International agreement to control modified organisms could add large new costs to world agricultural commodity trade.

Cartagena Protocol: A New Trade Barrier?

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On September 11, 2003, a new international agreement affecting world trade—the Biosafety Protocol (BSP)—entered into force. The BSP's stated objective is to contribute to the safe transfer, handling, and use of all living modified organisms (LMOs) produced through modern biotechnology that could adversely affect the conservation and sustainability of biological diversity or pose risks to human health. The BSP includes a number of broad and cross-cutting provisions, including mandatory labeling of LMOs exported from one country to another; liability and redress in the case of adverse effects; and institutional building of biosafety regulatory capacity, especially in developing countries.

Each of the BSP's provisions is important in its own right and deserves separate examination. Here, I focus my discussion on one of them: the labeling scheme required for the transboundary movement of LMOs used for food, feed, and in processing (LMO-FFPs). Because most agricultural commodities around the world are produced and traded for food, feed, and processing, biosafety labels could prove costly and disruptive for world agricultural commodity trade. How costly and disruptive will ultimately be determined by how the labeling scheme is implemented. Details of the labeling scheme will continue to be under consideration for some time.

The BSP obligates the signing parties to decide on the "detailed labeling requirements" within two years from its entry into force. Yet, by the end of the second meeting of the BSP's signing parties in June 2005, no consensus could be reached. The parties added some clarity to the labeling rules during a subsequent meeting in March 2006, but many of the detailed labeling requirements remain undefined, ambiguous, or subject to further review and consideration. Reaching consensus on the detailed labeling requirements has proved difficult, partly because their exact impacts are difficult to anticipate. As I discuss in this article, seemingly small changes in the labeling requirements can lead to significantly different trade impacts and compliance costs, unevenly distributed among the parties.

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HISTORY

The BSP got its start in 1992 as part of the Convention of Biological Diversity. The convention's objectives are to conserve biodiversity, ensure its sustainable use, and guarantee that the benefits of biodiversity are equitable. The convention contains specific provisions on LMOs. Since its inception, the convention has emphasized the "need for a protocol to set out conditions for the safe transfer, handling, and use of LMOs that could adversely affect the conservation and sustainable use of biological diversity." In 1994, at the first convention conference, delegates authorized a series of meetings to consider the "need and modalities" for such a protocol.

In the ensuing years, considerable disagreements emerged on the content of the protocol. A draft was finally produced in February 1999 at a meeting held in Cartagena, Colombia, but the parties could not reach agreement. Subsequent deliberations produced a compromise draft and the BSP was adopted on January 29, 2000, in Montreal. The BSP entered into force in September 2003. As of March 2006, 132 countries had ratified it.

The BSP creates rights and obligations for the signing parties on the transboundary movements of LMOs. Prior to the first transboundary transfer, exporting countries that ship biotech seeds and other LMOs intended for "introduction in the environment" must inform importing countries of their intent through Advanced Informed Agreements and must provide documentation during the material transfer that identifies the LMOs. Transboundary shipments of LMO-FFPs do not require these agreements. Instead, countries must report regulatory approvals that permit cultivation of LMOs inside their borders through a Web-based database, the Biosafety Clearing House. Furthermore, exporters in such countries must label export cargoes containing LMO-FFPs and indicate that they are not intended for introduction in the environment.

Importing countries can, in turn, place conditions or refuse imports when they judge that there is insufficient knowledge regarding the potential impact of specific LMOs on their biodiversity. Indeed, the BSP has advocated the use of the "precautionary principle." (See "The Paralyzing Principle," Winter 2002–2003.) In this context, the BSP allows restrictions on the trade of LMOs in the presence of perceived risks, however small.

Despite the introduction of such rights and obligations, the presence of the BSP has, so far, been hardly felt in international trade. This is, in part, because the signing parties have not yet fully determined how to implement it in practice. Therefore, the scope and impact of the BSP on global agricultural commodity trade are still unknown.

SCOPE AND IMPACTS Of particular interest here is the influence of the labeling provisions on the scope of the BSP. On these labeling requirements, the original text of article 18.2 (A) of the BSP dictated that

> Each party shall take measures to require that documentation accompanying living modified organisms that are intended for direct use as food or feed, or for processing, clearly identifies that they "may contain" living modified organisms and are not intended for intentional introduction into the environment, as well as a contact point for further information. The Conference of the Parties, serving as the meeting of the Parties to this Protocol, shall take a decision on the detail requirements for this purpose, including specification of their identity and any unique identification, no later than two years after the date of entry into force of this Protocol.

Small changes in the labeling requirements can lead to significantly different trade impacts and compliance costs.

The "detailed requirements" called for in Article 18.2 (A) can be grouped into three relevant sets. The first set would specify allowances for accidental commingling of LMOs with conventional crops in export cargoes. Such purity standards would, in turn, determine what is an LMO and when labeling might be necessary. A second set would cover the specific content of the information that must be provided by the exporter and how such information should be collected. The third set would detail how the importer receives and, in turn, uses the information provided by the exporter.

Negotiations during the March 2006 meetings in Curitiba, Brazil, focused mostly on the second set of labeling requirements and specifically on the use of "may contain" versus "contain" biosafety labels. In the end, the consensus document provided for both options and deferred a final decision until 2012 after sufficient experience in implementing labeling requirements could be gained. Most other labeling requirements were either not explicitly

TABLE 1

Country Percentage Shares of Global Exports for Selected Grains and Oilseeds

(2000-2004)

	Cottonseed	Corn	Canola	Rice	Soybeans	Wheat
EU	5.1	0.2	5.0	1.0	0.1	7.0
Argentina	1.2	12.6	0.0	1.1	11.7	8.1
Australia	32.4	0.0	14.8	1.3	0.0	13.1
Brazil	1.8	4.0	0.0	0.1	29.2	0.2
Canada	0.0	0.3	40.7	0.0	1.3	13.0
China	0.4	11.0	0.0	7.9	0.5	0.7
United States	23.2	55.1	3.3	11.5	49.8	23.2
TOTAL	**64.0**	**83.1**	**63.8**	**22.9**	**92.6**	**65.4**

SOURCE: FAOSTAT, 2005

addressed or handled through vague references that are open to interpretation.

These detailed requirements, whatever they turn out to be, will ultimately operationalize the labeling scheme and will influence the scope of the BSP. In this context, it is important to consider what portion of the global agricultural commodity trade could be affected by the BSP and what would be the potential impacts under alternative detailed requirements.

PRODUCTION AND TRADE The BSP already applies to a large share of the global commodity trade and could influence the vast majority of it in the near future, given recent trends in global crop production and trade. Over the last four decades, global production of crops used for food, feed, and industrial products has continued to grow rapidly, in response to increasing demand. Not only has the world's population been growing at a fast pace, but so too have incomes and wealth. These changes have led to diets with increased caloric intake and higher consumption of animal protein and vegetable oils.

Increased meat and oils consumption has translated into even higher demand for feed grains and oilseeds. As a result, demand for animal feed dominates much of global agriculture and accounts for the use of many key crops. Feed crops such as corn, soybeans, and sorghum have a dominant share of the cultivated land around the world. Indeed, four crops alone—wheat, rice, corn, and soybeans—account for approximately 50 percent of the world arable land, while another four—barley, sorghum, cotton and canola—account for an additional 15 percent of all planted acreage.

Not surprisingly, the same crops that dominate production also top agricultural commodity trade. Almost 300 million metric tons of wheat, corn, soybeans, and rice are traded every year across a large number of countries, accounting for the bulk of all agricultural commodities traded internationally.

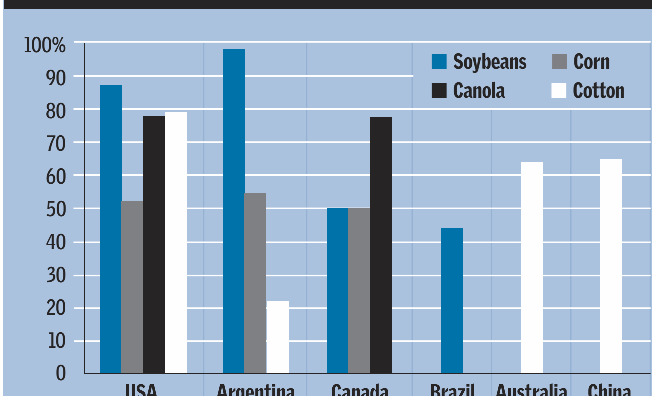
Just as there are a few key crops in global production and trade, there are also a few key exporters (Table 1). For instance, Argentina, Brazil, and the United States dominate soybean exports, while the United States, Argentina, and China supply most corn exports. Australia, Canada, and the United States provide the bulk of wheat exports while Argentina and the European Union also contribute significant amounts.

Indeed, with the exception of rice, between 60 and 90 percent of exports in all key crops are supplied by two or three from a handful of countries that have expansive agricultural sectors and are major exporters—namely, Argentina, Australia, Brazil, Canada, China, the EU, and the United States. Some of these countries also have large domestic markets (e.g., Brazil, China, the EU, and the United States). China's domestic market has expanded quickly in recent years and has become a significant net importer. Others, like Australia, Argentina, and Canada, have small domestic markets and export the bulk of their production.

FIGURE 1

Adoption of LMOs in Major Exporting Countries

(2005)



SOURCES: USDA NASS, USDA FAS, AAFC, and ISAAA

GLOBAL ADOPTION In this context, much of the adoption of LMOs has taken place in the same key crops and countries that dominate global production and trade (see Figure 1). Excluding Europe, all major crop-producing and exporting countries have commercially introduced one or more LMOs in their production systems. And, for commercial LMO crops, adoption has occurred at unprecedented rates, often covering more than 80 percent of the available acreage in just a few years.

Rapid LMO adoption is driven by strong economic incentives. Adopters generally enjoy substantial benefits from increased yields, lower production risks, reduced use of chemical pesticides, savings in management, labor, and capital equipment, as well as environmental and economic gains from reduced tillage and other synergistic production practices.

Incentives for adoption and use of LMOs have been stronger in export-minded countries with agricultural sectors that compete in global markets. Producers in these countries continuously look for more efficient technologies and improved farming systems in order to maintain their competitiveness. Countries with protected and inward-looking agricultural sectors have diminished incentives to use LMOs because they could add to domestic production surpluses and to government subsidy spending.

Because the adoption and use of LMOs is concentrated in the key crops and countries that dominate global production and trade, it is clear that the BSP pertains to a large portion of today's agricultural commodity trade. Its scope will only expand as LMOs are introduced and adopted in other widely traded agricultural commodities (e.g., rice and wheat) in the near future.

Just what changes might then be necessary in order to implement the labeling provisions of the BSP for the bulk of world agricultural commodity trade and how costly might they turn out to be? To answer those questions, one must first evaluate the current functions of the agricultural commodity marketing system, which provides a baseline to any such impact analysis.

MARKETING SYSTEM In any given year, the harvest from millions of small and large farms dispersed over vast terrain must be collected during a short period of time and moved to storage, where it will be gradually dispersed to animal feeding and processing facilities throughout the year. An expansive global marketing system moves crops from surplus to deficit areas, stores crops when they are plentiful, and uses crops of varying quality according to their highest use.

Although these functions of the global marketing system are conceptually simple, the execution is not, especially in the face of continually changing market conditions. Indeed, marketing chains in many countries and regions are not effective or well functioning. For instance, in developing countries, marketing chains suffer chronic under-investment in storage, logistics, and other assets. Others have misplaced physical assets with poor market access and ineffective information channels. In some countries, ineffective marketing chains have often created the need for large imports even in the presence of local bumper crops (e.g., the Soviet Union in the 1970s).

Even well functioning crop marketing chains must contend with uncertainties that complicate their operations. Local crop production and consumption volatility lead to significant investment risks for physical assets (e.g., storage silos, transportation assets, processing plants). Price risks are also significant. Crops change hands many times in any given year and in every transaction the buyer must confront price risk while owning the crop. Uncertainty in freight prices, interest rates, and exchange rates further add to the price uncertainty confronted by operators in the crop marketing chain. To manage these risks and control costs, sophisticated institutions (e.g., futures markets, grades and standards) and a vast physical infrastructure have developed over time.

Grades and standards provide information that enables buyers to determine grain quality without visual inspection. Public and private agencies provide inspection services and ensure that grain standards are upheld. In this way, a large number of transactions can be consummated with limited transaction costs. Grades and standards also help improve the efficiency of crop marketing chains. Crops from many farms are mixed and blended to meet set grades throughout the supply chain, resulting in perfectly fungible and divisible product streams. This fungibility facilitates the efficient use of discrete storage and transport assets and yields significant economies of scale. For example, barge transportation is only one-fifteenth the cost of truck transport, and storage in a port elevator is one-fifth the cost of a local elevator. Cheap bulk transport and storage are possible, however, only if product streams are fungible.

But the same institutions and physical assets that facilitate the efficient movement and trade of crops make the kind of biosafety labeling required by the BSP challenging. Today's global agricultural commodity system, which has been built around anonymous exchanges and continuous commingling and blending of crops, provides no immediate mechanism for easy identification of a cargo's origin or its DNA makeup. Hence, the current system will need to change in order to comply with the labeling provisions of the BSP. These changes will, in turn, determine the impacts of the BSP and associated compliance costs.

The same institutional and physical assets that facilitate the efficient movement and trade of crops make BSP biosafety labeling challenging.

COSTS

Understanding how the global agricultural commodity marketing system would need to change to comply with alternative "detailed requirements" in the BSP labeling scheme requires tedious technical analysis. Such analysis must confront esoteric details in the inner workings of grain production, storage, logistics, and testing that might look mundane and far-removed from the principled environmental conservation and sustainability goals of the BSP. Yet, scrutiny of such details is exactly what is needed, because seemingly small variations on how to label LMO-FFPs, how to construct such labels at the point of export, and how to enforce them at the point of import result in large swings in the impacts and associated compliance costs of the BSP. This is best illustrated with a few examples.

WHAT TO LABEL AND HOW? Consider first the implications of implementing different types of labeling schemes. The BSP calls for biosafety labels to be placed on LMO-FFP export cargoes. Positions on the exact content of the labels supported in the past by various stakeholders have included:

- Labeling that indicates that a cargo "may contain" LMOs and is not intended for planting.
- More detailed labeling that explicitly states the container "contains" LMOs and identifies the specific LMOs in the cargo.
- Even more detailed labeling that identifies the specific LMOs contained in the cargo and quantifies their shares or amounts.

Much of the debate in the March 2006 meetings centered on the first two options. In the end, both were allowed, at least for the present time. In cases where the identity of the LMOs in a particular cargo is "known through means such as identity preservation systems" a "contain" label is required. When the identity of the LMOs is not known through such means, a "may contain" label must be used. In both instances, the common scientific name of the LMO and the transformation event or the unique identifier or code that connects the LMO to the Biosafety Clearing House must be provided by the exporter. The BSP parties also agreed to "review and assess the experience gained with the implementation" of such labeling options during meetings in 2010 with "a view to considering a decision" in 2012 meetings for requiring the "contain" label for all LMO-FFP exports.

There are good reasons for the continuing hesitation and angst over the labeling decision. Because crops change hands multiple times as they travel through the marketing chain, co-mingled time and again in storage and transport, the exporter is the last in a long series of entrepreneurs that take ownership of the crops along their journey from the farm field to the export harbor. Importantly, the exporter is also the holder of the largest cargo in the supply chain. Export vessels typically contain product from some 40 barges or nearly 600 train cars, which in turn could include crops from hundreds of farms. Hence, under current typical operations, exporters do not know the LMO content of their cargoes.

Certainly, in the absence of a deliberate effort to exclude LMOs from cargoes through strict segregation of crops from the field to the port, vessels originating from countries with meaningful LMO production should be expected to contain LMOs. The exact level of types of LMOs, however, will vary drastically across vessels, depending on the production profile of the regions where the cargoes originated. Similarly, commercial production of an LMO in a country does not automatically warrant its presence in a particular export cargo. Accordingly, without testing each cargo for the presence of individual LMOs, exporters would be unable to indicate that cargos definitively "contain" specific LMOs simply on the basis that they are commercially produced in a given country. Under those conditions, the most accurate reporting by exporters might be to indicate that a cargo "may contain LMOs" while listing all those potentially present in the cargo. Such labeling can be implemented under today's conditions with modest operational changes and compliance costs.

Implementing "contain" labels when cargoes are known to contain specific LMOs through means of identity preservation also implies modest operational adjustments and costs. However, the possibility that the identity of the LMOs in an export cargo will be known through an identity preservation system is rather limited today. Only a very small share of international traded agricultural commodities is currently identity-preserved and, in most cases, such systems ensure the absence of LMOs, not their presence.

> **The most accurate labeling might be to indicate that a cargo "contains LMOs" and list the modified organisms that might be present.**

In contrast, generalizing the "contain" labels for all LMO-FFPs implies far greater complexity as it involves broad testing that cascades into a number of additional "detailed requirements" that must be decided, including:

- How should one appropriately sample an export cargo so that the test results are representative of its content?
- Should one test only for LMOs commercially produced in any given season or all LMOs that have been approved by the regulatory authorities?
- Should one test only cargoes with crops for which LMOs have been intentionally introduced or all crop export cargoes, since trace amounts of LMOs are likely to be present in most of them as a result of unintended admixtures?

Compliance costs change markedly depending on how one answers these and other questions. For instance, testing costs increase with the number of samples that must be evaluated; the type of tests required by the BSP (i.e., qualitative, quantitative); the number of LMOs that must be tested for; and the number of crops that must be evaluated.

Some of the compliance costs are easier to estimate than others. But some of the costs associated with testing export cargoes under different BSP implementation scenarios can be estimated by

TABLE 2

Estimated Annual LMO Testing Costs of Corn Export Cargoes

(U.S. dollars)

Samples Tested	Cargoes Tested	"Contains LMOs"	"Identifies LMOs"	"Quantifies LMOs"
1 sample per cargo	3,575	$936,650	$2,342,900	$4,356,900
20 samples per cargo	3,575	$18,733,000	$46,858,000	$87,138,000

SOURCE: Author's calculations

calculating a per-cargo testing charge and the total number of cargoes that would require such testing. Clearly, the number of cargoes exported from different countries varies from year to year, and so averages must suffice. Furthermore, practical data limitations allow only approximations in the number of export cargoes that would require testing. Nevertheless, such approximations can be revealing.

For instance, consider the testing costs that might be incurred for labeling corn export cargoes. Using customs data from the two main export countries, the United States and Argentina, it is possible to assess the appropriate number of ocean vessel export cargoes that might require testing. Book prices for relevant tests from various testing laboratories are used to calculate laboratory charges. Then, aggregate laboratory costs are calculated for six scenarios that are derived from two alternative sampling protocols and three testing procedures dictated by alternative "detailed labeling requirements."

In the first three scenarios, a single composite sample is used to evaluate the content of a vessel under three alternative test options:

- qualitative assessment of whether the cargo contains LMOs;
- identification of specific LMOs contained in the cargo; and
- measurement of the amount of each LMO in the cargo.

With an average cargo size of 25,000 metric tons of corn, vessels are sampled multiple times in set time intervals as the grain flows into the holds. A representative sub-sample of approximately 5 lbs. is sent to a laboratory for testing. From that, 10 grams of homogenized ground corn are tested for LMO content. Under this sampling approach, the laboratory testing costs for one cargo of corn for exports range between $936,000 and $4,356,000, with the highest costs incurred when quantification of the LMOs is necessary (see Table 2).

The relevance of the test results, of course, depends on whether the tested samples are representative of the content of the various vessels. Using 5 lbs. (or 10 grams that are actually tested) to accurately represent the contents of a 25,000 metric ton cargo might be a stretch. If extreme accuracy in the reproducibility of such results is necessary, then alternative sampling protocols might be necessary.

The EU Commission recently produced a draft of recommended practices for sampling and testing LMOs in bulk commodities. These testing plans were developed to address stratification/pockets of LMOs in shipments and to test the level of LMOs in a "lot" (e.g., vessel, ship hold, container, etc.). The draft plan requires collecting a large number of samples to be tested individually for each LMO. The recommended practices suggest that for lots exceeding 500 metric tons, 100 separate primary 0.5 kgr samples should be taken at regular time intervals as grain moves through the grain trade system, following broadly accepted sampling standards (e.g., ISO 13690, ISO 6664, and GAFTA Rule 124 Annex B). From those, at least 20 samples are to be separately tested and a composite test score is to be produced to represent the content of the lot. Under such potential sampling procedures, laboratory-testing costs explode. Even with the minimum recommended 20 tests per cargo, laboratory costs for corn exports range from $18 million to $87 million, as summarized in Table 2. Using average shipping costs in 2004 and 2005, such testing costs would increase shipping costs between 2 and 10 percent depending on origin, destination, and vessel size.

Beyond these laboratory costs, there are additional compliance costs in testing export cargoes for LMO content that are more difficult to calculate. They include handling and overhead charges incurred by exporters for maintain-

TABLE 3

Top Crop Importing Countries and BSP Membership

(In metric tons)

Importing Country	Maize	Soybeans	Wheat	Total	Signed BSP?	Ratified BSP?
Japan	16,321,093	4,935,444	5,692,039	26,948,576		Y
China	5,148,023	15,115,128	1,734,458	21,997,608	Y	Y
South Korea	8,797,167	1,415,089	3,745,042	13,957,298	Y	
Mexico	5,843,470	4,431,094	3,262,794	13,537,357	Y	Y
Spain	3,119,884	3,290,183	5,105,067	11,515,134	Y	Y
Netherlands	1,984,993	5,918,696	3,490,411	11,394,100	Y	Y
Egypt	4,758,902	335,994	4,993,845	10,088,740	Y	Y
Italy	685,158	1,110,760	7,621,149	9,417,067	Y	Y
Brazil	484,809	947,394	6,794,286	8,226,488		Y
Iran	1,510,498	425,563	5,280,467	7,216,527	Y	Y
Algeria	1,778,302	5	5,268,020	7,046,326	Y	Y
Germany	796,847	4,459,907	1,180,591	6,437,345	Y	Y
Indonesia	1,094,930	1,250,836	3,512,129	5,857,895	Y	Y
Belgium	610,703	1,574,064	3,374,756	5,559,523	Y	Y
Morocco	1,024,066	287,022	3,346,943	4,658,030	Y	
Malaysia	2,191,313	667,793	1,653,052	4,512,158	Y	Y
World	**84,955,692**	**57,064,364**	**116,105,862**	**258,125,917**		

SOURCE: FAOSTAT, 2005

ing an inventory of samples and managing the interface and test reporting with labs, sampling authorities, regulators, and their customers. These compliance costs increase as the number of samples tested increases.

The estimated compliance costs for testing corn cargoes are indicative of the compliance costs that could be incurred in implementing the BSP labeling provisions and illustrate the large differences in compliance costs that can emerge under seemingly small shifts in implementation details. Full accounting of the BSP compliance costs must, of course, tally expenditures for testing all crops that have LMOs (e.g., corn, canola, soybeans) and should also incorporate future increases in compliance costs that will come from: increasing adoption of LMO crops; an increasing number of LMOs per crop; an increasing number of LMO crops; and an increasing number of countries that will become LMO producers.

HOW TO ENFORCE? Another central implementation issue of the BSP is how the information provided through the biosafety labels of LMO-FFPs might be received and used at the point of import. Will confirmation of the labeling information be needed and, if so, will it be done through laboratory testing? If testing is required, the loaded vessel will likely be probed and sampled in ways that are different from the sampling procedures used at the point of export.

Testing the vessel at the point of import would more than double the laboratory testing costs that would be incurred in the marketing chain. It typically takes five to seven days to receive laboratory test results for any given vessel, suggesting costly delays at the point of import. On average, each additional day at the port adds $25,000–$30,000 to the freight costs.

Even more troublesome than the size of the direct testing costs are the implicit uncertainties associated with testing. Indeed, it is not clear how an importer might respond if the test results at the country of origin differ from the test results at the country of destination. And it is highly likely that these test results will differ.

Because LMO testing is a statistical process, repeated sampling and testing of the very same cargo would regularly produce different results. There are several sources of variance in test results, including differences in the testing and sampling methods as well as testing error. Testing methods can differ appreciably across various labs and are significant sources of variance. No standardization in LMO testing methods is expected in the near future and hence such sources of variance will not diminish.

Conflicting test results could occur even if identical lab testing protocols are used, unless the same sample is tested. Depending on the concentration and distribution of a particular LMO within a particular lot and how it was sampled, it could be difficult, if not impossible, to duplicate any set of test results. Finally, some assay error (e.g., false positive and/or false negative test results) will always exist.

If some divergence of the test results at origin and destination is to be expected, could it result in delays or rejections of cargoes at the point of import? The potential holdup costs from such circumstances would be astronomical. Depending on the size of cargo and port of import, demurrage charges from re-directing a vessel to an alternative destination and other costs could add up to millions of dollars per held-up vessel. There are some 10,000 vessels transporting corn and soybeans to various destinations in any given year. With even a small fraction experiencing such holdup problems, indirect compliance costs could quickly mount and dwarf testing and other direct compliance costs.

WHO PAYS? How might such compliance costs be distributed among the various importers and exporters? Anticipating relevant market shifts and distributional effects is less than straightforward. Markets for crops, food and feed ingredients, animal products, and various processed foods are vertically and horizontally linked within any given country but also with markets in other countries. Local institutions, national and regional agricultural policies, vertical integration, and market power all add complexity to such links. Under these conditions, fully anticipating the trade and welfare impacts from

TABLE 4

Average Cargo Sizes of U.S. Exports by Destination

(In metric tons)

CORN		SOYBEANS	
TOP 10			
	Average cargo size		Average cargo size
Egypt	49,338	Thailand	51,920
China	48,925	China	51,483
South Korea	44,973	Spain	49,391
Indonesia	44,404	Belgium	41,344
Turkey	40,430	South Korea	40,189
Syria	34,183	Indonesia	39,532
Japan	31,955	Portugal	37,577
Morocco	28,135	Netherlands	36,253
Lebanon	26,908	Malaysia	28,183
Saudi Arabia	25,468	Morocco	24,828
BOTTOM 10			
El Salvador	9,700	Philippines	12,268
Chile	9,596	Cuba	12,216
Honduras	8,615	Trinidad	7,826
Mozambique	6,657	Costa Rica	6,893
Trinidad	5,995	Colombia	6,143
Jamaica	5,933	Nigeria	4,686
Nicaragua	4,774	Jamaica	3,124
Barbados	4,530	Guatemala	3,080
Ghana	4,492	Barbados	2,822
Surinam	1,975	Nicaragua	1,810

SOURCE: Author's calculations

BSP compliance costs on selected market segments is difficult, especially in the absence of a formal trade model.

Nevertheless, some useful initial observations can be made. As noted earlier, most key agricultural commodity exporters are LMO users. In their domestic markets, LMOs are generally considered equivalent to conventional crops and their use implies no incremental handling costs. In export markets, LMO cargoes would incur compliance costs associated with the BSP, but the costs would be similar across all exporting countries. Under these conditions, the compliance costs associated with the implementation of BSP will likely become "costs of selling" in export markets, meaning that importers will pay the price.

It is therefore interesting to examine the spatial allocation of key crop imports. Countries with large import volumes, especially those that are signatories and have ratified the BSP, will likely incur a large share of the compliance costs. As Table 3 indicates, the top crop importers are developed and large developing countries, with Japan, South Korea, China, and Mexico leading the group. Almost all have signed and ratified the BSP and would end up paying compliance costs that are proportional to their import shares. Among the top commodity importers, South Korea has signed but has not yet ratified the BSP, but Japan, China, and Mexico are full members.

On a per-unit basis, small developing countries will likely incur disproportionately higher costs. As Table 4 illustrates, the average corn and soybean cargo size shipped from the United States to such destinations is typically significantly smaller than that of cargoes sent to many developed countries and large developing ones. Because the per-vessel compliance costs are more or less fixed, smaller cargoes will result in higher per-unit costs.

CONCLUSION

While I have focused much of my discussion on the LMO-FFP labeling provisions and their implications, other key provisions of the BSP also require close scrutiny. Chief among them is the proposed approach for risk assessment and the use of the precautionary principle and socio-economic considerations in biosafety regulatory assessments. If biosafety assessments across various countries result in unpredictable and scattered approvals, they could impose significant restrictions on the commercialization and trade of new biotech products. Other provisions that must be more closely studied are the liability and redress terms, documentation requirements for research material, and various provisions for compliance. Nevertheless, a key point of the discussion here is cross-cutting: for a broad and complex LMO labeling regulation like the BSP, the devil is in the (yet to be decided) detail.

Delineating the implementation details of the BSP involves weighing risks, costs, benefits, and politics—a difficult balancing act. On the one hand, absence of meaningful experience with any broad labeling scheme like the one called for by the BSP makes exact projections of its potential impacts difficult. Yet, intrinsic market and technical complexities in the global agricultural commodity system raise the spectacle of significant disruptions and compliance costs. On the other hand, while there has been significant and ongoing debate on the conjectural environmental and human health risks of modern biotechnology, there has been little tangible evidence of any actual risks associated with the LMOs currently on the market. In these circumstances, and in the face of large swings in the compliance costs for even small changes in the implementation details of labeling schemes, the option value of a "wait and see" approach will remain high. A gradual implementation strategy—one that focuses on expanding the biosafety capacity of countries while accumulating experiences on how to meet the objectives of the BSP without paralyzing world agricultural commodity trade—might be optimal. The March 2006 decisions in Curitiba, Brazil, seem to follow just such an approach.

Other perceived costs, risks, and benefits could also influence decisionmaking for some time to come and should be accounted for. Some countries, for instance, could conclude that compliance costs would be high but could find solace in that these costs could act as non-tariff barriers shielding (at least in the short run) domestic markets from import competition. Similarly, other countries might find the compliance costs imposed on imports unattractive, but could also see opportunity in financial inflows and technology transfer for biosafety capacity building.

Finally, entrenched political positions could also influence decisionmaking. For instance, some consumer and environmental groups have over the years adopted an anti-biotech stance that has carried over to their positions in the BSP negotiations. These and other embedded positions allow little flexibility in negotiation.

Under these conditions, reaching consensus on the specific LMO-FFP labeling provisions of the BSP will continue to be challenging. Nevertheless, careful consideration is critical as these provisions could have a significant impact on world trade and social welfare for many years to come. R

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