The Economics of Labeling: An Overview of Issues for Health and Environmental Disclosure

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During the last two decades, product labeling has become an increasingly used policy tool, particularly with respect to the provision of health and environmental information. Theory holds that the flow of information among market participants plays a critical role in the efficient operation of markets. This paper explores the role of product labeling policy in ameliorating two potential market deficiencies: asymmetric information and costly search behavior. Practical considerations for the design and implementation of labeling policy and of labeling research are explored.

During the last two decades, product labeling has become an increasingly used policy tool, particularly with respect to the provision of health and environmental information. As a result, product-labeling policy is a topic of growing interest and public debate at both the federal and state levels. An example at the federal level includes USDA's current rulemaking on organic labeling of foods. Examples at the state level include measures to impose price and environmental labeling of electricity, emissions labeling of automobiles, and ingredient labeling of cigarettes. The labeling debate is largely about information and the processing and use of that information by consumers. The debate centers on questions such as how much information to supply to consumers to facilitate effective choice and how that information should be supplied.

A tenet of economic theory holds that the flow of information among market participants plays a critical role in the efficient operation of markets. However, when the flow of information is associated with explicit costs (e.g., costly search [Diamond 1971], costly revelation of arbitrage opportunities [Grossman and Stiglitz 1980]) or implicit costs (adverse selection or moral hazard [Akerloff 1970]), markets can lose the neoclassical promise of efficiency (Stiglitz 1996). In this paper, we are interested in exploring the role of informational labeling in the operation of consumer product markets. We present an economic framework that might be used to estimate the economic benefits associated with labeling policies and explore a plethora of practical considerations that must be addressed before labeling policies are implemented. Throughout the paper we turn to both economic and psychological theory to explore several of these implementation issues.

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Labeling Defined

We begin our discussion of labeling issues by first defining what we mean by labeling or a labeling program. We define *product labeling* as any policy instrument of a government or other third party that somehow regulates the presentation of product-specific information to consumers. This information might describe use characteristics of the product, such as price, taste, and nutrition, or non-use characteristics, such as the environmental impact or moral/ethical elements surrounding the product's manufacturing process.

Labeling policy can differ along three major continua: compulsoriness, explicitness, and standardization. First, a labeling policy can vary in its degree of compulsoriness, the degree to which firms are required to provide product information. At one extreme, labeling restrictions are mandatory: certain pieces of information are required to be displayed on the product. At the other extreme,

labeling restrictions are voluntary: firms chose what information, if any, will be displayed. Most third-party certification programs (e.g., the Green Seal, Good Housekeeping Seal) fall into the voluntary category. An intermediate example is claims-based labeling, wherein firms are required to disclose particular items of information, often in a specified format, only when a certain type of claim is made about the product elsewhere on the label or in product advertising. Under these types of labeling policies, firms have at least some control over the information presented on their product.

The second major component of labeling policies is explicitness, the degree of information detail presented to consumers. Current ISO 14000 negotiations provide a useful nomenclature here. ISO 14000 identifies two types of labels (Type I and III) that are differentiated by the level of information detail.[1] Type I labels provide the least amount of detail concerning attribute values. With a Type I label, the information about a vector of attribute levels is condensed into a one-dimensional score by an agreed-upon scoring algorithm. Products receiving a score above a predetermined threshold may present a seal of approval or certification. At the other extreme are Type III labels, which provide the most detailed information. Information is disclosed about several of the products attributes (e.g., nutrition labels on food), and the disclosure typically involves continuous or categorial information about each element (e.g., grams of fat, high/medium/low risk). Type III labels are generally considered the most objective of the label categories, while Type I labels are often considered the most normative.

The third major component of labeling policies is standardization, the degree to which the regulation requires the information to be provided in a presentation format that is standardized and uniform across products. At one extreme, a labeling policy can make presentation format requirements quite explicit, where the firm has no discretion over the presentation. For example, warning labels on cigarettes and alcoholic beverages have wording, font size, font typeface, and message location prescribed by regulation. Alternatively, the content of the information may be regulated but the firm has some discretion over the presentation of the information (e.g., health claims on food labels).

Justifications for Labeling

To economists, an obvious next question is "What is the economic justification for labeling programs?" As we pointed out in the introduction, the efficiency of markets is eroded as the flow of information among market participants is impeded or as information flow becomes costly.

Simply stated, labeling policies can circumvent these market inefficiencies by making the information initially held by the firm also available to the consumer. This removal of information asymmetry or subsidization of search costs is clearly beneficial to consumers as they are now more informed as to the exact attributes of the product. Choices will be more closely in line with preferences, and uncertainty regarding the nature of product attributes is minimized during the choice process. Firms that produce goods with desirable attributes also gain, as they are rewarded for marginal improvements in the quality of various attributes. Even firms selling low-quality products may gain. Consider a case of severe adverse selection (e.g., Akerloff 1970) where consumers know only the average quality of goods and have no other means to infer quality. In such a case, labeling of product attributes is one method of creating a market that would otherwise collapse because of adverse selection. Hence firms selling low-quality goods will be able to sell goods and benefit from the existence of the market.[2]

However, the costs and benefits of labeling are likely to depend upon the type of attributes considered. Caswell and Mojduszka (1996) outline three types of product attributes: search, experience, and credence.[3] Search attributes are those that can be assessed prior to purchase via research and inspection (e.g., color and size). Experience attributes are those that are assessed only after purchase and use (e.g., convenience). Credence attributes are those that cannot be easily verified even after purchase and use but whose value effects utility (e.g., the nutritional component of food).

Caswell and Mojduszka suggest that labeling plays an increasingly beneficial role as attributes progress along the spectrum from search to experience to credence.[4] The movement along this spectrum is roughly correlated to the cost or difficulty an individual would face while trying to independently overcome the information asymmetry. For example, identifying the color and size of a certain object (search attributes) can be done rather quickly or cheaply by most individuals, while verifying that a firm used 75% postconsumer recycled material to create the package (credence attribute) would be tremendously difficult. In fact, the individual may have no legal authority to undertake such an investigation.

Conversely, as one progresses along the spectrum of attributes from search to credence, the comparative advantage of a government or other

third-party organization in providing the information services becomes more obvious. One obvious advantage is that such an organization has economies of scale in verifying, monitoring, and disseminating information. Another advantage is that such organizations have means to require the release of the asymmetric information and to penalize firms that they find to be misrepresenting such information. For example, governmental organizations may use force of law to require disclosure or to penalize deceptive firms, while third-party organizations may have economies of scale in harming deceptive firms' reputations by organizing protests or coordinating lawsuits.

However, labeling is not costless. There is often the fear that labeling will cause "excess inertia" or "lock-in" in the Farrel and Saloner (1985) sense. That is, for a particular product, a labeling regime may include only certain attributes or may use a certain criterion for the awarding of a seal of approval. If there are changes in the marketplace, with regards to either technology or consumer preferences, appropriate changes in the labeling scheme may be greatly lagged because of institutional bureaucracies and coordination difficulties. Also, there are the obvious costs of gathering, verifying, and monitoring the needed information and administrating the labeling program. These costs are likely to be positively correlated to the private costs mentioned above.

Given these cost and benefit considerations, one might imagine that labeling policies are least likely to be justifiable for search attributes. Often it is assumed that the market communications supplied by firms through voluntary labeling and advertising will provide a sufficient degree of information about search attributes to make the market work efficiently to the benefit of all participants. Even in the case of search attributes, however, labeling policies may offer benefits often overlooked in traditional economic analyses. We argue that without standardization of information disclosure, some search attributes effectively resemble experience or credence attributes. This occurs because certain search attributes, such as the pricing structure for some services (e.g., phone and electricity), are very complex and difficult to judge *ex ante*. We view consumers as boundedly rational (Simon 1955; Conlisk 1996): they face not only budget constraints during the decision process but also time and cognitive constraints. Consumers facing these constraints may optimally make decisions based on relatively poor information about the search attributes. The true nature of these search attributes may not become evident until after repeated use of the product (i.e., until one receives several representative bills), and the true ranking of products in terms of this attribute may never become obvious.

Consider the most fundamental of search attributes—product price. It is often implicitly assumed that firms reveal the product's price and that consumers understand it with precision and appropriately incorporate it during the decision-making process. However, consumers must use scarce time and cognitive resources to rank products or services on price and must determine price differences so that marginal tradeoffs with other attributes can be made. If different firms communicate price via different disclosure structures, comparisons among competing firms rapidly becomes difficult. For example, Estelami (1997) showed consumers' inaccuracies in judging the price of a single product increased as the complexity of the pricing scheme increased. From the unit pricing literature, Russo (1977) showed that consumers' ability to find the "best deal" was significantly hindered when only one price existed but product sizes varied. Even though formats were identical, information was still difficult to compare because the unit of comparison was nonstandard.

Psychological studies provide some insight to the comparison difficulties that arise when consumers encounter nonstandardized information. Kleinmuntz and Schkade (1993) outlined three major components of informational displays that affect the processing tactics consumers employ and, hence, the time and cognitive costs incurred and the accuracy derived from these efforts. These components are form (e.g., numeric/graphic/verbal), cross-product organization (matrix, paragraph, hierarchical), and sequence. Schkade and Kleinmuntz (1994) reported experimental results suggesting that all three elements affect the difficulty and accuracy of judgment, but the largest effect was due to cross-product organization. This suggests that standardizing the display across products would provide the largest benefit to consumers, while improving the sequence and actual display format is next. Coupey (1994) provided additional insight to this finding. She found that, when consumers are faced with information that is not standardized across products, they often take processing shortcuts, such as eliminating certain attributes, eliminating certain products, and rounding numbers. Hence, standardizing information format across competing products may increase the number of products or attributes considered during choice and may provide more precision in tradeoffs made by the consumer.

Other research confirms that standardization of the label format can reduce the cognitive costs of extracting information, thus facilitating the con-

sumer's primary uses of a product label, i.e., to make cross-product comparisons of attributes and to verify firm-provided claims made elsewhere on the label. For example, when Winneg et al. (1998) asked consumers to compare two hypothetical electricity services in terms of price, 82% could correctly identify the service that cost five dollars less per month when both products displayed a standardized format, while only 60% could do so when the products used different formats.

Beyond standardization, labels may help improve the credibility of firms' privately sponsored communications. Often consumers are highly skeptical of the honesty of firms' advertising (Calfee and Ringold 1988); the existence of labeling allows consumers to verify claims made by advertisers and may hinder some firms from overstating product qualifications.

It is unclear whether individual firms would ever find it privately beneficial to organize and display product information in a standardized format that would also benefit consumers.[5] Disincentives to do so may stem from a fear that standardized price displays would promote price competition in markets that were previously monopolistically competitive, hence driving down profit margins. There are also the more straightforward costs of coordination that must be overcome by all the participants. These include both the logistical costs and the costs individual firms expend while lobbying for disclosure formats that highlight their product's comparative advantage. In some cases, such as the products reviewed in *Consumer Reports,* market opportunities arise and a third party may profit by providing such standardized information. But for items such as household electric service, which varies greatly from region to region, the market may not offer such opportunities.[6]

Determining the Effectiveness of Labeling

How can economists contribute to the design and implementation of labeling programs? This question can be answered in two ways, depending on the audience. Among policymakers the question usually means "How can economists help in designing labeling programs that effectively move current consumer behavior toward some target behavior?" Among economists the question appears as "How can economists help in designing labeling programs to maximize net social benefit?" We'll discuss both of these questions, starting with the first.

While labeling has been the focus of major policy initiatives in the last few years, little empirical economic research has attempted to understand the market effects of different labeling policies.[7] Presumably, one reason for this lack of research is that policymakers have only recently shown interest in labeling programs. However, another potential reason is the relative difficulty in isolating the economic consequences of changes in information policy.

Most empirical studies have basically used one of three methods to identify the behavioral effects of changes in information:

1. They use time-series data to estimate the demand for a commodity or a group of commodities as a function of some index of information.
2. They estimate demand as a function of individual awareness or knowledge.
3. They assume demand shifts are due to a particular information change and use dummied-trend variables in the demand specification to denote the change in information.[8]

A problem with the first approach is that using an information index as a determinant of market behavior implicitly assumes information translates relatively cleanly into consumer awareness and concern. Psychology and marketing studies indicate that this assumption is often tenuous. Although studies that incorporate health-related awareness are valuable in linking changes in demand with changes in awareness, they are less valuable in linking changes in demand with policy-relevant instruments. Finally, the use of trend variables is problematic because trend variables, agglomerating all time-varying factors, do not allow identification and measurement of changes in demand due to changes in information. This is particularly troublesome because label-induced market changes may take months or years before some consumers notice or incorporate the new information (e.g., Levy et al. 1985; Levy and Stokes 1987; Schucker et al. 1983; Teisl, Roe, and Hicks, n.d.).

Ultimately, though, if economists are to make significant contributions to the design of labeling policies, the research question is more than whether labeling programs can work, for there is already research that indicates that labeling can make significant changes in both consumer behavior (e.g., Teisl and Levy 1997; Levy et al. 1985; Ippolito and Mathios 1990, 1996) and producer behavior (e.g., Frazao and Allshouse 1996). What is needed is research that develops understanding of what the conditions need to be for a labeling policy to be effective. That is, what characteristics of the inter-

action between the label, the consumer, and the product affect the impact of information?

For example, the effectiveness of environmental labeling is partially dependent upon the altruistic preferences of consumers and their knowledge of pathways to satisfy their preferences. Furthermore, the degree of altruism exhibited by an individual may depend on how information concerning an environmental attribute is presented, suggesting that different wording approaches may induce different warm-glow effects (Andreoni 1995).[9] In the environmental arena, this opens the debate to Scitovsky's (1986) delicate question—can resource costs be reduced without reducing consumer satisfaction? In our context we ask another question—might labels shape preferences by framing the information so that consumers give additional weight to attributes associated with environmental costs? What little market evidence there is does not support this idea; label information does not seem to alter consumer behavior in terms of gross "consumption" of product attributes but may simply allow consumers an increased ability to substitute across products (Teisl and Levy 1997). Thus, labels may increase consumer welfare but may not fulfill the goals of health and environmental policymakers.

The effectiveness of labeling efforts may also depend on the product category. For example, Strahilevitz and Myers (1998) find that a firm's offer to make a charitable contribution upon product purchase is more effective with products classified as "frivolous luxuries" (e.g., ice cream sundaes) than with "practical necessities" (e.g., detergent). It is unclear whether attribute labeling, which may be viewed as more objective and less persuasive, would also be product sensitive.

This lack of knowledge regarding the market effectiveness of labeling policy characteristics is particularly evident, and potentially troublesome, with respect to environmental labeling. Environmental labeling programs are widespread; government and nongovernment organizations have implemented various environmental labeling programs that cover thousands of products in more than twenty countries (U.S. EPA 1993). Their widespread use suggests that environmental labeling is perceived as an effective method of altering consumer and producer behavior; however, research concerning its effectiveness is limited and quantitative results are rare. Much of the research has measured effectiveness either by identifying changes in consumer awareness after exposure to label information (Hartwell and Bergkamp 1992; Hashizume 1992; Yakami 1992) or by asking consumers whether labeling programs would affect their purchase behavior (Chase and Smith 1992). However, a change in awareness does not necessarily translate into a change in behavior (Bonneville Power Administration 1985; U.S. EPA 1989), and consumers do not necessarily follow their own purchasing assertions (Bailey and Eastlick 1993; Gutfeild 1991). Market-based research investigating the effectiveness of other types of labels (e.g., nutrition labels) may not be applicable to environmental labeling because these other labeling programs provide information about the use characteristics of the product. Environmental labels often differentiate products with respect to non-use characteristics.

Environmental certification programs provide an example of the lack of knowledge surrounding the market effectiveness of different labeling characteristics. Currently, firms are spending substantial amounts of money and are altering production methods to obtain environmental certification labels, and organizations like the World Bank support the use of these Type I labeling programs. However, focus group research (Teisl, Halverson, and Holt 1997) indicates that consumers may react negatively to these Type I environmental labels, and experimental research (Winneg et al. 1998) indicates that these labels may be ineffective in altering consumer behavior. There seem to be two possible reasons for the counterintuitive results. First, consumers may view Type I labels as too value laden. Consumers seem to prefer the more detailed Type III labels, which allow them more flexibility in applying their own value judgments. The second reason consumers may not like Type I labels is that they may doubt the veracity of the certifying organization. That is, consumers may invoke a "schemer's schema" (Wright 1986) in which they try to guess the true motivation behind the communication effort. Consumers may view the certifying organization as just another marketing gimmick employed by the firm and may therefore disregard the information.

The Welfare Effects of Labeling Policy

Now we turn to the economists' version of our earlier question—how can economists contribute to the design of labeling programs to maximize net social benefit? In application, this question provides some interesting welfare and equity issues. For example, consumer research indicates that standardizing the presentation of information can reduce the cognitive costs of information processing. However, we also know that consumers vary in their ability to process information. As a result,

one question facing makers of information policy is the level of standardization that should be imposed. Policymakers cannot provide labels that satisfy everyone's information desires while simultaneously catering to consumers' cognitive and time constraints. As a result, policymakers need to understand how different information policies affect different sectors of the consumer population.

Economists, using cost/benefit analysis, may be able to provide a framework to help answer such questions. However, relatively little work has been done to develop a method of benefit analysis for information changes. For example, current practices in valuing the economic benefits of nutrition label changes take the position that the value of a label change should be judged by the degree to which it provides "nutritionally correct" behavior (e.g., Zarkin et al. 1991). This perspective, which presumes that the "correct behavior" can be prejudged by the researcher, is atypical for economists, who usually assume that the individual is the best judge of her/his well-being.

The empirical literature validates potential behavior changes in the face of label-provided information. Therefore, consumers prevented from making such adjustments by lack of information will be worse off. However, conceptualizing the welfare effect of improved information is somewhat perplexing. If one attempts to measure the welfare effect of information change by using changes in the consumer surpluses behind affected demand curves, then a paradox results. Consider a good, Z, whose production is found to decrease environmental quality. Dissemination of information on this link may lead to backward shifts in the demand for Z. The consumer surplus associated with the consumption of Z shrinks and, using this measure, the consumer *appears* to be worse off with the information than he/she was without it.

Foster and Just (1989) address this problem: ceteris paribus, individuals are viewed as worse off if information exists that would help them make better choices but, because they are ignorant of the information, they cannot optimally adjust their behavior. When comparing utility and behavior under two states of information, the choice made with less information can be viewed as restricted against the context of better information. While individuals make optimal decisions conditional on the information set available, utility differences under different information states can be measured as the difference between the optimal decision under better information and the restricted decision under better information (where the restricted decision is defined as the optimal decision under poorer information). To measure the welfare effects of providing information, one must assume that the individual eventually obtains better information and does not remain in ignorance. Ultimately, welfare effects must be measured against the correct information; ignorance is bliss only if the individual never learns the correct information.

To provide a modeling framework to measure changes in consumer behavior and welfare due to changes in label information, one needs to know how attribute information enters an individual's utility function (here defined in terms of a purchase occasion or decision). The utility evaluation can be represented by the indirect utility function

$$V^S = V(\mathbf{A}^S, \mathbf{q}, Y, \mathbf{p}),$$

where $\mathbf{A}^S$ denotes a vector of attribute-related quality assessments for m products given information set S (i.e., $\mathbf{A}^S = \acute{Y}(A_1^S, \ldots A_m^S)$, $\mathbf{q}$ denotes a vector of other (search) quality characteristics (e.g., taste or texture), $\mathbf{p}$ is a corresponding vector of prices, and Y denotes income. V^S is increasing in $\mathbf{q}$ and Y, decreasing in $\mathbf{p}$.

The technology that extracts and translates label information into an assessment of a product's attribute-related level of quality can be viewed as a "household production" process by which an individual combines her prior knowledge, cognitive abilities, time, and the information presented during the purchase decision. Thus, we could model the assessment process during the purchase decision as

$$A_j^S = f(S_j, G, t_j; \theta),$$

where A_j^S denotes the (subjectively) assessed attribute-related quality level of good j given information set S, S_j is the attribute information displayed about product j at the point of purchase, G denotes the consumer's prior stock of related information (which may include information from news accounts or firm-provided advertising), and t_j denotes the time that the individual devotes to processing S_j.

The objective level of the attribute represented by the information variable S is denoted by θ. For example, if S represents a dolphin-safe claim on a canned tuna label, then θ denotes that the production of the tuna led to no actual dolphin deaths. θ is separate from the assessment function because the individual does not observe it at the time of purchase except through the variable S. Although θ may be unobservable to the consumer at the time of the purchase decision, we include it within the discussion to distinguish between a factor that affects consumer decisions, S, and one that causes any health or environmental impacts, θ.

We begin by presenting expenditure functions under two alternative states of information. Denote

$$e(\mathbf{A}^0(\bullet), \mathbf{q}, U, \mathbf{p})$$

as the expenditure function when the product attribute is at level 0 and the information about the attribute accurately reflects that level ($S = 0$ and reflects the state of θ). Likewise,

$$e(\mathbf{A}^1(\bullet), \mathbf{q}, U, \mathbf{p})$$

is the expenditure function when the product attribute is at level 1 and the information about the attribute reflects the new level ($S = 1$ and reflects the state of θ).

Although not commonly framed as such, compensating variation (CV) measures the change in individual welfare when the qualities of a good change (denoted as a move from $\theta = \theta^0$ to $\theta = \theta^1$) along with a corresponding change in information about the quality change ($S = 0$ to $S = 1$). CV can be expressed as

$$CV = e(\mathbf{A}^1(\bullet), U^0, \mathbf{p}^0) - e(\mathbf{A}^0(\bullet), U^0, \mathbf{p}^0),$$

where U^0 denotes the initial utility level (q is dropped for simplicity).

CV is an appropriate welfare measure when a good's attribute changes and the individual is provided with information reflecting the change. However, CV is not appropriate when a good's attribute does not change but the individual is provided with new information so that she adjusts consumption to avoid possible welfare losses (due to a decrease in assessed quality) or to obtain possible welfare gains (due to an increase in assessed quality). Foster and Just (1989) suggest that a useful welfare measure in this case is the cost of ignorance.

The cost of ignorance (COI) measures the change in individual welfare when the quality of a good does not change but the *information* about the good's quality changes. Following Foster and Just, the consumer's choice without new information can be viewed as being restricted in terms of the allowed choice of $\mathbf{x}$ (the elements of the vector $\mathbf{x}$ measure the quantities purchased of different products). Foster and Just note that COI can be defined as the difference between a restricted and an unrestricted expenditure function

$$COI = \varepsilon(\mathbf{p}^0, U^0, \mathbf{A}^1(\bullet) | \mathbf{x}^0)) - e(\mathbf{p}^0, U^0, \mathbf{A}^1(\bullet)),$$

where $\varepsilon(\bullet)$ is a restricted expenditure function because the individual's consumption is restricted to the original bundle, $\mathbf{x}^0$ (that is, the quantities of goods chosen under the old information set). Note that the COI measure assumes that the individual eventually obtains better information. That is, the restricted expenditure function reflects the situation where the individual has obtained the better information but the individual's choice is restricted to what it was when the consumer was ignorant.

COI can be measured by finding a price vector, $\mathbf{p}^1$, such that the point represented by the restricted choice (given $\mathbf{p}^0$) is represented by an unrestricted choice (given $\mathbf{p}^1$). Using this approach, COI can be redefined as

$$COI = e(\mathbf{p}^0, U^0, \mathbf{A}^1(\bullet)) - e(\mathbf{p}^1, U^0, \mathbf{A}^1(\bullet)) + (\mathbf{p}^1 - \mathbf{p}^0)\,\mathbf{x}^0,$$

where $\mathbf{p}^1$ is the price vector such that the original consumption bundle, $\mathbf{x}^0$, would be freely chosen. Note that COI (for a normal good) is always greater than or equal to zero; COI denotes the amount of money an individual is willing to give up to gain better information about θ so that she is free to alter consumption.

Foster and Just's (1989) approach provides a valuable method of estimating the welfare effects of changes in information about product attributes. However, there is a lot yet to learn. First of all, to our knowledge, Foster and Just's paper is the only published attempt at empirically measuring the welfare effects of information change. However, their application was limited to information provided by the news media and focused on one product. How to determine the welfare effects of labeling when the program may cover a wide variety of products is less clear. Furthermore, possible differences in consumer welfare due to different consumer, label, or product characteristics have not been studied.

Interactions with Other Policy Instruments

Compared with command-and-control options or performance standards that directly affect the attributes firms produce, clear labeling of attributes may provide a less intrusive and often less expensive method of improving market outcomes.[10] Thus, a cost/benefit analysis may support a labeling policy to promote environmental or health goals, whereas another type of policy may not pass the cost/benefit test. However, given that environmental labeling may focus on attributes that have public good aspects, the potential for free-ridership in product choice may indicate that a labeling program by itself may not provide the socially optimal level of public goods. Because it is unlikely that labeling will replace other policy instruments, a potentially rewarding avenue for economic research is to determine the theoretical and empirical

interactions between labeling programs and other policy instruments.

Such interaction between labeling and other policy instruments is at least partially predicated upon the existence of altruistic preferences by consumers. Johansson (1997) shows that the socially optimal externality-correcting tax may be less than, greater than, or equal to the standard Pigouvian tax for cases in which agents have altruistic utility functions. The direction and magnitude of this deviation critically depends upon the type of altruism exhibited by the agents.[11] For example, Johansson shows that the optimal Pigouvian tax is still socially optimal in the presence of impure altruism (Andreoni 1990). Hence, the optimal policy prescription requires knowing how many agents exhibit each type of altruism—a very difficult (if not impossible) task, both methodologically and politically.

Dynamic Implications of Labeling on R&D Investment

A last area of potential research interest is in terms of the dynamic implications of labeling programs. That is, how do labeling programs affect firm investment in the development of new products? Research indicates that nutrient and health-related labeling of food products has made significant changes in the supply of new products by providing firms an incentive to improve the nutritional quality of those products (Ippolito and Mathios 1996; Levy and Stokes 1987; Frazao and Allshouse 1996). Similar supply-side changes may be expected to result from the issuance of the new organic standard. However, the effects of setting or altering labeling standards on industry research and development expenditures are difficult to gauge because of the many subtle and potentially contradicting incentives that may exist.

Consider a product category in which no item currently meets the criteria to qualify for a particular certification. If substantial rewards would go to the first firm to develop a product reformulation that meets these criteria and qualifies for the certification, then substantial research and development dollars might be devoted to producing such a facilitating technology. Now suppose the labeling criteria were changed such that several different products qualified for the certification without any reformulation whatsoever. Firms that qualify for the claim may have little if any incentive to continue research to improve the quality of their products. Firms that still do not qualify may simply adopt or license the technology used by the firms who qualify for the claims and drop their own research efforts. However, the existence of the new, "lower bar" may induce some firms to improve their product quality, whereas the old, "higher bar" may have been viewed as unachievable and may also have resulted in no research or product improvement. Questions concerning the supply-side and general-equilibrium effects of altering certification standards on research and development incentives in nutritional quality are difficult to answer and may require substantial theoretical and empirical analysis in order to improve our understanding.

Conclusions

Policymakers are increasingly using product labeling as a tool to alter the behavior of market participants. Furthermore, economists have long held that the flow of information plays a critical role in the efficient operation of markets. It is therefore somewhat surprising to find that there has been little in the way of empirical economics research to determine the market effects (policy effectiveness) of labeling programs. Of the little research that has been done, most has focused on nutrition labeling of food products. Although these studies provide valuable insights into the potential role of labeling in correcting market inefficiencies, empirical results from these studies may not be applicable to environmental labeling. Although current demand models can easily be adapted to analyze the market effects of labeling, data sets that actually allow isolation of label effects are probably rare. Experimental data sets, generated both in the lab and in the marketplace, may provide policy-relevant empirical results.

Beyond measuring the policy effectiveness of labeling programs, economists can contribute to the design and implementation of these programs so that they improve social welfare. A stated objective of the consumer research leading to the design of the current nutrition label was to enable the public to make more informed food choices by providing as complete information as possible while presenting the information in an easily processed form (Levy, Fein, and Schucker 1996). This suggests an implicit tradeoff between the cost of information acquisition and information accuracy. The type and volume of information presented on a label, as well as the format of the label, will affect the amount of time and effort an individual must supply in order to assess product attributes. After a point, simplified information that is easier to process can be obtained only at the cost of less

precision. However, simply increasing the amount of information on a label may actually make any given amount of information harder to extract (Chaffee and McLeod 1973). This may cause individuals without the time or ability to process information to ignore it (Heimback 1982; Achterberg 1990; Jacoby, Chestnut, and Silberman 1977; French and Barksdale 1974), leading to less optimal purchasing decisions (Magat, Viscusi, and Huber 1988).

Unfortunately, the optimum level of simplicity and detail is likely to be different for different individuals and for different products. Determining the optimal form of labeling program is an important welfare question because, given the unequal distribution over the population of cognitive abilities, consumer desires, and values of time, labeling regulations will have equity and distributional implications. However, only one published study has examined the welfare implications of information policy. To understand these implications, policymakers need to know the characteristics of labeling programs preferred by different sectors of the consumer population. Economists, using cost/benefit analysis, may be able to provide a framework in which to answer such policy questions.

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Notes

1. ISO 14000 also designates a Type II label, which differs from a Type I or III label in that a Type II label is a *self-declared,* single-criterion claim. Thus, Type II claims include "labels, statements and many other forms of marketing" (Kuhre 1997, p. 15), such as a "40% recycled content"

label on a paper product or a "dolphin-safe" label on a can of tuna.

2. Note that other policy interventions, such as minimum quality standards, often remove these low-quality items from the market, thus depriving firms and consumers from beneficial trades (Bockstael 1984).

3. These three categories follow Nelson's (1970, 1974) and Darby and Karni's (1973) classifications of products.

4. For example, the attribute of taste lies between search and experience. If one searches enough, one could taste-test a sample of many foods at a supermarket somewhere.

5. Gehrig and Jost (1995) note that, in some cases, firms may find it beneficial to impose some type of self-regulation of information provision. However, their results focus on experience attributes; credence and search attributes may have unique aspects that affect self-regulation incentives.

6. *Consumer Reports* has remarked that it does not plan to offer any summaries in the household electric service market.

7. Most studies have focused on studying the behavioral effects of information provided through the news media (Swartz and Strand 1981; van Ravenswaay and Hoehn 1991; Smith, van Ravenswaay, and Thompson 1988) or the medical literature (e.g., Brown and Schrader 1990; Chang and Kinnucan 1991; Capps and Schmitz 1991; Putler 1987; Zuo and Chern 1996).

8. In an exception, consumer researchers at the FDA (Levy et al. 1985; Levy and Stokes 1987; Teisl and Levy 1997) used a controlled-market experiment to determine the effect of nutrition labeling on consumer purchase behavior. Treatment stores exhibited shelf labels carrying nutrient information whereas, during the same time period, control stores did not carry the nutrient information on the shelf labels. The studies indicate that label information can significantly affect market behavior.

9. For example, Andreoni (1995) found that experimental participants were more likely to contribute to public goods when the experimental instructions implied that individual action would help rather than hurt others, even though the reward structures accompanying both sets of instructions were identical.

10. The labeling of attributes may allow some goods to exist that would otherwise be eliminated under a command and control policy (see note 2).

11. Johansson (1997) outlines four types of altruism: (1) paternalistic—an agent's value increases in the amount that other agents consume a particular good; (2) nonpaternalistic or pure—the utility derived by others enters an agent's utility function; (3) impure or warm glow—an agent's own utility increases only because a transfer is made to others, not because others increase consumption or utility; and (4) genuine—an agent acts like a social planner when optimizing.