THREE ESSAYS ON THE

EFFECTS OF CALORIE LABELING IN

FULL SERVICE RESTAURANTS

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PREFACE

Food expenditures away from home have steadily increased over the past thirty years. In 1980, 32% of food expenditure dollars were spent away from home, but by 2010, this share of food expenditures had grown to almost 44% (ERS, 2011). Further, Todd, Mancino, and Lin (2010) estimated that for each additional meal eaten away from home, consumers ate an additional 134 calories. By their estimation, the average person will gain two pounds each year just by eating out one meal a week!

The combined increases in eating away from home and U.S. obesity/overweight rates have caught the attention of policymakers. In an effort to help promote healthier food choices, a mandatory menu labeling law was passed in the 2010 health care bill. Though the official guidelines have not been set, it is proposed that chain restaurants (those restaurants with 20 or more outlets) will be required to provide: (1) calorie information for all menu items on all menu forms (including drive-throughs), (2) full nutrition profiles for all menu items available on site, and (3) a statement of the daily recommended caloric intake for the average person (FDA, 2011).

With the passage of this menu labeling legislation, research regarding the potential (and actual) effectiveness of mandatory calorie labels has grown rapidly. Despite the expanding literature, there are still many gaps which need to be addressed. The purpose of this research is to answer many of the questions about menu labeling which still remain using data from two field experiments in full service restaurants.

In Chapter 1, I estimate a structural model of consumer demand to determine the economic value of information for restaurant menu labels. Two types of calorie labels are examined: (1) a traditional numeric calorie label where only the number of calories are listed by each menu item and (2) a symbolic calorie label where we provide a traffic light symbol (which indicates specific calorie ranges) *in addition to* the number of calories for each menu item. The experimental design allows one to compare the effectiveness of calorie labels to a "fat tax" or "thin subsidy" at reducing caloric intake. Results show numeric labels did not influence demand, but symbolic traffic light labels reduced the marginal utility of caloric intake. Our model projects both labels would reduce intake more than high-calorie taxes or low-calorie subsidies. Ultimately, traffic light calorie labels led to the largest reduction in caloric intake but also one of the largest reductions in restaurant net returns.

One potential concern in Chapter 1 is that the experiment was designed in a way where all menu labeling treatments were examined simultaneously, which could cause the effect of the calorie labels to diminish over time. Thus, in the second restaurant, we designed the experiment so that there were distinct pre- and post-labeling periods. Chapter 2 offers a comparison of the two restaurants. Ultimately, both field experiments lead us to the same conclusion: the numeric calorie label (as currently proposed by the FDA) had little effect on total caloric intake. Our results do reveal, however, that the effectiveness of the numeric label could be enhanced with the addition of a traffic light symbol identifying low-, medium-, and high-calorie items.

A key issue in the labeling literature is the fact that there is still no consensus on whether or not calorie labels are effective at reducing caloric intake. This suggests the possibility of heterogeneity in responses to caloric labels across people with different attitudes and demographics. In Chapter 3, I explore the potential relationships between caloric intake and diners' socio-economic characteristics and attitudes. Results show that calorie labels have the greatest impact on those who are least health conscious. Additionally, calorie labels are more likely to influence the selection of the main entrée as opposed to supplemental items such as drinks and desserts. Finally, irrespective of the menu treatment to which a subject was assigned, this study identifies which types of people are likely to be low-, medium-, and high-calorie diners.

Lastly, in Chapter 4, I discuss the main findings of these studies and the potential implications of calorie labels for both consumers and restaurants.

CHAPTER I

THE VALUE AND COST OF RESTAURANT CALORIE LABELS: RESULTS FROM A FIELD EXPERIMENT

In 2009, Americans spent 42% of their food dollars on meals away from home (Morrison, Mancino, and Variyam, 2011). Consumers choose to eat outside the home for a variety of reasons including convenience, but there is mounting concern that this spending pattern will have a detrimental effect on Americans' diet and overall health. Todd, Mancino, and Lin (2010) estimated that for each additional meal eaten away from home, consumers ate an additional 134 calories. By their estimation, the average person will gain two pounds each year just by eating out one meal a week. Not only does food away from home tend to be higher in calories, its nutrient quality pales in comparison to meals prepared in the home (Todd, Mancino, and Lin, 2010).

The combined increases in eating away from home and U.S. obesity/overweight rates have caught the attention of policymakers. In an effort to help promote healthier food choices, several cities, counties, and states have passed or are considering legislation which would require nutrition labeling on restaurant menus (CSPI, 2010). With the passage of the 2010 health care bill, a standardized menu labeling system will soon be required in restaurants across the country.

The labeling guidelines currently being set by the Food and Drug Administration (FDA) will take precedence over local labeling laws. Although the specific guidelines have not been released (they are expected to be released by the end of 2011), it is probable that restaurants with 20 or more outlets will be required to provide: (1) calorie information for all menu items on all menus, menu boards, food tags, and drive-throughs, (2) additional nutrition information for all menu items available upon request, and (3) a statement of the recommended daily caloric intake (2,000 calories/day) for the average individual (FDA, 2011).

While the literature on menu labeling in restaurants is expanding, large gaps in knowledge remain. This research was designed to fill many of these gaps by explicitly calculating the value of information present in two types of calorie labels using data collected from a field experiment in which restaurant diners were unaware of the ongoing study. The innovativeness of our approach can be seen by briefly surveying the existing literature on the topic.

Past research on the effectiveness of menu labeling has been remarkably inconclusive. Some studies conclude providing nutritional information on menus lowers caloric intake (e.g., Milich, Anderson, and Mills, 1976; Wisdom, Downs, and Loewenstein, 2010). Yet, other studies find the information has no effect (e.g., Mayer et al., 1987; Harnack et al., 2008). Even among studies finding an effect, the size of the effect tends to be small. For example, Balfour et al. (1996) and Yamamoto et al. (2005) found that only a small proportion of consumers (16% and 29%, respectively) changed their menu item selection when presented with nutrition information. Importantly, none of these previous studies have provided an estimate of the economic value of nutritional information on restaurant menus that could be used in a cost-benefit analysis.

One of the primary weaknesses of previous research relates to issues concerning external validity. In particular, many of the previous studies have been conducted in artificial settings in which participants were aware of the on-going research. The earliest studies on restaurant menu labeling were not actually conducted in restaurants but in laboratory or cafeteria settings (Milich, Anderson, and Mills, 1976; Cinciripini, 1984; Mayer et al., 1987; Balfour et al., 1996; Yamamoto et al., 2005; Harnack et al., 2008). There is ample evidence that people often behave differently when they are aware that their behavior is scrutinized, suggesting the need for research in a more natural setting (Harrison and List, 2004; Levitt and List, 2007). More recent studies have been conducted in fast-food restaurants (Chandon and Wansink, 2007; Wisdom, Downs, and Loewenstein, 2010), but to our knowledge only one study has been conducted in a full service, sit-down restaurant (Pulos and Leng, 2010). This setting is of particular interest because diners actually have time to thoughtfully consider nutrition information presented on menus, which is often not the case in fast-food outlets. Moreover, the sample of consumers self-selecting into fast-food restaurants is likely to respond differently to menu labels than consumers selecting full service restaurants.

Another weakness of previous research relates to the type of nutritional information provided. Past research has solely focused on providing calorie information in a numeric format (i.e., the number of calories beside each menu item). Although this is a straightforward way to present information to diners, research has shown people are unfamiliar with calories, often grossly mis-estimate caloric intake, and are unaware of how many calories they should consume on a daily basis (Burton et al., 2006; Krukowski et al., 2006; Blumenthal and Volpp, 2010). Given these difficulties, one might question whether numeric calorie labeling will substantively influence consumer choice. As the research in behavioral economics shows, *how* information is provided can be just as (if not more) important as *which* information is provided (Thaler and Sunstein, 2008). Based on the information processing literature (Scammon, 1977; Russo et al., 1986), we hypothesize that symbolic presentation of nutrition information will have a larger effect than numeric calorie information. Symbols are easier to process for the consumer, and serve as a quick guide or normative suggestion to choose lower-calorie menu items.

Federal legislative efforts have primarily focused on food information policies, but these are not the only policy instruments which could be used to encourage healthier eating. Indeed, many have argued for pricing policies such as “fat taxes” and “thin subsidies” to direct consumers toward lower-calorie items. French (2003) found that imposing a “thin subsidy” for low-fat items in vending machines (50% price reduction) can dramatically increase sales on those items (93% increase); nevertheless, price changes of this magnitude are politically infeasible. Most studies on “fat taxes” have concluded they will have very little effect on caloric intake (e.g., see Kuchler, Tegene, and Harris, 2005; Dharmasena and Capps, 2011; Schroeter, Lusk, and Tyner, 2008) or obesity rates as these taxes will likely cause consumers to change where they eat rather than how much they eat (Anderson and Matsa, 2011). Regrettably, few studies have attempted to compare the relative effectiveness of different policy options (i.e., information or labeling policies versus pricing policies) under an over-arching experimental design. One exception is the study by Horgen and Brownell (2002) who studied labeling and pricing interventions in a restaurant setting. However, in their study, labels were not provided for all menu items and advertising was used to draw diners’ attention to the healthier and lower-priced items. Our research aims to compare policy options in a natural environment more similar to the world in which the policies would be implemented.

Finally, previous research has failed to determine how menu labeling will affect parties other than the consumer. Although there are costs associated with item reformulation and menu redesigns, there has been little accounting of how consumers' new choices might affect restaurant profitability. In fact, only one study to our knowledge considers the effect of calorie labels on restaurant revenue (Bollinger, Leslie, and Sorensen, 2011). Thorough economic analysis, however, should compare the benefit of providing caloric information to diners (via diners' value of information) to the cost of information provision (change in restaurant net returns over food and preparation costs due to menu label). Additionally, accounting for changes in net returns (over food and preparation costs) is needed to quantify the trade-offs for each policy option (e.g., Policy A will decrease caloric intake by X calories but will reduce restaurant net returns by Z dollars). Our study is designed to provide information on such tradeoffs.

The overall purpose of this research is to perform an in-depth examination of menu labeling and pricing policies in a full service, sit-down restaurant. Specifically, this research determines: (1) whether caloric labels in a full service restaurant influence food choice, (2) whether symbolic calorie labels are more/less influential than numeric calorie labels, (3) how effective menu labels are relative to "fat taxes" and "thin subsidies" at reducing caloric intake, (4) how menu labeling and "fat taxes/thin subsidies" affect restaurant net returns (over food and preparation costs), and (5) the economic value of menu labels.

II. Data and Experimental Design

From August to November 2010, daily lunch receipts were collected from The Rancher's Club, a full service, sit-down restaurant in Stillwater, Oklahoma. The Rancher's Club is upscale relative to other restaurants in town, with diners in our sample spending more than $14 on average for lunch including drinks and deserts. The restaurant is located on the Oklahoma State University campus but is open to (and frequented by) residents without affiliation with the University. Importantly, the restaurant had never previously been used for research purposes, making it unlikely diners would have any expectation of being part of a research study.

The restaurant was divided into three sections, each of which was assigned to a particular menu treatment. The authors informed restaurant staff of the general purpose of the study and stressed the need to maintain consistency over the course of the experiment (i.e., ensure diners were presented with the correct menu). Hosts and servers were also trained on how to address diners' questions on the new menus, with an emphasis on factually answering the question rather than offering opinions on diet and nutrition. Restaurant patrons were unaware of the ongoing study, and in an effort to minimize response bias, wait staff were instructed to refrain from telling diners about the study.

The restaurant offered a total of 51 menu options, including items such as soups and salads, burgers, pasta, and even prime steaks. This menu offering allowed for a wide range of caloric values and prices ranging from a low of $3 for a cup of soup to a high of $58 for the prime steak. Caloric contents were obtained for each item using The Food Processor nutrition analysis software.[1] The head chef entered recipes for each menu item to obtain the most accurate calorie counts. Although complete nutrition profiles were available for each item, we only provided calorie information on menus in an effort to mirror what is likely to be mandated by the FDA.

Upon entering the restaurant, a lunch-party was randomly assigned to one of three menu treatments. All menu versions included descriptions and prices of each menu item, but the level of caloric information provided varied. The control used the restaurant's conventional menu that

[1]More information on the software is available at http://www.esha.com/foodprosql

was in existence prior to the experiment. The control menu did not provide any information on an item's caloric content. The menu contained a brief description of each item and had the item's price. In the first manipulation, which we call the calorie only menu treatment, diners were given menus that had caloric information in parentheses immediately preceding each item's price. Other than this change, the menu was exactly the same as the control menu. In the second manipulation, which we refer to as the symbolic or calorie+traffic light menu treatment, diners were given menus with caloric information in parentheses immediately preceding each item's price plus a "traffic light" symbol that was red for items with more than 800 calories, yellow for items between 401 and 800 calories, and green for items with 400 calories or less. Caloric category cutoff points were selected so that each color was well represented on the menu. Aside from the addition of the traffic light symbols, the menu was identical to the one used in the calorie only treatment.

To be clear, all diners at a table received the same menu. However, each table was assigned to a menu treatment, and parties were randomly assigned to a table upon entering the restaurant. Thus, at any given time all three menus were in use in the restaurant. The strength of this experimental design strategy is that differences in ordering patterns across menu treatments cannot be attributed to changes in menu preferences over time (such as changes across seasons from Summer to Winter or from changes from Monday to Friday). A potential weakness of the design is that repeat customers to the restaurant may be assigned to a different menu treatment on a subsequent visit. A diner previously assigned to the traffic light menu may remember the information and utilize it if later assigned to the control menu. Such an effect would cause differences across treatments to diminish over time. This is an issue we control for in the data analysis.

The experiment ran a total of 19 weeks. After the 12th week, we manipulated the prices of selected menu items on all three menus. Items were selected based on how frequently they were ordered; those which were ordered most regularly were ideal candidates for the price manipulation. Table 1.1 outlines the specific menu items chosen for the price manipulation, their caloric contents, and the magnitude of their price changes. As shown in table 1.1, we see a "fat tax" was imposed on four high-calorie (red light) menu items, while a "thin subsidy" was imposed on three lower-calorie (green or yellow light) menu items. Most price changes ranged from 10-13% of the item's initial price; a constant percentage increase/decrease was not utilized in an effort to maintain the restaurant's pricing format (whole or half dollar pricing). Two high-calorie items (the West Coast Cheese Burger and the Cowboy Combo), however, were assigned much larger price changes (17% and 23% price increases, respectively) relative to the other options. These items were especially high in calories; thus, they were taxed more heavily.

The purpose of the price manipulation was twofold. First, we wanted to directly compare how caloric intake changed as a result of menu labels as compared to a calorie tax/subsidy. Secondly, in the structural demand model described in the next section, we wanted to ensure that the marginal utility of price could be clearly identified and as we describe momentarily, the price manipulation helps ensure the price effect is not confounded with unobserved quality effects.

IV. Model and Data Analysis

Our analysis is based on a random utility model constructed to explain the choice of main entrée. Diner i's utility from menu option j at time t is assumed to depend on the attributes of the menu choice option (e.g., price, caloric content) and a stochastic error term representing individual idiosyncrasies unobservable to the analyst. For an individual randomly assigned to menu type *m* (*m* = no label, calorie only label, calorie+traffic light label), the random utility function is:

(1) $U_{itj}^{m} = V_{itj}^{m} + \varepsilon_{itj}^{m}$

For the basic model we consider, the systematic portion of the utility function is:

(2) $$V_{itj}^{m} = \alpha Price_{itj} + \beta_1^m cal_j + \beta_2^m salad_j + \beta_3^m burger_j + \beta_4^m combo_j + \beta_5^m pasta_j + \beta_6^m veggie_j + \beta_7^m steakprime_j + \beta_8^m steakchoice_j,$$

where $Price_{itj}$ is the price of menu item *j* faced by individual *i* at time *t*, cal_j is the number of calories in menu item *j*, and the remaining variables are self-explanatory dummy variables describing *j*'s food type. The food-type dummy variables coincide with the major section headings on the menu. The marginal (dis)utility of price, α, does not have a menu superscript, *m*. This is an economic restriction we impose on the analysis which permits the calculation of welfare effects resulting from changes in menu label format. Without this restriction, one cannot calculate the monetary tradeoff needed to equate utility in two different menu treatments.

Equation (2) posits that consumers' utility for a menu item is affected by the item's calories. Colby, Elder, and Peterson (1987) found that consumers overwhelmingly consider a menu item's taste to be its most important attribute. Additionally, Horgen and Brownell (2002) suggest consumers may believe "healthy" menu items sacrifice taste, and thus, may choose less "healthy" options. For these reasons, we hypothesize that without any nutritional information, utility will be increasing with calories (i.e., $\beta_1^{no\ info} > 0$).

When calorie information is present, the marginal utility of calories may change. Numerous studies in the nutrition literature have shown people tend to underestimate the number of calories in the foods they consume (see Burton et al., 2006; Chandon and Wansink, 2007), so when consumers learn (via nutritional information) they are eating more calories than they believed, feelings of guilt or disappointment may arise from overeating, and their utility from that food choice may fall. Alternatively, the provision of nutrition information may reduce the bias in estimates of caloric intake, so simply being more aware of the nutritional content of one's food could also decrease utility. Whatever the reason, we expect the marginal utility of caloric intake will fall in the calorie only and calorie+traffic light treatments relative to the control.

If the error terms in equation (1) are distributed iid type I extreme value, McFadden (1974) shows that out of a set of *J* alternatives, the probability of alternative *j* being chosen is the familiar multinomial logit model:

$$(3) \qquad P_{itj}^{m} = \text{Prob}(\text{option } j \text{ is chosen}) = \frac{e^{V_{itj}^{m}}}{\sum_{k=1}^{J} e^{V_{itk}^{m}}}$$

Despite allowing all the non-price parameters to vary by menu treatment, equation (2) is a rather simplistic utility specification. Several alternative specifications were considered but none proved to significantly improve model fit. For example, because the experiment ran 19 weeks, it is possible that some diners were returning guests who might have become desensitized to the new menu labels. If this were the case, one would expect the effect of menu labeling to dissipate over time. However, when equation (2) is modified to include a time trend variable interacted with the attributes, none of the time-attribute interactions were statistically significant, and as a result we omitted them from the model.

Another potentially restrictive assumption of the multinomial logit is that the error term, ε_{itj}^{m}, is assumed independently and identically distributed across individuals and alternatives. However, some menu alternatives (or people) might share unobserved similarities which cause their errors to be correlated. To address this issue, we estimated error-component models. In this model, alternative-specific random effects were added in which it was assumed that items in the same sub-section of the menu shared a common error component. In such specifications, however, the estimated standard deviation of the random effects were not statistically different from zero, and this was true for specifications in which we assumed a menu-day random effect, day-only random effect, or no panel structure at all. A similarly motivated nested-logit specification, which assumes menu items within a nest (but not across nests) exhibit similar substitution patterns, did not significantly improve model fit either. As a result, the ultimate analysis rests on the conventional multinomial logit specification. We also tested for differences in error variance across menu treatments following Swait and Louviere (1993), but found no evidence of heteroskedasticity. Finally, likelihood ratio tests could not reject the null hypothesis that $\beta_k^{no\ label} = \beta_k^{calorie\ only} = \beta_k^{traffic\ light}$ for all $k > 1$, meaning that the calorie labels only influenced the marginal utility of calories but not the marginal utilities associated with food-type.

One final model specification issue which had a substantive impact on results relates to the potential for unobserved, alternative-specific quality attributes to correlate with the alternative's price leading to a biased estimate α (see Berry, Levinsohn, and Pakes, 1995 and Nevo, 2001). Petrin and Train (2010) suggested a relatively straightforward method to account for this type of endogeneity problem assuming one is in possession of a good instrument for price. A good instrument should be highly correlated with price but uncorrelated with the unobserved quality of the menu item. Fortunately, our experimental design was constructed to yield precisely such an instrument.

Let d_{1j} be a dummy variable indicating items for which we increased prices (and d_{2j} those for which we decreased prices) after the experimental price manipulation, and let t be a dummy variable indicating those observations obtained after the experimental price manipulation. The interaction between these variables, $d_{1j}*t$ and $d_{2j}*t$, are valid instruments for $Price_{itj}$ because they are clearly correlated with price but, by construction, they are not characteristics of the choice alternatives. The choice alternatives did not change over time, and so assuming that the marginal utilities of product characteristics (both observed and unobserved) do not change over time, the instrument is orthogonal to the error term.

Following Petrin and Train (2010), we regressed $Price_{itj}$ against the two instruments, $d_{1j}*t$, $d_{2j}*t$, the dummy variables d_{1j} and d_{2j}, and all the non-price attributes in equation (2). Letting e_{itj} be the error term from this regression, Petrin and Train (2010) show that an unbiased estimate of the price effect can be obtained by replacing equation (2) with:

(4) $$\tilde{V}_{itj}^{m} = \tilde{\alpha}Price_{itj} + \tilde{\beta}_1^{m}cal_j + \tilde{\beta}_2\ salad_j + \tilde{\beta}_3\ burger_j + \tilde{\beta}_4\ combo_j + \tilde{\beta}_5\ pasta_j + \tilde{\beta}_6\ veggie_j + \tilde{\beta}_7\ steakprime_j + \tilde{\beta}_8\ steakchoice_j + \lambda e_{itj}$$

This so-called control function approach produces unbiased estimates, but the conventional standard errors are incorrect. As a result, we used bootstrapping to obtain the standard errors.

Once the parameter estimates are obtained, expected caloric intake and restaurant net returns over food and preparation costs for menu type *m* can be calculated as:

(5) $$E[calories]^m = \sum_{j=1}^{J} \tilde{P}_j^m\ cal_j$$

and

(6) $$E[net\ returns]^m = \sum_{j=1}^{J} \tilde{P}_j^m\ Markup_j,$$

where $\tilde{P}_j^m$ is the probability of choosing menu item *j* given menu type *m*, which is obtained by substituting the utility specification in equation (4) into equation (3). $Markup_j$ represents the mark-up, or margin, for each menu item *j*, which provides the net returns for each menu item above its food and preparation costs. Mark-up values were provided by the restaurant's management team. In addition to studying the calorie and net return impacts of different menus, the effects of a "fat tax" or "thin subsidy" on caloric intake and net returns can also be simulated by changing the prices of certain menu items and re-calculating (5) and (6) at the altered probabilities of choice. For this application, we considered a “fat tax” in which the prices of all items more than 800 calories (i.e., the “red” items on the traffic light menu) were increased 10%, and also a “thin subsidy” in which the prices of all items less than 400 calories (i.e., the “green” items on the traffic light menu) were decreased 10%.

In addition to these calorie and net return changes, it is also useful to consider individuals’ willingness-to-pay for different menu items. The utility coefficients given in equation (4) can readily be used in this regard. For example, an individual’s willingness-to-pay for a prime steak instead of a salad is just the price difference between the two options that would generate the same level of utility: $\left[\left(\tilde{\beta}_7 + \tilde{\beta}_1^m cal_{prime\ steak}\right) - \left(\tilde{\beta}_2 + \tilde{\beta}_1^m cal_{salad}\right)\right] / -\alpha$.

A calculation more relevant to the policy debate, however, is the value of information or the welfare change resulting from a move from the conventional menus to the menus containing caloric information. One challenge with such a calculation is that the mandatory labeling policy does not actually change the underlying quality of the product. The labels simply serve to provide information to diners about the choices they actually face. Foster and Just (1998) introduced a method to measure welfare changes in situations such as this; an approach that was extended to random utility models by Leggett (2002).

In this framework, consumers are assumed to make choices based on their (potentially incorrect) *perceptions* of quality, but the utility they ultimately experience is determined by *actual* quality. Foster and Just (1998) argue that a “cost of ignorance” can be determined by calculating the welfare loss that would result if consumers gained new information (making perceived quality equal actual quality) but were constrained to make the same choices as they did before information. The value of information is negative one times the cost of ignorance.

In the discrete choice framework, Leggett (2002) showed that the appropriate welfare measure in this framework is:

$$(7) \qquad \left[\frac{\ln\left(\sum_{j=1}^{J} e^{\tilde{V}_{ij}^{calorie\ label}}\right) - \ln\left(\sum_{j=1}^{J} e^{\tilde{V}_{ij}^{no\ label}}\right)}{-\alpha}\right] - \left[\frac{\sum_{j=1}^{J} \tilde{P}_{k}^{no\ label}(\tilde{V}_{ij}^{calorie\ label} - \tilde{V}_{ij}^{no\ label})}{-\alpha}\right].$$

The first term in brackets is the conventional welfare calculation except that the utility in the no label world, $\tilde{V}_{ij}^{no\ label}$, is based on consumers' *perceptions* of caloric intake. This is the value Leggett (2002) refers to as the anticipated utility change. In our case, this change might very well be negative if consumers tend to under-estimate the number of calories consumed prior to labels (Chandon and Wansink, 2007). This anticipated change, however, is based on incorrect perceptions of quality in the pre-label environment. The second term in brackets captures the value of the adjustment in perceptions as they approach true quality in the post-label environment. It captures the cost of ignorance resulting from diners making a different set of choices than they would have with better information. The standard errors associated with the welfare effects of the label change are determined using the aforementioned bootstrapped utility parameters.

V. Results

Daily lunch receipts collected over a 19-week period yielded 1,532 usable observations. The focal unit of analysis for each observation was the main entrée choice. Recall restaurant patrons received one of three menus upon being seated: a menu with no nutritional information, a menu with calorie information only (numeric calorie label) for each item, or a menu with calorie information plus a traffic light symbol (symbolic calorie label) for each item.

Using the raw data, we compared how frequently each item was ordered under each menu treatment to determine whether calorie labels influence food choice. For illustrative purposes, figure 1.1 shows how often three menu items were ordered. The three items were chosen to represent a low, medium, or high-calorie menu option. Per the figure, we see that the Signature Cheese Burger (a high-calorie, red light, item) made up the greatest proportion of meals ordered, 5.1%, under the control menu where no calorie label was provided. Conversely, this item only composed 3.6% of total items ordered when diners had the symbolic calorie (calorie+traffic light) menu. The six ounce sirloin (a low-calorie, green light item), on the other hand, was especially popular in the symbolic calorie label treatment, comprising 5.3% of total meals ordered. In the case of the West Coast Rancher (a medium-calorie, yellow light item), it was frequently ordered in all three menu treatments, but accounted for the largest share of total meals ordered (10.2%) when the numeric calorie label was present.

Looking at the order frequency of individual menu items across treatments offers some insight on whether calorie labels influence food choice. However, with 51 menu items to choose from, we recognize some items will be ordered far more often than others, and some items may not be ordered at all (i.e., a $50 steak). Thus, figure 1.2 reports how frequently low, medium, and high-calorie items were ordered across menu treatments. From figure 1.2, it can be seen that low-calorie items, those with 400 calories or less, were ordered most often in the symbolic calorie label treatment (38.8% of all meals ordered) and least often in the no calorie label treatment (29.9% of all meals ordered). High-calorie items, those with more than 800 calories, were just the opposite. These items were selected most when no calorie label was present and least when the symbolic calorie label was present, representing 34.5% and 28.1% of all meals ordered, respectively. Medium-calorie items, those with 401-800 calories, were chosen at least one-third of the time in each of the menu treatments, and were most popular in the numeric calorie label treatment, accounting for 38.4% of all meals ordered. From figure 1.2, we can conclude that calorie labels resulted in significantly more low and medium-calorie items ordered compared to high-calorie items (p-value=0.01). The presence of either a numeric or symbolic calorie label reduced the proportion of high-calorie items chosen by 4.4% or 6.4%, respectively.

Structural Demand Estimates

While many previous studies have solely focused on analyzing the number of calories ordered/consumed, we estimated a structural demand model which allows us to estimate the welfare effects resulting from menu labeling changes and to simulate outcomes in alternative policy scenarios. Table 1.2 presents two sets of multinomial logit (MNL) estimates: the conventional model and the model corrected using the control function approach (Petrin and Train 2010) to resolve the potential price endogeneity issues.

The most notable difference between the two sets of estimates is the magnitude of the price coefficient. Under the conventional model, a one dollar increase in an item's price is projected to decrease utility by 0.0285 units; however, in the corrected model, a one dollar price increase results in a 0.1286 unit decrease in utility. Further, the control function approach yielded a more reasonable and intuitive coefficients for other attributes. Consider the estimates for prime and choice steaks. Under the conventional MNL estimates, the marginal utility of a prime (choice) steak was negative (positive) relative to the utility derived from the daily special. Holding all else constant, these estimates suggest individuals would be happier with a choice steak rather than a prime steak, a result which is inconsistent with the fact that prime steaks are of higher quality and are almost universally higher priced. The corrected MNL estimates depict a more likely story, as both the prime and choice steak coefficients were positive, and the prime steak coefficient was greater than that of the choice steak, meaning people would, holding all else constant, choose a prime over a choice steak.

Focusing on the corrected MNL estimates, we see that restaurant patrons had a positive marginal utility of calories, such that for every additional calorie a menu item has, an individual's utility increases by 0.0005 units. Based on previous research, this result is expected as people often link calories to taste, implying the more calories an item has, the better it tastes and the happier the consumer (Horgen and Brownell 2002).

When calories were interacted with menu type, however, we found the marginal utility of calories fell. More specifically, the interactions between calories and the calorie-only (numeric calorie label) and the calorie+traffic light (symbolic calorie label) menus show that the marginal utility of calories fell 0.0003 and 0.0006, respectively, relative to the control menu. Only the later effect, however, was statistically significant. That is, the numeric presentation of calorie information only (as mandated by the forthcoming law) was not significantly different from the control menu. Symbolic presentation of calorie information significantly lowered the marginal utility of information.

Because the model was estimated by interacting the treatment dummy variables with the calorie effect, the reported calorie effect shows the marginal utility of calories in the control menu and the coefficients on the interactions show the additional effects over and above the control. Thus, the marginal utility of calories was: 0.0005 for the control menu with no calorie label, 0.0005-0.003=0.0002 for the menu with the numeric calorie label, and 0.005-0.0006= -0.0001 for the menu with the symbolic calorie label.

The estimates also indicate that some menu categories are more preferred than others. For instance, the coefficients for salads, pasta, and vegetarian items were all significantly negative, implying diners would be happier eating the daily special over items from these categories holding all else constant. Of these categories, diners least preferred to order salads as this category had a marginal utility of -2.0356. Burgers, combo meals, and prime and choice steaks, conversely, were preferred to the daily special.

A key advantage of estimating a structural choice model over analyzing raw data is the ability to quantify how much people are willing to pay for certain menu items. For instance, an individual's willingness-to-pay for a prime steak with 1,000 calories over a salad with 300 calories is calculated as: $\left[\left(\tilde{\beta}_7 + \tilde{\beta}_1^m cal_{prime\ steak}\right) - \left(\tilde{\beta}_2 + \tilde{\beta}_1^m cal_{salad}\right)\right]/-\alpha$. Inserting the appropriate estimates, we find that, when no calorie label is present, an individual was willing to pay $\frac{[(2.2362+0.0005*1000)-(-2.0356+0.0005*300)]}{--0.1286} = \$35.94$ for the prime steak over the salad—an estimate that is well within the price variation present on the menu. Figure 1.3 illustrates this willingness-to-pay difference between steaks and salads for the three menu treatments. Notice the willingness-to-pay decreased by \$1.62 and \$3.26 for the numeric and symbolic calorie labels, respectively, relative to the control. This can be attributed to the fact that the marginal utility of calories falls in the calorie only and symbolic treatments.

Similarly, we can calculate a person's willingness-to-pay for an item as its caloric content changes. Figure 1.4 displays how the willingness-to-pay for a hypothetical burger over the daily special changes as the number of calories in the hypothetical burger increases. When no calorie label was present, willingness-to-pay increases as the calorie content of the burger increases. We observed a similar relationship with the numeric calorie label, except that willingness-to-pay increased at a much slower rate. On the contrary, when the symbolic calorie label was present, a negative relationship existed between willingness-to-pay and calories. In fact, at some point, a burger could have so many calories that the burger would have to be sold at a discount relative to the daily special to induce customers to order it.

Simulated Impacts on Calories and Net Returns

Federal legislative efforts have focused on information or labeling policies to combat rising obesity rates, yet other policy instruments such as pricing policies (i.e., “fat taxes” or “thin subsidies”) may be effective at achieving the same desired outcome.

Using the estimated model, we calculated the expected caloric intake and restaurant net returns (over food and preparation costs) per diner for four possible policy options: a numeric calorie label, a symbolic calorie label, a “fat tax,” and a “thin subsidy” based on equations (5) and (6). Recall for the “fat tax” that items with more than 800 calories (high-calorie or red light items) received a 10% price increase. Likewise, for the “thin subsidy,” items with 400 calories or less (low-calorie or green light items) were subject to a 10% price reduction. We use the term “fat tax” loosely as the policy simulated taxes calories, not fat or fatness.

Table 1.3 reveals the expected caloric intake for each policy option. Notice the expected intake was 641.03 calories at the status quo (no calorie labels, no calorie taxes/subsidies). Comparing information and pricing policies, table 3 shows that the information policies outperformed either pricing policy in terms of reducing caloric intake, with the numeric and symbolic calorie labels reducing intake by 27.43 and 55.62 calories, respectively. Only the symbolic label reduction was significantly different from zero at the 5% level, however. The 10% “thin subsidy” and “fat tax “only decreased caloric intake by 11.51 and 21.98 calories, respectively, neither of which was statistically different from zero. Clearly the symbolic calorie label (calorie+traffic light symbol) produced the greatest decrease in caloric intake, indicating that adding traffic light symbols to menus could enhance the effectiveness of the numeric calorie label currently being proposed.

Symbolic calorie labels may outperform the other policy options considered here in terms of influencing consumers to make lower-calorie choices; however, it is also important to consider the effect on restaurant net returns above food and preparation costs. Table 1.4 provides the simulated net return impacts for each policy option. If no information or pricing policy were enacted, the expected restaurant net return (over food and preparation costs) was $6.94/person/meal. Mandating a numeric or symbolic calorie label would reduce the expected net returns by $0.14 or $0.27, respectively, yet only the symbolic label produced a statistically significant reduction in restaurant net returns. In the case of pricing policies, a “fat tax” would actually result in a $0.16 (statistically insignificant) increase in restaurant net returns, but a “thin subsidy” would cause the largest ($0.34) decrease in net returns, which was statistically different from zero.

Striking a balance between consumer health and restaurant profitability will likely be challenging. While policymakers may want to mandate symbolic calorie labels because they produce the largest intake reductions (55.62 calories/meal), restaurants are likely to oppose this particular label because it also leads to significant reductions in net returns over food and preparation costs ($0.27/meal). Restaurants might instead promote the use of a “fat tax” because it does not negatively impact their net returns, yet policymakers may not be willing to trade the additional 33.64 calorie reduction which could be achieved via symbolic calorie labels. Ultimately, legislators will be forced to make a tradeoff, and our results suggest restaurants are likely to be on the losing end. Making these tradeoffs is different when comparing different units: calories lost by consumers to dollars lost by restaurants. A cost benefit analysis is needed to translate the lost calories into a dollar-benefit; and this is the role provided by the value of information calculation.

Value of Information

Calculating the value of information for both the numeric and symbolic menus will allow us to translate the benefits of the policy measure from calories to dollars. Using equation (7), we found that the value of the numeric calorie labels was $0.03/diner/meal and the value of the symbolic calorie label was $0.13/diner/meal. Thus, if a consumer dined out 100 times in a year, the value of information present in the symbolic calorie label would be $13.00/person/year. However, table 1.5 shows that the value of information associated with both numeric and symbolic calorie labels was not statistically different from zero.

Economists often apply benefit-cost ratios to determine if a particular policy should be pursued. If the ratio is greater than one, the policy is a viable option. Here, for a symbolic calorie label, the benefit to consumers is worth $0.13 and the cost to restaurants (in lost net returns) is $0.27, yielding a benefit-cost ratio of 0.481. Numeric calorie labels share a similar result, with an even smaller benefit-cost ratio of 0.214. These ratios indicate the benefits of the information do not outweigh the costs to the restaurants, implying these policy instruments are not economically efficient.

VI. Conclusion

With American obesity and overweight rates on the rise, policymakers have decided that consumers need to be re-educated on the foods they eat, especially the meals they eat away from home. With the passage of the 2010 health care bill, chain restaurants, defined as having 20 or more outlets, will be required to provide calorie information for each item as well as a statement of the recommended daily caloric intake on all menus. Complete nutrition profiles for each item must also be available on site (FDA 2011).

The proposed legislation mandates that calorie information must be provided in a numeric format (FDA 2011); yet, to our knowledge, no other information formats have been researched or tested. With any educational program, *how* the information is presented can be just as important as which information is presented. Moreover, information or labeling policies are only one potential solution; consumers may respond just as much to price changes on menus such as “fat taxes” or “thin subsidies.” The purpose of this research was to examine a wide array of potential policy instruments to determine which performs the best at encouraging lower-calorie choices. Additionally, this research reviewed each policy instrument from a restaurant’s perspective, examining how each instrument affected restaurant net returns above food and preparation costs. Finally, our study calculated the value of information consumers receive from two different labeling systems (numeric and symbolic calorie label).

Results of this study revealed menu labeling can influence food choice. When no calorie label was present, we found a greater proportion of higher-calorie meals (more than 800 calories) ordered than when either a numeric or symbolic calorie label was utilized. Note, however, the symbolic calorie label led to greater calorie reductions (55.6 cal/meal) than the numeric calorie label (27.4 cal/meal) currently proposed by the Food and Drug Administration. Each of the labels also outperformed the pricing policies at reducing caloric intake. Still, one is left to question: Is 55 calories a substantial reduction? An individual could simply order water instead of a soft drink and decrease his/her intake by 150 calories, almost three times the reduction produced by the symbolic calorie label!

From a restaurant's point of view, the majority of policy instruments will damage its net returns (over food and preparation costs). Only a "fat tax" will not negatively affect net returns, but this option is an unlikely candidate for implementation because information policies led to greater decreases in calorie intake. Possibly even more frustrating for the restaurant community is that consumers only place a $0.13 ($0.03) per meal value on symbolic (numeric) calorie labels, yet these labels would reduce their net returns by $0.27 or $0.14 per meal, respectively. Either label leaves restaurants searching to make up for lost net returns, often accomplished by raising prices and thus, reducing consumer welfare.

Collectively, our results suggest neither information nor pricing policies are likely to produce the substantial reductions in caloric intake which policymakers would prefer to see. If an alternative is to be chosen, however, this study finds that a symbol should be required *in addition to* the number of calories on restaurant menus. For future research, a more effective course of action may be to more thoroughly examine all potential policy options (calorie labels, food taxes/subsidies, re-structuring of farm programs, etc.) in both fast-food and full-service restaurant settings. It could be the case that a symbolic calorie label works best in fast-food settings because people need to make decisions quickly, whereas another policy option may be best suited in full-service establishments where people have more time to thoughtfully consider all aspects (price, calories, and so on) of menu items. Undoubtedly, this could complicate legislation; nonetheless, a blanket policy for all restaurants may not be the most appropriate for achieving the government's goal of a healthier America.

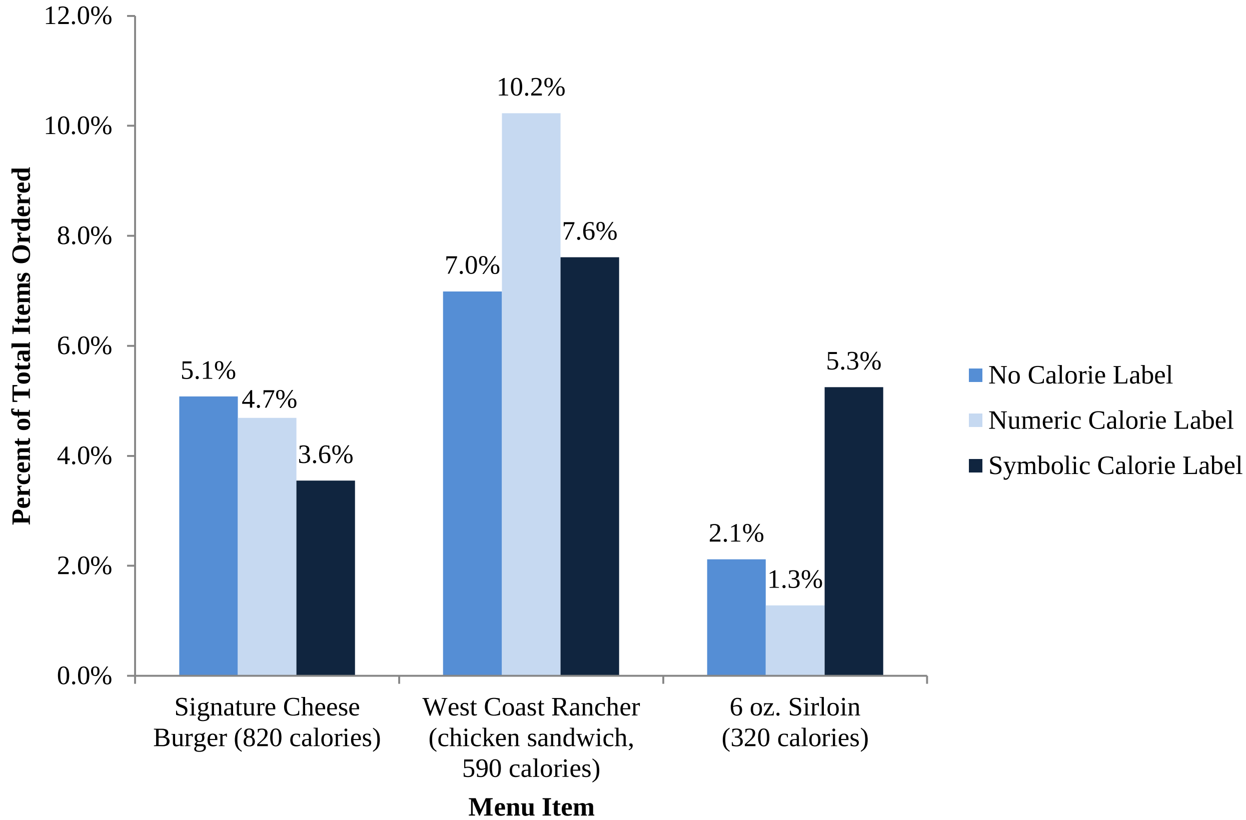

Figure 1.1 Percent of Total Meals Ordered Across Menu Types, Select Menu Items

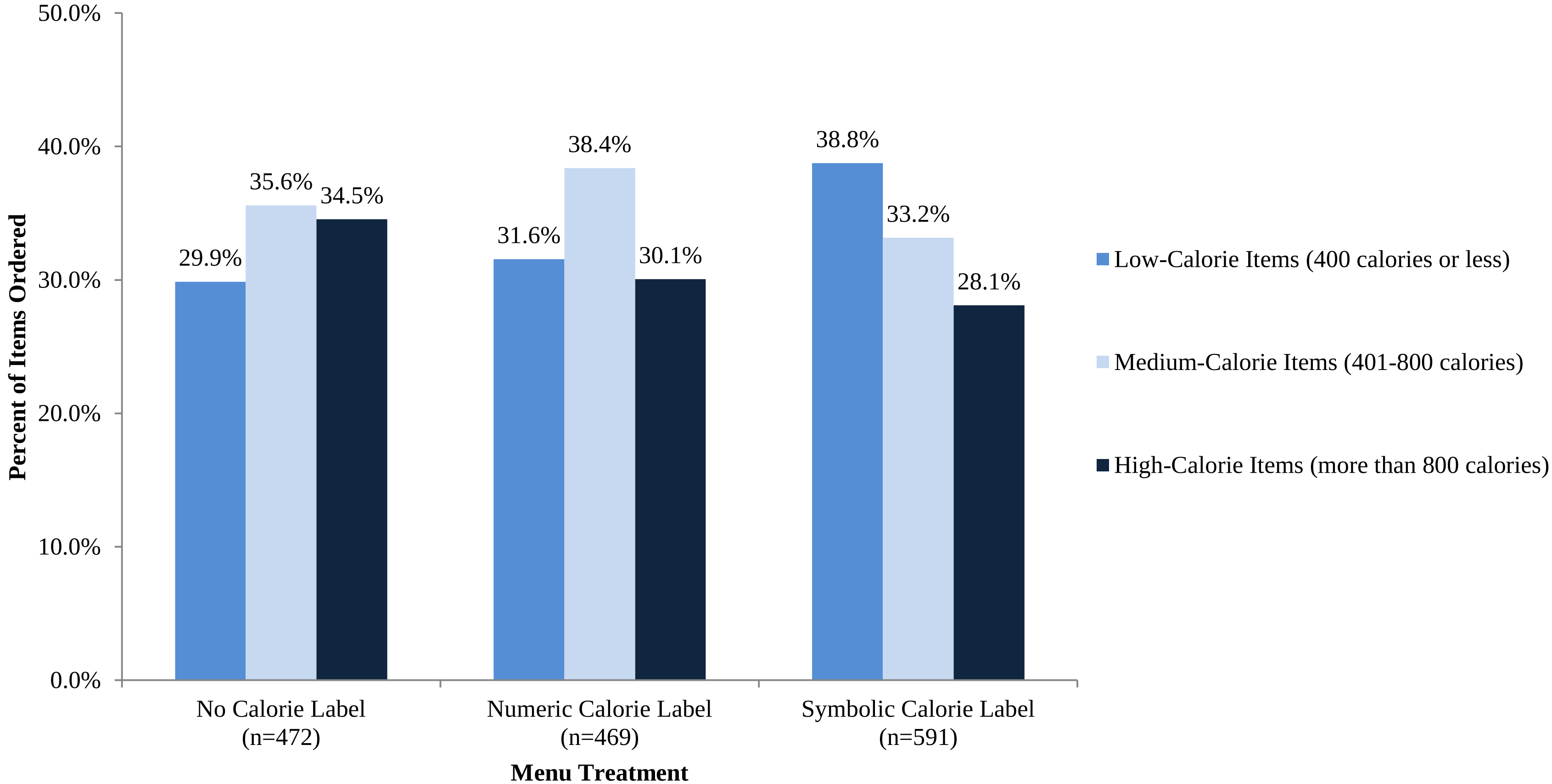

Figure 1.2 Percentage of Low, Medium, and High-Calorie Items Ordered by Menu Treatment

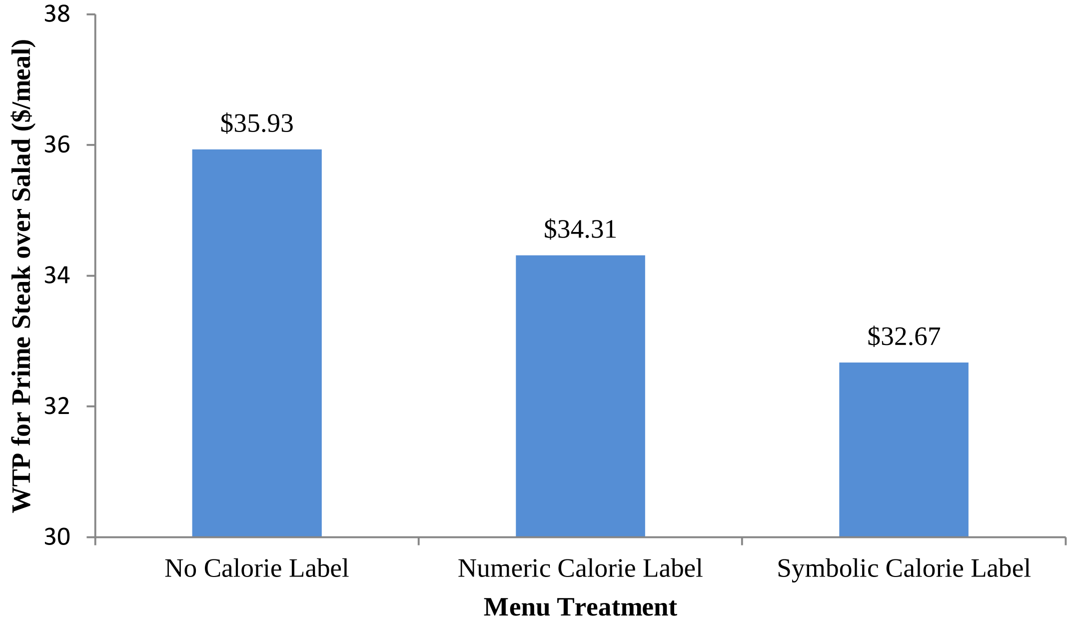

Figure 1.3 Willingness-to-pay for a Prime Steak (1,000 cal) over a Salad (300 cal) Across Menu Treatments

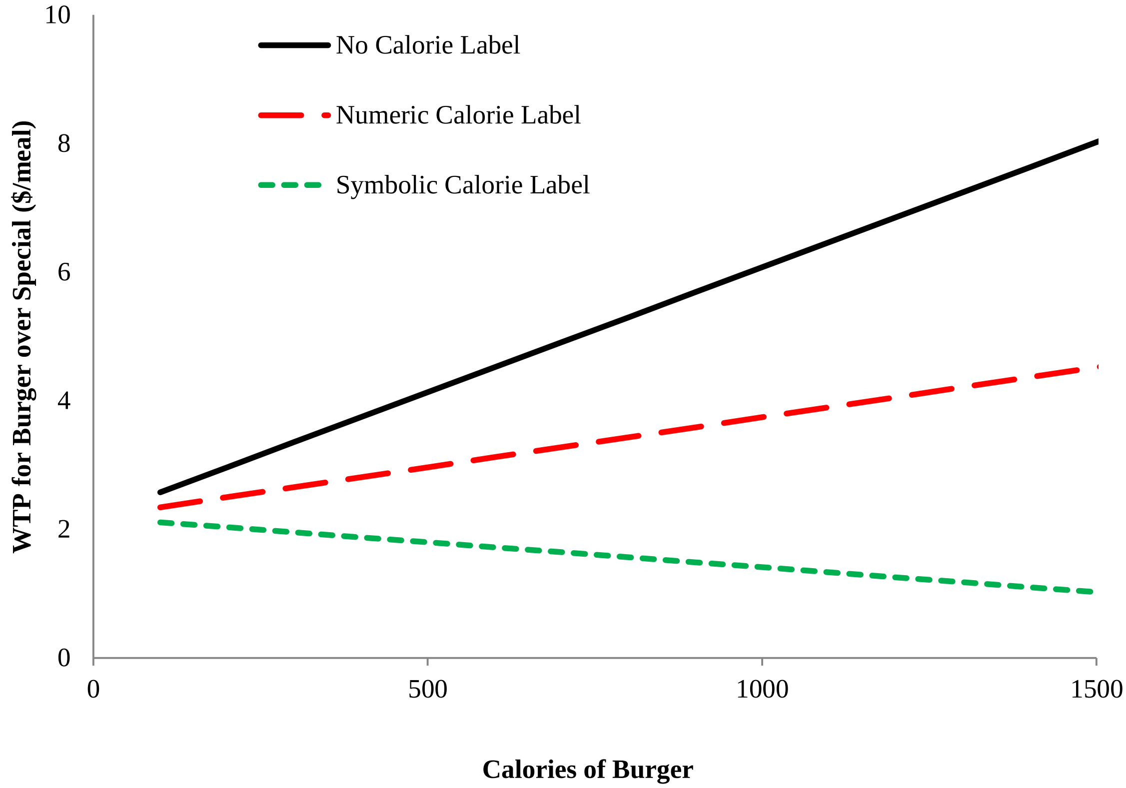

Figure 1.4 Willingness-to-pay for Burger over Daily Special across Menu Treatments

Table 1.1 Menu Items Selected for the Price Intervention

Menu Item	*Calories*	*Original Price*	*New Price*	*Percent Change*
Bacon Cheese Burger	920	8.5	9.5	+11.76%
Bleu Cheese Bacon Burger	920	8.5	9.5	+11.76%
West Coast Cheese Burger	970	8.5	10	+17.65%
West Coast Rancher Sandwich	590	9.5	8.5	-10.53%
Cowboy Combo	1185	13	16	+23.08%
Lentils	210	8	7	-12.50%
Pinchitos	280	8	7	-12.50%

Table 1.2 Multinomial Logit (MNL) Model of Menu Item Choice

Explanatory Variable	*Conventional MNL*	*Corrected MNL*[a]
Price	-0.0285***	-0.1286**
	(0.0106)[b]	(0.0627)
Calories	-0.00005	0.0005
	(0.0002)	(0.0004)
Calories*Calorie-Only Menu	-0.0003	-0.0003
	(0.0002)	(0.0002)
Calories*Calorie+Traffic Light Symbol Menu	-0.0006***	-0.0006***
	(0.0002)	(0.0002)
Salad[c]	-1.5012***	-2.0356***
	(0.1396)	(0.3567)
Burger[c]	0.7079***	0.2812
	(0.1087)	(0.3047)
Combo[c]	1.5734***	1.2504***
	(0.1106)	(0.2449)
Pasta[c]	-0.6848***	-0.9837***
	(0.1301)	(0.2452)
Veggie[c]	-0.5644***	-0.8851***
	(0.1511)	(0.2699)
Steak-Prime[c]	-0.7106**	2.2362
	(0.3371)	(1.8242)
Steak-Choice[c]	0.1588	0.8177**
	(0.1262)	(0.4086)
Residual for Menu Item Price		0.1086*
		(0.0648)
Log-likelihood	-5373	-5371
Number of Observations	1532	1532

Note: ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

[a] Corrected MNL estimates obtained using control function approach as discussed by Petrin and Train (2010).

[b] Standard errors are in parentheses. Standard errors for the corrected model were determined by bootstrapping.

[c] Effects of each menu category are relative to the daily special.

Table 1.3 Simulated Calorie Impacts

Policy Option	*E(Calories) Cal/Person/Meal*	*Change from Status Quo*
Status Quo	641.03	
	(15.11)[a]	
Numeric Calorie Label	613.6	-27.43
	(15.53)	(21.67)[a]
		[-70.24, 19.66][b]
Symbolic Calorie Label	585.41	-55.62
	(13.74)	(20.05)
		[-98.36, -20.15]
Fat Tax	619.05	-21.98
	(16.87)	(12.45)
		[-44.76, 3.22]
Thin Subsidy	629.52	-11.51
	(15.71)	(6.40)
		[-25.55, 1.34]

[a] Bootstrapped standard errors are in parentheses.

[b] 95% Confidence intervals are in brackets.

Table 1.4 Simulated Net Return (Over Food and Preparation Costs) Impacts

Policy Option	*E(Net Returns)* *$/Person/Meal*	*Change from* *Status Quo*
Status Quo	$6.94	
	($0.21)[a]	
Numeric Calorie Label	$6.80	-$0.14
	($0.19)	($0.12)[a]
		[-$0.47, $0.11][b]
Symbolic Calorie Label	$6.66	-$0.27
	($0.15)	($0.12)
		[-$0.59, -$0.11]
Fat Tax	$7.10	$0.16
	($0.23)	($0.23)
		[-$0.05, $0.50]
Thin Subsidy	$6.59	-$0.34
	($0.21)	($0.06)
		[-$0.48, -$0.24]

[a] Bootstrapped standard errors are in parentheses.

[b] 95% Confidence intervals are in brackets.

Table 1.5 Value of Information (VOI) for Calorie Labels

Calorie Label	*Mean VOI*
Symbolic Calorie Label vs. No Calorie Label	\$0.13
	(\$0.53)[a]
	[-\$0.76, \$0.77][b]
Numeric Calorie Label vs. No Calorie Label	\$0.03
	(\$1.03)
	[-\$0.20, \$0.33]

[a] Bootstrapped standard errors are in parentheses.

[b] 95% Confidence intervals are in brackets.

CHAPTER II

DO CALORIE LABELS REDUCE CALORIC INTAKE?
EVIDENCE FROM TWO FULL SERVICE RESTAURANTS

The United States has experienced a precipitous rise in the rate of obesity. In 1995, all 50 states had obesity prevalence rates of less than 20%. In 2010, however, every state had an obesity prevalence rate of *at least* 20%, with twelve states having an obesity prevalence rate of 30% or higher (CDCP, 2011). The growth in obesity rates has sparked concern among medical professionals, insurance providers, and policymakers over the cost of increased weight. Behan et al. (2010) estimated the medical costs of obesity alone were $127 billion in 2009, while the entire economic cost of obesity (including costs associated with employee absenteeism, workers' compensation claims, reduced employee productivity, etc.) was estimated at $270 billion per year in the U.S.

Given the costs of obesity, policymakers have sought ways to encourage healthier eating. One of the most recent efforts is reflected in the new mandatory calorie labeling policy for chain restaurants, which was included in the 2010 health care bill. Several cities and states had previously passed their own menu labeling policies, but this was the first federal legislation on the issue, and it aims to provide a uniform set of standards for chain restaurants across the country. The final guidelines have not been released by the Food and Drug Administration

(FDA), but it is expected that restaurants with 20 or more outlets will be required to provide calorie information for all items on all menus and food tags, have full nutrition profiles for all menu items available on site, and provide a statement of the recommended daily caloric intake, 2,000 calories/day (FDA, 2011).

The recent spike in menu labeling laws has incited a growing stream of research studying the effectiveness of calorie labels on restaurant menus. Thus far, much of the research has utilized an event-study approach. They study the mean pre- and post- caloric intake after a one-time labeling intervention. Despite the commonalities in experimental design and labeling format, the results across studies have been quite mixed. Some studies conclude the calorie labels fulfill their intended purpose by reducing caloric intake (see Milich, Anderson, and Mills, 1976; Bollinger, Leslie, and Sorensen, 2011; Pulos and Leng, 2010; Roberto et al., 2010; Wisdom, Downs, and Loewenstein, 2010), while others find the label has virtually no effect on eating behavior (see Mayer et al., 1987; Harnack et al., 2008; Elbel et al., 2009; Finkelstein et al., 2011). It should be noted that, even among studies finding an effect, the impact of the label is often marginal. For example, Bollinger, Leslie, and Sorensen (2011) and Pulos and Leng (2010) each find that calorie labels only lead to a 15-calorie reduction, on average.

In this study, we contribute to the current body of labeling literature by examining: (1) alternative experimental designs, (2) alternative labeling formats, and (3) the effects of menu labels on consumers *and* restaurants. First, consider the traditional one-time labeling intervention. While this design is likely the most intuitive and easiest to implement, it does have some potential drawbacks. Particularly, a one-time intervention cannot always account for changes in preferences over time. For example, a researcher may decide to implement his/her labeling intervention in late September, at the end of summer and beginning of fall when different vegetable offerings are making their way onto the table. While the changes in eating behavior pre- and post-intervention may be due to the addition of the menu label, there is also a possibility that the changes could be attributed to differences in preferences in summer and fall. One way to address this weakness is by employing an experimental design where the control and intervention conditions are examined simultaneously. In other words, some consumers receive a control menu with no nutritional information while others receive a menu with nutritional information provided for all menu items. It is important to note this design is also subject to criticism, as repeat diners may receive a different menu treatment on subsequent visits. This study implements both types of labeling interventions to obtain a more complete picture of the effectiveness of calorie labels in full service restaurants.

In terms of menu labeling format, the current literature has narrowly employed a numeric calorie label where the number of calories is listed by each menu item. The predominant use of this label is not surprising given the specifications set by early labeling legislation pieces (see CSPI, 2009 for local/state labeling laws under consideration before the federal legislation). However, it leaves one to question whether this is the best labeling format to influence consumer behavior. Berning, Chouinard, and McCluskey (2008) found that some groups of grocery store shoppers may be more responsive to what they describe as a summary label format (a star rating system) as opposed to a detailed label format revealing information about specific nutrients. Interestingly, though, alternative labeling formats have not been examined within the restaurant context. In this study, we compare the effectiveness of two labels at reducing caloric intake in full service restaurants: (1) the traditional numeric calorie label and (2) a symbolic calorie label which provides a “traffic light” symbol (used to indicate calorie ranges for each menu item) *in addition to* the number of calorie for each item.

Finally, this study adds to the literature because it explores how menu labels affect both consumers and restaurants. The intent of the federal labeling legislation is to create a healthier America. While health is undoubtedly important, a full accounting of the policy impacts must also evaluate the financial impacts on restaurants. To date, only Bollinger, Leslie, and Sorensen (2011) have considered how restaurants may be affected by menu labels. While the authors conclude profit was unchanged after the provision of caloric information, it is worth noting that this study examined calorie labels in Starbucks, a restaurant whose sales are dominated by beverages rather than foods. Conversely, our study focuses on how menu labels affect more traditional full service restaurants, where food dishes are the primary source of revenue rather than beverages.

The overall purpose of this research is to take a broader approach at studying the impacts of menu labels in full service restaurants. Using data from two field experiments in two different restaurants (each employing different experimental designs and labeling formats), we determine the effectiveness of numeric and symbolic calorie labels at reducing caloric intake and ask how restaurants' sales revenues are influenced by the implementation of menu labels.

In the next section, we describe our methods and findings from our first experiment in Restaurant 1. Next we discuss the differences in design between Restaurants 1 and 2 and follow with the methods and results obtained from our field experiment in Restaurant 2. The paper concludes with an overall discussion of the results and potential implications of this study.

Field Experiment 1: Effect of One-Time Numeric Calorie Intervention

Our first experiment study uses an event-study approach to investigate the effect of introducing numeric calorie labels in a full service restaurant on the number of calories ordered and on restaurant revenue.

Methods

Daily lunch receipts were collected from September through November, 2010, at Restaurant 1, a full service, sit-down restaurant located on the Oklahoma State University campus at Stillwater, Oklahoma. Restaurant 1 serves faculty, staff, students, and off-campus patrons. The restaurant had never previously been used for research purposes, making it unlikely diners would have any expectation of being part of a research study.

Throughout the data collection period, the restaurant offered 32 menu options. The average menu item price was $9.19, with the least and most expensive items priced at $4.00 and $14.00, respectively. The average number of calories per menu item was 387 calories, with the lowest and highest calorie options containing 120 and 660 calories, respectively. Caloric contents were obtained using The Food Processor nutrition analysis software. The head chef entered recipes for each menu option to generate the most accurate calorie counts. Although we were in possession of a complete nutrition facts panel for each menu item, we only utilize the number of calories, as this is the information being mandated in the new menu labeling law.

In Restaurant 1, we utilized the traditional approach used in prior studies on the issue, a one-time labeling intervention. The original menu contained each item's name, with a brief description and item price below the name. For the first six weeks (pre-intervention period), we collected receipts and examined food choices under the original menu format. Then, in the seventh week, we changed the existing menu by including the calorie counts of each menu item next to the item's name (item descriptions and prices remained beneath item names). We kept the calorie labels in place for the remainder of the experiment (weeks 7-14). All item names, descriptions, and prices were held constant over the fourteen week experiment, so that we could isolate the effect of the calorie labels.

Data are analyzed using linear regressions, where total calories ordered per diner and total meal expenditures per diner serve as dependent variables. We initially analyze the effect of introducing the calorie label on total calories and total expenditures, but then we also add in control variables such as days of the week, a daily time trend, and the interaction between the calorie label and daily time trend.

Results

Restaurant 1 had a total of 2,150 patrons during the fourteen week field experiment: 824 patrons visited the restaurant during the pre-calorie label phase, while the remaining 1,326 patrons were exposed to the new menus containing calorie information for each menu item. Table 2.1 provides descriptive statistics comparing the pre- and post-calorie label groups for the main variables of interest. From the table, we can see that the label did not incite a large change in calories ordered. The pre-calorie label group ordered 622.44 calories per diner per meal (standard deviation of 194.43 calories), on average, while the post-calorie label group ordered 627.54 calories/diner/meal (standard deviation of 207 calories), on average. This result reveals the calorie label actually increased, rather than decreased, mean caloric intake, a result incongruent with the intended purpose of the labeling legislation proposed by the FDA. The difference in mean calories ordered pre- and post-label intervention is not statistically different from zero according to a t-test.

Like total calories ordered, total meal expenditures also increased after the calorie label was instituted. Under the regular restaurant menu, diners spent $14.12 per person per meal (standard deviation of $3.45), on average; however, diners exposed to the calorie label increased their expenditures by $0.26 per meal (on average), pushing total expenditures to $14.38 per person per meal (standard deviation of $3.95). Again, the differences are not statistically different.

The results from table 2.1 are reproduced in the regressions reported in table 2.2, where we single out the effect of the calorie label on total calories ordered and total meal expenditures (see model 1 under each dependent variable). Table 2.2 shows that the marginal changes in total calories and total expenditures due to the calorie label are a 5.1 calorie and $0.26 *increase*, respectively. It is important to note, however, that the calorie label coefficient is not statistically significant in either model. Mayer et al. (1987), Harnack et al. (2008), Elbel et al. (2009), and Finkelstein et al. (2011) draw similar conclusions about the (lack of) effectiveness of calorie labels on caloric intake. However, note that unlike previous studies, our findings occurred in a full service restaurant where diners sat down and had ample time to read the menus.

Building on model 1, the second specifications include indicator variables for day of the week, a daily time trend, and the interaction between the calorie label and daily trend. Under this specification, we find that the presence of the calorie label again increased total calories ordered, this time on day zero by 16.24 calories per person per meal, on average (though still not statistically different from zero). Day of the week does not appear to significantly impact total calories ordered, but the daily time trend variable was negatively related to total calories ordered

($p < 0.05$). This means that for each additional day into the field experiment, average total calories ordered decreased, on average, 2.53 calories. The interaction between the calorie label and daily trend was insignificant; so too was the linear effect of the label. In short, there is no evidence that the label intervention had any effect on the number of calories ordered.

Turning to total meal expenditures, after the introduction of control variables, we see the presence of a calorie label significantly increases total average expenditures by $1.66 per person per meal ($p < 0.01$). Coupling this finding with the fact that that the number of calories ordered was unaffected by the label suggests that the label caused diners to shift purchases to similar-calorie yet higher-priced menu items. Our study is not the first to find that revenues may be positively influenced by calorie labels. Bollinger, Leslie, and Sorensen (2011) found that calorie labels had either a neutral or positive impact on Starbucks' revenue depending on store location.

While the findings may seem somewhat counter-intuitive (i.e., that labels increase revenue but do not change the number of calories ordered), it is worth noting Restaurant 1 promotes relatively healthy eating. According to the restaurant's website, its goal is to "create well balanced healthy options for guests without losing flavor and nutrients" (OSUa, 2011). In this case, the information provided may have surprised restaurant patrons in a positive manner (i.e., "I'm eating better than I thought") and lead them to reward themselves with an appetizer or dessert, for example (Wilcox et al., 2009; Vermeer et al., 2011).

Field Experiment 2: Effect of Simultaneous Numeric and Symbolic Calorie Label Intervention

In the previous field experiment, a one-time labeling intervention approach was employed because this has been standard practice in the majority of labeling studies. However, as discussed previously, there can be a drawback of this design. Namely, this experimental approach may have difficulty separately identifying changes in consumer preferences over time. In Restaurant 1, the labeling intervention occurred in October, so patrons in the pre-calorie label treatment may order differently than patrons in the post-calorie label treatment simply due to the change in seasons. Our regression results support the notion that total calories ordered is affected by more than just menu type, as the daily trend variable was significant at the 5% level. We adjust for this potential weakness in Restaurant 2, where all labeling treatments are studied simultaneously in an event study framework.

In Restaurant 2, we also move beyond the simple numeric calorie label implemented in Restaurant 1. Although the numeric calorie labels were used in Restaurant 1 in an effort to mimic previous labeling research as well as the FDA's proposed menu labeling legislation, it is possible to imagine other presentation formats which might be more effective – especially considering our finding that the numeric labels had little to no effect. Thus, in Restaurant 2, we supplement the numeric calorie information with a traffic light symbol for each menu item to indicate a specific calorie range. The traffic light symbols should allow diners to process the nutrition information more quickly and easily and can serve as a guide for those consumers who are unaware of how many calories should be consumed on a daily basis. Using data from Restaurant 2, we can directly compare the effectiveness of the symbolic labels to the numeric-only format.

Methods

From August to October 2010, daily lunch receipts were collected from Restaurant 2, another full service, sit-down restaurant in Stillwater, Oklahoma. Restaurant 2 is upscale relative to

Restaurant 1 and boasts that it “unites western and cowboy culture with a memorable dining experience” (OSUb, 2011). Whereas Restaurant 1 places an emphasis on providing “healthy options” for diners, Restaurant 2 focuses on creating a quality dining atmosphere which includes offering rich comfort foods and steaks. Similar to Restaurant 1, Restaurant 2 is located on the Oklahoma State University campus but is frequented by residents without affiliation with the University. As with Restaurant 1, Restaurant 2 had never previously been used for research purposes, making it unlikely diners would have any expectation of being part of a research study.

Restaurant 2 offered a total of 51 menu options over the twelve-week experiment, including items such as soups and salads, burgers, pasta, and even prime steaks. Restaurant 2 offered a wide range of item prices and caloric contents. The average menu item contained approximately 580 calories, with the lowest and highest calorie options containing 50 and 1540 calories, respectively. In terms of pricing, the average item cost $15.88, with the least and most expensive items listing at $3 (cup of soup) and $58 (prime steak), respectively.

Rather than using a one-time labeling intervention, Restaurant 2 was divided into three sections, each of which was assigned to a particular menu treatment. The menu treatments varied by the type and amount of caloric information provided to restaurant patrons. The control menu treatment contained no caloric information, just each item’s name, description, and price. The numeric or calorie-only menu treatment retained all the information from the control menu and added the number of calories for each menu item. Calorie information was listed in parentheses before each item’s price. The calorie-only menu essentially replicates the post-labeling intervention menu in Restaurant 1. In the symbolic or calorie+traffic light menu treatment, diners continued to receive information regarding each item’s name, description, price, and caloric content. In addition, a green, yellow, or red traffic light symbol was added for each menu item.

The traffic lights served as indicators for different calorie ranges; green light items contained 400 calories or less, yellow light items had between 401 and 800 calories, and red light items contained more than 800 calories. Calorie ranges were designed so that each traffic light color would be well represented on the menu.

Recall that our study design in Restaurant 2 differed from Restaurant 1 in that all menu treatments were evaluated simultaneously; thus, at any given time, all three menus were in use by restaurant diners. This design presents a few challenges. First, it is imperative that diners at each table receive the same menu and that the entire table receives the correct menu treatment. To ensure this, the authors emphasized the need for consistency to restaurant staff and the lead author visited the restaurant daily to monitor the progress of the field experiment. Secondly, there is the possibility that repeat customers may utilize information they received from a prior dining experience to make a meal selection on a subsequent dining occasion, even if the information is not present during the subsequent visit. If this occurs, the impact of the labels would wear off over time. This is an issue we control for in the data analysis.

Data analysis for Restaurant 2 is conducted in virtually the same manner as Restaurant 1. Linear regressions are estimated with total calories ordered per diner and total meal expenditures per diner as dependent variables. Again, two model specifications are used for each dependent variable. The first specification only examines the effects of the two types of calorie labels on total calories and total expenditures. In the second specification, we control for variables such as days of the week, a daily time trend, and the interaction between each labeling treatment and the daily time trend.

Results

Over the twelve-week field experiment, 946 patrons visited Restaurant 2, with 302, 301, and 343 patrons assigned to the no calorie, calorie-only, and calorie+traffic light labeling treatments, respectively. From table 2.3, we can see that diners in the no calorie label treatment ordered 740.75 calories per person per meal, on average (standard deviation of 342.07 calories). This is about 120 calories greater than diners who were in the same labeling treatment (pre-labeling intervention) in Restaurant 1. For diners assigned to the calorie-only labeling treatment, we find that they ordered 708.21 calories (standard deviation of 337.25 calories), on average, which is about 32.5 calories less than the control treatment. However, the change is not statistically significant according to a t-test.

When the traffic light symbol is added to the numeric calorie information, we find the average diner ordered 672.05 calories (standard deviation of 321.04 calories), resulting in a statistically significant 68.7 calorie reduction relative to the control. Hence, the addition of the traffic light symbol to the existing calorie information doubled the effectiveness of the standard numeric label (as currently proposed).

Turning to total meal expenditures, table 2.3 reveals that, on average, Restaurant 2 diners spent $12.98 per person per meal (standard deviation of $7.06) when no nutritional information is present. When the calorie-only label was added to the menu, average total expenditures fell by $0.51 per person per meal. Total expenditures among diners with the symbolic calorie label (calorie+traffic light label) averaged $13.69 (standard deviation of $8.27), which is higher than the control but not statistically different.

Moving to the regression results in table 2.4, we see that the findings from table 2.3 are replicated in the model 1 specifications for total calories ordered and total meal expenditures.

The calorie-only and calorie+traffic light labels reduced total calories ordered by 32.5 and 68.7 calories, respectively, yet only the effect of the calorie+traffic light label is statistically different from zero ($p < 0.01$). Neither of the calorie label treatments significantly impacted total meal expenditures.

The second model specifications include indicator variables for day of the week, a daily time trend, and interactions between each menu labeling treatment and the daily time trend. In the case of total calories ordered, we see the calorie+traffic light label had a similar effect on calories ordered (approximately a 74 calorie reduction, on average); however, this reduction is no longer statistically different from zero. Curiously, the addition of the control variables dramatically changed the estimated effect of the calorie-only label. The second model specification suggests that the total calories ordered was 120 calories lower, on average, than the control; a differences which is marginally significant ($p = 0.0514$). Despite the size of this effect, it is important to note that the interaction between the calorie-only label and the daily time trend is positive, so the marginal effect of the calorie-only label is actually $\frac{\partial Total\ Calories}{\partial Calorie\text{-}Only\ Label} =$ -120.12 + 3.26*Daily Trend. Thus, the effect of the calorie-only label relative to the control at, say, day 30 was only -120.12+3.26*30 = -22.32. Figure 2.1 shows the predicted mean by labeling treatment at the beginning, middle, and end of the study (all on Tuesday). At the beginning of the study, the results show that the calorie-only treatment appears to generate fewer calories ordered than the control; however, by the end of the study the reverse is true. The 95% confidence intervals overlap at all three dates shown, indicating differences in predicted means are not statistically significant.

Diners eating on Tuesdays ordered about 61 fewer calories (on average) than diners eating on Fridays. This could be explained in part by Restaurant 2's close proximity to the

University hotel. The restaurant may receive more travelers toward the end of the week, especially Fridays. If these diners are on vacation or visiting for a University event (i.e., football game), they may be less concerned with the "healthfulness" of their food choices.

Turning to the total meal expenditures model, the results reveal no significant effects for the calorie label or time trend coefficients.

Discussion

Results from Restaurant 2 reveal a similar fate for the calorie-only label as proposed by current legislation: it is relatively ineffective. There was some weak evidence that the calorie-only label might reduce total calories ordered (as intended) in the very early part of the study, but by the end of the study there was no difference. The addition of a traffic light symbol appeared overall more effective, and at mean values it is twice as effective as numeric calorie-only labels (32.5 average calorie reduction for the calorie-only label vs. 68.7 average reduction for the calorie+traffic light label). Figure 2.1 does reveal there may be some type of learning by repeat diners as the trend for total calories ordered under the control menu is negative (though not significant). Neither labeling treatment proved to significantly impact restaurant revenue.

Conclusion

With obesity and other diet-related diseases on the rise, U.S. policymakers are focused on designing legislation to help Americans help themselves at making "healthier" (generally interpreted as lower-calorie) food choices. Since an increasing proportion of food dollars are spent away from home, restaurants are the target of current legislative efforts. In fact, the Food and Drug Administration (FDA) has currently proposed that chain restaurants (those with 20 or more outlets) will be required to provide calorie information for all menu items on all menus and menu boards along with a statement of the daily recommended caloric intake. Additional nutrition information (fat, sodium, sugar, etc.) on menu items must also be available on site per a diner's request (FDA, 2011).

The increased attention on menu labeling laws has sparked a large stream of research regarding the potential (and actual, in some cases) effectiveness of these labels. Unfortunately, many studies leave themselves open to some common weaknesses in their experimental design (i.e., participant awareness of an ongoing study); further, the current literature has solely focused on the numeric calorie label as proposed by the FDA – no study has considered an alternative (for example, symbolic) labeling format. In this study we address some of these issues by conducting two separate field experiments in full-service restaurants using different experimental designs and multiple labeling formats. This study also adds to the literature by examining how the labels affect parties beyond the consumer; namely, we study how menu labels influence total meal expenditures.

In Restaurant 1, we employed the standard experimental design commonly found in other labeling studies: a one-time labeling intervention. Here, we also used the customary numeric calorie label where the number of calories is listed next to each menu item. Results of our experiment reveal that the numeric calorie label had no effect on the number of calories ordered by diners; in fact, the average number of calories ordered actually increased (though not significantly) after the label was implemented. Like calories ordered, we also find that total meal expenditures increased after the label was implemented, a result which might help to assuage the restaurant industry's fear that the labels will negatively affect their bottom line.

Whereas Restaurant 1 followed a more traditional research design, Restaurant 2 had some distinct differences. First, the effects of the different labeling formats were evaluated simultaneously (as opposed to a pre- and post-intervention comparison). This design was used so that any changes in preferences across time (i.e., season changes, day of the week) would not be confounded with the menu treatments. Secondly, in Restaurant 2 we opted to use two menu labeling formats: (1) a numeric calorie label like the label in Restaurant 1, and (2) a symbolic calorie label where a "traffic light" symbol was used for each item *in addition to* the numeric calorie information.

Restaurant 2 results reveal that both labeling formats behaved as expected: each of the calorie labels reduced average calories ordered per diner; however, only the symbolic format was statistically significant. The symbolic calorie label outperformed its numeric counterpart, producing a calorie reduction twice as large as the numeric calorie label.

Ultimately, this study provides evidence that the numeric calorie label, as currently proposed by FDA, will have limited effectiveness at reducing caloric intake. If helping Americans curb their daily caloric intake is the goal of policymakers, their efforts may be more successful if some type of symbolic label was used in conjunction with the number of calories. Secondly, this research reveals that calorie labels do not affect revenue.

One question this study did not address is *why* traffic light symbols might be more effective than simple numeric statements at reducing caloric intake. It could be that the symbols are more easily and quickly interpreted by diners. That is, the cost of information acquisition might be lower for symbolic labels. A different interpretation, however, is that the labels go beyond information provision and send a normative statement about what the consumer *should* order. A red traffic-light, after all, is synonymous with "STOP." While many people are relatively comfortable with the federal government taking on the role of providing unbiased information to facilitate market transactions, at least some subset of the population is likely to be less enthusiastic about policies that are viewed as paternalistic. Moreover, determination of cutoffs for traffic light labels are likely to be open to political manipulation by interested parties who do not want to find themselves on the wrong side of yellow. We leave to future research some of these challenges associated with traffic light labeling.

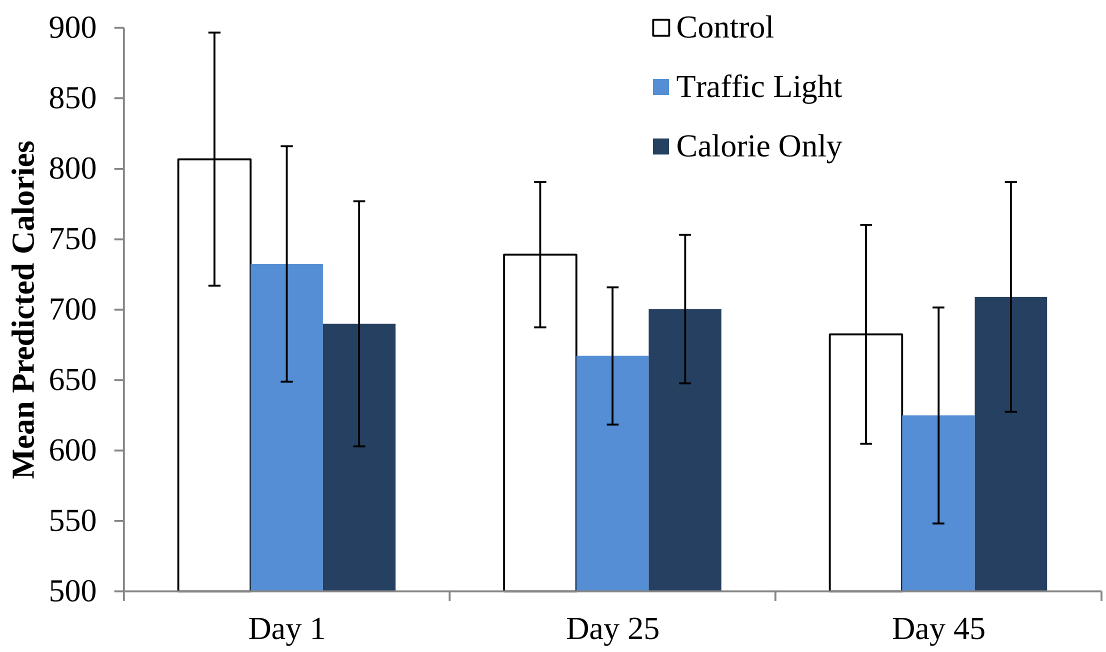

Figure 2.1 Predicted Number of Calories Ordered by Labeling Treatment and Day in Restaurant 2 (note: bars show 95% confidence intervals of predicted means)

Table 2.1 Consumption and Expenditure Statistics, Restaurant 1

Variable	Labeling Intervention	N	Mean	Std. Dev.	Minimum	25%	50%	75%	Maximum
Total Calories	Pre-Calorie Label	824	622.44	194.43	120.00	470.00	590.00	750.00	1400.00
	Post-Calorie Label	1326	627.54	207.00	120.00	450.00	595.20	770.00	1470.00
	Pooled	2150	625.58	202.24	120.00	450.00	590.00	760.00	1470.00
Total Expenditures	Pre-Calorie Label	824	$14.12	$3.45	$5.00	$12.00	$14.00	$16.00	$25.50
	Post-Calorie Label	1326	$14.38	$3.95	$5.00	$11.50	$14.00	$17.00	$33.00
	Pooled	2150	$14.28	$3.77	$5.00	$12.00	$14.00	$16.50	$33.00

Table 2.2 Linear Regression Estimates for Two Model Specifications, Restaurant 1

	Dependent Variable: Total Calories		*Dependent Variable: Total Expenditures*	
Parameter	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Intercept	622.44**	649.37**	$14.12**	$14.56**
	(7.05)[a]	(16.00)	($0.13)	($0.30)
Menu Label[b]	5.10	16.24	$0.26	$1.66**
	(0.57)	(33.85)	($0.17)	($0.63)
Tuesday[c]		-12.26		-$0.25
		(12.75)		($0.24)
Wednesday[c]		3.63		-$0.24
		(14.12)		($0.26)
Thursday[c]		13.33		$0.11
		(12.79)		($0.24)
Daily Trend		-2.53*		-$0.03
		(1.14)		($0.02)
Menu Label*Daily Trend		1.43		-$0.02
		(1.42)		($0.03)
Number of Observations	2150	2150	2150	2150

* Denotes 5% significance, ** Denotes 1% significance
[a]Numbers in parentheses are standard errors
[b]Effect of calorie labels present on menus relative to no calorie labels
[c]Effect of day of the week relative to Friday

Table 2.3 Consumption and Expenditure Statistics, Restaurant 2

Variable	Labeling Treatment	N	Mean	Std. Dev.	Minimum	25%	50%	75%	Maximum
Total Calories	Calorie+Traffic Light Label	343	672.05	321.04	50.00	370.00	620.00	890.00	1680.00
	Calorie-Only Label	301	708.21	337.25	103.00	417.00	640.00	920.00	1680.00
	No Calorie Label	302	740.75	342.07	70.00	450.00	717.50	970.00	1813.00
	Pooled	946	705.48	333.89	50.00	410.00	660.00	920.00	1813.00
Total Expenditures	Calorie+Traffic Light Label	343	$13.69	$8.27	$3.00	$9.38	$11.75	$15.00	$63.00
	Calorie-Only Label	301	$12.47	$4.83	$6.25	$9.50	$11.60	$14.00	$49.00
	No Calorie Label	302	$12.98	$7.06	$5.00	$8.54	$11.50	$14.00	$61.90
	Pooled	946	$13.07	$6.95	$3.00	$9.00	$11.54	$14.00	$63.00

Table 2.4 Linear Regression Estimates for Two Model Specifications, Restaurant 2

	Dependent Variable: Total Calories		*Dependent Variable: Total Expenditures*	
Parameter	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Intercept	740.75**	840.07**	$12.98**	$12.43**
	(19.16)[a]	(48.18)	($0.40)	($1.01)
Calorie+Traffic Light Label[b]	-68.70**	-74.44	$0.71	$2.03
	(26.28)	(59.94)	($0.54)	($1.25)
Calorie-Only Label[b]	-32.54	-120.12	-$0.51	$1.03
	(27.12)	(61.59)	($0.57)	($1.29)
Tuesday[c]		-61.27*		-$0.26
		(31.06)		($0.65)
Wednesday[c]		-30.42		-$0.72
		(29.10)		($0.61)
Thursday[c]		-15.52		-$0.58
		(30.17)		($0.63)
Daily Trend		-2.83		$0.04
		(1.52)		($0.03)
Calorie+Traffic Light Label*Daily Trend		0.10		-$0.05
		(2.10)		($0.04)
Calorie-Only Label*Daily Trend		3.26		-$0.06
		(2.15)		($0.04)
Number of Observations	946	946	946	946

* Denotes 5% significance, ** Denotes 1% significance
[a]Numbers in parentheses are standard errors
[b]Effect of calorie+traffic light and calorie-only labels relative to no calorie labels
[c]Effect of day of the week relative to Friday

CHAPTER III

LOOKING AT THE LABEL AND BEYOND: THE EFFECTS OF CALORIES LABELS, HEALTH CONSCIOUSNESS, AND DEMOGRAPHICS ON CALORIC INTAKE IN RESTAURANTS

In 1980, about 32% of food expenditures occurred outside the home. By 2010, the figure had increased to nearly 44% (ERS, 2011). Although there is a general consensus that, on average, caloric intake tends to be higher for meals consumed away from home than at home (Stewart, 2011), relatively less is known about *who* consumes fewer or greater calories away from home and how different people might respond to interventions designed to improve the healthfulness of food consumed away from home. A number of efforts have focused on providing consumers information about the foods they eat, often using nutrition labels at the point of purchase. With the rise in eating away from home, nutrition labels have become common on many restaurant menus. Research on the effects of nutrition labels in restaurant-type settings dates back to the 1970s (Milich, Anderson, and Mills, 1976). Despite the growing literature on nutrition labeling in restaurant settings since that time, there are still no definitive conclusions which can be drawn. Some studies find labeling influences food choice while others say it has no significant effect (see Harnack and French, 2008, for a review of the labeling literature).

Despite the mixed results, many people continue to advocate the menu labeling laws. The most prominent example is contained in the 2010 healthcare bill which mandates chain restaurants to provide calorie information on all menu forms (FDA, 2011). The more recent research has advanced the literature by studying the effects of menu labels in real (rather than laboratory or experimental) restaurant settings (Elbel et al., 2009; Pulos and Leng, 2010; Bollinger, Leslie, and Sorensen, 2011; Finkelstein et al., 2011; Ellison, Lusk, and Davis, 2012). Unfortunately, moving the labels into a real-world setting has not settled the debate on the effectiveness of menu labels, as these studies also generated conflicting results on whether menu labels significantly reduce caloric intake.

The lack of consensus on the effectiveness of menu labeling suggests that there may be more to the story. That previous studies have employed similar experimental designs yet reach different conclusions suggests the discrepancy may relate to differences in the types of people involved in the studies. People self-select into different types of restaurants, and it is possible that menu labels are more influential for some groups of people than others. Consider health consciousness, for example. Individuals who are highly health conscious likely possesses a large amount of health/nutrition awareness and knowledge, so the label will probably have minimal influence on their food choices because such individuals already know which foods are lower calorie. People with low health consciousness, on the other hand, may find the label provides novel information which can be used to select a lower-calorie menu item. If such a phenomenon exists, it is possible that research conducted in restaurants that attract more health conscious individuals (a trait likely correlated with income and education) would be less likely to find menu labels influential than research conducted in restaurants with less health conscious individuals.

The impact of menu labels may also vary with demographic factors, such as gender, income, age, and education. Glanz et al. (1998) found that nutrition is more important to women and older individuals; thus, these groups may be more responsive to menu labels as opposed to young males. Surprisingly, the menu labeling literature has largely neglected the impacts of demographics and attitudinal characteristics. There have been several studies on the types of people who eat at fast food restaurants (see Rydell et al., 2008 for a review), but little work has actually examined what people eat once inside the restaurant. In other words, there has been no segmentation between low-, medium-, and high-calorie diners based on demographic variables, a gap the present study aims to fill.

In this paper, we also investigate the effect of the format in which calories are displayed on menu labels. The vast majority of labeling studies have provided the number of calories for each menu item. From the literature, it is clear this type of label has limited effectiveness, which leads us to ask: is there a more effective way to convey caloric information? Ellison, Lusk, and Davis (2012) compare the effectiveness of symbolic versus numeric menu labeling and found that symbolic labeling led to lower caloric intake, on average, than numeric labeling. An open question this study aims to answer is whether symbolic information might be more influential on those consumers with limited nutrition knowledge (those who are less health conscious).

The overall purpose of this study is to gain a better understanding of restaurant patrons' choices in the face of differing nutrition labels. More specifically, we will determine which types of people are most responsive to nutrition labeling on restaurant menus by examining the relationship between caloric intake and (1) menu labeling format, (2) health consciousness, and (3) demographic factors.

Data and Experimental Design

Survey data were collected for two weeks during the 2010 Fall semester at the Rancher's Club, a restaurant on the Oklahoma State University campus. Using the experimental design of Ellison, Lusk, and Davis (2012), the restaurant was split into three sections. Each section was assigned to a unique menu treatment. All treatments listed the name, description, and price for each menu item but the caloric information differed across treatments. Diners in the control menu treatment received no nutritional information, patrons in the calorie-only menu treatment were provided the number of calories in parentheses before each item's price, and individuals in the calorie+traffic light menu treatment were presented with a green, yellow, or red traffic light symbol (indicating specific calorie ranges) in addition to the numeric caloric information preceding each item's price. Calorie ranges were chosen so that each traffic light color would be well represented on the menu. Green light options contained 400 calories or less, yellow light options had between 401 and 800 calories, and red light options consisted of more than 800 calories.

Upon completion of their meal, restaurant patrons were asked to complete a survey. Prior to this point, diners were unaware that their prior dining choices had been recorded as a part of the research study. Using the restaurant's computerized record-keeping system, we were able to match up each diner's actual choices with their survey responses. Our data set consists of the survey responses and orders of 138 diners. Summary statistics regarding the demographic composition of our sample are presented in table 3.1. Although the restaurant is open to the entire community, table 3.1 shows that a large proportion of diners who frequent this establishment are young (approximately 70% are between 18 and 35 years old) and are currently students at Oklahoma State University (63%). The relatively high proportion of students in the sample might also be attributed to the timing of the survey-portion of this study, which took place near the end of the semester when many students attempt to draw down the balance on their bursar account.

The one-page survey consisted of 15 questions, and was completed by diners in approximately five to ten minutes. Survey questions sought to learn about diners': (1) demographic characteristics, (2) levels of health consciousness, (3) frequency of and reasons for dining at the Rancher's Club, and (4) method of menu item selection (i.e., whether items were selected based on taste, price, healthfulness, etc). On the back of the survey, participants were presented a menu (matching their designated treatment) and subjects were asked three additional questions: which menu item(s) they ordered, if they ordered dessert, and what they had to drink. Figure 3.1 presents the exact survey given to participants.

One of the key variables in this analysis is health consciousness. Following Kraft and Goodell (1993) and Berning, Chouinard, and McCluskey (2008), we measured this construct by asking participants to answer three five-point Likert scale questions regarding their daily caloric intake, fat intake, and use of nutrition labels (for exact phrasing, refer to questions 8, 9, and 10 in figure 3.1). Summing the values across the three questions provides a person's level of health consciousness; scores could range from three to fifteen, with fifteen representing the most health conscious consumer. Although Berning, Chouinard, and McCluskey (2008) used nine items to measure health consciousness, we used only three questions given the need to quickly acquire the necessary information in the restaurant setting.

Model and Data Analysis

The first part of our analysis utilizes ordinary least squares (OLS) regressions to determine factors affecting diners' levels of caloric intake. In this study, we disaggregate total caloric intake into two components: (1) main entrée calories consumed from the main portion of the meal, and (2) extra calories derived from extra items consumed over the course of the meal, such as drinks, desserts, additional side items such as soup or salad which are served before the main course, etc. Many of these extra items were not listed on the menu, and in concordance with the new federal labeling law, they were thus not required to possess a menu label. The model for calorie intake type *m* (*m* = entrée calories, extra calories) by individual *i* is specified as follows:

$$(1) \qquad CI_i^m = \beta_0^m + \beta_1^m TLS_i + \beta_2^m CAL_i + \beta_3^m HC_i + \beta_4^m Female_i + \beta_5^m Student_i + \beta_6^m Bachelors_i + \beta_7^m Party_i + \gamma_1^m TLS_i * HC_i + \gamma_2^m CAL_i * HC_i + \varepsilon_i$$

where β_0 is the intercept, β_1, …, β_7 are the effects of the calorie+traffic light (TLS_i) and calorie-only (CAL_i) menu labeling formats, health consciousness (HC_i), gender ($Female_i$), status as a current student ($Student_i$), college education ($Bachelors_i$), and party size ($Party_i$) on caloric intake, γ_1 and $\gamma_2$are the effects of the interactions between each menu labeling format (calorie+traffic light and calorie-only) and health consciousness on caloric intake, and $\varepsilon_i \sim N(0, \sigma_\varepsilon^2)$ is a random error term. It is important to note age and income variables were originally included in the model, but neither significantly affected caloric intake in the entrée or extra calorie specifications. Thus, for sake of parsimony, these variables were removed from the final model as shown in equation (1), however it should be noted that the sign and significance of the remaining variables are unaffected by the inclusion or exclusion of the age and income variables.

Despite mixed results from previous studies, we hypothesize lower caloric intake among those individuals who receive menus providing nutritional information (the calorie+traffic light and calorie-only menus in this study) compared to those individuals who receive no nutritional information; i.e., we hypothesize $\beta_1 < 0$ and $\beta_2 < 0$. Research has shown consumers have a tendency to underestimate the caloric contents of their meal choices (Burton et al., 2006; Chandon and Wansink, 2007), so the nutritional label corrects the misperception and may lead to lower-calorie choices. Additionally, we expect these negative relationships to hold more strongly in the entrée calorie specification as opposed to the extra calorie specification. This is mostly due to the fact that many of the extra calorie items (i.e., drinks and desserts) are not included on the menu (and, thus, not subject to having a posted calorie label), meaning diners are less aware of their potential (un)healthfulness.

Secondly, we hypothesize a negative relationship between health consciousness and caloric intake ($\beta_3 < 0$). The more health conscious a person is (i.e., the more a person monitors his/her calorie and/or fat intake or spends time reading nutrition labels), the greater amount of nutrition knowledge/awareness the individual has, and thus, the fewer calories that individual is expected to order.

Despite the hypothesis that more health conscious individuals will consume fewer calories, we expect higher health conscious individuals to be less influenced by menu labels. Consider the case of an individual who (1) is high in health consciousness and (2) receives a menu with nutritional information. If the individual has a high level of health consciousness, he/she probably already has reasonably accurate perceptions of the calorie contents of menu items, meaning the nutritional information provided on the menu is of little value to this restaurant patron. In other words, we hypothesize a high level of health consciousness will moderate the effect of menu labeling format. Thus, we hypothesize that menu labeling format will lead to the greatest calorie reductions for those individuals who are less health conscious (i.e., we hypothesize $\gamma_1 > 0$ and $\gamma_2 > 0$).

Inspection of the data revealed large differences in the variances in caloric intake across the three menu labeling treatments, suggesting the possibility of heteroskedasticity. Test results indicated that heteroskedasticity was present in both model specifications. To correct for this, we use White's heteroskedasticity consistent standard errors.

In the second portion of our analysis, we focus on determining what types of people (male vs. female, older vs. younger, etc.) are low-, medium-, and high-calorie diners. We again consider both entrée calories ordered and extra calories ordered. However, instead of examining them as continuous variables, we segregate people into low, medium, and high categories. For the entrée calories, we used the intuitive cutoff points corresponding to our traffic light specifications. Thus, low-calorie diners were those diners who ordered 400 entrée calories or less (in other words, they ordered a green light entrée). Similarly, medium-calorie diners ordered between 401 and 800 entrée calories (a yellow light entrée), and high-calorie diners ordered more than 800 entrée calories (a red light entrée).

Defining the low, medium, and high levels of extra calories, on the other hand, was more challenging. Recall that extra calories are defined as those calories obtained from food choices beyond that of the main entrée – this could include additional side items like a soup or salad, desserts, and drinks. For our analysis, we opted to classify low-calorie diners as those people who ordered zero extra calories. These diners strictly adhered to their main entrée choice and did not supplement their meal with any additional sides or dessert. It should be pointed out that patrons ordering only a diet soft drink in addition to their entrée would still fall into the low-calorie diners as diet drinks contain zero calories. Medium-calorie diners were classified as those who ordered between one and 250 extra calories, and high-calorie diners ordered more than 250 extra calories.

Once the low-, medium-, and high-calorie categories are established for both entrée calories and extra calories, we calculated the mean values for a host of variables under each category, including gender, age, income, and education. The average levels of health consciousness are also compared across the categories of diners as well as the proportion of people who responded that taste or health was the most important characteristic when making a menu selection. A dummy variable for the menu labeling treatment to which an individual was assigned was also included to determine whether one format lead to more low (or even high) calorie diners than another. Finally, we include variables relating to whether individuals were repeat diners and their reason for visiting the restaurant (business vs. lunch with friends). Because the majority of our variables were discrete, we used Chi-squared tests to test for difference between the types of diners. Only health consciousness was continuous, so we performed an ANOVA test to determine if there was any significant difference across low-, medium- and high-calorie diners.

Results

We first compare the average number of entrée, extra, and total calories ordered across the three menu formats. Figure 3.2 reveals that, in terms of entrée calories, the calorie-only and calorie+traffic light labeling treatments resulted in lower caloric intake relative to the control menu with no caloric information. Note, however, that the calorie+traffic light menu label led to a significantly fewer entrée calories ordered (significant at $p < 0.05$ level) compared to the other two labeling formats (114 and 129 entrée calories fewer, on average, compared to the calorie-only and control menus, respectively). Turning to extra calories, diners receiving menus with nutritional information actually order *more* extra calories as opposed to those diners who receive no nutritional information (though the difference is not statistically different from zero). These results suggest that diners who receive menus with calorie labels may be experiencing a licensing effect in that ordering a lower-calorie entrée gives a diner license to order an extra side item or dessert (Wilcox et al., 2009; Vermeer et al., 2011).

Combining the entrée and extra calorie measures gives us the average total calories ordered under each menu treatment. The combined effect of the entrée and extra orders show that the calorie-only label actually increased average caloric intake compared to the control menu. The calorie+traffic light label, conversely, continued to reduces total calorie intake (by 69 and 121 calories, on average, compared to the control and calorie-only menus; however, only the latter is significant at the 5% level).

Regression Analysis

First consider the regression results for entrée calories. Table 3.2 shows that both the calorie+traffic light and calorie-only labels significantly reduce entrée calories ordered (by 496.34 and 610.69 calories, respectively), thus $\beta_1 < 0$ and $\beta_2 < 0$ as hypothesized. Based on figure 2, one might have expected the calorie+traffic light label to have a greater reduction in entrée calories than the calorie-only label; however, it is important to consider the interactions between each menu treatment and the health consciousness score when interpreting the mean effect of a menu treatment. Table 3.2 reveals that both interactions between menu treatment and health consciousness are significantly positive, indicating the effect of the labels are less pronounced for more health conscious individuals. The marginal effect of the calorie+traffic light label relative to the control is $\frac{\partial CI^{extra}}{\partial TLS}$ = -496.34 + 38.16*HC, and the marginal effect of the calorie-only label relative to the control is $\frac{\partial CI^{extra}}{\partial CAL}$ = -610.69 + 55.79*HC. For a person with the lowest level of health consciousness (HC = 3), the calorie+traffic light and calorie-only labels lead to 381.86 and 443.32 fewer calories ordered relative to the control menu, respectively. By contrast, when the level of health consciousness goes up (HC = 9), the marginal effects are only -152.90 and -108.58 for the calorie+traffic light and calorie-only labels, respectively. Thus, calorie labels lead to greater caloric reductions among the least health conscious. Comparing the two calorie labels, we find that at low levels of health consciousness, the calorie-only label leads to larger calorie reductions; however, at higher levels of health consciousness, the calorie+traffic light is more effective at reducing entrée calories, all else held constant.

Figure 3.3 illustrates this effect by plotting the predicted caloric intake as a function of HC score for the three menu treatments, while holding all other variables constant at the overall means. At low HC levels, the difference in the caloric intake between the control treatments and the other two treatments is greatest. However, at higher HC levels, the lines converge.

Table 3.2 also reveals that entrée calories are negatively related to health consciousness, such that the more health conscious a person is, the fewer entrée calories the individual orders (significant at the 1% level). Under the control menu, every one unit increase in health consciousness results in a 52.48 entrée calorie decrease, on average. However, under the calorie+traffic light and calorie-only label treatments, the effects of health consciousness are not as pronounced (in effect, the labels cause less health conscious individuals to order more similarly to the more health conscious individual). The marginal effect of health consciousness in the calorie+traffic light treatment is -52.48 + 38.16 = -14.32, so the negative relationship continues to hold but at a much lower absolute magnitude than in the control menu. In the calorie-only treatment, on the other hand, the marginal effect of health consciousness is -52.48 + 55.79 = 3.31 – effectively zero. These results suggest that the calorie-only label does not really tell the most health conscious individuals any new information; therefore, entrée calories are not further reduced under this labeling treatment. Figure 3.3 provides further evidence of this as the calorie-only line is relatively flat across all levels of health consciousness. The calorie+traffic light label, however, appears to provide a slightly different type of information – a normative rating system which suggests some menu items are better/worse than others. This new information could explain why entrée calories are further reduced in this menu condition among the more health conscious individuals.

In terms of demographics, we find that women order significantly fewer ($p < 0.05$) entrée calories compared to their male counterparts. This result aligns with the finding by Glanz et al. (1998) that nutrition is more important to women than men; thus, it is probable that women will select entrées which would be considered more nutritious (have fewer calories) than men. Student status, education, and party size proved to have no significant impact on entrée calories ordered.

Turning to the extra calories regression estimates, table 3.2 reveals that the effects of the calorie+traffic light and calorie-only labels disappear – neither coefficient is significantly different from zero. This result is not entirely surprising since many of the primary sources of extra calories (such as drinks and desserts) are not actually listed on the menu, meaning there is no label to inform diners of their caloric contents. Interestingly enough, none of the parameters significantly related to entrée calories are significant in the extra calories model. Education, however, does appear to at least marginally affect ($p < 0.10$) the number of extra calories ordered, as people who have received a bachelor's degree order 91.91 extra calories fewer, on average, than those diners who do not have a degree. Additionally, party size is negatively related (significant at the 1% level) to extra calories ordered such that the mean extra calories ordered will decline by 39.91 calories for each additional person seated at a table.

Characteristics of Low-, Medium-, and High-Calorie Diners

Table 3.3 offers insight into the characteristics of low-, medium- and high-calorie diners in terms of entrée calories ordered. Table 3.3 shows that the proportion of females was significantly different ($p < 0.01$) across the three groups of diners such that a higher proportion of females (0.750) ordered low-calorie entrées compared to the proportions who ordered medium- or high-calorie entrées (0.565 and 0.333, respectively). Additionally, there were marginal differences ($p < 0.10$) across diners based on education variables. Current university students made up larger proportions of medium- and high-calorie diners whereas people who hold a bachelor's degree made up a greater proportion of low-calorie diners. Age was another demographic factor which varied across categories as younger patrons (ages 18-34) were more likely to order medium- or high-calorie entrées; conversely, older patrons (ages 55 and older) were more likely to order low-calorie entrées. Both the gender and age results support previous research which concludes nutrition is more important to women and older individuals (Glanz et al., 1998).

In addition to demographics, we also considered menu treatment variables for each class of diners. While neither the calorie+traffic light nor the calorie-only menus were statistically significant ($p = 0.14$ and $p = 0.40$, respectively), the results reveal that people who received the calorie+traffic light menu make up larger proportions of low- and medium-calorie diners. Forty-seven percent of high-calorie diners, on the other hand, received the calorie-only menu, as compared to only 25% percent of people who received calorie+traffic light menu. These results offer further evidence that the calorie+traffic light menu is more effective than the calorie-only menu in terms of reducing caloric intake.

On the survey instrument, we asked diners to indicate which characteristic (price, anticipated taste, healthfulness, or recommendation from a server or friend) is most important when making a menu selection. Table 3.3 reports no statistical difference across categories for those who valued taste the most, but there was a significant difference (at the 1% level) for those who considered health to be the most important. Twenty-five percent of low-calorie diners considered health as the most important compared to only 4.8% and 2.8% of medium- and high-calorie diners, respectively. Health consciousness revealed a similar result. Low-calorie diners had a mean health consciousness score of 11.2, while the mean health consciousness scores for medium- and high-calorie diners declined to 10.29 and 9.389, respectively (significantly different at the 5% level).

A final set of variables relate to the reasons for eating at the restaurant. Unquestionably, some occasions warrant different eating behaviors than others (i.e., a job interview lunch vs. lunch with friends). During our survey period, the top two reasons people gave for visiting the restaurant were to have lunch with friends or some type of business or work-related meal, so these are the two variables we include in table 3.3. From the table, we see that people who were eating lunch with friends make up larger proportions of medium- and high-calorie diners as opposed to low-calorie diners (significant at the 5% level). People visiting for business reasons were just the opposite as these patrons accounted for 30% of low-calorie diners but only 16.1% and 11.1% of medium- and high-calorie diners, respectively.

Turning to table 3.4, we also categorized people as low-, medium-, or high-calorie diners based on the number of extra calories ordered. The effect of gender disappears when focusing on extra calories ordered; however, there are still differences in terms of education variables. Again, current university students make up greater proportions of medium- and high-calorie diners ($p < 0.10$). Additionally, 47% of low-calorie diners hold a bachelor's degree compared to 13.3% and 28.6% of medium- and high-calorie diners (significant at the 1% level). In terms of age, a substantial proportion (0.90) of medium-calorie diners were 18-34 years old ($p < 0.05$).

Although income was a non-factor in the entrée calorie analysis, table 3.4 reveals there are some differences across the three classes of diners based on income. Low income diners (those with < \$25,000 in annual household income) make up the greatest proportions of medium- and high-calorie diners (0.60 and 0.452, respectively). Alternatively, higher income patrons (those with ≥ \$100,000 in annual household income) were more likely to be low-calorie diners as opposed to medium- or high-calorie diners (significant at the 5% level).

Variables related to health had a much smaller role in classifying extra calorie diners. Health consciousness was only marginally significant ($p < 0.10$). Similar to the entrée calorie results, low-calorie diners had the highest health consciousness scores, on average, yet the difference in health consciousness scores across the three diner groups was much smaller in the extra calories case. As mentioned previously, this result could be explained by the fact that caloric contents were not listed for the majority of extra calorie items, so diners could have been less aware of the "healthfulness" of these items.

Finally, in terms of dining purpose, we again find that patrons visiting the restaurant for business or work-related purposes are more likely to be low-calorie diners as opposed to medium- or high-calorie diners (significant at the 5% level).

Conclusion

The federal government passed a menu labeling law as part of the 2010 health care bill requiring chain restaurants to post caloric information for all menus. Increased attention to labeling laws has caused a surge in research related to the potential (and actual) effectiveness of calorie labels in restaurants. As these studies become more prevalent, one would expect the results to eventually converge and the research community to reach consensus on the impact of these labels; however, this has been far from the case. Some studies find calorie labels significantly reduce intake while others conclude the labels really have no effect.

These inconclusive results lead us to ask: are there factors beyond the label's presence which influence a person's level of caloric intake? Do women eat differently than men? Does a person's level of health consciousness affect which items the individual chooses to order? Are food choices different depending on the reason (i.e., business lunch vs. lunch with friends) for which a person is eating in a restaurant? In this paper, we aim to provide insight on other variables (beyond the menu label itself) that could influence caloric intake in restaurants. Additionally, we seek to advance the literature by answering the "who eats what" question for restaurant patrons. Most studies have determined who is likely to eat in certain types of restaurants (namely fast-food establishments), but few have looked at what those people actually order once they are inside the restaurant. Just because an individual chooses to eat in a restaurant does not mean he/she must eat "unhealthy" (in this context, high-calorie) foods. On the contrary, restaurants today are introducing an increasing number of low-calorie options for those patrons who are concerned with maintaining good nutrition outside their own kitchen (York, 2011). Thus, this paper looks to identify which types of people are low-, medium-, and high-calorie diners in restaurants.

To answer these questions, we collected survey data from 138 restaurant patrons in a full-service restaurant. Survey questions related to the diner's demographic characteristics, level of health consciousness, reason for and frequency of dining in the restaurant, and menu item selection(s). For each diner, we computed two measures of caloric intake: main entrée calories (calories from the main portion of the meal) and extra calories (calorie from additional side items, desserts, drinks, etc.). We then performed regressions on each of these measures of caloric intake as a function of (1) type of menu label, (2) health consciousness, and (3) demographic characteristics. Finally, we categorize people as low-, medium-, or high-calorie diners (based on both entrée and extra calories) and determine which types of people are likely to fall in each category.

Results of this study show that menu labels have a greater effect on entrée calories than on extra calories. Both the calorie+traffic light and calorie-only labels significantly reduced entrée calories ordered but neither affected extra calories ordered. The label could be less influential on extra calories because many of the extra calorie items (such as drinks and desserts) are not presented on the menu, so diners were not exposed to their caloric contents. Further, we found that the more health conscious a person was, the fewer entrée calories the individual ordered. It should be noted, however, that the interactions between each calorie label and health consciousness were significant and reveal that both labels are more effective among the least health conscious. These are precisely the people that menu labeling laws are often trying to influence.

Moreover, our results suggest that the calorie+traffic light menu is more effective than the calorie-only menu at reducing entrée calories ordered as health consciousness increases. This may happen because the calorie+traffic light label provides new information that even the most health conscious people may not know. Particularly, the traffic light symbol offers a normative suggestion to diners as to which items are better/worse for them to consume.

When we classify patrons as low-, medium-, or high-calorie diners based on the number of entrée calories ordered, we found that women made up the largest proportion of low-calorie diners, whereas men made up the greatest proportion of high-calorie diners. Other demographic groups that ordered higher proportions of low-calorie entrées included diners with a bachelor’s degree and diners who were 55 years or older. Congruent with the regression results, we found that diners who placed a high value on health when making menu selections and who were more health conscious tended to be low-calorie diners. Our results also revealed that calories ordered may depend on why a patron is visiting a restaurant in the first place. People who were at the restaurant for a business or work-related meal made up a larger proportion of low-calorie diners compared to medium- or high-calorie diners.

Together our results suggest that calorie labels in restaurants can be effective, but only among those restaurant patrons who have lower levels of health consciousness. For those who are highly health conscious, a calorie label provides little new information. However, our findings would suggest that the addition of a symbol (in our study, a traffic light symbol) to the calorie information could further reduce calories ordered, even for individuals with high levels of health consciousness.

QUESTIONNAIRE

1. **On average, how many times do you dine at the Rancher's Club in a month?**
   - ❑ 1-2 times/month
   - ❑ 3-4 times/month
   - ❑ 5 or more times/month
   - ❑ This is my first visit

2. **What is your reason for dining with the Rancher's Club today?**
   - ❑ Business/work-related
   - ❑ Celebratory occasion (i.e., birthday)
   - ❑ Lunch with friends
   - ❑ No specific reason

3. **What is your gender?**
   - ❑ Male
   - ❑ Female

4. **Are you currently an OSU student?**
   - ❑ Yes
   - ❑ No

5. **Do you have a Bachelor's degree from a University or College?**
   - ❑ Yes
   - ❑ No

6. **What is your age?**
   - ❑ 18-34 years old
   - ❑ 35-54 years old
   - ❑ 55 years or older

7. **What is your annual household income?**
   - ❑ Less than $25,000
   - ❑ $25,000 to $99,999
   - ❑ More than $100,000

8. **Do you agree or disagree that: I try to monitor the number of calories I consume daily?**
   - ❑ Strongly agree
   - ❑ Somewhat agree
   - ❑ Neither agree nor disagree
   - ❑ Somewhat disagree
   - ❑ Strongly disagree

9. **Do you agree or disagree that: I try to avoid high levels of fat in my diet?**
   - ❑ Strongly agree
   - ❑ Somewhat agree
   - ❑ Neither agree nor disagree
   - ❑ Somewhat disagree
   - ❑ Strongly disagree

10. **Do you agree or disagree that: I spend time looking at nutritional labels while shopping for my food?**
    - ❑ Strongly agree
    - ❑ Somewhat agree
    - ❑ Neither agree nor disagree
    - ❑ Somewhat disagree
    - ❑ Strongly disagree

11. **Do you agree or disagree that: The government should advise consumers on what to eat at restaurants?**
    - ❑ Strongly agree
    - ❑ Somewhat agree
    - ❑ Neither agree nor disagree
    - ❑ Somewhat disagree
    - ❑ Strongly disagree

12. **Do you agree or disagree that: I thought very hard about which menu item(s) I selected today?**
    - ❑ Strongly agree
    - ❑ Somewhat agree
    - ❑ Neither agree nor disagree
    - ❑ Somewhat disagree
    - ❑ Strongly disagree

13. **Do you agree or disagree that: I am good with numbers?**
    - ❑ Strongly agree
    - ❑ Somewhat agree
    - ❑ Neither agree nor disagree
    - ❑ Somewhat disagree
    - ❑ Strongly disagree

14. **Which item characteristic is *most important* when making a menu selection?**
    - ❑ Price
    - ❑ Anticipated taste
    - ❑ Healthfulness
    - ❑ Recommendations from a friend or server

15. **Next semester, the Rancher's Club will use new menus. Which menu format would you *most* like to see?**
    - ❑ Menu with no nutritional information
    - ❑ Menu with calorie contents of menu items listed
    - ❑ Menu with a symbol to represent the calorie content of menu items

Figure 3.1 Survey Instrument

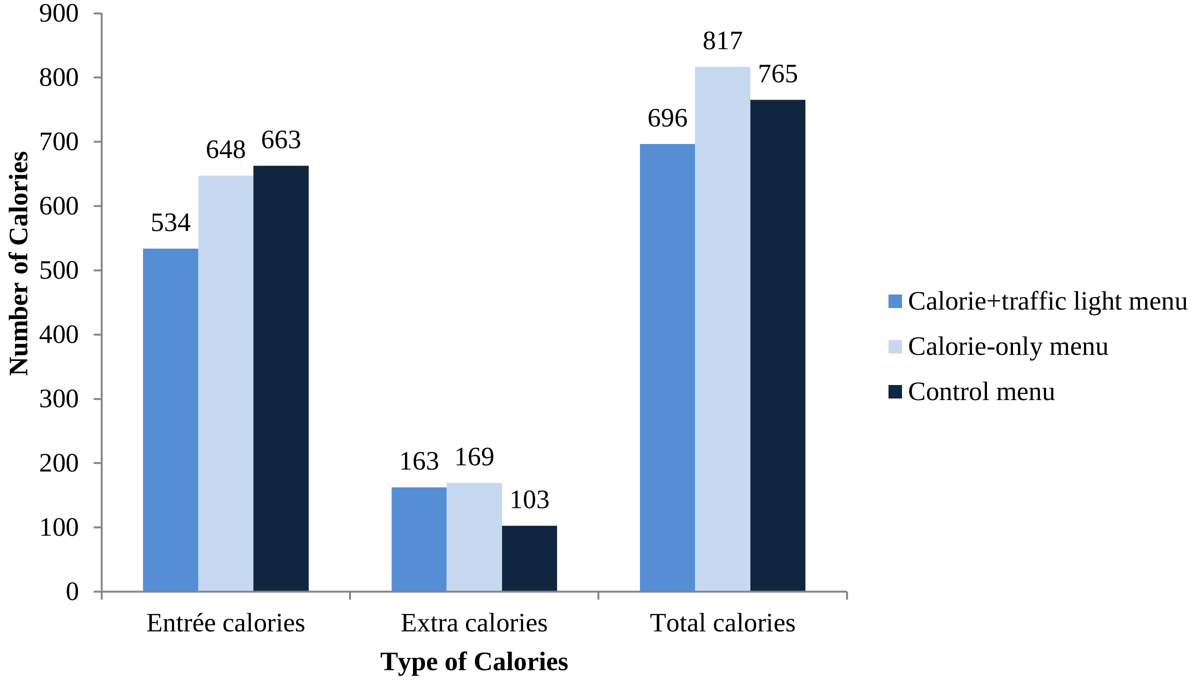

Figure 3.2 Average Number of Entrée, Extra, and Total Calories across Three Menu Treatments

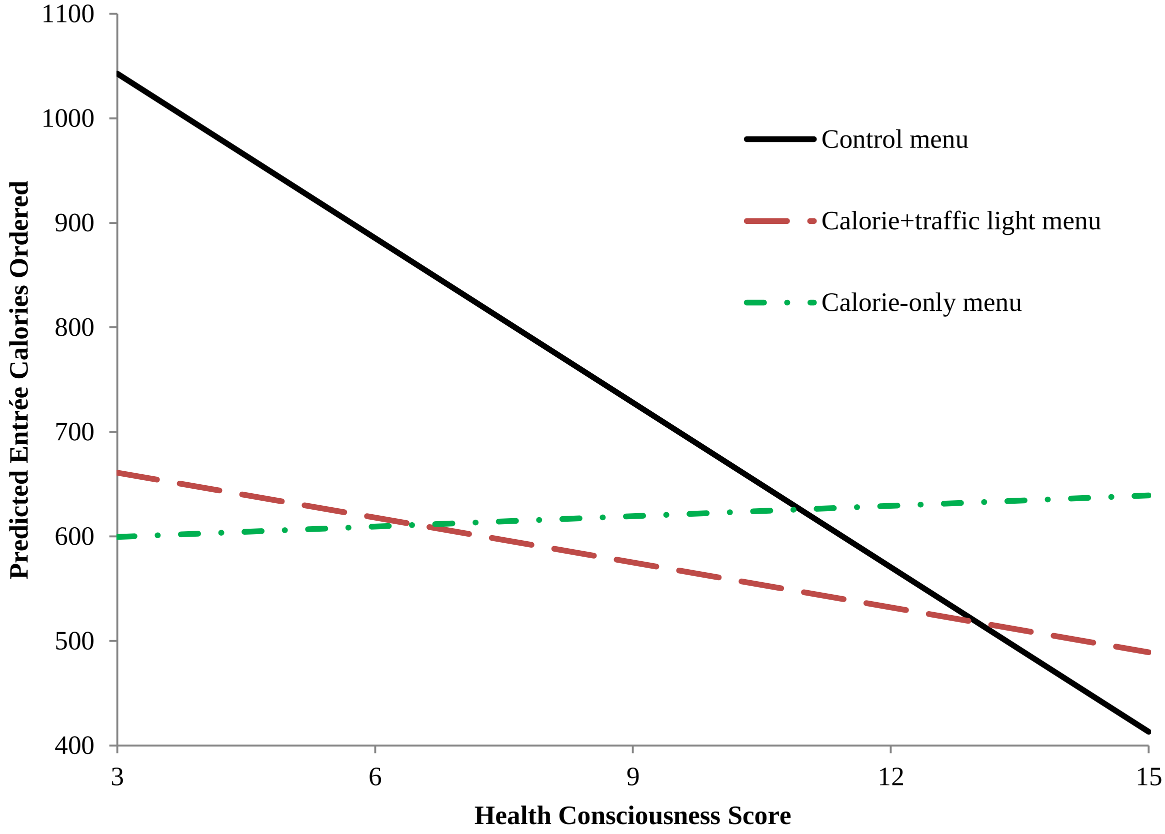

Figure 3.3 Relationship between Health Consciousness and Entrée Calories Ordered in Three Menu Treatments

Table 3.1 Characteristics of Survey Respondents and Definition of Variables (*N*=138)

Variable	Definition	Mean
Female	1 if female; 0 if male	0.558
Student	1 if current Oklahoma State University student; 0 otherwise;	0.630
Bachelor's	1 if obtained bachelor's degree; 0 otherwise	0.341
Age1	1 if age is 18 to 34.99 years; 0 otherwise	0.696
Age2	1 if age is 35 to 54.99 years; 0 otherwise	0.181
Age3	1 if older than 55 years of age; 0 otherwise	0.123
Income1	1 if annual household income is less than $25,000; 0 otherwise	0.442
Income2	1 if annual household income is between $25,000 and $99,999; 0 otherwise	0.399
Income3	1 if annual household income is $100,000 or greater; 0 otherwise	0.159
Health Consciousness (HC)	Level of health consciousness (can range from 3 to 15)	10.319
Value Taste	1 if taste is most important characteristic in meal selection; 0 otherwise	0.725
Value Health	1 if healthfulness is most important characteristic in meal selection; 0 otherwise	0.101
Party	Number of guests seated per table	2.928
Calorie+traffic light	1 if diner received calorie+traffic light menu; 0 otherwise	0.391
Calorie-only	1 if diner received calorie-only menu; 0 otherwise	0.391
Control	1 if diner received control menu with no nutritional information; 0 otherwise	0.217
Repeat Visitor	1 if diner is repeat visitor to the restaurant; 0 otherwise	0.616
Lunch with Friends	1 if occasion for eating is lunch with friends; 0 otherwise	0.638
Business Lunch	1 if occasion for eating is business or work-related; 0 otherwise	0.188
Entrée Calories	Main entrée calories ordered per diner	606.341
Extra Calories	Extra calories beyond main entrée (i.e., additional side items, desserts, drinks) ordered per diner	152.174
Total Calories	Total calories ordered per diner	758.515

Table 3.2 Regression Estimates for Entrée Calories Ordered and Extra Calories Ordered

	DV: Entrée Calories	*DV: Extra Calories*
Variable	Estimate	Estimate
Intercept	1185.75***	456.19***
	(189.04)[a]	(144.99)
Calorie+traffic light	-496.34**	101.34
	(210.66)	(145.80)
Calore-only	-610.69***	-77.02
	(193.01)	(140.47)
Health Consciousness (HC)	-52.48***	-15.57
	(14.93)	(9.71)
Female	-99.01**	5.12
	(40.25)	(32.23)
Student	4.82	-49.99
	(65.90)	(50.92)
Bachelor's	-19.59	-91.91*
	(75.00)	(49.90)
Party	25.06	-39.91***
	(17.55)	(10.12)
Calorie+traffic light*HC	38.16**	-7.67
	(18.06)	(11.99)
Calorie-only*HC	55.79***	13.67
	(17.19)	(12.22)
R-Squared	0.24	0.18
Number of Observations	138	138

Note: ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively

[a]Standard errors are in parentheses (heteroskedasticity consistent standard errors)

Table 3.3 Demographic Characteristics of Low-, Medium-, and High-Calories Diners (Based on Entrée Calories)

Variable	Low Calorie Diners (≤ 400 Entrée Calories)	Medium Calorie Diners (401-800 Entrée Calories)	High-Calorie Diners (> 800 Entrée Calories)
Female***	0.750	0.565	0.333
Student*	0.500	0.710	0.639
Bachelor's*	0.475	0.274	0.306
Age1**	0.525	0.790	0.722
Age2	0.225	0.161	0.167
Age3***	0.250	0.048	0.111
Income1	0.375	0.516	0.389
Income2	0.400	0.387	0.417
Income3	0.225	0.097	0.194
Calorie+traffic light	0.475	0.419	0.250
Calorie-only	0.325	0.387	0.472
Value Taste	0.625	0.742	0.806
Value Health***	0.250	0.048	0.028
Health Consciousness**	11.200	10.290	9.389
Repeat Visitor	0.700	0.581	0.583
Lunch with Friends**	0.500	0.742	0.611
Business Lunch*	0.300	0.161	0.111
Number of Observations	40	62	36

Note: ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively

Table 3.4 Demographic Characteristics of Low-, Medium-, and High-Calories Diners (Based on Extra Calories)

Variable	Low Calorie Diners (0 Extra Calories)	Medium Calorie Diners (1-250 Extra Calories)	High-Calorie Diners (> 250 Extra Calories)
Female	0.561	0.567	0.548
Student*	0.545	0.800	0.643
Bachelor's***	0.470	0.133	0.286
Age1**	0.606	0.900	0.690
Age2*	0.227	0.033	0.214
Age3	0.167	0.067	0.095
Income1*	0.364	0.600	0.452
Income2	0.394	0.367	0.429
Income3**	0.242	0.033	0.119
Calorie+traffic light	0.379	0.333	0.452
Calorie-only*	0.348	0.467	0.405
Value Taste	0.682	0.767	0.762
Value Health	0.106	0.033	0.143
Health Consciousness*	10.939	9.700	9.786
Repeat Visitor	0.636	0.467	0.690
Lunch with Friends	0.561	0.667	0.738
Business Lunch**	0.273	0.067	0.143
Number of Observations	66	30	42

Note: ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively

CHAPTER IV

DISCUSSION

With obesity and other diet-related diseases on the rise, U.S. policymakers are focused on designing legislation to help Americans help themselves at making “healthier” (generally interpreted as lower-calorie) food choices. Since an increasing proportion of food dollars are spent away from home, restaurants are the target of current legislative efforts. Currently the FDA has proposed a menu labeling law which will require chain restaurants to provide calorie information for all menu items on all menus and menu boards (FDA, 2011). The purpose of this research is to provide some insight on how consumers *and* restaurants may be affected by mandatory calorie labeling legislation.

Using two field experiments in full service restaurants, I am able to glean some key insights about calorie labels. First, my results show that labeling policies are likely to outperform pricing policies (such as “fat taxes/thin subsidies”) in terms of reducing caloric intake. Secondly, the results reveal that the type of calorie label implemented (numeric vs. symbolic calorie label) does matter. The menu labeling legislation, as currently proposed by the FDA, would mandate a numeric calorie label where the number of calories is listed by each menu item. Both restaurants in this research, however, showed that this type of calorie label will have a modest (if any) effect on caloric intake. Results from these studies would suggest that the effectiveness of the numeric calorie label could be enhanced by adding some type of symbol (in this case, a traffic light symbol) which also conveys nutrition information.

Third, calorie labels provide the greatest benefit to those restaurant patrons with lower levels of health consciousness. People who are already knowledgeable about food and nutrition are less likely to be influenced by calorie labels. It is important to note, however, that the symbolic calorie label can still reduce caloric intake even among the most health conscious, which suggests that the traffic light symbol may offer new information to a larger subset of the diner population.

Fourth, this research reveals that restaurants are unlikely to be affected by the addition of calorie labels on their menus. Entrée dollars could decline, but it appears that dollars spent over the entire meal will remain stable.

While these results show that a symbolic calorie label is likely to lead to the largest reductions in caloric intake, this type of label could still be problematic from a policy standpoint. One question this research did not address is *why* traffic light symbols might be more effective than simple numeric statements at reducing caloric intake. It could be that the symbols are more easily and quickly interpreted by diners. That is, the cost of information acquisition might be lower for symbolic labels. A different interpretation, however, is that the labels go beyond information provision and send a normative statement about what the consumer *should* order. A red traffic-light, after all, is synonymous with "STOP." While many people are relatively comfortable with the federal government taking on the role of providing unbiased information to facilitate market transactions, at least some subset of the population is likely to be less enthusiastic about policies that are viewed as paternalistic. Moreover, determination of cutoffs for traffic light labels are likely to be open to political manipulation by interested parties who do not want to find themselves on the wrong side of yellow. We leave to future research some of these challenges associated with traffic light labeling.

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VITA

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Doctor of Philosophy

Thesis: THREE ESSAYS ON THE EFFECTS OF CALORIE LABELING IN FULL SERVICE RESTAURANTS

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Major Field: Agricultural Economics

Scope and Method of Study:

Two field experiments were conducted in restaurants on the Oklahoma State University campus to study the effects of calorie labels on restaurant menus. Two types of calorie labels were implemented: a numeric calorie label where the number of calories was listed by each menu item and a symbolic calorie label where a traffic light symbol (indicating specific caloric ranges) was provided in addition to the number of calories for each menu item.

Findings and Conclusions:

Results show that the numeric calorie label (as currently proposed by the FDA) will have a modest (if any) effect on caloric intake, yet the effectiveness of the numeric label can be enhanced with the addition of a traffic light symbol. Additionally, this study finds that calorie labels have the most influence on diners who are the least health conscious. It is important to note, however, that the symbolic calorie label causes even the most health conscious people to reduce their caloric intake, suggesting that the traffic light label has the potential to influence a greater proportion of diners.

ADVISER'S APPROVAL: Dr. Jayson Lusk