WHY ARE US AND EU POLICIES TOWARD GMOs SO DIFFERENT?

Lee Ann Jackson and Kym Anderson

leeann.jackson@adelaide.edu.au
kym.anderson@adelaide.edu.au
Centre for International Economic Studies
University of Adelaide
Adelaide SA 5005
Australia

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ABSTRACT

The development of genetically modified (GM) agricultural products requires new policies to manage potential food safety and environmental risks. The policy positions taken to date on GM foods by the United States and the European Union are very different. The US has few restrictions on production and trade in GM food products and no costly labelling requirements, whereas the EU has close to a ban on the production and importation of GM foods. This paper seeks to explain (a) why both the US and EU policies are extreme in the light of the uncertainty about the risks associated with GM foods, (b) what their consequences are for income distribution and trade in farm products, and (c) what it means for the GM policies and economic welfare of people in other (particularly developing) countries. In this paper we use the GTAP global economy wide model to estimate the extent of the trade, national welfare and income distributional effects of the actual policy choices of the US and the EU as compared with what they would be if GM products were adopted with less-distortionary GM policies. The distributional effects are used to also shed light on why the US and EU have adopted such different sub-optimal GM policies.

Keywords: genetically modified crops, trade barriers, productivity growth, political economy of agricultural protection

JEL codes:

Contact author:
Lee Ann Jackson
Centre for International Economic Studies
University of Adelaide
Adelaide SA 5005
Australia

Phone +61 8 8303 4927
Fax +61 8 8223 1460
leeann.jackson@adelaide.edu.au

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The development of genetically modified (GM) agricultural products is bringing new dimensions to global science and technology policy, international standards setting, and global trade policy. Some groups believe GM products require new types of oversight to reduce potential environmental and food safety risks associated with their production and/or consumption, including restrictions on their international trade. Yet other groups who believe that environmental and food safety risks are low criticize policies that reduce trade in these products for being very costly and perhaps illegal.[1] Reconciling those groups' differing viewpoints in international fora is essential if the full global benefits from creating and adopting the new technologies and thereby lowering food costs are to be reaped without incurring excessive environmental and food safety risks.

The European Union and the United States have very different policy positions regarding the production, use and trade of agricultural biotechnology products. The EU has imposed a moratorium on the import and introduction of these products because it claims these products represent undetermined risks to the food safety and environmental health of member countries.[2] In contrast, the US has widely adopted GM crops following their first approval in the mid-1990s. In the US consumer resistance to these crops has developed only gradually and remains much lower than in the EU.

While the US and EU GM regulatory policies differ dramatically, they have similar impacts on domestic farmers. In the case of the US, farmers are already supported in numerous ways such as via production and export subsidies, and the present stance of minimalist regulation of GM production and consumption simply adds to that economic support through not raising costs of production and marketing or lowering consumer demand. In the EU the situation is slightly more complicated. Certainly a ban on GM production prevents EU farmers from taking advantage of the new technology. But if the technology would always be of less advantage to those farmers on their small farms and in close proximity to populations concerned about the natural environment, they would find it difficult to catch up with adoption in less-densely populated countries, particularly the US. In that case, a ban on imports of soybean and maize from countries using GM technology has the prospect of providing EU farmers economic protection from import competition that may more than offset any potential extra profit from being able to adopt GM technology.

Labelling has been proposed as a possible solution to the impasse between these two regulatory approaches. Economists argue that labels efficiently address the imbalance between information controlled by producers and information desired by consumers. In

[1] Trade restrictions are costly not only for the usual comparative static reasons but also because they reduce the incentive to produce and exploit new biotechnologies; and they may be illegal to the extent that they contravene international trade agreements, most notably under the WTO.

[2] In October 2002 the European Union adopted tough regulations on authorising imports of new GM crops. However, EU member country governments are unlikely to support new crop approvals without additional rules requiring identity preservation of GM products (Financial Times 2002).

theory, if products that contain GM content are labelled as such, those consumers that are averse to GM technologies can avoid them while consumers who are close to indifferent will base their consumption more on relative prices than GM content.

The purpose of this paper is to disentangle the various incentives that exist within national economies to accept or reject the import of GM products. The results reported here are based on simulations using the GTAP model (see Hertel 1997 for a complete description of this model). The GTAP model provides information on the economic implications of productivity increases, import bans and labelling regulations. The results from these simulations are used to estimate distributional impacts within the EU and US economies. As explained in the first section, this is a necessary first step for understanding the political economy of GM policy choices. The next section provides details of the GTAP policy simulations, including structural changes to the model and assumptions made for three policy simulations. The following section uses a political economic approach to interpret simulation results and to analyse national regulatory incentives. The paper concludes with a discussion of the implications of these policy incentives for global trade in GM products.

The standard theory

GM food crops pose two separate types of risks. First, the production of these crops may alter the healthy functioning of natural ecosystems, for example by generating negative externalities in the form of increased pesticide resistance. They may also may cross-pollinate with neighbouring conventional or organic crops, making it difficult for producers of non-GM crops to claim their product is GM-free. Second, because these products contain new combinations of genes, they may also present new types of food safety risks for consumers, including through the introduction of allergenic material. Those who perceive these products to be radically different from traditional products prefer to avoid consuming them.

Even if a private-sector Coasian solution between the parties cannot be reached, the theory of regulation suggests efficient ways to address these concerns. In the case of negative production externalities, the introduction of an appropriate tax could be devised to encourage producers to constrain their production to the socially optimal level (Baumol and Oates 1988). On the consumption side, the primary concern is that consumers do not have full information about the content of the goods they are consuming. The GM content of a product can be thought of as a credence characteristic – a characteristic that consumers cannot perceive directly though taste, smell or touch (Nelson 1970). Labelling systems, through providing information to consumers on these types of credence characteristics, provide an efficient way to address the problem of insufficient information.

Regulatory regimes in the EU and the US have not adopted either of these approaches. In the US, GM production proceeds with minimal intervention: farmers are not required to segregate GM crops from conventional varieties, and labelling has been emphatically denounced, particularly by industry actors (New York Times 2003). From an efficiency viewpoint then the US regulatory system may lead to over-production of these crops and an under-provision of information to consumers. In the EU, on the other hand, production of GM crops is all but banned and a strict labelling regime requires labels for all products that contain greater than 0.9% GM content (Stamps 2002). These high standards may mean that many products carry such labels as “may contain GMOs”, information that is of little value to consumers. Thus, the EU regulatory regime leads to sub-optimal levels of GM crop production and an inefficient mechanism for product differentiation for consumers.

The divergence in regulatory approaches between the US and the EU is puzzling, given the many similarities of these economies. Most analysts have argued that these differences stem from fundamental differences in consumer attitudes and expectations (e.g., Bernauer and Miens 2001). We know that consumers, even with the support of environmental groups, are traditionally weak trade policy lobbyists relative to producer groups (Anderson and Hayami 1986; Hillman 1989). This paper therefore explores the hypothesis that differences in US and EU farmers' interests provide an additional or alternative explanation. It does so by examining distributional effects of actual policies to see if they can shed light on these differing GM policy choices.

Simulating GM agricultural policies

The global, economy-wide GTAP model can capture the effects of productivity increases of GM crops, of consumer aversion to consuming GM products, and of the substitutability of GM and non-GM products as intermediate inputs into final consumable food. The version used here was adapted by Stone et al. (2002) and is aggregated to 9 regions, 13 sectors, and four types of factors: agricultural land, non-human capital, skilled labour and basic (unskilled) labour. Non-human capital and both types of labour are assumed to be perfectly mobile within the economy, while land is assumed to be sector-specific.

Data on global adoption of GM technologies show a wide divergence in adoption across countries (see James 2002). Therefore, the GTAP model includes assumptions about the level of GM adoption in countries. In these GTAP simulations 40% of North American (NA) coarse grain production and 65% of its oilseed production is assumed to be GM. In contrast, only 10% of EU coarse grains and oilseed production is assumed to be GM. These are conservative estimates of current levels of GM adoption in NA and probably over-estimate current levels of EU adoption but they reflect estimates by James (2002). In addition, 10% of coarse grains and oilseed production in Australia, China, Japan, and Korea and 15% of coarse grains and oilseed production in the Rest of the World are assumed to be GM. Neither the Middle East nor New Zealand is assumed to produce GM crops.

To distinguish GM from non-GM productivity, the coarse grain oilseeds sectors are each sub-divided into GM and non-GM product and an output augmenting, Hicks neutral, productivity shock is implemented on the GM component of these two commodities to capture their higher productivity.[3] This assumes that GM technology uniformly reduces the level of primary factors and intermediate inputs needed per unit of output.[4]

In the CES production nest, producers choose first between imported and domestic inputs, and then choose whether or not to use GM or non-GM intermediate inputs in their production of final goods. This model structure supports the analysis of segregated markets in our scenario that examines mutual adoption of a labelling system.

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[3] GM wheat and rice are yet to be widely commercialised and so are not considered in our analysis.

[4] Because it makes little difference to the results being analysed here, we simply follow previous analysts in assuming that the productivity effects of genetic modification do not differ across crops or inputs. See Nielsen and Anderson (2001), Nielsen, Theirfelder and Robinson (2001) and Van Meijl and van Tongeren (2002).

In order to capture consumer aversion to GM products, two changes are made to the traditional GTAP demand structure. First, elasticities of substitution between GM and non-GM products are set at low levels to capture the perceived low substitutability of these products. In addition, preference shift parameters are included to capture the group of consumers that, because of food safety or environmental concerns, refuse to consume GM crops regardless of their price.

GTAP provides a comprehensive decomposition of changes in national economic welfare as measured by the equivalent variation in income. However, national and world measures of welfare changes ignore the distributional implications within countries of GM policies. They therefore fail to provide insights into the potential political economy of GM policy choices. While the total benefits from trade decrease when inefficient policies such as import bans are implemented, some groups within national economies will be beneficiaries. Hence further assumptions about the intra-national distribution of factor ownership are required to disaggregate GTAP welfare measures (see below).

Three separate policy simulations were conducted to examine the impact of GM regulations.

Scenario 1: Selected regions adopt GM grain and oilseeds

The first scenario captures the effects of productivity shocks on GM technologies. This scenario represents the base case conditions in which some countries have adopted GM coarse grain and oilseeds and experienced productivity increases from these crops, in the absence of any policies to control the adoption, importation or labelling of GM products. Following Stone et al. (2002), these model simulations assume that GM oilseeds have a 6% productivity gain and GM coarse grains have a 7.5% productivity gain.

Scenario 2: Accompanying GM adoption in selected regions an EU moratorium on GM products is introduced

The second scenario is the same as scenario 1 except it assumes that this productivity shock occurs in conjunction with an EU moratorium on GM imports from North America (NA). Under this scenario there is no segregation between GM and non-GM products and therefore the import ban is imposed upon all coarse grains and oilseeds from NA. Hence, this scenario is modelled by increasing the tariff on imports of all coarse grains and oilseeds from NA to the EU to a prohibitive level. Similar simulations were conducted looking at impacts of a moratorium imposed also by Japan, Korea and Australasia. The moratorium by this extended group of countries simply leads to similar (albeit larger) impacts, and so that experiment is not reported here.

Scenario 3: Accompanying GM adoption in selected regions a labelling system is adopted in the US and the EU

The third scenario is as for scenario 1 except it assumes the EU and North America implement labelling policies that allow consumers to choose between non-GM products and those that may contain GM content. In this scenario all countries adopt labelling regulations and diehard consumers in the EU, Australia, New Zealand, Korea and Japan avoid consuming coarse grains and oilseeds.[5] This is modelled by a 25%

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[5] In this simulation, segregation is assumed to be not required for labelling. Products from countries that produce both GM and non-GM grains and oilseeds label their products "may contain GMOs." This assumption reflects the difficulty in credibly segregating bulk commodities such as coarse grains into

reduction in final consumption of coarse grains and oilseeds in those countries from all sources.

Effects of GM regulatory policies

National welfare effects

Table 1 shows that global welfare increases in the first scenario by US$ 2.5 billion per year. In the strongly GM-adopting region of North America these gains in economic welfare are primarily due to the GM-induced productivity changes, although there is a small offsetting terms of trade effect. By way of contrast, in the EU more than half of the (much smaller) welfare gains come for improvements in allocative efficiency. This is mainly because subsidized agricultural sectors contract in the wake of increased import competition from NA.

In the second scenario which models the EU ban on GM imports, world welfare results decrease by US$ 0.35 billion per year. This is partly because the EU import ban encourages higher-cost grain and oilseed production in the EU to expand so much that its welfare loss from increased resource inefficiency more than outweighs the welfare gain from the new technology. And in NA the gain from the new technology is offset by a larger effect of an adverse terms of trade change following the EU import ban plus an allocative efficiency loss (because farm resources move from lightly assisted coarse grains and oilseeds to more-heavily assisted crops). Notice also that China and other developing countries gain more in this scenario because of better terms of trade.[6] The EU is the only region to experience a net welfare decline with the moratorium, but the benefit of the technology to NA is much diminished as compared with Scenario 1, through its greater adverse terms of trade change.

In the third scenario, labelling regulations provide an alternative mechanism for managing the introduction of GM technology. Results indicate that both NA and the EU benefit from the adoption of labelling regulations as compared with the policy environment in which the EU has imposed a moratorium. In the EU this is driven by a large positive change in allocative efficiency instead of a negative one as in Scenario 2. In NA this result is due to the combined (small) positive allocative efficiency effect and the smaller negative terms of trade impact.

Distributive effects within nations

Assumptions concerning the economic characteristics of groups of agents within the various economies allow preliminary disaggregation of the above aggregated national welfare measures. Economies are assumed to be composed of three groups of households: farmers, basic wage earners, and owners of human and other capital. Income of each group comes from a combination of factors. Farm households earn income from farm and non-farm activities. GTAP data provide information on factor income shares for farm income in farm households. Factor income shares for non-farm activities of farm households are assumed to be the same as those for other capital owners. The shares of

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separate GM and conventional product streams. US policy makers often cite these types of difficulties to justify their aversion to identity preservation schemes. Since this simulation does not examine the implications of identity preservation then, unlike in (Stone et al. 2002), it does not include segregation costs.

[6] However, bear in mind the point made in footnote 1 above, namely, that this comparative static result ignores the fact that the EU moratorium is dampening the incentive to invest in GM technology, including for developing countries.

farm household income from non-farm activities is assumed to be 90% in Japan and Korea, 50% in China and the EU, 35% in NA, 25% in Australasia, and 20% in other developing countries. Basic wage earners receive all their income from unskilled nonfarm labour. Capital owners earn most of their income from skilled labour and other non-farm capital.

GTAP model results provide estimates of changes in factor rewards following a shock which, in conjunction with factor income shares, allows calculations of nominal income changes for each group. The former are shown in Table 2. Rewards to land decrease in all cases except in Scenario 2 for the EU when it imposes its import ban. However, in that EU moratorium case wages and capital returns decrease, whereas they increase in the other two scenarios (as they do for NA).

Table 3 presents the nominal and real income changes for each type of household under each scenario. The nominal income changes draw from Table 2 plus the assumptions about the sources of income for the different types of households. The real income changes subtract from the nominal changes the change in the cost of living, given the shares of expenditure on the various products in each economy (taken from the GTAP data base). NA farmers lose from the new technology, which is a not-uncommon result when the shock affects a large share of global production of products whose price elasticity of demand is low. They lose slightly more when labelling were then to be introduced, but very much more with the EU moratorium (row 1 of Table 3). The real incomes of basic wage earners and other non-farm households go up however, and by just as much regardless of policy responses abroad. Little wonder, then, that NA farmer groups are the ones lobbying heavily against regulatory policies at home and abroad, and especially the EU moratorium. If accepting labelling is the price to pay for getting rid of the import ban, then it is not surprising that NA farmers would go along with that since, according to the income effects in Table 3, that would be almost as good for them as having no regulatory policies.

Row 4 of Table 3 shows that EU farmers lose from GM technology when there are no policy responses, and lose even more if labelling is introduced. When the EU import ban is in place, however, they gain substantially. In that latter case the EU's non-farm households are shown to lose income, but recall that our welfare measure does not take account of the utility associated with the knowledge that in the moratorium case consumers ahve greater assurance that they are buying GM-free food. If the latter effect on welfare more than compensates for the loss in spending power shown in Table 3 then it is understandable that that group of EU households (or at least the most concerned among them) would support farmers in lobbying for the ban to remain in place. But note from the final column of Table 3 that non-farm households in the EU would be much better off if labelling replaced the moratorium. It is the most zealous opponents of GMOs that tend to be in the active lobbying groups, however, so they may continue to hold out along with farmers to try to maintain the status quo even though it is less beneficial and possibly even harmful for the masses of consumers/voters they often claim to represent.

Developing country farm households lose slightly from the new technology's adoption by NA except when the EU moratorium is in place. The loss results from the lower price of coarse grains and oilseeds in international markets and hence lower returns to their land, and it changes to a real income gain when the EU bans imports from NA because developing countries can then export more to the EU in lieu of NA. The boost to real incomes of non-farm households in developing countries results not only from lower food prices but also a greater demand for their factors of production, because the non-farm sector expands when farm output declines in developing countries because of the improved competitiveness of GM-adopting countries. That boost in non-farm household incomes is least under the EU moratorium though – and would be even lower when one takes into account the fact that the EU's moratorium policy is dampening multinational investments in new GM technologies for developing countries.[7]

In short, these results are not inconsistent with the hypothesis that producer interests are influencing GM policy choices in both the US and EU.

Consequences for Trade

Both GM productivity shocks and the EU ban on imports of GM products alter the distribution of exports. Table 4 presents the changes in the share of each region's exports that go to particular import markets (for brevity's sake other OECD countries are not shown). Comparing the trade distribution of Scenario 1 with the pre-shock trade distribution we can see that the trade distribution does not change discernably (even though volumes traded are larger). The same is true if labelling is applied. When the EU imposes a moratorium, however, the GM-adopting NA countries lose their markets in the EU which allows non-adopting developing countries to experience an increase in exports to the EU (and a commensurate reduction in the share of their exports to other developing countries which are supplied more from NA). In addition, exports among EU countries also increase under the ban on imports from NA, while their exports to the rest of the world including to developing countries are reduced.

Conclusion

The simulations described here provide a preliminary indication of the intra-national distributional (as well as bilateral trade impacts) of GM policies. The results suggest that agricultural households in the EU benefit disproportionately from bans on GM products from NA, and that US farm households benefit more from the current NA policy than they would under labelling. This result supports the hypothesis that producer interests, not just differences in consumer attitudes, may be behind the current sub-optimal policy settings affecting GM coarse grains and oilseeds in the US and EU.

[7] In a follow-up paper we will examine the additional impact of first China and then also other developing countries joining NA in embracing GM coarse grain and oilseed technologies. China's adoption has been examined by Anderson and Yao (2004) but their analysis focused only on its impact on production, consumption and trade, not on aggregate national welfare or its distribution.

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Table 1: Decomposition of global economic welfare impacts of GM adoption without and with policy responses

(US$ million)

	Equivalent Variation			
Without any policy responses	**Total**	Allocative efficiency	Terms of trade	Technical change
NA	**1243**	28	-161	1376
EU	**368**	201	47	120
Australia+New Zealand	**-15**	1	-22	6
Japan+Korea	**173**	35	132	5
China	**146**	22	17	107
Other DCs[a]	**587**	76	-14	524
Total	**2502**			
With EU moratorium response				
NA	**358**	-321	-662	1358
EU	**-2148**	-2341	54	127
Australia+New Zealand	**9**	3	0	6
Japan+Korea	**253**	42	211	5
China	**175**	37	28	107
Other DCs[a]	**994**	88	368	531
Total	**-358**			
With labelling response				
NA	**1189**	5	-190	1375
EU	**518**	334	65	119
Australia+New Zealand	**-23**	3	-32	6
Japan+Korea	**-30**	-177	142	5
China	**161**	28	26	107
Other DCs[a]	**604**	91	-11	524
Total	**2420**			

[a] Includes Middle East, Eastern Europe and the former Soviet Union

Source: Authors' GTAP model results

Table 2: Percentage change in factor prices in North America and the EU under three scenarios

	Farm Land	Skilled Labour	Unskilled Labour	Other Capital
Without any policy response				
NA	-2.03	0.02	0.03	0.03
EU	-1.12	0.00	0.01	0.01
With EU moratorium response				
NA	-2.99	-0.03	-0.01	-0.02
EU	9.58	-0.04	-0.06	-0.05
With labelling response				
NA	-2.15	0.03	0.04	0.03
EU	-2.13	0.01	0.02	0.01

Source: Authors' GTAP model results

Table 3: Percentage change in nominal and real household incomes

	Nominal Income			Real Income		
	Without policy response	**With EU moratorium**	**With labelling response**	**Without policy response**	**With EU moratorium**	**With labelling response**
NA						
Farmers	-0.13	-0.25	-0.14	-0.12	-0.19	-0.13
Unskilled Labour	0.03	-0.01	0.04	0.05	0.05	0.05
Capital Owners	0.02	-0.03	0.02	0.04	0.04	0.04
EU						
Farmers	-0.03	0.30	-0.07	-0.03	0.23	-0.05
Unskilled Labour	0.01	-0.06	0.02	0.02	-0.12	0.03
Capital Owners	0.00	-0.04	0.01	0.01	-0.10	0.02
China						
Farmers	-0.01	-0.01	-0.01	0.01	0.02	0.00
Unskilled Labour	0.03	0.01	0.04	0.04	0.04	0.05
Capital Owners	0.02	0.00	0.02	0.03	0.03	0.04
Other DCs						
Farmers	-0.03	0.05	-0.04	-0.01	0.06	-0.02
Unskilled Labour	0.15	0.05	0.21	0.18	0.05	0.23
Capital Owners	0.07	0.08	0.09	0.09	0.08	0.11

Source: Authors' GTAP model results

Table 4: Network of trade in coarse grains and oilseeds

(percentage of each region's total exports of these products that go to particular import markets)

Exporters:	Import market		
Original data			
	NA	**EU**	**DCs**
NA	15	13	23
EU	3	72	24
DCs	3	23	33
Without any policy response			
NA	15	13	23
EU	3	72	24
DCs	3	23	33
With EU moratorium response			
NA	17	1	27
EU	2	78	19
DCs	3	34	29
With labelling response			
NA	15	13	23
EU	3	72	24
DCs	2	23	33

Source: Authors' GTAP model results