



**AgEcon** SEARCH  
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

*The World's Largest Open Access Agricultural & Applied Economics Digital Library*

**This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.**

**Help ensure our sustainability.**

Give to AgEcon Search

AgEcon Search  
<http://ageconsearch.umn.edu>  
[aesearch@umn.edu](mailto:aesearch@umn.edu)

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*



INTERNATIONAL FOOD  
POLICY RESEARCH INSTITUTE  
*sustainable solutions for ending hunger and poverty*  
Supported by the CGIAR

IFPRI Discussion Paper 00704

May 2007

## **The Economics of GM Food Labels: An Evaluation of Mandatory Labeling Proposals in India**

Sangeeta Bansal, Jawaharlal Nehru University

Bharat Ramaswami, Indian Statistical Institute

Environment and Production Technology Division

## **INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE.**

The International Food Policy Research Institute (IFPRI) was established in 1975. IFPRI is one of 15 agricultural research centers that receive principal funding from governments, private foundations, and international and regional organizations, most of which are members of the Consultative Group on International Agricultural Research.



INTERNATIONAL FOOD  
POLICY RESEARCH INSTITUTE  
*sustainable solutions for ending hunger and poverty*  
Supported by the CGIAR

IFPRI Discussion Paper 00704  
May 2007

## The Economics of GM Food Labels: An Evaluation of Mandatory Labeling Proposals in India

Sangeeta Bansal, Jawaharlal Nehru University

Bharat Ramaswami, Indian Statistical Institute

Environment and Production Technology Division

PUBLISHED BY

**INTERNATIONAL FOOD POLICY  
RESEARCH INSTITUTE**

2033 K Street, NW  
Washington, DC 20006-1002 USA  
Tel.: +1-202-862-5600  
Fax: +1-202-467-4439  
Email: [ifpri@cgiar.org](mailto:ifpri@cgiar.org)

**[www.ifpri.org](http://www.ifpri.org)**

**Notices:**

<sup>1</sup> Effective January 2007, the Discussion Paper series within each division and the Director General's Office of IFPRI were merged into one IFPRI-wide Discussion Paper series. The new series begins with number 00689, reflecting the prior publication of 688 discussion papers within the dispersed series. The earlier series are available on IFPRI's website at [www.ifpri.org/pubs/otherpubs.htm#dp](http://www.ifpri.org/pubs/otherpubs.htm#dp).

<sup>2</sup> IFPRI Discussion Papers contain preliminary material and research results. They have not been subject to formal external reviews managed by IFPRI's Publications Review Committee, but have been reviewed by at least one internal and/or external researcher. They are circulated in order to stimulate discussion and critical comment

Copyright 2007 International Food Policy Research Institute. All rights reserved. Sections of this material may be reproduced for personal and not-for-profit use without the express written permission of but with acknowledgment to IFPRI. To reproduce the material contained herein for profit or commercial use requires express written permission. To obtain permission, contact the Communications Division at [ifpri-copyright@cgiar.org](mailto:ifpri-copyright@cgiar.org).

## CONTENTS

1. Introduction.....	1
2. Parameters of Labeling Laws.....	4
3. Verification Mechanisms .....	6
4. Quality Standards and Labeling.....	9
5. Can Mandatory Labeling Make a Difference?.....	11
6. The Role for Government in Voluntary Labeling.....	14
7. When Does Mandatory Labeling Make a Difference? .....	15
8. Does Labeling Matter to Consumers?.....	17
9. Summary and Concluding Remarks .....	23
References.....	25



## **ACKNOWLEDGMENTS**

This work has gained from comments and conversations with Guillaume Gruere, S. R. Rao and the participants of a policy dialogue on Economic Consideration of Biosafety and Biotechnology Regulations in India in New Delhi. The authors acknowledge support from the South Asia Biosafety Program, an IFPRI managed program funded by the United States Agency for International Development. We alone are, however, responsible for the views in this paper and any errors of fact.





## **ABSTRACT**

Labeling of genetically modified (GM) foods is a contentious issue and internationally, there is sharp division whether such labeling ought to be mandatory. This debate has reached India where the government has proposed mandatory labeling. In this context, this paper evaluates the optimal regulatory approach to GM food labels. Mandatory labeling aims to provide greater information and correspondingly more informed consumer choice. However, even without such laws, markets have incentives to supply labeling. So can mandatory labeling achieve outcomes different from voluntary labeling? The paper shows that this is not the case in most situations. The paper goes on to explore the special set of circumstances, where mandatory labeling makes a difference to outcomes. If these outcomes are intended, mandatory labeling is justified; otherwise not.

**Keywords: genetically modified (GM) foods, biosafety, food labeling, India**



# 1. INTRODUCTION

Policies towards labeling of genetically modified or GM foods have varied between countries. The great divide is between the European Union that has favored mandatory labeling and the United States, which has chosen not to impose such requirements. Developing countries have also been confronted with this issue. While Brazil and China have adopted mandatory labeling laws, Philippines and South Africa have pursued approaches based on voluntary labeling. In India, a recent recommendation from the Ministry of Health has proposed mandatory labeling of all GM foods. In light of this proposal and the absence of an international consensus, this paper evaluates the optimal regulatory approach to GM food labels. In particular, what can justify a mandatory labeling policy? Although the Indian context provides the motivation, the core arguments in this paper are applicable to other country contexts as well.

Unlike many other quality attributes of agricultural produce, genetic modification cannot be known by visual inspection or even after consuming the good. In the terminology of Darbi and Karni (1973) for classification of goods, GM attribute is neither a search attribute nor an experience attribute but rather a credence attribute.

Therefore, GM labeling is meaningful only when there is certification that *verifies* the labeled status. Such certification is typically costly to produce. In the generic case, a food product cannot be verified to be GM-free unless documented steps have been taken to preserve the identity of the product in the production and marketing chain.

In the usual kind of instances that are subject to labeling requirements, labeling costs are trivial. Examples are laws that require packaged products to display the weight of the product or the nutritional composition of foods. The seller either already possesses the information or can obtain it through inexpensive tests. Moreover, the label itself can be verified by a third party (an inspector or a court) through relatively simple means. As we shall argue, the consequences are quite different when labeling costs, as in the GM case, are non-trivial.

Two kinds of justifications are commonly offered in favor of mandatory labeling: that it is necessary to warn consumers about potential health impacts and that such labeling is a response to a consumer's right to know. We evaluate these arguments in the context of a policy world where besides mandatory labeling, governments have other policy instruments as well – namely the specification of quality standards and laws that facilitate voluntary labeling. We will argue that labeling is not the appropriate response to concerns about health impacts and that the only legitimate argument for mandatory labeling rests on consumer's right to know. But does mandatory labeling result in consumers

receiving greater information? And does it increase economic welfare as a result? This is the question that we explore in this paper.

There is a rapidly growing literature on optimal labeling policies for GM foods. Results vary depending on how each paper defines the content of mandatory labeling, on how the costs of labeling are borne by market participants, and whether the policy is evaluated from the point of view of producers or consumers or of society as a whole. The literature makes a distinction between a positive label (“this product may contain GM organisms”) and negative label (“this product contains no GM organisms”). Quite clearly, voluntary labeling could only be of the negative kind while mandatory labeling could be of either type. Runge and Jackson (2000) argue that voluntary negative labeling policies would be optimal while Crespi and Marette (2003) show that the socially optimal label depends on the number of consumers averse to GM foods. A similar result is derived by Kirchhoff and Zago (2001) who show that the comparison between mandatory and voluntary labeling depends on the distribution of consumer preferences and in particular on the extent of consumer aversion to GM foods. Carter and Gruere (2003) argue that mandatory labeling does not facilitate consumer choice and acts as a market barrier. In its presence GM products do not appear at the retail shelf. These results depend on the assumption that in some scenarios, the labeling cost is borne by suppliers of GM foods. However, in so far as it is non-GM foods that command a price premium such an assumption is not incentive compatible.

In this paper, we assume non-GM products would command a premium over the GM products (at least for the first generation of GM foods which involve no significant benefits to the consumer). If this is so, then the onus is on the producer who claims GM-free status to be able to prove it. Suppliers of GM foods who label their products accordingly do not have to prove so and therefore do not have to incur the costs of segregation and identity preservation.<sup>1</sup>

Unlike previous authors, we conclude that under standard assumptions on consumer preferences, mandatory and voluntary labeling are equivalent. The market share of GM food is invariant to the policy regime. The extent of consumer aversion to GM foods will matter to the market share of GM food but given consumer preferences, the policy regime does not matter to the market share.

By departing from standard assumptions, the paper sketches a scenario where outcomes under mandatory labeling can be different from that under voluntary labeling. In this scenario, preferences for some consumers are ‘label-sensitive’ i.e., their preferences change on encountering a label. However, when this is so, it is not possible to compare welfare under the two labeling scenarios.

The plan of the paper is as follows. The next section surveys labeling policies internationally and the proposed laws in India. If a label is to be verified, certain mechanisms must be employed. These are

---

<sup>1</sup> This is recognized in Moschini and Lapan (2006) and Lapan and Moschini (2007)

described in Section 3. Section 4 distinguishes between quality standards and labeling policies. The section argues that known health and safety considerations are best handled by prescription of quality standards rather than labeling policies. The consumer's right to know is the only legitimate argument for mandatory labeling. This is closely examined in Section 5 that shows that under standard assumptions on the stability of preferences, mandatory labeling does not improve upon the outcomes achieved by voluntary labeling. Section 6 argues that even with voluntary labeling, the government has a role to play in setting standards and in requiring labeling to be truthful. Section 7 relaxes the assumption of stable preferences. Here consumers are allowed to change their demand upon seeing a label. Section 8 reports a limited experiment that showed that consumers were price-sensitive vis-a-vis "high quality" goods. Conclusions are collected in Section 9.

## 2. Parameters of Labeling Laws

Labeling policies can vary across countries according to the following parameters.

(i) Specifying what is legal: The contrast here is between mandatory labeling laws and voluntary labeling policies. The latter also requires a legal framework in so far as labels are required to be truthful. Countries may also develop standards and guidelines that govern the use of voluntary labels.

(ii) Scope of labeling: The mandatory labeling provision could apply to some foods or to all foods. The scope is narrowest when the labeling provision is restricted to foods with detectable levels of GM materials (transgenic protein or DNA). The scope can be expanded to include highly processed products derived from GM ingredients but containing no detectable levels of transgenic protein. Some countries may also require that GM labeling apply to animal feed, additives and flavors, meat and animal products fed with GM feed and to food sold in restaurants.

(iii) Threshold levels: What is the maximum threshold level above which a food is regarded as genetically modified? The tolerance levels range from 0.1 to 5 percent.

(iv) Enforcement: This is a particular issue in developing countries where regulations may not be enforced strictly.

The scope of labeling also automatically implies the verification mechanisms that need to accompany labeling. If labeling is required only for foods with detectable levels of GM ingredients, then verification of 'GM-free' status can rely on testing of the final product for genetically modified protein or DNA. However, if labeling is extended to processed foods where existing testing mechanism cannot detect the transgenic DNA accurately or at a reasonable cost, then compliance for these products will require evidence of 'identity preservation' (IP).<sup>2</sup> An IP system requires production, processing and distribution systems where the identity of the food or trait is preserved (Smyth and Phillips 2002). This could result in segmented channels of production, processing and marketing.

Countries can be placed in a matrix according to the stringency of their regulations with respect to type of labeling (mandatory vs. voluntary), scope of labeling, the accompanying verification mechanisms (process or product), the prescribed tolerance levels and the extent of enforcement (Gruere and Rao 2007). The international comparisons reveal that labeling regulations have the widest scope in the European Union, Brazil and China. Indeed, in terms of the law, regulations are more stringent in Brazil and China. In Brazil, there are no exemptions to the labeling law while the EU excludes meat and animal products. Similarly, in China, the tolerance level is 0 percent while it is 0.9 percent in EU. However,

---

<sup>2</sup> Even where product testing is feasible, companies may still follow IP to make sure the final product measures up to the advertised claim regarding its source of ingredients.

operationally it is the EU laws that are most stringent because they are implemented fully while they are not implemented at all in Brazil and only partially implemented in China.

Japan, South Korea and some other countries in southeast Asia also have mandatory labeling laws. However, they exclude processed products and their tolerance level is usually in the range from 1-5 percent. Canada, Argentina, South Africa, Philippines and the United States have voluntary labeling laws (or draft proposals) based on product content.

Within this range of international experiences, the Indian draft law proposes mandatory labeling laws that are among the most stringent globally. There are no exemptions either in terms of animal products or processed foods. The draft rules state that “a GM food, derived there from, whether it is primary or processed or any ingredient of food, food additives or any food product that may contain GM material shall be compulsorily labeled, without any exceptions”. The definition of a GM food makes it clear that it includes foods that are produced from genetically modified organisms even though the foods may not themselves contain it. Examples of such foods would be soy oil and meat from animals that are fed on genetically modified grains. Hence the verification mechanism that is proposed is that of identity preservation. The tolerance level is not specified, which may imply a 0 percent threshold level.

If applicable, the label would indicate that the foods have been subject to genetic modification. The requirement is applicable for both imported and domestically produced food items. In the case of imported foods, an additional requirement is that the label will also indicate that the product has been cleared for marketing and use in the country of origin.



### 3. Verification Mechanisms

Under the proposed Indian draft law, suppliers of GM food would have to label their foods accordingly. The implication is that an unlabeled food is GM-free. Suppliers of unlabeled foods would therefore have to supply documentation to support the claim that their product is GM-free. When an organism is genetically modified, it means that a fragment of 'foreign' DNA is introduced, that manufactures a protein not normally produced by that species. Protein-based methods of detection (the enzyme-linked immunosorbent assay or ELISA tests) involve antibodies or enzymes that detect either the newly introduced protein, or its by-products. The test is specific to the protein expressed by the transgene. These methods have significant limitations and are best used for fresh, raw foodstuffs. Even here, the methods are not very accurate; however it is inexpensive.

DNA-based methods (PCR tests) use the newly introduced 'foreign' DNA as a 'tag' or marker for detecting a GM product. DNA markers could include the new gene itself, or the accompanying promoter/terminator gene or the marker genes that confer antibiotic resistance. While DNA-based methods are more reliable and more expensive as well, there are several challenges as well. The first step in the procedure is to extract the DNA from the food sample. As the target DNA might be present in quantities too minute for detection, polymerase chain reaction (PCR) is used to amplify the target DNA. PCR reactions are available for the limited number of markers that are popularly used in genetic modification. However, as new GM foods are developed, the old markers may be discontinued and new ones used. Hence the technology for detection must keep pace with the development of GM foods.

The other challenge to DNA based methods is that food processing can contribute to significant degradation of target DNA. Indeed, DNA detection methods are not applicable to refined sugars or oils, because plant DNA is completely separated or destroyed in the course of processing. A third limitation is that some common food components inhibit PCR reaction, reduce the amplification process and therefore may not be able to detect GM ingredients. These include calcium, iron and trace heavy metals, carbohydrates, tannins, phenolics, and salts.

The fourth challenge is to be able to quantify precisely the amount of GM material. To detect minute quantities, one would need to increase the extent of PCR amplification. Clearly then, it would be far more expensive to test for threshold limits at say 0.1 percent than at 1 percent.

An instance of the difficulties in detecting GM ingredients is oil derived from GM soybeans. The proteins of the 'foreign' DNA are largely retained by the de-oiled cake. As a result, the oils contain very minute foreign DNA that cannot be reliably tested and quantified. Thus, there is no reliable way to distinguish soy oil from GM soybean from that of soy oil from non-GM beans.

The only way this can be done is to construct a separate production and marketing channel for the two oils so that their identity is preserved up to the time the oil reaches the consumer. Identity preservation is a complex and expensive procedure. The process begins with the purity of seed. Then on the farmers' fields non-GM beans would have to be grown separately. The fields must be isolated to prevent cross-pollination or contamination from GM beans. Guidelines have to be formulated for minimum isolation distance that would vary from crop to crop. All equipment, bins, storage containers must be cleaned and inspected before and after each use. Similar segregation would have to accompany the transport of beans to the wholesale markets and then onto the oil mills where they would have to be stored, processed and packaged in separate facilities. As all this would have to be capable of verification, there would have to be appropriate documentation of the separate market channel and the movement of the product through it.

It should be noted that even when product-testing verification is feasible, it might call for some segregation. For instance, with respect to grains, even though it would be possible to test for their GM status, the only way of ensuring a GM-free status would be to physically separate them from GM grain in production, transport and storage.

The major costs of GM labeling arise from identity preservation and associated segregation systems. As discussed earlier, the cost would be borne by the supplier of the GM-free product. A close analogue is the structure of the organic food industry. Organic foods command a premium and it is the suppliers of these foods who incur the costs of segregation in production, processing and transport. However, even GM producers might have to incur IP costs in some cases. An instance of this is the case where corn containing the Starlink gene was approved for feed but not for human consumption. A supplier of GM corn might then be required to demonstrate that it does not contain Starlink gene (as is required for US corn exports to Japan).<sup>3</sup>

Some estimates are available of IP costs in the United States and other developed countries. Moss, Schmitz and Schmitz (2002) compile IP costs from various studies done up to 2000. Most of these computations are from IP costs in the marketing channel and ignore the separation costs at the farm level. For an average grain price of \$2 per bushel, the numbers in their paper indicate IP costs in the range of 8 to 16 percent of the product price. In the only study of a developing country, de Leon, Manalo and Guilatco (2004) estimate that IP costs due to mandatory labeling would lead to an increase of 11-12 percent of total costs in the food trade and processing sector in the Philippines. There are other estimates

---

<sup>3</sup> The EU mandates that GM products must be 'traceable', i.e., all handlers of GM products must be able to identify their supplier and the firms to which their products have been supplied.

as well which are presented in terms of the additional cost per capita. However, it is not clear how to interpret them and what magnitude should be considered large or small.

## 4. Quality Standards and Labeling

It is important to distinguish labeling laws from prescription of quality standards. The latter is a common kind of government intervention all around the world. For reasons of health and safety, the government prescribes minimum quality standards for many food and manufactured items. In the Indian context, an example is the Fruit Products Order of 1955 that specifies minimum standards for the processing of fruit and vegetable products. These are mandatory for all companies in this line of activity. However, not all quality prescriptions are of this kind. The government can also prescribe specifications and standards and allow the compliance with it to be voluntary. However, those who comply can freely advertise this fact. Examples of this are AGMARK specifications for agricultural produce.<sup>4</sup>

Although labeling laws are closely related to quality standards, they are conceptually distinct. Quality standards are motivated by health and safety considerations. Society considers exposure to some risks unacceptable and when this is not in doubt, one response can be to lay down minimum quality specifications whether for fruit juices, electrical cables or automobiles. In specifying quality standards, the government makes a decision on what products will be available in the market on behalf of consumers.

Labeling, on the other hand, is a response based on the consumer's right to know. Here the government acknowledges consumer concerns about the product's attributes but does not judge these concerns to be widely applicable to all consumers. A requirement to label products relevant to consumer concerns signals the relevant attribute to consumers and allows them to make the choice.

Implicit in this argument are two assumptions. The first is that without labeling consumers are unable to ascertain characteristics of the product whether through visual inspection or even indeed after use. The second is that consumers are interested in knowing about the labeled characteristics. Thus, for instance, consider a law that requires foods to label the nutritional composition of foods. The idea is that consumers would like to make choices based on such information – say, cholesterol content. However, the consumer has no means by which to detect and quantify such food properties.

Quality standards, however, may not be considered appropriate here because while cholesterol is manifestly a health risk in a statistical sense, medical science does not tell us the causal mechanism and nor is the association between cholesterol and health status reasonably uniform across all individuals. On the other hand, if consumers are informed about scientific evidence, then they could make their own decisions provided they receive enough information about the cholesterol levels in their food purchases.

---

<sup>4</sup> Compliance is compulsory for some commodities for export.

Governments, of course, have to decide what health or safety issues are applicable to all consumers and which are relevant to only a subset of them. This can differ between governments and over time as well. For instance, recently the State of New York in the United States has banned the use of partially hydrogenated oils in restaurants rather than merely require the restaurants to signal its use.

## 5. Can Mandatory Labeling Make a Difference?

The case for mandatory labeling for GM products is often made on three grounds. The first reason that is advanced is that GM foods have known adverse health effects and therefore consumers should be informed before they decide to consume them. However, as discussed earlier, if such effects are well known and if they operate uniformly over the population, then the appropriate response should be to impose quality standards such that these foods are excluded. Therefore, this is not a valid ground for mandatory labeling. The health impacts of GM foods are not universally accepted. In all countries, including India, commercial approval of GM foods is contingent on extensive tests for food safety among other things. So it is evident that a GM food can be legally available only if the product does not result in any known health impacts.

The second reason that is advanced for mandatory labeling is that GM foods may have unknown but probable health impacts especially if they are consumed over long periods of time. The population has not been exposed to such foods for enough time for these impacts to be measured. Because of lack of data, this cannot be confirmed or refuted by scientific evidence. However, as consumers may nonetheless form preferences because of these unknown impacts, mandatory labeling would endow consumers with the right to know.

The third reason stems from religious or ethical preferences. Some consumers may not wish to consume GM food for these reasons. Here again, mandatory labeling could be advanced as a reason to inform consumer choices.

This suggests that the basic purposes of introducing mandatory labeling are the twin objectives of providing information and greater consumer choice. A common argument for mandatory labeling that illustrates these supposed impacts is the following. In the absence of labeling, consumers cannot distinguish between GM and GM-free foods. Firms supply only GM food and because of ignorance, even those consumers that are averse to GM foods end up consuming these foods. Mandatory labeling informs these consumers who accordingly shift demand to GM-free foods, which therefore results in the supply of these foods to meet their preferences. Thus, in the absence of mandatory labeling, consumers have no choice but to consume GM-foods. On the other hand, mandatory labeling results in provision of both GM and GM-free foods, and the consumer has the choice of consuming according to her or his preferences. This seemingly reasonable argument fails to hold up, however, whenever labeling involves fixed costs.

The reason is that a complete justification of mandatory labeling must include a demonstration that the market on its own would fail to provide the information and choice that mandatory labeling can

provide. Note that it is not the case that the market outcome involves no labeling at all. Product differentiation with voluntary labeling is a market response to varying consumer preferences. Therefore, the mandatory labeling case would have to be compared with voluntary labeling rather than the no labeling case. For instance, in North America, which does not have a mandatory labeling law, there is considerable voluntary labeling accompanied by IP and segregation in order to meet consumer preferences. It is estimated that 2.5 million acres of corn and soybean have been identity-preserved and directed to the non-GM market segment every year since the late 1990s (Kalaitzandonakes 2004). If food suppliers voluntarily label produce, would mandatory labeling be needed?

Suppose all the producers have the same cost differential of producing GM vs. non-GM food, with GM food being cheaper than the non-GM food. In addition to the variable cost there is a fixed cost of undergoing the process of certification and providing a label. Further assume that consumers differ in their willingness to pay for the GM-free variety of food, with some consumers willing to pay more than others. Following the literature, in this section we assume that the willingness to pay for GM-free food does not depend on whether and what label is attached to the food. In other words, consumers have stable preferences.

If the segment of consumers willing to pay more for GM-free variant is sufficiently large, so that it is profitable to product differentiate, producers on their own would supply both variants of the product to the market with identity preservation. Mandatory labeling would not result in additional benefits. It could result in additional costs, however, because of the administrative and legal infrastructure associated with such a policy.

Consider the other situation, where the market size for GM-free variant is small and not viable for segregation. In the absence of mandatory labeling, the GM-free food would not be supplied. But the introduction of mandatory labeling would not change the economics of private suppliers. As the market size for GM-free foods remains small, only the GM variant would be supplied to the market and producers would not bother to identity preserve the GM-free foods. The only difference from the benchmark case would be that while earlier products were not labeled, they would now be labeled under the mandatory provision as containing GM ingredients. Thus, the labeling policy does not change consumer choices but provides more information that is redundant. There is no addition to social benefit, but possibly some increase in administrative costs. The same reasoning could also apply to the other corner case solution with no GM at all because consumers are willing to pay sufficiently to avoid GM altogether (as is the case in EU).

We now consider an alternative scenario, where some producers have a cost advantage in producing GM foods depending on geographical, technical factors, but others do not have such an advantage. The latter would produce traditional GM-free foods. In the benchmark case of voluntary labeling, both kinds of foods would be supplied. If it were profitable to segregate the two foods, the market would segregate them and if it were not profitable then the two foods would reach market in an unlabeled form. In this case, there would be some probability that the food would contain GM ingredients.

This situation would not change even after mandatory labeling. If it were not profitable to segregate and label GM-free varieties, even GM-free food would enter the market labeled as GM food. Since market size is not viable, producers would not undertake the effort and incur expenses involved in segregating and labeling the product. Thus in the absence of labeling requirements all products would enter the market unlabeled and in the presence of labeling requirements all products would be labeled as GM. Here the labeling requirement neither benefits consumers through greater choice nor provides increased information.

In sum, in all these cases, mandatory labeling would make no difference to consumer choice or information provision that is useful to consumers. In the instances where mandatory labeling would result in labeled GM-free products, voluntary labeling would result in the same outcome. Thus, the policy is redundant as there is no market failure that can be addressed by mandatory labeling. The point is that product segregation and labeling entails cost, and if the market does not provide sufficient incentive to producers to incur such a cost, then regulatory policy also cannot induce them. In fact regulatory policy might reduce these incentives by increasing the cost.<sup>5</sup>

---

<sup>5</sup> It should be noted that we have assumed that firms have the knowledge about consumer preferences and their aversion to GM foods. If this is not true, mandatory labeling could have impacts not realized in its absence. While it could be unrealistic to assume that firms have perfect knowledge, it is likely that in a competitive market such an assumption is closer to reality than its opposite.



## 6. The Role for Government in Voluntary Labeling

The redundancy of mandatory labeling does not mean that the government does not have a role to play. Consumer concerns can be met by voluntary labeling only if labeling is truthful. This requires laws that would make producers liable to damages if they make claims on labels that cannot be verified.

Furthermore, even with voluntary labeling, labels could be privately owned or promoted by the government. An instance of a sector where both kinds of labels are available is the organic food sector. Exports are the principal market for organic foods produced in India. Much like GM foods, product testing cannot certify organic foods. The certification of organic agriculture requires special processes of production, which makes sure of physical segregation and identity preservation. The certification is done by the agency that owns the label. For labeling to work, the label must be credible to the consumer. Therefore, private labels owned by companies that have good contacts with retail networks in the importing countries are more successful than government labels.

However, private labels need not be a solution in all circumstances. If the food industry consists of a few large players and many small players, then the private labels would tend to be owned and promoted by the large firms. The small firms might find the cost of certification to be too forbidding to enter the segment of certified foods. Second, competing private labels would follow different standards of certification in order to product differentiate and fragment the market. In both these cases, the government can facilitate entry by small players and market growth by coordinating standard setting. In the case of organic foods, countries have pursued different approaches to this question. The United States, the European Union and Japan have comprehensive legislation, which defines organic standards, and certification agencies (public or private) have to comply with them. In countries without such laws (such as Canada, India), government guidelines for organic standards may exist but are not binding while private firms and non-profit organizations handle certification.

An example of a voluntary but publicly owned label in India is Agmark. The Agricultural Produce (Grading and Marketing) Act lays down specifications for large number of agricultural commodities such as pulses, cereals, fruits and vegetables, spices as well as processed foods such as edible oils, ghee and vermicelli. The object is to set the standards for grading. Products that comply with these specifications receive the certification label AGMARK. Compliance is voluntary except for some commodity exports.

## 7. When Does Mandatory Labeling Make a Difference?

In an earlier section, we argued that voluntary labeling renders mandatory labeling redundant in the sense that mandatory labeling would not result in greater information or product choice to consumers. There is, however, a special set of circumstances where mandatory labeling can alter outcomes.

The underlying assumption of the analysis in Section 5 was that consumer preferences are stable. What that means is that consumer preferences between GM and GM-free food do not depend on the label. The label provides information and consumers make choices according to their preferences. However, the label itself does not alter preferences. With stable preferences, Section 5 argued that mandatory labeling is redundant.

But suppose this assumption is not true. In particular, suppose there are consumers who are indifferent between GM and GM-free food but who shift their preference to GM-free food when they see a label on GM food possibly because they interpret the label as a signal of low quality. These are 'label-sensitive' consumers.<sup>6</sup> In addition, suppose that there are fixed costs (due to the infrastructure for segregation and identity preservation) that are incurred in establishing a GM-free marketing channel. If fixed costs are large enough, then it might happen that GM-free foods are not labeled differently from GM foods under voluntary labeling but that such distinction does take place under mandatory labeling.

Consider the following example to clarify the logic. An economy consists of three types of consumers. When GM-free and GM products are priced identically,  $\alpha$  consumers purchase GM products,  $\gamma$  consumers purchase only GM-free food while  $\beta$  consumers are label sensitive and consume GM products as long as there is no labeling, but switch to GM-free products when there is labeling. Note it is not assumed that these consumers are ignorant about the products they buy and that the switch happens for that reason. The consumers are fully aware of the properties of the foods on offer. The switch is because of a change in preferences triggered by the label.

Suppose also that there is a single firm in the industry. Net of variable costs, the firm receives a profit  $r$  per unit of quantity from the sale of food which is the same whether the product is GM or GM-free. However, the provision of GM-free food requires a fixed cost  $k$ . Consider first the case where there is no mandatory labeling. The firm has the choice of either supplying unlabeled or labeled food. The firm's profit from supplying unlabeled food (i.e., GM products) is  $(\alpha+\beta)r$  as the  $\gamma$  consumers will decline

---

<sup>6</sup> A scenario where labels could change preferences is if it enables anti-GM NGOs mount effective advertising and media campaigns against GM foods.

to consume the product knowing that it has GM ingredients. If the firm decides to label its food, then the profits from supplying GM food is  $\alpha r$  as the  $\beta$  consumers defect to GM-free food. The profits from supplying GM-free food is  $(\beta+\gamma)r - k$  and the total profits become  $(\alpha+\beta+\gamma)r - k$ .

It would not be profitable to label food if  $(\alpha+\beta)r > (\alpha+\beta+\gamma)r - k$  which is the case if the fixed costs of labeling are high enough such that  $k \geq \gamma r$ . Now suppose mandatory labeling is in place. The firm has a choice of supplying both types of food or it can supply GM food alone.<sup>7</sup> Once again, profits from supplying both GM and GM-free food are  $(\alpha+\beta+\gamma)r - k$ . However, profits from supplying GM food alone falls to  $\alpha r$  as mandatory labeling leads the  $\beta$  consumers to switch to GM-free food. Hence, the firm would supply both products as long as  $(\beta+\gamma)r > k$ . Thus, if fixed costs are such that  $(\beta+\gamma)r > k \geq \gamma r$ , then we have an instance where GM-free foods would not be supplied without mandatory labeling.

This example has been deliberately constructed to be simple. It can be generalized in several respects. The critical assumptions are the existence of label-sensitive consumers and the presence of fixed costs. Without either of these features, mandatory labeling will not result in outcomes any different from voluntary labeling. When mandatory labeling with label-sensitive consumers results in a different outcome, the outcomes with and without labeling cannot be ranked in terms of conventional welfare criteria because such criteria assume stable preferences. The outcomes can be ranked only in terms of the government's own objective function. If the government wishes to shift consumer preferences and hence food purchases from GM to GM-free products, then it can justify mandatory labeling.<sup>8</sup> But if it wishes labeling to be neutral between these products, then mandatory labeling is not justified.

---

<sup>7</sup> Since there are no fixed costs in the supply of GM food, such food will always be supplied as long as there is a market. Thus, the choice of only supplying GM-free food will never be exercised.

<sup>8</sup> Health warnings such as cigarettes or alcohol clearly fall in the category where it is clear that government would like to shift consumer preferences through labeling.

## 8. Does Labeling Matter to Consumers?

Any kind of labeling, mandatory or voluntary, presumes that consumers care about the characteristics that are labeled. There has been considerable work attempting to measure the degree of aversion to GM foods in Europe and North America. Consumer surveys typically indicate a large preference for GM-free foods. However, responses to hypothetical questions may not always indicate purchasing behavior. Studies that utilize experiments with real payoffs show that consumers also care about price and the price-quality trade-off is an important part of decision-making.

Such studies do not exist for developing countries. One issue, which has been found in the developed countries as well, is the understanding of GM foods among consumers. The additional complication in India is that with no approved GM food, the responses of consumers to attitude surveys can only be hypothetical which can be far removed from their purchasing behavior.

We considered a more fundamental issue: do quality labels matter to consumers and how much? To that end, we conducted a small experiment at the Jawaharlal Nehru University in June 2006. We set up a stall in a popular shopping area in the University in the evening hours. The subjects who participated in the experiment were predominantly students but also included some workers and faculty.

The participants were faced with a choice of two bags: A and B. Bag A contained 400 mg of apple juice that advertised on its packaging “No preservatives and added colors”. Bag B also contained the same quantity of apple juice but without the same claim. The market price for the labeled product is Rs. 30 while that of the unlabeled product is Rs. 20. The choice of B (given away free) was accompanied by Rs. 20 in cash. The choice of A (given away free) was accompanied by Rs.  $x$  in cash where  $x$  was drawn by the participant from a box and it could be 0, 5, 10 or 15. The random payoff was first drawn and then the participant was asked to make the choice.

In this experiment, the difference between Rs. 20 and Rs.  $x$  is the amount foregone if the participant chooses bag A. It therefore represents the price of the labeled product. Out of 90 respondents, 49 chose the labeled product and 41 chose the unlabeled product. We found the probability of choosing the labeled product to be negatively correlated with its price. Also women are more likely to choose the labeled product than men.

This small experiment demonstrates the price sensitivity of the demand for labeled products even for low price items. This suggests that it would be difficult to assess the demand for labeled GM-free products from hypothetical attitude surveys. It also showed that the importance of labeling will vary with social groups.

The fact that the demand for the labeled 'high quality' product is negatively correlated with its price means that suppliers have to consider the trade-offs between market share and labeling. As noted earlier in section 5, it is this trade-off that determines the supply of labeled products. Under stable preferences, mandatory labeling requirements will not alter this trade-off and hence the supply of labeled products.

## 9. Summary and Concluding Remarks

India is considering a labeling policy for GM foods. The Health Ministry has proposed the use of mandatory labels on GM foods. While international approaches are varied, the Indian proposal if accepted would make Indian laws the most stringent globally. Is this an optimal policy for India?

We consider two arguments for mandatory labeling. First is the case when mandatory labeling is justified by known adverse impacts on health. However, we show that if a product has known adverse health effects for all consumers then the appropriate policy should be to either prohibit the sale and use of product or to impose minimum quality standards. Mandatory labeling should not be advocated when quality standards can be used.

The second argument is based on the right to know. Some consumers may not wish to consume GM foods because of religious or ethical preferences or because they believe GM foods could have adverse health impacts in the future but which are not detectable at present. For any of these reasons, these consumers would like to know what they are consuming. GM labeling makes sense only when it is accompanied by information that verifies the labeled status. In the typical case, a food product cannot be verified to be GM-free unless the identity of the product is preserved through the production and marketing chain. This is a costly process. This would, at least initially (as the GM-free food segment would be a lot smaller), make GM-free foods much more expensive than GM products. Greater is the stringency of regulation, greater would be the price-premium commanded by GM-free products. As consumers typically consider price in their purchase decisions, the market share of GM-free products is likely to be small which means that such products are not likely to be supplied at all irrespective of whether the government mandates labeling or not. On the other hand, if consumer preferences are such that they are willing to pay considerable premiums for GM-free food, then no GM food would be supplied irrespective of whether the government mandates labeling or not.

Because of these fundamental economic considerations, mandatory labeling is likely to be redundant in the sense that it would not alter the quantities of GM-free food that is sold. In other words, the right to know argument can be addressed just as well by voluntary labeling. It should be noted that labeling, mandatory or voluntary, does not necessarily provide information to all consumers who need it. In particular, if the number of consumers willing to pay a premium for GM-free foods is not large enough, then the small minority of consumers who wish to know whether a food is genetically modified will not receive this information either through voluntary labeling or mandatory labeling.

The exception occurs when consumers do not have stable preferences and when additional fixed costs are incurred in the production of GM-free products. In this case, as we have shown, mandatory

labeling can result in greater market share for GM-free products. Whether this is good or bad depends on whether this is the goal of the government. One possible scenario where this could happen is if the bulk of GM food is supplied by imports. Then mandatory labeling could be a way of influencing consumption away from imports and protecting domestic producers. The mandatory labeling policy could also be seen as a substitute for a lack of infrastructure for screening GM food imports. Finally, while the paper has not considered the implementability of labeling laws, this will be an important issue as most of the foods in the Indian market are sold unpackaged.

## REFERENCES

- Carter, C.A. and G.P. Gruere. 2003. Mandatory labeling of genetically modified food: Does it really provide consumer choice? *AgBioForum* 6 (1&2): 68-70.
- Crespi John M., and S. Marette. 2003. 'Does contain' vs. 'Does not contain': Does it matter which GMO label is used? *European Journal of Law and Economics* 16: 327-344.
- Darbi, M. R. and E. Karni. 1973. Free competition and the optimal amount of fraud. *Journal of Law and Economics* 16: 67-88.
- de Leon, A., A. Manalo, and F. C. Guilatco. 2004. The cost implications of GM food labeling in the Philippines. Manila: The Philippine Bureau of Food and Drugs.
- Desquilbet M. and D. S. Bullock. 2003. Who pays the costs of non-GMO segregation and identity preservation and who is to blame. Accessed April 2007 at <http://www.inra.fr/internet/Departements/ESR/UR/lea/seminaires/texte0203/DES02WHO.pdf>
- Gruere, G. and S. R. Rao. 2007. A review of international labeling policies of genetically modified food to evaluate India's proposed rule. *AgBioForum*, 10 (1): 51-64.
- Kalaitzandonakes, N. 2004. Regulating biotechnology: GM food labels. In *Biotechnology: Science & Society at a Crossroad*, National Agricultural Biotechnology Consortium Proceedings, Cornell University.
- Kirchhoff S. and A. Zago. 2001. A simple model of voluntary vs. mandatory labeling of GMOs. Working Paper 7/01. Rome, Italy: Istituto Nazionale di Economia Agraria.
- Harvey E. Lapan and GianCarlo Moschini. 2007. Grading, minimum quality standards, and the labeling of genetically modified products, *American Journal of Agricultural Economics*, forthcoming.
- Moschini GC. and H. E. Lapan. 2006. Labeling regulations and segregation of first- and second-generation genetically modified products: innovation incentives and welfare effects. In *Regulating agricultural biotechnology: Economics and policy*, ed. R.E. Just, J.M. Alston and D.Zilberman. New York: Springer Publishers.
- Moss, C. B., T. G. Schmitz and A. Schmitz. 2002. Differentiating GMOs and non-GMOs in a marketing channel. Department of Food and Resource Economics. Gainesville, Fl.: University of Florida. Accessed April 2007 at <http://cnas.tamu.edu/publications/powerpoint/papers/Schmitz.pdf>
- Runge C. F. and L.A. Jackson. 2000. Labelling, trade and genetically modified organisms: A proposed solution. *Journal of World Trade* 34 (1):111-122.
- Smythe S. and P. W. B. Phillips. 2000. Product differentiation alternatives: identity preservation, segregation and traceability. *AgBio Forum* 5 (2): 30-42.





## RECENT IFPRI DISCUSSION PAPERS

For earlier discussion papers, please go to [www.ifpri.org/pubs/pubs.htm#dp](http://www.ifpri.org/pubs/pubs.htm#dp).  
All discussion papers can be downloaded for free.

702. *The Bang for the Birr: Public Expenditures and Rural Welfare in Ethiopia*. Tewodaj Mogues, Gezahegn Ayele, and Zelekawork Paulos, 2007.
701. *Public Spending and Poverty Reduction in an Oil-Based Economy: The Case of Yemen*. Mohamed A. Chemingui, 2007.
700. *Integrated Management of the Blue Nile Basin in Ethiopia: Hydropower and Irrigation Modeling*. Paul J. Block, 2007.
699. *Building Public-Private Partnerships for Agricultural Innovation in Latin America*. Suresh Babu, Maria Veronica Gottret, Frank Hartwich, and Jaime Tola, 2007.
698. *Cost Implications of Agricultural Land Degradation in Ghana: An Economywide, Multimarket Model Assessment*. Xinshen Diao and Daniel B. Sarpong, 2007.
697. *Is HIV/AIDS Undermining Botswana's 'Success Story'? Implications for Development Strategy*. James Thurlow, 2007.
696. *Supermarket Purchases and the Dietary Patterns of Households in Guatemala*. Abay Asfaw, 2007.
695. *Agricultural Growth Linkages in Ethiopia: Estimates using Fixed and Flexible Price Models*. Xinshen Diao, Belay Fekadu, Steven Haggblade, Alemayehu Seyoum Teffesse, Kessu Wamisbo, and Bingxin Yu, 2007.
694. *Is the Relationship Between Aid and Economic Growth Nonlinear?*. Andros Kourtellos, Chih Ming Tan, and Xiaobo Zhang, 2007.
693. *Regional Disparities in Ghana: Policy Options and Public Investment Implications*. Ramatu M. Al-Hassan and Xinshen Diao, 2007.
692. *Innovación en el Cultivo del Maní en Bolivia: Efectos de la Interacción Social y de las Capacidades de Absorción de los Pequeños Productores*. Frank Hartwich, Tito Arispe, y Mario Monge, 2007.
691. *Marriage, Schooling, and Excess Mortality in Prime-Age Adults: Evidence from South Africa*. Futoshi Yamauchi, 2007.
690. *Renegotiating the Food Aid Convention: Background, Context, and Issues*. John Hoddinott and Marc J. Cohen, 2007.
689. *Agricultural Growth and Investment Options for Poverty Reduction in Rwanda*. Xinshen Diao, Shenggen Fan, Sam Kanyarukiga and Bingxin Yu, 2007.



**INTERNATIONAL FOOD POLICY  
RESEARCH INSTITUTE**

**[www.ifpri.org](http://www.ifpri.org)**

**IFPRI HEADQUARTERS**

2033 K Street, NW  
Washington, DC 20006-1002 USA  
Tel.: +1-202-862-5600  
Fax: +1-202-467-4439  
Email: [ifpri@cgiar.org](mailto:ifpri@cgiar.org)

**IFPRI ADDIS ABABA**

P. O. Box 5689  
Addis Ababa, Ethiopia  
Tel.: +251 11 6463215  
Fax: +251 11 6462927  
Email: [ifpri-addisababa@cgiar.org](mailto:ifpri-addisababa@cgiar.org)

**IFPRI NEW DELHI**

CG Block, NASC Complex, PUSA  
New Delhi 110-012 India  
Tel.: 91 11 2584-6565  
Fax: 91 11 2584-8008 / 2584-6572  
Email: [ifpri-newdelhi@cgiar.org](mailto:ifpri-newdelhi@cgiar.org)

