How Labeling of Safety and Process Attributes Affects Markets for Food

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Consumers are increasingly considering information on the safety and process (how foods are produced) attributes of food in making their buying decisions. Producers, processors, and retailers may choose voluntary labeling of these attributes, may be required to label by government regulations, or may use a combination of these approaches. The market effects depend on consumer perceptions of the attributes, the benefits and costs of labeling for companies, and the goals of government policy. These effects are illustrated through a discussion of labeling of foods that are produced with the use of biotechnology (genetically modified organisms) or that are organically grown.

The safety of food products and the characteristics of the processes used to produce them are becoming increasingly important in the operation of food systems. Consumers are considering information on these attributes in making their purchasing decisions, while governments and companies are choosing labeling options. Producers, processors, and retailers may voluntarily choose to label the safety and process attributes of their products or may be required to do so by government regulations. Frequently a combination of voluntary and mandatory approaches to labeling is in place. Our discussion uses several examples to illustrate how the market effects of labeling depend upon its impact on consumer perceptions of the product attributes, the benefits and costs of labeling for companies, and the goals of government policy.

The use of labeling on food products is gaining in prominence in many countries as a regulatory tool to inform consumers and influence markets for food quality. Labeling policies may be used as a substitute for more restrictive forms of government regulation or as a complement to other policies. In either case, governments can use labeling policies to reach food quality targets, to encourage competition in product markets, and to provide consumers with information and protection from deception. Labeling policies differ from other regulatory approaches because they work more directly in conjunction with consumer demand in the marketplace. At the same time, food companies have a vital interest in the voluntary use of labels as a means of differentiating their products to consumers.

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Markets for Food Quality Attributes

Standard tools of economic analysis apply to markets for quality attributes. Consumers' market demand is expressed by their willingness to pay for higher levels of quality attributes, which in turn reflects their perception of the benefits they receive from those attributes (Caswell and Mojduszka 1996). In most cases, the amount that consumers are willing to pay for each additional unit of a particular quality attribute will fall (Swinbank 1993). Consumers with different preferences, including different risk preferences, will rationally choose different bundles of foods. These choices will maximize the consumers' utility from their food purchases as long as their perceptions of the quality attributes of foods are correct. In other words, consumers will buy those products that give them the most value, as long as they are able to accurately judge the quality attributes.

On the supply side of the market, food producers supply food quality if it is profitable for them or if they are required to do so (Caswell and Mojduszka 1996). Economic models of food quality usually assume that the marginal cost of supplying additional units of food quality is likely to increase. In markets with no imperfections, the falling demand

(marginal benefit) curve intersects with the rising supply (marginal cost) curve to determine an optimum level of food quality at a market clearing price. Markets for food quality rarely work perfectly, however, most often because information is imperfect. As a result, governments are active in regulating markets for food quality using a range of regulatory regimes including input standards, process standards, product performance standards, information requirements, conditions of sale or service requirements, and conditions of use requirements. The ultimate target of these regulatory regimes is to ensure certain levels of important quality attributes or to prevent consumer deception.

The economics literature now includes a large body of work on markets for quality and on how quality is communicated (signaled) to consumers. These models focus on the types of goods or attributes being sold, asymmetries in the quality information available to buyers and sellers, companies' incentives to provide quality and quality information, the structure of markets, and how government regulation may affect markets for product quality.

The effects of information asymmetries on market operation are most important to analysis of voluntary and mandatory labeling programs. The information environment is characterized by whether the product's important attributes are search, experience, or credence attributes (Nelson 1970, 1974; Darby and Karni 1973). The safety and process attributes we are concerned with here are largely or wholly credence attributes, where the consumer cannot judge the quality even after he or she inspects, buys, and uses the product. For example, a consumer cannot reliably judge whether a food has been produced organically by inspecting or using the product, nor is it practicable for the consumer to have the product tested to verify its quality. Companies may use quality signaling, but a reputable certification agent is often required because consumers cannot verify the truthfulness of the claims. Where truthful labeling is used, it transforms credence attributes into search attributes, allowing the consumer to judge the product before purchase. The intent of labeling policy is to improve the information environment in order to improve the functioning of markets for the quality attributes themselves.

Regulatory Choices for Food Labeling

Public policies to influence the information environment for products can take several forms. There may be no policy on claims for particular attributes, leaving companies free to use claims voluntarily as they see fit. More frequently, a basic policy that claims may not be deceptive is in place, with governments engaging in case-by-case enforcement against questionable claims. This type of activity regulates claims by using prominent cases as examples to set parameters for acceptable labeling practices. For example, in the United States during the early 1990s, the Food and Drug Administration successfully challenged several companies' label claims that their pasta sauces or orange juice products were "fresh" when the products were heat-processed. Governments may also publish guidelines indicating the types of claims they are likely to find acceptable.

Beyond these basic policies, governments may require mandatory disclosure of information about the nature of a product or how it should be used; may place controls on voluntary claims used in product promotion or the use of product names; may provide public information and education; and may subsidize the provision of information (Caswell and Mojduszka 1996). The choice of labeling policy depends in significant part on the existing incentives companies have to make claims and disclose information. Companies have market incentives to do so for the positive but not the negative attributes of their products. Mandatory disclosure requirements may force disclosure of negative attributes or the balanced disclosure of positive and negative attributes. For example, nutrition labeling may require a complete accounting of the nutrient content of a product or require that if a voluntary claim is made (e.g., high fiber), then information on all nutrients must be provided (e.g., fat and cholesterol content). Labeling regulations that mandate disclosure of information or circumscribe voluntarily provided information perform the basic transformation of former credence attributes into search attributes.

Labeling policies require a significant level of support functions, primarily in the form of standards setting and enforcement or certification. They usually require specific standards regarding the types of attributes that must or may be labeled and the form that claims take. Labeling standards must also be updated over time to keep in step with the evolution of scientific information and understanding of effective communication methods. Once standards are set, labeling policies require certification and/or enforcement programs to ensure compliance. Certification programs may be private or public, while some public enforcement mechanism is required to assure the overall integrity of the labeling program.

Labeling regulations are intended to improve

quality signaling and the market for quality attributes where private markets and incentives are not functioning adequately. It should be recognized, however, that labeling programs have the possibility of stifling or damaging the development of private markets for food quality attributes (Ippolito and Mathios 1990, 1996), particularly if they are not well designed. For example, government quality standards and labeling formats may fall behind new developments in product formulation and presentation, making it more difficult for new products and processes to be introduced. They could also stifle competition among companies to make claims because they limit the range and form of these claims. These considerations indicate that regulators must be cognizant of how private markets for quality signaling, quality certification, and quality itself are operating. When considering labeling programs, governments must evaluate the potential for private systems to operate efficiently. Improvements in information, if well designed, should create incentives for manufacturers to compete for market shares from sales to attribute-conscious, label-using consumers.

Labeling of Food Safety Attributes

In most countries, labeling has not been a prominently used regulatory tool in the area of food safety, nor has voluntary labeling of food safety attributes by companies been widespread. Governments and companies have extensive inspection and quality assurance programs in place intended to assure that unsafe products do not reach consumers. Labeling policies may be used to complement or substitute for direct regulation by government. For example, a government could require testing and labeling of foodborne pathogen levels in meat products, in effect creating a market for reduced pathogen levels as companies compete for market share. This policy could be pursued as a complement to inspection programs, with labeling applying to attribute levels below the maximum set by the regulatory system for negative attributes and above the minimum for positive attributes. Alternatively, labeling could be used instead of inspection and standards programs if the government thought the market for the attribute would work reasonably well as long as the information environment was improved.

There is evidence that future demographic changes will result in the expansion of markets for safety-improved products (see, for example, Roberts et al. 1997). Factors include rising standards of living, the apparent income elasticity of demand for food safety, and increases in vulnerable populations (e.g., for foodborne pathogens, people with suppressed immune systems and the aged). New scientific and medical knowledge is likely to better identify foodborne risks, those populations that are most susceptible, and food purchasing and consuming practices that will reduce risk.

As noted, governments have relied on more direct forms of regulation (e.g., process or performance standards) for food safety and have made only minor use of labeling policies, frequently discouraging voluntary safety labeling. A major rationale for this approach is that direct regulation offers more certain and consistent minimum standards of safety for all consumers. Regulators have been concerned that substituting labeling and market demand forces for direct regulation will not create adequate incentives for firms to supply safer products. They have also been concerned that labeling policies provide uneven levels of protection across consumer groups, with the more highly educated and richer consumers being more protected than the less educated and poorer because they are better able to use label information and to afford safer products. Thus labeling has rarely been used as a stand-alone policy in the food safety area.

Governments have pursued varying policies for labeling as a complement to other types of regulation for food safety. One complementary use of labeling is for companies to use it voluntarily to differentiate safety levels above the minimum levels set by direct regulation. This type of labeling requires identification of important health risks; specification of safety improvements related to those risks that are significant enough to merit labeling (i.e., that represent real improvements on which consumers may wish to base their buying decisions); and design of label claims that effectively communicate the safety attribute to consumers. Policy design in this area is challenging. For example, accurate labeling of levels of foodborne pathogens may be difficult because these levels can change after the product leaves the processing plant. This raises the question of where in the distribution chain the safety level should be measured and labeled. In some cases, governments have actively discouraged this type of labeling, believing it is likely to be inherently deceptive because of difficulties in controlling product quality or because the attribute being differentiated does not represent a true safety difference relative to the standard product.

An example of the use of labeling to differentiate above the minimum quality standard is seen in efforts to market pasteurized shell eggs in the United States (Morales 1996; Roberts et al. 1997).

The incidence of *Salmonella enteritidis*–related foodborne infections increased more than threefold in the United States from 1975 to 1993, with epidemiological evidence linking a high proportion of the outbreaks to the consumption of Grade A shell eggs. This incidence resulted in a variety of measures being undertaken, including tracing eggs back to their flock of origin, improving production practices, encouraging the use of pasteurized egg products in food service operations, and educating consumers about the danger of eating foods that contain raw eggs.

Several companies responded to the situation by developing processes for in-shell pasteurization of eggs and beginning test marketing. For example, in April 1996, Michael Foods (Minneapolis, Minn.) began test marketing of its product under the Crystal Farms Pasteurized Egg label. Prior to marketing, the company had conducted a telephone survey of Minnesota adults in order to define the niche market for pasteurized eggs. Roberts et al. (1997, p. 172) note that "the results showed that 95% of the sample had heard about *Salmonella,* 75% responded that they were aware that eggs could carry *Salmonella,* and that chicken and eggs were the two foods identified as most likely to cause *Salmonella* food poisoning." Based on its research, the company set the suggested retail price for in-shell pasteurized eggs at $1.39 per dozen, compared with the average price of $0.85 per dozen for large, Grade A, unpastuerized eggs. Other competitors also entered this niche market, some of whom sought certification by the U.S. Department of Agriculture.

Pasteurized shell eggs are an example of marketing of the safety attributes of a food product, with a basic regulatory framework in place that requires that label claims cannot be deceptive. Any claims made by the companies regarding the safety of the product are voluntary and subject to case-by-case review by the U.S. government. There was no mandatory labeling program for safety risks associated with eggs or formal program for regulating voluntary claims. As the market develops, the need may arise for more formal systems to regulate safety claims.

A secondary, complementary use of labeling in the food safety area is to educate consumers about safe use practices for the product. For example, a government may not view it as economically or technically feasible to eliminate all foodborne pathogens from a food product. However, even with foodborne pathogens being present, the food may be safe to eat if properly handled and cooked by the food service operator or consumer. In this situation, labels that inform the user about safe practices may be more effective than other types of regulation in reducing foodborne illness.

An example of this use is mandatory labeling in the United States since 1994 to inform users about recommended safe food handling practices for fresh meat and poultry products. The U.S. Department of Agriculture had rejected such labeling in 1987, arguing for voluntary efforts to educate consumers about proper practices. However, the agency rethought its position after a foodborne illness outbreak in the western United States in early 1993 related to *E. coli* O157:H7 in undercooked hamburgers. The mandatory labels were implemented as a complement to a longer term, comprehensive revamping of food safety control systems that includes the adoption of a Hazard Analysis at Critical Control Points (HACCP) regulatory approach at the processing level.

The safe handling labels educate consumers and other food handlers about practices that will reduce foodborne risks associated with fresh meat and poultry products. The label text notes: "This product was prepared from inspected and passed meat and/or poultry. Some food products may contain bacteria that could cause illness if the product is mishandled or cooked improperly. For your protection, follow these safe handling instructions." The recommended practices include the following: keep refrigerated or frozen; thaw in refrigerator or microwave; keep raw meat and poultry separate from other foods; wash working surfaces (including cutting boards), utensils, and hands after touching raw meat and poultry; cook thoroughly; and keep hot foods hot, refrigerate leftovers immediately or discard.

USDA's rationale for the mandatory labeling policy is that safe handling practices can effectively reduce the risk of foodborne illness and that many users are insufficiently aware of these practices. The label may differentiate fresh meat and poultry products from other food products that do not carry specific handling instructions. How this informational labeling affects the market depends on whether consumers see it as an indicator of a risky product or take it as a simple reminder to use good food handling practices.

Overall, governments have taken a cautious approach to the use of labeling as a policy tool for food safety regulation. It is likely that consumer-level, private markets for food safety attributes are being stifled to some extent by governments' reluctance to allow some forms of safety labeling. There are also market and legal (e.g., tort liability) factors that have resulted in companies being reluctant to market products based on safety (Caswell and Johnson 1991). Serious policy design

questions exist related to the increased use of labeling for food safety attributes. Most difficult are identifying important attributes and designing formats that accurately communicate complex safety information to consumers. As markets for safety attributes develop, a key issue is the extent to which a range of safety levels is offered on the market. Price differentials and differing consumer preferences may support a range of safety offerings, but it is also possible that only products with the highest safety level will be viable in the market.

Labeling of Process Attributes

Labeling of process attributes poses complicated issues because specification of processes themselves can be complex and because the process may affect a range of other attributes (e.g., safety, nutrition). Regulators and consumers may care about process attributes for a number of reasons. First, there may be concerns about the impact of use of the process on the final quality attributes of consumer-ready products. Second, the process may have impacts on the environment, animal welfare, worker safety, or other important attributes.

In policy and public discussions, these two types of concerns are often mixed together, leading to significant confusion. On the one hand, voluntary labeling with certification programs may be appropriate for process attributes that consumers care about and are willing to pay for to get or avoid. On the other hand, the labeling of process attributes may be taken as an indicator of final, consumer-level safety in cases where regulators believe it is not. As a result, some countries have been reluctant to allow labeling of process attributes that they have judged to be safe in production and at the consumer level. In some cases, companies that wish to market based on these process characteristics have been frustrated. In other cases, food companies, and sometimes governments, may resist labeling of process attributes because they oppose product differentiation based on a particular attribute. The opposition may be due in part to added costs in the supply chain related to segregating products and verification. As with food safety, the fundamental impact of truthful labeling of process attributes is to transform them from credence to search attributes. We look at two examples.

Foods Produced with the Use of Biotechnology

Countries are pursuing diverse policies on the labeling of biotechnology-related inputs or products (materials and/or products produced from genetically modified organisms [GMOs], alternatively referred to as genetically engineered organisms [GEOs]). From the consumer viewpoint, the use of biotechnology is a process attribute, which may affect other attributes such as safety or nutrition as well as other process attributes. For example, the use of biotechnology (e.g., "Roundup Ready" soybeans, bovine somatotropin [rbST] for milk production) may raise concerns about the environmental (e.g., possible increased pesticide use) or animal welfare impacts of its use. In most cases, the use of biotechnology is a credence attribute, although it may also be a search or experience attribute if it affects the appearance of the product or its use characteristics.

The choice of labeling policy is important to how markets for foods produced with the use of GMOs develop. The main policy options for governments are:

1. Allow no labeling regarding the use or nonuse of GMOs.
2. Require mandatory labeling of products that use GMOs.
3. Allow voluntary labeling of products that do or do not use GMOs.
4. Allow voluntary labeling of products that do not use GMOs, with an accompanying disclaimer noting the government's judgment about any differences (e.g., safety) between products that use and those that do not use GMOs.

The options have markedly different implications for market development. Under the first option, no differentiation is possible based on use or nonuse of GMOs. This approach may be viewed as desirable by proponents of the new technology because under it the use of GMOs is treated as no different from the use of existing technologies. However, this approach has the drawback of suggesting that regulators and producers who use the technology are afraid of consumer sovereignty and want to suppress other producers' ability to differentiate products based on nonuse of the technology.

From a regulator's point of view, the second option of mandatory labeling of the use of GMOs has the advantage of giving consumers full information. However, if there are no real differences between products that use and those that do not use the technology, the label may not be useful to consumers or could actually be deceptive and may unnecessarily impede adoption of the technology. Furthermore, labeling is not costless since it requires segregation of product and verification. Users of GMOs also tend to oppose mandatory label-

ing because they believe it will hurt market acceptance. Whether this is the case depends on the market; companies are just beginning to explore the possibility of marketing the use of GMOs as a positive attribute (e.g., promoting a products' advantages due to the use of new technology).

The third option of voluntary labeling has the advantage of allowing producers to communicate the absence or presence of the technology to consumers, making it possible for them to choose products that align with their preferences. This is an attractive alternative because it relies on market forces to determine the acceptance of new technologies. Under the fourth option, regulators may seek to place restrictions on the form of voluntary labeling to prevent what they view as possible consumer deception. An example would be requiring a disclaimer that there is no safety difference between products that use and those that do not use a GMO technology on a label that says the technology has not been used.

In the United States, the favored approach was developed in the mid 1990s in response to the marketing of dairy products from cows treated with supplemental rbST. The U.S. Food and Drug Administration (FDA) chose the last of the four policy options, issuing guidelines that labels may not claim milk products are "bST free" because the hormone occurs naturally in milk, nor may they claim to be "rbST free" because that implies the milk is different. Products may state that they come "from cows not treated with rbST" but should also provide a proper context, for example, stating that "no significant difference has been shown between milk derived from rbST-treated and non-rbST-treated cows." The FDA's approach allows voluntary labeling but also requires a disclaimer that it views as necessary to prevent consumers from being misled about safety differences. The FDA approach is a middle ground under which consumers can use labels to find products from untreated cows and companies can market based on the absence of rbST treatment, although the scope of companies' claims is limited by the disclaimer.

The FDA policy is representative of the U.S. government's overall position on the labeling of the use of GMOs. The FDA believes its position is consistent with guidance on labeling of GMOs being developed by the Codex Alimentarius Commission's Committee on Food Labeling, the international standards-setting body. The Codex position assumes that safety is already established and then recommends mandatory labeling of a food or food ingredient produced with the use of a GMO when it is no longer substantially equivalent to the corresponding existing food or food ingredient as regards composition, nutritional value, or intended use. The U.S. government supports applying this labeling standard equally to the use of all technologies. Beyond this, it supports the use of voluntary labeling to the extent that the information provided is truthful and not misleading.

The European Commission has been adopting mandatory labeling, with some exceptions, of foods obtained through the use of GMOs based on consumers' desire and right to know about this process attribute. The United States opposes this policy and argues that it causes a nontariff barrier to trade in violation of recent trade agreements. Thus whether labeling is voluntary or mandatory is the key point of contention between the trading partners' preferred approaches.

Labeling allows markets to work more effectively as producers that prefer to use or not use a particular technology are more easily matched to consumers who want to buy products with specific process attributes. Voluntary labeling of the use or nonuse of GMOs allows companies to choose a production process and related marketing and labeling that maximize their own returns, while allowing consumers to make choices based on a range of price and process attribute combinations offered in the market. This allows the market to decide on the degree of acceptance of a new technology. Mandatory labeling of the use or nonuse of GMOs serves the same purpose but does so at a higher cost, in that the entire market must be segregated and labeled even though only a portion of products or consumers cares about the attribute. Governments are likely to prefer voluntary or mandatory approaches based on their perceptions of what proportion of their citizens wants information about the technology. In either case, labeling of process attributes is likely to become more prevalent in the future. At a most basic level, governments will be called on to prevent deceptive practices regarding these types of claims. Food companies will need to view labeling as an opportunity, not a threat, and devise marketing strategies that work with labeling policies.

Organic Foods

The use of organic labels is widespread to indicate that food products have been produced and processed under certain standards. Efforts are under way to standardize the use of organic labels (e.g., Codex guidelines, the U.S. Department of Agriculture's proposed rule) in order to protect consumers against deception and protect producers of organic products against misrepresentation of other agri-

cultural products as being organic when they do not meet recognized standards. A voluntary or mandatory organic labeling program requires the detailed specification of practices that are consistent with the label. This includes a materials list; production practices for crops and livestock; transition time from nonorganic production; who certifies compliance and how; and methods of communication in the supply chain and to consumers. In some cases, private programs may work effectively to correct market imperfections, without requiring a government program or requiring minimal government involvement. For example, there may be no need for a government program if farmers or processors can effectively set organic production standards, certify growers, and administer labeling programs.

Organic products illustrate the possible links between process standards and final product quality. In practice, one of the key reasons consumers demand organic products is because they perceive those products to be lower in pesticide residues and, as a result, safer. Many consumers also demand organic products because they believe their production causes less environmental damage or risk to workers. Demand for organic products tends to surge in periods when concern about pesticide residues is highest (e.g., during the publicity about Alar use on apples in the United States).

However, there is no necessary link between organic production/processing and lower risk to consumers from pesticide residues in foods. For example, Codex's *Draft Guidelines for the Production, Processing, Labeling, and Marketing of Organically Produced Foods* (1996) state that "organic agriculture is a holistic production management system which promotes and enhances biodiversity, biological cycles, and soil biological activity. It is based on the low use of external inputs and non-use of artificial fertilizers and pesticides . . . it would be expected that substantially lower levels of residues than those from effective pesticide use would be achieved from organic management systems. In all cases such levels would not exceed established maximum residue levels for agricultural products and foodstuffs"(p. 2). While organic practices are expected to result in lower residue levels, at minimum those practices would result in products being within established maximum residue levels, which most governments seek to set at a level that yields something akin to a reasonable certainty of no harm. By accepted scientific standards there is likely to be little or no safety differential between organic and conventionally grown produce from a consumer safety viewpoint, nor do products need to show a safety differential in order to carry an organic label.

Organic labeling standards are process standards that always specify how a product is produced but do not always specify performance attributes at the consumer level, such as food safety. However, many consumers use organic labels as a indicator of pesticide residue safety. In that sense, the labels effectively operate as safety labeling and are an example of differentiation of products based on perceived (or real, if the consumer views government residue standards as inadequate) safety differentials. Codex's guidelines-setting efforts and the U.S. Department of Agriculture's proposed rule-making on organic labeling focus on setting process standards for the voluntary use of organic labels, leaving the consumer safety issue ambiguous.

Concluding Thoughts

The use of labeling to influence the operation of markets for food safety and process attributes is limited in at least three important respects not discussed above. First, space on the label itself is limited and is in high demand for use by food companies to market their products. Mandatory labeling programs use some of this precious space, which marketers resist. Because only a limited amount of label space may be used by labeling regulations, governments must make decisions about what are the highest and best uses of the scarce labeling resource. These decisions involve the choice of attributes to emphasize and the form and length of messages. Second, mandatory labeling regulations may be limited by a country's notion of companies' rights to commercial free speech. Labeling regulations may be seen as an infringement on companies' rights to market their products and use label space as they see fit. Finally, labeling is a scare resource in that consumers devote only a limited amount of time to using label information, especially at the point of purchase (Caswell and Padberg 1992). This limitation also suggests the need for careful consideration of the highest and best uses of labeling regulations.

In general, labeling has been underutilized for communicating the safety and process attributes of food products. Voluntary and mandatory labeling programs can improve the operation of markets for food quality. Caution is required if labeling is to be used as a substitute for other types of safety regulation, such as process and performance standards, because it will yield more variable levels of protection across consumer groups. The level of pro-

tection consumers receive would depend more upon their ability to process label information and to pay for higher safety levels.

Mandatory labeling requirements should be reserved for key attributes related to human health, while voluntary labeling of other attributes, under government guidelines where appropriate, is encouraged. Since a baseline level of safety is provided by regulatory approaches other than labeling, in most cases voluntary labeling of safety levels above the minimum is an appropriate policy. Similarly, voluntary labeling is often most appropriate for process attributes, allowing producers, processors, and consumers to match up with each other. In all cases, the emphasis in labeling policy should be on creating competitive markets for quality attributes, such as food safety and process attributes, and providing reasonable consumer protection. In international trade, efforts to reduce or control barriers related to labeling requirements are important, particularly if labeling policy is used more intensively by trading partners.

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