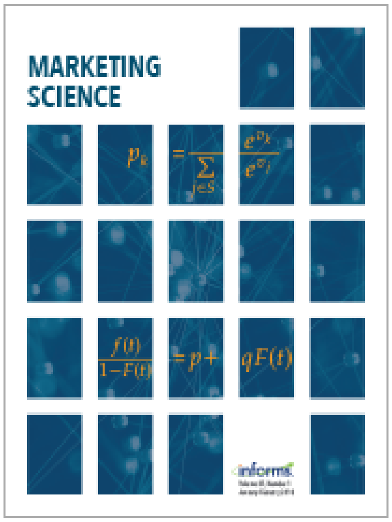

Marketing Science

Publication details, including instructions for authors and subscription information:
http://pubsonline.informs.org

Unintended Nutrition Consequences: Firm Responses to the Nutrition Labeling and Education Act

Christine Moorman, Rosellina Ferraro, Joel Huber,

To cite this article:
Christine Moorman, Rosellina Ferraro, Joel Huber, (2012) Unintended Nutrition Consequences: Firm Responses to the Nutrition Labeling and Education Act. Marketing Science 31(5):717-737. https://doi.org/10.1287/mksc.1110.0692

MARKETING SCIENCE
Vol. 31, No. 5, September–October 2012, pp. 717–737
ISSN 0732-2399 (print) | ISSN 1526-548X (online)

http://dx.doi.org/10.1287/mksc.1110.0692

Unintended Nutrition Consequences: Firm Responses to the Nutrition Labeling and Education Act

Christine Moorman
Fuqua School of Business, Duke University, Durham, North Carolina 27708, moorman@duke.edu

Rosellina Ferraro
Robert H. Smith School of Business, University of Maryland, College Park, Maryland 20742, rferraro@rhsmith.umd.edu

Joel Huber
Fuqua School of Business, Duke University, Durham, North Carolina 27708, joel.huber@duke.edu

This paper investigates how firms responded to standardized nutrition labels on food products required by the Nutrition Labeling and Education Act (NLEA). Using a longitudinal quasi-experimental design, we test our predictions using two large-scale samples that span 30 product categories. Results indicate that the NLEA reduced brand nutritional quality relative to a control group of products not regulated by the NLEA. At the same time, among regulated products, brand taste increased. Although this reduction in nutrition represents an unintended consequence of regulation, there were a set of category, firm, and brand conditions under which the NLEA produced a positive effect on brand nutritional quality. We find that firms were more likely to improve brand nutrition when firm risk or firm power is low. Lower risk occurs when the firm is introducing a new brand rather than changing an existing brand, and weaker power in a category is reflected by lower market share in a category. Furthermore, firms competing in low-health categories (e.g., potato chips) or small-portion categories (e.g., peanut butter) improved nutrition more than firms competing in high-health categories (e.g., bread) or large-portion categories (e.g., frozen dinners). Recommendations for firm strategy and the design of consumer information policy are examined in light of these surprising firm responses.

Key words: nutrition labels; nutrition; taste; firm strategy; public policy; quality information
History: Received: August 14, 2009; accepted: October 26, 2011; Eric Bradlow served as the editor-in-chief and Scott Neslin served as associate editor for this article. Published online in *Articles in Advance* February 16, 2012; revised July 12, 2012.

1. Introduction

The Nutrition Labeling and Education Act (NLEA) sought to eliminate untruthful nutrition claims and to improve consumers' abilities to access and process nutrition information at the point of sale. It required manufacturers to provide a "Nutrition Facts" label displaying standardized information on all nutrients, recommended daily values, and an ingredient list on food products by May 1994 (*Federal Register* 1993). Health claims making diet–disease links or using terms such as "light" were also regulated for truthful content.

Before the act, nutrition labels were required only when manufacturers made an explicit nutrition claim in advertising or on the package (e.g., low sodium) or when the product was fortified with additional nutrients (*Federal Register* 1973).[1] As a result, prior to the NLEA, most food products did not disclose nutrition information, making comparisons within and across categories difficult for consumers. Furthermore, even those products providing nutrition information did not list recommended daily values for important nutrients such as fat, sodium, and cholesterol.

Theory suggests that the NLEA's required labels should promote consumer search and, in turn, stimulate competition to improve brand nutrition levels (e.g., Salop 1976, Stigler 1961). As noted by the Federal Trade Commission (1979, p. 14), "Information remedies have the direct benefit of improving the free flow of truthful commercial information. Informed consumer decisions then give sellers an economic incentive to improve the quality and selection of their marketplace offerings." This logic may

[1] The required nutrition information was serving size, number of servings per container, calories, carbohydrates, protein, and fat per serving, as well as percent Recommended Daily Allowances for protein, vitamins A and C, thiamine, riboflavin, niacin, calcium, and iron. In 1985, the rule was expanded to include sodium per serving.

be compelling, but we still do not know if the NLEA improved nutrition quality. Studies focusing on select categories or nutrients generate mixed results (e.g., Balasubramanian and Cole 2002, Ippolito and Pappalardo 2002). Furthermore, no research has utilized a control group to examine changes in brand nutrition. Such a control group requires a set of food products not regulated by the NLEA sold during the same time frame. Nearly two decades after the regulation, it is time for a comprehensive evaluation. Our first objective is to perform such an evaluation.

Our second objective is to examine the firm, category, and brand conditions under which firms did or did not improve nutritional quality following the NLEA. Past research leaves a number of key questions unanswered. First, prior research has shown that food firms with more power in a category were more likely to survive following the NLEA (Moorman et al. 2005). However, we do not know whether these firms survived by improving nutrition levels or by improving taste. Second, we know that firms were more likely to increase some nutrients (e.g., vitamins) that would not affect taste in existing brands and to reduce other nutrients (e.g., fat) that would affect taste in new brands (Moorman 1998). However, we do not know how the overall nutrition of new and existing brands changed. Third, previous studies generate mixed results across different product categories and offer little insight into category differences that might explain these findings. Finally, these studies have not examined whether an individual brand's preexisting nutrition level affected the firm's decision to increase nutrition following the NLEA. Did firms further improve those brands already high in nutrition or those brands low in nutrition in an effort to capture a nutrition-sensitive segment?

To achieve these objectives, we offer hypotheses about the effect of the NLEA on brand[2] nutritional improvements. We propose that because taste is more important than nutrition, and nutrition is perceived to be negatively correlated with taste, firms decided to decrease nutrition. We then describe two large-scale quasi-experiments that investigate the impact of the NLEA on the nutritional quality of food products.

2. Did the NLEA Impact Brand Nutritional Quality?

Stigler (1961) proposes that when information is made available in the market, search costs decrease and search benefits increase, which leads to an overall increase in the level of consumer search (see Lynch and Ariely 2000 for evidence of these effects). Search, in turn, stimulates firms to compete on disclosed attributes. Salop (1976) describes this dynamic between information, consumers, and firms as the market-perfecting role of information. There are examples where information disclosure has performed such an important role. For example, Jin and Leslie (2003) find that the introduction of hygiene-quality grade cards displayed in restaurant windows improved restaurant hygiene. The case of nutrition information is more mixed (e.g., Viscusi 1994). We examine this evidence while discussing the reasons why firms may choose not to compete in nutrition following the NLEA.

First, firms may choose not to compete in nutrition following the NLEA because they believe consumers value taste over nutrition in food. There is evidence to support this view (see Chandon and Wansink 2010 for a review). For example, a national survey of 2,976 adults found that, on a five-point scale (where $1 =$ not at all important and $5 =$ very important), consumers rated the importance of taste higher (overall mean $=$ 4.68) than the importance of nutrition (overall mean $=$ 3.85)[3] (Glanz et al. 1998). Other research finds similar priorities (e.g., Borradaile 2007, French et al. 1999, Stewart et al. 2006).

Food consumption trends point to the growing importance of taste over nutrition. Between 1970 and 1999, per-capita U.S. consumption increased 29% for food products with added sugars and 32% for food products with added fats (see Putnam et al. 2000). Likewise, the average number of calories consumed in snacks increased 101% (1978–1996) compared with smaller calorie increases at breakfast (15.5%) and lunch (20.5%), as well as a calorie decrease at dinner (−37.2%) (Cutler et al. 2003). Given snack foods generally have higher levels of sodium, sugar, and fat, which improve taste, higher snack consumption points to a preference for taste over nutrition.

Although not measuring consumers' priority for taste, field studies examining the effect of nutrition labels on product purchase indicate mixed response to nutrition information. Seymour et al. (2004) review 11 studies examining the effect of nutrition information (in the form of point-of-sale displays, signs, and brochures) on the purchase of nutritious offerings in stores. Seven studies showed no increase, three studies found mixed results, and one study found a positive effect across categories. Balasubramanian

[2] We use the term "brand" to refer to individual branded products offered by firms in the marketplace. We ignore SKUs reflecting package size differences given nutrition occurs at the "per-serving" level. However, brand does reflect offerings with flavor differences (e.g., Edy's chocolate ice cream or DiGiorno pepperoni pizza) and nutrition differences (e.g., Jif creamy peanut butter and Jif creamy reduced fat peanut butter).

[3] Glanz et al. (1998) do not examine the statistical differences between taste and nutrition. Their paper also does not report variance. Hence, it is not possible to provide more detailed tests to determine the value of different attributes.

and Cole (2002) find fewer purchases of vitamin-fortified juice, lower-calorie juices, and lower-calorie frozen dinners and entrees but more purchases of lower-sodium soups and lower-fat cheese and cookies following the NLEA. This mixed evidence offers additional support that other attributes, such as taste, may be more important than nutrition.

Second, firms may anticipate that consumers will not select nutritious products because consumers think that nutrition is negatively correlated with taste. Sheeksha et al. (1993) document that as consumers' perceptions of a taste–nutrition trade-off increase, the reported value of performing health behaviors decrease. Raghunathan et al. (2006) observe across four lab experiments that information about the healthiness of a food item reduces inferred taste. Kiesel and Villas-Boas (2012) likewise find a negative effect on consumer choice for a low-fat option in a field experiment introducing shelf labels for microwave popcorn. They conclude that consumer response to nutritional labeling may be influenced by consumers' taste perceptions. The reverse effect can happen as well. If a firm promotes the rich creamy taste of its ice cream, consumers are likely to assume that it is both better tasting and less nutritious. In general, if managers anticipate that consumers will negatively associate taste and nutrition, they will be less likely to improve brand nutrition in response to the NLEA and may instead decrease it.

Third, evidence indicates that consumers prioritize price over nutrition (Glanz et al. 1998). Research generally finds more nutritious products are also more expensive. Putnam et al. (2002) document that retail prices for fruits and vegetables increased 89% between 1985 and 2000, while prices increased only 35% for fats and oils and 20% for carbonated drinks. Likewise, Kuchler and Stewart (2008) observe that between 1980 and 2006, the price index for fresh fruits and vegetables rose 49% while the same index rose only 6% for cakes, cupcakes, and cookies.[4] Given these priorities and trade-offs, managers may not change or even reduce nutrition to keep prices low.

In summary, the research reviewed indicates that the case for the effect of the NLEA on brand nutritional quality improvements is mixed at best and negative at worst. Given this, we predict the following.

Hypothesis 1 (H1). *The NLEA had a negative effect on brand nutrition levels compared with control brands not required to have a nutrition label.*

[4] The authors show that when convenience improvements in fruits and vegetables are accounted for, such as cut, washed, and bagged status or the availability of these offerings in off-season time periods, this price difference disappears. Given our focus on nutrition versus price—and not convenience—these differences are less important.

3. When Did the NLEA Improve Brand Nutritional Quality?

Hypothesis 1 predicts a *negative* effect for the NLEA on brand nutritional quality, in general. In this section, we examine the category, firm, and brand conditions under which the NLEA produced a *positive* effect on nutritional quality.

3.1. The Impact of Firm Power and Risk

We first consider whether *new brands* differ from existing brands in their response to the NLEA. For existing brands currently being sold in supermarkets, the risks of improving nutrition may be higher relative to offering a new brand that has no current customers and for which the firm has made no investments. Managers of existing brands may reason that it is not worthwhile to put current brands at risk given the nutrition–taste trade-offs discussed earlier. These worries deepen if nutrition improvements spur competitive retaliation in taste or price (Chen and Xie 2005). In support of this reasoning, Moorman (1998) documents that firms decreased negative nutrients (e.g., cholesterol) in new brands and increased positive nutrients (e.g., vitamins) in existing brands following the NLEA. Given the positive nutrients (e.g., vitamins and minerals) examined had minimal effect on taste, this strategy allowed firms to respond to the NLEA without risking their current brands and customers. At the same time, new brands with lower levels of fat and cholesterol could attract new segments of customers. Although instructive, this study is limited because it includes only 124 brands. We predict the following.

Hypothesis 2 (H2). *The NLEA had a positive effect on brand nutrition for new brands compared to existing brands in the category.*

A second firm factor we investigate is the *brand's market share level*. Following the logic above, firms should be more risk averse with their large-share brands. In fact, because of their strong consumer following, large-share brands are less likely to benefit from and may even be harmed by increasing nutrition. Therefore, we expect firms to make fewer changes to the nutrition of their large-share brands while being more likely to improve the nutrition of their small-share brands. Hence, we predict the following.

Hypothesis 3 (H3). *The NLEA had a positive effect on brand nutrition for brands with a smaller compared to a larger preexisting market share in the category.*

The third factor we consider is the *firm's market share in the category*—that is, the aggregate of the firm's individual brand shares in the category. Several viewpoints support the idea that a firm's market share in a category reflects a firm's power in that category. For example, the Department of Justice uses a firm's market share in a category to make an assessment of the anticompetitive potential of mergers and acquisitions. In addition, a meta-analysis of the relationship between market power and actions finds that firm market share is related to product quality and firm investments in advertising and sales force—key resources that can be used to respond to regulation (Szymanski et al. 1993).

We are not aware of any prior literature examining the impact of firm category market share on the firm's nutritional responses to the NLEA. Moorman et al. (2005) observe that food firms with large category shares were more likely to survive the NLEA. However, they offer no evidence regarding whether these firms increased or decreased nutrition or taste in order to survive. We predict that firms with large category shares will be less likely to improve nutrition following the NLEA. A strong following of customers across offerings in the category means that these firms have the least to gain and the most to lose from such improvements. Countering this prediction, powerful firms are more likely to have the resources and capabilities to make nutrition improvements. They have the ability to invest in nutrition, to test and relabel brands, to advertise nutrition improvements, and to manage the channel to ensure shelf space. However, we predict that given the risk, large-share firms do not act on these capabilities.

Hypothesis 4 (H4). *The NLEA had a positive effect on brand nutrition for brands whose parent firms have smaller compared with larger preexisting market shares in the category.*

3.2. The Impact of Category and Brand Nutritional Characteristics

We now consider how the nutritional characteristics of product categories and brands affect whether or not firms improved brand nutrition following the NLEA. The first is whether the category is a *low-health category*. Jacobson (1985, p. 85) uses the colloquial term "junk food" to reflect low-health products that "have little or no nutritional value, or products with nutritional value but which also have ingredients considered unhealthy when regularly eaten, or those considered unhealthy to consume at all."

Before the NLEA, managers may have worried that improving nutrition for a generally unhealthy category might be completely missed by consumers. In support of this, Moorman (1996) finds a negative relationship between product category healthiness and the level of nutrition information acquired by consumers. Furthermore, before the NLEA, consumers may have made more inferences about brand nutrition on the basis of category characteristics; for example, all cookies are unhealthy (Coupey 1994). However, following the NLEA, brand-level differences should be attended to more deeply and be perceived as more credible quality signals. Given this, firms competing in a *low-health category* could see an opportunity to stand out among generally less healthy alternatives by improving nutrition.[5] Following this logic, we predict the following.

Hypothesis 5 (H5). *The NLEA had a positive effect on brand nutrition for brands in lower-health categories compared to brands in higher-health categories.*

The second nutritional characteristic of product categories that will influence whether firms improve the nutritional quality of their brands is whether or not the brands are in a *large-portion category*, defined as a category whose offerings constitute the majority of a meal. For example, a large-portion category is frozen dinners, and a small-portion category is peanut butter.

We predict that firms competing in large-portion categories are more likely to improve brand nutritional quality compared to firms competing in small-portion categories. Like brands from low-health categories, brands from large-portion categories may have suffered from category-level inferences before the NLEA. For example, brands in large-portion categories might have been viewed as less nutritious because they constitute the majority of calories eaten for a meal (e.g., the total amount of fat in a pizza is higher than the total amount of fat in salad dressing). However, following the NLEA, brand-level differences should play a bigger role in consumer decision making because the NLEA made it possible for consumers to compare within and across categories. As a result, consumers are more likely to attend to brand-level nutrition improvements in large-portion over small-portion categories. We predict the following.

Hypothesis 6 (H6) *The NLEA had a positive effect on brand nutrition for brands in large-portion categories compared to brands in small-portion categories.*

Finally, we expect that preexisting *brand nutrition level* will influence whether a firm improves nutrition following the NLEA. The literature indicates mixed findings on this issue. Mathios (2000) finds that salad dressings highest in fat experienced the largest reductions in fat following the NLEA. In contrast, Moorman (1998) finds no effect for brand healthiness on nutrition improvements following the NLEA.

[5] Also supporting this prediction, low-health category brands are not at a ceiling for nutrition, so improvements could be made. Furthermore, brand nutrition could decrease for all the reasons highlighted in our discussion of H1.

We predict a negative effect of preexisting nutrition on brand nutrition improvements for two reasons. First, if brands are already performing well in nutrition relative to other brands in the category, managers may conclude that there would be very little consumer impact of additional investments in nutrition. Second, managers may reason that if the brand is already high in nutrition, additional improvements may adversely affect taste, or at least consumers' inferences about taste. For these reasons, we predict the following.

Hypothesis 7 (H7). *The NLEA had a positive effect on brand nutrition for brands with lower compared to higher preexisting nutrition levels.*

We test these predictions in two studies. The first study involves a multiyear sample of brands from Corinne T. Netzer's *Complete Book of Food Counts* books (1991, 1994, 1997) that report nutrition for brands both required and not required to be labeled under the NLEA. The second study involves a multiyear sample of brands from *Consumer Reports*, which examines brand nutrition, taste, and price for select product categories. Both studies use a longitudinal quasi-experimental design with observations before and after the NLEA. We present the Netzer study first, given its greater breadth of nutrients and scope of brands. We then present the *Consumer Reports* study, which involves a subset of categories from Netzer but has the advantage of including measures of price and taste, which are relevant for the theoretical and policy implications of our results.

4. Netzer Study

4.1. Research Design

We examine the effect of the NLEA using a quasi-experimental design that examines brand nutritional quality before and after the new labels. A quasi-experimental design is used when investigators have control over the scheduling of data collection procedures without control over the scheduling of experimental stimuli (Campbell and Stanley 1963). Our use of this design follows the tradition of quasi-experimental designs in marketing (e.g., Anderson et al. 2010, Bronnenberg et al. 2010, Moorman 1998, Moorman et al. 2005). Specifically, our design uses two periods before and one period after the NLEA. For explication, the early pre-NLEA time period is denoted *pre1-NLEA*, the second pre-NLEA time period is denoted *pre2-NLEA*, and the post-NLEA time period is denoted *post-NLEA*. Furthermore, we observe a control group of food products for which the NLEA did not apply, giving us a multiple time-series quasi-experimental control group design.

4.2. Sample

Our sample was drawn from three editions of Corinne T. Netzer's *Complete Book of Food Counts*. Specifically, we used the second edition (published in March 1991, data collected in 1990), third edition (published in March 1994, data collected in 1993), and fourth edition (published in January 1997, data collected in 1996). Even though the books do not contain all food products available in the market, they are considered a definitive source of nutritional information for food products sold in supermarkets and in some restaurants. Given this, we do not consider selection issues to be a problem. However, to be certain, we test for selection bias, as described in the next section. Over time, the number of products reviewed has increased, reflecting brand proliferation. There were more than 8,500 products listed in the second edition, 12,000 products listed in the third edition, and an estimated 13,750 products listed in the fourth edition. These numbers compare reasonably to the number of individual food brands included in the IRI *Marketing Factbook* (accessed through Wharton Research Data Services; https://wrds-web.wharton.upenn.edu/wrds/).[6]

To limit the sample to a manageable number of product categories, we select 30 product categories using two criteria:

1. Given that we seek to replicate our findings across two data sets (Netzer and *Consumer Reports*), we include product categories that were also reviewed by *Consumer Reports* before and after the NLEA. This resulted in a set of 12 product categories: bread, cheese, hot dog, ice cream, lasagna frozen dinners, margarine, peanut butter, potato chip, raisin bran cereal, soup, steak frozen dinners, and tomato sauce.

2. To provide a control group to examine change in brand nutrition, we select two groups of food products not regulated by the NLEA. The first group includes four categories of fresh products that are sold in supermarkets but are not required by the NLEA to be labeled. These are fresh meats (beef, chicken, and pork) and bulk nuts. It is important to note that unlike many fresh fruits and vegetables, which also are not labeled, firms could improve nutrition in these categories. The nutritional quality of fresh meats can change depending on the way the meats are cut and how the animals are raised (i.e., to have less fat), and the nutritional quality of nuts can change by

[6] Netzer does not state how many listings are in the fourth edition. Based on the number of pages (770 pages), we use the listings per page in the third edition (12,000/672 pages, or 17.85) to estimate listings in the fourth edition. The number of individual food brands listed in the IRI *Marketing Factbook* is $n = 8{,}076$ in 1990, $n = 8{,}490$ in 1993, and $n = 9{,}036$ in 1996.

the level of fat and sodium added during preparation. The second group includes product categories sold in supermarkets that are also sold in restaurants or retail stores listed in Netzer. For example, french fries are sold in Burger King and in supermarkets, and ice cream is sold in Baskin-Robbins retail outlets and in supermarkets. This resulted in the inclusion of 14 additional product categories (baked bean, baked potato, barbeque sauce, Danish, English muffin, french fry, hash brown, muffin, pancake syrup, pizza, pork sausage, salad dressing, sour cream, and tartar sauce) as well as unlabeled ice cream brands (labeled ice cream is already included as a category, see item 1 above).

In selecting these categories for inclusion, we used several additional guidelines to ensure the comparability of the control group and labeled group. First, we stipulated that the restaurant products had to be listed separately in Netzer (e.g., a plain English muffin instead of an English muffin with butter). This was necessary because supermarket products are sold and listed in this fashion, which allows us to compare products across stores and restaurants. Second, we do not include fast-food products that are not sold in supermarkets because these products tend to have different characteristics. For example, we did not include cheeseburgers because there was no supermarket counterpart for sale during our observation period. Third, we required a sample size of at least five brands in the supermarket and in the fast-food restaurant to include a category.[7]

One concern about the use of restaurant foods as a control group arises because "eating out" evokes a unique set of taste–nutrition trade-offs, and so consumers may prefer taste over nutrition in these settings. However, if so, we believe that restaurant brands should be more likely to improve taste and not nutrition following the NLEA. Hence, if we are able to demonstrate that labeled brands decrease in nutrition relative to this control group of restaurant products, this strengthens our confidence in the test of H1.[8] A final concern about the control group is that consumers may be more focused on nutrition for the three control categories of fresh meats. As a result, firms may be more likely to improve nutrition in these categories. To resolve these concerns, we also test H1 by limiting the analysis to those categories with both labeled and unlabeled brands (i.e., removing fresh meats) as a robustness check.

With the exception of the fresh meats, which are classified by cuts and types, and bulk nuts, which are classified by type, Netzer lists all products at the individual brand level, not the SKU level. For example, for peanut butter, Jif creamy and Jif creamy reduced fat are listed separately, but Jif creamy in different sizes is not. There are several reasons why this level of analysis is appropriate for examining changes in nutrition. First, given our measure of nutrition is at the "per-serving" level, it is not influenced by package size differences that are often associated with SKUs and important to consumption (Wansink 2003). Second, given separate brands reflect flavor or texture differences (e.g., chunky peanut butter, or peanut butter and jelly spread) and for nutrition differences (e.g., reduced fat peanut butter), we are able to observe changes that might be obscured if a higher unit of analysis were used (i.e., only Jif was listed).

Tables 1 and 2 summarize key features of the Netzer sample. We examine 2,746 brands over the three periods from the 30 product categories we study: 1,172 brands in *pre-NLEA* and 1,574 brands in *post-NLEA*. We observe fewer brands before the NLEA because of a general increase in the number of brands over the period and because some nutrition information is missing from Netzer for these periods (see §4.4.1 for details). Given the natural entry of new brands and the exit of existing brands, not all brands are observed in all time periods, resulting in an unbalanced panel. A total of 254 brands repeat in the data set from *pre1-NLEA* to *post-NLEA*, whereas 416 brands repeat from either *pre-NLEA* period to *post-NLEA*. Our estimation approach accounts for this data structure.

4.3. Internal Validity Threats

Because quasi-experiments give up the control of the laboratory for external validity, extra care must be taken to rule out threats to internal validity (Cook and Campbell 1979). Although the use of a control group of unlabeled food products that was not regulated by the NLEA reduces these concerns, we discuss those reasonable threats and how each is ruled out through additional analyses.

4.3.1. Mortality Threat. This bias occurs when the observed effect is not due to the intervention but to certain types of brands exiting the sample. We view this shift in available brands as a part of the NLEA effect, not a threat to validity. Nevertheless, we investigate the issue of mortality by examining the change in nutrition for the subset of brands for which we have both *pre-NLEA* and *post-NLEA* data (see item 6 in §A.1 of the appendix).

[7] Note that the final number of brands for a category in the analysis may be below this threshold given some missing nutrient information.

[8] A counterview is that restaurant brands might have been influenced by NLEA to increase nutrition because restaurant owners perceived that customers were becoming more nutrition conscious. We think it is more likely that food manufacturers and restaurants both had a good understanding of consumers' focus on taste and nutrition and that these did not vary. As discussed in the section on selection bias, although we match the product categories across the labeled and unlabeled groups, we cannot rule out all differences between the two in our analysis.

Table 1 **Summary of Nutrition Data for the Netzer and *Consumer Reports* Samples**

Category[a]	Netzer brands required to be labeled by NLEA	Netzer brands not required to be labeled by NLEA[b, c]	Number of labeled brands in *Consumer Reports*	NLEA control group analysis		NLEA-labeled product analysis	
				Netzer	*Consumer Reports*	Netzer	*Consumer Reports*
1. Baked bean	70	5		X		X	
2. Baked potato	7	23		X		X	
3. Barbeque sauce	100	6		X		X	
4. Bread	276		116	X		X	X
5. Cheese	195		19	X		X	X
6. Danish	27	5		X		X	
7. English muffin	51	2		X		X	
8. French fry	24	10		X		X	
9. Fresh beef		143		X			
10. Fresh chicken		64		X			
11. Fresh pork		168		X			
12. Hash brown	8	4		X		X	
13. Hot dog	98		68	X		X	X
14. Ice cream	105	120	150	X		X	X
15. Lasagna frozen dinner	44		41	X		X	X
16. Margarine	77		101	X		X	X
17. Muffin	82	4		X		X	
18. Nuts	40	60		X		X	
19. Pancake syrup	34	12		X		X	
20. Peanut butter	40		123	X		X	X
21. Pizza	183	83		X		X	
22. Pork sausage	30	14		X		X	
23. Potato chip	102		40	X		X	X
24. Raisin bran cereal	16		25	X		X	X
25. Salad dressing	114	27		X		X	
26. Sour cream	27	10		X		X	
27. Soup	58		67	X		X	X
28. Steak frozen dinner	24		23	X		X	X
29. Tartar sauce	8	2		X		X	
30. Tomato sauce	144		137	X		X	X

[a]Although categories were selected with *n* greater than 5, the reported *n* may be lower than this due to brands dropping out because of missing nutrients.

[b]Fresh beef, chicken, and pork are not required by the NLEA to disclose nutrition information. Bulk nuts are not required to be labeled, but branded nuts are labeled.

[c]The unlabeled baked bean, baked potato, barbeque sauce, Danish, English muffin, french fry, hash brown, muffin, pancake syrup, pizza, pork sausage, salad dressing, sour cream, and tartar sauce brands are sold in fast-food restaurants, and the unlabeled ice cream brands are sold in retail stores (e.g., Baskin-Robbins). The NLEA did not require the disclosure of nutrition information on either set of brands.

4.3.2. Selection Bias Threat. This bias occurs when the observed effect is due to Netzer's selection of brands, which may not be representative of all brands in supermarkets at the time. The ideal test would be to compare the nutritional quality of brands selected and not selected by Netzer. This test is not possible because we are unable to locate nutrition information for brands not included in the Netzer books. However, we address this concern in four ways. First, we reiterate that the Netzer books are considered to be a definitive source of nutrition information. Second, the Netzer books are sold to national markets and must contain a full range of brands available in order to succeed from a publishing perspective. Third, we compare the market share levels of the brands in the Netzer sample with a full sample of brands from the IRI *Marketing Factbook*. We find no market share differences between brands selected and not selected by Netzer ($F_{1,4843} = 0.028$, n.s.). Finally, to test sample selection over time, we examine the average market share for the final sample of brands in each of the three years of the Netzer sample and find that, after accounting for product category, market share does not vary over time ($M_{1990} = 1.70$, $M_{1993} = 1.42$, and $M_{1996} = 1.50$; $t_{1990\text{ vs. }1993}(1401) = -1.33$, n.s., $t_{1993\text{ vs. }1996}(1401) = 0.49$, n.s., $t_{1990\text{ vs. }1996}(1401) = -0.98$, n.s.).[9] Finally, the use of a control group reduces concerns with selection bias threat and history threat (discussed in the next section). However, given the products compared are not matched on every feature, concerns about selection, although attenuated, cannot be completely eliminated.

[9] This and the prior test involving market share includes only the labeled brands because of a lack of market share information for the unlabeled brands.

Table 2 Sample Characteristics

	Netzer sample				*Consumer Reports* sample							
	Average nutrition level[a]				Average nutrition level			Average taste level		Average price level		
Category	*Pre-NLEA*	*Post-NLEA*	Nutrition based on[b]	Years[b]	*Pre-NLEA*	*Post-NLEA*	Nutrition based on:	*Pre-NLEA*	*Post-NLEA*	*Pre-NLEA*	*Post-NLEA*	Years
1. Baked bean	75.42	76.14	Fat	1990								
2. Baked potato	76.75	72.97	Cholesterol	1993								
3. Barbeque sauce	71.06	70.76	Sodium	1996								
4. Bread	74.63	74.59	Fiber		96.82	96.12	Calories	52.81	55.33	0.05	0.05	1988, 1994, 1999
5. Cheese	72.00	71.01			96.77	98.80	Fat	37.10	31.56	0.12	0.11	1990, 1993, 1996
6. Danish	67.05	66.34										
7. English muffin	74.53	74.04										
8. French fry	69.59	70.93										
9. Fresh beef	58.88	58.89										
10. Fresh chicken	55.04	54.38										
11. Fresh pork	56.60	56.14										
12. Hash brown	75.74	70.62										
13. Hot dog	62.15	62.26			81.90	84.71	Fat, sodium	55.42	57.52	0.16	0.17	1993, 2007
14. Ice cream	65.63	70.59			86.26	85.44	Fat	70.72	64.66	0.21	0.19	1986, 1994, 1999
15. Lasagna frozen dinner	70.60	66.18			72.81	72.01	Sodium	40.64	43.77	1.20	0.97	1988, 1993, 1999
16. Margarine	70.55	71.22			86.06	88.19	Fat	51.25	32.86	0.03	0.02	1989, 1994, 2000
17. Muffin	72.03	68.23										
18. Nuts	71.68	71.00										
19. Pancake syrup	74.02	73.91										
20. Peanut butter	66.70	67.67			93.24	92.47	Sodium	48.69	71.89	0.16	0.14	1987, 1990, 1995
21. Pizza	54.19	54.07										
22. Pork sausage	56.92	59.41										
23. Potato chip	70.54	70.86			86.15	90.77	Fat	57.62	66.00	0.13	0.16	1991, 1996
24. Raisin bran cereal	78.26	79.14			96.66	97.89	Fat	47.80	60.05	0.13	0.10	1992, 1996
25. Salad dressing	65.69	67.98										
26. Soup	73.08	67.18			67.78	66.76	Sodium	52.67	44.93	0.30	0.25	1987, 1993, 1999
27. Sour cream	72.43	72.40										
28. Steak frozen dinner	60.98	61.68			59.04	63.72	Sodium	26.00	32.91	1.28	1.03	1988, 1993, 1999
29. Tartar sauce	70.86	66.63										
30. Tomato sauce	71.29	71.21			72.04	79.81	Sodium	51.08	75.85	0.22	0.28	1985, 1992, 1996

[a]The average nutrition means, *pre-NLEA* and *post-NLEA*, cut across labeled and unlabeled products in the 16 categories containing both types of products. This includes baked bean, baked potato, barbeque sauce, Danish, English muffin, french fry, hash brown, ice cream, muffin, nuts, pancake syrup, pizza, pork sausage, salad dressing, sour cream, and tartar sauce.

[b]The nutrients and years listed apply to all 30 categories in the Netzer sample.

4.3.3. History Threat. This threat refers to the situation in which the observed effect is due to another event, not the NLEA. One possibility is that some firms introduced new labels before the May 1994 deadline to gain an advantage. Moorman (1998) addresses this threat by counting the brands with the new nutrition label in January 1994 (five months prior to the NLEA) and finds that only 1% of all food products in stores had the new label. Another possibility is that firms changed the composition of their brands in response to the NLEA but did not change their labels until May 1994. This seems unlikely, because if a firm made early investments to improve brand nutrition, why would the firm not also attempt to gain a competitive advantage through early introduction of the label? Certainly, firms invested in product development and marketing research in anticipation of the NLEA. However, evidence suggests that new brands were not introduced and current brands were not labeled until the NLEA deadline. We also include a variable for the time trend to rule out the possibility that the passage of time, not the NLEA, is responsible for our effects.

4.4. Measures

4.4.1. Brand Nutrition Measure. Netzer reports fat, cholesterol, sodium, and fiber, but not vitamins or minerals.[10] We had two choices when forming our nutrition measure—form nutrient-specific measures (e.g., fat per serving) or form an overall measure of

[10] Netzer also provides information about protein and carbohydrate levels. However, these macronutrients are of less interest from a public health perspective.

nutrition across nutrients. We use an overall nutrition measure for three reasons. First, nutrients vary in terms of how relevant they are for various product categories. For example, fiber is a key ingredient in bread but not in margarine or cheese. Conversely, fat is a key ingredient in margarine and cheese but not bread. Therefore, examining the effect of specific attributes limits our ability to make statements across categories. Second, although some consumers care about specific nutrients—for example, diabetic patients care about added sugars and cardiac patients care about fat and cholesterol levels—most consumers seek a well-balanced diet with desirable levels of all nutrients. Finally, *Consumer Reports* data (see §5.2) provide only one nutrient for each category (e.g., sodium for soup and fat for margarine), and this nutrient differs across categories (see Table 2). As a result, it is not possible to examine the same nutrients across all the categories. Thus, to keep relatively uniform procedures across the two studies, we use an overall measure of nutrition in the Netzer sample.

We create a measure of *overall brand nutrition* using fat, sodium, cholesterol, and fiber by taking the following steps. First, nutrient levels are reported on a per-serving basis. Given serving sizes were standardized by the NLEA, we utilize the *post-NLEA* serving size to equate servings across years. Second, each of the four nutrients is converted to a percentage of Recommended Daily Value (%*RDV*), which was the standard established by the NLEA.[11] Three of the four nutrition variables (fat, cholesterol, and sodium) are attributes for which more is generally worse for one's health; fiber is the opposite—more is better. Given this, and because we sought an overall nutrition measure that accounts for the four nutrients, we average the fiber %*RDV* with (100 − %*RDV*) for fat, cholesterol, and sodium to produce our nutrition measure.[12] Given its construction, a higher number means more nutritional value. We test the robustness of our results using an alternative overall measure of nutrition and individual nutrition measures in the appendix.[13]

4.4.2. Moderating Variable Measures. We test H2–H7 with two different models—one model involving lagged variables and another involving nonlagged variables. The lagged variable analysis tests H3, H4, and H7, which focus on preexisting levels of brand market share, firm market share, and brand nutrition, respectively. The moderator analysis variables are measured as follows:

- *Category predictors*: We determined the *low-health categories* by asking two nutritionists to classify those categories that are low-health using the criteria described earlier. There was agreement that the Danish, french fry, hash brown, hot dog, pancake syrup, pork sausage, and potato chip categories are low-health. We classify *large-portion categories* as those that constitute the majority of calories and nutrients for a meal; they are hot dog, lasagna frozen dinner, steak frozen dinner, pizza, and pork sausage. Note that although fresh meats are large-portion, they are not included in this analysis because they did not require nutrition labels.
- *Firm predictors*: Whether the brand is *new versus existing for the firm* is measured by searching for the brand in the prior year in the IRI *Marketing Factbook* (i.e., 1989, 1992, and 1995). If the brand is new, we coded this variable as 1; if not, we coded it 0. For *lag firm market share*, we again use the IRI *Marketing Factbook*. We aggregate the firm's market share across all of its brands in a category in the prior time period. Following convention (Buzzell and Gale 1987), we normalize the measure to the largest firm category market share by dividing the firm category market share by this value.

[11] We use 65 grams of fat, 2,400 milligrams of sodium, 300 milligrams of cholesterol, and 25 grams of fiber as standards (http://www.fda.gov/Food/LabelingNutrition/ConsumerInformation/ucm078889.htm#see6).

[12] We do not include other macronutrients, such as protein or carbohydrates, in our brand nutrition measure because their effect on public health is less important and because it is unclear how to combine these indicators to form an overall measure of brand nutrition. We do not include a measure of calories given it is highly correlated with fat level ($\rho = 0.80$).

[13] The Netzer books sometimes did not provide fiber, cholesterol, or sodium information during the pre-NLEA years. If an average nutrition score is formed for brands across the remaining nutrients, the measure will not be a valid comparison relative to brands for which all of the nutrient data are available. This is especially problematic because fiber is reverse-scored relative to the other three nutrients. We therefore restrict our sample to only those brands that had fat, sodium, cholesterol, and fiber information. One concern is that the brands with missing nutrition information from the *pre-NLEA* period may be systematically better or worse in nutrition than the brands with complete information. If so, eliminating these brands may bias our sample. To test for such bias, we compare the pre-NLEA brands with complete nutrition information to the pre-NLEA brands eliminated because they were missing one or more nutrients on the two nutrients that had more complete information—fat and sodium. We form a combined measure of fat and sodium by averaging the (100 − %*RDV*) of fat and sodium. Results, after accounting for product category, indicate that brands eliminated because they were missing fiber or cholesterol information are not different from brands containing all four nutrients that are retained in the sample ($M_{\text{eliminated}} = 84.60$ versus $M_{\text{retained}} = 84.50$, $t(2275) = -0.19$, n.s.). Another concern is that brands with missing nutrient information might have smaller market share compared to the brands containing all four nutrients. We compare those pre-NLEA brands eliminated and retained on brand market share and find no difference ($M_{\text{marketshare, eliminated}} = 1.49$ versus. $M_{\text{marketshare, retained}} = 1.44$, $t(1187) = -0.29$, n.s.). The difference in degrees of freedom between the market share test and the nutrient test is because a number of brands are also missing market share information.

• *Brand predictors*: *Lag brand market share* is measured as the lagged brand market share for the same brand in the prior time period. As with firm market share, we normalize brand market share to the largest brand market share in the category. *Lag brand nutrition* is the measure of nutrition for the same brand in the prior time period.

4.5. Modeling and Estimation Approach

We test our predictions using three models.[14] Model 1 is a control group analysis of both labeled and unlabeled brands used to test H1. Model 2 examines the nonlagged moderators to test H2, H5, and H6.[15] Model 3 tests the lagged moderator predictions in H3, H4, and H7, which examine the effects of the preexisting brand market share, firm market share in the category, and brand nutrition, respectively.

4.5.1. Control Group Analysis. H1 predicts that, compared to the unlabeled products, nutrition for labeled products decreased following the NLEA. Hence, our focus is on the effect of the interaction of the NLEA and the labeled status on brand nutrition. Our sample is all labeled and unlabeled brands ($n = 2{,}746$). We estimate Model 1 for brand b at time t:

$$\begin{aligned} Nutrition_{bt} = {} & \beta_0+\beta_1 x_{1bt}+\beta_2 x_{2bt}+\beta_3 x_{1bt}x_{2bt} \\ & +\beta_4 x_{3bt}+\beta_5 x_4+\cdots+\beta_{33}x_{32}+e_b+e_{bt}, \quad (1) \end{aligned}$$

where x_{1bt} is the NLEA variable that is 1 in *post-NLEA*, and 0 in *pre-NLEA*, and x_{2bt} is the labeled variable that is 1 if the brand required a nutrition label and 0 if not. Our focus is on $x_{1bt}x_{2bt}$, which is the interaction of the NLEA and labeled variables. Given that an important alternative hypothesis is that the mere passage of time, and not the NLEA, accounts for changing nutrition levels, we include a linear *time trend* variable (x_{3bt}). Finally, x_4 to x_{32} are the set of fixed product category dummy variables; barbeque sauce is the omitted category. In this and the other models, all variables in the predicted interactions are mean centered to improve interpretation. Mean centering allows us to examine the effect of the NLEA at the mean level of the other variables in our model.

In Model 1, the error term is $e_{bt} \sim \mathrm{N}(0, \sigma^2_{bt})$, and we also include a random effect for brand, $e_b \sim \mathrm{N}(0, \sigma^2_b)$, to capture variance in nutrition as a result of specific brands. We are not explicitly interested in the set of brands selected, so treating the effect as random allows us to generalize beyond the sample analyzed. Within a category, each unique brand is identified across time periods to enable the model to account for the covariance within brands. We use a mixed model estimated using maximum likelihood to account for the fixed and random effects. Models 1–3 are estimated in SAS 9.2.

4.5.2. Nonlagged Moderator Analysis. The moderator analysis focuses on those brands required by the NLEA to include a label (H2–H7). We test our predictions with two different models—one model involving lagged variables and another involving nonlagged variables. We made this choice because although we have 1,984 labeled products, only 366 contain lagged values of brand nutrition and brand market share. Hence, we test our predictions involving nonlagged variables (H2—new brand, H5—low-health category, H6—large-portion category) in the larger sample and our predictions involving lagged variables (H3—lag brand market share, H4—lag firm market share, and H7—lag brand nutrition) in the smaller sample while controlling for the low-health category and large-portion category predictors.

Model 2 tests the nonlagged moderators in H2, H5, and H6. Specifically, we examine nutrition for brand b at time t:

$$\begin{aligned} Nutrition_{bt} = {} & \beta_0+\beta_1 x_{1bt}+\beta_2 x_{2bt}+\beta_3 x_{1bt}x_{2bt}+\beta_4 x_{3bt} \\ & +\beta_5 x_{1bt}x_{3bt}+\beta_6 x_{4bt}+\beta_7 x_{1bt}x_{4bt}+\beta_8 x_{5bt} \\ & +\beta_9 x_{6bt}+\beta_{10}x_{7bt}+\beta_{11}x_8 \\ & +\cdots+\beta_{32}x_{29}+e_b+e_{bt}, \qquad (2) \end{aligned}$$

where x_{1bt} is the NLEA variable that is 1 in *post-NLEA* and 0 in *pre-NLEA*, x_{2bt} is the new brand variable that is 1 if the brand is new and 0 if it is existing, x_{3bt} is the low-health category variable that is 1 if the category

[14] Field studies in marketing increasingly adopt a difference-in-differences modeling approach to rule out observed change due to unobserved levels and change in demand or supply characteristics. We do not feature this approach for three reasons. First, this approach requires survival over time. When observing customers, this requirement is important because mortality could change the composition of responding customers. However, given our interest in studying how firms responded to the NLEA and the very real possibility that firms may introduce or eliminate brands as part of that response, a sample that requires brands to be present over time would introduce a survival bias. Second, the number of brands that were in each of the three periods and for which we also had firm market share information drawn from The *Marketing Factbook* was 9% of the $n = 1{,}984$ labeled products. Limiting our analysis to these brands would reduce the external validity of our findings. Third, we have a control group that improves our confidence in the effects. As a safety check, we do include a difference-in-differences approach (see §4.6.1) to test for the differential effect of labeled versus unlabeled brands (H1).

[15] The interaction effects tested in Model 2 were not estimated in Model 1 because of the manner in which we captured whether a brand was new or existing for the firm. Specifically, this variable was measured by searching for the brand in the prior year in the IRI *Marketing Factbook*. The set of unlabeled brands includes fresh items and items sold at fast-food restaurants, which are not included in the *Marketing Factbook*. As a result, it was not possible to examine the three-way interaction of *NLEA* ∗ *Labeled brands* ∗ *New brand*.

is low-health and 0 otherwise, and x_{4bt} is the large-portion variable that is 1 if the category is a large-portion category and 0 otherwise. Our predictions relate to the moderating effects of these variables, so we focus on their interactions with the NLEA—specifically, $x_{1bt}x_{2bt}$, $x_{1bt}x_{3bt}$, and $x_{1bt}x_{4bt}$. The x_{5bt} term captures the time trend effect. We include the contemporaneous values of brand market share (x_{6bt}) and firm market share in the category (x_{7bt}) as control variables given their role in the lagged Model 3. Finally, x_8 to x_{29} are the set of dummy variables for the product categories.[16] As before, the error term is e_{bt} with a random effect for brand, e_b, and we estimate a mixed model with maximum likelihood.

4.5.3. Lagged Moderator Analysis. We limit this analysis to brands that repeat at least once across the three time periods. It compares brands that exist across the two *pre-NLEA* time periods to brands that exist in at least one *pre-NLEA* and the *post-NLEA* time period. We test Model 3 for brand b at time t:

$$\begin{aligned} Nutrition_{bt} &= \beta_0+\beta_1x_{1bt}+\beta_2x_{2bt-1}+\beta_3x_{1bt}x_{2bt-1}+\beta_4x_{3bt-1} \\ &\quad+\beta_5x_{1bt}x_{3bt-1}+\beta_6x_{4bt-1}+\beta_7x_{1bt}x_{4bt-1}+\beta_8x_{5b}+\beta_9x_{1bt}x_{5b} \\ &\quad+\beta_{10}x_{6b}+\beta_{11}x_{1bt}x_{6b}+\beta_{12}x_7+\cdots+\beta_{25}x_{20}+e_b+e_{bt}, \qquad (3) \end{aligned}$$

where x_{1bt} is the NLEA variable that is 1 if the brand repeats in the data set in one of the *pre-NLEA* time periods and in the *post-NLEA* time period and 0 if the brand repeats in the data set in the two *pre-NLEA* time periods, x_{2bt-1} is the lag value of brand market share, x_{3bt-1} is the lag value of brand nutrition, and x_{4bt-1} is the lag value of firm market share in the category. Our focus is on the interaction of the NLEA variable with lagged brand market share ($x_{1bt}x_{2bt-1}$), the interaction of the NLEA variable with lagged brand nutrition ($x_{1bt}x_{3bt-1}$), and the interaction of the NLEA variable and firm category market share ($x_{1bt}x_{4bt-1}$).

Given our other predictions, we include the low-health category (x_{5b}), large-portion category (x_{6b}), and their interactions with the NLEA variable ($x_{1bt}x_{5b}$ and $x_{1bt}x_{6b}$, respectively) as covariates in the analysis. There is no new versus existing brand variable because all brands in Model 3 repeat. Additionally, x_7 to x_{20} are the product category dummy variables, the error term is e_{bt}, and we also include a random effect for brand, e_b.[17] No time trend variable is needed because it is perfectly correlated with the NLEA. We again use a mixed model estimated with maximum likelihood.

Table 3 Control Group Analysis—Netzer Sample

	Dependent variable: *Brand nutrition*	
	NLEA-only effect	Model 1 results
Intercept (β_0)	71.709 (0.667)**	71.807 (0.674)**
NLEA (β_1)	0.169 (0.169)	0.123 (0.169)
Labeled brands (β_2)		0.244 (0.410)
H1: *NLEA* ∗ *Labeled brands* (β_3)		−0.550 (0.179)**
Control variables		
Time trend (β_4)	−0.076 (0.035)*	−0.088 (0.035)*
Product category 1 (β_5)	3.667 (0.679)**	3.566 (0.680)**
Product category 2 (β_6)	0.544 (0.717)	0.479 (0.717)
Product category 3 (β_7)	−1.667 (0.671)*	−1.665 (0.703)*
Product category 4 (β_8)	−4.256 (0.999)**	−4.221 (0.999)**
Product category 5 (β_9)	−0.102 (0.949)	−0.214 (0.950)
Product category 6 (β_{10})	−3.281 (1.101)**	−3.264 (1.101)**
Product category 7 (β_{11})	−9.520 (1.219)**	−9.552 (1.219)**
Product category 8 (β_{12})	−3.469 (0.923)**	−3.433 (0.923)**
Product category 9 (β_{13})	0.394 (0.717)	0.438 (0.718)
Product category 10 (β_{14})	−12.078 (0.934)**	−11.813 (1.010)**
Product category 11 (β_{15})	−15.478 (1.200)**	−15.198 (1.260)**
Product category 12 (β_{16})	−14.072 (0.858)**	−13.790 (0.941)**
Product category 13 (β_{17})	−0.023 (0.781)	−0.011 (0.782)
Product category 14 (β_{18})	−8.840 (0.816)**	−8.900 (0.816)**
Product category 15 (β_{19})	−0.014 (1.068)	0.032 (1.072)
Product category 16 (β_{20})	−16.643 (0.678)**	−16.591 (0.680)**
Product category 17 (β_{21})	−2.963 (0.719)**	−2.915 (0.721)**
Product category 18 (β_{22})	7.399 (1.686)**	7.285 (1.686)**
Product category 19 (β_{23})	0.173 (0.860)	0.305 (0.870)
Product category 20 (β_{24})	2.065 (1.216)+	2.154 (1.244)+
Product category 21 (β_{25})	−4.175 (1.195)**	−4.225 (1.196)**
Product category 22 (β_{26})	−0.740 (0.872)	−0.773 (0.872)
Product category 23 (β_{27})	0.177 (1.631)	0.218 (1.634)
Product category 24 (β_{28})	−14.083 (1.271)**	−14.069 (1.276)**
Product category 25 (β_{29})	1.568 (1.159)	1.569 (1.160)
Product category 26 (β_{30})	4.842 (0.866)**	4.860 (0.866)**
Product category 27 (β_{31})	3.060 (1.139)**	3.087 (1.141)**
Product category 28 (β_{32})	−3.403 (1.769)+	−3.391 (1.770)+
Product category 29 (β_{33})	3.480 (1.041)**	3.419 (1.041)**
σ_b^2	26.106	26.122
σ_{bt}^2	2.078	2.053
−2 log likelihood	15,455.5	15,445.9

Notes. Both models include a random effect for brand. Standard errors are in parentheses.
** $p < 0.01$; * $p < 0.05$; + $p < 0.10$.

4.6. Netzer Study Results

4.6.1. Control Group Results. Table 3 contains results for the control group analysis ($n = 2{,}746$). To increase understanding, we report the effect of the NLEA only in the first column and Model 1

[16] There are only 22 category dummy variables instead of 29 because 3 unlabeled categories (i.e., fresh beef, chicken, and pork) are not included in this analysis and 4 category dummies are omitted to avoid perfect linear transformations with the low-health or large-portion variables.

[17] There are only 14 category dummy variables instead of 26 because 9 of the labeled product categories (i.e., baked potato, Danish, french fry, hash brown, lasagna frozen dinner, nuts, salad dressing, steak frozen dinner, and tartar sauce) are not represented in the lagged analysis and 3 product category dummies were omitted from the model to avoid perfect linear transformations with the low-health and large-portion covariates.

results in the second column. Alone the NLEA has no effect across pooled labeled and unlabeled brands ($\beta_1 = 0.123$, $t(819) = 0.73$, n.s.). However, consistent with H1, the *NLEA ∗ Labeled brands* interaction is significant ($\beta_3 = -0.550$, $t(838) = -3.08$, $p < 0.01$). The nutrition mean, calculated from the raw data, increases from 59.15 before the NLEA to 64.02 after the NLEA for the unlabeled brands. In contrast, the nutrition mean for the labeled brands decreases from 70.09 before the NLEA to 68.38 after the NLEA. Given these results, we test for a significant difference in nutrition across time periods using Model 1. Although the change in nutrition for the unlabeled brands is not significant ($t(768) = 1.01$, n.s.), nutrition for the labeled brands decreases significantly from *pre-NLEA* to *post-NLEA* ($t(941) = -3.09$, $p < 0.01$).[18]

To gain more insight, we examine brand nutrition for the labeled and unlabeled brands across the three time periods. The unlabeled brands decrease in nutrition from *pre1-NLEA* to *pre2-NLEA* ($M_{pre1\text{-}NLEA} = 60.08$ to $M_{pre2\text{-}NLEA} = 58.19$; $t(757) = -3.66$, $p < 0.001$) and then increase significantly from *pre2-NLEA* to *post-NLEA* ($M_{post\text{-}NLEA} = 64.02$; $t(762) = 2.65$, $p < 0.01$). The labeled brands, on the other hand, show no change in nutrition from *pre1-NLEA* to *pre2-NLEA* ($M_{pre1\text{-}NLEA} = 70.05$ to $M_{pre2\text{-}NLEA} = 70.11$; $t(837) = 0.48$, n.s.) and then decrease significantly from *pre2-NLEA* to *post-NLEA* ($M_{post\text{-}NLEA} = 68.39$; $t(918) = -2.79$, $p < 0.01$).

Although we do not use a difference-in-differences test as our primary modeling approach because of its limited sample size (see Footnote 14), we use it to test Model 1 given its importance to this research. The dependent variable is the difference in nutrition between the *post-NLEA* and *pre-NLEA* nutrition levels for all brands in our sample that existed before and after the NLEA. The independent variable is the labeled variable, where 1 = labeled and 0 = unlabeled. Although we include product category dummy variables, the brand random effect and time trend variables are no longer relevant given the differencing approach. Results show a significant negative effect of labeled brands over unlabeled brands ($\beta = -2.861$, $t(390) = -6.65$, $p < 0.0001$), supporting H1.[19]

We also test the negative interaction of *NLEA ∗ Labeled brands* on nutrition restricted to those product categories with both labeled and unlabeled brands—specifically on the baked bean, baked potato, barbeque sauce, Danish, English muffin, french fry, hash brown, ice cream, muffin, nuts, pancake syrup, pizza, pork sausage, salad dressing, sour cream, and tartar sauce categories. We replicate the significant negative interaction ($\beta = -0.663$, $t(585) = -2.65$, $p < 0.01$).

We expected that the NLEA would influence both nutrition and taste decisions by the firm. Furthermore, we argued that nutrition and taste influence one another. However, because our test of Model 1 with the Netzer data does not include taste, it may produce biased estimates. To resolve this endogeneity concern, we utilize an instrumental variable for the NLEA. As reported in the appendix (point 1 of the robustness checks), our results replicate.

4.6.2. Nonlagged Moderator Results. Table 4 presents the results of the nonlagged moderator model estimation, which focuses on the labeled brands. Because we include brand market share and firm market share in the category as covariates in the model, the effective sample size is $n = 1{,}366$ as some of the labeled brands are missing this information. Model 2 (see Table 4, column 2) tests our predictions regarding the new brand (H2), low-health (H5), and large-portion (H6) categories. Consistent with H2, the positive interaction effect of *NLEA ∗ New brand* ($\beta_3 = 3.027$, $t(527) = 3.58$, $p < 0.001$) indicates that new brands increased in nutrition relative to existing brands after the NLEA. Supporting H5, the interaction of *NLEA ∗ Low-health category* is positive ($\beta_5 = 1.981$, $t(368) = 4.50$, $p < 0.0001$) and indicates that brands in low-health categories increased in nutrition relative to the brands in high-health categories after the NLEA. Contrary to our prediction in H6, the interaction of *NLEA ∗ Large-portion category* is negative ($\beta_7 = -2.029$, $t(351) = -5.90$, $p < 0.0001$), indicating that brands in large-portion categories decrease in nutrition relative to brands in small-portion categories.

4.6.3. Lagged Moderator Results. Table 5 presents the results for Model 3. This analysis compares brands that exist across the two *pre-NLEA* time periods (NLEA = 0) to brands that exist in at least one *pre-NLEA* and the *post-NLEA* time period (NLEA = 1). This sample involves $n = 366$ brands. Considering H3, we find a significant positive coefficient on the interaction *NLEA ∗ Lag brand market share* ($\beta_6 = 0.207$, $t(115) = 2.37$, $p < 0.05$). Given these results run counter to our prediction in H3, we examine the

[18] Examples of specific labeled brands with decreasing nutrition levels are Pappalo's 12″ pizza and Progresso minestrone soup. Pappalo's 12″ pizza decreased in its overall nutrition level from 54.60 to 46.90. On a per-serving basis, fat increased from 24 grams to 32 grams, sodium increased from 1,200 milligrams to 1,420 milligrams, and fiber decreased from 8 grams to 4 grams. Cholesterol decreased from 80 milligrams to 60 milligrams; however, this was not enough to overcome the negative movement on the other three nutrients. Progresso minestrone soup decreased from an overall nutrition level of 71.94 to 69.04. Fat and cholesterol stayed the same at 2.5 grams and 0 milligrams, respectively, whereas sodium increased from 766.3 milligrams to 960.0 milligrams, and fiber decreased from 5.9 grams to 5.0 grams.

[19] Although we conclude that an overall measure of nutrition that cuts across nutrients is superior (see §4.4.1), we also attempt to replicate our results at the individual nutrient level. For H1, our results replicate for fat and cholesterol but not for sodium and fiber. Other nutrient-specific results are in the robustness checks.

Table 4 Nonlagged Moderator Analysis of Labeled Products—Netzer Sample

	Dependent variable: *Brand nutrition*	
	NLEA-only effect	Model 2 results
Intercept (β_0)	69.776 (0.851)**	69.539 (0.848)**
NLEA (β_1)	−0.639 (0.285)*	0.373 (0.334)
Firm-level predictors		
New brand (β_2)		1.617 (0.424)**
H2: *NLEA ∗ New brand* (β_3)		3.027 (0.844)**
Category-level predictors		
Low-health category (β_4)		3.125 (1.308)*
H5: *NLEA ∗ Low-health category* (β_5)		1.981 (0.440)**
Large-portion category (β_6)		−16.397 (1.729)**
H6: *NLEA ∗ Large-portion category* (β_7)		−2.029 (0.344)**
Control variables		
Time trend (β_8)	0.007 (0.062)	−0.045 (0.057)
Brand market share (β_9)	−1.799 (0.513)**	−1.508 (0.486)**
Firm category market share (β_{10})	0.202 (0.373)	0.098 (0.359)
Product category 1 (β_{11})	4.741 (0.668)**	3.288 (0.724)**
Product category 2 (β_{12})	1.936 (0.752)*	0.415 (0.794)
Product category 3 (β_{13})	−3.260 (0.819)**	−4.676 (0.854)**
Product category 4 (β_{14})	−2.996 (0.996)**	12.674 (2.013)**
Product category 5 (β_{15})	1.477 (0.975)	−0.010 (0.992)
Product category 6 (β_{16})	−2.057 (1.237)+	−3.528 (1.228)**
Product category 7 (β_{17})	−8.189 (1.178)**	6.924 (2.097)**
Product category 8 (β_{18})	−1.808 (0.907)*	−3.248 (0.929)**
Product category 9 (β_{19})	1.547 (0.726)*	−0.090 (0.771)
Product category 10 (β_{20})	0.913 (0.930)	−3.510 (1.377)*
Product category 11 (β_{21})	−8.036 (0.894)**	3.762 (1.455)**
Product category 12 (β_{22})	1.504 (1.462)	−3.888 (1.756)*
Product category 13 (β_{23})	−15.413 (0.706)**	−0.438 (1.894)
Product category 14 (β_{24})	−0.793 (0.785)	−2.327 (0.823)**
Product category 15 (β_{25})	7.756 (2.117)**	6.333 (2.051)**
Product category 16 (β_{26})	1.007 (1.124)	−0.411 (1.124)
Product category 17 (β_{27})	−0.686 (1.156)	−2.743 (1.159)*
Product category 18 (β_{28})	5.071 (2.367)*	−0.516 (2.499)
Product category 19 (β_{29})	3.041 (1.267)*	1.590 (1.257)
Product category 20 (β_{30})	6.374 (0.978)**	4.628 (0.994)**
Product category 21 (β_{31})	−1.306 (2.596)	−2.856 (2.499)
Product category 22 (β_{32})	5.084 (1.068)**	3.596 (1.075)**
σ_b^2	23.362	21.420
σ_{bt}^2	2.393	2.004
−2 log likelihood	7,822.0	7,670.6

Notes. Both models include a random effect for brand. Standard errors are in parentheses. There are only 22 category dummy variables instead of 29 because 3 unlabeled categories (i.e., fresh beef, chicken, and pork) are not included in this test and 4 category dummies are omitted to avoid perfect linear transformations with the low-health or large-portion variables.
$^{**}p < 0.01$; $^{*}p < 0.05$; $^{+}p < 0.10$.

Table 5 Lagged Moderator Analysis of Labeled Products—Netzer Sample

	Dependent variable: *Brand nutrition*	
	NLEA-only effect	Model 2 results
Intercept (β_0)	67.918 (0.800)**	69.796 (0.475)**
NLEA (β_1)	−0.293 (0.132)*	−0.155 (0.174)
Brand-level predictors		
Lag brand market share (β_2)		0.116 (0.084)
H3: *NLEA ∗ Lag brand market share* (β_3)		0.207 (0.087)*
Lag brand nutrition (β_4)		0.779 (0.040)**
H7: *NLEA ∗ Lag brand nutrition* (β_5)		0.018 (0.056)
Firm-level predictors		
Lag firm market share (β_6)		−1.014 (0.457)*
H4: *NLEA ∗ Lag firm market share* (β_7)		−1.293 (0.581)*
Control variables		
Low-health category (β_8)	3.872 (1.384)**	0.639 (0.913)
NLEA ∗ Low-health category (β_9)	0.317 (0.669)	−0.816 (1.100)
Large-portion category (β_{10})	−12.551 (1.512)**	−1.962 (1.099)+
NLEA ∗ Large-portion category (β_{11})	−0.190 (0.725)	0.786 (1.526)
Product category 1 (β_{12})	4.657 (1.036)**	0.718 (0.616)
Product category 2 (β_{13})	1.533 (1.102)	−0.753 (0.651)
Product category 3 (β_{14})	−2.257 (1.243)+	−0.528 (0.763)
Product category 4 (β_{15})	0.560 (1.225)	−0.121 (0.701)
Product category 5 (β_{16})	−3.068 (1.660)+	−1.096 (1.033)
Product category 6 (β_{17})	4.347 (1.667)*	1.748 (0.967)+
Product category 7 (β_{18})	−0.406 (1.778)	−1.210 (1.033)
Product category 8 (β_{19})	−3.665 (1.574)*	0.022 (0.968)
Product category 9 (β_{20})	1.659 (1.397)	0.090 (0.801)
Product category 10 (β_{21})	−0.325 (1.870)	−3.055 (1.176)**
Product category 11 (β_{22})	9.179 (2.530)**	1.631 (1.435)
Product category 12 (β_{23})	1.516 (1.778)	−0.029 (1.064)
Product category 13 (β_{24})	5.714 (1.932)**	0.829 (1.140)
Product category 14 (β_{25})	4.416 (1.349)**	1.073 (0.805)
σ_b^2	10.863	2.701
σ_{bt}^2	0.593	1.174
−2 log likelihood	1,661.7	1,450.4

Notes. Both models include a random effect for brand. Standard errors are in parentheses. There are only 14 category dummy variables instead of 26 because 9 of the labeled product categories (i.e., baked potato, Danish, french fry, hash brown, lasagna frozen dinner, nuts, salad dressing, steak frozen dinner, and tartar sauce) are not represented in the lagged sample and three product category dummies were omitted from the model to avoid perfect linear transformations with the low-health and large-portion covariates.
$^{**}p < 0.01$; $^{*}p < 0.05$; $^{+}p < 0.10$.

means derived from the regression model using a spotlight analysis (Aiken and West 1991). We observe no significant change in the movement of large-share brands but a small, yet significant, decrease in nutrition for the small-share brands, which explains the positive result.

H4 predicts a negative interaction between the NLEA and lag firm category market share. In support of this prediction, the interaction is negative and significant ($\beta_8 = -1.293$, $t(134) = -2.22$, $p < 0.05$), indicating that firms with more power in a category were less likely to improve nutrition following the NLEA. Finally, turning to the effect of lag brand nutrition, results fail to support H7. We observe no interaction of *NLEA ∗ Lag brand nutrition* ($\beta_3 = 0.018$, $t(120) = 0.33$, n.s.), indicating that preexisting nutrition is not predictive of firm response to the NLEA.

5. *Consumer Reports* Study

Despite its considerable strengths, the Netzer books do not include taste or price information, both of which are important to consumer food choice. *Consumer Reports* provides nutrition, taste, and price in its evaluations of food categories. We use these data to examine the effect of the NLEA on brand nutrition while controlling for taste and price.[20]

5.1. Design and Sample

As with Netzer, we sought a sample that examined nutrition in two periods prior to the NLEA and in one period after its implementation. Nine categories met our criteria (bread, cheese, ice cream, lasagna frozen dinner, margarine, peanut butter, steak frozen dinner, soup, and tomato sauce), and three other categories were evaluated once before and once after (hot dog, potato chip, and raisin bran cereal) (see Table 1).[21] *Consumer Reports* evaluated different product categories in different time periods, so the year of data collection varies across the categories. For example, for cheese, the *pre1-NLEA* period is 1990, the *pre2-NLEA* period is 1993, and the *post-NLEA* period is 1996; for margarine, the *pre1-NLEA* period is 1989, the *pre2-NLEA* period is 1994, and the *post-NLEA* period is 2000. Three categories are published in 1994 but before the May 1994 NLEA implementation date. We contacted Consumers Union, the publisher of *Consumer Reports*, to determine publication lead time and found it takes an average of six months from data collection to publication. Therefore, we include these categories in the *pre-NLEA* sample. The time trend variable accounts for the varying time points.

The sample of products evaluated by *Consumer Reports* is very broad. It includes national brands (e.g., Prego tomato sauce) and store brands (e.g., Kroger margarine). Given that *Consumer Reports* seeks to help a range of consumers and to remain objective, we believe the sample of selected products is not biased with respect to the health of the brands or their market shares. However, to mitigate concerns, we show that the types of brands selected do not vary across time. To do so, we compare the market share of brands from the *Consumer Reports* sample for which we have this value (i.e., national brands) to the category market share average as determined using the Netzer sample. In other words, we test whether the selected brands differ from the average brand market share across the *pre-NLEA* and *post-NLEA* time periods. This test shows no effect of the NLEA ($\beta = -0.420$, $t(114) = -1.15$, n.s.).

The *Consumer Reports* sample consists of 910 brands (623 brands across the two *pre-NLEA* periods and 287 brands *post-NLEA*). Given the natural entry of new brands and the exit of existing brands, not all brands are observed in all time periods. Our analysis accounts for this unbalanced panel status.

5.2. Measures

5.2.1. Nutrition Measure. Consumers Union tests the nutritional quality of all evaluated products in its own laboratory. In contrast to Netzer, *Consumer Reports* typically selects one nutrient in a category (e.g., sodium in soup or fat in margarine).[22] Although limited, the attribute chosen is important to both taste and health. Hence, if competition were to occur on nutrition, this attribute would likely be the focus. We took the same steps to form our measure of nutrition in these data as with the Netzer sample; however, the measure was focused on the one nutrient. Table 1 reports the nutrient selected for each category. Average values are reported in Table 2.

5.2.2. Price Measure. Price information is provided by *Consumer Reports* in the form of price per serving. As with the nutrition measure, we utilize the *post-NLEA* serving size in equating across years. Prices were adjusted for inflation using the base year 1982–1984 Consumer Price Index for Food and Beverages (see Table 2 for mean price by category).

5.2.3. Taste Measure. Consumers Union performs sensory testing of food brands using multiple raters. Strict controls are used to ensure reliability. Consumers Union has developed "criteria for excellence" for each category. For example, an excellent chocolate chip cookie should taste buttery. We compared the criteria for excellence used by *Consumer Reports* across each of the time periods to ensure that they were similar. *Consumer Reports* has generally used an interval 0–100 scale to report taste evaluations (see Table 2 for mean taste by category).[23]

[20] Replicating all of our predictions from the Netzer sample is not possible for several reasons. First, *Consumer Reports* did not rate unlabeled products from our categories before and after the NLEA, making a full test of H1 impossible. Second, the IRI *Marketing Factbook* does not contain the store brands in *Consumer Reports*. Hence, these brands cannot be coded for new brand (H2) or brand market share (H3).

[21] Frozen chicken dinners were also reviewed three times. However, widely varying descriptions and the treatment of the category in the Netzer books led us to disqualify this category from both samples.

[22] *Consumer Reports* would sometimes evaluate more than one nutrient but did not use this practice frequently enough to make comparisons across time possible.

[23] In a subset of evaluations (hot dog in 2007, ice cream in 1986, lasagna frozen dinner in 1999, steak frozen dinner in 1999, soup in 1987, and tomato sauce in 1985), *Consumer Reports* only reports ratings on a five-point scale ranging from poor (1) to excellent (5). When this approach is used, it also rank orders the brands within each of these levels so that brands have both a numerical score

5.3. Model and Estimation

Recall that the Netzer data did not contain taste information, and hence we had to resolve endogeneity as a result of an omitted variable bias. The *Consumer Reports* data contain information on both taste and price in addition to nutrition. Endogeneity is also a concern in this analysis because the firm is making nutrition, taste, and price decisions simultaneously; thus the NLEA is likely to impact taste and price as well. This results in correlation between nutrition and the error term. To resolve, we model the effect of the NLEA on nutrition utilizing a two-stage least squares regression (2SLS) estimation with instrumental variables for taste and price.

The instrumental variable for brand taste is the *number of taste-related patents* registered with the U.S. Patent and Trademark Office (USPTO) in a product category in the year the brand is observed. This measure therefore reflects new taste technology available in a category in a year. Of course, patents are protected, and only the company registering the patent is able to commercialize related products. However, broadly speaking, the measure reflects taste knowledge among firms in a category in a given time period. To produce our counts, we searched for the term "taste" in the patent title that did not also contain "nutrition" in each product category in the USPTO database. For example, U.S. Patent 5,468,500 is focused on bringing a fruit flavor to ice cream products by inventing "a natural tasting soursop flavoring composition prepared by combining methyl butanoate, methyl 2-butenoate, butanoic acid, methyl hexanoate, methyl 2-hexenoate, hexanoic acid and linalool" (Rodriguez-Flores and Rivera-Gonzalez 1993). This flavoring is used to improve taste, not nutrition. Unlike the effect of patents on high-tech or pharmaceutical products, taste patents should not affect brand price either. This is the case because fast-moving consumer packaged goods products are more likely to recoup investments from scale or from first-mover advantages than from price mark-ups, which are difficult in highly competitive supermarket settings.

from 1 to 5 and a rank within that score. To compare taste rankings over time, we converted these ordinal scores to the 100-point scale used in other years. Using the fact that *Consumer Reports* also reported the range for each score (e.g., $5 = 91$–100), we classified the brands into one of five levels, and we calculated the median interval value for each level. This median value was assigned to the middle-ranked brand in the ordinal data. Furthermore, we calculated the distance from the median value to the minimum and maximum values within each ordinal level. Each of these distances was then divided by the number of brands below (and above) the middle brand. The score assigned to brands below (and above) the middle brand was determined by decrementing (or incrementing) the median score, and each successive score, by that distance.

The instrumental variable for brand price is the level of *price deals* in a product category in the year the brand is observed. Price deals reflect the average savings due to shelf-price reductions or coupon redemptions. We collected this variable from the IRI *Marketing Factbook* from 1990, 1993, and 1996 to capture the *pre1-NLEA*, *pre2-NLEA*, and *post-NLEA* time periods, respectively. Price deals are unlikely to be related to nutrition or taste and instead are driven by brand or firm strategy, inventory levels, or competitor activities.

We used ivreg2 in Stata 11 to test Model 4:

$$\begin{aligned} \mathit{Nutrition}_{bt} = {} & \beta_0 + \beta_1\, \mathit{NLEA} + \beta_2\, \mathit{Taste}^*_{bt} + \beta_3\, \mathit{Price}^*_{bt} \\ & + \beta_4\, \mathit{Time\ trend}_t \\ & + \beta_{5-15}\, \mathit{Category\ dummies} + e_b + e_{bt}. \quad (4) \end{aligned}$$

In the first stage of the analysis, the exogenous *Taste* and *Price* instruments are used to determine the "instrumented" *Taste** and *Price** variables, which are used in place of the endogenous *Taste* and *Price* variables in the second stage. We test for the quality of our instruments during the first stage as reported below. In both stages of the model, we follow the approach in the Netzer analysis and include time trend and product categories dummy variables as control variables. Likewise, mirroring our Netzer approach, the error term is decomposed into two parts: $e_{bt} \sim \mathrm{N}(0, \sigma^2_{bt})$ captures the individual brand error term, and $e_b \sim \mathrm{N}(0, \sigma^2_b)$ captures the error related to brands that repeat in the data over the time periods. The correlation between repeating brands is accounted for by the covariance matrix.

5.4. *Consumer Reports* Study Results

To assess the quality of the two instruments, we first note that their raw correlations are significant. The simple bivariate correlations between each instrument and the endogenous variable are significant for brand taste and taste patents ($\rho = 0.06$, $p = 0.051$) and for brand price and price deal level ($\rho = -0.15$, $p < 0.0001$). More important, we examine the instruments jointly (Cragg and Donald 1993) and individually (Angrist and Pischke 2008) using critical values established by Stock and Yogo (2005). The null hypothesis in these tests is that the instrument is weak. Results indicate that the joint test of the quality of the taste and price instruments meets the highest threshold for the Stock–Yogo weak instrumental variable test (Cragg–Donald Wald $F(2, 691) = 12.77$, Stock–Yogo critical value for two instruments $= 7.03$). Using the Angrist–Pischke (AP) F-test of excluded individual instruments (Angrist and Pischke 2008), both the taste instrument (AP $F_{1,691} = 72.19$) and the price instrument (AP $F_{1,691} = 21.07$) surpass the highest threshold for the Stock–Yogo test of one instrument (threshold = 16.38). The strong rejection of the null hypothesis indicates that these are appropriate instruments.

The overall fit of Model 4 is significant ($F_{15,691} = 135.19$, $p < 0.00001$) (Wooldridge 2006). Our findings replicate the results from the Netzer analysis of the labeled products. Specifically, the NLEA has a significant negative effect on brand nutrition ($\beta_1 = -2.65$, $z = -2.49$, $p < 0.05$). Average nutrition decreases from 83.12 in *pre-NLEA* to 80.47 in *post-NLEA*.[24] In terms of nonhypothesized results, we observe a positive relationship between nutrition and price ($z = 2.80$, $p < 0.01$) and a negative, but not significant, relationship between nutrition and taste ($z = -0.52$, n.s.). We explore nonhypothesized results involving brand taste outcomes in the discussion.

6. Discussion

6.1. Policy Implications

There is little doubt that the NLEA increased the availability and truthfulness of nutrition information. However, our results indicate that the NLEA resulted in lower brand nutrition. This unintended consequence is an important reminder that effective policy should be designed to align consumer and firm responses. Our results identify two conditions that require different solutions to ensure this alignment.

In the first condition, policy regulates the disclosure of attribute information that is universally valued by consumers. In this condition, consumers search on the basis of the disclosure, and firms have an economic incentive to improve the attribute's quality levels, resulting in the market-perfecting benefit of information (Federal Trade Commission 1979, Salop 1976). For example, the introduction of hygiene-quality grade cards displayed in restaurant windows improved restaurant hygiene (Jin and Leslie 2003). In this condition, information produces the desired alignment.

In the second condition, policy regulates information disclosure about an attribute that is less important to consumers than at least one other attribute. In the most challenging policy situation, the disclosed attribute is, or is perceived to be, negatively correlated with the more important attribute. In this condition, labels may not stimulate quality improvements on the disclosed attribute as firms focus on the more important attribute. We believe that this condition was present at the time of the NLEA—consumers valued taste over nutrition and believed that nutrition and taste were negatively correlated.

To test this idea, we examine the effect of the NLEA on taste with the *Consumer Reports* data using the 2SLS approach in Model 4. To do so, we used the same instrument for price and introduced an instrumental variable for nutrition in the first stage.[25] This produced Model 5:

$$\begin{aligned} Taste_{bt} = {} & \beta_0 + \beta_1\, NLEA + \beta_2\, Nutrition^*_{bt} + \beta_3\, Price^*_{bt} \\ & + \beta_4\, Time\ trend_t \\ & + \beta_{5-15}\, Category\ dummies + e_b + e_{bt}. \qquad (5) \end{aligned}$$

The overall fit of Model 5 is significant ($F_{15,691} = 9.07$, $p < 0.00001$) (Wooldridge 2006). Results indicate that the NLEA improved brand taste ($\beta_1 = 17.63$, $z = 3.46$, $p < 0.001$), increasing brand taste from 66.16 in *pre-NLEA* to 83.40 in *post-NLEA*. In terms of nonhypothesized results, we observe no relationship between taste and price ($z = 1.20$, n.s.) or taste and nutrition ($z = 1.39$, n.s.).

Our results thus support the idea that well-meaning regulation generates unintended consequences when the disclosure concerns an attribute that is perceived to be negatively correlated with a more valued attribute. Additional strategies that account for the interrelatedness of the valued (taste) and the disclosed (nutrition) attributes are necessary to reduce the likelihood of these consequences. We now consider firm- and consumer-focused strategies that policy makers could use to reduce these problems.

Policy directed toward firms could involve educational programs at the time of the new labels that provide evidence about the nature and size of this market as well as the profitability of improving nutrition in new or existing products. Providing information on how to segment markets and market nutritious products would be very instructive to

[24] Given the use of instruments and a two-stage model, we report means as derived from the regression model parameters as opposed to raw means directly calculated from the data for Models 4 and 5.

[25] The instrumental variable for brand nutrition is the number of nutrition-related references made about a food category during the year of observation in Factiva, a database that archives information published across media sources. To generate our measure, we searched for the terms "nutri*" and "health*" together with each of the product category names in each year of observation. The asterisk allows us to pick up all grammatical variations on these search terms. This instrument should be correlated with nutrition but not with taste or price. Results indicate that the joint test of the quality of nutrition and price instruments meets the highest threshold for the Stock–Yogo weak instrumental variable test (Cragg–Donald Wald $F(2, 691) = 9.49$, Stock–Yogo critical value for two instruments = 7.03) as does the individual nutrition instrument (AP $F_{1,691} = 23.48$; Stock–Yogo threshold for one instrument = 16.38). The price instrument is close to the highest threshold (AP $F_{1,691} = 15.34$) and clears the next Stock–Yogo threshold (8.96) with ease. These tests reject the null hypothesis of weak instruments. The simple bivariate correlations between the instruments and the endogenous variables are also significant: brand nutrition and nutrition-related references ($\rho = 0.34$, $p < 0.0001$) and brand price and price deal level ($\rho = -0.15$, $p < 0.0001$).

small firms that lack the resources to do large-scale research studies or to purchase syndicated research. Finally, regulators could publicize firm success stories on policy websites or create awards for firms that minimize the nutrition–taste trade-off with new products or new technologies.

Considering other approaches, at one end of the spectrum, policy could help firms offer foods that are high on nutrition and taste at a reasonable cost by shifting the production possibility curve with policies that encourage R&D for new products and processes. Specifically, incentives could be offered to firms that introduce new products with higher nutrition levels, firms that perform R&D to develop healthier products that also taste good, or firms that build or purchase equipment to manufacture healthier products. These results dovetail with our finding that firms are more likely to improve nutrition in new products. Finally, on the other end of the spectrum are excise taxes on foods that contain high levels of fat or sodium, similar to the gas-guzzler tax for some automobiles.

There are also a number of promising consumer-focused policy strategies. First, policy should try to increase how much consumers value nutrition. This long-term strategy would use public service campaigns that make people aware of the health benefits of nutrition and include school science curricula that offer consistent education about the importance of nutrition. Second, given the perceived trade-off between taste and nutrition, educational campaigns should challenge the assumption that "good nutrition = bad taste." Public service campaigns highlighting contexts in which nutrition is paired with good taste and sharing the results from taste tests on products with different nutrition levels with consumers are possible strategies. This contrasts with educational activities at the time of the NLEA, which focused on the mechanics of reading the label (e.g., http://www.heathierus.gov/dietaryguidelines). Third, policy could seek to change consumer behavior by providing subsidies for nutritious food purchases. For example, food stamps could offer a 50% increase in value when they are used to buy high-fiber, low-fat, or low-sodium foods. Policy could also eliminate the use of food stamps for certain foods, such as New York State's attempt to ban the purchase of soft drinks with food stamps.

6.2. Firm Strategy Implications

We theorized that managers were nervous about making improvements to nutrition because they believed that consumers care more about taste than nutrition and that any improvements in nutrition might create a perceived taste trade-off. This view is supported by our findings that firms were less likely to improve nutrition in existing brands or when the firm had more power in the category.

We realize that there will always be firms that focus on taste over nutrition. However, we think that there is greater opportunity for firms to improve nutrition than they may have considered following the NLEA. Furthermore, given the public health crisis and the costs associated with the obesity epidemic in the United States, we advise firms to give these options strategic consideration. Given our results, we recommend five strategies for firms.

First, based on our results, firms should focus on increasing nutrition in new products and brand extensions. These products are particularly likely to succeed if they extend popular brands, such as low-sugar Edy's ice cream or low-fat Oreos. Importantly, this strategy limits the risk to the original brand while giving consumers healthier options. Second, in these new products, firms can replace fats with water, air, or other low-calorie fillers—all of which allow the product to retain its taste (and size) at fewer calories (Wansink and Huckabee 2005). If these taste-maintaining, nutrition-enhancing R&D strategies are successful, this suggests a third strategy. Specifically, firms introducing healthy new brand extensions should encourage consumers to do a taste test with the original product and the more nutritious introductions to challenge the belief that high-nutrition brands taste bad. Food manufacturers introducing healthy-line extensions could also issue coupons to shoppers who have recently purchased full-calorie versions of products to induce trial. Alternatively, healthy-line extensions could be priced low during introduction given that price is more important than nutrition to many consumers. As Wansink and Huckabee (2005) point out, replacing calories with water or air can also reduce ingredient costs, savings that could then be passed on to the consumer. If so, the result is a double win, as such brands are not only more nutritious but also cheaper.

A fourth strategy that increases nutrition without degrading taste is to introduce single-serving or smaller-serving packages that deliver the same taste but with fewer calories (Wansink and Huckabee 2005). Wansink (2006) reports the majority of consumers (57%) surveyed were willing to pay up to a 15% price premium for these portion-controlled packages. Therefore, although changes to packages can mean higher costs for firms, given the size and price insensitivity of this potential market, these costs would easily be recouped.

A fifth strategy for firms is to increase the value consumers place on nutrition. Specifically, firms could feature the current "nutrition facts" label with front-of-package labels. Some retailers such as Kroger and Walmart have already begun requiring front-of-package labeling that post the most critical nutrition information (e.g., calories, trans fat) or summarize the brand's overall nutrition with a numerical or verbal overall score (Martin and Brat 2010). For example, the NuVal system scores each brand between 0 and 100 depending on how well it performs relative to recommended daily values. The idea is that this simplification will increase consumer focus on nutrition at the point of sale. Food manufacturers may also find that publishing their own front-of-package label increases the emphasis on nutrition and simplifies nutrition information use. Product lines that have developed such systems since the NLEA was passed include Kraft's "Sensible Solution," PepsiCo's "Smart Spot," and General Mills' "Goodness Corner," which include either overall ratings or color coding.

6.3. Consumer Welfare Implications

The story of the NLEA is not all negative. For consumers who found fewer brands with the nutrition they value, the availability of nutrition information made it easier to search for brands that met their needs. Furthermore, the market is better for consumers who value taste, which improved following the NLEA. Most importantly, we observe nutrition improvements for brands in low-health categories. The general findings are consistent with Nowlis and Simonson (1996), who show that building on weak attributes has a greater impact on consumer welfare than building on strong attributes. Put differently, our results demonstrate diminishing marginal value from nutrition improvement, with the greatest consumer impact arising from a low base. From a public health perspective, raising the nutritional quality of the brands and categories with the lowest nutritional value will help consumers more than improving already-healthy alternatives. It also will help poor consumers more, given that they are more likely to buy these categories and brands that are, on average, lower in price.

Finally, it is important to note that although the average brand nutrition decreased following the NLEA, it is likely that some consumers shifted purchases toward more nutritious products, which would limit welfare losses. Future research could investigate this possibility with a more complete investigation of the market share changes associated with brands with varying nutrition levels over time.

7. Conclusion

As an information policy, the NLEA gave consumers the opportunity to search for and process nutrition information at the point of sale. We find that the NLEA also prompted an unintended set of firm responses, resulting in lower brand nutrition and improved brand taste. We suggest that these results occurred because nutrition is less important to consumers than taste and because high nutrition signals poor taste. Our findings also indicate that among those food products regulated by the NLEA, nutrition improved among new brands, brands in low-health categories, and brands in small-portion categories. Future research is needed to uncover additional mechanisms that will help information disclosure policy align consumer and firm responses in positive ways.

Acknowledgments

This research was supported by National Science Foundation [Grant SBR-98088992] and a Marketing Science Institute grant to the first author. The authors thank the editor, associate editor, and reviewers for advice in the review process. The technical support of Tao Chen, Chris Gelpi, Geoff Huang, Carl Mela, Yue (Vivian) Qin, Rick Staelin, Michael Trusov, Michel Wedel, and Simone Weiss is also acknowledged, as are the comments from seminar participants at Northwestern University, Erasmus University, Colorado State University, Harvard Business School, and Özyeğin University. The first and second authors contributed equally to this paper.

Appendix

A.1. Netzer Study Robustness Checks

1. *Omitted variable bias*. Our test of Model 1 in the Netzer study may produce biased estimates because it does not account for brand taste. To resolve this endogeneity concern from the omitted variable, we model the effect of the NLEA on nutrition utilizing a two-stage least squares regression estimation with an instrumental variable for the NLEA. We replicate our results using two different instrumental variables for the NLEA collected across our 30 categories.

First, we count the number of press mentions in a Factiva search for a set of terms related to the nutrition labels—specifically, "nutrition label*," "food label*," "nutrition fact*," "food fact*," "nutrition education," "nutrition information," "fat label*," "fat information," "sodium label*," "sodium information," "fiber label*," "fiber information," "cholesterol label*," "cholesterol information," "health claim*," or "nutrition claim*," where the asterisk reflects all grammatical variations on the word (e.g., "label*" also captures "labels"). We expect the number of press mentions to increase following the implementation of the NLEA. Importantly, this instrument should be related to the NLEA but not to the omitted variable, taste.

Second, we count the number of Federal Trade Commission (FTC) consent decrees and decisions. The FTC issues decrees and decisions in response to alleged violations of federal law prohibiting unfair acts, practices, and methods of competition. The decisions include "cease and desist" orders that forbid companies from engaging in certain practices. For example, in June 1991, the FTC brought a suit against Campbell's for advertising that their soup reduces the risk of heart disease. In this case the soup had a high sodium content, which is a disease risk for cardiovascular patients. Recall that the NLEA established a set of legal guidelines for the nutritional labeling of products as well as for using health claims (e.g., "low in sodium") and diet–disease claims (e.g., "low fat reduces heart disease"). Given this, in the presence of the NLEA, there should be more decisions by the FTC adjudicating on nutrition label cases. Before the NLEA, fewer cases would be brought by the FTC because the laws were weaker. Our instrument is therefore the number of FTC consent decrees and decisions focused on nutrition. We used the same set of nutrition label search terms used in the Factiva search across all 30 categories. The number of such FTC actions should be related to the NLEA but not to the omitted variable, taste.

Recall that we observe the nutrition of brands in 1990 (*pre*1-*NLEA*), 1993 (*pre*2-*NLEA*), and 1996 (*post-NLEA*). To avoid proximity to the NLEA (passed in 1994), we used instrumental variable counts lagged one year before the brand nutrition observation. Therefore, each instrumental variable was collected in 1989 (*pre*1-*NLEA*), 1992 (*pre-NLEA*2), and 1995 (*post-NLEA*). We used ivreg2 in Stata 11 to test Model 1 as a two-stage least squares analysis. We find similar results using either instrument, so we report only the Factiva search results here. We assess the quality of instrumental variable using the AP *F*-test and critical values established by Stock and Yogo (2005). Results reject the null hypothesis of a weak instrument. Specifically, the AP $F_{1,2004} = 2{,}784.57$ meets the highest threshold for the Stock–Yogo test of one instrument (threshold = 16.38). The simple bivariate correlations between the instrument and the endogenous variable is also significant (NLEA and nutrition-information references; $\rho = 0.65$, $p < 0.0001$). The overall fit of the model in the second stage is significant ($F_{33,2004} = 147.63$, $p < 0.00001$) (Wooldridge 2006). We replicate the *NLEA ∗ Labeled brands* interaction predicted in H1 ($\beta_3 = -0.93$, $z = -2.21$, $p < 0.03$). We also replicate our results using the Factiva measure lagged two years before the brand nutrition observation.

2. *Alternative overall nutrition measure*. In addition to the overall brand nutrition measure used in our models, we reestimate our models using a measure of *weighted brand nutrition*. This measure weights each of the nutrients by the mean level of that nutrient in the product category. This means that the nutrition level is more heavily weighted by the most important nutrient for that category. For example, fat is given a greater weight in the nutrition measure for ice cream, whereas sodium is given a greater weight for soup. All results replicate except for the lagged firm category market share result, which has the same directional effect but is not significant.

3. *Nutrient-specific measures*. H1 results for individual nutrients are provided in Footnote 19. For the nonlagged moderator analysis (H2, H5, and H6), all three predicted interactions replicate for fat and sodium, large-portion category replicates for cholesterol, and low-health category and large-portion category replicate for fiber. For the lagged moderator analysis, the brand market share interaction (H3) and the firm category market share interaction (H4) replicate for cholesterol and fiber only. We do not consider H7 given it was not significant in the main lagged moderator analysis. Across the five predictions and four nutrients in the moderator analysis, we replicate 15 of the potential 20 findings.

4. *Year-specific dummy variables*. We reanalyze the control group model (Model 1) using a set of dummy variables for the three time periods rather than using only one dummy variable to capture the pre-NLEA versus post-NLEA periods. We create two dummy variables to denote brands from 1990 and brands from 1996; thus the 1993 brands serve as the baseline. Both dummy variables are interacted with the labeled versus unlabeled brand variable, and both are significant (see details in §4.6.1).

5. *Importance of specific product categories*. To test the stability of our results, we use a variant of a jackknife analysis (Ang 1998). Specifically, we reestimate Model 1 30 times, each time deleting the brands from a specific product category. We calculate a jackknife pseudo-value, which captures the bias between the beta estimated from the model on the full data set and the beta estimated from the data set deleting out the brands from a specific product category ($J = k\beta + (k-1)\beta^*$, where k is the number of product categories). A 95% confidence interval is created around the mean pseudo-value. We check that the estimated beta from the full data set is within that confidence interval and find that it was for the *NLEA ∗ Labeled brands* from Model 1. A similar analysis for Models 2 and 3 indicates that the betas associated with the predicted interaction effects also fall within the respective confidence intervals.

6. *Mortality threat*. To examine the mortality threat, we reestimate Models 1 and 2 on those brands that repeat in the data for at least one *pre-NLEA* period and the *post-NLEA* period and replicate our results. We do not examine this threat for Model 3 because it is already tested on brands that survive over time.

A.2. *Consumer Reports* Study Robustness Checks

1. *Generalizability of our results*. To improve the external validity of our results, we reestimate our model weighting by the percentage of households buying in the product category as reported in the IRI *Marketing Factbook*. We replicate our NLEA result.

2. *Alternative nutrition measure*. Following *Consumer Reports*, our brand nutrition measure focuses on different nutrients across product categories. To put the nutrients on a more comparable footing, we create a *z*-score for nutrition based on the type of nutrient. For example, all brands with the fat nutrient are grouped together and a *z*-score developed based only on these brands. We do the same for sodium and calories. We replicate our NLEA result using this measure of nutrition.

3. *Year-specific dummy variables*. As with the Netzer data, we examine brand nutrition across the three time periods. Results from Model 4 indicate that the *pre1-NLEA* nutrition is not significantly different from *pre2-NLEA* nutrition ($\beta = 3.34$, $z = 0.86$, n.s.), whereas the *post-NLEA* nutrition is significantly lower than that of *pre2-NLEA* nutrition ($\beta = -2.55$, $z = -1.95$, $p < 0.05$). The pattern of results offers strong support about the impact of the NLEA on nutrition.

4. *Importance of specific product categories*. We reestimate Model 4 12 times, each time deleting the brands from a specific product category, and calculate the jackknife pseudo-value statistic. The estimated beta for the NLEA from the model using the full data set falls within the 95% confidence interval around the jackknife statistic.

5. *Mortality threat*. We reestimate Model 4 on only those brands that repeat in at least one *pre-NLEA* period and the *post-NLEA* period. We replicate our results.

6. We replicate our findings for Models 4 and 5 using limited-information maximum likelihood estimation, which produces estimates that are robust to the possibility of weak instruments.

References

Aiken, L. S., S. G. West. 1991. *Multiple Regression: Testing and Interpreting Interactions*. Sage, London.

Anderson, E. T., N. M. Fong, D. I. Simester, C. E. Tucker. 2010. How sales taxes affect customer and firm behavior: The role of search on the Internet. *J. Marketing Res.* **47**(2) 229–239.

Ang, R. P. 1998. Use of the jackknife statistic to evaluate result replicability. *J. General Psych.* **125**(3) 218–228.

Angrist, J. D., J.-S. Pischke. 2008. *Mostly Harmless Econometrics: An Empiricist's Companion.* Princeton University Press, Princeton, NJ.

Balasubramanian, S. K., C. Cole. 2002. Consumers' search and use of nutrition information: The challenge of the Nutrition Labeling and Education Act. *J. Marketing* **66**(3) 112–127.

Borradaile, K. E. 2007. Price and taste trump nutrition when Americans eat out. *Sci. Daily* (October 23), http://www.sciencedaily.com/releases/2007/10/071022120256 .htm.

Bronnenberg, B. J., J.-P. Dubé, C. F. Mela. 2010. Do digital video recorders influence sales? *J. Marketing Res.* **47**(6) 998–1010.

Buzzell, R. D., B. T. Gale. 1987. *The PIMS Principles: Linking Strategy to Performance*. Free Press, New York.

Campbell, D. T., J. C. Stanley. 1963. *Experimental and Quasi-Experimental Designs for Research*. Houghton-Mifflin, Boston.

Chandon, P., B. Wansink. 2010. Is food marketing making us fat? A multidisciplinary review. *Foundations and Trends in Marketing* **5**(3) 113–196.

Chen, Y., J. Xie. 2005. Third-party product review and firm marketing strategy. *Marketing Sci.* **24**(2) 218–240.

Cook, T. D., D. T. Campbell. 1979. *Quasi-Experimentation: Design and Analysis for Field Settings*. Rand-McNally, Chicago.

Coupey, E. 1994. Restructuring: Constructive processing of information displays in consumer choice. *J. Consumer Res.* **21**(1) 83–99.

Cragg, J. G., S. G. Donald. 1993. Testing identifiability and specification in instrumental variables models. *Econometric Theory* **9**(2) 222–240.

Cutler, D. M., E. L. Glaeser, J. M. Shapiro. 2003. Why have Americans become more obese? *J. Econom. Perspect.* **17**(3) 93–118.

Federal Register. 1973. Nutrition labeling. **38**(January 19) 2125–2137.

Federal Register. 1993. Food labeling regulations implementing the Nutrition Labeling and Education Act of 1990. **58**(3, January) 2065–2964.

Federal Trade Commission. 1979. *Consumer Information Remedies*. U.S. Government Printing Office, Washington, DC.

French, S. A., M. Story, P. Hannan, K. K. Breitlow, R. W. Jeffery, J. S. Baxter, M. P. Snyder. 1999. Cognitive and demographic correlates of low-fat vending snack choices among adolescents and adults. *J. Amer. Dietetic Assoc.* **99**(4) 471–475.

Glanz, K., M. Basil, E. Maibach, J. Goldberg, D. Snyder. 1998. Why Americans eat what they do: Taste, nutrition, convenience, and weight control concerns as influences on food consumption. *J. Amer. Dietetic Assoc.* **98**(10) 1118–1126.

Ippolito, P. M., J. K. Pappalardo. 2002. Advertising nutrition and health: Evidence from food advertising, 1977–1997. Staff report, Federal Trade Commission Bureau of Economics, Washington, DC.

Jacobson, M. 1985. *The Complete Eater's Digest and Nutrition Scoreboard*. Anchor Press/Doubleday, Garden City, NY.

Jin, G., P. Leslie. 2003. The effect of information on product quality: Evidence from restaurant hygiene grade cards. *Quart. J. Econom.* **118**(2) 409–451.

Kiesel, K., S. B. Villas-Boas. 2012. Can information costs confuse consumer choice? Nutrition labels in a supermarket experiment. *Internat. J. Indust. Organ.* Forthcoming.

Kuchler, F., H. Stewart. 2008. Price trends are similar for fruits, vegetables, and snack foods. Economic Research Report 55, U.S. Department of Agriculture, Washington, DC.

Lynch, J. G., Jr., D. Ariely. 2000. Wine online: Search costs affect competition on price, quality, and distribution. *Marketing Sci.* **19**(1) 83–103.

Martin, T. W., L. Brat. 2010. The new nutritionist: Your grocer. *Wall Street Journal* (July 27) D2, D6.

Mathios, A. D. 2000. The impact of mandatory disclosure laws on product choices: An analysis of the salad dressing market. *J. Law Econom.* **43**(2) 651–677.

Moorman, C. 1996. A quasi-experiment to assess the consumer and informational determinants of nutrition information processing activities: The case of the Nutrition Labeling and Education Act. *J. Public Policy Marketing* **15**(1) 28–44.

Moorman, C. 1998. Market-level effects of information: Competitive responses and consumer dynamics. *J. Marketing Res.* **35**(1) 82–98.

Moorman, C., R. Du, C. F. Mela. 2005. The effect of standardized information on firm survival and marketing strategies. *Marketing Sci.* **24**(2) 263–274.

Netzer, C. T. 1991. *The Complete Book of Food Counts*, 2nd ed. Dell Publishing, New York.

Netzer, C. T. 1994. *The Complete Book of Food Counts*, 3rd ed. Dell Publishing, New York.

Netzer, C. T. 1997. *The Complete Book of Food Counts*, 4th ed. Dell Publishing, New York.

Nowlis, S. M., I. Simonson. 1996. The effect of new product features on brand choice. *J. Marketing Res.* **33**(1) 36–46.

Putnam, J., J. Allshouse, L. S. Kantor. 2002. U.S. per capita food supply trends: More calories, refined carbohydrates, and fats. *Food Rev.* **25**(3) 2–15.

Putnam, J., L. S. Kantor, J. Allshouse. 2000. Per capita food supply trends: Progress toward dietary guidelines. *Food Rev.* **23**(3) 2–14.

Raghunathan, R., R. W. Naylor, W. D. Hoyer. 2006. The unhealthy = tasty intuition and its effects on taste inferences, enjoyment, and choice of food products. *J. Marketing* **70**(4) 170–184.

Rodriguez-Flores, M., S. Rivera-Gonzalez. 1993. Soursop flavour. U.S. Patent 5,468,500, filed October 29, 1993, and issued November 21, 1995.

Salop, S. 1976. Information and monopolistic competition. *Amer. Econom. Rev.* **66**(2) 240–255.

Seymour, J., A. L. Yaroch, M. Serdula, H. Michels Blanck, L. K. Khan. 2004. Impact of nutrition environmental inventions on point-of-purchase behavior in adults: A review. *Preventive Medicine* **39**(Supplement 2) S108–S136.

Sheeksha, J. D., D. M. Woolcott, N. J. MacKinnon. 1993. Social cognitive theory as a framework to explain intentions to practice healthy eating behavior. *J. Appl. Soc. Psych.* **23**(19) 1547–1573.

Stewart, H., N. Blisard, D. Jolliffe. 2006. Let's eat out: Americans weigh taste, convenience, and nutrition. *Econom. Inform. Bull.* **19**(October) 1–10.

Stigler, G. 1961. The economics of information. *J. Political Econom.* **69**(3) 213–225.

Stock, J. H., M. Yogo. 2005. Testing for weak instruments in linear IV regressions. D. W. K. Andrews, J. H. Stock, eds.

Identification and Inference for Econometric Models: Essays in Honor of Thomas Rothenberg. Cambridge University Press, Cambridge, UK, 80–108.

Szymanski, D. M., S. G. Bharadwaj, P. R. Varadarajan. 1993. An analysis of the market share-profitability relationship. *J. Marketing* **57**(July) 1–18.

Viscusi, K. W. 1994. Efficacy of labeling of foods and pharmaceuticals. *Annual Rev. Public Health* **15** 325–343.

Wansink, B. 2003. Can package size accelerate usage volume? *J. Marketing* **60**(3) 1–14.

Wansink, B. 2006. *Mindless Eating: The Hidden Persuaders That Make Us Lose and Gain Weight*. Bantam-Dell, New York.

Wansink, B., M. Huckabee. 2005. De-marketing obesity. *Calif. Management Rev.* **47**(4) 1–13.

Wooldridge, J. M. 2006. *Introductory Econometrics: A Modern Approach*. Thomson/South-Western, Mason, OH.

CORRECTION

In this article, "Unintended Nutrition Consequences: Firm Responses to the Nutrition Labeling and Education Act" by Christine Moorman, Rosellina Ferraro, and Joel Huber (first published in *Articles in Advance*, February 16, 2012, *Marketing Science*, DOI: 10.1287/mksc/1110.0692), the seventh sentence of the abstract was corrected to read as follows: "Lower risk occurs when the firm is introducing a new brand rather than changing an existing brand, and weaker power in a category is reflected by lower market share in a category."