WP 2010-19
October 2010

Working Paper

Charles H. Dyson School of Applied Economics and Management
Cornell University, Ithaca, New York 14853-7801 USA

Evaluating advertising strategies for fruits and vegetables and the implications for obesity in the United States

Jura Liaukonyte, Bradley J. Rickard, Harry M. Kaiser, and Timothy J. Richards

It is the Policy of Cornell University actively to support equality of educational and employment opportunity. No person shall be denied admission to any educational program or activity or be denied employment on the basis of any legally prohibited discrimination involving, but not limited to, such factors as race, color, creed, religion, national or ethnic origin, sex, age or handicap. The University is committed to the maintenance of affirmative action programs which will assure the continuation of such equality of opportunity.

Evaluating Advertising Strategies for Fruits and Vegetables and the Implications for Obesity in the United States

Jura Liaukonyte
Dake Family Assistant Professor, Charles H. Dyson School of Applied Economics and Management
Cornell University, Ithaca, NY 14853

Bradley J. Rickard
Assistant Professor, Charles H. Dyson School of Applied Economics and Management
Cornell University, Ithaca, NY 14853

Harry M. Kaiser
Gellert Family Professor, Charles H. Dyson School of Applied Economics and Management
Cornell University, Ithaca, NY 14853

Timothy J. Richards
Morrison Chair, Morrison School of Agribusiness and Resource Management,
W. P. Carey School of Business
Arizona State University, Mesa, AZ 85212

Abstract: We investigate consumer response to various types of advertising for fruits and vegetables—a food category which health officials uniformly agree is significantly under-consumed in the United States. Using an adult, non-student subject pool of participants in the experiment, consumers' response to different broad-based (not used currently in the United States) and commodity-specific (widely used in the United States) advertising campaigns for various fruits and vegetables is empirically measured. We show that broad-based advertising effects far exceed those of the commodity-specific advertising and discuss the implications of the effective fruit and vegetable advertising programs on caloric intake and obesity management policies.

Key words: Advertising, Experiments, Food Marketing, Fruits and vegetables, Obesity, Willingness to pay

October 2010

Evaluating Advertising Strategies for Fruits and Vegetables and the Implications for Obesity in the United States

The United States has the highest obesity rate of any country in the world with 26.7%of the population being classified as obese (OECD Health Data 2005; Doheny 2010). Moreover, obesity rates have significantly increased: nearly doubling in adults and tripling in children in the past 30 years (Grady 2010). Some have called this increase a medical crisis (Hensrud and Klein 2006). Medical science has shown that being obese or overweight poses significant health risk for serious diseases such as diabetes, heart disease, hypertension, stroke, and certain types of cancer (Andreyeva et al. 2004). A recent article indicates that the costs of this problem in the United States are immense, approaching $150 billion a year to deal with medical costs associated with these illnesses (Lillis 2010).

Several factors have been cited for this problem, such as relatively low prices for high fat and sweetened foods, agricultural subsidies which lower consumer prices for foods that use wheat, soybeans, and corn (and high fructose corn syrup) as ingredients, aggressive advertising and promotion by the fast food industry, increased sedentary lifestyles of adults and children, less parental oversight of children's eating behaviors, environmental factors, and the low level of advertising to promote fruits and vegetables relative to other food groups (Nestle 2002). The enormity of this problem has prompted government policy proposals such as fat and sweetener taxes, posting of calories on menus, banning junk food in schools, limiting marketing to children and other wellness initiatives to combat obesity and promote healthy living (Goldberg and Gunasti 2007; Desrochers and Holt 2007; Moore and Rideout 2007; Grier et al. 2007; Seiders and Petty 2007; Dority, McGarvey and Kennedy 2010).

This paper examines consumer response to various types of advertising for fruits and vegetables—a food category which health officials uniformly agree is significantly under-

consumed in the United States (Center for Disease Control and Prevention 2010; Severson 2010). It then focuses on the impact that such programs may have on reducing obesity rates in the United States.

Consumption of fruits and vegetables has been decreasing over the past 15 years, with per capita fruit consumption declining by 12.5%and per capita vegetable consumption decreasing by 7.6% (USDA, Economic Research Service 2010). The number of dinners prepared at home that include a salad dropped from 22% in 1994 to 17% in 2010; at restaurants, salads ordered as a main course dropped by one-half since 1989, to 5% (NKD Group 2010). Only 26% of the U.S. adults eat vegetables three or more times a day, and an average American eats less than half of what public health officials target with their recommendations (Center for Disease Control and Prevention 2010). Only 23% of meals include a vegetable (excluding potato fries). All these statistics indicate an alarming situation regarding fruit and vegetable consumption in an average American household, and highlight the fact that the situation is worsening despite the two decades of public health initiatives and updated government dietary guidelines.

Evidence in medical studies (Bazzano 2006; Tohil 2005) suggests that increasing fruit and vegetable consumption can be a successful dietary weight management strategy to prevent obesity by reducing overall energy density of the diet, promoting satiety, decreasing total energy intake, and increasing nutritional quality of a diet (Rolls, Drewnowski and Ledikwe 2005, Rolls, Ello-Martin and Tohill 2004; Ledikwe et. al 2006). Also, empirical evidence suggests that a considerable amount of diet-related disease and associated health care costs can be prevented by a higher intake of fruit and vegetables (Gundgaard et al. 2003). The results of these studies have prompted the World Health Organization to target increasing fruit and vegetable consumption as a global public health nutrition priority (World Health Organization 2003a; 2003b; 2004).

How best to increase fruit and vegetable consumption is, of course, a difficult question. Of the marketing tools offered by Goldberg and Gunatsi (2007), promotion—or the relative lack thereof—is often cited as the primary barrier to increasing fruit and vegetable "stomach share." There are two types of advertising used to promote consumption of fruit and vegetables, defined generically[1]: (1) "commodity-specific" programs for individual fruits and vegetables, e.g., the recent campaign for carrots (see http://www.babycarrots.com/) and (2) "broad-based" programs that promote the consumption of all fruits and vegetables collectively (*e.g.*, the U.S. *Fruit and Veggies—More Matters* campaign, Australian *Go for 2&5*® campaign and the United Kingdom's *5 a Day* campaign). Currently, in the United States there are 38 state and federal fruit and vegetable commodity-specific programs and over 50 commodity-specific programs in other states that are funded primarily by industry growers. In 2004, these commodity-specific programs had advertising budgets totaling $114 million to promote consumption of fruits and vegetables (Carman and Alston 2005). In addition, there is one federal (*Fruit and Veggies—More Matters*) and one state (*California 5 a Day*) broad-based program for fruit and vegetables. However, expenditures on commodity-specific and broad-based advertising are just a fraction of the advertising budgets for less healthy foods. For example, recent research reports that food, beverage, candy and restaurant advertising was $11.26 billion in 2004, which is over 100 times the advertising budget for fruits and vegetables, and this does not include the other (non-advertising) marketing expenditures for less healthy foods and beverages (CP-EHNCU 2005).

The success of a large-scale broad-based advertising campaign "*Go for 2&5*" has been documented in Australia (Pollard et al. 2008). The campaign was designed to increase adults' awareness of the nutritional benefits of eating more fruits and vegetables. The campaign was largely successful as it increased consumption of the mean number of servings of fruit and

vegetables by 0.8 per day over a three-year period (Pollard et al. 2008). This study concluded that sustained and well-executed social marketing is effective in improving nutrition knowledge, attitudes and consumption behavior and it provides guidance for future nutrition promotion through social marketing.

The U.S. fruit and vegetable industry has recently considered whether they should adopt a mandatory broad-based advertising for all produce marketed in the country in addition to the many commodity-specific programs that currently exist. Whether commodity-specific or broad-based advertising efforts would lead to greater sales of fruits and vegetables has been widely debated among industry stakeholders (see Prevor 2009), and there is no clear consensus among growers and packers on this issue. Some producers see commodity-specific programs competing for "stomach share" in a destructive game of advertising competition, whereas broad-based programs have the capacity to increase sales for all fruits and vegetables. Others in the industry are less supportive of broad-based advertising because the central message in these programs simply emphasizes an already well-known fact—that eating a diet rich in fruits and vegetables is good for your health—and believe that such promotion efforts will have little impact on the demand for these products.

In this paper, we measure the impact of broad-based advertising, commodity-specific advertising, and two hybrid programs that include broad-based and commodity-specific advertising across eight selected fruits and vegetables. We use experimental methods to elicit consumers' willingness to pay for various fruits and vegetables subject to either broad-based or commodity-specific advertising. Willingness to pay estimates from treatments in our experiment are subsequently used in a simulation model to outline the calorie implications for a group of representative adult consumers.

While the seminal articles in economics (Philipson and Posner 2003; Chou, Grossman, and Saffer 2004; Cutler, Glaser and Shapiro 2006 and Lakdawalla and Philipson 2009) construct economic models of obesity using classical assumptions and aggregate data, we measure a response to advertising with micro-level, experimental data. We are interested in three questions regarding the impact of broad-based and commodity-specific advertising on increasing demand for fruits and vegetables. First, would commodity-specific, broad-based, and hybrid advertising increase the demand for fruits and vegetables? Second, which type of advertising would have the largest impact on fruit and vegetable demand? Third, what would be the impacts of the effective fruit and vegetable advertising programs on caloric intake? Using an adult, non-student subject pool of participants in the economic experiment, we empirically measure how consumers respond to different broad-based and commodity-specific advertising campaigns for various fruits and vegetables.

Economic simulation models are widely used to estimate the likely impact of either foods (Smed, Jensen and Denver 2007; Cash, Sunding and Zilberman 2004) or specific nutrients (Richards, Patterson and Tegene 2007; Chouinard, et al. 2007). Typically, studies of this nature either estimate native food-price elasticities or take elasticities from the published literature, as we do here. Many such studies simulate the effects of taxes on either a food or nutrient of interest, and measure the resulting effect on foods that are related in consumption. Economic modeling is necessary because of the complexity of the interrelationships involved – foods from seemingly unrelated categories (snack foods and dairy, for example) have significant cross-price effects because they compete for both a fixed amount of income (the budget constraint) and relatively fixed stomach-size. These studies often find counter-intuitive outcomes. Taxing snack foods that are high in fat, for example, can exacerbate the obesity problem by causing consumers

to consume more snack foods that are high in carbohydrates (Richards, Patterson and Tegene 2007). We use a similar approach, but use advertising as a policy tool instead of taxation.

The experiment developed in this paper allows us to shed some new light on the influence of advertising on fruit and vegetable consumption, and on combating obesity. It also provides results that contribute to the literature examining the economic effects of generic advertising in two significant ways. First, very few studies have used experimental economics to evaluate consumer response to promotional efforts for agricultural products (a notable exception is Messer et al. 2009). Many econometric studies have examined the effects of generic advertising on demand for horticultural products using aggregate, market-level data on consumption, market prices, and advertising expenditures (for a good summary, see Alston et al. 2007). An experimental approach is advantageous because it offers an excellent way to control for other demand factors that can cloud consumer response to advertising. Second, our research is the first to empirically measure the economic effects of both broad-based advertising and commodity-specific advertising. There have been hundreds of studies that have measured the market impacts of commodity-specific campaigns (*e.g.*, Kaiser, Lui, and Consignado 2003), but the economic effects of broad-based advertising campaigns have not been studied in detail. In addition, no study has investigated the efficacy of the two advertising approaches simultaneously or researched broad-based advertising effects with Americans. Third, a non-hypothetical experiment, in which consumers respond to real economic incentives, is better able to replicate the real-world decision process than mere surveys or choice experiments (Friedman and Sunder 1994).

EXPERIMENTAL DESIGN

A total of 271 adult, non-student subjects participated in the experiment, which measured WTP response to alternative broad-based and commodity specific advertisements. First, subjects viewed three 90-second episodes of *The Simpsons* (a popular animated television show), which were originally broadcasted as part of the *Tracey Ullman Show* in the late 1980s. All subjects except those in the control group also viewed four 30-second fruit and vegetable advertisements with two shown between the first and second *Simpsons* episode and the other two shown between the second and third Simpsons episode. Second, subjects were asked to bid in an auction for four fruits and four vegetables. The experiment took just under one-hour and subjects earned $25 in cash and/or groceries.

Subjects were assigned to one of six treatments. The control group (Treatment 1) included 58 subjects who were not exposed to any ads, but did view three 90-second episodes of *The Simpsons*. The broad-based advertising treatment (Treatment 2) included four 30-second advertisements for fruits and vegetables from the Australian "*Go For 2&5*" and the United Kingdom "*5-A-Day*" campaigns. The 41 subjects in this treatment watched all three *Simpsons* and all four broad-based advertisements before the auction. Two commodity-specific treatments were included featuring apple advertising (Treatment 3) and potato advertising (Treatment 5).[2] Treatment 3 had 44 subjects who viewed the *Simpsons* clips and three 30-second ads for New York State apples and one 30-second advertisement for Washington State apples. Treatment 5 (n=42) subjects viewed four 30-second Idaho potato advertisements in addition to the *Simpsons*. Finally, two hybrid broad-based, commodity specific treatments were included. Treatment 4 (n=38) featured two 30-second apple (one Washington and one New York State) advertisements and two 30-second broad-based advertisements between the *Simpsons* clips, and Treatment 6

(n=48) consisted of two 30-second potato and two 30-second broad-based advertisements. For each of these treatments, the broad-based advertisements included one Australian and one United Kingdom advertisement.

After viewing the media clips, subjects were taught how the auctions worked. To elicit maximum WTP for each auctioned item, a computerized sealed first price auction was used. This type of auction was chosen because it is easy for subjects to learn and research has shown it is demand revealing (Elyakime, Laffont, Loisel and Voung 1994; Kagel 1995). To teach subjects the basic mechanics of the auction, a practice round was included where subjects submitted bids for a pen. In the practice round, subjects started a computer clock with their bids beginning at $0.00 and increasing in $0.10 increments every two seconds until they hit the withdraw button or the bid reached $2.00, which was the maximum bid for the pen.

After learning the auction for the pen, eight auctions for fruits and vegetables were conducted with the bid clock ranging from $0.00 to a maximum of $6.00, increasing by $0.10 increments every two seconds. The eight commodities included one pound each of apples, oranges, bananas, table grapes, carrots, red bell peppers, Russet potatoes, and tomatoes, and the order of the auctions was randomized for each session. Before the auctions, participants were told that the grocery items were recently purchased from a local supermarket and none were organically produced. To prevent any satiation or budget constraint impacts on bidding, participants were informed that only one-half of the auctions would result in an actual transaction, and those would be randomly chosen after all auctions were held. Because no subject bid $6.00 for any commodity in any session, there were no satiation or budget constraints impacting the bids. The highest bidder for each item was not announced until all auctions were concluded.

After all auctions were completed, participants completed a computerized questionnaire eliciting their attitudes towards the advertisements in the experiment, likeability of fruits and vegetables, and demographic information such as weight, height, age, income, and education.

EXPERIMENT RESULTS

In this section we present and discuss the descriptive statistics of data collected in experiments and the results of the estimated econometric model. Table 1 summarizes the descriptive statistics for the demographic variables in each treatment. Table 2 shows the average overall WTP across treatments for the fruits and vegetables included in the experiment; it also shows the average WTP for each commodity in each treatment. Table 2 shows that all of the treatments that included broad-based advertising (treatments 2, 4 and 6), have WTP averages that are significantly higher than control. Table 2 also shows that overall WTP averages were not higher for treatments exposed to the apple and potato commodity-specific advertising programs. WTP for the advertised commodities (apples for treatment 3, and potatoes for treatment 5) also were not statistically different than WTP for those commodities in the control group.

<Insert Table 1 about here>

<Insert Table 2 about here>

Theoretically, WTP measures the maximum an individual is willing to pay to acquire an item. Therefore, WTP can be used to construct inverse compensated demand curves by calculating and plotting the percentage of individuals with WTP greater than particular price levels (Lusk and Hudson 2004). The resulting demand curves are represented in Figure 1. In

general, this figure represents the same patterns that are apparent in the descriptive statistics table, just graphically. The demand curves with broad-based advertising are significantly higher than the control group's demand curve. However, the demand curves with commodity specific advertising are not significantly different from the control group's demand curve.

<Insert Figure 1 about here>

Next, we present a thorough analysis on the effects of commodity-specific and broad-based advertising on the WTP for fruits and vegetables that controls for all of the demographic variables listed in Table 1. Since participants in the experiments were allowed to submit zero bids for auctioned items (as indicated in Table 1, depending on the treatment, approximately 12-20% of the observations were zero bids), we estimate the following linear regression Tobit model for l*eft-*c*ensored* dependent variables[4]:

$$\begin{cases} WTP^{*}_{itj} = \alpha_t + \beta_t\, Treat\_dummy_t \cdot \hat{Q}_{it} + \sum_l \gamma_{lt}\, x_{lit} + \varepsilon_{ijt} \\ WTP_{itj} = max\left(WTP^{*}_{itj}, 0\right) \end{cases}$$

Here, subscript ***i*** refers to an experiment participant, ***j*** to the commodity (apples, bananas, carrots, grapes, oranges, peppers, potatoes or tomatoes) and ***t*** to experiment treatment. The constant is denoted as α_t, $Treat_{d_t} \cdot \hat{Q}_{it}$ is the advertisement quality-adjusted treatment dummy variable, γ_{lt} represents the marginal effect of each demographic attribute x_{lit} on willingness to pay, and, finally, the error term is $\varepsilon_{ijt} \sim N(0,1)$.

<Insert Table 3 about here>

To examine the persuasiveness component of advertising programs in our experiment and to control for whether the advertising types or advertising quality are driving the changes in WTP across the treatments, we weight the treatment specific dummies by the advertising quality variables, Q_{it}. Quality is defined in a subjective way. That is, our measure of quality was elicited from participants at the end of the experiment where participants were asked to evaluate advertisements on a scale from 1 to 5. In the cases where both commodity-specific and broad-based advertising were shown, we constructed the Q_{it} by averaging the revealed likeness variable across the two types of advertisements. It is important to note that the elicited bid and advertising likeness variables are determined simultaneously and therefore Q_{it} is endogenous. Following standard econometric procedures, we deal with the endogeneity issue by instrumenting Q_{it} with individual specific exogenous demographic characteristics.

Table 3 presents the results obtained by estimating the Tobit model. The coefficients in the first six rows describe the difference between the advertising quality weighted WTP associated with the presence of a marketing activity and the control treatment, where no advertisements were shown. The results in Table 3 reiterate the patterns depicted with inverse compensated demand curves in Figure 1: only treatments with broad-based advertising (treatments 2, 4 and 6) have statistically significant positive effects. Treatment 2 is statistically significant at 5% level, whereas treatments 4 and 6 are statistically significant at 1% level (t-values are 2.49, 4.47 and 3.29 respectively).

Results from subjects exposed to commodity-specific advertising are different from those in the broad-based treatment. The estimated commodity-specific treatment effects are not

statistically significant.[5] Therefore we conclude that the broad-based advertising effect outweighs the commodity-specific advertising effect as treatments that combine commodity-specific advertising and broad-based advertising appear to generate results that are closer to the broad-based results. For the remainder of the paper we will assume that the commodity-specific advertisements did not influence consumers' WTP for the selected fruits and vegetables, and that these treatment effects are zero.

The interpretation of the marginal effects of estimated treatment fixed effects is more intuitive when they are evaluated at a constant advertising quality level (in this case, the mean quality level summarized in column 3 of Table 3). Column 4 in Table 3 depicts monetary WTP changes associated with treatments 2 (Broad-based ads only), 4 (Hybrid ads: Broad-Based + Apples) and 6 (Hybrid ads: Broad-based+Potatoes). After controlling for demographics and attitudes towards advertising, on average, participants exposed to broad-based advertising bid 14 cents higher than participants in the control group. Whereas the average differences for hybrid treatments with apple and potato advertisements were 28 and 15 cents respectively. In percentage terms, treatments with broad-based advertisements and hybrid advertisements resulted in an average increase in WTP of 18.1%, 32.8%, and 22.9% respectively (and an overall average of 24.6%).

Several of the demographic and attitudinal variables also had a significant impact on WTP to fruits and vegetables in our experiment. In Table 3 we see that sex, income, race, education, BMI, having children, being aware of "5-A-Day" campaign and buying conventional vegetables have significant effects on WTP for fruits and vegetables. Males and Asian participants were found to bid less, whereas higher education, income and BMI, "5-A-Day"

knowledge and buying conventional (not organic) vegetables and fruits translated into higher bid levels.

Given the WTP data points before and after an advertisement campaign, the change in WTP (ΔWTP) can be interpreted as the vertical shift in the demand curve due to the campaign. The corresponding horizontal shift, ΔQ_t, is measured as the product of the vertical shift, ΔWTP, and the own-price elasticity of demand: $\eta_t \cdot \Delta WTP_t = \Delta Q_t$ (Carpio and Isengildina-Massa, 2010). Since we can back out the horizontal and vertical shifts in the demand curve from data collected in the experiments, we can calculate the implied price elasticity for fruits and vegetables in the treatments with broad-based advertising. We calculate the implied elasticity for treatments with broad-based advertising at three points of the demand curve: at the 25th and 75th percentiles, and the median). The elasticity results are presented in the last three columns of Table 3. The median implied elasticities for these three treatments range between -0.59 to -0.55 and are close to empirical fruit and vegetable elasticities found in the literature. For example, Huang and Lin (2000) estimate an aggregate own-price elasticity of demand for fruits and vegetables of -0.77, which is slightly more elastic than our implied estimate, but fairly close.

Based on these experimental results, it is clear that broad-based advertising as, either alone or coupled with existing commodity-specific advertising, has a significant impact on fruit and vegetable demand. At the same time, the two commodity-specific advertising campaigns examined have no impact on overall fruit and vegetable demand. Since the fruit and vegetable sector currently relies almost exclusively on commodity-specific advertising for promotion, a key implication of this research is that a switch to either an exclusive or a hybrid broad-based advertising program would have a larger impact on demand.

A methodological implication of our results, and the results of Messer et al. (2009), is the lack of statistical significance found for commodity-specific advertising when using experimental economics. In contrast, the overwhelming majority of previous studies that have used secondary market data to estimate the impact of commodity-specific advertising have found positive and statistically significant impacts of commodity-specific generic advertising. The three commodity-specific advertisements that have been studied using experimental economics—including apples and potatoes in our study, and beef in Messer et al. (2009)—found no statistical significance for advertising. In contrast, using market-level data, Ward and Forker (1991) found generic apple advertising elasticity of demand to be positive and statistically significant, Ward and Lambert (1993) found beef to be statistically significant, and Lanclos, Devodoss, and Guenthner (1997) found generic frozen potato advertising to be statistically significant. This suggests that further research is needed to examine why results from experimental techniques yield insignificant effects from commodity-specific advertising, while results from studies using secondary market data do not. One possible reason is that it is difficult to control for other demand effects when using secondary market data, and some of the found significance to advertising may be due to an omitted variable.

EXAMINING POTENTIAL LINKS BETWEEN BROAD-BASED PROMOTION AND OBESITY

Research has indicated that advertising is important in creating social norms and promoting healthy eating practices, especially for groups of consumers nutritionally at risk (Story and Faulkner 1990). Television, a medium that reaches millions of people for hours each day, is ideal for presenting positive health-related images and nutritional information (Avery et. al 1997). However, the frequency of health claims reported in advertising content studies has been small, ranging from 1% to 3% of advertisements (see Teisl, Levy, and Derby 1999). In terms of

achieving the desired effect, the public advertising message content is also important. Briley and Aaker (2006) argue that certain target groups would be more persuaded by a positive promotion strategy, i.e. health appeal that focuses on the potential benefits gained by adopting better eating habits (such as eating more fruits and vegetables) than by a negative prevention strategy, i.e., health appeal that focuses on problems to be avoided (such as keeping off extra weight).

Here we use a simulation model to quantify how different promotion strategies for fruits and vegetables would influence demand for all food products, and the associated impacts of total caloric intake levels. The simulation model includes a set of equations to describe the supply, demand, and market clearing conditions for 10 food products. Our analysis then introduces exogenous demand shocks into the model to simulate the market effects of effective advertising for fruits and vegetables. Simulated changes in consumption patterns across the 10 food products are then used to calculate changes in overall, and per capita, caloric consumption. Agricultural economists have used similar simulation models to study a wide range of research topics that examine small changes in demand and supply for food products or the inputs used to produce food (for a summary, see Alston, Norton, and Pardey 1995). We expect that an effective advertising campaign for fruits and vegetables will increase consumption of fruits and vegetables, decrease consumption of other food products (many of which are more calorie dense than fruits and vegetables), decrease consumption of total caloric intake, and ultimately lead to a decrease in obesity.

Following a model developed in Okrent (2010) and used by Alston, Rickard, and Okrent (2010), we assess how changes in demand for fruits and vegetables, due to promotional activities, would affect total food consumption and influence caloric intake. Using the effects of fruit and vegetable promotional efforts estimated above, we simulate the associated consumption

implications across eight exhaustive categories of food-at-home products (i.e., cereals and bakery products, red meat, poultry and eggs, fish and seafood, dairy products, fruits and vegetables, nonalcoholic beverages, other foods including fats and oils and sugars and sweeteners), a composite food-away-from-home product, and alcoholic beverages. To capture the substitution effects between food products, our framework uses existing estimates of the own- and cross-price elasticities of demand for the 10 food categories included in the simulation model.[6] Ideally, we would also use own- and cross-price advertising elasticities for the food categories. However, these data are not available, and it is reasonable to assume that the advertising response to an increase in fruit and vegetable advertising in the non-fruit and vegetable categories would be very small.

<Insert Table 4 about here>

We performed three simulation experiments to better understand how the fruit and vegetable promotion strategies that included broad-based advertisements would affect food consumption, and annual per capita caloric intakes. Table 4 presents the consumption and caloric impacts from adoption of three different broad-based promotion strategies for fruits and vegetables that were analyzed here (i.e., broad-based advertising, broad-based coupled with apple advertising, and broad-based coupled with potato advertising). We do not include simulation results for the commodity-specific advertising efforts as the econometric findings did not show any significant relationship between advertising and subjects' WTP. The top portion of Table 4 describes the simulated changes in prices and quantities of the 10 food categories for an exogenous demand shock for fruits and vegetables due to advertising. The exogenous shocks are

modeled as vertical shifts in demand and calculated using the estimated effects from advertising listed in Table 3. Specifically, in the results for broad-based advertising we model the effects of a 18.1% change in the willingness to pay for fruits and vegetables, for broad-based plus apple advertising we model the effects of a 32.8% change in willingness to pay, and for broad-based plus potato advertising we model the effects of a 22.9% change in willingness to pay. We also report the results from a 24.6% change in willingness to pay which represents the average change across our treatments that included broad-based advertisements.

Table 4 provides an indication of the effects that successful advertising programs for fruits and vegetables might have on obesity rates. However, because our data were collected in a lab setting, and because subjects were not exposed to other advertisements in our experiment, we assume that the results in Table 4 provide an upper bound on the results we would expect to see among the general population. The results in Table 4 suggest that all three types of advertising will slightly increase the consumption of poultry and eggs, fish and seafood, dairy and other food category and decrease consumption of cereals and bakery, red meats, nonalcoholic beverages and food away from home. The promotion efforts appear to have very little effect on the consumption of alcoholic beverages. Because food categories cereals and bakery, red meats, nonalcoholic beverages and food away from home are relatively calorie dense, these changes would lead to an overall decrease in energy consumption in the range of 1,328 to 2,408 calories per person annually. Such changes are equivalent to a 0.50% to 0.85% change in body weight, and although they appear to be small changes, they may represent non-trivial changes over a longer time period. Obesity is a dynamic process, and many have argued that obesity is a problem that emerges slowly over the course of adulthood (e.g., Hill et al. 2003). Therefore, it is likely that successful solutions to the obesity problem will also occur gradually over time. If

fruit and vegetable marketers followed an advertising approach that adopted broad-based advertising to reduce overall caloric intake of around 1,800 calories per person per year, this by itself would lead to a change in average body weight of approximately 5.2 pounds over 10 years.

PUBLIC POLICY IMPLICATIONS

Our results are consistent with the findings regarding an actual broad-based advertising program that was conducted over a three-year (2002-2005) period in Australia. The *Go for 2&5* promotional campaign included a wide range of marketing activities, including television, radio, and print ads, point-of-sales promotions, public relations campaigns, nutritional school activities, and a website (Pollard et al., 2008). Our results, and the findings on the Australian program, suggest that both industry stakeholders and government health agencies should consider adopting a broad-based promotional strategy. There is evidence that a broad-based program has the capacity to increase consumers' WTP (and thus revenues for horticultural producers) and to combat obesity. The fruit and vegetable sector in the United States currently has voluntary broad-based program that is significantly smaller than the *Go For 2&5* broad-based program used in Australia. The U.S. industry has discussed adopting a mandatory broad-based program that would be used in addition to the current commodity-specific programs. In 2009 advocates of a mandatory program proposed to assess first handlers of all fruits and vegetables an annual per-unit tax in order to raise $30 million for broad-based advertising. However, the majority of growers did not want to adopt the proposed program and the policy failed after a plebiscite was conducted among all first handlers in 2009. Even if adopted, a $30 million program would be tiny in relation to the promotional programs conducted for the beverage, candy and restaurant industries ($11.26 billion in 2004).

If the federal government is serious about mitigating the obesity problem, they could consider funding, or partially funding a broad-based program for fruit and vegetables. Such a program would need to be large enough to adequately counter competing promotional campaigns for unhealthy foods. Government involvement in such a campaign could be justified on the basis of compensating for the negative externalities regarding increased health costs associated with unhealthy diets. While the government would likely need to be the primary funder of such a program, it could require matching funds from the fruit and vegetable industry to support the effort. There is evidence from other programs that the industry would have more of an incentive to agree to a mandatory program if their contributions were matched with government funds.

If the government and/or industry decided to implement a broad-based promotional program for fruit and vegetables, there are some recommendations from previous research, as well as the results of this study that should be considered. First, any program should have a clear message that emphasizes the health benefits of fruit and vegetable consumption. Ciliska et al. (2000) reviewed 15 different community interventions (18 reports) designed to increase fruit and vegetable consumption in developed countries. Their findings suggest that the outcomes of interventions vary more with the intensity and clarity of the message than by the age or site of the intervention. They concluded that the most effective fruit and vegetable promotion interventions incorporated behavioral theories and goals providing a consistent framework; succesful programs also gave clear messages about increasing fruit and vegetable consumption, and provided longer, more intensive interventions. Some public health advocates have argued that the nutrition guidelines should be made even clearer and more simplified. One proposal is to make Americans think about it visually, filling half the plate or bowl with vegetables (Severson, 2010).

Second, the broad-based program should invest in making vegetables more easily available. One of the main conclusions of the CDC report was: "We have to make the healthy choice the easy choice, and the choices need to become ingrained," (Severson 2010). Clear guidance is necessary, but probably not sufficient. Health officials now concede that convincing people to eat more fruits and vegetables means making them more affordable and more available.

Third, the broad-based program needs to have a long-term, sustainable strategy. The findings of previous reviews of intervention effects on consumption are varied, but most of them find that the majority of fruit and vegetable promotion interventions lead to increased consumption at least in the short term. Comprehensive multi-component strategies that are implemented strategically *over sustained periods of time* are required to increase fruit and vegetable consumption (Pomerleau 2005a; 2005b). Evidence shows only large scale efforts (such as National TV campaigns) have large-scale significant results (Pollard et al. 2008).

Fourth, the broad-based program ideally would be a public and private partnership, where both parties are invested in the program. This partnership could consist of a hybrid structure similar to what we investigated (broad-based plus commodity-specific) or could consist of exclusive broad-based promotion with funding from both the government and industry.

Finally, an effective broad-based promotional program in mitigating obesity will likely have to target more disadvantaged and less educated segments of the United States population. Ciliska et al. (2000) find that social interventions appear to have the greatest impact on those whose knowledge of healthy diets is the lowest. Targeting these groups within the school system should be part of the broad-based program because interventions are more effective for younger audiences.

FINAL REMARKS

There is a significant body of literature examining the causes of obesity and documenting the related health and monetary costs. In this paper, we examine one of the potential causes in the United States, the negligible amount of advertising used to promote fruits and vegetables relative to unhealthy food groups, and look at how a well-developed advertising campaign might affect fruit and vegetable consumption. Additionally, we investigate the effectiveness of two different types of advertising used for such products – broad-based and commodity-specific. We use an experimental approach in this study, because it allows us to systematically track and separately identify consumer responses to specific advertising messages and control for various factors that would be unobservable and more difficult to control in the secondary advertising and consumption data.

We find strong support that broad-based advertising has a significant positive effect, and commodity-specific advertising does not have any effect, on consumers' willingness to pay for fruits and vegetables. While the magnitude of the broad-based advertising effect we find in our experiments might seem large, we interpret our results as an upper bound of such effect, since individuals in our experiments were not subjected to competing advertising campaigns for other food products. However, our results are consistent with the findings of Pollard et al. (2008), where they find that a large scale broad-based advertising campaign in Australia resulted in an increase in overall fruit and vegetable consumption by approximately 20%.

Broad-based advertising has the capacity to increase demand for fruits and vegetables, and it also has the capacity to decrease caloric consumption and obesity. We find that a successful broad-based advertising campaign for fruits and vegetables, either alone or as a hybrid with commodity-specific campaigns, would reduce average annual caloric intake per person by

approximately 1,800 kcal. Although this reduction may appear small, such a strategy could be used as one component of an overall program to reduce obesity and the serious health risks associated with it. Therefore, based on the results of our study, an increase in broad-based advertising would lead to benefits for producers of fruits and vegetables and consumers more generally.

There are four general unresolved issues pertaining to the design of such a campaign that should be the subject of more careful future research. First, there is a question of scope. More research is needed to understand how big a program needs to be in order to be effective, and how can it be used to target specific demographic groups. For comparison purposes, the U.S. dairy industry spends about $450 million per year on fluid milk and dairy product advertising. Second, there are questions related to funding. That is, should such a campaign be financed by the government, industry stakeholders, or jointly between a public health agency and fruit and vegetable growers? Third, stakeholders in the fruit and vegetable industry need to be clear about their message. Fruits and vegetables, as a food category, are essentially competing with other "food groups" and growers might be better off thinking strategically as a food group rather than as growers of several hundred individual commodities within a food group. It is possible to expand fruit and vegetable advertising through the use of commodity-specific advertising, but our results indicate that the more efficient and likely more successful way to increase demand for fruits and vegetables is through broad-based advertising. Lastly, there will likely be distributional implications resulting from a broad-based campaign; that is, there will likely be winners and losers from broad-based advertising since the demand for some commodities may be more responsive to the advertisements than other commodities. This uncertainty would lead many growers to believe that broad-based advertising would be less effective for them than

would commodity-specific advertising. Therefore, in order to get the fruit and vegetable industry to fully commit to a broad-based campaign, a government matching program (similar to current government programs that fund export promotion activities for certain agricultural products) may be needed to entice all industry stakeholders to contribute.

REFERENCES

Alston, J.M., G.W. Norton, and P.G. Pardey (1995), "*Science Under Scarcity: Principles and Practice for Agricultural Research Evaluation and Priority Setting,"* Ithaca, New York: Cornell University Press.

_____, B.J. Rickard, and A. Okrent (2010), "Farm policy and obesity in the United States," *Choices,* 25(3), forthcoming.

_____, D.A. Sumner, and S.A. Vosti (2008), "Farm subsidies and obesity in the United States: National evidence and international comparisons," *Food Policy*, 33(6), 470–479.

_____, J.M. Crespi, H.M. Kaiser, and R.J. Sexton (2007), "An Evaluation of California's Mandated Commodity Promotion Programs," *Review of Agricultural Economics,* 29(1): 40–63.

Andreyeva, T., R. Sturm, J.S. Ringel (2004), "Moderate and Severe Obesity Have Large Differences in Health Care Costs," *Obesity Research,* 12, 1936–1943.

Avery, R. J., Mathios, A. Shanahan, J. and Bisogni, C. (1997), "Food And Nutrition Messages Communicated Through Prime-Time Television," *Journal of Public Policy & Marketing,* Vol. 16 (2), 217–227.

Bazzano, L.A. (2006), "The high cost of not consuming fruits and vegetables," *Journal of the American Dietetic Association*, 106(9), 1364–1368.

Briley, Donnel A. and Jennifer L. Aaker (2006), "Bridging the Culture Chasm: Ensuring that Consumers are Healthy, Wealthy and Wise," *Journal of Public Policy and Marketing*, 25, 53–66.

California Pan-Ethnic Health Network and Consumer Union (2005), "*Out of Balance: Marketing of Soda, Candy, Snacks and Fast Foods Drowns Out Healthful Message,"* (accessed August 3, 2010), [available at http://www.consumersunion.org/pdf/OutofBalance.pdf].

Carman, H.F. and J.M. Alston (2005), "California's Mandated Commodity Programs," in *Commodity Promotion: Lessons from California*, edited by Harry M. Kaiser, Julian M. Alston, John M. Crespi, and Richard J. Sexton, Chapter 2, Peter Lang Publishing, Inc. New York City.

Carpio, C.E., and O. Isengildina-Massa (2010), "To Fund or Not to Fund: Assessment of the Potential Impact of a Regional Promotion Campaign," *Journal of Agricultural and Resource Economics*, 35(2):245–260.

Cash, S. B., D. L. Sunding, D. and D. Zilberman (2004), "Fat Taxes and Thin Subsidies: Prices, Diet, and Health Outcomes," paper presented at the *Annual Meeting of the American Agricultural Economics Association*, Denver, CO, August 1-4, 2004.

Center for Disease Control and Prevention (2009), "State Indicator Report on Fruits and Vegetables," (accessed August 3, 2010), [available at http://www.fruitsandveggiesmatter.gov/health_professionals/statereport.html].

Chou, Shin-Yi, Michael Grossman and Henry Saffer (2004), "An economic analysis of adult obesity: results from the Behavioral Risk Factor Surveillance System," *Journal of Health Economics*, 23(3), 565–587.

Chouinard, H. H., D. Davis, J. T. LaFrance, and J. M. Perloff (2007), "Fat Taxes: Big Money for Small Change," *Forum for Health Economics and Policy,* 10, 1-28.

Ciliska, Donna, Elizabeth Miles, Mary A. O'Brien, Cathy Turl, Helen Hale Tomasik, Ursula Donovan and Joanne Beyers (2000), "Effectiveness of Community-Based Interventions to Increase Fruit and Vegetable Consumption," *Journal of Nutrition Education*, 32(6), 341–352.

Cutler, David M., Edward L. Glaeser, and Jesse M. Shapiro (2003), "Why Have Americans Become More Obese?" *Journal of Economic Perspectives*, 17(3), 93–118.

Hensrud, D.D. and S. Klein (2006), "Extreme obesity: a new medical crisis in the United States" *Mayo Clinic Proceedings*.

Desrochers, Debra M. and Debra J. Holt (2007), "Children's Exposure to Television Advertising: Implications for Childhood Obesity," *Journal of Public Policy & Marketing*, 26, 182–201.

Doheny, K. (2010), "Obesity Rates Still Rising, CDC Says," WebMD, (accessed August 3, 2010), [available at http://www.webmd.com/fitness-exercise/news/20100803/obesity-rates-still-rising-cdc-says].

Dority, Bree L., Mary G. McGarvey Patricia F. Kennedy (2010), "Marketing Foods and Beverages in Schools: The Effect of School Food Policy on Students Overweight Measures," *Journal of Public Policy and Marketing*, forthcoming.

Elyakime, B., J.J. Laffont, P. Loisel, and Q. Vuong (1994), "First-Price Sealed-Bid Auctions with Secret Reservation Prices," *Annales d'Economie et de Statistique,* 34, 115–141.

Goldberg, Marvin E. and Kunter Gunasti (2007), "Creating an Environment in Which Youths Are Encouraged to Eat a Healthier Diet," *Journal of Public Policy & Marketing*, 26, 162–81.

Friedman, D. and S. Sunder (1994), *Experimental Methods: A Primer for Economists* Cambridge, U.K.: Cambridge University Press.

Grady, D. (2010), "Obesity Rates Keep Rising, Troubling Health Officials." *New York Times*, (accessed August 3, 2010), [available at http://www.nytimes.com/2010/08/04/health/nutrition/04fat.html].

Grier, Sonya A., Janell Mensinger, Shirley H. Huang, Shiriki K. Kumanyika, and Nicolas Stettler (2007), "Fast-Food Marketing and Children's Fast-Food Consumption: Exploring Parents' Influences in an Ethnically Diverse Sample," *Journal of Public Policy & Marketing*, 26, 221–35.

Gundgaard J., Nielsen J., Olsen J., Sorensen J. (2010), "Increased intake of fruit and vegetables: estimation of impact in terms of life expectancy and healthcare costs," *Public Health Nutrition*, 6(1), 25–30.

Hill, J.O., H.R. Wyatt, G.W. Reed, and J.C. Peters (2003), "Obesity and the Environment: Where Do We Go from Here?," *Science* 299(7), 853–855.

Huang, K.S. and B.H. Lin (2000), "Estimation of Food Demand and Nutrient Elasticities from Household Survey Data," Technical Bulletin No. 1887, *USDA/Economic Research Service*, Washington, D.C.

Kagel, J. H. (1995), "Auctions: A Survey of Experimental Research", in J.H. Kagel and A.E. Roth, eds. *Handbook of Experimental Economics*. Princeton University Press, 501–585.

Kaiser, H.M., D.J. Lui, and T. Consignado (2003), "An economic analysis of California raisin export promotion," *Agribusiness,* 19(2), 189–201.

Lakdawalla, D. and T. J. Philipson (2009). "The Growth of Obesity and Technological Change," *Economics and Human Biology* 7: 283-293.

Lanclos, D., S. Devadoss, and J. Guenthner (1997), "Impacts of Foreign Direct Investment and Advertising on the Export Demand for U.S. Frozen Potatoes." *Agribusiness,* 13, 273–284.

Ledikwe J., H. Blanck, L. Kettel Khan, M. Serdula, J. Seymour, B. Tohill and B. Rolls (2006), "Dietary energy density is associated with energy intake and weight status in US adults," *American Journal of Clinical Nutrition,* 83(6), 1362–1368.

Lillis, M. (2010), "CDC: Skyrocketing Obesity Translates into Enormous Health Costs," *The Hill,* (accessed August 3, 2010), [available at http://thehill.com/blogs/healthwatch/state-issues/112455-cdc-skyrocketing-obesity-translates-into-enormous-health-costs].

Lusk, Jayson L. and Darren Hudson (2004), "Willingness-to-Pay Estimates and Their Relevance to Agribusiness Decision Making," *Review of Agricultural Economics*, 26(2), 152–169.

Messer, K., H.M. Kaiser, C. Payne, and B. Wansink (2009), "Can Advertising Alleviate Consumer Concerns About Mad Cow Disease?" *Applied Economics,* 41, 1466–4283.

Moore, Elizabeth S. (2007), "Perspectives on Food Marketing and Childhood Obesity: Introduction to the Special Section?" *Journal of Public Policy & Marketing*, 26, 157–161.

_____ and Victoria J. Rideout (2007), "The Online Marketing of Food to Children: Is It Just Fun and Games?" *Journal of Public Policy & Marketing*, 26, 202–220.

Nestle, M. (2002), "Food Politics: How the Food Industry Influences Nutrition and Health", University of California Press.

NPD Group (2010), “Eating Patterns in America”, Annual Report.

OECD Health Data (2005), (accessed August 3, 2010), [available at http://www.nationmaster.com/graph/hea_obe-health-obesity].

Okrent, A. (2010). The effects of farm commodity and retail food policies on obesity and economic welfare in the United States." Doctoral dissertation. University of California, Davis.

_____ and J.M. Alston (2010), “Demand for Food in the United States,” University of California Giannini Monograph. *Forthcoming*.

Philipson, T. J. and R. A. Posner (2003), “The Long Run Growth in Obesity as a Function of Technological Change.” *Perspectives in Biology and Medicine,* 46, S87-S107.

Pomerleau J., K. Lock, C. Knai and M. McKee (2005), “Interventions designed to increase adult fruit and vegetable intake can be effective: a systematic review of the literature,“ *Journal of Nutrition*, 135(10), 2486–2495.

Pomerleau J., K. Lock, C. Knai and M. McKee (2005), *“Effectiveness of interventions and programmes promoting fruit and vegetable intake,” World Health Organization*.

Pollard, C.M., M.R. Miller, A.M. Daly, K.E. Crouchley, K.J. O'Donoghue, A.J. Lang, and C.W. Binns (2008), "Increasing fruit and vegetable consumption: Success of the Western Australia Go for 2&5® campaign." *Public Health Nutrition,* 11(3), 314–320.

Prevor, J. (2009), "Generic promotion program requires due diligence," *Produce Business,* (June), 8.

Richards, T. J., P. M. Patterson and A. Tegene, (2007), "Obesity and Nutrient Consumption: A Rational Addiction?" *Contemporary Economic Policy,* 25, 309-324.

Rolls, B.J., J. Ello-Martin, B. Tohill (2004), "What can intervention studies tell us about the relationship between fruit and vegetable consumption and weight management?," *Nutrition Reviews*, 62(1), 1–17.

_____, A. Drewnowski A. and J.H. Ledikwe (2005), "Changing the Energy Density of the Diet as a Strategy for Weight Management," *Journal of the American Dietetic Association,* 105, 98–103.

Seiders, Kathleen and Ross D. Petty (2004), "Obesity and the Role of Food Marketing: A Policy Analysis of Issues and Remedies," *Journal of Public Policy & Marketing*, 23, 153–69.

Severson, Kim (2010), "Told to eat its vegetables, America order Fries," *New York Times*, (accessed September 24, 2010), [available at http://www.nytimes.com/2010/09/25/health/policy/25vegetables.html].

Smed, S., J. D. Jensen, and S. Denver (2007), "Socio-economic Characteristics and the Effect of Taxation as a Health Policy Instrument," *Food Policy*, 32, 624-639.

Teisl, M.F., Levy, A.S. & Derby, B.M. (1999), "The Effects Of Education And Information Source On Consumer Awareness And Diet-Disease Relationships." *Journal of Public Policy & Marketing*, 18 (2), 197–207.

Tohill, B.C. (2005), "*Dietary intake of fruit and vegetables and management of body weight," World Health Organization*.

U.S. Department of Agriculture, Economic Research Service (2010), "Food Availability (Per Capita) Data System," (accessed September 24, 2010), [available at http://www.ers.usda.gov/Data/FoodConsumption/].

Ward, R.W., and O.D. Forker (1991), "Washington Apple Advertising: An Economic Model of Its Impact," Washington Apple Commission WAC 91:1, University of Florida, Gainesville.

_____ and C. Lambert (1993), "Generic Promotion of Beef: Measuring the Impact of the U.S. Beef Checkoff," *Journal of Agricultural Economics*, 44, 456–465.

World Health Organization (2003), "Diet, Nutrition and the Prevention of Chronic Disease," *WHO Technical Report Series 916*, Geneva, World Health Organization.

World Health Organization (2003), *"Global strategy on diet, physical activity and health," World Health Assembly resolution, WHA57.17,* Geneva.

World Health Organization and Food and Agriculture Organization (2004), *"Fruit and Vegetables for Health" Report of a Joint FAO/WHO Workshop, Kobe, Japan.*

Footnotes:

[1] There is also branded advertising, but unlike generic advertising that is designed to increase overall consumption, brand advertising focuses on increasing market share for a specific firm.

[2] Apples and potatoes were chosen for the commodity-specific treatments because each are important commodities in terms of consumption and value (USDA-NASS, 2009). We chose not to include other commodity specific treatments because subjects may interpret a series of advertisements for specific fruits and vegetables as a broad-based campaign, which would make it difficult to disentangle commodity-specific from broad-based advertising effects.

[3] These percentages can be converted to market quantities by making certain assumptions about the number of individuals in a particular market and the number of units purchased per unit time (Lusk and Hudson, 2004). We rely on this transitional property in the simulation section of the paper.

[4] A small number of the respondents submitted very low bids in all auctions. Table 1 shows that this sub-group included no more than three subjects per treatment, and twelve subjects across all treatments. We expect that this sub-group of subjects did not want to have binding bids for any of the auctioned items and used this approach to ensure that they would receive the full participation endowment. Therefore, in our econometric estimations we exclude this small sub-sample of subjects with average bids (across all eight products) of $0.10 or less.

[5] We also estimated a more restricted commodity-specific advertising effect specification: we allowed the effect of commodity-specific advertising to be only on advertised commodities, i.e. on apples for treatment 3 and potatoes for treatment 5. We found no statistically significant commodity-specific advertising effects under this restricted specification.

[6] Own- and cross-price elasticities of demand for the 10 food categories were estimated by Okrent and Alston (2010) following a Barten's Synthetic Final Model using data from the Bureau of Labor Statistics and the Bureau of Economic Analysis between 1960 and 2007. More information about the data and estimation procedures are available from the authors, as is the paper that is forthcoming as a Giannini Monograph (http://giannini.ucop.edu/monograph.htm).

TABLE 1. Means and Standard Deviations of Demographic Variables by Treatment

	Treatment					
	Control	**Broad Based Ads**	**Apple Ads**	**BB & Apple Ads**	**Potato Ads**	**BB & Potato Ads**
Age	42.948	42.634	40.841	37.132	39.857	36.146
	(9.485)	(12.125)	(11.958)	(12.881)	(11.746)	(13.903)
Male	0.241	0.195	0.341	0.395	0.238	0.354
	(0.428)	(0.397)	(0.475)	(0.490)	(0.427)	(0.479)
Caucasian	0.862	0.878	0.818	0.737	0.714	0.729
	(0.345)	(0.328)	(0.386)	(0.441)	(0.452)	(0.445)
African	0.017	0.000	0.000	0.132	0.000	0.083
	(0.130)	(0.000)	(0.000)	(0.339)	(0.000)	(0.277)
Asian	0.086	0.073	0.159	0.079	0.167	0.083
	(0.281)	(0.261)	(0.366)	(0.270)	(0.373)	(0.277)
Education	2.776	2.805	3.045	2.658	3.095	2.583
	(1.191)	(1.111)	(1.244)	(1.200)	(1.132)	(1.153)
BMI	28.438	26.436	26.269	26.198	25.755	26.568
	(6.909)	(5.013)	(5.365)	(4.986)	(3.932)	(5.796)
Children	0.362	0.439	0.386	0.211	0.238	0.229
	(0.481)	(0.497)	(0.488)	(0.408)	(0.427)	(0.421)
Primary Shopper	0.793	0.902	0.841	0.711	0.810	0.854
	(0.406)	(0.297)	(0.366)	(0.454)	(0.393)	(0.353)
Income	2.207	2.220	2.091	1.789	2.000	1.688
	(0.906)	(0.926)	(0.794)	(0.801)	(0.874)	(1.065)
Number of Fruit Servings	2.138	2.073	2.227	2.316	2.238	2.563
	(1.153)	(0.868)	(0.823)	(1.240)	(1.813)	(1.621)
Number of Veg. Servings	3.310	2.683	2.955	2.605	2.810	3.021
	(3.419)	(1.200)	(1.707)	(1.331)	(1.710)	(1.679)
5 A Day	0.690	0.878	0.659	0.579	0.762	0.792
	(0.463)	(0.328)	(0.475)	(0.495)	(0.427)	(0.407)
Vegetarian	0.017	0.049	0.068	0.053	0.024	0.125
	(0.130)	(0.216)	(0.252)	(0.224)	(0.153)	(0.331)
Conventional	0.931	0.927	0.977	0.895	0.976	0.938
	(0.254)	(0.261)	(0.149)	(0.307)	(0.153)	(0.242)
Quality of Apple Ads	N.A.	N.A.	3.705	3.278	N.A.	N.A.
	N.A.	N.A.	(0.869)	(1.240)	N.A.	N.A.
Quality of Potato Ads	N.A.	N.A.	N.A.	N.A.	2.810	2.625
	N.A.	N.A.	N.A.	N.A.	(1.141)	(1.014)
Quality of Broad Based Ads	N.A.	3.902	N.A.	3.278	N.A.	3.500
	N.A.	(1.009)	N.A.	(1.382)	N.A.	(1.119)
# subjects	58	41	44	38	42	48
# bids	464	328	352	304	336	384
% of zero bids	15.52%	12.20%	21.88%	8.55%	20.24%	15.63%
#subjects with avg WTP<0.1	2	3	3	1	1	2

TABLE 2. Means and Standard Deviations of WTP by Commodity

	Treatment					
	Control	**Broad Based Ads**	**Apple Ads**	**BB & Apple Ads**	**Potato Ads**	**BB & Potato Ads**
WTP: overall	0.741	0.836	0.692	0.832	0.740	0.814
	(0.685)	(0.691)	(0.700)	(0.608)	(0.720)	(0.675)
WTP: apples	0.624	0.776	0.650	0.819	0.667	0.733
	(0.479)	(0.508)	(0.588)	(0.641)	(0.644)	(0.547)
WTP: bananas	0.466	0.476	0.373	0.591	0.400	0.431
	(0.366)	(0.344)	(0.242)	(0.472)	(0.269)	(0.313)
WTP: carrots	0.436	0.646	0.552	0.963	0.629	0.650
	(0.431)	(0.541)	(0.637)	(0.713)	(0.667)	(0.604)
WTP: grapes	1.010	1.117	0.782	1.181	1.093	1.100
	(0.744)	(0.769)	(0.752)	(0.850)	(0.778)	(0.667)
WTP: oranges	0.731	0.839	0.730	1.116	0.679	0.935
	(0.556)	(0.548)	(0.659)	(0.679)	(0.627)	(0.634)
WTP: peppers	1.148	1.190	0.923	0.973	0.933	1.138
	(0.897)	(1.004)	(0.879)	(0.839)	(0.896)	(0.952)
WTP: potatoes	0.460	0.537	0.475	0.806	0.469	0.490
	(0.401)	(0.428)	(0.630)	(0.686)	(0.484)	(0.416)
WTP: tomatoes	1.055	1.110	1.055	1.169	1.055	1.031
	(0.907)	(0.776)	(0.802)	(0.765)	(0.885)	(0.692)

TABLE 3. Tobit Model Estimates

	Estimate	St. Error	Mean ad likeness	Marginal effect[1]	Implied price elasticities[2]		
					Median	p25	p75
Treatment Fixed Effects							
T2: Broad Based Ads	0.034**	0.014	3.942	$0.135	-0.589	-0.679	-0.205
T3: Apple Ads	0.000	0.014	3.679	-	-	-	-
T4: BB & Apple Ads	0.067***	0.015	3.634	$0.243	-0.574	-1.104	-0.067
T5: Potato Ads	0.002	0.019	2.791	-	-	-	-
T6: BB & Potato Ads	0.056***	0.017	3.048	$0.170	-0.547	-0.760	-0.254
Demographic Effects							
Age	0.002	0.001					
Male	-0.122***	0.040					
Caucasian	-0.068	0.071					
African	-0.080	0.110					
Asian	-0.178*	0.093					
Education	0.028*	0.016					
BMI	0.006**	0.003					
Children	0.061*	0.037					
Shopper	0.046	0.045					
Servings of Fruit	0.001	0.013					
Servings of Veg.	0.005	0.011					
Five-A-Day	0.099**	0.043					
Vegetarian	-0.024	0.077					
Conventional	0.149**	0.072					
Income	0.054***	0.020					
Constant	-0.066	0.251					

Notes: # of Obs.: 2,062; *** p<0.01, ** p<0.05, * p<0.1;

[1] Marginal effect is evaluated at the mean level of ad likeness; [2] Implied elasticities are calculated at 3 points along the demand curve (at median, 25th and 75th percentiles of bid levels)

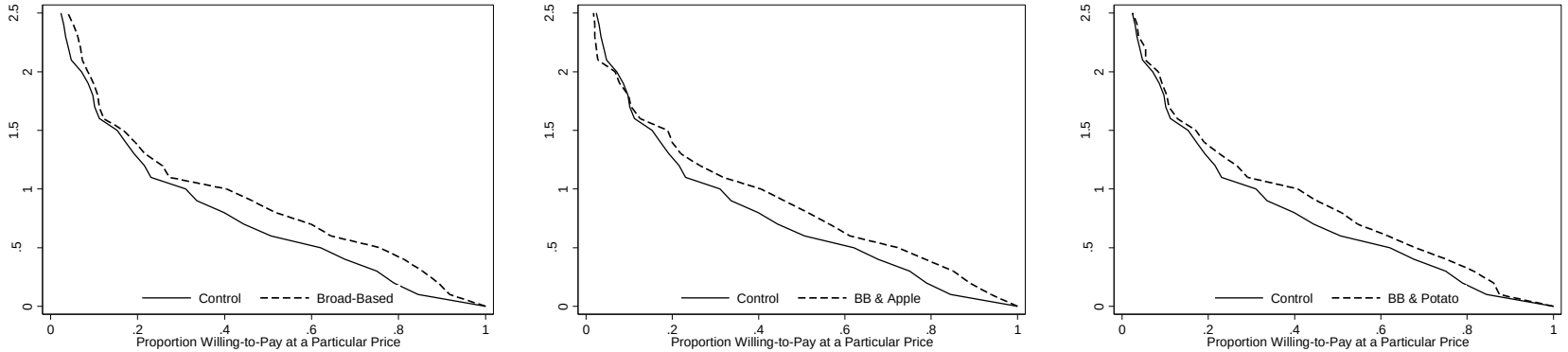
TABLE 4. Simulated Effects of Promotional Activities on Consumption and Weight

Food categories	Promotional Activity			
	BB	BB+Apples	BB+Potatoes	Average
	Demand shocks (increase in WTP)			
	18.1%	32.8%	22.9%	24.6%
Simulated Percentage Change in Quantities Consumed:				
Cereals and bakery	-2.07	-3.74	-2.61	-2.81
Red meats	-3.69	-6.69	-4.67	-5.02
Poultry and eggs	2.40	4.35	3.04	3.26
Fish and seafood	6.20	11.23	7.84	8.42
Dairy	2.74	4.96	3.46	3.72
Fruits and vegetables	11.48	20.80	14.52	15.60
Other foods	1.45	2.62	1.83	1.97
Nonalcoholic beverages	-1.23	-2.23	-1.55	-1.67
Food Away from Home	-2.23	-4.03	-2.82	-3.02
Alcoholic beverages	0.90	1.63	1.14	1.23
Annual Impacts on Per Capita Caloric Consumption and Weight:				
Consumption (kcal)	-1328.78	-2407.96	-1681.17	-1805.97
Weight (lbs)	-0.84	-0.69	-0.48	-0.52
Weight (%)	-0.47	-0.85	-0.59	-0.64

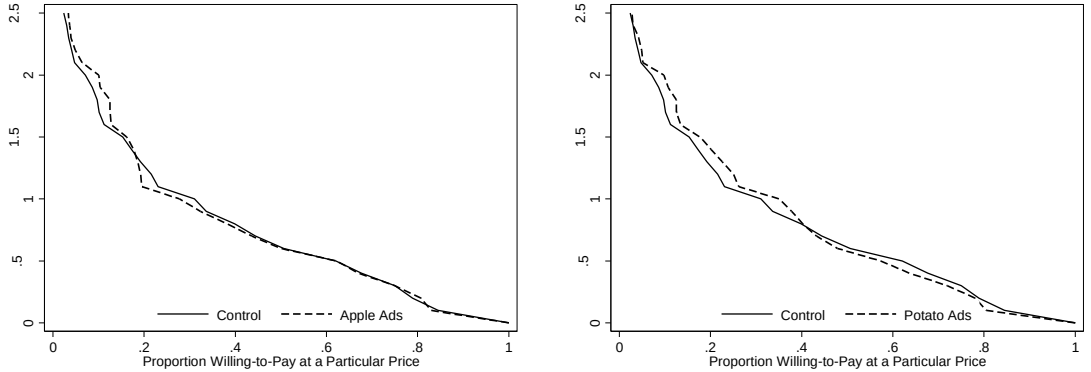
Note: Average weight of an adult individual in 2005-2006 National Health and Nutrition Examination Survey was 178.5 lbs. The calculation assumes 3,500 kcal additional consumption would add one pound to weight.

FIGURE 1. Demand Changes with Broad-Based and Commodity-Specific Advertising

(i) Demand Changes with Broad-Based (BB) Advertising:



(ii) Demand Changes with Commodity-Specific Advertising Only:



OTHER A.E.M. WORKING PAPERS

WP No	Title	Fee (if applicable)	Author(s)
2010-18	The Role of the World Bank in Middle Income Countries		Kanbur, R.
2010-17	Stress Testing for the Poverty Impacts of the Next Crisis		Kanbur, R.
2010-16	Conceptualizing Social Security and Income Redistribution		Kanbur, R.
2010-15	Food Stamps, Food Insufficiency and Health of the Elderly		Ranney, C. and M. Gomez
2010-14	The Costs of Increased Localization for a Multiple-Product Food Supply Chain: Dairy in the United States		Nicholson, C.F., Gómez, M.I. and O.H. Gao
2010-13	Wine in your Knapsack?		Conrad, J.M., Gómez, M.I. and A.J. Lamadrid
2010-12	Examining consumer response to commodity-specific and broad-based promotion programs for fruits and vegetables using experimental economics		Rickard, B., Liaukonyte, J., Kaiser, H. and T. Richards
2010-11	Harnessing the Forces of Urban Expansion – The Public Economics of Farmland Development Allowance		Chau, N. and W. Zhang
2010-10	Estimating the Influence of Ethanol Policy on Plant Investment Decisions: A Real Options Analysis with Two Stochastic Variables		Schmit, T., Luo, J. and J.M. Conrad
2010-09	Protecting the Poor against the Next Crisis		Kanbur, R.
2010-08	Charitable Conservatism, Poverty Radicalism and Good Old Fashioned Inequality Aversion		Kanbur, R. and M. Tuomala
2010-07	Relativity, Inequality and Optimal Nonlinear Income Taxation		Kanbur, R. and M. Tuomala
2010-06	Developing viable farmers markets in rural communities: an investigation of vendor performance using objective and subjective valuations		Schmit, T. and M. Gomez

Paper copies are being replaced by electronic Portable Document Files (PDFs). To request PDFs of AEM publications, write to (be sure to include your e-mail address): Publications, Department of Applied Economics and Management, Warren Hall, Cornell University, Ithaca, NY 14853-7801. If a fee is indicated, please include a check or money order made payable to Cornell University for the amount of your purchase. Visit our Web site (*http://aem.cornell.edu/research/wp.htm)* for a more complete list of recent bulletins.