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Nutritional Labeling and Consumer Choices

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Abstract

In 1994, nutritional facts panels became mandatory for processed foods to improve consumer access to nutritional information and to promote healthy food choices. Recent applied work is reviewed here in terms of how consumers value and respond to nutritional labels. We first summarize the health and nutritional links found in the literature and frame this discussion in terms of the obesity policy debate. Second, we discuss several approaches that have been used to empirically investigate consumer responses to nutritional labels: (*a*) surveys, (*b*) nonexperimental approaches utilizing revealed preferences, and (*c*) experiment-based approaches. We conclude with a discussion and suggest avenues of future research.

INTRODUCTION

How the provision of nutritional information affects consumers' food choices and whether consumers value nutritional information are particularly pertinent questions in a country where obesity is pervasive. Firms typically have more information about the quality of their products than do consumers, creating a situation of asymmetric information. It is prohibitively costly for most consumers to acquire nutritional information independently of firms. Firms can use this

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information to signal their quality and to receive quality premiums. However, firms that sell less nutritious products prefer to omit nutritional information. In this market setting, firms may not have an incentive to fully reveal their product quality, may try to highlight certain attributes in their advertising claims while shrouding others (Gabaix & Laibson 2006), or may provide information in a less salient fashion (Chetty et al. 2007). Mandatory nutritional labeling can fill this void of information provision by correcting asymmetric information and transforming an experience-good or a credence-good characteristic into search-good characteristics (Caswell & Mojduszka 1996). Golan et al. (2000) argue that the effectiveness of food labeling depends on firms' incentives for information provision, government information requirements, and the role of third-party entities in standardizing and certifying the accuracy of the information. Yet nutritional information is valuable only if consumers use it in some fashion.

Early advances in consumer choice theory, such as market goods possessing desirable characteristics (Lancaster 1966) or market goods used in conjunction with time to produce desirable commodities (Becker 1965), set the theoretical foundation for studying how market prices, household characteristics, incomes, nutrient content, and taste considerations interact with and influence consumer choice. LaFrance (1983) develops a theoretical framework and estimates the marginal value of nutrient versus taste parameters in an analytical approach that imposes a sufficient degree of restrictions to generality to be empirically feasible. Real or perceived trade-offs between nutritional and taste or pleasure considerations imply that consumers will not necessarily make healthier choices. Reduced search costs mean that consumers can more easily make choices that maximize their utility. Foster & Just (1989) provide a framework in which to analyze the effect of information on consumer choice and welfare in this context. They argue that

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when consumers are uncertain about product quality, the provision of information can help to better align choices with consumer preferences.

However, consumers may not use nutritional labels because consumers still require time and effort to process the information. Reading a nutritional facts panel (NFP), for instance, necessitates that the consumer remove the product from the shelf and turn the product to read the nutritional information on the back or side. In addition, consumers often have difficulty evaluating the information provided on the NFP or how to relate it to a healthy diet. Berning et al. (2008) present a simple model of demand for nutritional information. The consumer chooses to consume goods and information to maximize utility subject to budget and time constraints, which include time to acquire and to process nutritional information. Consumers who have strong preferences for nutritional content will acquire more nutritional information. Alternatively, other consumers may derive more utility from appearance or taste. Following Becker & Murphy (1993), Berning et al. show that nutritional information may act as a complement to the consumption of products with unknown nutritional quality, similar to the way advertisements complement advertised goods.

From a policy perspective, the rise in the U.S. obesity rate coupled with the asymmetry of information have resulted in changes in the regulatory environment. The U.S. Food and Drug Administration (FDA) is currently considering a change to the format and content of nutritional labels, originally implemented in 1994 to promote increased label use.

Consumers' general understanding of the link between food consumption and health, and widespread interest in the provision of nutritional information on food labels, is documented in the existing literature (e.g., Williams 2005, Grunert & Wills 2007). Yet only approximately half

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of consumers claim to use NFPs when making food purchasing decisions (Blitstein & Evans 2006). Moreover, self-reported consumer use of nutritional labels has declined from 1995 to 2006, with the largest decline for younger age groups (20–29 years) and less educated consumers (Todd & Variyam 2008). This decline supports research findings that consumers prefer for short front label claims over the NFP's lengthy back label explanations (e.g., Levy & Fein 1998, Wansink et al. 2004, Williams 2005, Grunert & Wills 2007). Furthermore, regulatory rules and enforcement policies may have induced firms to move away from reinforcing nutritional claims through advertising (e.g., Ippolito & Pappalardo 2002). Finally, critical media coverage of regulatory challenges (e.g., Nestle 2000) may have contributed to decreased labeling usage over time.

Excellent review papers on this topic preceded and inspired this present review (e.g., Baltas 2001, Williams 2005, Drichoutis et al. 2006). In particular, Drichoutis et al. (2006) reviews the nutritional labeling literature and addresses specific issues regarding the determinants of label use, the debate on mandatory labeling, label formats preferred by consumers, and the effect of nutritional label use on purchase and dietary behavior. The current review article updates and complements these earlier reviews by focusing on recent work and highlighting major contributions in applied analyses on how consumers value, utilize, and respond to nutritional labels. We first cover the health and nutritional aspects of consumer food choices found in the literature to frame the discussion on nutritional labels in the context of the recent debate on obesity prevention policies. Second, we discuss the different empirical approaches that are utilized to investigate consumers' response to and valuation of nutritional labels, classifying existing work into three categories according to the empirical strategy and data sources. First, we present findings based on consumer surveys and stated consumer responses to

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labels. The second set of articles reviewed utilizes nonexperimental data and focuses on estimating consumer valuation of labels on the basis of revealed preferences. Here, the empirical strategy is structural, using hedonic methods, structural demand analyses, or discrete choice models and allowing for estimation of consumers' willingness to pay (WTP) for nutritional information. The last set of empirical contributions discussed is based on experimental data, differentiating market-level and natural experiments from laboratory evidence. These studies employ mainly reduced-form approaches. Finally, we conclude with a discussion of avenues for future research.

CONSUMER FOOD DEMAND, NUTRITIONAL LABELS, AND OBESITY PREVENTION

The U.S. Department of Health and Public Services declared the reduction of obesity rates to less than 15% to be one of the national health objectives for 2010, yet in 2009 no state met these targets, with only two states reporting obesity rates less than 20% (CDC 2010). Researchers have studied and identified many contributing factors, such as the decreasing relative price of calorie-dense food (Chou et al. 2004) and marketing practices that took advantage of behavioral reactions to food (Smith 2004). Other researchers argue that an increased prevalence of fast food (Cutler et al. 2003) and increased portion sizes in restaurants and at home (Wansink & van Ittersum 2007) may be the driving factors of increased food consumption. In addition, food psychologists have focused on changes in the eating environment, pointing to distractions such as television, books, conversation with others, or preoccupation with work as leading to increased food intake (Wansink 2004).

Although each of these factors potentially contributes to the obesity epidemic, they do not necessarily mean that consumers will eat more. If consumers are well-informed about these

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structural changes and the nutritional characteristics of food products, they could adjust their dietary habits appropriately.

Nutritional labeling has become of increasing interest to both consumers and policy makers. Nutritional attributes can be defined as credence attributes (Darby & Karni 1973, Nelson 1970, Roe & Sheldon 2007) but can be transformed into search attributes once nutritional information is provided (Caswell & Mojduszka 1996). Consumers, food processors, and third-party entities all play a role in determining which of a food's many attributes are described on food labels. Policy interventions can be traced back as far as the White House Conference on Food, Nutrition, and Health in 1969 (Golan et al. 2000). The Nutrition, Labeling, and Education Act (NLEA) of 1990 then gave the FDA the authority to require nutritional labeling for most food products. As a result, NFPs were implemented to improve consumers' access to nutritional information and to promote healthy food choices. There is a large literature investigating consumer demand and the use of nutritional labels. Yet evidence on whether this objective has been achieved has been mixed.

EMPIRICAL STUDIES OF CONSUMER RESPONSES TO AND VALUATIONS OF NUTRITIONAL LABELS

As both opportunity cost and preferences for information vary across consumers, consumers' use of information varies as well (McCluskey & Swinnen 2004). The effectiveness of nutritional labels lies in providing the appropriate nutritional label to specific consumer segments (Caswell & Padberg 1992). Labels are likely to be effective when they address specific informational needs and can be processed and used by their target audience (Verbeke 2005). In this section, we first discuss findings of a set of studies that utilizes consumer surveys and stated consumer responses to labels. Within this group of studies, there are two main subgroups. In one subgroup,

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researchers combine stated responses to events and measure how respondents' dietary choices or attitudes change when respondents are faced with events such as advertising (Ippolito & Mathios 1990) and labeling changes (e.g., Kim et al. 2000, 2001; Driskell et al. 2008; Todd & Variyam 2008). These researchers also take advantage of having detailed respondent information to measure heterogeneity in the population among the outcomes of interest. The second subgroup among survey-based studies reviewed here includes those that aim at measuring consumer's WTP for food labeling (e.g., Drichoutis et al. 2009a). The second set of papers reviewed and discussed in this section is based on nonexperimental data and focuses on estimating consumer label valuations on the basis of revealed preferences through consumers' actual purchase behavior. The empirical strategy is reduced form in the form of both hedonic methods as well as structural demand analyses and estimation of consumer's WTP for labels. The last set of papers pertains to empirical findings based on experimental data sets and has therein two subgroups of studies. The first subgroup utilizes data originating from laboratory experiments, and the second group uses data from field experiments at the point of purchase.

SURVEY-BASED STUDIES

There are trade-offs to using survey-based evidence in empirical research. Although the main disadvantage may have to do with the fact that what the respondent states in the survey questionnaire may not truly reflect what he would do in a real-world setting, many advantages make such survey-based research valuable. In particular, one can obtain information on consumers' exogenous characteristics, such as age and gender, and ask questions about consumers' attitudes toward health and their beliefs about relevant information or product attributes, among others. This set of papers combines survey data from a variety of sources with exogenous changes in information and with carefully constructed measures of interest to

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understand how consumers use and perceive nutritional labels, whether they say that they respond to those labels, and finally how much they are willing to pay for those labels.

The U.S. Department of Agriculture's Continuing Survey of Food Intakes by Individuals (CSFII), in conjunction with its companion Diet and Health Knowledge Survey (DHKS), has been a major source of research on nutritional labeling and consumer behavior (Ippolito & Mathios 1990; Kim et al. 2000, 2001; Todd & Variyam 2008). This survey provides detailed 24-hour food intake data for independent national samples of women, and the data set also contains the nutritional value of 4,600 food items. The National Health and Nutrition Examination Survey (NHANES) has also been an important source of data in this set of papers, discussed next. The NHANES data are unique in that they combine interviews and physical examinations.

Using data from the DHKS and data from the Diet Behavior and Nutrition module of the 2005–2006 NHANES, Todd & Variyam (2008) find that, although a majority of consumers report using nutritional labels when buying food, label use has declined for most nutrient components, with the exception of fiber. Using survey data on fiber content intake for women, Ippolito & Mathios (1990) find a significant effect on consumers' behavior from consumers being informed about the health benefits of fiber intake via advertising. Moreover, Ippolito & Mathios find that, although health advertising was banned, government and general information sources had limited impact on fiber cereal choices in the years prior to advertising. This research highlight that theories of information acquisition are important in explaining who responds most quickly to new information. Household and individual characteristics that reflect costs of acquiring new information, ability to process information, and valuation of health are all important determinants of fiber cereal choices. Finally, Ippolito & Mathios also find that

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advertising reduces the differences across consumers by lowering costs of acquiring information for broad segments of the population.

Using CSFII and DHKS data for 1994 to 1996, Kim et al. (2000) find that the nutrient intake of calories from saturated fat, fat, cholesterol, and sodium is lower and nutrient intake of fiber is higher for Americans who use nutrient-specific labels relative to those who do not. In an accompanying study, Kim et al. (2001) use the same data to investigate heterogeneity in the survey respondents' label usage. In doing so, they construct a respondent-specific healthy eating index (HEI) and assess how label usage affects this index for the average respondent and different respondent types. Label usage increases the probability of achieving a higher HEI. Females are more likely to use labels, and label usage decreases with age and with lower income. Regardless of label use, certain factors contribute to higher HEI, such as college education and income.

Researcher-generated survey data sets (Burton & Andrews 1996; French et al. 1999; Nayga 2000; Drichoutis et. al. 2005, 2008; Blitstein & Evans 2006; Stranieri et al. 2010) also provide consistent empirical findings with the results discussed above. Burton & Andrews (1996) collected data from a quarterly mail survey in which they presented consumers with nutritional labeling in three different formats: (*a*) a format consistent with pre-NLEA labels, (*b*) a post-NLEA full format, and (*c*) a simplified format for packages that are small and thus cannot have the full information. The survey questionnaire allowed the authors to construct five dependent measures that they used to assess nutritional evaluations, label information usage, and perceived label understandability. Their findings suggest that the format of nutritional information matters, as the formats have strong, significant effects on nutritional attitude and

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purchase likelihood, especially for younger respondents. French et al. (1999) examine the motivations, beliefs, and behavior intentions regarding low-fat vending snacks in a heterogeneous survey sample of adults and adolescents. They find that females, infrequent vending machine users, and older youths reported higher intentions to choose low-fat vending snack machines. Among these researchers' findings, the following positively correlated with current and intended low-fat vending snack choices: positive beliefs about low-fat vending snacks, self-efficacy to choose a low-fat vending snack, higher ranked importance of snacks with fewer calories and lower fat, desire to choose a healthful snack, and interest in monitoring body weight. In terms of responses to the NFP, Blitstein & Evans (2006) find in a cross-sectional survey data set that 53% of the sample report using NFP information on a consistent basis. When one is confronting stated usage with respondents' attributes and constructed types, the importance of knowledge to maintain healthy body weight is the only belief variable associated with use of NFP information; a greater association is shown for married and educated females.

In a cross-sectional survey of Athens's supermarket consumers, Drichoutis et al. (2005) find that, overall, consumers with lower levels of income and education are more likely to report low levels of nutritional knowledge and low levels of label use. Interestingly, different types of consumers use nutrient-specific information differently, and the findings are similar to those of Kim et al. (2001). Drichoutis et al. (2008) use a utility theoretic framework in which consumers maximize utility as a function of consumption of products, given a time constraint of making their choices, including time spent reading labels. Using data from the same survey as the above study (Drichoutis et al. 2005), Drichoutis et al. (2008) find that the factors identified in the theoretical utility model affect label information use. Factors that increase label use include time constraints, level of physical activity, overweight status, being female, and younger age.

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Nutritional knowledge positively affects nutritional information stock, thus showing that increased general knowledge of nutritional principles may facilitate the acquisition of specific nutrient content knowledge. Information sources play a role in the acquisition of nutritional information: People who use specialists (e.g., doctors or nutritionists) as their primary source of information have lower stocks of specific information than people whose main source of nutritional information is the media. Higher education and age lead to higher nutritional information stock.

Driskell et al. (2008) use a survey to study dining hall patron responses to a voluntary nutritional labeling scheme implemented locally, termed Nutrition Bytes. Overall, their findings suggest that the labeling scheme positively impacts food choices and eating habits for their sample. They also find heterogeneous effects in terms of gender, lack of time, and concern about health, consistent with previous studies. In a European setting, Stranieri et al. (2010) use a survey data set in Italy to examine whether and how food labels can transform credence attributes into search attributes and can influence consumers' quality perceptions, preferences, and prior expectations. The EU directive studied[1] identifies two types of label information: nutritional labeling (energy value, protein, carbohydrate, fat, and fiber content) and nutritional claims extolling particular nutritional properties. Their results show that, although nutritional labeling is an important instrument for product choice, many consumers do not use labeled information during food shopping. The proportion of consumers using nutritional labeling is smaller than that using nutritional claims, especially for claims about fiber, vitamin, and fat content. Finally, nutritional claims appear to be used by consumers who do not usually read nutritional labels. This suggests that short messages on front labels can increase consumer awareness and improve consumer choices.

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All the above papers combine survey responses with exogenous events (such as advertising changes or labeling regulatory changes) and measure changes in stated behavior. A related stream of literature uses survey questionnaires to investigate consumers' preferences and WTP for food labeling. Using survey data collected from European shoppers, Loureiro et al. (2006) found that, on average, consumers were willing to pay an approximately 11% premium for a box of cookies with a nutritional label compared with a similar product without a nutritional label. Loureiro et al. found a significant difference in WTP for a group of consumers suffering from diet-related health problems. Utilizing data from a survey conducted in Athens, Greece, Drichoutis et al. (2009a) find that consumers value and are willing to pay approximately 5.9% of the original price for nutritional information on the food product under study. In terms of heterogeneity, consumers who are non-price-sensitive, are nutritionally knowledgeable, and have a longer time horizon are willing to pay more for nutritional information than are other consumers. Non-price-sensitive consumers' WTP is almost double that of price-sensitive consumers' WTP. Finally, on the basis of the WTP values determined in this study, costs of nutritional labeling are not prohibitive to firms, as the average economic value of nutritional information is estimated as €17,064 (US$23,473).

Berning et al. (2008) empirically evaluate consumer preferences for nutritional information with choice experiment data collected in a survey of grocery shoppers in the San Francisco Bay Area. These researchers asked consumers to choose their preferred format of nutritional information between detailed and summary formats. The detailed nutritional information explicitly describes specific nutrients but may be more costly to process and difficult to understand. Summary nutritional information reduces processing effort but provides a condensed description of nutritional content. Additionally, Berning et al. collected information

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about demographics, labeling use, and attitudes, which further allowed them to conclude that a summary format may benefit shoppers who are less likely to use nutritional information otherwise.

REVEALED PREFERENCE–BASED STUDIES

The limited number of market-level empirical studies exhibits mixed results regarding the effectiveness of nutritional information provisions in changing consumer behavior. Ippolito & Mathios (1990) find significant effects of voluntary labels on consumer choices prior to the NLEA, but Mojduszka & Caswell (2000) argue that information provided by firms voluntarily prior to the NLEA was incomplete and not reliable. Mathios (2000) employ pre- and post-NLEA scanner data to investigate the effects of mandatory disclosure laws on consumer choice of salad dressing. He finds that despite voluntary disclosure of low-fat products, mandatory guidelines resulted in a significant decline in sales of high-fat products. In a similar study, Teisl et al. (2001) find that consumer behavior was significantly altered but that purchases of healthy products increased in only some of the product categories.

Ippolito & Mathios (1995) focus on fat labeling and fat consumption in the United States. They find that the existence of information may not be sufficient to affect behavior fully, especially if barriers limit the spread of information. Specifically, they examine changes in fat and saturated fat consumption in the United States as information connecting lipids to heart disease and cancer risks spread. The study analyzes changes in consumption during two regulatory regimes: (*a*) the years 1977–1985, when government and general information sources continued their efforts to educate the public about the links between fats and disease risks and when producers were free to label these characteristics on food packages and in advertising, and

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(*b*) the years 1985–1990, when the regulatory ban was lifted that prohibited producers from explaining the reasons why consumers should be interested in the content of foods. This controversial regulatory change allowed the use of so-called health claims in labeling and advertising, subject to the normal deception rules for all advertising and labeling claims. Consumers continued to reduce fat consumption through 1990, even though the basic information had been available for 30 years. Moreover, the regulatory experiment of the 1985–1990 period suggests that advertising may play an important role in spreading this type of information, with substantial effects on market behavior.

EXPERIMENTAL APPROACHES

Behavioral economics extends the traditional approach to economic analysis by incorporating findings from other disciplines in the behavioral sciences. In particular, whereas economists have historically restricted their attention to the roles of price, income, and information in driving consumer choice, behavioral economists allow for the possibility that cognitive, social, and emotional factors may be important in certain situations. Food choices and the question of what drives individuals to choose unhealthy foods rather than healthy alternatives have become prominent applications in recent years.

Although food decisions in their complexity, information costs, and potential real or perceived trade-offs between taste and nutritional value of food are difficult to quantify through traditional econometric means, causal effects can identified and documented through controlled experimentation. Participants in economic experiments make choices involving real products and real money. These incentive-compatible mechanisms ensure that participants truthfully reveal their preferences, simultaneously addressing biases in survey-based valuation methods and

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weaknesses in existing market data analyses. Davis & Holt (1993) provide an introduction to experimental economics, and detailed coverage of the use of auctions can be found in Lusk & Shogren (2007). As mentioned above, Williams (2005) reviews the existing literature on the extent to which consumers want and use nutritional information and health claims on food products. He summarizes that consumers do not clearly distinguish between nutrient content, functional food attributes, and health claims. The same study finds that visual aids may be required to help consumers differentiate between health claims, although consumers may use the visual aid rather than strength of the scientific evidence associated with the health claim to form expectations about overall product quality. Below we review and document the findings of recently published experiments in the field as well as in the laboratory,[2] concluding with findings of food away from home and restaurant labeling as a new research focus.

Evidence from the Laboratory

Controlled laboratory settings in the context of nutritional labeling have focused on interdependencies of information provision, perceptions, and attitudes as barriers to healthier food choices. Recruiting female participants only, Geyskens et al. (2007) find that health claims increase the amount of low-fat snacks consumed in a laboratory. Although both low-fat and regular potato chips were perceived as less healthy after participants were primed with health claims, participants also altered their perceptions about their weight. Participants perceived their own weight as lower, and although they also reported a lower ideal weight, the distance from their ideal body weight decreased. This introduced bias may explain the observed increased caloric food intake as a result of labeling claims. In this context, other studies also cite perceptions of an increased acceptable serving size and a reduction in consumption guilt as an additional explanation (e.g., Wansink & Chandon 2006). Aikman et al. (2006) further confirm

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that taste and health, but also guilt and comfort, are the strongest predictors of food attitudes in general and that the context and format in which the information is provided affect the perception of healthiness by consumers.

Focusing on information format, Antonuk & Block (2006) compare single-serving labeling only to single-serving as well as entire-package labeling on snack foods for dieting and nondieting marketing students. Dieters seemed to pay greater attention to, perceived the necessity of, and had a better understanding of the labeling information. They also considered the provided serving as more adequate. Although nondieters ate significantly less when exposed to both labels, these differences decreased when single-serving and package labels were used. In a similar study, Behrens et al. (2007) analyze the effect of formed expectations through nutritional and health claims on the acceptability of soy milk. They suggest that sensory and information aspects are integrated in consumers' minds. If a product is perceived as worse than expected on the basis of the labeling information, consumers seem to adjust their choices less than if the product is better than expected. Finally, Baixauli et al. (2008) experiment with how information about fiber content influences consumer acceptance of muffins. The provided information does not increase the acceptance of the healthier option, either because consumers do not understand this information or because they associate the disclosed fiber content with negative food characteristics such as additive content.

Evidence from Field Experiments

Although experimental methods have several advantages, they are open to criticism of context-specific results and external validity. Field experiments in grocery stores overcome many of these problems and constitute a natural experiment in the sense that they exogenously introduce

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nutritional labels into treatment stores and observe responses of shoppers who are unaware that they are even part of an experiment. Such experiments are time-consuming and expensive to conduct but have the potential to provide more believable and generalizable estimates of the effect of treatment variables (Lusk 2011).

Originally applied in test marketing, an introduction of new products or marketing strategies in a few stores or regions to expose problems that would otherwise go undetected until full-scale introduction of the product or strategy, experimental studies have also been undertaken for more than two decades by applied economists with an interest in food consumption and marketing. Russo et al. (1986) displayed lists of information on vitamins and minerals as well as on sugar content in supermarkets. Although the posting resulted in increased nutritional information use, it had limited influence on actual purchases. Only a shorter list of added sugars highlighted in a second experiment increased the market share of low-sugar breakfast cereals at the expense of high-sugar brands. Teisl et al.'s (2001) study has a traditional economics focus on the welfare effects of the provision of nutritional information. In a cooperative effort between a supermarket and the FDA, Teisl et al. tested the efficacy of nutritional shelf labeling. Nutritional information was posted on the shelf labels and consisted of a simple message highlighting whether the food product was low or reduced in fat, cholesterol, sodium, and calories. They note that nutritional labeling is likely to have a smaller effect on the behavior of those individuals who have prior knowledge of the nutritional content of the products they are consuming. Their results also highlight that information provision may not always lead consumers to switch their consumption away from unhealthy products to more healthy alternatives. Therefore, they distinguish between a health effect (information allows the consumer to reduce his purchases of unhealthy products in favor of healthy products) and a substitution effect (information increases

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the consumers' ability to substitute across food categories so as to maintain an overall health consideration while increasing utility associated with other food attributes such as taste).

Kiesel & Villas-Boas (2011) and Berning et al. (2010) use a field experiment approach to examine the effect of grocery store nutritional labels on the sales of microwave popcorn in the East Bay Area of California. Kiesel & Villas-Boas (2011) test whether information costs prevent consumers from fully optimizing their purchase decisions with regard to nutritional content by estimating the effect of making nutritional information provided on the NFP more salient and easier to process. In contrast to Teisl et al. (2001), Kiesel & Villas-Boas (2011) focus on the experimental design and credible identification of treatment effects in a reduced-form approach most common in the experimental data analysis. By displaying one nutrient or combining multiple nutrient claims, these researchers increase the information content while simultaneously increasing potential information costs. Difference-in-difference and triple-difference estimations (see Gruber 1994, Meyer 1995, Bertrand et al. 2004) as well as a synthetic control method approach (Abadie et al. 2007) suggest that information costs can prevent consumers from incorporating nutritional information into their purchasing decisions. These findings were not driven by consumers simply paying more attention to labeled products, as indicated by the diverse labeling effects. Berning et al. (2010) estimate the effect of these nutritional labels on the demand for healthy (products that merit a nutritional label) and unhealthy (products that do not merit a nutritional label) microwave popcorn in an incomplete demand system. Contrary to expectations, these papers find that nutritional labels can decrease sales of healthy popcorn and increase sales of unhealthy popcorn. They hypothesize that nutritional labels on popcorn may signal unwanted product characteristics such as undesirable taste in the context of low fat. These results demonstrate a counterintuitive response to nutritional labels that are unlikely to have been

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detected in a lab experiment. Lab participants, when faced with a low-fat label, would likely have taken it as a signal of what they should buy, but absent the artificially induced social pressures of the lab, people behaved differently.

Finally, following the tradition of test marketing, Ackerberg (2001, 2003) finds that yogurt advertising can have significant effects on inexperienced buyers by providing additional information on search and experience characteristics. It does not affect experienced buyers, suggesting that advertising health-related product characteristics results in economically and statistically insignificant prestige effects.

Experiments on Restaurant Labeling

Although restaurants were originally exempt from labeling regulations under the NLEA, increased consumption of foods prepared outside the home is a possible cause of rising rates of obesity and poor diet quality. This food is typically higher in calories, is of poorer nutritional quality, and is served in larger portions. Furthermore, even trained nutritionists have great difficulty estimating the calories in restaurant meals (Roberto et al. 2010). Recent market-level field experiments provide some estimates of impacts on obesity with regard to nutritional labeling on restaurant menus. Yamamoto et al. (2005) uses the provision of calorie and fat content information on the menus of three popular restaurants and finds that the posting did not modify food choice behavior of a U.S. adolescent sample. A recent study of pre- and postcalorie labeling of Starbucks's menu items in New York in 2008 estimates a 6% reduction in calories per sales transaction and further projects a decrease in long-term body weight of less than 1% (Bollinger et al. 2010). Although calorie posting led consumers to buy fewer food items and to switch to lower calorie food items, beverage choices at Starbucks were unaffected. Finally, an

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impact assessment in Los Angeles County estimates that restaurant menu labeling may decrease the annual weight gain of residents by 41% on the basis of estimates from other reports that 10% of restaurant patrons select reduced-calorie meals as a result of menu labeling with an average calorie reduction per meal of 100 kcal (Kuo et al. 2009).

Studies in the laboratory also provide much needed insights into this new policy focus. Howlett et al. (2008) argue that product claims and consumer motivation moderate the effects of nutritional information provision. Burton et al. (2006) use a survey methodology to examine how accurately consumers estimate the nutrient content of typical restaurant meals. Survey results show that consumers significantly underestimated levels of calories, fat, and saturated fat in less healthy restaurant items. Actual fat and saturated fat levels were two times and calories were almost two times of consumers' estimates. In a subsequent experiment on items for which levels of calories, fat, and saturated fat substantially exceeded consumers' expectations, the provision of nutritional information had a significant influence on product attitude, purchase intention, and choice.

Drichoutis et al. (2009b) use experimental auctions to estimate consumers’ WTP for different products with different types of nutritional labels. Subjects bid more for the products with nutritional labels, and among products with nutritional information, subjects’ WTP values differed, depending on the type of nutritional label on the product. In a similar approach, Roberto et al. (2010) randomly assigned participants to a menu without calorie labels, a menu with calorie labels, or a menu with calorie labels and a label stating the recommended daily caloric intake for an average adult. Food choices and intake during and after the study dinner were measured. Results indicated that participants in the calorie label groups ordered fewer calories

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than did those in the group with the no-calorie labels. When calorie label conditions were combined, that group consumed 14% fewer calories than did the no-calorie label group. Individuals who were in the calorie label condition group consumed more calories after the study dinner than did those in both other conditions. When calories consumed during and after the study dinner were combined, participants in the calorie label group plus information group consumed an average of 250 fewer calories than did participants in the other groups.

Chandon & Wansink (2007) specifically focus on potential backfiring effects of menu labels by pointing to the paradox that despite the increase in health claims, the United States still has a high level of calorie intake. In four experimental studies, they show that people are more likely to underestimate the caloric content of main dishes and to choose higher-calorie side dishes, drinks, or desserts when fast-food restaurants claim to be healthy (e.g., Subway) compared with when they do not (e.g., McDonald's). Although an increase in attention to nutritional information by respondents improved the accuracy of calorie estimations, it did not reduce the halo effects of health claims: Health claims lead consumers to unknowingly order beverages and side dishes containing more calories.

On the basis of these findings, it seems unclear whether nutritional labeling in restaurants will lead to healthier food choices overall. The Health Care and Education Affordability Reconciliation Act of 2010 now mandates calorie labeling of foods sold in restaurant chains with more than 20 outlets and vending machines. Although this legislation applies to calories only, it instructs restaurants to include other nutrients and a statement regarding suggested daily caloric intake so consumers can put the information in the context of a daily diet. The next section summarizes and concludes our review of existing studies. We discuss future research directions

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evaluating these recent regulatory changes and provide further insights regarding the role that successful and effective nutritional labeling can play in promoting healthier food choices.

DISCUSSION AND FUTURE RESEARCH DIRECTIONS

On the basis of our review, we conclude that label use has the potential to improve dietary quality, but the magnitude of these improvements is relatively small. The record for nutritional labeling is mixed. The presentation of nutritional information, such as its complexity, specificity, credibility, location on the package, and perhaps even ink color, may significantly affect the manner in which consumers actually use such information in the marketplace. Although consumers generally view nutritional information as useful, they prefer short, succinct wording over long and complex claims and believe that the government should approve claims. Consumers often do not clearly distinguish between nutrient content claims, function claims, and health claims (Williams 2005).

There is widespread interest in the provision of nutritional information on food packages, but this interest differs between people, situations, and products. On the positive side, many consumers do read food labels, and nutrition is an important consideration in food purchases. Food producers have also responded by creating healthier foods. On the negative side, obesity in the United States has increased since the introduction of mandatory nutritional labels (e.g., Mokdad et al. 1999), and this trend continues. Although some studies report positive welfare effects, these effects seem small compared with the large numbers of deaths per year that continue to be attributed to obesity. Therefore, nutritional labeling has potentially led to some improvement in overall health but continues to be more than counterbalanced by the many

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factors that lead to obesity, such as lack of exercise, increased food consumption, and increased consumption of ready-to-eat foods.

In addition, nutritional labels have not always provided information in an efficient and effective manner. There might be gains from mandating a standardized format, such as the British traffic light approach, in contrast to the current environment, in which firms are allowed to alter the format. Label users are more likely to consider such initiatives as beneficial (Gracia et al. 2007). Loureiro et al. (2006) and Drichoutis et al. (2009a), for instance, find that European consumers would value having standardized nutritional information in food products. Mandating nutritional information, however, creates asymmetric opportunities for firms, which then affects their strategies and survival. Regulatory rules and enforcement policies may have induced firms to move away from reinforcing nutritional claims through advertising (e.g., Ippolito & Pappalardo 2002). In addition, Moorman et al. (2005) find that the NLEA in the United States led to an increase in small-share firm exits. The findings from the studies discussed here suggest that there are still many inconsistencies and gaps in the literature related to nutritional labeling.

In this context, it is important to consider ethnic diversity and cultural appropriateness when developing and applying nutritional information programs. Without appropriate consumer education programs that enhance consumers' knowledge and understanding of information, NFPs will likely have limited and sometimes unintended consequences. In an era of high-speed Internet and fast information, it is not surprising that many people seek information through Internet sources. What requires policy makers' attention is the fact that up to 80% of the visits and time spent on seeking health and nutritional information (at least for Canadians) on commercial Web sites are for information that are often poor and misleading (Ostry et al. 2008).

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Many factors drive label usage and food consumption behavior, including heterogeneous values of time, health concerns, tastes, incomes, and culture. The nature and extent of consumer heterogeneity make explaining food consumption patterns across individuals difficult. To mitigate heterogeneity effects empirically, researchers should seek panel data methods, which hold constant some of the heterogeneity attributed to individual variation over time. Regulators must consider the consumer segments they are trying to target when implementing new policies. Alternatively, a multiple-tier system of regulation or labeling is possible. In the context of food safety, Graff Zivin (2006) develops a model of a differentiated food market with two types of government-certified quality standards: a minimum standard and a higher one. This meets the needs of a population that is heterogeneous in its susceptibility to food-related health risks.

Many emerging areas of future research warrant our attention. An important area is the opportunity for economists to collaborate with researchers from other disciplines, including nutrition, food science, sensory science, marketing, neuroscience, and psychology, to better understand how consumers respond to the trade-offs that are involved in food choice. Discovering the particular situations or environmental cues that influence the behavioral response to nutrition will require careful study across disciplines. Advances in neuroscience, for instance, are allowing scientists to understand the brain and to make inferences about motivation and decisions in real time (Camerer et al. 2005). Similarly, it is becoming increasingly feasible to measure endocrine hormones such as cortisol and to test directly for genes that impact obesity, depression, or even risk-seeking behavior, both in the laboratory and in conjunction with large-sample social sciences surveys (Rosmond et al. 2002, Kreek et al. 2005, Kuhnen & Chiao 2009). These new tools have spawned biological interpretations of many of the phenomena studied by behavioral economists, which may help researchers understand the peculiarities of consumer

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dietary behavior (Smith 2009). Furthermore, economists working across disciplines have begun to understand the many visceral or psychological determinants of choice, and applications to food are often immediately apparent. Visceral influences such as hunger can limit an individual's ability to make decisions consistent with long-term health, as can emotional states such as stress or depression (Greeno & Wing 1994, Loewenstein 1996, Mancino & Kinsey 2008, Smith 2009). Imperfections in our sensory perceptions sometimes result in difficulties in linking food intake with nutrition. In an experiment, Wansink et al. (2005) provide an illustration of this problem. They served soup to half their participants in a self-refilling bowl, which provided a biased visual cue. The self-refilling bowls slowly and imperceptibly refilled as their contents were consumed. Wansink et al. found that the participants who unknowingly ate from self-refilling bowls ate 73% more soup than did those who ate from normal bowls. Furthermore, the participants eating from self-refilling bowls did not believe they consumed more, nor did they perceive themselves as more sated than those eating from normal bowls. These interdisciplinary collaborations can be conducted in both traditional (e.g., market and scanner) and nontraditional (experimental) data-collecting environments. Policy changes and marketing strategies that constitute natural experiments are occurring with great frequency, and they are often not analyzed at an academically rigorous level. Academia-industry partnerships may be beneficial for both parties, as long as the academic researchers remain in charge of their own research agendas. Data-sharing alliances benefit the firm that obtains free and unbiased research and the researcher who advances his or her research agenda.

Current regulations related to nutritional labeling are focused mainly on food that is purchased to be consumed at home, rather than the food-away-from-home market. More research is needed that can provide information about consumers' perceptions, attitudes, and use of

nutritional information in these markets. Overall, economists can contribute important insights by becoming more involved in the evaluation of programs and policies related to nutritional information and education. More specifically, economists can develop and apply robust econometric and statistical methods that accurately measure policies' effectiveness in improving dietary and health behavior as well as quality of life.

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[1]Regulation 1924⁄2006 is a legal framework for nutritional messaging and food product labeling as well as for the specific determinants affecting the use of nutritional claims.

[2]In the marketing literature (e.g., McDaniel & Gates 2006), laboratory studies are conducted in a controlled setting, whereas field experiments are conducted in the marketplace. Harrison & List (2004) define laboratory experiments on the basis of a standard subject pool of students, an abstract framing, and an imposed set of rules. Field experiments recruit subjects outside of the classroom and use actual goods and a real-life context.