Economics of Food Labeling. By Elise Golan, Fred Kuchler, and Lorraine Mitchell with contributions from Cathy Greene and Amber Jessup. Economic Research Service, U.S. Department of Agriculture. Agricultural Economic Report No. 793.

Abstract

Federal intervention in food labeling is often proposed with the aim of achieving a social goal such as improving human health and safety, mitigating environmental hazards, averting international trade disputes, or supporting domestic agricultural and food manufacturing industries. Economic theory suggests, however, that mandatory food-labeling requirements are best suited to alleviating problems of asymmetric information and are rarely effective in redressing environmental or other spillovers associated with food production and consumption. Theory also suggests that the appropriate role for government in labeling depends on the type of information involved and the level and distribution of the costs and benefits of providing that information. This report traces the economic theory behind food labeling and presents three case studies in which the government has intervened in labeling and two examples in which government intervention has been proposed.

Keywords: labeling, information policy, Nutrition Labeling and Education Act, dolphin-safe tuna, national organic standards, country-of-origin labels, biotech food labeling

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Summary

Federal intervention in food labeling is often proposed with the aim of achieving a social goal such as improving human health and safety, mitigating environmental hazards, averting international trade disputes, or supporting domestic agricultural and food manufacturing industries. We find that mandatory food-labeling requirements are best suited to alleviating problems of asymmetric information and are rarely effective in redressing environmental or other spillovers associated with food production and consumption.

In this report, we trace the economic theory behind food labeling and present three case studies in which the government has intervened in labeling decisions (nutrition content, dolphin-safe tuna, and organic) and two examples in which government intervention has been proposed (country-of-origin and biotech). We examine how different types of benefit-cost calculations influence the information supplied by private firms, the information required by governments, and the role of third-party entities in standardizing and certifying the veracity of the information.

The costs and benefits relevant to a private firm's labeling decision are reflected in its balance sheet. Assuming that a firm attempts to maximize profits, it will add more information to product packaging so long as each additional message generates more revenues than costs. Firms provide information on all positive attributes that merit the cost. Consumer skepticism, warranties, and competition among firms help to expose many negative attributes about products so that, even in the absence of government intervention, a great deal of product information is revealed.

Firms are sometimes unable to convince consumers of the validity of labeled information. In these cases, the value of the label is diminished. Third-party services could change the private, voluntary labeling decision of firms by either reducing the costs or increasing the benefits of labeling. When these services bolster the credibility of voluntary labeling, they facilitate market transactions and increase market efficiency, in both domestic and international markets. The primary services that third-party entities offer to help strengthen labeling claims are standard setting, testing, certification, and enforcement.

Third-party labeling services can be provided by a wide variety of entities including consumer groups, producer associations, private third-party entities, and international organizations. The government also could play a role in bolstering voluntary labeling by providing some or all of these services. Government-provided services could be funded through user fees or through specific or general taxes. In some cases, government support of voluntary labeling may be a more cost-effective way of delivering credible, relevant information to consumers than mandatory labeling requirements.

The government may decide that some information must be provided on labels. Such a situation is most likely to occur either when the market does not supply enough information to allow consumers to make consumption choices mirroring their preferences (asymmetric information), or when individual consumption decisions affect social welfare in a way that is not reflected in the market (externalities). The costs and benefits relevant to the government's decision to intervene in

labeling are broader than those of relevance to private firms. Benefits may include improved health or environmental quality. Costs may include the government's administrative costs, higher consumer prices, and industry compliance costs. The distribution of these costs and benefits may be as important in determining the desirability of the policy as the level of net benefits.

Policymakers must weigh the benefits and costs of labeling as well as the distribution of benefits and costs to determine whether labeling is a cost-effective policy option. Even if the benefits of mandatory labeling outweigh the costs, however, labeling may not be the best policy option. The government has a number of policy tools at its disposal to correct for asymmetric information and to control externalities (including taxes, education programs, and production regulation). We conclude that labeling may be an appropriate policy tool in the following circumstances:

- *Consumer preferences differ.* Labeling may be preferable to other policy tools if consumer preferences differ widely with respect to product characteristics.

- *Information is clear and concise.* The information on the label must be clear, concise, and informative. Information that is unread or is misunderstood will lead neither to better informed consumption decisions nor to a better matching of preferences with purchases. Unclear information may increase search and information costs.

- *Information on product use enhances safety.* For some products, the manner in which consumers use or consume the product influences the quality attributes of the product. Information that helps consumers avoid or minimize risk is particularly valuable.

- *Costs and benefits of consumption are borne by the consumer.* If the consumption or production of a food creates externalities (that is, affects someone else's welfare in a way that is not reflected in the market), then information-based policies will usually be insufficient to align private consumption choices with socially optimal choices.

- *Standards, testing, certification and enforcement services can be established.* Mandatory labeling will result in confusion and actually increase transaction costs if it is not supported by clear, achievable quality standards; testing services to measure the validity of labeling claims; certification services substantiating the validity of the quality claim; and mechanisms for enforcing labeling rules.

- *No political consensus on regulation exists.* In many regulatory policy debates, there is little consensus on the appropriate regulatory response. Some groups may advocate complete product bans while others advocate no government intervention at all. In these cases, labeling may represent the best compromise solution, both domestically and internationally. Labeling in such instances, however, may provide consumers with little real information, particularly when the lack of political consensus arises from a lack of scientific consensus.

The case studies and examples illustrate the points raised in the theory section. They examine the amount of information that was voluntarily supplied by private firms, the role of third-parties in enhancing the value of voluntary labeling, and the costs and benefits of government intervention in labeling. Each study involves dif-

ferent types of costs and benefits and different sets of political, legal, social, and scientific objectives and considerations.

The case studies and examples illustrate the observation that it is difficult to measure the costs and benefits of government labeling policy. Cost-benefit analyses for the case studies and examples require quantifying such difficult notions as the benefits of a healthier population (nutrition labeling), fewer dolphin deaths (dolphin-safe tuna), and reductions in transaction costs (national organic standards). In every case, the task of actually measuring the costs and benefits of labeling involves difficult methodological and philosophical problems. The examples and case studies also show the potentially far-reaching costs and benefits of labeling, including impacts on industry structure and on food quality and cost.

The case studies and examples also illustrate the observation that the impetus for government involvement in labeling may originate from many different sources, including the government (nutrition labeling), consumer groups (dolphin-safe tuna and biotech), and producer groups (organic labeling and country-of-origin).

The nutrition labeling case study shows labeling is an effective policy tool when consumer preferences differ. Consumers have different concerns about nutrition. The standardized nutrition label provides a large amount of clear, concise nutrition information and allows consumers to make their own choices.

The dolphin-safe tuna case study and the biotech example illustrate the potential power of labeling as a middle ground in international trade disputes. In the dolphin-safe tuna case, labeling, but not banning, was acceptable under provisions of the General Agreement on Tariffs and Trade. In the biotech example, international consensus on biotech regulation has been difficult to achieve, which may explain why labeling continues to be debated.

The dolphin-safe tuna and organic labeling cases illustrate the strong role that the Federal Government may play in setting standards, establishing certification, and providing enforcement mechanisms.

The country-of-origin example highlights the observation that the fact that private firms do not provide information on label may indicate that the information is not of value to consumers. In these cases, there is no reason for the government to establish mandatory labeling requirements. The example illustrates why any proposed government intervention in labeling decisions ought to arise from a demonstrated market failure.

The biotech labeling example illustrates three observations made in the theory section of the report. First, to establish successful mandatory labeling requirements the government must also provide or arrange for standards, testing, certification, and enforcement. Second, labeling of complex, unclear information will not reduce information and search costs. Third, labeling is not the best policy tool for redressing externalities.

Economics of Food Labeling

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with contributions from Cathy Greene and Amber Jessup

Introduction

There is a lot to know about the food we eat. For example, the ingredients for a jar of spaghetti sauce, a box of cereal, or a cup of coffee could come from around the corner or around the world; they could be grown with numerous pesticides or just a few; they could be grown on huge corporate organic farms or on small family-run conventional farms; they could be harvested by children or by machines; they could be stored in hygienic or pest-infested storage facilities; or they could increase or decrease the risk of cancer. A description of any one food product could include information on a myriad of attributes.

Consumers, food processors, third-party entities, and governments all play a role in determining which of a food's many attributes are described on food labels. Consumers use their purchasing power (their consumption choices) and political activities to help determine which attributes are described on labels. Private firms seek out attributes that are attractive to consumers and voluntarily provide information about these attributes when the benefits of doing so outweigh the costs. Third-party entities, including private organizations, governments, and international organizations, contribute to enhancing the intelligibility and credibility of information about some food attributes through standard setting, certification, and enforcement. These services can increase the amount of information supplied by labels. Governments may require that information on some attributes be included on food labels.

Government intervention in labeling in the United States has served three main purposes: to ensure fair competition among producers, to increase consumers' access to information, and to reduce risks to individual consumer safety and health (Hadden, 1986). Table 1, which highlights some of the major milestones in U.S. food labeling, shows that a motivation for many government labeling laws has been to ensure fair competition.

In recent years, government intervention in labeling has begun to target a new purpose, namely, influencing individual consumption choices to align them with social objectives. We traced the first explicit mention of the link between labels and a social goal to the White House Conference on Food, Nutrition, and Health in 1969. One of the major recommendations from this conference was that, to help address deficiencies in the U.S. diet, the Federal Government should consider developing a system for identifying the nutritional qualities of food (U. S. Food and Drug Administration, 1998). Two decades after that White House conference, the Food and Nutrition Board of the National Academy of Sciences convened a committee to consider how food labels could be improved to help consumers adopt or adhere to healthy diets. The U.S. Food and Drug Administration (FDA) proposed the Nutrition Labeling and Education Act (NLEA) in 1990 (for reviews of food labeling history in the United States, see Blechner and Fontana, 1997, and U.S. Food and Drug Administration, 1998).

Designing a labeling policy to achieve a social objective like a healthier population highlights some of the problems at the heart of any government decision to intervene in labeling, for whatever reason. As with any policy, the costs and benefits of government intervention in labeling must be weighed, and the sometimes conflicting demands of economic efficiency, consumer and producer concerns, public opinion, political expediency, and current events must be sorted and evaluated.

In this report, we examine the economics of food labeling. We examine how different types of benefit-cost calculations influence the information supplied by private firms, the information required by governments, and the role of third-party entities in standardizing and certifying the veracity of the information. We show that the appropriate level of government intervention in labeling decisions, whether establishing mandatory labeling laws, providing services to enhance voluntary

Table 1--Milestones in U.S. food labeling

Date	Law or event[1]	Objective[2]			
		Regulate competition	Information	Safety	Social goal
1906	The Federal Pure Food and Drugs Act and the Federal Meat Inspection Act authorize the Federal Government to regulate the safety and quality of food. These acts also defined adulteration and prohibited selling misbranded or adulterated foods.	x	x	x	
1913	The Gould Amendment requires food packages to state the quantity of contents.	x	x		
1924	In U.S. v. 95 Barrels Alleged Apple Cider Vinegar, the Supreme Court rules that the Food and Drugs Act condemns every statement, design, or device which may mislead, misdirect, or deceive, even if technically true.	x	x	x	
1930	The McNary-Napes Amendment requires labeling on products that do not meet common-usage standards.	x	x	x	
1938	The Federal Food, Drug, and Cosmetic Act replaces the 1906 Food and Drugs Act. Among other things, it requires the label of every processed, packaged food to contain the name of the food, its net weight, and the name and address of the manufacturer or distributor. A list of ingredients also is required on certain products. The law also prohibits statements in food labeling that are false or misleading.	x	x		
1950	The Oleomargarine Act requires prominent labeling of colored oleomargarine to distinguish it from butter.	x			
1951	Nutrilite Consent Decree allows the FDA to establish industry guidelines for vitamin and mineral labeling.	x	x	x	
1957	The Poultry Products Inspection Act authorizes USDA to regulate, among other things, the labeling of poultry products.	x	x		
1958	The Food Additives Amendment (which contains the Delaney Clause) expands the FDA's authority to monitor dietary and health claims and food ingredients (including restricting or banning any additive or food ingredient deemed unsafe). Processors are required to prove that additives are safe. Creates the "zero-risk" standard for carcinogens in processed foods.		x	x	
1966	The Fair Packaging and Labeling Act requires all consumer products in interstate commerce to contain accurate information and to facilitate value comparisons.	x	x		

[1]The primary source for this information is "Good Reading for Good Eating," U.S. Food and Drug Administration, http://www.fda.gov/fdac/special/foodlabel/goodread.html. We have augmented and updated the FDA list of milestones (Hadden, 1986; Blechner and Fontana, 1997).

[2]Hadden (1986) finds three main purposes underlying U.S. labeling laws: ensuring fair competition among producers, increasing consumers' access to information, and reducing risks to individual consumer safety and health. Recently, a fourth purpose has emerged, namely that of altering individual consumption choices to align them with wider social costs or benefits.

Table 1--Milestones in U.S. food labeling, continued

Date	Law or event[1]	Objective[2]			
		Regulate competition	Information	Safety	Social goal
1966	FDA publishes proposed dietary supplement regulations. Proposal triggers legal challenges from industry.	x	x	x	
1969	The White House Conference on Food, Nutrition, and Health addresses deficiencies in the U.S. diet. It recommends that the Federal Government consider developing a system for identifying the nutritional qualities of food.				x
1973	FDA issues final dietary supplements regulation. Industry continues legal challenges.	x	x	x	
1973	FDA issues regulations requiring nutrition labeling on food containing one or more added nutrients or whose label or advertising includes claims about the food's nutritional properties or its usefulness in the daily diet. Nutrition labeling is voluntary for almost all other foods.	x	x		
1975	Voluntary nutrition labeling, postponed from its originally planned 1974 date, goes into effect.	x	x		
1976	Vitamin-Mineral amendments limit FDA's authority and enforcement power in relation to vitamin and dietary supplements.				
1983	In face of legal setbacks and Federal budget cuts, FDA repeals dietary supplement regulation.				
1988	Surgeon General C. Everett Koop releases The Surgeon General's Report on Nutrition and Health, the Federal Government's first formal recognition of the role of diet in certain chronic diseases.				x
1989	The National Research Council of the National Academy of Sciences issues "Diet and Health: Implications for Reducing Chronic Disease Risk," which presents additional evidence of the growing acceptance of diet as a factor in the development of chronic diseases, such as coronary heart disease and cancer. Under contract with FDA and USDA's Food Safety and Inspection Service (FSIS), the Food and Nutrition Board of the National Academy of Sciences convenes a committee to consider how food labels could be improved to help consumers adopt or adhere to healthful diets. Its recommendations are presented in Nutrition Labeling: Issues and Directions for the 1990s.				x

Table 1--Milestones in U.S. food labeling, continued

Date	Law or event[1]	Objective[2]			
		Regulate competition	Information	Safety	Social goal
1990	Dolphin Protection Consumer Information Act regulates labeling of dolphin-safe tuna.				x
1990	Congress passes the Organic Foods Production Act requiring the Secretary of Agriculture to establish a Federal organic certification program.	x	x		
1990	FDA proposes extensive food labeling changes, which include mandatory nutrition labeling for most foods, standardized serving sizes, and uniform use of health claims. The proposed Nutrition Labeling and Education Act reaffirms the legal basis for FDA's labeling initiative and establishes an explicit timetable.	x	x		
1991	FDA issues more than 20 proposals to implement NLEA. In addition, the agency issues a final rule that sets up a voluntary point-of-purchase nutrition information program for raw produce and fish. FSIS unveils its proposals for mandatory nutrition labeling of processed meat and poultry and voluntary point-of-purchase nutrition information for raw meat and poultry.	x	x		x
1992	Dietary Supplement Act delays implementation of new dietary supplement regulation until the end of 1993. Authorizes the FDA to grant permission to producers to make specific health claims for products.		x		
1992	FDA's voluntary point-of-purchase nutrition information program for fresh produce and raw fish goes into effect.	x	x		x
1993	FDA issues the final regulations implementing NLEA. Regulations covering health claims become effective.	x	x		x
1994	NLEA regulations pertaining to nutrition labeling and nutrient content claims become effective (including those for meat and poultry).	x	x		x
1994	The Dietary Supplement Health and Education Act (DSHEA) defines a "dietary supplement" as a food, not as a drug, thereby subjecting supplements to less restrictive regulatory and labeling requirements.	x	x	x	
1997	USDA releases the first proposed rule for a national organic foods standard (in compliance with the Organic Foods Production Act). The proposal drew over 275,000 comments, largely negative.	x	x		
1997	FDA issues final rules implementing the major provisions of the DSHEA of 1994.	x	x	x	

Table 1--Milestones in U.S. food labeling, continued

Date	Law or event[1]	Objective[2]			
		Regulate competition	Information	Safety	Social goal
1999	Mandatory labeling of foods containing biotech ingredients is proposed in the House (HR 3377).		x		x
2000	USDA releases the second proposed rule for a national organic foods standard (in compliance with the Organic Foods Production Act). The most controversial aspects of the first proposal—the potential to allow the use of genetic engineering, irradiation, and sewage sludge in organic production—were dropped from the second proposal.	x	x		
2000	White House announces Food and Agricultural Biotechnology Initiatives: Strengthening Science-Based Regulation and Consumer Access to Information authorizing (1) FDA to develop guidelines for voluntary efforts to label food products under their authority as containing or not containing bioengineered ingredients in a truthful and straightforward manner, consistent with the requirements of the Federal Food, Drug, and Cosmetic Act; (2) USDA to work with farmers and industry to facilitate the creation of reliable testing procedures and quality assurance programs for differentiating non-bioengineered commodities to better meet the needs of the market.	x	x		
2000	Mandatory labeling of foods containing biotech ingredients is proposed in the Senate (S 2080).		x		x

labeling, or not intervening at all, depends on the type of information involved and the level and distribution of the costs and benefits of providing that information. In general, we find that mandatory food-labeling requirements are best suited to alleviating problems of asymmetric information and are rarely effective in redressing environmental or other spillovers associated with food production and consumption.

We begin by examining the types of benefit-cost calculations used by private firms when deciding whether or not to provide specific product information. Next we explore the reasons for third-party involvement in labeling. We then examine the types of benefit-cost calculations relevant to determining the government's role in labeling. We conclude the theory section of the report by providing some guidelines as to when mandatory labeling may be an appropriate policy tool. In the second part of the report we present three case studies in which the government has intervened in labeling: nutritional labeling, dolphin-safe tuna labeling, and organic labeling. We also examine two examples in which the government has contemplated intervention: country-of-origin labeling and biotech labeling.

Part One: Theory

The Firm's Voluntary Labeling Decision

For a firm, labeling is one of many advertising options and its labeling decision can be examined just like any other advertising decision. Assuming that firms attempt to maximize profits, they will add more information to product packaging so long as each additional message generates more revenues than it costs.

A label is intended to help consumers differentiate the labeled product from otherwise similar products. A label calls to consumers' attention the desirable attributes of the product. When a firm labels its product, it assumes that the information it provides is important to consumers and that they will respond by changing their purchase decisions. Schmalensee (1972) described the incentive for firms to advertise, claiming that if a firm's advertising has any effect, it will be to allow the firm to sell more without reducing the price it charges or to raise the price without losing sales or market share.

While it is easy to say that firms disclose information that is advantageous to them, deciding which attributes consumers will find desirable is not a trivial problem. If firms could easily decide which information is advantageous to disclose on labels and how to disclose it, big Madison Avenue advertising firms would be neither big nor located on Madison Avenue. The labeling decision is complex for two reasons. First, for even the simplest of products, there are many attributes that could be labeled. For example, the attributes of bottled water include the size and shape of container, trace mineral content, and place of origin. Some bottled-water labels name particular springs or types of springs while others suggest snow-melt from Alpine mountains as a source. Second, the labeling decision is complex because consumers are not all alike. Consumers have diverse preferences. For example, some will care whether animals were harmed in product testing, while others will not. Some will care about organic production methods and others will not. All consumers may want their food to be safe, but may differ widely in risk perceptions and risk preferences and in ability to process information about health risks.

In 1997, U.S. producers spent $48.7 billion on packaging and $21 billion on advertising (Elitzak, 1999). Together these amounts represent over 12 percent of domestic food expenditures. Even if only a small share of packaging goes toward labels, we know that there must be substantial rewards for constructing successful label messages.

Markets Work To Inform Consumers

Labeling decisions may enhance economic efficiency by helping consumers to target expenditures toward products they most want. Thus, in their drive to persuade the maximum number of consumers to purchase their products, firms may provide a public service by increasing the information available to consumers. The value of this service depends on the importance consumers attach to the attribute and the difficulty they face in assessing the attribute on their own.

Economic studies have characterized product attributes as search, experience, or credence attributes. Search goods are those for which consumers examine product characteristics, such as price, size, and color, before purchasing. Experience goods are those for which consumers evaluate attributes after purchasing the product. For example, consumers choose particular brands of canned tuna without sampling the product first (Nelson, 1970). Credence goods have attributes that consumers cannot evaluate even in use (Darby and Karni, 1973). For example, consumers cannot inspect particular produce items and determine whether they were grown organically or whether they are the result of biotechnology. Consumers cannot inspect canned tuna and determine if the tuna was caught without harming dolphins.

Though producers may wish to conceal the negative attributes of their products, a number of factors make this difficult, even for experience and credence goods. First, consumer skepticism may lead to a situation in which consumers are informed about all attributes of goods. For example, if a consumer could not determine the contents of a box before purchase and had to rely on a label claiming that the box contained "at least three oranges," a rational consumer might assume exactly three oranges. If there were really four oranges in the box, the seller would say so because a box of four would command a higher price than a box of three. So if the rational consumer expects the worst—that labels are as optimistic as truth permits—the firm has an incentive to highlight all the positive attributes of its product. Consumers can infer that every attribute that the firm does not discuss is negative; either the

product does not possess desirable attributes or attributes are of low quality.[1]

Second, warranties offer consumers a mechanism for deducing product information for credence goods. If a product has an observable characteristic related to the credence attributes, the firm can offer a warranty. For example, suppose an automobile manufacturer wanted to distinguish its product from other cars with a claim of overall better quality. While it is difficult to observe the quality of a car (or even to state precisely what a car's quality is), a low-quality car will break down more often than a high-quality car. An automobile dealer can offer a warranty against particular types of failures. Unwillingness to offer warranties for particular failures amounts, in the eyes of skeptical consumers, to admission that some attributes of the car are low quality.

Third, competition among firms also reinforces consumers' ability to deduce relatively complete information about the hidden quality dimensions of products (Ippolito and Mathios, 1990a). For example, the producer of a food product low in fat might voluntarily advertise that fact. A competitor with a similar product low in both fat and sodium would have an incentive to advertise its product's two desirable attributes. Consumers would then be suspicious of products that failed to make both claims. This competitive disclosure, which Ippolito and Mathios named the "unfolding" theory, results in explicit claims for all positive aspects of products and allows consumers to make appropriate inferences about foods without claims. The unfolding theory also leads to the conclusion that firms' advertising would inadvertently alert consumers to negative aspects of products. For example, without any cigarette labeling requirements, the cigarette brand that advertises less tar would be alerting consumers to a negative aspect of all cigarettes. Disclosure of tar levels would be likely among low-tar cigarettes and nonexistent among others. The unfolding theory implies that the presence of advertising (including labels) is a signal of quality and that competitive products without such advertising are alerting consumers to its absence.

Empirical tests of the effectiveness of the market in producing full disclosure of quality to consumers have yielded mixed results (Mojduszka and Caswell, 2000).

Prior to 1994, when the NLEA went into effect, nutrition labeling was provided on a voluntary basis. Mojduszka and Caswell, examining the frequency with which food products carried nutrition labels in 1992-93, found that for food groups defined as salted snacks, cereal, yogurt, and margarine spreads, almost all products carried voluntary nutrition labels, regardless of nutrition profiles. This result differs from predictions logically derived from the Grossman model (labels should be found frequently on nutritionally superior products and absent on others). For other food groups, their results were largely inconclusive.

Limitations of Market Incentives

While consumer skepticism, warranties, and competition among firms may expose many product attributes, they are not always sufficient to guarantee complete disclosure (Ippolito and Mathios, 1990a). For example, when an entire product category has an undesirable characteristic that cannot be changed appreciably (e.g., cholesterol content of eggs), unfolding depends on producers of entirely different foods to draw attention to the undesirable characteristics. In these cases unfolding may be weaker than in cases where variations exist within the same product category.

Another limitation to market incentives to disclose information arises when information has a "public good" aspect, that is when information pertains to a whole product type, not one particular product. In these cases, even if information increases sales, the chances that the benefits of labeling outweigh the costs for a single firm are reduced: the costs are borne by the single firms while the benefits are shared by many. For example, if the producers of Oat Snappy Cereal label their cereal boxes with the information that oat bran cereals have been linked to lower heart disease, they provide information not only about their cereal, but also about all other oat cereals as well. The producers of Oat Snappy Cereal bear the costs of labeling but the benefits are shared with their rivals. In this case, the information is a public good, and like all public goods is less likely to be produced voluntarily (Hadden, 1986; Caswell and Kramer, 1994).

Market incentives and legal prohibitions may also be unable to eliminate partial disclosure and innuendo (Scherer, 1980). The possibility of deception erodes the efficiency of the market. Widespread deception makes consumers less responsive to messages, even those that provide truthful information. It makes consumers doubt the veracity of claims made by honest producers.

[1] Grossman (1981) shows that this result occurs even where there is only one seller and where consumers have had no experience with the seller and will have no further experience—where the incentive to mislead is greatest.

Third-Party Services for Voluntary Labeling

Third-party services could change the private, voluntary labeling decision of firms by either reducing the costs or increasing the benefits of labeling. These services bolster the credibility of voluntary labeling, thereby facilitating market transactions and increasing market efficiency. These services could prove valuable in both domestic and international markets. The primary services that third-party entities offer to help strengthen labeling claims are standard setting, testing, certification, and enforcement.

Standards. Standards establish the level of quality that a good must possess. Standards set by third-party entities facilitate market transactions to the extent that the standards are recognized by numerous producers and consumers. Successful third-party standards establish a common terminology for goods possessing the same quality characteristics. Without standards, many market transactions would require lengthy negotiation about the quality characteristics of a product. Standards could also establish the way that labeled information is presented, ensuring that information is provided in a uniform manner, allowing consumers to compare products more easily.

Testing services. Third-party testing services help producers strengthen their claims of product quality by providing a more objective measure of product attributes. Particularly for credence attributes, testing services increase the value of the information provided by the label. In addition, third-party testing services could reduce the costs of verifying that standards have been met. If the average cost of testing declines with the volume of tests run, it may be less expensive for one party to provide testing for many firms rather than for each firm to test or for each consumer to try to test the veracity of product claims. In some cases, testing is not possible and identity-preservation systems, in which product quality is assured by strict segregation and tracking systems, may emerge.

Certification. Third-party certification provides assurances to consumers that the information supplied by firms is correct. Consumers may question the validity of the information provided by firms, particularly for credence goods. Third-party certification provides consumers with an objective evaluation of the product's quality attributes and helps firms establish credible market claims. Third-party certification could also be used to establish the credentials of other third-party services, including other third-party certifiers. Accreditation is a process for certifying certifiers (Toth, 2000, discusses this point).

Enforcement. Third-party enforcement of quality standards provides further assurances that quality claims are valid. If firms making fraudulent claims are penalized, incentives to make truthful claims are strengthened. The more onerous the penalty for fraud and the higher the probability of being caught, the more reliable quality claims are likely to be. Third-party enforcement services include watchdog services, de-certification, and legal requisites. Watchdog-type enforcement services rely on negative publicity to discourage fraud. Firms with valuable reputations will be most susceptible to this type of enforcement. De-certification provides a clear indication that a product has failed to comply with quality standards and represents the most powerful enforcement tool available to most private third-party certifiers. De-certification by government entities could carry the added penalty of prohibiting marketing of the product. Legal requisites concerning advertising provide the ultimate enforcement against fraudulent quality claims, even for voluntary claims.

Third-party services can be provided by a wide variety of entities, including consumer groups, producer associations, private third-party entities, national governments, and international organizations. For example, the Good Housekeeping Institute, founded for the purpose of consumer education and product evaluation, sets product standards and provides consumer guarantees for a wide range of goods including foods; the American National Standards Institute (ANSI), a nonprofit membership organization, facilitates development of voluntary private-sector standards for a wide range of products; Underwriters Laboratories (UL), a private nonprofit entity, provides standards and certification, primarily for electrical appliances; the Council of Better Business Bureaus works with the National Advertising Review Board to investigate questions of truth and accuracy in national commercial advertising; the USDA's Agricultural Marketing Service (AMS) has established standards for 233 agricultural commodities; and ISO, a worldwide federation of national standards

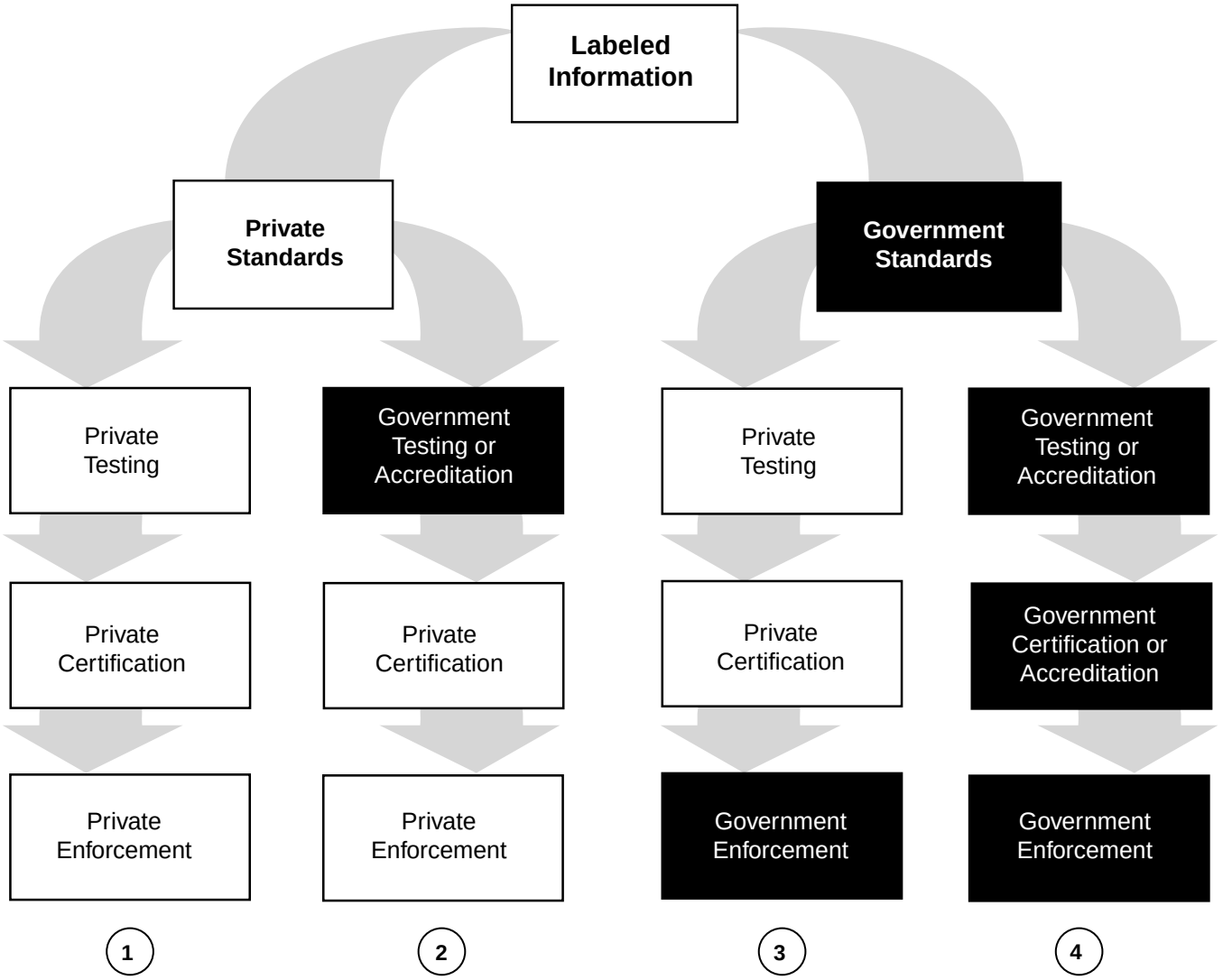
bodies, promotes the development of standardization and international standards for a wide range of products.

Figure 1 illustrates the mix of service providers available to producers to bolster the credibility of voluntary labeling claims. Producers could employ just one or two labeling services, or they could employ a combination of the four. For any branch along the labeling services tree, the government provides an ultimate enforcement: fraud is always subject to legal sanctions. Even with private standards and private testing and certification, the government, through laws prohibiting fraudulent and deceptive advertising, plays a role in enforcing the truthfulness of product claims.

The first branch of the labeling tree shows the case where a private third-party entity sets standards, provides testing and certification, and enforces truthful compliance with standards. There are many examples of this case, including most kosher labeling and private organic standards (such as those set and administered by Oregon Tilth).

The second branch of the tree illustrates the case where private entities set standards, and provide certification and enforcement, but the government assists in the process by providing testing services or accreditation of testing services. Such a situation could emerge when standards are technically difficult to test for and gov-

Figure 1. Labeling tree



ernment services help establish testing norms. For example, USDA's Grain Inspection, Packers and Stockyards Administration (GIPSA) has established a reference laboratory to evaluate and verify the validity of analytical techniques applied to the detection of genetically enhanced traits in grains and grain products.

The third branch of the tree illustrates the case where the government sets voluntary quality standards and provides for protection against fraud, but relies on private testers and certifiers to guarantee that standards have been met. In some cases, the voluntary standards set by AMS are certified and enforced by private entities.

The fourth branch of the labeling tree shows the case where the government is responsible for providing or accrediting providers of all four services. For example, many States set standards for organic foods and provide certification and enforcement services. This branch of the labeling services tree also depicts the case where the government requires labeling, as will be discussed in the next section of the report.

In general, the value of the labeling service depends on the credibility and reputation of the entity providing the service. Services provided by entities that are trusted and well known by a large number of consumers will be most successful in reducing search and information costs, facilitating market transactions, and increasing market efficiency. In many cases, national governments or associations of national governments may be the most widely recognized and reputable third-party providers of labeling services. However, this is not always the case. For example, although U.S. consumers tend to have confidence in USDA and FDA to regulate food safety, Europeans rank national bodies and industry far below international, environmental, and consumer and farm organizations in terms of trustworthiness (Gaskell et al., 1999).

The value of third-party labeling services also depends on the extent to which they are responsive to consumer preferences and technological capabilities. This is particularly true for standards. If standards are more lenient or strict than consumer preferences, consumers will search out goods with quality standards that match their preferences more closely. For example, if standards are so strict that production costs rise beyond consumers' willingness to pay, consumers will seek products with lower standards (which may be difficult, if not impossible, to find if standards are legally mandated). If standards surpass the technological ability of producers to meet or of consumers to verify, they will eventually lose their value. For example, a standard that sets a zero tolerance level for biotech ingredients in non-biotech oils would be virtually impossible to verify given the current state of biotech testing. Neither consumers nor producers would be able to test compliance, and the standard would become meaningless.

The most flexible standards with respect to changes in consumer preferences or technology may actually be those set without third-party participation. In the absence of third-party standards, producers and consumers must establish standards and quality requirements through contractual agreements—most of which are updated periodically to reflect changes in consumer preferences and technologies. Standards set by government or international organizations may often be the least flexible and most difficult to modify in response to changes in preferences and technologies. For example, the Delaney Clause (Federal Food, Drug, and Cosmetic Act) prohibits the use of any food additive found to induce cancer in humans or animals, no matter how small the risk. This prohibition was not considered overly restrictive when it was written into law in the 1950's. However, since then, chemical detection sensitivity has increased by several orders of magnitude, and carcinogens have been detected in foods once considered hazard free. For pesticides, the Environmental Protection Agency tried to substitute a negligible risk standard, but litigation in the 1990s required the agency to comply with a strict interpretation of the Delaney Clause. A major change in pesticide legislation (Food Quality Protection Act, 1996) was required to mitigate the problems the Delaney Clause raised for regulators, consumers, and the agricultural sector.

Standards can also be misused, as when they are used to establish barriers to entry benefiting a particular, usually well-established group of producers. Such standards not only suppress fair competition, they hinder innovation and technological change. These standards are costly to consumers and to market development.

If properly designed and implemented, third-party standard setting, testing, certification, and enforcement all increase the value of a label by increasing the reliability and credibility of the labeling claim. These services reduce uncertainty for producers, reduce search and information costs for consumers, and increase the likelihood that consumers will purchase those goods and services that best match their preferences. Because they increase the value of information, these third-party services can increase the amount of information that

producers choose to provide to consumers through product labels. These services can enhance the efficiency of domestic and international markets.

Though potentially very valuable, third-party services can work only with producer incentives. These services cannot change producers' fundamental reluctance to disclose information about undesirable product characteristics. Other mechanisms must be employed to encourage disclosure of important negative product attributes. In the next section we examine the role of government in mandating labeling.

Mandatory Labeling

In addition to a potential role in bolstering voluntary labeling, the government may also decide that some information must be labeled. Most demands for mandatory labeling (including the "consumer's right to know" and calls for fair competition) arise in two general economic situations: when the market does not supply enough information to allow consumers to make consumption choices mirroring their individual preferences (asymmetric or missing information); and when individual consumption decisions affect social welfare differently than they affect the individual consumer's welfare (externality problems). In both of these situations, social costs and benefits may suggest a different labeling outcome than the one resulting from a private firm's labeling decision. Each situation is examined below.

Mandatory Labeling To Correct Asymmetric or Imperfect Information

Properly functioning markets provide a valuable service to society. In properly functioning markets, consumers are able to purchase the goods and services that best match their preferences. As a result, society's resources are used in ways that match consumers' preferences. However, sometimes the market supplies too little information to enable consumers to make consumption choices reflecting their preferences. One such situation occurs when there is asymmetric information, that is, the seller knows relevant information about a product that the buyer does not know (for example, someone selling a used car has information about the car that the buyer does not have). In cases of asymmetric information, resources are used less efficiently than with perfect, symmetric information.[2]

Asymmetric information may particularly be a problem in markets for foods with negative credence attributes or for markets in which information has a public good aspect. In these cases, firms may have no incentive to provide consumers with information. As a result, consumers may end up purchasing goods that do not match their preferences. In this case, the market does not work efficiently: goods that would be profitable with full disclosure may go unproduced while those of lesser value to consumers are produced instead.

In some cases of asymmetric information, the government may decide to intervene in the market to require producers to disclose critical information. Mandatory labels targeting asymmetric information are designed to provide consumers with greater access to information and to increase the efficiency of the market. The objective of government intervention in these types of cases is not so much to *alter* consumption behavior but to increase *informed* consumption (Magat and Viscusi, 1992, develop this point).[3]

Another type of information problem that may occur in food markets is that of imperfect information. Unlike the case of asymmetric information, where producers know relevant information about the product that consumers do not, in cases of imperfect or missing information, relevant market information does not exist or is contradictory. This situation could arise when the long-term health effects of a food or food attributes are unknown, or when scientific opinions differ about the health consequences of consumption. In these cases, the government might require full disclosure of even preliminary or contradictory information to provide consumers with the fullest information possible. Hadden (1986, p. 263) argues "It is a perversion of the intent of information provision to wait until full knowledge is available before labeling products." Indeed, if such information is valuable to consumers, it could improve market efficiency as in the case of asymmetric information.

Mandatory Labeling To Correct Externalities

Individual food consumption decisions can have a wide variety of social welfare consequences, including effects on the environment, health and productivity, labor conditions, and farm and industry structure. For example, consumers who choose diets high in saturated fat increase their risk of heart disease and cancer, creating costs not just for themselves, but also for employers and public health systems. Conversely, diets high in oat bran may lower the risk of heart disease, creating productivity gains and medical-care savings that benefit the whole society.

[2] One of the best-known studies of the effects of asymmetric information is Akerlof, 1970. For an overview of asymmetric information see Carlton and Perloff, 1994, or Varian, 1993.

[3] In some cases, government labeling requirements may force firms to generate new information or present information in a new format.

When the food consumption choices of consumers affect the welfare of others, and these welfare effects are not priced, then consumers may consume more or less than is socially optimal. If the price of the food were changed to fully reflect these welfare effects, then the market outcome would be socially optimal. For example, if the price of saturated fat were raised to reflect the costs of public health impacts, then less saturated fat would be consumed. Economists describe situations in which action of one economic agent affects the utility or production possibilities of another in a way that is not reflected in the marketplace as *externalities*.[4]

Where private consumption decisions result in externalities, social welfare may be maximized by a labeling choice that differs from the one generated by private firms. In the diet example, the potential social benefits of providing dietary information on labels include a healthier, more productive population and reductions in medical costs. These potential benefits may be larger than the increase in profits that compose a private firm's labeling benefits. As a result, the social benefits of labeling may outweigh the social costs even though the private benefits do not outweigh private costs. The opposite could also be true, with negative net social benefits and positive net private benefits. For example, the social costs of labeling red wine with the information that moderate consumption lowers the risk of heart disease may be greater than the social benefits. The potential social costs of such a label include increased rates of birth defects, car accidents, and alcohol-related health costs, while the potential social benefit is the reduction in heart disease. The private firm's costs of redesigning labels are potentially much lower than the benefits of increased sales.

In externality cases where private firms do not supply relevant information, the government may decide to intervene in labeling decisions to try to maximize net social benefits. Government-mandated labeling can be a useful tool for achieving social objectives because of the potential power of information to influence consumption decisions. In this role, labeling falls into that category of government policy dubbed by Magat and Viscusi (1992) as "information provision programs to alter people's economic behavior."

[4] A seminal analysis of externalities is Bator, 1958. See Just et al., 1982, for a thorough description of economic implications of externalities.

The primary difficulty in regulating to achieve a social objective comes in clearly identifying "the social objective." Although particular special or public interest groups may advocate labeling as a means of influencing consumption decisions to align them with a particular social objective, such objectives may not be widely valued. Society is composed of a diverse variety of individuals and interest groups. It is not a trivial task to design regulation that truly reflects widespread public interest. This is not to say that it is difficult to identify activities that affect social welfare. In fact, if social welfare is defined to include the "public purse," it may be difficult to find an activity that does not qualify (Shultz, 1980). What is difficult is determining if the benefits of a given social objective merit the costs of government intervention in the market.

Is Labeling an Effective Policy Tool?

Even if informational and social welfare considerations indicate that there may be a role for government intervention, labeling may not be an effective policy tool. Magat and Viscusi (1992) argue that information policy such as labeling generally is not very effective and there are some circumstances, such as when people do not read or do not care about the information on the label, in which it may not be effective at all.

Empirical studies have found labels to be both successful (Ippolito and Mathios, 1990b and 1995) and unsuccessful (Variyam, Blaylock, and Smallwood, 1995 and 1997; Moorman, 1996) in educating consumers and changing consumption behavior. These and other studies highlight the observation that consumers often make hasty food choices in grocery stores and usually do not scrutinize food labels (see Aldrich, 1999, for a summary of research on consumers' label usage). These studies also illustrate the fact that the format and context of the information are important elements in maximizing the possibility that labeled information will influence its audience.

Consumers are more likely to read and understand labels that are clear and concise (a point argued by Hadden, 1986; Viscusi and Magat, 1992; Noah, 1994). A large number of warnings or a large list of detailed product information may cause many consumers to disregard the label completely. Even if consumers do consider each piece of information on a label, they may find it difficult to order the information according to importance. For example, out of 10 warnings on a label, consumers may have difficulty picking out the

most important. As a result, consumers may underreact to important information or overreact to less important information (Noah, 1994).

While clear, concise labels could possibly be designed to address problems of asymmetric information, problems for which information exists, it is unlikely that labels would be successful in addressing problems of imperfect information. By definition, the information available in these situations is unclear. Not only is it difficult to convey such information on a label, it is difficult for consumers to decipher it. Consumers have a particularly difficult time making sense of small probabilities or of information about an issue that lacks scientific or political consensus (for analysis of how consumers react to risk information see Slovic, Fischhoff, and Lichtenstein, 1980; Viscusi and Magat, 1987; and Magat and Viscusi, 1992). As observed by Hadden (1986, p. 196), "It is unreasonable to expect individuals to process information that has confounded the experts." Providing information that leaves consumers confounded is unlikely to lead to improvements in market efficiency.

A more comprehensive and better targeted approach to inadequate information might include research and science education programs that stress the probabilistic nature of scientific knowledge. As noted by Slovic, Fischhoff, and Lichtenstein (1980, p. 178), "It is important to recognize that informing people, whether by labels, package inserts, or more extensive programs, is but part of the larger problem of helping people cope with the risks and uncertainties of modern life."

Labels may also be a poor means of addressing problems of externalities and advancing social objectives. Individuals tend to weigh their individual private costs and benefits, exclusive of externality costs, when making consumption decisions. Even if certain individuals alter their behavior to completely reflect externality costs, the fact that others do not means that the objective will probably not be met. For example, while some consumers may purchase only free-range chickens, the goal of more humane treatment of chickens will not be achieved so long as most consumers continue to purchase coop chickens. Differing preferences for the targeted consumption good may also lead to less than optimum results. For example, even if all agree that a slimmer, fitter population is a good social (and personal) objective, some consumers' preferences for fatty foods and inactivity may outweigh their valuation of the social objective.

Labels may also be unable to change behavior enough to meet a social objective if some consumers free-ride on others' socially responsible behavior. For example, although a consumer may feel that sea turtles should be protected and that strict laws protecting them should be enforced, he or she may decide that eating one small bowl of turtle soup will not really make a difference. The uneven distribution of collective benefits also mitigates against the achievement of social goals through labeling. Even if individuals have similar preferences over the social outcome, the fact that some benefit more than others probably means that not everyone will change their behavior to match the social optimum (Hadden 1986, p. 38).

Economic theory identifies a number of policy tools that may be more suited to redressing externalities than information remedies. Bans, quotas, production regulations or standards, and Pigouvian taxes[5] may all be more successful than mandatory labels in adjusting consumption and production to better match socially optimum levels.[6]

Regardless of the objective, effective labeling hinges on the existence of standards, testing, certification, and enforcement services. To establish credible, effective mandatory labeling, the government must ensure that every step along the labeling tree (fig. 1) exists. The government must ensure that the quality standards in question are clear and achievable; that testing services, if necessary, are available to measure the validity of labeling claims; that producers (and consumers) are able to certify or otherwise prove the validity of the quality claim; and that a mechanism for enforcing labeling rules exists, including a mechanism to punish producers who make fraudulent claims. The government must either perform these services (and find a way to finance them) or accredit third-party agents to perform them (as described by branch 4 of the labeling tree). Mandatory labeling laws that are not supported by standards, testing, certification, and enforcement services could result in confusion and actually increase transaction costs.

[5] A Pigouvian tax is a tax that imposes the externality cost of an activity, e.g., pollution, on the generator of that pollution.

[6] For an analysis of policies for obtaining social optimality in the presence of externalities see Just, Hueth, and Schmitz, 1982

Weighing the Costs and Benefits of Mandatory Labeling

Effective labeling may generate a variety of benefits. Effective or not, it generates a variety of costs. Policymakers must weigh the benefits and costs of labeling as well as the distribution of benefits and costs to determine whether labeling is an appropriate policy option.

Measuring the Benefits of Mandatory Labeling

In measuring the benefits of mandatory labeling, analysts must consider a wide set of effects, few of which are found on a balance sheet. The task of actually measuring benefits may involve difficult methodological and philosophical problems.

The primary benefits of a government labeling program are increases in informed consumption and socially desirable changes in consumption behavior. To measure these benefits, analysts need to answer a number of difficult questions. Has the label increased the number of informed consumers? What is the value of the increase in informed consumption? Has the label changed behavior as desired? What is the value of this changed behavior, that is, what is the value of this additional contribution to the social objective? Answering these questions requires gauging public preferences and measuring the value that consumers attach to different social outcomes. The fact that these outcomes usually involve goods without established market prices, such as health and environmental quality, makes it particularly difficult to assign dollar amounts to these outcomes for cost-benefit comparisons.[7] The fact that the stated objective often involves social goals over which different groups of consumers may have diametrically opposing opinions and valuations makes the task of measuring benefits even more challenging.

Another type of benefit arising from government intervention in labeling could be those stemming from product reformulation. Firms that are forced to disclose negative characteristics of their products may choose to reformulate to eliminate the negative characteristics rather than risk losing sales as a result of the disclosure label. In this way, labeling benefits all consumers who use the products, not just those who read the label (Salop, 1976; Beales, 1980; OECD, 1997). These benefits could actually be quite large. For example, Ippolito and Mathios (1990b) found that health claims on cereal boxes helped change consumer behavior and resulted in significant product innovation. Some analysts argue that more healthful foods resulting from reformulation may be the largest benefit of labeling (Beales, 1980).

Social benefits other than those targeted by the labeling policy may also arise from government-mandated labeling. Caswell and Padberg (1992) argue that cost-benefit analyses of labeling policies should include the value of such policies in (1) generating consumer confidence in product quality; (2) establishing the parameters for advertising; (3) signaling which of the product's quality attributes are important; and (4) reinforcing other forms of education at the consumer level.

Measuring the Costs of Mandatory Labeling

The costs of government labeling policy could be as far ranging and difficult to measure as the benefits. The least difficult costs to gauge are the actual costs to the government of program initiation, administration, and enforcement. Industry costs of relabeling are also relatively easy to assess and, in some cases, these costs may be absorbed in the normal label-change cycle if the compliance period is sufficiently long (French and Neighbors, 1991).

Some of the industry costs of labeling will most likely be passed on to consumers in higher prices (with the exact amount depending on the magnitude of industry costs and the elasticity of demand and supply). As a result, consumers who do not particularly value the information are forced to pay for it through higher prices. A redistribution of welfare occurs. Mazis (1980, p. 8) comments that because of this price change, labeling may produce a "reverse Robin Hood effect" in which the poor and less educated pay for information they cannot use and do not want. Hadden (1986, p. 224) continues this argument by pointing out that this price increase may force poorer individuals to consume larger amounts of lower priced, riskier products.

The costs of any reformulation resulting from labeling laws could also be quite large—and quite difficult to measure. For example, though the costs of reformulation after the NLEA were expected to be large, the difficulty in predicting and quantifying firms' reactions to the rule precluded including these costs in the official regulatory impact analysis for the NLEA (*Federal Register,* 1991).

Labeling programs may also result in changes to industry structure that could be viewed as costs. For example, mandatory labeling could result in higher additional

[7] Magat and Viscusi (1992) present a number of examples of cost-benefit studies grappling with these issues.

per-unit costs for small firms than for large firms. As a result, the market price may not compensate small firms for the additional costs of labeling, thus putting them at a competitive disadvantage. This could impose disproportionate costs on rural economies and communities.

Costs of additional labeling also include the extent to which it dilutes the effectiveness of the information already included on the product label. As mentioned before, too much information on a label reduces the chances that consumers will read it. If consumers do read it, too much information reduces the chance that they will be able to accurately evaluate the importance of each piece of information (Noah, 1994).

The distribution of the benefits and costs of labeling could play as important a role in influencing the government's decision to intervene in labeling as the overall level of net benefits. Any intervention will yield some distributional consequences. Changes in consumption choices or product reformulation resulting from labeling will lead to growth in some sectors of the economy and declines in others. Policy that imposes costs on certain critical groups, even if it confers benefits on a wide variety of other groups, may be undesirable from a political or equity standpoint.

Conclusion–When is Mandatory Labeling an Appropriate Policy Tool?

Even if mandatory labeling is effective and the net benefits and distributional consequences are positive, it may not be the best policy option. The government has a number of policy tools at its disposal to correct for asymmetric information and to control externalities. The government has used taxes, bans, education programs, and regulation of production and marketing practices to influence food consumption decisions or increase informed food choices. For example, Federal and State governments levy excise taxes on alcohol; FDA has banned the use of a variety of food colorings to eliminate health hazards associated with their consumption; the FDA established a maximum acceptable level of mercury content for all swordfish landed or imported into the United States to reduce the risk of mercury poisoning; the EPA regulates the use of pesticides in agriculture; to decrease the risk of birth defects, the FDA requires that enriched grain products contain folic acid; and to improve nutritional status, the Federal Government contributes to many diet and health educational programs, including the Five-A-Day For Better Health campaign.

In each of the examples listed above, the government could have opted for a labeling policy instead. Indeed, in many similar cases, policymakers chose labeling as the appropriate policy response. For example, Louisiana mandates warning labels on fresh shellfish; USDA requires safe handling labels on meat and poultry; the Bureau of Alcohol, Tobacco, and Firearms requires warnings on alcohol about the increased risk of birth defects and accidents due to alcohol consumption; and the FDA mandates standardized nutrition labels to educate consumers about the nutritional content of foods.

The question of when labeling is the most appropriate policy tool has been examined at many different levels of government and by numerous policymakers, economists, and commentators (primarily Morris, Mazis, and Barofsky, 1980; Hadden, 1986; Magat and Viscusi, 1992; Noah, 1994; OECD, 1997). A review and synthesis of this literature, most of which focuses on warning labels, reveal a few suggestions for when labeling may be an appropriate policy tool.

Consumer preferences differ. Labeling may be preferable to other policy tools if consumer preferences differ widely with respect to product characteristics (Magat and Viscusi, 1992). Information is often the best solution in cases where "one man's meat is another man's poison." Unlike a ban, information allows consumers to match their individual preferences with their individual purchases. A ban on high-sodium foods, for example, may be good public health policy for one group of consumers, but unnecessary for another group. For sodium-tolerant consumers, such a ban would reduce welfare. Saccharine labeling is an interesting example of labeling to accommodate differences in consumer preferences. In 1977, FDA determined that saccharine posed an unacceptable health risk because of its demonstrated association with increased bladder cancer in animal studies. FDA proposed banning saccharine as an ingredient in food products while allowing saccharine to be sold as a nonprescription drug product so long as such products were labeled with an appropriate cancer warning. In response to consumer outcry, Congress placed a moratorium on FDA's proposed action, mandating instead that a warning label appear on all food products containing saccharine.

Information is clear and concise. The information on the label must be clear, concise, and informa-

tive. Information that is unread or misunderstood will not lead to better informed consumption decisions nor to a better matching of preferences with purchases. Too much information diminishes the value of all the information on the label. Information should focus on concrete facts and explanations about how such facts should be interpreted. As stated by Slovic, Fischhoff, and Lichtenstein (1980, p. 179), scientifically complex labels "if not ignored, are likely to confuse people or raise anxiety levels without providing much information relevant to decision making."

Information on product use enhances safety. For some products, the manner in which consumers use or consume the product influences the quality attributes of the product. In these cases, information about how to enhance the positive characteristics of the product or reduce the negative ones could benefit consumers. Labeled warnings are particularly valuable to consumers if they include instruction on how to avoid or minimize the risk. An example of this type of labeling is the safe handling instructions label on meat and poultry. This label, mandated by USDA in 1994, not only alerts consumers to the health risks due to possible bacterial contamination of meat and poultry, it also describes how to avoid these risks. (Hadden, 1986, argues that the true purpose of labeling should primarily be instruction for safe use.)

Costs and benefits of consumption are borne by the consumer. If the consumption or production of a food creates externalities (that is, affects someone else's welfare in a way not reflected in the market), then information-based policies will usually be insufficient to align private consumption choices with socially optimal choices. For example, information about environmentally detrimental production practices on the label of a product would not succeed in eliminating these practices if most consumers continued to purchase the good. In these cases, bans, quotas, production regulations or standards, and Pigouvian taxes may all be more successful than mandatory labels.

Each of the steps along the labeling tree can be established. Mandatory labeling will result in confusion and actually increase transaction costs unless it is supported by clear, achievable quality standards, testing services to measure the validity of labeling claims, certification services substantiating the validity of the quality claim, and mechanisms for enforcing labeling rules, including mechanisms to punish producers who make fraudulent claims. The government must either perform these services or accredit third-party agents to perform them (as described by branch 4 of the labeling tree).

No political consensus on regulation exists. In many regulatory policy debates, there is little consensus on the appropriate regulatory response. Some groups may advocate complete product bans while others advocate no government intervention at all. These debates could be national or international and could lead to difficult problems in harmonizing standards for a wide range of goods (biotech labeling is a case in point). In these cases, labeling may represent not just the best compromise solution but also the path of least resistance, both domestically and internationally. In this capacity, the labeling option has a political appeal that is independent of its merits (a point made by Magat and Viscusi, 1992, with respect to hazard-warning programs). However, labeling to avoid political stalemate may provide consumers with no real information. This may particularly be the case when the inability to reach a political consensus arises from a lack of scientific consensus. As pointed out by Hadden (1986, p. 196), "Policymakers like labeling precisely because it leaves these difficult choices to the individuals who will benefit from or suffer the risk. Unfortunately, many labels do not describe the hazards at all, and, of the ones that do describe the hazard, most give limited information about severity and none about probability."

For situations characterized by these descriptions, labeling may be one of the best tools for increasing the match between preferences and purchases, and for changing consumption patterns to achieve a social objective. However, more than any hard and fast rules, the costs and benefits associated with specific circumstances determine the best use of labeling as a policy tool. The decision of when to label and when to use another form of regulation, or no regulation at all, depends on the interaction among a complicated set of political, legal, social, and scientific objectives and considerations. In some situations, mandatory labeling may be the least restrictive and most cost-effective policy tool, while in other very similar cases, alternative policies may be better.

Part Two: Case Studies and Examples

In this section, we illustrate the points raised in the theory section by considering three case studies in which the government has intervened in labeling and two examples in which the government has contemplated intervention. The case studies are nutritional labeling, dolphin-safe tuna labeling, and organic labeling. The examples are country-of-origin labeling and biotech labeling. For each case study and example we examine the amount of information that was voluntarily supplied by private firms, the role of third parties in enhancing the value of voluntary labeling, and the costs and benefits of government intervention in labeling. Each study involves different types of costs and benefits and different sets of political, legal, social, and scientific objectives and considerations.

Nutrition Labeling (Amber Jessup, FDA)

Nutrition labels are intended to help consumers choose more healthful foods. Providing nutrition information increases incentives for producers to create more healthful foods and aids consumers in choosing a healthier diet, which leads to lower costs from diet-related illnesses. In contrast to nutrition "standards," nutrition labels do not constrain choice, they allow consumers to balance their own nutritional preferences and requirements. The costs of mandatory food labeling include higher production costs and food prices. The health benefits of nutrition labeling are difficult to measure and in many cases have been obscured by other factors that affect health, such as lack of exercise, increased food consumption, and increased consumption of ready-to-eat foods. The benefits of mandatory nutrition labeling appear to exceed the costs.

Background

The National Labeling and Education Act (NLEA) required the inclusion of nutrition information on almost all packaged foods and set standards for the appearance of the nutrition label. Before implementation of the NLEA in 1994, food processors were required to include nutrition information on their products only if they made claims about the nutrient content of the food. Even among foods that did include nutrition information, the lack of standardization made it difficult to compare nutrition information across products and to interpret the information that was provided.

The impetus for passage of the NLEA arose mainly from two possible problems caused by a lack of nutrition information. First, if it is difficult for consumers to obtain information about the healthfulness of the foods they eat, food producers have less incentive to create more healthful foods. Second, without nutrition information, consumers may choose less healthful foods than they would with nutrition information. Since diet has a direct effect on health, the costs of poor diets may be high. Studies have estimated that obesity-related morbidity accounts for 6.8 percent of U.S. health care costs (Mokdad et al., 1999). Moreover, poor nutrition choices lead to poor health and higher health costs for reasons other than obesity.

Nutrition labels may be beneficial, but they are not costless. Mandatory nutrition labels require expenditure of government resources to create standards and enforce the labeling requirements. Food producers have to interpret and decide how to deal with the new regulations and must then test their products and either redesign their labels or reformulate their products. These costs to the government and food producers also impose costs on consumers in the form of tax dollars and higher food prices. Even if nutrition labels have value, there are some questions the government should answer before intervening. First, does the market provide the information without the government's intervention? Second, do the benefits of intervention outweigh the costs and if so, how can the net benefits be maximized?

The Firm's Decision Prior to NLEA—Many, But Not All, Foods Were Labeled

A producer's decision to include or exclude nutrition information depends on the costs and benefits to the producer. Producers will decide to include a nutrition label if sales revenues will rise by more than the cost of the label. FDA estimated 61 percent of annual sales of packaged foods had nutrition labels in 1988. This translated into approximately 40 percent of all brands (*Federal Register*, 1991), so for many producers the private benefits of nutrition labels exceeded the costs. In addition, as discussed in the theory section of the report,

some information is revealed by a firm's decision not to provide a label. For example, the lack of an organic label tells the consumer the food is not organic as clearly as would a label saying "not organic." However, this unfolding process is not as robust for nutritional content because of the complexity of nutrition information. Therefore, the producer's decision not to include a nutrition label may convey little information for consumers.

Third-Party Services

Nutrition labels are less beneficial if consumers have difficulty using them. A third-party service, in this case the Federal Government, had the potential to increase the benefits of nutrition labels by standardizing the label. Standards created by the government dictate the format of the label, the list of micro and macronutrients that should appear on the label, serving sizes, location of the label, and units of measurement. This standard aids consumers in making comparisons between products and in interpreting nutrition information.

Estimated Social Benefits of Mandatory Labeling Outweighed Costs

That the private market failed to provide nutrition information is not alone sufficient to justify mandatory nutrition labels. For society to be better off with mandatory nutrition labels, the social benefits of labeling must exceed the costs. FDA attempted to discover if the social costs or benefits were greater in the economic analysis of the proposed amendment to the nutrition labeling regulations (*Federal Register*, 1991). The analysis of the costs identified five specific costs firms would incur:

- administrative costs, which are the costs of interpreting the rule and deciding on an appropriate action in response to the regulation; estimated at $152 million for 8,900 firms.

- costs of testing to determine the nutrient content (would not affect firms that already included nutrition information on their label, since they had already carried out analytical testing); estimated at $112 million in the first year and $195 million over 20 years (includes only firms that were not labeling voluntarily).

- printing costs, the costs of changing the printing plates or other printing mechanism; estimated at $756 million (the largest costs associated with the required labeling).

- inventory costs, the dollar value of the labels in inventory that cannot be used due to the rule; estimated at $421 million (the agency estimated a total quantified cost of $1.5 billion over 20 years for the regulation).

- reformulation, changing product recipes, costs of which the agency did not attempt to quantify (difficulty in predicting a firm's reaction to the rule made it impossible to quantify the costs of reformulation).

FDA based the estimate of benefits on health improvements resulting from consumers' changing their diets in response to the nutrition information. The health benefits arising from the labeling changes were assessed using a three-step model: (1) changes in consumer diets, leading to (2) changes in health states, and (3) valuation of these health changes. The analysis focused on changes in consumption of fat and cholesterol and their effect on cancer and coronary heart disease (CHD). The first step of the model, changes in consumer behavior, hinged on how much consumers would change their diets based on the newly available nutrition information. To approximate the amount of the change, the FDA looked at a small study that measured how consumers changed their consumption of fat and cholesterol in response to nutrition information flags on grocery store shelves. This study found fat consumption fell an average of 1.25 percent and cholesterol an average of 0.1 percent for consumers at that grocery store.

This change in fat and cholesterol consumption was hypothesized, in turn, to lead to reduced incidence of cancer and CHD. FDA estimated that the decrease in fat and cholesterol due to the nutrition information would prevent 35,179 cancer cases, 4,024 cases of CHD, and 12,902 premature deaths over 20 years. Finally, to estimate the benefits of nutrition labeling, the agency valued this reduction in deaths and illnesses. Economists attempt to measure consumers' own value of reductions in illnesses and deaths by looking at consumers' willingness to pay for accepting small changes in the probability of death. For example, the wage premium to workers in risky jobs or consumer purchases of safety equipment represents implicit valuation of small probabilities of death. The willingness to pay for the reduction in illnesses and deaths brought about by

nutrition labeling was $3.6 billion and the reduced medical costs were $0.6 billion over 20 years.

This $4.2 billion may underestimate total social benefits. The analysis includes only cancer and CHD. Many other illnesses are diet related, such as diabetes, arthritis, and stroke. By excluding these other diseases, the analysis underestimates benefits. Also, consumers may value having nutrition information, even if they do not act on it.

Other policy tools targeted at improving nutrition, such as nutrition standards, do not provide the flexibility of nutrition labeling. For example, a nutrition standard limiting the amount of salt in a food would constrain all consumers' choices, not just those of consumers on low-salt diets. Consumers have different nutritional needs and concerns. What is a positive nutrition attribute for one consumer may be a negative attribute for another. For example, a consumer on a low-fat, low-carbohydrate diet may have different definitions of "good" and "bad" foods than one on a high-protein diet. A consumer on a low-carbohydrate, high-protein diet might find low-fat foods that have been formulated by substituting sugar for fat quite undesirable. Labeling is an effective policy tool when consumer preferences and concerns differ. Nutrition labels do not limit choice. By providing more complete, comparable information, standardized nutrition labels may even expand choice.

Conclusion

The record for nutrition labeling is mixed. On the positive side, consumers do read food labels and nutrition is an important consideration in food purchases. Results from USDA's Diet and Health Knowledge Survey, 1994-96, indicate that 65 percent of adults use the nutrition label (answering that they either always or sometimes use the label). The Food Marketing Institute reported in 1999 that 59 percent of consumers have changed purchases because of information on the product label, and nutrition is the second most important factor in consumer food purchase decisions after taste (FMI, 1999). Food producers have also responded by creating healthier foods. New Product News reported the introduction of more than 6,500 reduced–fat foods between 1995 and 1998. On the negative side, obesity in the United States has increased since mandatory nutrition labels. From 1991 to 1998 the prevalence of obesity increased from 12 percent to 17.9 percent (Mokdad et al., 1999). Although 12,902 lives saved over 20 years is a large number, it is small compared with the 280,000 to 300,000 deaths per year that continue to be attributed to obesity. Therefore, nutrition labeling has led to a small improvement in health that continues to be more than counterbalanced by the many factors that lead to obesity, such as lack of exercise, increased food consumption, and increased consumption of ready-to-eat foods.

Dolphin-Safe Tuna Labeling (Lorraine Mitchell, ERS)

The development of a market for dolphin-safe tuna illustrates the role of consumers in influencing food labels. This example shows that labeling alone may be insufficient to achieve environmental quality goals. However, labeling may be a second-best solution if the alternative is regulation of imports and likely international trade disputes.

Background

Dolphin-safe tuna labeling was one of many responses to concerns about tuna-fishing practices in which fishermen encircled dolphins with their nets, frequently entangling and killing the dolphins. The declining dolphin population led to the Marine Mammal Protection Act of 1972, which limited the killing of dolphins by U.S. fishing boats (but not by foreign boats). In the late 1980's, dolphins were still being killed, and some consumers boycotted tuna. In 1990, tuna-canning firms began purchasing tuna from fishermen who did not kill dolphins, and labeled the tuna "dolphin-safe." To prevent fraud, the government created a legal definition of "dolphin-safe." Also, the government imposed an import ban on tuna from countries whose fishing fleets killed more dolphins than U.S. fishermen did. Mexico filed a complaint with the GATT, which ruled that the import ban was illegal. In 1992, the United States joined an international environmental agreement for dolphin protection with Mexico and other countries. Signatories agreed to avoid killing dolphins, to adhere to a dolphin mortality quota, and to accept international observers on boats. The United States also banned the sale of "dolphin-unsafe" tuna. In 1997, Congress lifted the import embargo on tuna caught with nets and adjusted the meaning of "dolphin-safe" (Vogel, 1995; Buck, 1997). Figure 2 shows a timeline of regulations and dolphin deaths.

Private Firms Had Incentives To Produce and Label Dolphin-Safe Tuna

Private firms had an incentive to produce and label dolphin-safe tuna because enough consumers were willing to pay for this quality attribute (and many were unwilling to accept the alternative). The first widespread manifestation of consumer concern over dolphin deaths came in the late 1980's with the canned-tuna boycott. While it is unclear whether the boycott noticeably affected total sales, producers realized that dolphin-safety was a quality that some consumers wanted (Newsweek, 1990). For a time, two distinct types of tuna were sold: dolphin-safe tuna and generic tuna caught with any fishing method. The price premium dolphin-safe tuna commanded was measured at $400 per ton (Lones, 1989; Vogel, 1995).

The price premium reflected demand and the higher production costs of dolphin safety. Tuna fishermen faced two options for producing dolphin-safe tuna, each more costly than using encircling nets. Fishermen could comply with the dolphin-safety regulations if they caught tuna on lines. Another option was to continue using nets, but move the fishing boats to the western Pacific, where dolphins and tuna do not swim together (Vogel, 1995). Most U.S. fleets took this latter route, but then had to change their off-loading locations, since the move placed them closer to Asia.

The three major name-brand U.S. tuna-canning companies publicly pledged to sell only tuna caught without the use of purse seine nets. This indicated that the producers of canned tuna felt that they could supply the dolphin-safe tuna at a price that compensated them for their change in fishing locations and technologies (Lones, 1989; Vogel, 1995). Additionally, the three largest canned tuna producers had an 84-percent share of the market (U.S. House of Representatives, Committee on Merchant Marine and Fisheries, 1990). Action on their part dictated the outcome for the whole market.

Role of Standardization and Verification

In 1990, almost all firms began labeling their tuna as dolphin-safe. However, without a standard definition of "dolphin-unsafe," consumer groups worried that firms that used technology that was harmful to dolphins might be labeling erroneously (Vogel, 1995). The government responded by limiting the dolphin-safe label to tuna from fishing fleets that had not used drift nets or, in the Eastern Tropical Pacific, purse seine nets to encircle dolphins (U.S. House of Representatives, Committee on Merchant Marine and Fisheries, 1990).

The U.S. Congress recently expanded the definition of dolphin-safe to include tuna caught by fleets that encircle dolphins in nets, as long as no dolphins are killed. Many environmentalists argue that encircling dolphins can injure them, and disrupt feeding and mating. Others argue that a standard that prohibits any dolphin deaths is actually more stringent than one that prohibits encir-

Figure 2. Timeline of dolphin deaths and interventions

Annual Dolphin Deaths		Interventions and Legislation
500,000	**1960's**	
	1972	**Marine Mammal Protection Act limits killing of dolphins by U.S. boats**
100,000 18,000-16,000 by U.S. boats	**Late 1980's**	**Consumer boycott of tuna; U.S. Government begins pressuring other countries to improve fishing practices to save dolphins**
	1990	
	April	**Tuna producers announce dolphin-friendly practices and labeling of "dolphin-safe"**
	October	**U.S. enforces import ban on tuna from countries that kill more dolphins than the United States does**
	November	**Dolphin Protection Consumer Information Act regulates labeling of dolphin-safe characteristics**
28,000	**1991**	**Mexico files complaint with GATT, alleging that embargo and labeling legislation are illegal**
	1992	**International Dolphin Protection Agreement is signed. Sale of dolphin-unsafe tuna is banned**
5,000	**1993**	
	1997	**Congress changes definition of dolphin-safe to allow tuna caught in nets, as long as no dolphins were killed; Congress lifts import embargo to allow boats with no observer aboard to use nets**

cling nets. Currently, two types of dolphin-safe tuna exist. The U.S. Department of Commerce certifies the new standard. The major canning companies and several grocery and restaurant chains have pledged to use only tuna that meets the older definition. Two different logos are in use, identifying different types of dolphin-safe tuna. Some nonprofit groups, like the Humane Society, maintain lists of processors and retailers who are adhering to the old standard.

This new development illustrates the fact that standards may have to change as circumstances change. It also illustrates the potential pitfalls of government attempts to establish a standard in the presence of competing interests in the private sector. If consumers have one standard in mind, and tuna fleets and other countries have another, there is the potential for consumers to reject the government standard that effects a compromise between the two.

Verification of labeled claims was another important third-party service provided by the government. Dolphin safety is a credence attribute; it is difficult, if not impossible for consumers to detect fraudulent claims. Enforcement of the Marine Mammal Protection Act effectively verified label claims. Passage of the Act required observers on each U.S. boat to verify that dolphins and other marine mammals were not dying in large numbers. By counting dolphin deaths per boat each season, observers' reports offered canners a reliable means of selecting tuna that meets a claim of no dolphin deaths.

The Government's Role – Considering Externality Costs and Trade Relations

The active role the Federal Government played in establishing standards and verification for dolphin-safe tuna labeling came in recognition of the fact that tuna fishing practices imposed an externality cost. This cost, enumerated in dolphin deaths, was borne by those who value the preservation of the species. This cost was not reflected in tuna production costs or tuna prices.

In devising an appropriate response to the externality (and to environmental groups who lobbied for legal solutions to dolphin mortality), policymakers had to consider the trade ramification of any policy response. The GATT ruled that the trade embargo was illegal. The effect of production on a resource (dolphins) outside U.S. borders did not give the United States the right to exclude imports. Also, the United States had not exhausted all other possibilities for saving dolphins. The Dolphin-Tuna Case is regarded by some as a GATT ruling overturning an environmental law that served as an effective trade barrier. However, the GATT ruled that the labeling law was legal.

The trade dispute with Mexico under the GATT illustrates three points. First, when a country proposes a labeling regulation, costs and benefits may depend on interaction with similar laws (or lack thereof) enacted by trading partners. The labeling provision was challenged under the GATT, along with the import ban, because Mexico regarded the label as a barrier to trade. This suggests that each time a country's firms label their goods in a way that its trading partners do not, there is the potential for a trade dispute, if the labels cause consumers to choose domestic over imported products. Second, mediating between domestic and international perspectives in establishing standards is a difficult process. Recent changes in the definition of dolphin-safe were enacted to appease partners in the International Dolphin Conservation Program, who wanted to be able to export tuna to the United States. These changes have not been accepted by all consumers. Third, if labeling is unlikely to violate international trade agreements, it may be the best policy response to social concerns. The GATT, the forerunner of the WTO, upheld the labeling provision because it did not prohibit the movement of goods, and was applied equally to foreign and domestic products (Vogel, 1995). We have seen that labeling is not a method that will guarantee achievement of social goals. However, some may regard it as a second-best solution if more stringent regulation of imports induces trading partners to file a WTO complaint.

What Impact Did the Labels Have?

The dolphin-safe label allowed consumers to signal their preferences for saving dolphins. But purchasing dolphin-safe tuna might still yield an environment in which many dolphins are killed despite consumers' willingness to pay to prevent those deaths. Some consumers might be willing to pay more than the dolphin-safe tuna price premium to protect dolphins. Others might be unwilling to pay any premium. As the latter group has no reason to take other consumers' preferences over dolphin deaths into account, their purchases of low-cost tuna would support the production of tuna that incidentally yields dolphin deaths. Thus, the impact of the label on dolphin deaths depended on the number of consumers who were and were not willing to pay a premium. So, was labeling enough to reduce dolphin deaths to a level at which the willingness to

pay by U.S. society, composed of all of different types of consumers, was equal to the additional cost?

Answering the question is difficult because several different actions influenced dolphin deaths. The Marine Mammal Protection Act required fishing fleets to reduce their levels of incidental marine mammal mortality, to have an inspector on board, and to use only specific types of fishing technology. As a result, dolphin deaths dropped substantially long before labeling began.

Since canneries were free to purchase tuna from either U.S. or foreign sources, the U.S. regulations were insufficient to assure consumers that they were purchasing dolphin-safe tuna. Vogel (1995) reports that between 1989 and 1991, dolphin deaths dropped further. In 1990, the boycott prompted canneries to switch to dolphin-safe tuna, allowing consumers to reveal their preferences for dolphin-safe tuna by buying more of it. However, when canneries began using the dolphin-safe label, the United States also pressured Mexico and other countries to change their fishing regulations and imposed a trade embargo against countries whose fishing fleets had high numbers of dolphin deaths. Since U.S. consumers were 50 percent of the canned tuna market, labeling could have had some independent effect, but it is difficult to state unequivocally whether the reduction in dolphin deaths was due to the labeling effort and resulting consumer pressure on tuna canneries and fishermen or to one of the government initiatives (see Buck, 1997). It is also impossible to know whether labeling alone, without all of the marine mammal legislation, would have resulted in an adequate reduction in dolphin mortality.

In addition to the social benefits, there were also social costs to the government's actions. It has already been noted that many fishing fleets moved their operations to the western Pacific. Indeed, foreign fishing fleets, which could not always afford to fish so far away from home ports, argued that they bore very high costs as a result of the embargo and the pressure to change fishing techniques (Vogel, 1995). Additionally, the government bears the substantial costs of having an observer on each boat, which reduces the verification costs for producers. Again, however, because the labeling, consumer activism, the Marine Mammal Protection Act, and the embargo all took place around the same time, it is unclear whether or not the labeling legislation by the government was primarily responsible for these social costs. The Congressional Budget Office estimated that labeling legislation, negotiating with foreign governments, and making the sale of dolphin-unsafe tuna illegal would cost about $6 million per year (U.S. House of Representatives, Committee on Merchant Marine and Fisheries, 1990).

Another possible cost of the dolphin-safe label is any impact of labeling and the change in production practices on tuna prices. The fact that "dolphin-unsafe" tuna was essentially driven out of the market after these changes means that all tuna consumers were forced to purchase dolphin-safe tuna. Tuna is a relatively inexpensive source of protein (and is included in the U.S. Department of Agriculture's food and education program for Women, Infants, and Children (WIC)). An increase in tuna prices as a result of new production methods and labeling could impose costs on low-income households that may be unwilling (and/or unable) to pay for dolphin safety. As a result, a redistribution of welfare from low-income consumers to high-income consumers could occur. In the dolphin-safe tuna example, however, prices did not obviously increase after the change in production practices and labeling. The longrun trend in the price of tuna has actually been slightly downward, with prices decreasing from $2.35 per pound in 1980 to $2.12 in 1999 (nominal dollars). It is, however, difficult to decipher whether or not the change in tuna production practices contributed to or damped this trend.

In spite of the general fall in price, U.S. per-capita tuna consumption peaked in 1989 and has fallen since. Some ascribe this drop in sales to poor advertising, others to the lower quality tuna available in the western Pacific (Ferraiuolo, 1998). If labeling and the shift in production practices had an effect on tuna prices, quality, or consumption, analysts would need to include these effects in a complete cost-benefit analysis of the dolphin-safe label.

Organic Labeling (Cathy Greene, ERS)

In the United States, both the private and public (non-Federal) sector provide third-party certification of organic food. Certification standards vary among certifying organizations, and farmers' ability to choose among certifiers varies regionally. The U.S. Department of Agriculture is currently developing regulations that would set national standards for foods marketed as organic and make certification to these standards mandatory for all but the smallest producers. National standards may reduce transaction costs between farmers and food manufacturers, and may reduce costs of meeting EU organic standards. National standards may help to abate any environmental problems caused by conventional agriculture only to the extent that they increase use of organic farming systems.

Background

Organically grown food has been produced and marketed for over half a century in the United States. The most influential early advocate of organic farming systems in the United States was J.I. Rodale, who began popularizing these systems in the 1940's with the publication of *Organic Farming and Gardening* magazine (Kelly, 1992). A few farmers began experimenting with these systems, marketing directly to consumers, and, by the late 1950's, organic foods were being featured in small health food stores. By the late 1960's, "a new generation of environmentally conscious consumers—Baby Boomers—were coming of age and demanding foods produced without chemicals" (Mergentime, 1994). Large natural foods supermarkets began developing in the 1980's, and industry analysts estimate that retail sales of organic food totaled about $4 billion annually in the mid-1990's, approximately 1 percent of consumer expenditures for food consumed at home (Scott, 1996). The amount of certified organic cropland in the United States more than doubled between 1992 and 1997 (Greene, 2000). Analysts expect retail sales growth to continue at 20-30 percent annually in most industrial countries for at least a decade (International Trade Centre, United Nations Conference on Trade and Development/World Trade Organization, 1999).

Firms Have an Incentive To Label Organic Food

From J.I. Rodale to the Baby Boomers, many U.S. consumers have preferred and sought foods grown without chemicals. Surveys indicate that consumers purchase organic products for a variety of reasons: personal safety, which might be compromised by dietary intake of pesticides; environmental concerns, such as the impacts of pesticide use on the environment, groundwater, and wildlife; and farmworker safety (Hartman & New Hope, 1997; Bruhn et al., 1992; Weaver, Evans and Luloff, 1992; Cuperus et al., 1996; Goldman and Clancy, 1991; Davies, Titterington, and Cochrane, 1995; and Morgan, Barbour, and Greene, 1990). Whatever the reasons, demand for organic foods has translated into a price premium for organic goods.

The existence of organic price premiums was documented by USDA for several crop sectors in the 1970's (USDA, 1980). By the late 1980's, USDA had determined that organically grown produce formed a distinct market and was tracking premiums for representative commodities in its vegetable market reports (USDA, 1989). Thompson and Kidwell (1998, p. 280), measuring fresh fruit and vegetable prices, stated "...the average premiums found in the stores ranged from over 40% to as high as 175%." Organic grains and soybeans command price premiums, and the price gap between organic and conventional widened during the late 1990's for some of these crops (Dobbs, 1998). Of course, the cost of producing organic foods is also higher than the cost for conventional food. For organic producers to stay in business, organic premiums must cover differences in farm production practices as well as differences in processing and transportation costs, including segregation costs. The premium also must cover any certification costs.

Farmers, food processors, and other businesses that produce and handle organically grown food certainly have a financial incentive to advertise that information. Organic food is a credence good. Consumers cannot visually distinguish organic food from conventional food. Thus, consumers must rely on labels and other advertising tools for product information. Firms would have no way of acquiring a price premium without labels.

Third-Party Services Bolster Organic Label Claims

As the demand for organic food has grown from a handful of consumers bargaining directly with farmers to millions of consumers acquiring goods from supermarket shelves as well as market stalls, varying State

and private institutions providing third-party verification of label claims evolved. Private organizations, mostly nonprofits, began developing certification standards in the early 1970's as a way to support organic farming and thwart fraud. The first organization to offer third-party certification, California Certified Organic Farmers, was formed in 1973, and the first regulations and laws on organic labeling were also passed in the 1970's. The States' approaches to regulation vary. About half the States currently have some form of legislation pertaining to the labeling of organics.[8] At least 49 organic certification organizations, including more than a dozen States, are currently conducting third-party certification of organic production in the United States.

Third-party certification has been developing as a means to set organic production and handling standards and verify that producers meet these standards, thereby strengthening claims of organic product quality. Most large food processors and grain traders now require certification and many growers have turned to certification as a marketing tool.

Certification offers producers additional benefits such as greater marketplace recognition, because of the promotion and consumer education activities of certification organizations, and may facilitate greater information exchange among participating farmers (Tourte and Klonsky, 1998). However, small producers may currently receive fewer benefits from certification relative to the costs of becoming certified. In California, for example, certification is much more common among large producers than among smaller ones.

Most private certifiers charge fees on a sliding scale based on the farmer's gross sales of organic products, number of acres operated, or other measure of size (Fetter, 1999; and Graf and Lohr, 1999), while State certifying programs often charge only nominal, unremunerative fees to producers of all sizes. Some certifiers also charge an hourly rate for inspection and audit services. The University of California Cooperative Extension service estimates certification fees generally represent less than 1 percent of the total operating costs for large organic growers in that State.

Industry Groups Sought Federal Assistance in Establishing Consistent Standards

Even with voluntary certification increasingly available from State and private certifiers, organic food producers and processors experienced a number of marketing problems as the industry expanded in the 1980's, and led the industry request for national organic standards. One problem was that, even though industry standards were largely overlapping, small differences caused disagreements among certifying agents over whose standards would apply to multi-ingredient organic processed products. That is, the certifier as well as certification came under negotiation between buyers and sellers (*Federal Register*, 2000). Also, the variable State standards have required the organic industry to take on the costs of private accreditation or shipment-by-shipment certification, to gain access to some foreign markets such as the European Union (EU).

Congress passed the Organic Foods Production Act (OFPA) of 1990 largely to address these marketing problems. The OFPA requires the Secretary of Agriculture to establish an organic certification program for farmers, wild-crop harvesters, and handlers of agricultural products that have been produced using organic methods. The stated objectives of this legislation are: (1) to establish national standards governing the marketing of certain agricultural products as organically produced products; (2) to assure consumers that organically produced products meet a consistent standard; and (3) to facilitate interstate commerce in fresh and processed food that is organically produced. This legislation will require that all except the smallest organic growers (those with annual sales under $5,000) must be certified by a State or private agency accredited under national standards currently being developed by USDA. State and private groups that currently certify growers and processors are expected to seek accreditation by USDA when the national organic standards are implemented.

USDA has released two proposed rules to implement this legislation. The first was released on December 16, 1997, and drew over 275,000 comments (the largest public response to a proposed rule in recent USDA history), largely objecting that the proposed standards were weaker than those the industry was currently

[8] Most States still do not mandate third party-certification, and many small organic producers still market goods without certification. Of the States with legislation, some allow voluntary certification; others require all products marketed as organic to be certified. Some States require registration of all organic growers. Some States provide organic certification services. Others have State-specific private certification agencies.

using. The second proposal was released on March 13, 2000, and reflects the recommendations made in response to the first proposal. The most controversial aspects of the first proposal—the potential to allow the use of genetic engineering, irradiation, and sewage sludge in organic production—were dropped from the second proposal. Also, USDA program fees were lowered in the second proposal. The second proposal drew only 40,000 comments, many expressing support for the revisions.

USDA lacked the data to make a quantitative estimate of the benefits of the proposed rule, or to calculate net benefits, but expects many different groups to benefit. The primary benefits from implementation of the proposed rule are expected to be improved consumer protection from false and misleading claims, and potentially improved access to international markets from elevating reciprocity negotiations to the national level. The costs of the proposed regulation are the direct costs for accreditation and the costs of complying with the specific standards in the proposal, including the reporting and recordkeeping requirements. Certifiers will be charged fees based on the actual costs of the accreditation work done by USDA staff. Smaller certifiers, with less complex programs, are expected to pay lower fees. Organic farmers, ranchers, and wild-crop harvesters will have to pay fees for organic certification from a State or private certifier, but will not be charged any additional fees by USDA.

One general issue with standards set by government is that they may be less flexible than industry standards, and may reduce innovation. Organic production methods are still developing. If national standards are fixed, certifiers will have less flexibility to promote innovation by setting new standards. In this case, sellers would be unable to communicate their willingness and ability to innovate, and consumers would be unable to signal their preferences, selecting foods with innovative characteristics. On the other hand, food processors and distributors might benefit from holding all certifiers to exactly the same standard. For example, if most organic food consumers dislike the idea of biotech foods, an organic standard that prohibits biotech means processors and distributors only have to observe the organic label to know that the food they purchase is free of biotech attributes. They would not have to be concerned with the possibility that some certifiers might allow biotech. Thus, any choice for a standard will embody some tradeoffs. Under the current proposal, State and private certifiers are required to have programs that meet the national standard. State certification programs would be allowed to have organic standards that are more strict than the national standard, but would not be allowed to block interstate trade of products that meet the national standard. Private certification programs would not be allowed to set stricter standards, although they could meet contractual arrangements for stricter standards, label additional requirements, and propose changes to the national standard.

While the Organic Foods Production Act of 1990 does not target improvements in environmental and human health as an explicit objective of the regulation, these concerns are addressed in Section 2119 of the Act, which establishes the criteria for approving and prohibiting substances for use in organic production and handling operations: (1) the potential of such substances for detrimental chemical interactions with other materials used in organic farming systems; (2) the toxicity and mode of action of the substance and of its breakdown products or any contaminants, and their persistence and areas of concentration in the environment; (3) the probability of environmental contamination during manufacture, use, misuse, or disposal of such substance; (4) the effect of the substance on human health; (5) the effects of the substance on biological and chemical interactions in the agroecosystem, including the physiological effects of the substance on soil organisms (including the salt index and solubility of the soil), crops, and livestock; (6) the alternatives to using the substance in terms of practices or other available materials; and (7) the compatibility of such substances with a system of sustainable agriculture.

Most countries in Europe and several States offer some financial support for conversion to organic farming systems as a way to capture the environmental benefits of these systems. Organic crop production is eligible for cost-share support with Federal conservation funds in Iowa, for example, and in Minnesota, the State will reimburse two-thirds of the cost of organic certification. Some States that run certifying programs subsidize program costs with general revenues.

The Organic Foods Protection Act may also have implications for the structure of the organic farming industry. All certifiers will need to pay for accreditation, and all organic farmers with sales over $5,000 will need to pay for certification to label their products as organic. According to USDA's regulatory impact analysis, even with the small business exemptions, some small organic farms and some small certifiers may exit the industry and small operations may be discouraged from entering the industry. However, the analysis indicates that other

features of the national organic program, such as the livestock standards, which restrict confinement operations, may be easier for small operations to comply with than for large.

The national standard is likely to have only a modest impact on environmental externalities caused by conventional production methods. Organic food is still a niche market in the United States—a small portion of agricultural production requiring only a small portion of agricultural resources. Thus, the impact of the national standard will be measured by the extent to which it causes the organic market to grow. The national standard could influence the structure of the certifying industry, especially if State agencies continue to subsidize organic agriculture and have flexibility in setting standards. However, if the national standard increases the demand for organic food, the demand for certification will rise as well.

Country-of-Origin (Fred Kuchler, ERS)

A label will not always influence demand enough to make it worth the cost. Market behavior suggests that the costs of country-of-origin labels for beef and lamb are greater than the benefits. The following example illustrates why any proposed government intervention in labeling decisions ought to arise from a demonstrated market failure.

Background

The Conference Report accompanying the Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 1999, directed the Secretary of Agriculture to conduct a study on the potential effects of mandatory country-of-origin labeling of imported fresh muscle cuts of beef and lamb. (Muscle cuts include steaks, chops, and roasts, but not hamburger.) Labels would be required on packages purchased by consumers. The Conference Report requested that the study include the impact of new country-of-origin labeling requirements on segments of the food production, processing, and distribution chain (FSIS, 2000).

Mandatory labels would be new activities for some, but not all meat suppliers. According to the Federal Meat Inspection Act, imported consumer-ready packages must already identify country of origin. If imported meat is intended for sale intact to a processor, wholesaler, food service institution, grocer, or household consumer, in the packaging in which it is imported, the country of origin must be conveyed to the recipient (FSIS, 2000).

USDA's study, "Mandatory Country of Origin Labeling of Imported Fresh Muscle Cuts of Beef and Lamb," said that some livestock producer organizations and farmer organizations supported mandatory labels, while importers, meatpackers, food processors, and grocers were opposed (FSIS, 2000). For U.S. farmers to benefit financially from mandatory labels, consumers would have to prefer domestic products to imports. If consumers do prefer domestic products, labels would allow consumers to discriminate between imports and domestic products. As a result, demand for domestic meat products in the United States would rise along with domestic meat prices. Further, domestic products would increase their market share at the expense of imports.[9] However, if consumers do not generally prefer domestic products, labeling will not confer any financial benefits to domestic producers.

Labeling Costs Outweigh Benefits for Firms Producing Beef and Lamb

If consumers are willing to pay extra for the certainty that their meat was produced domestically, and if labeling is relatively inexpensive, there is a financial incentive to make consumers aware of the different product characteristics. Grocers, meatpackers, and farmers would share the increased revenues and have an incentive to voluntarily label. Why is it that grocery items are not ablaze with country-of-origin labels?

The people who are best informed, and who have the greatest incentive to be informed about the costs and benefits of labeling, are grocers, meatpackers, and farmers. Their voluntary use of labels identifying U.S. products is, at most, rare. Their market behavior suggests that they believe that net benefits of labeling are negative—costs outweigh benefits. There are at least three possible explanations for rarely observing U.S. country-of-origin labels.

Consumers might not care where their food comes from. If country of origin does not influence demand, there is no incentive to label country of origin. That is, domestic beef and lamb producers may not be able to acquire a competitive advantage over importers by alerting consumers to country of origin. Grocers or meatpackers that did provide country-of-origin labels would incur labeling costs but receive no benefit.

Some analysts argue that origin does not matter to U.S. consumers (see, for example, Blank, 1998). A fast-food hamburger could be made from lettuce and tomato from Mexico, a bun fabricated from Canadian wheat, and a meat patty composed of lean meat from Australia and fat trimmings from the United States. Current fast-food restaurant advertising does not mention origin. Instead, it emphasizes price, portion size, flavor, and promotional toys.

[9] For beef, the distinction between "domestic" and "imported" is not always obvious. Some feedlots import feeder cattle from Mexico, selling meat as U.S. product; and some feeder cattle exported to Canada are reexported to the United States as fed cattle. A labeling regulation might deal with this issue explicitly, but no such regulation has yet been written. Here, we can ignore definition problems. The regulatory definition of domestic and imported would not affect the qualitative results discussed here.

Consumers might prefer the imported product. The lack of domestic labels could mean that consumers want to know the origin of meat products, but view the imported product as superior. In this case, mandatory labeling would only decrease domestic market share. Most imported lamb comes from New Zealand and Australia and is already consumer-ready packaged. Suppliers in both countries have engaged in promotional activities and frequently label their products, highlighting the country of origin. Often, this labeling goes far beyond minimum legal requirements.

Consumers might prefer domestic products, but not enough to cover labeling costs. Even if consumers do favor domestic over imported products, labeling costs may outweigh the benefits from increased demand. Part of the reason benefits are small is that imported muscle cuts are a small fraction of total domestic beef consumption (1-2 percent in recent years (FSIS, 2000)). If labels served to exclude a portion of imported beef, the realized price increase would be relatively small in the short run, and most likely zero in the long run.

Livestock industries are characterized by production cycles lasting several years. Full adjustment to any mandated label requirement would likely also take several years. Physical capital required for beef and lamb production and a stock of animals that is fixed in the short run could eventually adjust to maximize profits under new market conditions. Full adjustment is likely to leave no benefits for producers. The consumers who want labels are the only ones who can benefit from labels over the long run.

To see this, suppose labeling made it possible for farmers to earn above-normal returns. These profits would attract new entrants. Absent any barriers to entry, domestic production would expand, bidding market price down. Under constant returns to scale, new entry would end when production is so large that price returns to its pre-label level. There, above-normal returns would end. Similarly, below-normal returns earned by importers would induce exit until the import price returned to its original level. The only persistent effect of labels is to offer consumers product characteristics they want.

Similarly, ending a requirement for labels would induce exactly the opposite shortrun impacts (Tullock, 1975). Without labels, consumers would no longer be able to distinguish domestically produced beef and lamb from imports, reducing the demand for domestic production. That is, domestic producers would have a strong interest in maintaining the mandate even though they would be operating at normal rates of return. Losing the mandate would be costly in the short run, from their perspective.

Is There a Need for Third-Party Certification?

Country of origin is a credence attribute. Existing government programs, as well as wholesale and retail market conditions, suggest that country-of-origin labels on beef and lamb could be credible to consumers. Problems of verification and certification appear not to be significant reasons for the lack of voluntary use of labels.

USDA's Food Safety and Inspection Service (FSIS) is responsible for labels on meat products. FSIS labeling policy allows fresh muscle cuts of beef and lamb to be identified as "U.S. beef" or "U.S. lamb" so long as the statement is truthful. USDA's Agricultural Marketing Service (AMS) offers a voluntary program to officially certify that livestock, meat, and meat products originate from the United States and are eligible to be labeled as "U.S. beef." The voluntary program certifies that livestock and meat products have been produced from livestock born, raised, slaughtered, and processed in the United States. In effect, USDA has offered to overcome the major stumbling block for labels: verification and certification. To certify U.S. origin, AMS audits production and processing records. FSIS noted that when its report was written, there were no participants in the program (FSIS, 2000).

Labeling product characteristics is not new to the meat industry. Poultry products have been sold for years under company labels. Some beef is sold under brand labels, e.g., Coleman Natural Products, Inc., and Certified Angus Beef. The Nebraska Cattlemen's Association has also tried to develop a label for Nebraska (O'Hanlon, 1998).

For a country-of-origin label to be credible and verifiable, the industries that produce, distribute, and market beef and lamb would have to undertake some new activities. If they continue to sell both domestic and imported products, they would have to segregate domestic and imported products. Segregation is not new to the meat industry. Slaughter plants currently segregate beef carcasses once they have been graded. Grading programs result in some labeling claims that follow products through distribution to the retail level. Carcasses generally move through fabrication grouped

according to grade, being packaged in boxes or bags that are appropriately labeled (FSIS, 2000).

The Government's Role—Weighing the Social Costs and Benefits

Livestock producers associations argued that consumers have a right to know where their food is produced and that consumers want to know where their food is produced. Some livestock producers and producer-related associations argued that consumers prefer domestic beef and lamb for a number of reasons: some consumers believe that domestic food is safer, many wish to support domestic farmers, and many wish to support the pesticide, environmental, and worker protection laws under which domestic beef and lamb is produced (FSIS, 2000).

Is commingling of domestic and imported beef and lamb leading to a situation in which U.S. consumers make choices they would reject if given the opportunity to do so? Would some consumers choose to buy domestic products over imports if given the opportunity to do so? Probably not.

The nice feature of the market mechanism is that efficient outcomes usually occur quickly even if all the sellers do not instantly recognize that consumers want products with particular characteristics. If consumers really wanted domestic products (if they really believed that choosing domestic products increased the safety of meat, supported domestic farmers, and reinforced pesticide, environmental, and worker safety laws), it would take only one grocer to recognize what consumers want. The lines of consumers at the grocery stores that supplied domestic products and the absence of consumers at all other stores would be a strong signal to all other grocers. Grocery store meat counters would all quickly begin to offer domestic products once one store began profitable discrimination between domestic and imported meat. As grocers asked meatpackers and distributors for domestic products, that demand would be passed back to farmers. Because there are no impediments to voluntary country-of-origin labeling for beef and lamb, the absence of voluntary labels suggests that labels would not lead to different consumer choices.

In addition, the arguments that imported meat is produced under weaker pesticide, environmental, and worker safety laws may not hold. The United States has imported almost all muscle cuts of beef from Canada and almost all muscle cuts of lamb from Australia and New Zealand (FSIS, 2000). These countries enforce their own pesticide, environmental, and worker safety laws.

Unless we can argue that there is a reason that markets do not yield efficient outcomes, there is no way to argue that social costs and benefits differ from their private counterparts. The private sector's choices can be assumed to be best. However, even if labels had the effect domestic producers desire, and if imports were produced under weaker pesticide, environmental, and worker safety laws, labels would not solve the problems cited by the livestock producers. Because beef and lamb, like most agricultural commodities, are exchanged in international markets, the meat excluded from the United States would be sold elsewhere. Other policies might be more effective at redressing international pesticide, environmental, and worker safety problems.

Biotech Food Labeling (Elise Golan, ERS)

The biotech labeling example illustrates three observations made in the theory section of this report. First, to establish successful mandatory labeling requirements, the government must provide or arrange for standards, testing, certification, and enforcement. Second, labeling of complex, unclear information will not reduce information and search costs. Third, labeling is not the best policy tool for redressing externalities (even theoretical externalities).

Background

Extensive cultivation of biotech crops began in the United States in the mid-1990's with the introduction of biotech varieties of corn, soybeans, and cotton.[10] Introduction of these major biotech varieties did not mark the first use of biotechnology in agriculture, but it, along with the use of rbGH in milk production, did herald the widespread introduction of biotech ingredients into a broad variety of food products. Whether through direct consumption, or by consumption of processed foods or meat, consumers are exposed to a wide variety of food items containing or, in the case of meat, fed with corn, soybeans, or cottonseed meal or oil. The use of biotechnology in flavoring and enzyme production further increases the potential for widespread consumption of food products containing biotech ingredients.

Labeling requirements are established by USDA for meat and poultry and by FDA for all other food products. Both agencies require labeling of a biotech food if the food's composition differs significantly from that of its conventional counterpart.[11] Most biotech foods on the market have been found to be essentially equivalent to their conventional counterparts, hence, most biotech foods are unlabeled. Despite assurances from the government (and many other organizations) about the safety of biotech foods on the market, some consumers have expressed a desire to be able to distinguish between foods and food products containing biotech ingredients and those that are biotech free. In this chapter, we examine the costs and benefits of meeting this demand.

The Firm's Decision

When deciding whether or not to advertise the non-biotech or biotech characteristics of their products, the question for food producers, including farmers, processors, and manufacturers,[12] is whether someone will eventually compensate them for their trouble. Producers will have the incentive to label and safeguard the integrity of biotech products with positive consumption attributes like better flavor or nutritional content. These characteristics are of value to consumers and advertising their presence may boost demand. For example, Calgene voluntarily labeled its Flav'r Sav'r tomatoes to distinguish them from conventional varieties. However, most biotech foods currently on the market are "first-generation" varieties, varieties with positive producer attributes (cost reducing or yield enhancing) but no obvious consumer attributes. Producers do not have an incentive to label these products.

Currently, the decision confronting most firms is whether to pursue a non-biotech strategy. Such a strategy entails eliminating biotech ingredients from a product, labeling the product as non-biotech, and then marketing the product to consumers who place a value on knowing that their food does not contain biotech ingredients. The costs and benefits of this strategy for private firms are outlined below.

Costs to the Firm of Non-Biotech Labeling

Numerous private costs could be incurred in the process of establishing a credible non-biotech product label. First, a producer must consider the opportunity costs associated with the non-biotech labeling decision. The opportunity costs of adopting a non-biotech strategy are the forgone benefits of biotech cultivation and utilization. For first-generation biotech crops, these potentially include reduced chemical use, less harmful chemical use, reduced tilling, reduced labor time, less production and financial risk, and in some cases,

[10] Agricultural biotechnology is a collection of scientific techniques, including conventional hybridization, that are used to modify or improve plants, animals, and microorganisms. Recently, the term biotechnology has been used to refer more specifically to products that have been genetically engineered (biochemical manipulation of genes or DNA). This is the meaning adopted here.

[11] The FDA, EPA, and USDA all have responsibilities in regulating the safety of agricultural biotechnology. A good overview of U.S. federal regulation of agricultural biotechnology is at http://www.aphis.usda.gov/biotech/OECD/usregs.htm.

[12] In the remainder of the biotech example we use the terms "producers" and "firms" to mean farmers, food processors, and food manufacturers.

increased yields. To date, the evidence on whether or not biotechnology has actually delivered these benefits is positive, although results vary by variety, region, and year (Heimlich et al., 2000a and b). The economic surplus created by cultivation of biotech varieties is then distributed among farmers (increased profits), seed producers and biotech firms (higher seed prices, technology fees, and increased profits), and manufacturers and consumers (through lower input prices and food prices) (Falck-Zepeda et al., 2000; Moschini et al., 2000).

The second set of costs that arises in pursuing a non-biotech marketing strategy are the costs of keeping non-biotech commodities and food products free of biotech material. This segregation could be achieved by either specializing in biotech or non-biotech, establishing separate facilities for biotech and non-biotech, or taking precautions to sequence or separate biotech and non-biotech production (including a thorough cleaning of equipment and storage facilities after each biotech variety). As an alternative to segregation, processors could choose to reformulate their products to use ingredients from crops that are exclusively non-biotech, thus minimizing the risk of inadvertently using a biotech variety. For example, corn emulsifiers could be replaced with rice emulsifiers. The cost of any of these options varies greatly depending on the flexibility of the production and marketing systems, the tolerance level for biotech content, the volume of biotech and non-biotech commodities and products processed by the system, and the likelihood of achieving economies of scale.

Another set of costs arises in convincing manufacturers and consumers that the product is truly non-biotech. One way to achieve this is to test for biotech content, and a number of private firms have begun to market biotech-testing products. Another method of monitoring the integrity of the non-biotech label is to establish a system of identity preservation (IP) in which producers at each stage of the marketing chain attest to the integrity of their non-biotech products. Such a system relies on strict segregation and product tracking more than on continual testing. Whether they use testing, or IP, or both, it may be difficult for individual firms and farmers to establish a credible non-biotech label. As with other credence goods, consumers may be skeptical of producers' claims. Such skepticism could be fueled by the observation that biotech tests are not completely reliable or consistent, and that it is difficult to ensure the integrity of an IP system.

Benefits to the Firm of Non-Biotech Labeling

Benefits to the firm of non-biotech labeling arise to the extent that labeling increases profitability. Labeling could increase a firm's profitability for a number of reasons. First, for firms selling biotech food products or commodities that have not been approved for sale in the EU or other foreign markets, pursuing a non-biotech strategy is the only way to gain access to these markets. For some firms, the benefits of access to these markets could be high, while for others they could be inconsequential. Second, firms could profit from a non-biotech label to the extent that such a label enhances the firm's reputation for safety or environmental leadership, thereby strengthening the firm's marketing position. This could be the reason that many baby food manufacturers have adopted a non-biotech strategy. Third, the market for biotech foods and commodities is still very unstable and market signals are difficult to decipher. For example in August 1999, ADM recommended that producers segregate biotech from non-biotech varieties and EU-unapproved from EU-approved varieties, but in February 2000 they withdrew this recommendation. Producers could choose a non-biotech strategy to avoid risk of uncertain biotech markets and to be in a position to gain sales if demand for non-biotech grows.

The fourth reason farmers may consider a non-biotech strategy is that some grain elevators have begun to offer price premiums for non-biotech crops. Evidence suggests that for 1999, premiums ranged from 10-15 cents (roughly a 2-3 percent premium) for soybeans and from 5-10 cents (roughly a 2-6 percent premium) for corn, though only a small number of elevators offered premiums (USDA, ERS, 2000). The February 2000 survey commissioned by Pioneer Hi-Bred and conducted by Farm Progress Companies estimated that slightly more than 1 out of 10 elevators were planning to offer a price premium for non-biotech products in the fall of 2000.

Private Benefits Outweigh Private Costs for Some Firms but Not for Others

For some firms, the benefits of creating a non-biotech label outweigh the costs. These firms are tailoring their production to benefit from the emerging markets and potential price premiums for non-biotech products. This is particularly true in the EU where even before labeling was required, many grocery stores and food chains had developed non-biotech product lines. Even in the United States, a number of manufacturers and handlers have moved to create non-biotech product lines, and

non-biotech labels can be found in most health food stores. For other firms, the costs of non-biotech labeling outweigh the benefits. For these firms, the benefits arising from the lower production costs associated with first-generation biotech varieties and a bulk production and marketing system outweigh the benefits of the non-biotech label.

Potential Third-Party Role in Non-Biotech Labeling

Third-party services could change the labeling decision of many firms by either reducing the costs of biotech labeling or increasing the benefits associated with the non-biotech label. Standards, testing, certification, and enforcement could all facilitate the development of a market for non-biotech foods. Despite the value of third-party services, few are currently available in the United States. This observation reflects both the small size and youth of the non-biotech market in the United States. It also reflects the difficulty of establishing these services for biotechnology.

Third-party entities may have a particularly difficult time establishing well-recognized, achievable standards. Biotech standards or tolerance levels would determine the maximum amount of biotech ingredients allowable in a "non-biotech" commodity or food. To achieve such standards, the risks of biotech foods would need to be both small and measurable. Like regulation of dietary intake of pesticides, third-party entities could establish biotech tolerances under these conditions. For example, if rodent test results indicated a possibility of harm from biotech foods, analysts could estimate the theoretical risk to humans and use these estimates to guide the setting of tolerance levels.

Currently, opinions about biotech risks do not lend themselves to tolerance assessment. The FDA and many consumers believe that, from a risk perspective, biotech foods and their non-biotech counterparts are identical. That is, there is no additional risk from biotech foods and therefore no reason to set tolerance levels. Some consumer groups, however, characterize the possible outcomes from consuming biotech food as undefinable but catastrophic. On this reasoning, even the smallest amount of biotech food in the food supply should be avoided and therefore, no tolerance granted. No one is suggesting that there are small risks that might be managed through tolerances. Some national governments are imposing tolerances. In the absence of a consensus on risks, tolerance levels for biotech content are being guided by consumer demand, the feasibility of the system to segregate biotech from non-biotech, and the feasibility of testing technologies to test for biotech content.

The fact that biotech tolerances are currently being determined by rather arbitrary considerations may make it more difficult for government policymakers to participate in setting standards. Policymakers may have particular difficulty reaching consensus on "consumer preferences." In addition, if the government does set standards (particularly if they are mandatory), there is a danger that these standards could outlive the topical considerations upon which they were based. As previously discussed, it may be difficult for government to change standards in response to changes in consumer preferences and technological advances.

Testing for biotech content is another important third-party service, and third-party entities have begun to provide testing services. Two types of tests have been developed to detect use of biotechnology: PCR (polymerase chain reaction) tests and ELISA (enzyme-linked immunosorbent assay) tests. To certify the validity (and limitations) of these tests, private, third-party entities and government both have taken steps to accredit and standardize testing procedures. The Joint Research Council in the EU has validated both the ELISA and PCR methods. In the United States, the Grain Inspection, Packers and Stockyards Administration (GIPSA) has established a reference laboratory to evaluate and verify the validity of analytical techniques applied to the detection of genetically enhanced traits in grains and grain products.

The third major service that could be supplied by third-party entities is certification. The ultimate viability of a market for non-biotech commodities hinges on the ability of producers to provide credible assurances to consumers that the products they purchase are truly non-biotech. Some third-party certifiers are emerging, many of whom have already established credible identity preservation systems for other types of high-valued commodities and food products such as organic foods. However, inconsistent standards and variable testing results make certification a risky endeavor.

Consistent enforcement of standards, testing, and certification would also decrease transaction costs and increase market efficiency. Again, as with certification, because standards are inconsistent and testing results variable, enforcement may be difficult.

Mandatory Labeling: Weighing the Costs and Benefits

The first question that must be addressed when considering mandatory labeling is will it be effective? In other words, will it generate any benefits? Clearly, mandatory labeling will not be effective if it is not accompanied by consistent, achievable standards, testing services (or IP), certification services, and enforcement. In fact, labeling requirements in the absence of these services have more potential to disrupt the market than they do to reduce transaction costs. For example the inconsistent manner in which EU tolerance levels have been applied has increased uncertainty and information and search costs. In many cases, food manufacturers are uncertain how best to comply with EU standards and ensure access to the European market.

Even if the government is able to establish standards, testing (or IP), certification, and enforcement, the effectiveness of biotech labeling for addressing problems of missing or asymmetric information and externality problems is questionable. A simple label proclaiming "this product contains biotech ingredients" does not convey any information about potential costs and benefits or probabilities. Though such labeling may be informative to some consumers, it may also lead to greater confusion on the part of others and reduce, rather than enhance, economic efficiency. Even if information on theoretical consequences and probabilities were included on the label, it would be unreasonable to expect consumers to be able or willing to evaluate such information.

Labeling is also not the policy tool best suited for reducing any of the potential externalities associated with this technology. Labeling may lead to a better matching of individual consumer preferences, but when preferences differ, some consumers will necessarily be unsatisfied by the social outcome. For example, if consumers perceived biotech foods as posing potential health and environmental risks, then presumably, risk-averse consumers would choose to consume more conventional foods, while the risk-neutral would choose either biotech or conventional foods. For individual health risks, labels would lead to a better market outcome, allowing consumers to better match their individual health-risk preferences. However, as long as any consumers choose to consume biotech foods, the potential risks to the environment and to public health remain, and the social outcome preferred by biotech-averse consumers is not attained.

For agricultural biotechnology, labeling may be even less successful in correcting for externality problems if the objective is to "internalize" the externality. An externality is internalized when the firm or farmer creating the externality is made to bear the costs of the externality. The cultivation of biotech has the potential to impose externality costs on non-producers, because these producers may need to take precautions to assure that their products are not mixed with biotech products. For example, non-biotech farmers may need to take precautions to ensure that their crops are not cross-pollinated by biotech crops. Mandatory biotech labeling has been suggested as one means of passing some of these costs back to biotech producers. However, mandatory labeling will probably be unsuccessful in transferring the costs of segregation from non-biotech to biotech producers and consumers (Golan and Kuchler, 2000). Even if biotech producers label their products with "may contain biotech" or "does contain biotech," non-biotech producers will still need to certify that their products are indeed non-biotech. As a result, even with mandatory biotech labeling, non-biotech producers and consumers will bear the costs of segregation, and labeling will be unsuccessful at internalizing externality costs.

Regulation targeted directly at potential externalities is probably a better policy option than labeling. Biotech cultivation regulations (for example, boundaries and refuges) and well-defined property rights may be better suited to controlling the potential environmental externalities of biotech production.

Once the efficacy of mandatory labeling is established, policy analysts still must determine whether the benefits outweigh the costs. This is a difficult task because most of the social benefits and costs of mandatory labeling are largely theoretical. Labeling advocates cite social benefits ranging from informed consumers to reduced risk of ecological disaster. Labeling opponents claim that the cost of labeling (and segregation) would be so high that food manufacturers would be forced to stop using biotech crops, thereby reducing the demand for biotech crops to the point that the technology would be abandoned. In this extreme scenario, many of the environmental or social benefits of agricultural biotechnology would be lost. Policy analysts will be hard pressed to calculate the costs and benefits of such theoretical and extreme predictions.

The wide variety of theoretical social costs and benefits, all with varying and unknown probabilities of

occurrence, may argue for labeling as one of the best political options for dealing with concerns about biotech consumption and production (and may explain why labeling continues to be debated). As discussed in Part 1, where political or regulatory consensus is not possible, labeling may represent the best compromise solution and the path of least resistance. Nevertheless, any decision to require labeling must consider whether labeling will have an impact on the social objectives, whether labeling is the least-cost government tool, and of course, whether market forces and individual incentives have already responded to address the policy concern.

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