Effects of a Home-Country Process Standard in the Case of GM Products

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Roadmap

- What are GMOs?
- Science, Trans-Science, and Policy Behind GMOs
- GMOs and Trans-Atlantic Divide
- How Can Economics Contribute to the Debate?
- An International Trade Model Under the Assumption of a Home Country Process (GMO) Standard
- Conclusions and Implications

What are GMOs?

- The World Health Organization (WHO, 2002) defines genetically modified organisms (GMOs) as those organisms in which the genetic material has been altered in a way that does not occur naturally.

- The safety assessment of GM foods should investigate (WHO, 2002):

  a) toxicity,

  b) allergenicity,

  c) specific components thought to have nutritional or toxic properties,

  d) stability of the inserted gene,

  e) nutritional effects associated with genetic modification, and

  f) any unintended effects which could result from the gene insertion.

GM Foods – No Risk to Human Health?

- According to the information reported by the WHO (2014), the GM products that are currently on the international market have all passed risk assessments conducted by national authorities.

- Great! We are safe!

- But, is that what GMO science tells us?

The Ambiguous Science of GMOs

- After reviewing scientific information concerning the potential toxicity of GM/transgenic plants using the Medline database and including studies about the safety of the potential use of potatoes, corn, soybeans, rice, cucumber, tomatoes, sweet pepper, peas, and canola plants for food and feed, the number of references was surprisingly limited. (e.g., Domingo, 2007; Filip et al., 2004)

- The following question can be raised: where is the scientific evidence showing that GM plants/food are toxicologically safe?

- More recent “safety evidence” is even more troubling!

The Ambiguous Science of GMOs

- (Séralini et al., 2013, p. 476):

  “Our recent work (Séralini et al., 2012) remains to date the most detailed study involving the life-long consumption of an agricultural genetically modified organism (GMO). This is true especially for NK603 maize for which only a 90-day test for commercial release was previously conducted using the same rat strain (Hammond et al., 2004). It is also the first long term detailed research on mammals exposed to a highly diluted pesticide in its total formulation with adjuvants. This may explain why 75% of our first criticisms arising within a week, among publishing authors, come from plant biologists, some developing patents on GMOs, even if it was a toxicological paper on mammals, and from Monsanto Company who owns both the NK603 GM maize and Roundup herbicide (R).

The Ambiguous Science of GMOs

(Séralini et al., 2013, p. 476, continued):

> "…Our study has limits like any one, and here we carefully answer to all criticisms from agencies, consultants and scientists, that were sent to the Editor or to ourselves. At this level, a full debate is biased if the toxicity tests on mammals of NK603 and R obtained by Monsanto Company remain confidential and thus unavailable in an electronic format for the whole scientific community to conduct independent scrutiny of the raw data. In our article, the conclusions of long-term NK603 and Roundup toxicities came from the statistically highly discriminant findings at the biochemical level in treated groups in comparison to controls, because these findings do correspond in an blinded analysis to the pathologies observed in organs, that were in turn linked to the deaths by anatomopathologists. GM NK603 and R cannot be regarded as safe to date."

Trans-Science

- It seems that the results of the GMO research are insufficient and ambiguous making this one of the trans-science issues.

- Weinberg (1972) defined trans-science questions as ‘questions which can be asked of science and yet which cannot be answered by science’, although ‘they are, epistemologically speaking, questions of fact . . .’

- Since the time Weinberg (1972) introduced the term trans-science, we have come to view the interface between science and regulation as part fact, part policy and part decision making. (Miljkovic, 2005)

Trans-Science

- The factual aspect derives from scientific evidence, which makes some policies more reasonable than others and some decisions more effective or more efficient than others.

- The policy aspect is reflected in the determination to base decisions on the best available scientific evidence, but to bridge any remaining gaps in our scientific knowledge with default inference rules based on non-scientific considerations.

- The decisional aspect stems from the responsibility of the regulatory government to act expeditiously, often despite the fact that our scientific knowledge of consequences is incomplete and our policies are vague and conflicting.

The Transatlantic Divergence over the GMOs

- One of the world's strongest and fastest growing sectors—the biotech industry—has seemingly been without influence in the EU's efforts to regulate GMOs. Why?

- Possible explanations:
  - internal unity;
  - access to decision-making;
  - strength of counterbalancing forces;
  - prevalent cultural values and identity-related public concerns regarding food and agriculture.

- The role of biotech industry in regulating GMOs in the US considerably different

GMOs in International Trade: A Challenge

Notice:

- (a) There may or may not be actual health externality present due to GM foods consumption based on inconclusive scientific evidence, i.e., it may not be measured in certain scientific terms but its presence cannot be disproved with certainty either.
- (b) the perception among the consumers in the importing country that GM food represents potential health hazard is real; thus the presence of externality is real as well; hence the need for its suitable regulation.

Theoretical Model of Trade with a Cross-Border Externality

- A GMO product and its counterpart non-GMO product are considered to be like products as defined by WTO. Note: this is not the case currently, but more conclusive and transparent science may allow for this scenario in the future.
- In a two country model, the exporter, or foreign country, produces the GMO variety while the importer, or home country, produces only non-GMO variety.
- Although classified as like products, the GMO variety has an externality (denoted by *m*), be it excessive presence of a toxin, relative to non-GMO variety.
- Several scenarios are considered. Objectives: maximize foreign- and home-country welfare.

Theoretical Model of Trade with a Cross-Border Externality

- GMO and non-GMO products are treated as a “like product,” which is defined, based on the WTO standard, as: “… a product which is identical, i.e. alike in all respects to the product under consideration, or in the absence of such a product, another product which, although not alike in all respects, has characteristics closely resembling those of the product under consideration.” (AD Agreement, Art. 2.6; SCM Agreement, Art. 15.1, fn. 46.)

Case (a): No Free Trade Agreement

- A tariff on imports of the GMO good produced by the offending country will be nationally optimal.
- No other feasible policy, such as a consumption tax, will be superior to a discriminatory tariff, given this extraterritoriality (Markusen, 1975).
- Issues:
  - Justification for a tariff reinforces the familiar, beggar-thy-neighbor motive for trade restriction, i.e. the non-cooperative trade-policy equilibrium is affected by the presence of the externality.
  - It is no longer clear that bilateral or multilateral trade liberalization is an appropriate goal of international negotiations, as the externality is to some degree regulated by the trade barriers.
  - Possible outcome: some new policy instrument, directed at the externality, may have to be introduced in order to guarantee welfare gains from trade liberalization.

Case (b): Free Trade Agreement-The Foreign Country Actions

- The externality, e.g., the level of some toxin found in GM food, produced per unit of the good can be reduced by some new toxin-reducing health-conscientious technology to a level m, where $m \leq \underline{m}$.
- The reduction per unit of production would be ($\underline{m}$ - m). While costs are assumed increasing in the level of toxin reduction ($\underline{m}$ - m), they are linear in the quantity of the good produced, holding constant the toxicity rate, m. Therefore we are assuming that there are no economies of scale in toxin reduction.
- A firm producing x units of output will therefore spend c(m)x on health improvement via toxin reduction.
- The firm can be induced to reduce its health damaging practices either through a tax on the externality or by a subsidy on health improvement expenditures. We consider the case of tax in here since production and welfare outcomes are same in both cases.

Case (b): Free Trade Agreement-The Foreign Country Actions

- Maximizing foreign welfare through the choice of the optimal GMO tax

yields an implicit expression for e*:

$$e^*m^* = \{B - \rho(e^*)\}\{A - c(m^*)\}/1 + B - \rho(e^*), \qquad (7)$$

where $m^* = m(e^*)$ and $\rho(e)$ is the elasticity of response in toxin level reduction level m with respect to changes in the rate of externality tax e

Case (b): Implications

- First, e* does not generally coincide with the world optimum level of tax (e* = 1). This is because the foreign country is not imposing the GMO tax in order to suppress the production of a harmful food(s), but is doing so for the purely selfish motive of exploiting its monopoly power in trade.

- Second, em(e) is the effective export tax arising from the use of the GMO tax. The optimal level (from equation (7)) is lower than the export tax that the foreign country would unilaterally impose (demonstrated in the paper).

- Third, trade liberalization is likely to lead to an increase in foreign country's ability to further manipulate terms of trade in its own favor via introduction of the GMO tax.

- The outcome for the home country is that, under a free-trade agreement, it has lost any influence over the level of the externality (e.g., toxicity), through relinquishing its import tariff, as well as having no means of retaliating against the behavior of the foreign country.

Case (c): **Model of a Home-Country Process Standard with a Free-Trade Agreement**

- A process standard is imposed by the home country on goods sold on its domestic market.
- Rationale: Designed to moderate the fears of the health lobby but could also satisfy to some extent protectionists too.
- Assumption: The process standard takes the form of an upper bound on the level of externality (e.g., toxicity) produced per unit of the good manufactured.
- Assumption: The government of H can determine which products exceed this limit and prevent them from entering the country, while goods that satisfy the standard are imported without further restriction.

Case (c): **Model of a Home-Country Process Standard with a Free-Trade Agreement**

- Let z denote the process standard, in which GM commodities meeting this standard

involve per-unit production of the externality that is no greater than this limit.

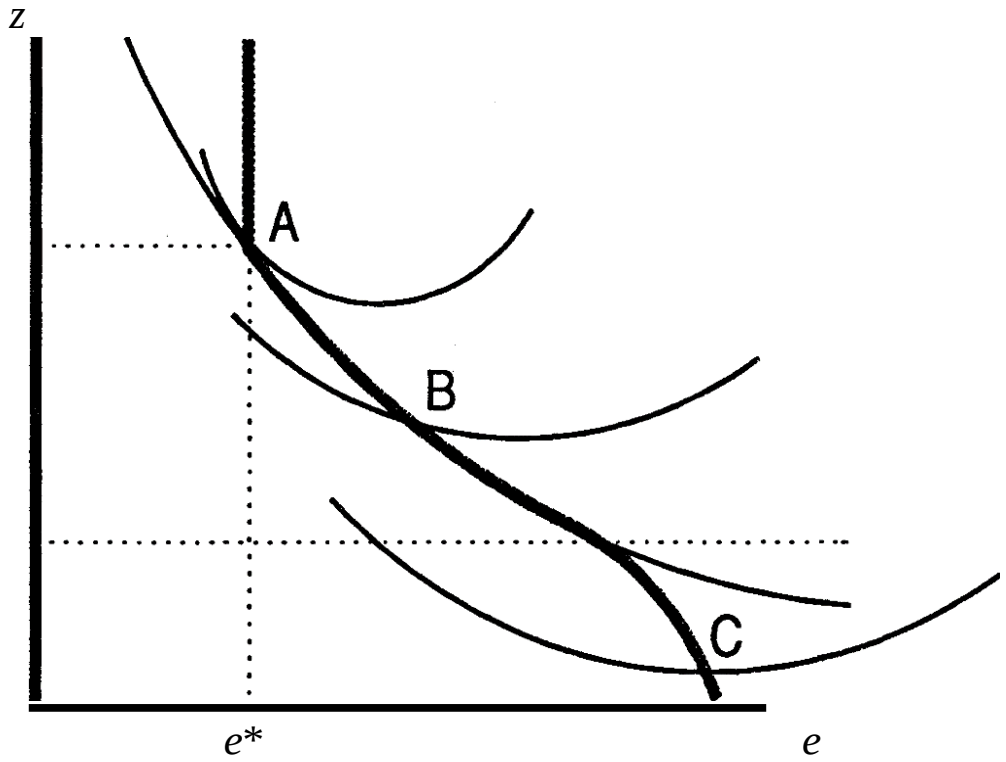
- Three cases:
  - (1) Process standards above m* will not be binding. This is because the unconstrained optimal GMO tax e* induces firms to choose m*, which more than satisfies the process standard. This is represented by point A in figure 1. Hence, if we let e(z) denote the best response of the foreign country to process standard z, then e(z) = e*, for all z > m*. In other words, when the home country introduces an ineffectual policy, F's best response is to ignore it and continue to follow what continues to be its optimal tax policy.

Case (c): **Model of a Home-Country Process Standard with a Free-Trade Agreement**

- For process standards tighter than m*, that is, z < m*, there are two possibilities.
  - (2) The foreign country can choose an externality tax that will induce exactly the same level of m as z. It chooses e(z) so that m(e(z)) = z. Such a choice is represented by point B in figure 1.
  - (3) If foreign country chooses its GMO tax so that it has no effect on firms' choices of m, it is essentially using the externality tax solely as a trade-policy instrument. Its optimal choice, in this case, is to set e such that e(z) is equal to its optimal export tax which is represented by point C in figure 1.
  - Given the continuity of the welfare functions, this implies that for some (perhaps small) range of process standards, F will choose a tax that induces exactly the standard imposed by H.

Case (c): **Model of a Home-Country Process Standard with a Free-Trade Agreement**

Figure 1

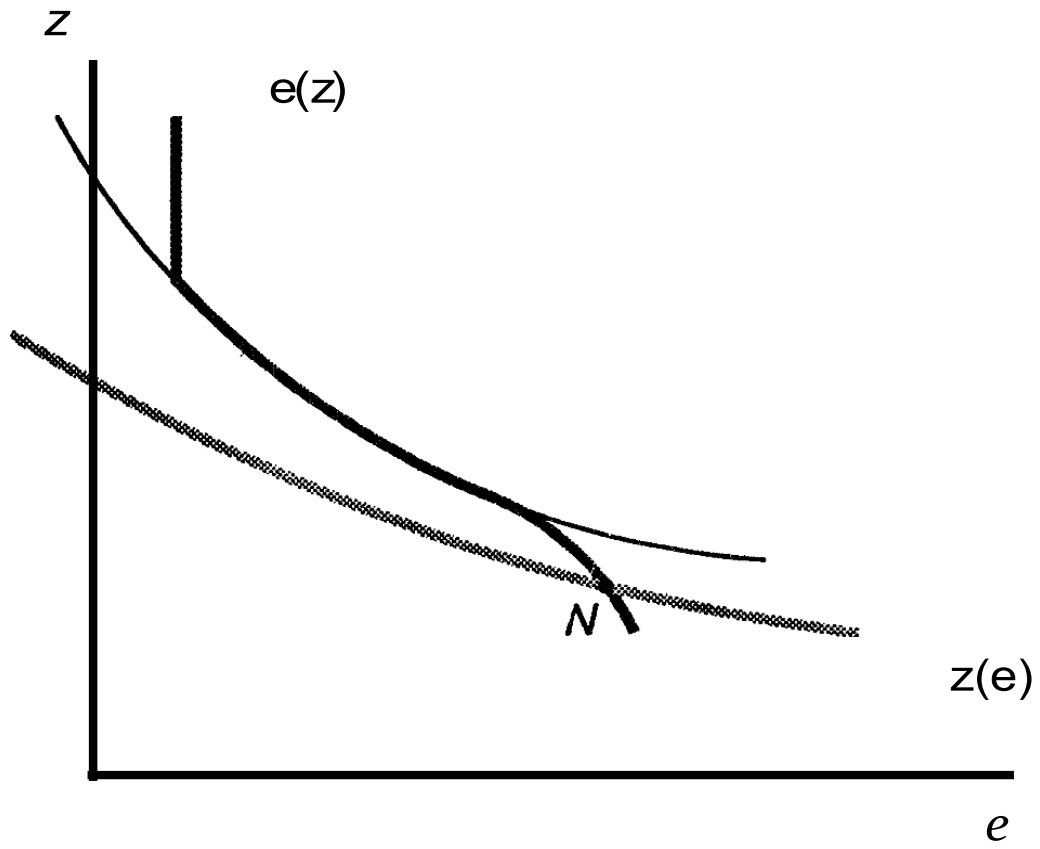


Combining Home Country Process Standard and Foreign Country GMO/Externality Tax

- The best-response GMO tax of foreign country is represented by the three line segments shown in Figure 2 as e(z).
- The home country's best-response process standard is shown on figure 2 as the locus z(e).
- The Nash equilibrium N is at the intersection of e(z) and z(e). It can be shown that the Nash-equilibrium GMO tax is strictly greater than unity, the rate in the world optimum. Thus we have the somewhat ironic result that competition between countries in controlling toxicity leads to more restrictive measures than they would choose cooperatively.

Combining Home Country Process Standard and Foreign Country GMO/Externality Tax

Figure 2



Conclusions and Implications

- A GMO product and its counterpart non-GMO product are considered to be like products as defined by WTO. Although classified as like products, the GMO variety has an externality, be it excessive presence of a toxin, relative to non-GMO variety.
- In a two country model, the exporter, or foreign country, produces the GMO variety while the importer, or home country, produces only non-GMO variety.
- Several scenarios are considered.

Conclusions and Implications

- First, when no free trade agreement is in place between two countries or regions, they are free to use whatever trade policies in their disposal.
- A tariff on imports of the GMO good produced by the offending country will be nationally optimal.
  - It is then unclear in the presence of this health/GMO externality that bilateral or multilateral trade liberalization is an appropriate goal of international negotiations, as the externality is to some degree regulated by the trade barriers.

Conclusions and Implications

- If a free trade agreement is introduced irrespective of recognizing the presence of a GMO externality, both countries will try to manipulate their terms of trade via non-trade policies since the agreement prevents them to import first best import tariff or export tax policy.

- Foreign country's second best policy is to impose a GMO tax, but is doing so not for altruistic reasons but for the purely selfish motive of exploiting its monopoly power in trade.

- Home country would be best served if introducing a process standard that takes form of an upper bound on the level of externality (e.g., toxin) produced per unit of the manufactured good.

- Given that a non-cooperative game is assumed here, competition between countries in controlling toxicity leads, ironically, to more restrictive measures than they would choose cooperatively.

Conclusions and Implications

- Our assumptions may or may not be realistic given current “binary” mindset among different nations: GM foods are either completely safe or extremely detrimental to humans and animals.

- However it is possible, if not likely, that more transparent science behind key parameters of safety of GMOs would lend us in a situation similar to one described in this paper where GMO and non-GMO product could be recognized as like products with some identifiable externality being present in GMO product and as such subject to non-trade type of policy.