267***	-4.359***	0.986
	(0.001)	(0.002)	(0.336)	(0.007)
Observations	12,727,007	14,111,102	12,690,294	12,690,294
Overall R- Squared	0.587	0.999	0.543	0.537
Number of Market-Chain-Product-Month Panels		609,757	564,571	564,571

Robust standard errors clustered at the market level in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2.11: BEER: Total Sold Within Market and Total Units of A Given Product Sold Within Chain Regressed On Unemployment

BEER

Estimator	OLS	OLS	GLS - First Stage	GLS - Second Stage - (Spec. 1)	GLS - Second Stage - (Spec. 2)	GLS - Second Stage - (Spec. 1)	GLS - Second Stage - (Spec. 2)
Variables	Ln (Total Units Purchased in Category)	Ln(UPC Units Purchased)	LnQWAvPrice	Ln (Total Units Purchased in Category)	Ln (Total Units Purchased in Category)	Ln(UPC Units Purchased)	Ln(UPC Units Purchased)
Variable Level	Market-Month	UPC-Chain-Market-Month	UPC-Chain-Market-Month	Market-Month	Market-Month	UPC-Chain-Market-Month	UPC-Chain-Market-Month
Ln (Unempl. Rate)	0.0126***	-0.0295***		0.0144***	0.00883*	-0.0316	-0.0107
	(0.000)	(0.002)		(0.004)	(0.005)	(0.020)	(0.037)
Ln(Qty. Wt. Avg. Price Paid)	-0.000497***	-0.121***					
	(0.000)	(0.001)					
1- Month Lagged Ln(Qty. Wt. Avg. Price Paid)			0.985***				
			(0.001)				
Ln(Qty. Wt. Avg. Price Paid) I.V.				-0.000364**		-0.917***	-0.864***
				(0.000)		(0.068)	(0.064)
Demographic Controls	YES	YES	NO	YES	YES	YES	YES
Region Controls	YES	YES	NO	YES	YES	YES	YES
Quarter FE	YES	YES	NO	YES	NO	YES	NO
Quarter of Year FE	NO	NO	NO	NO	YES	NO	YES
TimeTrend	-0.000629***	-0.00309***		-0.000609***		-0.00724***	
	(0.000)	(0.000)		(0.000)		(0.000)	
Constant	15.47***	2.459***	0.0267***	15.47***	15.38***	3.670***	3.478***
	(0.001)	(0.006)	(0.002)	(0.007)	(0.008)	(0.267)	(0.269)
Observations	14,157,260	14,153,155	14,111,102	14,111,462	14,111,462	14,107,077	14,107,077
R - Squared Overall	0.440	0.020	0.999	0.441	0.462	0.009	0.009
Number of Market-Chain-Product-Month Panels			609,757	609,820	609,820	609,820	609615

Robust standard errors clustered at the market level in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 2.12: CIGARETTES: Percent of Total Units Purchased At Drug Stores Regressed on Unemployment

CIGARETTES

Estimator	OLS	OLS	GLS - First Stage	GLS - Second Stage - (Spec. 1)	GLS - Second Stage - (Spec. 2)	GLS - Second Stage - (Spec. 1)	GLS - Second Stage - (Spec. 2)
Variables	Ln (Total Units Purchased in Category)	Ln(UPC Units Purchased)	LnQWAvPrice	Ln (Total Units Purchased in Category)	Ln (Total Units Purchased in Category)	Ln(UPC Units Purchased)	Ln(UPC Units Purchased)
Variable Level	Market-Month	UPC-Chain-Market-Month	UPC-Chain-Market-Month	Market-Month	Market-Month	UPC-Chain-Market-Month	UPC-Chain-Market-Month
Ln (Unempl. Rate)	-0.275***	-0.305***		-0.164***	0.0061	-0.127***	0.0403
	(0.000)	(0.000)		(0.049)	(0.071)	(0.048)	(0.085)
Ln(Qty. Wt. Avg. Price Paid)	0.0107***	0.0180***					
	(0.000)	(0.000)					
1- Month Lagged Ln(Qty. Wt. Avg. Price Paid)			0.988***				
			(0.001)				
Ln(Qty. Wt. Avg. Price Paid) I.V.				-0.0514**	-0.0640***	0.0302	0.00128
				(0.024)	(0.024)	(0.031)	(0.030)
Demographic Controls	YES	YES		YES	YES	YES	NO
Region Controls	YES	YES		YES	YES	YES	YES
Quarter FE	YES	YES		YES	NO	YES	NO
Quarter of Year FE	NO	NO		NO	YES	NO	YES
TimeTrend	-0.00401***	-0.00504***		-0.00415***		-0.00508***	
	(0.000)	(0.000)		(0.001)		(0.001)	
Constant	11.14***	12.95***	0.0252***	10.97***	10.70***	12.41***	12.15***
	(0.002)	(0.002)	(0.002)	(0.640)	(0.655)	(0.717)	(0.730)
Observations	21,304,831	21,304,831	21,249,226.00	21,249,357	21,249,357	21,249,357	21,249,357
Overall R- Squared	0.66	0.711	0.999	0.647	0.641	0.707	0.705
Number of Market-Chain-Product-Month Panels			1,083,282.00	1,083,331	1,083,331	1,083,331	1,083,331

Robust standard errors clustered at the market level in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 2.13: CIGARETTES: Percent of Total Units Purchased At Drug Stores Regressed on Unemployment

CIGARETTES

Estimator	OLS	GLS - First Stage	GLS - Second Stage - (Spec. 1)	GLS - Second Stage - (Spec. 2)
Variables	Ln(Percentage Units Sold at Drug Stores)	LnQWAvPrice	Ln(Percentage Units Sold at Drug Stores)	Ln(Percentage Units Sold at Drug Stores)
Variable Level	UPC-Market-Month	UPC-Chain-Market-Month	UPC-Market-Month	UPC-Market-Month
Ln (Unempl. Rate)	0.0438***		-0.00194	0.315*
	(0.001)		(0.094)	(0.165)
Ln(Qty. Wt. Avg. Price Paid)	-0.0125***			
	(0.000)			
1- Month Lagged Ln(Qty. Wt. Avg. Price Paid)		0.948***		
		(0.005)		
Ln(Qty. Wt. Avg. Price Paid) I.V.			-0.0555	-0.0437
			(0.044)	(0.045)
Demographic Controls	YES	NO	YES	YES
Region Controls	YES	NO	YES	YES
Quarter FE	YES	NO	YES	NO
Quarter of Year FE		NO	NO	YES
TimeTrend	0.0111***		0.0109***	
	(0.000)		(0.002)	
Constant	-1.442***	0.0965***	-1.254	-1.870**
	(0.002)	(0.009)	(0.920)	(0.920)
Observations	21,185,433	21,249,226	21,130,226	21,130,226
Overall R- Squared	0.686	0.999	0.684	0.686
Number of Market-Chain-Product-Month Panels		1,083,282	1,082,104	1,082,104

Robust standard errors clustered at the market level in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2.14: CIGARETTES: Total Sold Within Market and Total Units of A Given Product Sold Within Chain Regressed On Unemployment

CIGARETTES

Estimator	OLS	OLS	GLS - First Stage	GLS - Second Stage - (Spec. 1)	GLS - Second Stage - (Spec. 2)	GLS - Second Stage - (Spec. 1)	GLS - Second Stage - (Spec. 2)
Variables	Ln (Total Units Purchased in Category)	Ln(UPC Units Purchased)	LnQWAvPrice	Ln (Total Units Purchased in Category)	Ln (Total Units Purchased in Category)	Ln(UPC Units Purchased)	Ln(UPC Units Purchased)
Variable Level	Market-Month	UPC-Chain-Market-Month	UPC-Chain-Market-Month	Market-Month	Market-Month	UPC-Chain-Market-Month	UPC-Chain-Market-Month
Ln (Unempl. Rate)	-0.112***	-0.154***		-0.114***	-0.0126***	-0.206***	0.0468
	(0.000)	(0.001)		(0.007)	(0.002)	(0.025)	(0.038)
Ln(Qty. Wt. Avg. Price Paid)	0.00112***	-0.470***					
	(0.000)	(0.000)					
1- Month Lagged Ln(Qty. Wt. Avg. Price Paid)			0.948***				
			(0.005)				
Ln(Qty. Wt. Avg. Price Paid) I.V.				0.00108***	0.000659***	-0.472***	-0.483***
				(0.000)	(0.000)	(0.013)	(0.010)
Demographic Controls	YES	YES	NO	YES	YES	YES	YES
Region Controls	YES	YES	NO	YES	YES	YES	YES
Quarter FE	YES	YES	NO	YES	NO	YES	NO
Quarter of Year FE	NO	NO	NO	NO	YES	NO	YES
TimeTrend	-0.00418***	-0.00204***		-0.00416***		-0.00565***	
	(0.000)	(0.000)		(0.000)		(0.000)	
Constant	15.61***	3.144***	0.0965***	15.61***	15.46***	2.986***	2.590***
	(0.000)	(0.005)	(0.009)	(0.031)	(0.005)	(0.178)	(0.190)
Observations	21,304,831	21,304,099	21,249,226	21,249,357	21,249,357	21,248,524	21,248,524
R - Squared Overall	0.391	0.135	0.999	0.390	0.451	0.132	0.132
Number of Market-Chain-Product-Month Panels			1,083,282	1,083,331	1,083,331	1,083,196	1,083,196

Robust standard errors clustered at the market level in parentheses
*** p<0.01, ** p<0.05, * p<0.1

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