

Labels for GM Foods: What Can They Do?

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Labelling of genetically modified foods is a contentious issue and internationally there is sharp division on whether such labels ought to be mandatory. This debate has reached India where the government has proposed mandatory labels. Mandatory labelling aims to provide greater information and correspondingly more informed consumer choice. However, even without such laws, markets have incentives to supply labels. So can mandatory labelling achieve outcomes different from the voluntary type? The paper argues that this is not the case in most situations. It goes on to explore the special set of circumstances, where mandatory labels make a difference to outcomes. If these outcomes are intended, mandatory labelling is justified; otherwise not. Although the Indian context provides the motivation, the core arguments given are general and applicable to other country contexts as well.

Policies towards labelling of genetically modified (or GM) foods have varied between countries. The great divide is between the European Union (EU) that has favoured mandatory labelling and the United States (US), which has chosen not to impose such requirements. Developing countries have also been confronted with this issue. While Brazil and China have adopted mandatory labelling laws, Philippines and South Africa have pursued approaches based on voluntary labelling. In India, a recommendation from the ministry of health proposed mandatory labelling of all GM foods in 2006 at a time when no GM food crops had been permitted by regulators. Mandatory labelling became more topical when Bt brinjal, a GM plant that was approved by regulators, came up for political clearance.

Two kinds of justifications are commonly offered in favour of mandatory labelling: first, that it is necessary to warn consumers about potential health impacts and second, that such labelling is a response to a consumer's right to know and would result in greater consumer choice. We evaluate these arguments in a policy context where governments have other policy instruments as well besides mandatory labelling – namely, the specification of quality standards and laws that facilitate voluntary labelling. We will argue that labelling is not the appropriate response to concerns about health impacts and that the only legitimate argument for mandatory labelling rests on a consumer's right to know. But does mandatory labelling result in consumers receiving greater information and correspondingly more choice? And does it increase economic welfare? Who gains and who loses from such a policy? These are the questions we explore in the paper.

1 Parameters of Labelling Laws

Labelling policies can vary across countries, depending on the following parameters:

(1) Specifying what is legal: The contrast here is between mandatory labelling laws and voluntary labelling policies. The latter also require a legal framework insofar as labels are required to be truthful. Countries may also develop standards and guidelines that govern the use of voluntary labels.

(2) Scope of labelling: The mandatory labelling provision could apply to some foods or to all foods. The scope is narrowest when the labelling provision is restricted to foods with detectable levels of GM materials, whether transgenic proteins or deoxyribonucleic acid (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 labelling apply to animal feed, additives and flavours, meat and animal products fed with GM feed and to food sold in restaurants.

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(3) 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%.

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

The scope of labelling also automatically implies the verification mechanisms that need to accompany labelling. If labelling is required only for foods with detectable levels of GM ingredients, then verification of non-GM status can rely on testing of the final product for genetically modified protein or DNA. However, if labelling 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".¹ An identity preservation 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 labelling (mandatory versus voluntary), scope of labelling, the accompanying verification mechanisms (process or product), the prescribed tolerance levels and the extent of enforcement (Gruere and Rao 2007). International comparisons reveal that labelling regulations have the widest scope in the EU, 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 labelling law while the EU excludes meat and animal products. Similarly, in China, the tolerance level is 0% while it is 0.9% in EU. However, operationally, EU laws 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 south-east Asia also have mandatory labelling laws. However, they exclude processed products and their tolerance level is usually in the range of 1-5%. Canada, Argentina, South Africa, Philippines and the US have voluntary labelling laws (or draft proposals) based on product content.

Within this range of international experiences, the Indian draft law proposes mandatory labelling 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 (Bansal and Gruere 2010:31):

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 labelled, without any exceptions.

The definition of a GM food makes it clear that it includes foods that are produced from GM 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 GM grains. Hence the verification mechanism proposed is that of identity preservation. The tolerance level is not specified, which may imply a 0% 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 should also indicate that the product has been cleared for marketing and use in the country of origin.

GM labelling is meaningful only when there is certification that verifies the labelled status. This is because whether a food is GM cannot be known by visual inspection or by consuming the product. Such certification is typically costly to produce. In the generic case, a food product cannot be verified to be non-GM unless documented steps have been taken to preserve the identity of the product in the production and marketing chain.

In the usual instances that are subject to labelling requirements, labelling 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 labelling costs, as in the GM case, are non-trivial. In the next section, we describe verification mechanisms and indicate the kind of costs entailed.

2 Verification Mechanisms

Under the proposed Indian draft law, suppliers of GM food would have to label their foods accordingly. The implication is that unlabelled food is non-GM. Suppliers of unlabelled foods would therefore have to supply documentation to support the claim that their product is non-GM. 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 they are inexpensive.

DNA-based methods 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, 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. PCRs 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 PCRs, reduce the amplification process and therefore may prevent detection of GM ingredients. These include calcium, iron and trace heavy metals, carbohydrates, tannins, phenolics, and salts. The fourth challenge is 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% than at 1%.

An instance of the difficulties in detecting GM ingredients obtains in 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 between soy oil from GM soybean and soy oil from non-GM beans.

The only way this distinction can be maintained is by constructing separate production and marketing channels for the two oils so that their identity is preserved up to the time the oils reach 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 distances. These 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. These processes would have to be capable of verification. Thus there is a need for appropriate documentation of the separate market channels and the movement of the product through them.

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 non-GM status would be to physically separate them from GM grain in production, transport and storage.

The major costs of GM labelling arise from identity preservation and associated segregation systems. As discussed earlier, the cost would be borne by the supplier of the non-GM 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 identity preservation 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).² Another instance where GM producers incur identity preservation costs is in the EU which mandates that GM products must be traceable, i.e., all handlers of GM products must be able to identify their suppliers and the firms to which their products have been supplied (Directorate-General for Health and Consumer Protection 2007).

Some estimates are available of identity preservation costs in the US and other developed countries. Moss, Schmitz and Schmitz (2002) compiled identity preservation costs from various studies completed up till 2000. Most of these computations are from identity preservation costs in the marketing channel and ignore separation costs at the farm level. For an average grain price of \$2 per

bushel, the numbers in their paper indicate identity preservation costs in the range of 8 to 16% of the product price. In the only study of a developing country, de Leon, Manalo and Guilatco (2004) estimate that identity preservation costs due to mandatory labelling would lead to an increase of 11-12% in total costs in the food trade and processing sector in the Philippines. There are other estimates 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.

3 Quality Standards and Labelling

It is important to distinguish labelling 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, governments prescribe 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.³ These apply mandatorily to all companies in this line of activity.

Although labelling 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 behalf of consumers regarding what products will be available in the market.

Labelling, 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 labelling, 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 labelled characteristics. Thus, for instance, consider a law that requires labelling of 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 for the risk. Nor is the association between cholesterol and health status reasonably uniform across all individuals. On the other hand, if consumers are informed about the scientific evidence, they can make their own decisions, provided they receive enough information about cholesterol levels in their food purchases.

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 decision can differ between governments and over time as well. For instance, recently the US state of New York banned the use of partially hydrogenated oils in restaurants, instead of merely requiring that restaurants signal its use.

4 Can Mandatory Labelling Make a Difference?

The case for mandatory labelling 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 does not constitute valid grounds for mandatory labelling. 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 labelling 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. Due to lack of data, this claim cannot be confirmed or refuted by scientific evidence. However, as consumers may nonetheless form preferences based on these unknown impacts, mandatory labelling 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 labelling could be advanced as a reason to inform consumer choices.

This suggests that the basic purposes of introducing mandatory labelling are the twin objectives of providing information and greater consumer choice. A common argument for mandatory labelling that illustrates these supposed impacts is the following. In the absence of labelling, consumers cannot distinguish between GM and non-GM 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 labelling informs these consumers, and they are accordingly able to shift their demand to non-GM foods, which therefore results in the supply of these foods to meet their preferences. Thus, in the absence of mandatory labelling, consumers have no choice but to consume GM foods. On the other hand, mandatory labelling results in provision of both GM and non-GM foods, and the consumer has the choice of consuming either according to her or his preferences.

While the argument is seemingly reasonable, it is incomplete because a complete justification of mandatory labelling must include a demonstration that the market on its own would fail to provide the information and choice that mandatory labelling can offer. It is not the case that the market outcome involves no labelling at all. Product differentiation with voluntary labelling is a normal market response to varying consumer preferences. Therefore, mandatory labelling case would have to be compared with voluntary labelling, rather than the no-labelling case. For instance, in North America, which does not have a mandatory labelling law, there is considerable voluntary labelling accompanied by identity preservation 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 labelling be needed?

It should be recognised that the form of mandatory and voluntary labels would almost certainly differ. Mandatory labelling requires the GM food to be labelled. By implication, the unlabelled food is non-GM. Voluntary labels are unlikely to be of this nature. In this paper, we assume non-GM products would command a premium over GM products (at least for the first generation of GM foods which involve no significant benefits to the consumer). If this premium is sufficiently high, it would be in the interest of non-GM food suppliers to label their food accordingly and to differentiate themselves from GM foods. The onus is on the producer who claims non-GM status to be able to prove it. By implication, the unlabelled food does not claim to be non-GM and is not so. Suppliers of GM foods, therefore, do not incur the costs of segregation and identity preservation.⁴

This remains true even under mandatory labelling where it is the GM food that is required to be labelled. The legal obligation of the GM food producer ends with applying a label. On the other hand, compliance with labelling laws will require that an unlabelled food is non-GM. This means the suppliers of these foods have to invest in segregation and identity preservation systems to make sure they do not have to label their foods with the GM tag. The GM food producer does not need to incur these expenses except only to ensure that their handling does not contaminate the processing by non-GM suppliers.⁵ An exception to this occurs if traceability is also imposed on GM foods. An instance of this is the EU regulation which requires GM suppliers to trace the GM food back to the farm.⁶ The Indian draft law does not require traceability.

Provision of GM and non-GM foods, however, with either voluntary or mandatory labels, requires segregation of products and marketing channels. Typically, there are fixed costs associated with such logistics and marketing infrastructure which means that segregation will happen only if there is a critical minimum market size for the higher priced non-GM product. Therefore, if the segment of consumers willing to pay more for the non-GM variant is sufficiently large, so that it is profitable to differentiate products, then producers on their own would supply both variants of the product to the market with identity preservation. Mandatory labelling would not result in additional benefits.

Consider the other situation, where the market size for the non-GM variant is small and not viable for segregation. In the absence of mandatory labelling, the non-GM food would not be supplied. But the introduction of mandatory labelling would not change the economics of private suppliers. As the market size for non-GM foods remains small, only the GM variant would be supplied to the market and producers would not bother to identity preserve the non-GM foods. The only difference from the benchmark case would be that while earlier products were not labelled, they would now be labelled under the mandatory provision as containing GM ingredients. Thus, the labelling policy does not change consumer choices but provides information that is redundant. There is no addition to social benefit, but possibly some increase in administrative costs.

We now consider an alternative scenario, where some producers have a cost advantage in producing GM foods depending on

geographical or technical factors, but others do not have such an advantage. The latter would produce traditional non-GM foods. In the benchmark case of voluntary labelling, 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 unlabelled form. In this case, there would be some probability that the food would contain GM ingredients.

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

In sum, in all these cases, mandatory labelling would make no difference to consumer choice or useful information provision to consumers. In the instances where mandatory labelling would result in labelled non-GM products, voluntary labelling would result in the same outcome. Thus, the policy is redundant as there is no market failure that can be addressed by mandatory labelling. The point is that product segregation and labelling 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.⁷

5 The Government Role in Voluntary Labelling

The redundancy of mandatory labelling does not mean that the government does not have a role to play. Consumer concerns can be met by voluntary labelling only if labelling 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 labelling, 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 labelling 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 costs of certification for entry into the segment of certified foods too forbidding. 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 US, the EU and Japan have comprehensive legislation to define organic standards, and certification agencies (public or private) have to comply with them. In countries without such laws (such as Canada and India), government guidelines for organic standards may exist but are not binding. Private firms and non-profit organisations 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 a 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.

6 When Can Mandatory Labelling Make a Difference?

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

The assumption underlying the analysis in that section was that consumer preferences are stable. What that means is that consumer preferences between GM and non-GM 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 4 argued that mandatory labelling is redundant.

But suppose this assumption is not true. In particular, suppose there are consumers who are indifferent between GM and non-GM foods, but who shift their preference to non-GM foods 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.⁸ When products are not labelled, these label-sensitive consumers are indifferent between GM and non-GM foods. However, once the product is labelled, the consumers switch decisively to non-GM food. If the fixed costs of segregation systems are large enough, then non-GM foods may not be labelled differently from GM foods under voluntary labelling, but will be distinguished under mandatory labelling.

Consider the following illustrative example to clarify the logic. An economy consists of three types of consumers. Suppose for a given relative price configuration for non-GM and GM foods, α proportion of consumers purchase GM products, γ proportion of consumers purchase only non-GM food while β proportion of consumers are label-sensitive and consume GM products as long as there is no labelling, but switch to non-GM products when there is labelling.

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, the same regardless of whether the product is GM or non-GM.⁹ However, provision of two marketing channels with identity preservation requires a fixed cost k . Consider first the case where there is no mandatory labelling.

The firm has the choice of supplying either unlabelled or labelled food. The firm's profit from supplying unlabelled GM products is

$(\alpha + \beta)r$, as γ consumers will decline 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 αr as β consumers defect to non-GM food. The profits from supplying non-GM 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 labelling are high enough such that $k \geq \gamma r$.

Now suppose mandatory labelling is in place. The firm has a choice of supplying both types of food or it can supply GM food alone.¹⁰ Once again, profits from supplying both GM and non-GM food are $(\alpha + \beta + \gamma)r - k$. However, profits from supplying GM food alone falls to αr as mandatory labelling leads β consumers to switch to non-GM 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 non-GM foods would not be supplied without mandatory labelling. It is immediately seen that if β increases for given γ and k , the above condition is more likely to be satisfied. By the same argument, it is less likely to be satisfied if β falls. Also note that since the sum of α , β and γ is 1, the effect of an increase in α (for given γ and k) is exactly the same as that of a fall in β .

Let us now look at the effect of a rise in γ . If γ rises with a corresponding fall in α , the chances of labelled non-GM products being supplied increase both under voluntary and mandatory labelling policies. If, however, γ rises at the expense of β , there is no change in the condition determining supply of both products under mandatory labelling but likelihood of supply of labelled non-GM product increases under voluntary labelling.

This example has been deliberately constructed to be simple. It can be generalised in several respects. The critical assumptions are the existence of label-sensitive consumers and the presence of fixed costs.¹¹ Without either of these features, mandatory labelling will not result in outcomes any different from voluntary labelling.

In the case when mandatory labelling with label-sensitive consumers results in a different outcome, the outcomes with and without labelling 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 so that food purchases shift from GM to non-GM products, then it can justify mandatory labelling.¹² But if it wishes labelling to be neutral between these products, then mandatory labelling is not justified.

In the scenario where fixed costs are sufficiently small, i.e., $k < \gamma r$, the labelling policy does not affect economic welfare because the market outcome remains the same under both mandatory as well as voluntary labelling. Both variants are supplied in the market with identity preservation. Similarly, in a scenario where the fixed costs are sufficiently large ($k > r$), the labelling policy does not affect economic welfare. Only the GM variant is supplied under both the policies. The labelling policy, however, has welfare implications in the intermediate scenario, i.e., when $(\beta + \gamma)r > k \geq \gamma r$.

Let us now address the question of who benefits from the mandatory labelling policy. It turns out that the γ consumers, who want to consume only non-GM free products benefit from the mandatory labelling policy as they are able to exercise the greater

choice made possible by it. All α consumers anyway do not care about the status of GM products. The welfare implications for the label-sensitive consumers cannot be evaluated.

7 Summary and Concluding Remarks

India is considering a labelling policy for GM foods. The health ministry has proposed the use of mandatory labels on GM foods.¹³ While international approaches are varied, the Indian proposal if accepted would make Indian laws the most stringent globally.

We consider two arguments for mandatory labelling. First is the case when mandatory labelling 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 labelling 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 future health impacts that are not detectable at present. For any of these reasons, these consumers would like to know what they are consuming. Is mandatory labelling required for this purpose?

In this paper, we argued that the counterfactual to mandatory labelling is not the absence of labelling but voluntary labelling. Under standard assumptions, mandatory labelling achieves nothing beyond what is accomplished by voluntary labelling. Typically, GM food labelling is not costless because it involves setting up segregation systems. If, as is likely, there are fixed costs to putting segregation systems into place, then such segregation would take place voluntarily if there is a critical mass of consumers who would like to consume only non-GM foods. If the market size of non-GM foods is not large enough, then voluntary segregation would not take place and non-GM foods would not be supplied. Neither of these outcomes can change with mandatory labelling. The policy is redundant.

In other words, the right to know argument can be addressed just as well by voluntary labelling. It should be noted that labelling, 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 non-GM 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 labelling or mandatory labelling.

If mandatory labelling has no impact, why are such policies so contentious? This is possibly because the parties to this debate realise that a label not only provides information but may also be a signal to some consumers to change preferences towards the unlabelled food, namely non-GM foods. In such a scenario, the paper shows that mandatory labelling does achieve something beyond voluntary labelling and leads to a greater market share for non-GM foods.

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 labelling could be a way of influencing consumption away from imports and protecting domestic producers. The mandatory labelling policy could also be seen as a substitute for a lack of infrastructure for screening GM food imports.

To take a concrete example, consider the case of Bt brinjal which was approved for commercial release by regulators in October 2009 but was subsequently subjected to a moratorium by the ministry of environment and forests. If it had been approved, it would have been the first GM food crop in Indian markets. What would have been the consequences of mandatory labelling for Bt brinjal?

Vegetables in India are largely sold in the informal market in an unpackaged form. Less than 1% of the total produce is sold through organised retail. Like other vegetables, brinjal does not go through mechanised processing before reaching the final consumers. The entire handling of the crop is in the unorganised sector. How could such producers comply with segregation systems? This would pose serious challenges for the implementation of the proposed GM labelling requirement.

Abstracting from implementation issues, suppliers would have to make a choice about whether to segregate the two variants (Bt and non-Bt) and supply them to the final consumers with identity preservation or supply brinjal in a commingled form, labelled as GM. Three scenarios can be conceived of. In the first scenario, where the market for non-GM brinjal is sufficiently large that even without a mandatory labelling policy, both variants are supplied with identity preservation. In the second scenario, even after the introduction of mandatory labelling, the market size for the non-GM variant remains small and unviable and therefore, only commingled brinjal is sold in the market. In the third scenario, the market size for the non-GM variant is small but the introduction of mandatory

labelling policy enlarges the market size and makes its supply viable due to some shift in consumer demand to non-Bt brinjal.¹⁴

The introduction of mandatory labelling policy would not affect the market outcome and thus economic welfare in the first and second scenarios. In the third scenario, however, the market outcome would change as a result of mandatory labelling policy. Who benefits from this policy? The consumers who continue to buy GM (or commingled GM) are similarly placed under both voluntary and mandatory labelling, and therefore, there is no welfare gain for them. It is the consumers who prefer non-GM brinjal who gain as this variety would not be supplied in the absence of mandatory labelling. These would typically be the consumers who belong to the upper income groups and buy their vegetables in upmarket stores. Only specialised stores will be able to provide credible certified non-GM brinjals. In addition, there could be second order effects through changes in prices. If prices for the commingled GM brinjals increase due to the segregation process, then this would adversely affect the consumers of (cheaper) GM brinjals.

Finally, a word on what may cause label sensitivity. Each product has many quality attributes. If one of these attributes is identified by the government and information on it is mandated by law, consumers might perceive it as a subtle signal or warning from the government to be cautious about it and switch preferences. Thus the mandatory labelling policy may have a strategic dimension not recognised in the previous literature.

NOTES

- 1 Even where product testing is feasible, companies may still follow identity preservation (also called IP) to make sure the final product measures up to the advertised claim regarding its source of ingredients.
- 2 The monitoring of Starlink gene in US corn exports is done under a joint plan of the US Department of Agriculture and Japan's health ministry (Segarra and Rawson 2001).
- 3 Accessed 10 June 2010: <http://mofpi.nic.in/images/File/FICCI%20Data/Indian%20Food%20Laws/Fruit%20Products%20Order,%201%20955.pdf>
- 4 This is recognised in Moschini and Lapan (2006) and Lapan and Moschini (2007).
- 5 It can also be seen that if there was no additional cost of declaring oneself to be a non-GM producer, then GM suppliers would also label their foods as non-GM and earn the non-GM price premium.
- 6 The traceability requirement need not be tied to labelling. An example of this is meat products in the EU, which are subject to traceability but not labelling. We thank Guillaume Gruere for bringing this to our attention.
- 7 It should be noted that we have assumed that firms possess knowledge about consumer preferences and their aversion to GM foods. If this is not true, mandatory labelling could have impacts not realised 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.
- 8 One scenario where labels could change preferences occurs if labelling enables anti-GM non-governmental organisations (NGOs) to mount effective advertising and media campaigns against GM foods.
- 9 The parameter r can also be thought of as price mark-up over per unit variable cost.
- 10 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 non-GM food will never be exercised.

- 11 Bansal, Chakravarty and Ramaswami (2010) conducted experiments where consumers were endowed with money and they bid for GM and non-GM foods. In their sample of university students and faculty in New Delhi, label-sensitive consumers were estimated to be 11% of the population. These consumers were identified by their responses to probabilistic information and to labels.
- 12 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 labelling.
- 13 These proposals were meant as amendments to the Prevention of Food Adulteration Act. Under the Food Safety and Standards Act of 2006, a new agency called the Food Safety and Standards Authority has been created which is empowered to issue orders and notifications encompassing the earlier laws of the subject. It is this agency which has to now decide the labelling policy for GM foods.
- 14 Another possible scenario is where farmers do not adopt Bt technology and only traditional brinjal is sold in the market. The labelling policy does not affect welfare in this case.

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