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The Economics of Labeling GM Foods

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This article discusses GM food-labeling policy options and evaluates the factors that impact the outcomes that correspond with each option. Costs and benefits associated with each policy option are also examined. These factors are used to explain some of the current differences in GM policies globally. Empirical evidence of the impacts of GM food labels is briefly discussed.

Key words: biotechnology, economics, food, GMOs, labels.

Introduction

This article focuses on the economics of labeling genetically modified (GM) foods and some implications of GM-labeling policies. Food labels are one potentially important source of information about attributes of food that consumers can use in their decision-making processes, but there are both economic and political concerns involved in deciding what can and should be included on these food labels.

The introduction of GM crops in the mid-1990s has resulted in a division among crop-trading countries. For example, US regulatory agencies have declared GM crops and foods to be safe (Belson, 2000). Likewise, products derived from genetically modified organisms (GMOs) obtained relatively quick regulatory approval and consumer acceptance in Canada, Argentina, and Brazil. In contrast, there has been a largely negative regulatory and consumer reaction in the European Union and Japan. In addition, environmental groups—such as Greenpeace and Friends of the Earth—and some consumer groups have expressed resistance (Huffman & Rousu, 2006). The concerns are generally over unknown environmental and health consequences, such as unanticipated allergic responses, the spread of pest resistance or herbicide tolerance to wild plants, and inadvertent toxicity to wildlife.

In addition, there are sometimes conflicts between the principles of "right-to-know" and "need-to-know." The philosophy of "right-to-know" is part of the precautionary principle, which is central to the European Union's approach to regulation of GM foods (Carsing, 2000; Hathcock, 2000). "Need-to-know" is concerned with information about potential allergens balanced with information overload on consumers and possible misinterpretation of scientific information where technology is judged to be safe (Qaim, 2009). We look at several related issues in the following sections.

Economics of Information (from Food Labels)

The economics of information is an important part of labeling policy. Two broad types of information exist; public, which is freely available to everyone, and private, which is held by particular private individuals, groups, or firms and may be used strategically to affect economic and political outcomes. This latter type is a form of asymmetric information that can be used strategically to enhance private gains by the "informed" (Molho, 1997). Stigler (1961) showed that the optimal amount of information is the level at which the marginal expected return is equal to the marginal cost. With modern information technologies, much of today's information has approximately a zero marginal cost of distribution (Varian, Farrell, & Shapiro, 2004). The cost of information comes from interpreting information, especially when there is contradictory information (Rousu, Huffman, Shogren, & Tegene, 2007; Schultz, 1975) and misinterpretation is possible and can lead to significant losses.

Labeling Options

The policy options for labeling include voluntary labeling, mandatory labeling, and a ban on labeling. The US labeling policy is best described as voluntary. In 1992, the US Food and Drug Administration (FDA) ruled that GM food and food products were to be regulated the same as those created by conventional means (Belson, 2000). GMOs have to meet three conditions: (i) nutritional value is not to be lower, (ii) no new substance is to be added that is not already in the food chain, and (iii) no new allergenic substances. Hence, labeling is required only if new substances are added to GM food that was not in similar conventional food.

Most of the GM crops that have been widely adopted have "first-generation" genetic modifications, which reduce production costs. In contrast, "second-generation" GM products include quality traits or product-enhancing attributes such as nutritional benefits (Kalaitzandonakes, 2000). With first-generation GM traits, there is no incentive for the food industry to voluntarily label for GM content because labeling it as such would be expected to reduce the market price of GM products. There is a segment of the market where consumers are willing to pay more for foods that are GM-free or have a low probability of GM content. This is currently being served in the United States by the organic food industry (Huffman & Strzok, 2013). In contrast, for second-generation GM products, consumers can be expected to pay a premium price, and the GM industry has an incentive to differentiate its products from conventional ones with branding or labeling. Fernandez-Cornejo, Wechsler, Livingston, and Mitchell (2014) review both studies estimating consumer willingness-to-pay premiums for GM-free food products and studies where consumers are willing to pay premiums for GM products with enhanced characteristics.

The European Union imposed mandatory labeling of GM products with greater than 0.9% GM ingredients in 1997 (Carter & Gruère, 2003; Gruère & Rao, 2007). It requires mandatory labeling in all member states for all new products containing substances derived from GMOs. Furthermore, they adopted the precautionary principle, which imposes a burden of proof on those who create potential risk, even if no cause-effect relationship is known. It also requires regulation of these activities even if it cannot be shown that there is significant potential harm. In addition, no weight is apparently given to the benefits from GM crops replacing large amounts of commercial pesticides that cause major environmental and health risks. In addition, Japan and Australia have mandatory GM labeling policies (Gruère & Rao, 2007).

Effective labeling of GMOs requires an enforcement mechanism. Even if there is only one standard for GM labeling, it requires segregation and identity preservation, which places a major burden on the production, transportation, marketing, and processing chain for crops. If GMOs are the low-priced ingredient, there is an incentive for adventitious mixing of GM with non-GM products, so a testing and verification system is needed. A fact that may be lost is that it is not economically or physically possible to have zero presence of GMOs in countries where GMOs are produced or traded. Moreover, improved accuracy of scientific instrumentation can measure ever-lower concentration levels of GMOs, so tolerance levels become the maximum impurity level that is tolerated in a product that still carries the non-GMO label. There are generally two types of tolerance levels. The first are set by government regulatory agencies. The second are those set by the commercial trade industry (Wilson & Dahl, 2005). Frequently, these tolerance levels are different because the private trade may want more restrictive tolerance levels than regulatory agencies require. For example, Frito-Lay and McDonalds have low tolerance levels for GMOs and only contract with those producers who can deliver such products. However, when every country has a different tolerance level, the risks and costs of an effective enforcement mechanism become high.

Both consumers and producers bear the cost of mandatory labeling with tolerance levels. This cost affects the market for a particular commodity in the same way as an excise tax. Hence, the relative sizes of the price elasticities of supply and demand are major determinants of how the burden is borne, but consumers can be expected to bear part of it. However, consumers are not homogenous, so some would be more affected than others. For example, in Fall 2012, citizens of California voted on Proposition 37 to require mandatory labeling of food sold to consumers made from plants and animals with genetic modification. This launched a debate because the risk and preferences are different across voters.

Some proponents of the proposition argued about the dangers of GMOs and how bad they are for human health and the environment, and a yes vote for the proposition led in early polls (Zilberman, Kaplan, Kim, & Waterfield, 2013). However, this argument was countered by results from studies by the National Research Council (NRC), and testimonials by many scientific academies and organizations that said that GMOs are as safe as conventional food. The opponents emphasized the value of GMOs, in terms of increased crop yields, reduced prices for food, and saved lives in developing countries. However, this argument did not generate much power either. The most effective argument in favor of the proposition was the "right-to-know" argument. This was practically countered by the fact that one can have voluntary labeling. Zilberman et al. reports, however, that the most effective argument in opposition to the proposition was that labeling would not be cheap for consumers; a widely publicized estimate was that it would increase the cost of food to California households by $400 per year. The proposition failed with 58% opposition (Zilberman, 2012). Hence, when consumers recognized that mandatory labeling was not a "free good," opposition grew. Ballot initiatives to require mandatory labeling of foods with GMO ingredients

Table 1. Evaluation of GMO labeling policies.

Policy option	Small market for GMO-free	Large market for GMO-free
Labeling ban	Inefficient	Inefficient
Voluntary labeling	Works well, but needs some enforcement mechanism to minimize false claims	May work if the right enforcement mechanisms are in place
Mandatory labeling	Works, but imposes costs on all for the benefit of a few	Works and is no different from voluntary labeling if the market is large

have also failed in the State of Washington (2013), Colorado (2014), and Oregon (2012 and 2014). However, Vermont passed a GMO labeling law in May 2014. Earlier GMO labeling laws passed in Maine and Connecticut will not go into effect until certain conditions are met.

More about Benefits and Costs of Labeling

Supporters of mandatory labeling claim the "right-to-know" is a first priority of consumer sovereignty. However, critics argue that there are differences in willingness to pay in order to know whether foods contain GM ingredients, and it carries potential for information overload, and consumers face time- and knowledge-based constraints in interpreting food labels (i.e., it is costly, and data-based decisions do not always occur). The biotech industry argues that GMO labeling would unfairly stigmatize products that contain GM ingredients and unduly reduce sales (i.e., consumers would view the labels as a warning). The most compelling argument against mandatory labeling is the sizeable cost of preserving the identity of all foods that could potentially be GM through the supply chain and the cost imposed on those who are indifferent to GMOs. However, costs would be reduced if all trading countries were to adopt the same standard.

Table 1 summarizes key components of the GM labeling debate where some consumers want to consume GM-free products. It is useful to consider the situation for a large country, where (1) only a few consumers prefer GM-free foods, interpreted as a small market for GM-free, and (2) almost all consumers prefer GM-free foods or there is a large market for GM-free. In both situations, a labeling ban does not satisfy requirements because it is inefficient in many ways. Consumers who value GMO-free products more than the cost of their production are prevented from buying products with a voluntary GMO-free label. With voluntary labeling and a small market, voluntary labeling works well, but there is a need for some type of enforcement mechanism to minimize false claims. In a large market, voluntary labeling might work also if an enforcement mechanism is in place. With mandatory labeling and a small market, those who prefer GM-free products can buy them, but it imposes costs on all the consumers who are indifferent to GMOs to benefit a few consumers. In the second case, with a large market, mandatory labeling gives almost all what they want, but is no different from voluntary labeling. Hence, big losses occur when there is mandatory GM labeling and only a small share of consumers prefers GM-free products.

This type of reasoning might be used to explain the difference in perspective between US and EU consumers on GMOs. In both areas, there are more than 300 million consumers. In the United States, there is a small market for GM-free products, so mandatory labeling for GM content would impose major costs on the majority to benefit a small minority. However, in the European Union, there is a strong preference for GM-free products, so mandatory labeling benefits most consumers and only harms a small minority. In this latter case, voluntary and mandatory labeling both lead to similar results. Why do these inherent preferences differ? Most likely, the differences arise from long-term cultural differences, agricultural policy politics, and the potential for consumers and farmers to benefits from the application of advances in science to agriculture.

Empirical Evidence: Impact of GM Food Labels

In research on food products that were made from raw first-generation GM materials that used cost-reducing traits in the production process, consumers have been shown to discount GM foods. In the United States and Canada, the discount for GM content has been small. This has been confirmed by a number of different studies and research methods. In the European Union and Japan, there are fewer studies, but discounts for GM farmer traits have been larger than in North America. In China, the discounts have been small. See Huffman and McCluskey (2012) for a summary.

In research on consumers' acceptance of second-generation GM traits, where consumers benefit directly, the tide is turning with consumers being willing to pay for products with GM content rather than conventional products. In the United States, Colson, Huffman, and

Rousu (2011) showed that consumers were willing to pay 25% more for fresh vegetables that were enhanced with high levels of antioxidants and Vitamin C when the GM traits came from within the species rather than from a transgenic source or for a conventional product. In China, consumers have shown a willingness to pay a premium for Golden rice, which is enhanced with high levels of Vitamin A since consumption of Vitamin A reduces the incidence of blindness and some other human health problems. In Nordic countries, scientists have shown that consumers are willing to pay a premium for GM cheese, which has a "better taste" due to special GM bacteria. See Fernandez-Cornejo et al. (2014) for discussion of additional studies.

Conclusions

Food labels are one potentially important source of information about attributes of food that consumers can use in their decision-making process, but both economics and politics are involved in deciding on what can and should be included on these food labels. In specialty or small-volume crop and livestock production, segregation and identity preservation have been achieved for some time at modest costs relative to the value of the final product. In large-volume bulk grains and oilseeds (including GM), segregation and identity preservation becomes potentially costly relative to the value of the final product. Hence, major trading countries would gain from reaching an agreement on how to manage GMOs, including adopting a common official tolerance level. Shipments of grains and oilseeds to the European Union or Japan that do not meet local standards are a big problem for the trading world. However, the European Union and United States come to the topic of GMOs and GM labeling from diverse perspectives that make a compromise difficult. Moreover, their decision impacts developing countries because of their need for foreign aid from rich countries and their concerns about the future potential to export to the European Union. However, consumers in these countries cannot afford to wait for access to the opportunities provided by GM crop technologies. A large share of their population suffers from hunger and malnutrition, and their farmers either do not have access to effective pesticides or they do not know how to use them. In this environment, Bt technology represents a potentially easy-to-use, high-payoff input that can increase the supply of food faster than traditional technologies.

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