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Biosafety at the Crossroads

An Analysis of South Africa's Marketing and Trade Policies for Genetically Modified Products

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ABSTRACT

South Africa is the only country in Africa that has both adopted genetically modified (GM) crops and developed a functional biosafety system to manage any risks related to the use of GM products. But it is also one of the only countries that trade both GM and non-GM crops, despite being surrounded by countries banning the use of GM products. In this paper, we analyze the marketing and trade policies for GM products in South Africa that have been successful in the past and critically review recent reforms to these policies.

By providing trade volume estimates of potentially GM products, we show that South Africa is effectively a significant exporter and importer of both GM and non-GM products. We then show that although its import approval system has been effective, recent reforms have allowed regulators to use biosafety regulations as an apparent nontariff barrier to trade. On the export side, South Africa has been able to adapt to each specific demand, but potential export risks have gradually entered the decisionmaking process through the inclusion of socioeconomic considerations. On the marketing side, we show that although non-GM maize segregation has been successful so far, it has generated some adjustment costs and could be improved. At the same time, by excluding all current GM products, the GM food labeling regulation in place has not been fully satisfactory and is bound to change; it could be heading toward a strict mandatory system, despite limited public demand.

Therefore, there is a clear movement toward more costly and rigid trade and marketing regulations for GM products in South Africa, with local special-interest groups having an increasing influence on decisionmaking. Yet, the past 10 years have demonstrated that South Africa’s success in taking advantage of biotechnologies under changing global conditions stems mainly from its adaptation capacity and the flexibility of its system. Based on the analysis presented in this paper, we provide six policy recommendations to improve rather than rigidify market and trade regulations—policies that would allow South Africa to better adapt to global changes, to manage risks rigorously but efficiently, and to take advantage of safe and potentially promising new GM technologies.

Keywords: South Africa, genetically modified products, trade regulations

1. INTRODUCTION

Eleven years after their introduction, genetically modified (GM) crops are produced, consumed, and traded in a large number of countries. Despite divergent opinions and positions on their use and increasingly strict regulatory frameworks, GM crops are grown in an expanding area in an increasing number of countries. Though many GM crops have been developed and tested in different countries, thus far only a few have been commercialized. In fact, soybeans, cotton, maize, and canola represent almost the entire GM crop area. This specialization and continued growth has resulted in intensive GM crop production of these four crops: today, most of the soybeans, about a third of the global cotton production, and an increasing share of maize and canola are genetically modified. Because these four crops are mostly traded commodities, GM products have been traded and consumed worldwide during the last decade, largely in animal feed, textiles, industrial products, and food,

Despite this increased use, markets for GM products have remained regionally polarized. Depending on the product, national or regional regulations, private standards, and alternative consumer demand have contributed to the separation of markets for products that contain or may contain GM from their conventional counterparts purely based on non-GM material (with the purity threshold depending on each product, regulation, or standard). In addition, each GM product has been approved for production or consumption in a limited set of countries, whereas many other countries have not adopted any regulations on the use of GM products. For instance, GM soybean products from Brazil are largely exported to China, which does not allow the planting of GM soybeans. They are also exported to Japan as soybean oil, to Europe as soy meal used mainly for animal feed, and to many other countries that have no implemented regulations on GM imports. This double division (geographic and product-based) has resulted in the setting up of sophisticated regulatory, marketing, and trading systems, allowing GM and non-GM products to flow from producers to consumers. In particular, traceability and identity preservation systems are increasingly used to separate and track GM and non-GM products from their origins to their end uses.

To complete this picture, GM products have also moved informally across borders. Some GM crops with formal approval in their original countries for particular purposes have moved to other countries or marketing channels, either intentionally through illegal introduction by farmers (for example, cotton in India, soybeans in Brazil) or due to unintentional introduction (Starlink corn, for example, was intended for animal feed, not human consumption). Lastly, a few GM varieties that were tested but not approved for use in any countries have been circulating in their original countries and were sometimes even exported to other countries (for example, GM rice tested in China and the United States and found there and in Europe) although on a limited scale and with limited risks.

In this complex international trading context, adaptation is crucial for taking advantage of market and biotechnology opportunities, while managing any potential biosafety or commercial risks. In this respect, South Africa can be seen both as a unique example and as a pioneer. First, South Africa is one of only a few countries, and the only African country, with a relatively large production of GM crops. It produces GM cotton, maize, and soybeans. Second, it is also the only country on the African continent with a biosafety system in place that produces, imports, and exports GM crops, while maintaining biodiversity. It was one of the first countries with a biosafety regulatory system in place before 2000. Third, it is the only country where small-scale farmers have been producing and consuming a subsistence GM “food” crop: white maize. Both GM cotton and GM maize are reported to have had positive economic effects on small farmers, with variations by seasons and varieties (Gouse, Pray, and Schimmelpfennig 2004; Gouse et al. 2006). Fourth, it has managed to keep a normal trading relationship with neighboring countries and its main trading partners, although they have consistently rejected a number of GM food products. Fifth, it is one of the few ratifying members of the Cartagena Protocol on Biosafety that produces GM crops extensively. Lastly, despite relatively imperfect market infrastructures, in parallel with its GM production channel, it produces non-GM food and feed products and exports them to a number of sensitive markets in Europe or Asia.

For these reasons, South Africa may be considered a good example for other countries to follow. However, recent developments suggest that its situation may not be stable. As GM production grows, and with changes in political power and market conditions, South Africa's management of marketing and trade of GM crops has continued to evolve. First, on the regulatory front, by ratifying the Cartagena Protocol on Biosafety, it recently had to adapt its own national regulatory system, an issue which is not yet settled (Jaffe 2007). Second, on the market front, as farmers adopted more GM maize traits and planted them in an increasingly large area, many countries in the region have started to ban imports of GM maize, making the GM/non-GM coexistence more challenging. Third, on the domestic front, export considerations seem to have gradually entered the biosafety decision linking safety related measures to purely economic interests. Fourth, as producers have increasingly adopted GM crops, a small share of higher-income consumers have started to demand non-GM products.

In this context, South African policies and regulations on GM products have changed and are about to change again. Imports and marketing strategies are being questioned. Export- and competition-related considerations are increasingly accounted for in the regulatory framework. Domestic marketing regulations are being discussed. It is not clear what direction the country will take on these regulatory issues and their consequences for the use of future GM crops, but it may be a good time to analyze some of the options it may face on these policy matters.

A few recent studies have been published on the issue of trade and regulation of GM products in South Africa and the wider region (Gouse 2006a; Gouse 2006b; Wolson and Gouse 2005 Muputola 2005. They all help explain why this situation is unique and identify some of the factors that make it feasible. Yet they also avoid diving into some of the critical questions that are on the table in South Africa, relating to its use of GM crops and potential commercial risks. What regulatory systems can help South Africa continue to manage its production, imports, and exports of GM crops in a changing domestic and international environment? How can it maintain trade opportunities in countries rejecting GM crops? What labeling and marketing strategies would best support this flexible system in South Africa? What elements of these strategies could be used in other countries and under what conditions?

The purpose of this paper is to analyze the current and potential future of South African trade-related policies on GM products in a comprehensive manner. We review the public and private strategies adopted in South Africa that have contributed to their visible success. To complement other studies, we provide a first tentative, quantitative look at the marketing and trade of GM products in South Africa and the region. We then discuss the evolution of regulatory practices and their potential consequences for the country, as a producer, consumer, and trader of GM crops.

As a trader, South Africa lies at a crossroad between the GM-producing and GM-rejecting nations. But it is also at a crossroad in its biosafety system, as upcoming decisions on regulatory issues may result in a step forward or backward in its use of GM crop technology. Because it has been able to adapt to this rapidly changing market and technology world, South Africa provides an example that may help other countries to design their own adaptation strategies. At the same time, because the regulatory framework is rapidly changing, we hope to provide food for thought for South African decisionmakers and associated stakeholders who are contributing to the debate.

Our analysis is based on the synthesis of three types of data. First, we conducted 16 semistructured interviews or meetings with key government, public, and private experts in the Pretoria–Johannesburg area of South Africa between June 12 and 26, 2007 (a list of organizations interviewed is provided in Appendix A). During these interviews, we discussed a number of issues related to the use of genetically modified organisms (GMO) in South Africa, relative to trade and marketing considerations. Part of our discussion also focused on the wider Southern Africa region and the position of South Africa as a GM exporter in a non-GM region. To complement our local data collection, we also went to Windhoek, Namibia, in June 2007, to conduct several meetings with public and industry experts on issues related to the Namibian rejection of GM maize imports from South Africa and its relationship to its GM-free-fed beef exports to the European Union (EU). Second, secondary data were collected directly from the persons and institutions we visited in South Africa and from our own literature review of available studies on GM crop and trade issues. Third, we used bilateral trade data from national and international datasets published by the United Nations (UN) Food and Agricultural Organization (FAO) and the UN Comtrade database.

The paper is organized as follows. In Section 2, we provide a bilateral trade analysis of the import and export of potential GM products by South Africa. In Sections 3 and 4, we focus on import and export regulations and strategies. In Section 5, we discuss the domestic market issues today and potential changes in years to come. We conclude by discussing some of the upcoming issues and directions that countries may choose to follow.

2. A UNIQUE BUT CHALLENGING SITUATION

GM Crop Production

In 1997, South Africa approved the use of the first varieties of GM crops, Bt cotton and Bt maize, both genetically engineered to resist targeted insect pests (cotton bollworms and corn borers). While Bt cotton was first used in 1997/98 and Bt yellow maize in 1998/99, Bt white maize (using the same genetic event)[1] was first planted after back crossing with local varieties in 2001 (Gouse et al. 2005). Herbicide-tolerant GM soybeans were approved for planting in 2002. Herbicide-tolerant traits were also later introduced in varieties of maize and cotton. Bt II cotton, a more advanced insect-resistant cotton, was approved in 2003. Most recently, multitrait crops have entered the market. Table 1 reports the succession of GM event approvals by year, crop, and trait. By 2007, 11 GM events had been approved for planting, including 6 for cotton, 4 for maize, and 1 for soybeans. Each approved event may have been inserted into multiple varieties, so the total number of GM crop varieties exceeds this total.

Table 1. Chronology of GM events approved for planting in South Africa

Year	Crop	Trait	Number of events
1997	Cotton	Insect-resistant	1
2000	Maize	Insect-resistant	1
	Cotton	Herbicide-tolerant	1
2001	Soybean	Herbicide-tolerant	1
2002	Maize	Herbicide-tolerant	1
2003	Cotton	Insect-resistant	1
	Maize	Insect-resistant and herbicide-tolerant	1
2005	Cotton	Insect-resistant and herbicide-tolerant	1
2007	Cotton	Insect-resistant and herbicide-tolerant	2
	Maize	Insect-resistant and herbicide-tolerant	1
Total			**11**

Source: AGBIOS database (www.agbios.com), consulted on 02/01/08.

Table 2 shows the estimated areas of GM crops and their share of total crop areas from 1999 to 2007.[2] These figures show three distinctive patterns for each of the three GM crops approved in South Africa. The adoption of GM maize started very slowly before reaching a rapid expansion. Wolson and Gouse (2005) attribute this slow early evolution to a number of factors, including the relative inadequacy of the first varieties released and the lack of productivity effects they demonstrated, compared with the non-GM, in periods of low infestation. In 2000/01 better- performing local varieties were released that contained the Bt genes, and GM maize became progressively more appealing. In contrast, GM cotton was adopted relatively quickly in a large proportion of the cotton planting area, although total cotton production has been declining in recent years in South Africa. Lastly, the adoption of GM soybeans grew relatively rapidly and linearly in South Africa, starting from 6,000 hectares to more than 130,000 hectares, concurrent with the overall growth in soybean production area in the country.

As in other countries, there are no official reported figures on the production of GM crops; only area estimates are available. But since most GM events were first adopted by a large share of commercial producers, using intensive practices with larger-than-average yields, it is reasonable to assume that the proportion of GM crops in total production exceeds the reported proportion of planted area. Moreover, available empirical studies show that, although the productivity effects vary by region, variety, practice,

1 A genetic “event” is a unique combination of crop traits.

2 Estimates of the adoption rate of cotton and maize in earlier years are unavailable.

and season, insect-resistant crops obtained higher yields on average, compared with their conventional counterparts. Therefore, assuming that the proportion of GM cotton and soybean area remained at the level of 2006, more than 90 percent of cotton, at least 45 percent of maize, and 60 percent of soybeans produced in South Africa in 2007 were genetically modified.

Table 2. Estimated area and adoption rate of GM crops in South Africa, 1999–2007

Season	GM maize		GM cotton		GM soybeans		Total GM crop area
	Area (ha)	% total	Area (ha)	% total	Area (ha)	% total	
1999/00	50,000	1%	13,200	50%	0	0%	63,200
2000/01	75,000	2.5%	12,000	<40%	0	0%	87,000
2001/02	166,000	5%	26,500	70-80%	6,000	5%	192,500
2002/03	252,000	7%	21,500	82%	11,000	10.9%	273,500
2003/04	425,000	13%	32,500	88%	47,000	35%	504,500
2004/05	410,000	15%	19,000	90%	70,000	50%	515,000
2005/06	455,000	29%	19,900	92%	135,000	59%	607,000
2006/07	1,150,000	45%	12,555.	93%	214,000	79%	1,400,000

Sources: Combined from Gouse 2006b; Wolson and Gouse 2005; Monsanto 2007; Department of Agriculture 2007; Van Der Walt 2006.
Note: n.a. is "not available."

To put these shares in the national context, cotton production is relatively small in South Africa and soybean production is only a recent development, but maize is and has historically been the first crop in South Africa. Yellow maize is largely used for animal feed and other purposes. White maize is a staple food crop in South Africa and is grown by a large number of small-scale producers. South Africa is also a net exporter of maize most years, whereas it largely imports soy-derived products and cotton. As explained further in Section 5, the domestic marketing channel for maize largely mixes GM and non-GM products. Apart from specific export demands from countries mostly located in the Southern African region, only a few private buyers require non-GM maize as inputs. The starch industry is considered the leading buyer of non-GM maize domestically (see Section 5). The supermarket chain Woolworth has also started to seek products without GM ingredients, with questionable success (Wolson and Gouse 2005; Viljoen, Dajee, and Botha 2006). The Middle East was interested in the use of non-GM feed for their small but growing imports of meat, but South Africa is not a large exporter of meat outside of the region. Overall, most markets do not have any requirements on GM or non-GM content, and there is no quote for non-GM maize in the South African Futures Exchange (SAFEX).

Trade Analysis: General Methodology

As in the case of production, no formal figures have been published on imports and exports of GM (or potentially GM) versus non-GM products by country.[3] The only available data are a mix of GM and non-GM products. However, national import regulations and demand constraints are relatively well known, and so are the countries that produce GM crops and GM products. Therefore, by making some assumptions on countries or sectors with unknown policies and demand and by sorting out bilateral trade data based on their origin or destination, it is possible to derive approximations of imports and exports of products that may contain GM versus the products that can be defined as non-GM.

3 As shown in Sections 4 and 5, GM quantities allowed under import and export permits by South Africa are publicly available, but they do not provide a full representation of trade in GM products. First, a discrete permit does not necessarily reflect the actual trade flow in a given year. Second, it only shows data for living modified organisms, excluding processed products. Third, in the absence of a defined threshold level, there may be some GM material in traded shipments not under permit.

In the next two sections, we use historical bilateral trade data from international databases from 1997 to 2006. We focus on 13 traded products that are potentially GM or derived from GM crops: maize, maize flour, maize starch, maize oil, cotton lint, cottonseed, cottonseed oil, cottonseed oilcakes, soybeans, soy cakes, soy oil, rapeseed (canola), and rapeseed oil.[4] We use FAOSTAT bilateral trade matrices (quantities) for South Africa to separate out imports by country of origin and exports by country of destination.[5] For products that are not reported in the database and for the year 2006, we use the UN Comtrade database, which is consistent with FAOSTAT but includes complementary products and years. Because both databases are known to be imperfect and to include a number of blanks, particularly for countries in Sub-Saharan Africa, we verified that all the main partners (countries of the South African Development Community) were included in the matrices.[6] Because Botswana and Namibia were not reported in the original matrices, we used their own import or export matrices to determine the trade relationships of South Africa with these two countries.[7]

By the end of the process, we had obtained tables of South African exports and import quantities by destination and origin for each product from 1997 to 2006 (except for maize flour and soybeans, which are only present in the UN's Comtrade database for the period 2000–06). We then followed different steps for imports and exports.

Imports of Potentially GM Products

To determine the potential shares of GM and non-GM imports for each product, we made the simplifying assumption that all products from GM-producing countries may contain GM materials. We believe this assumption to be reasonable because South Africa does not have a strong import demand for non-GM commodities. Based on our discussions, only a few companies purchase non-GM products, and the existing GM labeling policy does not apply to current GM products and therefore does not push the market toward non-GM products (Carter and Gruere 2003a). The main caveat of this assumption is that we do not account for re-exported commodities, which could make a non-GM source potentially GM (for example, where GM maize travels through the port of a non-GM-producing country). This means that our estimates of GM shares of imports are probably undervalued, since many countries import and potentially transport GM products, particularly those derived from GM soybeans.

Naturally, the adoption of GM crops has changed over time; therefore, we use the years of commercial releases (or approved use) of each GM crop as a benchmark for when the country became a GM producer and potential exporter. Table B1 in Appendix B shows the initial years and countries we used to differentiate GM from non-GM imports. For example, we assume that any soy product imported from Argentina is potentially GM starting in 1996, but all cotton products imported from India are potentially GM starting in 2002. Naturally, by doing so, we may overestimate the chance of imports containing GM material the first year of release of these countries, but it is the only way to derive GM import shares in the absence of knowledge about the first adopters' characteristics. Furthermore, this exercise is not intended to determine the actual volume of imported GM products but the share of imports that are likely to be mixed GM/non-GM.

We also assume that the South African import regulations have been enforced since the introduction of GM crops— that, for example, GM soybeans could only be found after GM soybeans were approved for import. Table 3 provides a chronology of GM events cleared for imports in South Africa by crop. GM rapeseed (canola) was first approved in 2001, so we focus on 2001–07 data for

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4 Most oil products do not contain any quantified amount of GM material, but we included them because their import and consumption are regulated in certain countries.

5 The FAOSTAT trade matrices are available under Trade State at http://faostat.un.org.

6 For more on Comtrade limitations, see http://comtrade.un.org.

7 Because import and export data do not always correspond in the trade matrices, by using corresponding import and export data from these two countries, we neglect a potential bias. [OK? UNCLEAR TO ME OK.] The only other solution would be to assume that no trade occurred between South Africa and these two countries when in fact they are neighboring countries and important trading partners of South Africa.

rapeseed and rapeseed oil imports. GM cotton and maize were approved for import in 1997, while GM soybeans were only approved in 2001. Table 3 also notes that several GM events of maize and soybeans and all GM events of canola were only authorized for import, not for production, while a few GM maize events were approved for planting at least a year after they were cleared for import. We will come back to this issue of "asynchronicity" of import approvals in Section 3.

Table 3. Chronology of GM events approved for imports in South Africa, by crop

	Canola	Cotton	Maize	Soybeans
1997		1 event	1 event	
2000		1 event		
2001	4 events (4;0)		2 events (2;0)	2 events (1;0)
2002			4 events (2;1)	
2003		1 event	1 event(1;0)	
2004			1 event (0;1)	
2005		1event		
2007		2 events		
Total	**4 events**	**6 events**	**9 events**	**2 events**

Source: Department of Agriculture 2005; AGBIOS database (www.agbios.com), consulted on 01/02/08.
Note: The first number in parentheses is the number of GM events approved for import only, not for planting; the second is the number of GM events first approved for import and then for production in a later year.

Table 4. Descriptive statistics on the share and total quantity of South African imports that may have contained GM material, for each product

	Period	Minimum	Median	Maximum	Standard deviation	Sample share average	Total quantity average
Maize	1997-2006	42%	95%	100%	18%	**89%**	**92%**
Maize flour	00-06	0%	49%	99%	37%	**58%**	**92%**
Maize starch	97-06	0%	4%	31%	9%	**7%**	**7%**
Maize oil	97-06	0%	71%	100%	50%	**54%**	**74%**
Cotton lint	97-06	0%	1%	2%	1%	**1%**	**1%**
Cottonseed cakes	97-06	0%	8%	18%	8%	**8%**	**7%**
Cottonseed	97-06	0%	0%	4%	2%	**1%**	**1%**
Cottonseed oil	97-06	0%	4%	100%	45%	**32%**	**19%**
Soybean cakes	01-06	99%	100%	100%	1%	**100%**	**99%**
Soybean oil	01-06	94%	98%	100%	2%	**98%**	**98%**
Soybeans	01-06	74%	94%	100%	11%	**91%**	**76%**
Rapeseed oil	01-06	0%	0%	30%	12%	**5%**	**1%**
Rapeseed	01-06	0%	0%	0%	0	**0%**	**0%**

Source: Authors' derivations based on UN FAOSTAT and UN Comtrade data.

Table 4 shows the minimum, median, maximum, sample average share, and total average quantity of imported products that may contain GM for the relevant periods of reference.[8] Products derived from the four crops are ranked based on the average import value they represent for South Africa. These results first show that the average shares of GM imports across years and overall vary significantly

8 The sample share average is computed as the sample average of shares of potentially GM imports across years, giving the average share in any given year, while the total quantity average of potentially GM imports is computed as the ratio of total potentially GM imports over total imports for the whole period.

by product. At one end of the range, imported cotton and rapeseed products are mostly non-GM. Imports of cotton lint, cottonseed, and rapeseed are close to 100 percent non-GM. Cotton products are largely imported from other African nations, particularly West Africa, an exporting region that has not adopted GM cotton.[9] Rapeseed products are mostly imported from Western Europe, which also does not produce GM rapeseeds. At the other end of the range, not surprisingly, soy products are almost entirely GM. The largest exporters of soybeans (Argentina, Brazil, and the United States) have adopted GM soybeans.[10] In the middle of the range, the share of GM maize imports vary by products, from maize grain imports with average GM shares of 89 percent to maize starch imports that are more than 90 percent non-GM.

The second conclusion from the results in Table 4 is that the share of GM imports historically varies more for some products than for others. The sixth column of Table 4 shows the standard deviation of each time series. It indicates that the share of GM maize, GM maize flour, and maize oil derived from GM maize varied quite significantly by year. In contrast, imported cotton products (except cottonseed oil) were almost all non-GM, while imported soybean products have remained mostly GM during their respective periods. South Africa imports only marginal quantities of cottonseed oil and maize oil, which may explain the large observed variance for these two products.

To better interpret the results, the historic evolution of the GM share by products are shown in Figures 1, 2, 3, and 4 for selected products (which represent a high value of imports under each crop). The evolutions of the GM share of imports for the nine other products are shown in Appendix B, Figures B1 to B9.

Figure 1 shows the evolution of non-GM and potentially GM maize imports during 1997–2006. South Africa was a net exporter during the whole period but it still imported significant volumes of maize, reaching about 860,000 metric tons (mt) in 2002 and more than 1 million tons in 2006.[11] Figure 1 confirms that, in any year, most maize imported by South Africa came from GM-producing countries. Detailed analysis shows that the leading exporter of maize to South Africa was Argentina in 1997/98 (accounting for 60–90 percent of South Africa’s imports), followed by the United States in 1999–2000 (60–80 percent), and Argentina again after 2002 (85–98 percent). In 2001, Brazil was the leading source of maize, but their export quantity was inferior to the import quantities from Argentina and the United States. Non-GM maize was marginally imported during this period, with a peak of 170,000 tons in 2002, coming mostly from Brazil and Mexico.

Figure 2 shows the case of cottonseed imports. GM cotton is generally different from other crops because its main output, cotton lint, is not regulated nor differentiated in the world market. There is only a small international market niche for organic cotton and fair-trade cotton, both of which do not allow the use of GM materials. Almost the entire cotton output is a mix of GM and non-GM fibers. However, GM cottonseeds are subject to higher scrutiny, because they can be replanted, and because they are used for animal feed. Figure 2 shows that South Africa imported between 35,000 and 120,000 tons of cottonseed between 1997and 2006, which are virtually all from countries that do not produce GM cotton.

9 Burkina Faso has been conducting field trials of Bt cotton for the last few years, but it has not approved its commercialization.

10 Furthermore, the rate of adoption of GM soybeans in Argentina and the United States is close to 100 percent.

11 For the purposes of this paper, all tons are metric tons (mt).

Figure 1. Imports of GM/non-GM maize (1000mt)

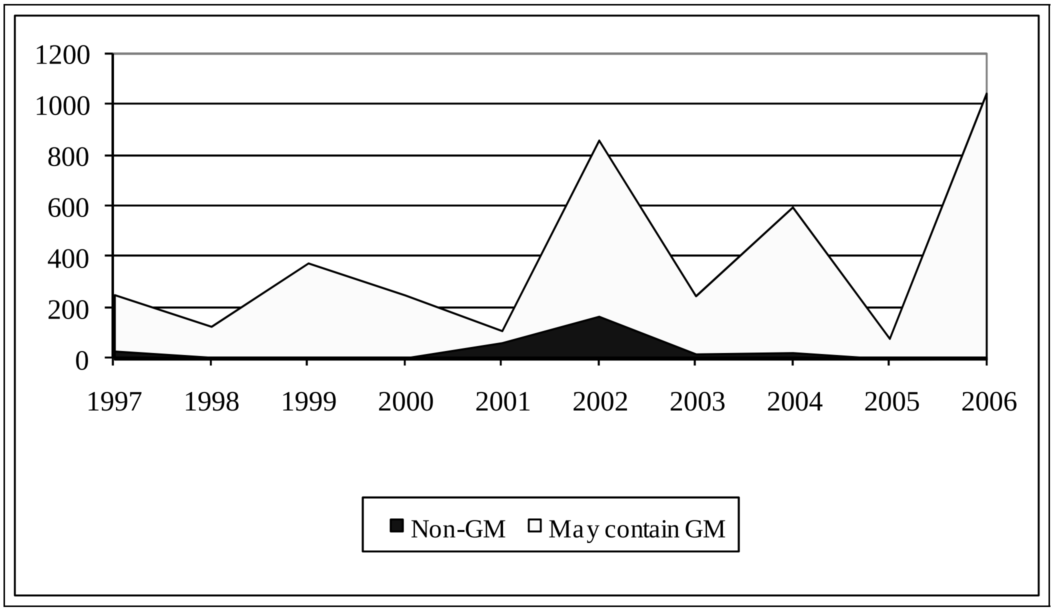
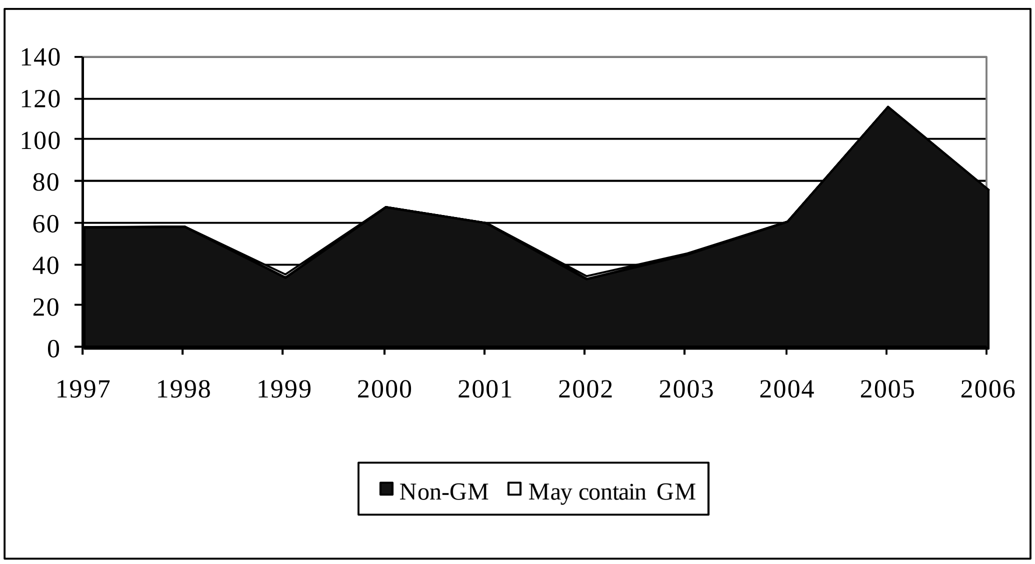


Figure 2. GM/non-GM cottonseed imports (1000mt)



Figures 3 and 4 show the evolution of the share of GM soy cakes and GM rapeseed in South African imports. Soy cakes represent by far the highest value imports of soy products by South Africa. Although South Africa produces soybeans, the industry has only developed recently. According to the data we used, South Africa imported between 500,000 and 800,000 metric tons of soy cakes between 2001 and 2006. More importantly, the entire quantity can be considered a GM/non-GM mix. In contrast, rapeseed imports are much smaller (under 120 metric tons) and only non-GM.

Figure 3. GM/non-GM soy cake imports (1000mt)

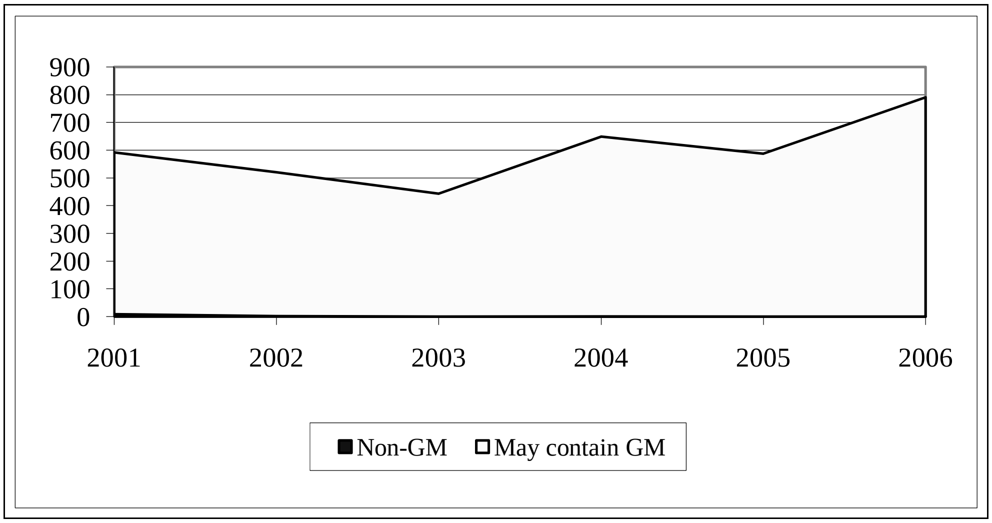
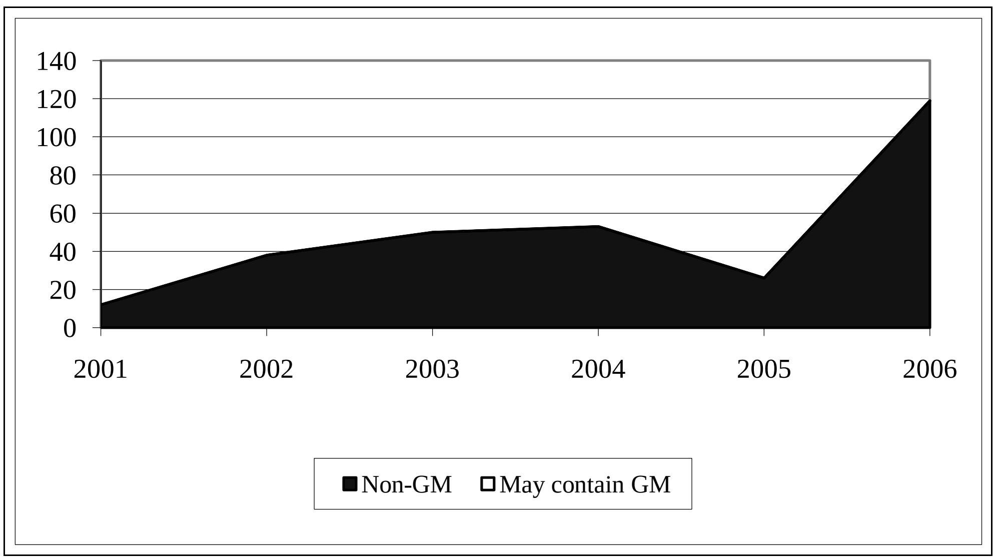


Figure 4. GM/non-GM rapeseed imports (mt)



Exports of Potentially GM Products

To determine the potential share of mixed GM exports from South Africa, we sorted out bilateral export data by differentiating importing countries based on their import policies and regulations and a basic knowledge of the effects of their marketing regulations. More specifically, for each product and each year, we divided importing countries into four groups: (1) countries that have stringent importing and labeling policies, and significant non-GM demand, such as European and East Asian countries; (2) African countries that have initiated a ban on GM imports, like Zimbabwe; (3) African countries who have officially banned imports of GM grains but may not have completely implemented their policies, like Kenya; and (4) other countries that have no explicit or effective policy on GM imports.

There are three main difficulties in proceeding with this division. First, it is not easy to know when countries started to implement their official or actual importing policies, particularly for those that do not have formal biosafety regulatory frameworks in place. Second, although one can separate countries of group (1) from the others, the distinction between groups (2) and (3) is subjective and may be inaccurate, because some of the countries assumed to be in group (2) may have a strict official position but a loosely enforced policy. To deal with this issue, we used qualitative information obtained from traders and experts we met in South Africa. Third, it is important to note that the group division does not only depend on policies, but it also depends on the type of products. In particular, cotton lint is not regulated anywhere, and highly processed products, such as oil, are imported and sold as non-GM in countries like Australia, Japan, or New Zealand. Still, we are not completely certain of the product coverage of informal GM import policies in Southern and Eastern Africa—groups (2) and (3). Available information suggests that most of these countries focus on grains, and that maize is the most scrutinized commodity at the borders. Zimbabwe was the only country that was reported to test soy products at the border.

The first three groups of countries we use in our analysis are shown for each product and year in Table 5 (the last group includes all other countries). In group (1), Western European countries are assumed to import only soy products that are used for animal feed. East Asia, Australia, and New Zealand import only GM products that are not required to be labeled, such as highly processed food products. China, Japan, and Korea are also assumed to regulate soybean imports as a food product.

In group (2), we only include countries that have explicitly rejected GM products in the past and that are recognized by South African traders or experts as having implemented their ban. In fact, Zimbabwe is the only country that was consistently reported to have implemented its ban (except in cases of emergencies in 2002, when it accepted milled maize), with strict polymerase chain reaction (PCR) testing and identity preservation-requirements. Namibia and Zambia are both known for their clear rejection of GM maize imports from South Africa; however, some of the stakeholders we met in South Africa reported that they do not necessarily enforce their bans strictly. According to them, Namibia and Zambia require GM-free certificates, but they do not seem to test imports systematically. Therefore, these two countries could be either listed in group (2) or (3), but we decided to keep them in group (2).[12] Lastly, group (3) is made up of countries that are either known to officially accept only non-GM products or that sometimes require non-GM certificates but do not seem to be hard to satisfy.[13]

Table 5. Groups of importers based on their acceptance of GM products

	Group (1) Countries with clear import and marketing regulations that demand non-GM imports	**Group (2)** African countries with a GM import ban for selected products	**Group (3)** African countries that officially reject GM imports for selected products
Maize	EU-15 (1997-2003), EU-25 (2004-06), other Western Europe (1997-2006), Japan (2000-06), South Korea (2000-06), Australia and New Zealand (2000-06), China (2002-06).	Namibia (2003-06), Zambia (2002-06), Zimbabwe (2003-06).	Angola (2004-06), Botswana (2003-06), Kenya (2003-06), Malawi (2003-06), Mozambique (2003-06), Mauritius (2003-06), Sudan (2004).
Maize flour	Same as maize	Same as maize	Same as maize
Maize starch	Same as maize, excluding China.	None	None
Maize oil	EU (1998-2006), other Western Europe (1998-2006).	None	None

12 We discuss the policies in these countries in more detail in Section 4.

13 For instance, one person we talked to noted that the importing country may test the contents of one truckload but not test all the following trucks, which are part of the same load. Another person noted that if the importer finds some GM, the transporter is fined but can still enter the country with its GM shipment.

Table 5. Continued

	Group (1) Countries with clear import and marketing regulations that demand non-GM imports	**Group (2)** African countries with a GM import ban for selected products	**Group (3)** African countries that officially reject GM imports for selected products
Cotton lint	None	None	None
Cottonseed cakes	Same as maize starch.	None	None
Cottonseed	Same as maize	Zimbabwe (2003-06)	None
Cottonseed oil	Same as maize oil	None	None
Soybean cakes	Japan, South Korea (2000-06), China (2002-06)	Zimbabwe (2003-06)	None
Soybean oil	Same as maize oil	None	None
Soybeans	Japan, South Korea (2000-06), China (2002-06)	Zimbabwe (2003-06)	None

Source: Authors, based on meeting information; Gouse 2006b.

After this group division, we distinguished three categories of exports: purely non-GM exports, which covers exports to countries from groups (1) and (2); exports that are officially non-GM, which includes quantities going to countries of group (3); and exports that may contain GM, which consists of shipments to countries in group (4) (calculated as the remaining exports). We only accounted for potentially GM exports after the introduction of the relevant GM crops in South Africa. Therefore, we did not include rapeseed products that are not produced in South Africa, and we only accounted for soybeans, maize, and cotton products the calendar year *after* their approval (as indicated in Table 1).[14,15] Because we do not know the nature of the commodity shipments, we did not distinguish exports from re-exports, or even food aid shipments (that are included in the FAOSTAT data we used). Further, our analysis only focuses on available data from reported formally traded shipments. All knowledgeable persons we met in South Africa and Namibia admitted that informal trade, which may include GM maize, happens daily across borders without any control.

In the process, we also assume that countries of group (1), importing mostly non-GM products, will *only* receive non-GM products from South Africa. Our estimates of GM export shares may therefore be undervalued. Besides, because we do not account for re-export, we may underestimate these shares for some of the exports from South Africa that may contain GM imported products. On the other hand, we do not account for specialty organic or fair-trade niche markets, therefore overvaluing our estimates of the share of GM products in total exports. Furthermore, because of the unavailability of bilateral export data on white versus yellow maize, our estimates of the share of GM before 2001 are based only on the possibility of exported yellow maize being GM, and therefore are likely to be significantly positively biased.

These limitations are important, but our goal is not to derive accurate estimates of GM products (or the GM share of products) exported from South Africa to other countries, but rather to provide an overview of the evolution of the possible presence of GM in South African exports, based on importers' specific demands. Indirectly, our results help to assess the status and changes in the regulatory situation in

14 According to the crop calendar in South Africa, maize is planted from October–January and harvested in May–June, while soybeans are planted in October–December and harvested in April–June (FAO 1999). UNCTAD (2008) reports that cotton is planted in November–December and harvested in May–July.

15 As noted by Gouse et al. (2005), Bt yellow maize was first planted in 1998/99; therefore we only show shares of potentially GM maize exports starting in 1999.

target export countries and therefore give an outlook of export opportunities for South African products potentially derived from GM crops.

Descriptive statistics for the estimated shares of exports and the total quantity average that may contain or be derived from GM during the relevant periods are shown by product in Table 6. These shares are computed as the sum of the share of exports to group (4) countries, compared with that for group (3) countries. In other words, to compute the results in Table 6, we assume that some exports to group (3) contain GM materials because of imperfect enforcement at the border.

Table 6. Descriptive statistics on the shares of South African exports that *may contain* or *be derived from* GM crops

	Period	Minimum	Median	Maximum	Standard deviation	Sample share average	Total quantity average
Maize	1999-2006	24%	48%	99%	27%	**54%**	**49%**
Maize flour	2000-06[a]	50%	95%	100%	22%	**82%**	**91%**
Maize starch	99-06	88%	93%	99%	4%	**93%**	**93%**
Maize oil	99-06	100%	100%	100%	0%	**100%**	**100%**
Cotton lint	98-06	100%	100%	100%	0%	**100%**	**100%**
Cottonseed cakes	98-06	65%	100%	100%	14%	**91%**	**93%**
Cottonseed	98-06	12%	100%	100%	35%	**80%**	**35%**
Cottonseed oil	98-06	100%	100%	100%	0%	**100%**	**100%**
Soybean cakes	02-06	100%	100%	100%	0%	**100%**	**100%**
Soybean oil	02-06	100%	100%	100%	0%	**100%**	**100%**
Soybeans	02-06	3%	47%	100%	38%	**55%**	**14%**

Source: Authors' derivations based on UN FAOSTAT and UN Comtrade data.
Note: [a]Data unavailable for 1999/2000.

Even more than for imports, these results have to be carefully interpreted. For instance, a 100 percent average share does not mean that all exports contain GM, but that, to our knowledge in any give year, 100 percent of the exports may possibly contain (or be derived from) GM material. Naturally we do not claim to know the exact GM content of exports, we only provide an estimate of the share of likely exports with mixed GM/non-GM products in any given year or over the whole period. More important perhaps, our results indirectly indicate the average share of non-GM exports in a given year and the total average quantity of likely non-GM exports for the relevant period.

With this in mind, these results suggest first that most of the selected products are largely exported to countries that do not have particular requirements for the presence or absence of GM products. Second, three products stand out: maize, cottonseed, and soybeans, of which in any given year, a fifth of exports go to countries with non-GM requirements (or GM bans/restrictions). In total, more than 45 percent of exported products are likely non-GM. More specifically, on average across years, 41 percent of maize, 20 percent of cottonseeds, and 45 percent of soybeans exported are going to countries that have rejected GM maize in recent years. For the whole period, we estimate that 45 percent of maize, 65 percent of cottonseed, and 86 percent of soybeans exported are probably non-GM. Of course these results are the consequences of the assumptions presented in Table 5. We assume that importing African partner countries control the entry of GM grains (rather than processed products), that they worry mostly about food or feed, and that they do not all enforce their policies.

Table 7. Descriptive statistics on the shares of potentially GM maize and flour exports, assuming group (3) countries are enforcing their import bans

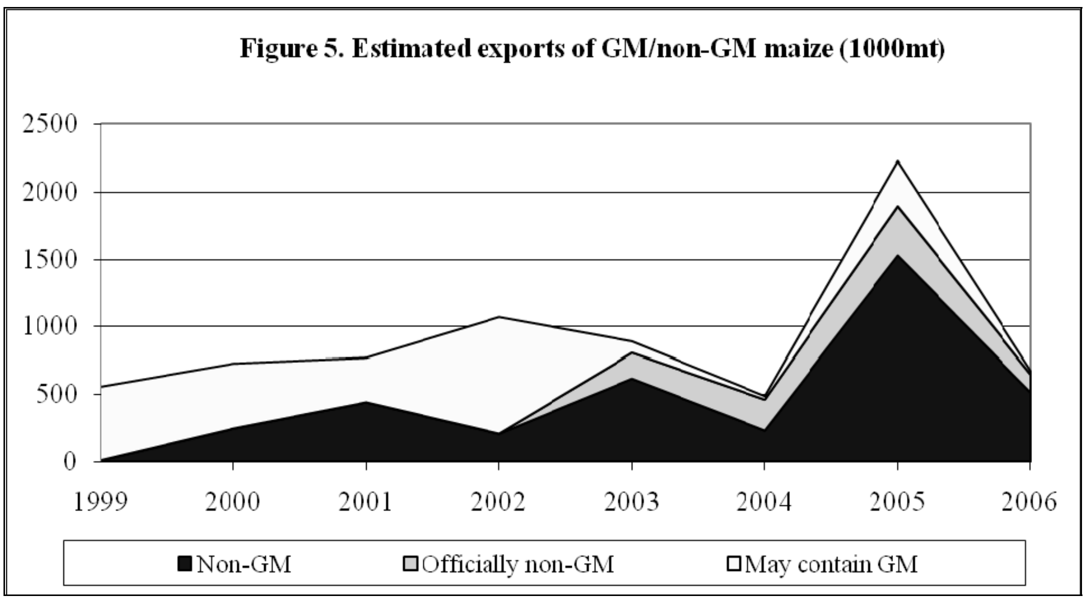
	Period	Minimum	Median	Maximum	Standard deviation	Sample share average	Total quantity average
Maize	1999-2006	4 %	29%	99%	38%	**40%**	**36%**
Maize flour	2000-06	11%	85%	100%	22%	**63%**	**81%**

Source: Authors' derivations.

As a complement, Table 7 shows the shares of potentially GM maize and maize flour exports, assuming all African countries with regulations for example, groups [2] and [3]) enforce their bans. Maize and maize flour are the only two products imported and targeted by group (3) countries.[16] Compared to Table 6, as expected, the average share of potentially GM exports in a given year are lower, reaching 40 percent for maize and 63 percent for maize flour. Similarly, the share of the total quantity of potentially GM exports decreases to 36 percent and 81 percent for maize and maize flour, respectively.

To explain the discrepancy between average annual shares and quantity shares, Figures 5, 6, and 7 show the evolution of export quantities by type for three selected products: maize, maize flour, and soybeans. Similar figures for other products are shown in Appendix B, Figures B10 to B17.

Figure 5. Estimated exports of GM/non-GM maize (1000mt)



16 Therefore, for all other products, the shares are the same whether or not group (3) countries are enforcing their regulations.

Figure 6. GM/non-GM maize flour exports (1000mt)

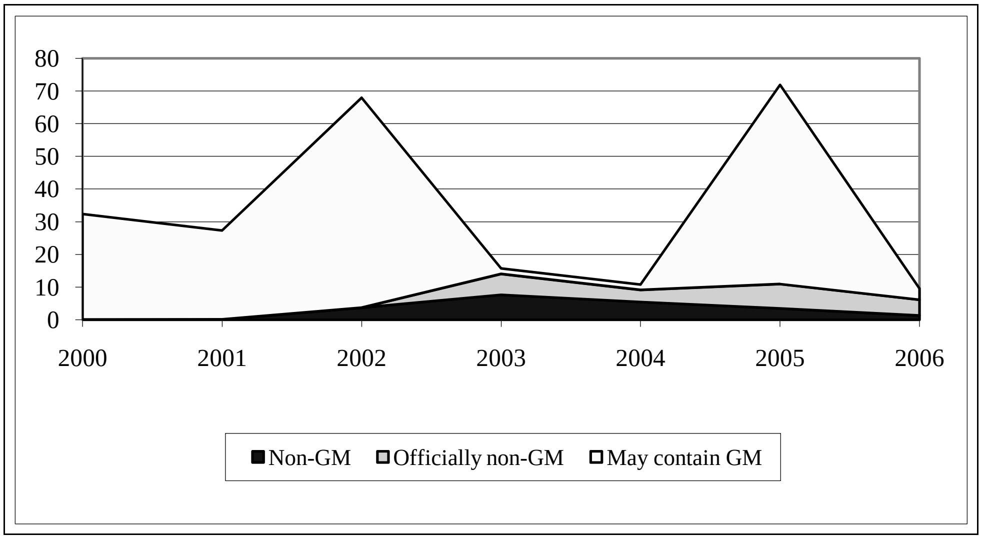
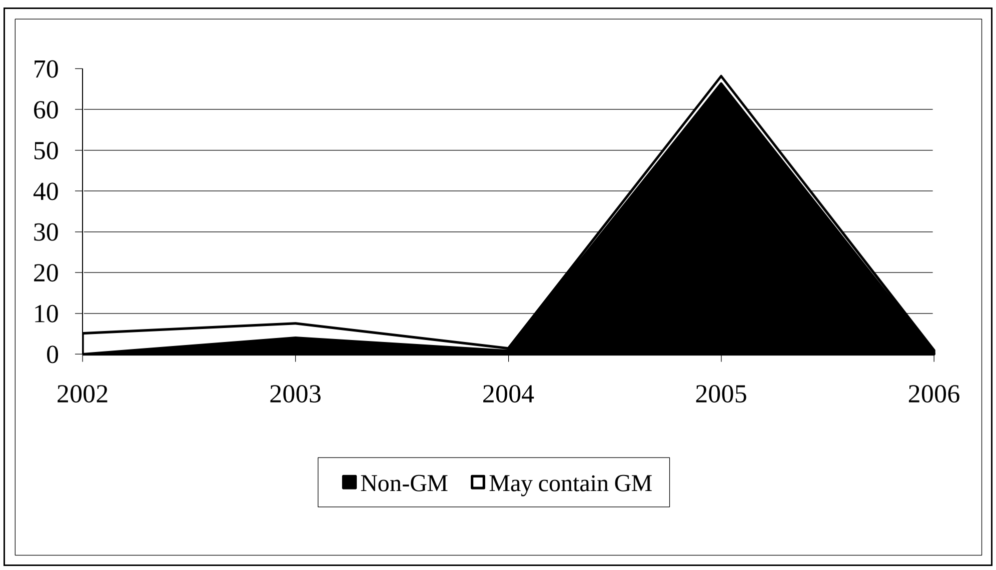


Figure 7. GM/non-GM soy exports (1000mt)



In the case of maize, Figure 5 shows a progressive increase in the share and total quantity of non-GM exports. This reflects the regulatory pressure by an increasing number of countries that reject GM imports. This result is especially driven by Zimbabwe, which in recent years has seen its maize production fall to one-twelfth of its earlier amount;[17] It has become a large importer of non-GM maize in the region and the main country responsible for the observed 2005 peak in Figure 5.

The pattern is different for maize flour exports, indicating a large amount of exports in 2002 and 2005 of mostly mixed GM/non-GM maize. In 2002, most maize was going toward countries in the region such as Angola, Botswana, Malawi, and Zimbabwe, because of a severe drought that led to food

17 According to a representative of Tongaat-Hulett starch, a company working in Zimbabwe, Zimbabwe used to produce about 8 million tons before the land reform; in 2007 it produced about 600,000 tons of maize.

assistance. To our knowledge, these countries accepted GM maize imports only if the maize was milled, therefore allowing GM maize flour. In contrast in 2005, more than 80 percent of exports went to Iran, which we assume did not regulate GM imports. Because the share of non-GM was large in years when exports were low, the average share over time is quite low, while the total quantity average is relatively large. In recent years, more countries have been officially banning GM maize and maize flour, as demonstrated by the growing width of the intermediate band in Figures 5 and 6.

Lastly, in the case of soybeans, 2005 was the only year in the series with significant exports for South Africa. That year, almost the entire export quantities went to Zimbabwe, which we assume was testing for and rejecting GM soybeans. Because most of the small quantity exported in 2002 and 2003 was potentially GM, the average share across the years in Table 6 is much larger (55 percent) than the share of total quantity exported (14 percent).

Synthesis: A GM And Non-GM Importer and Exporter

By conducting a bilateral trade data analysis, we have confirmed our claim that for the last 5 to 10 years South Africa has been a significant *importer and exporter* of GM crops and products derived thereof. At the same time, it has maintained non-GM exports of processed and unprocessed products. By being a mixed GM/non-GM trader to mixed GM/non-GM trading partners, South Africa’s trading industry has demonstrated its ability to successfully adapt to changing regulatory situations. Furthermore, South Africa’s situation is unique; to our knowledge no other main GM-producing country is known to be both an importer and exporter of GM and non-GM products. Argentina, Australia, Brazil, Canada, India, and the United States are mostly large exporters of GM products, while China is a large importer of GM crops.

We have also found that no general conclusion can be drawn on GM trade in South Africa, as the situation varies by product and year.

- From 1999 to 2006, South Africa was a net exporter of maize. Exports of maize from South Africa have increasingly gone to countries that only allow non-GM maize. At the same time, because of differences in regulations for processed products, exports of maize flour were likely milled from mixed GM/non-GM maize. In addition, our assessment shows that there was no market access restriction on GM maize oil (and GM maize starch) in traditional export markets for South Africa. During the same period, South Africa also imported significant quantities of mostly GM maize from the United States and then from Argentina.
- South Africa is a net cotton importer. Interestingly, unlike other importers, most of the cotton products imported in South Africa came from non-GM producing countries. Most GM cotton products are not regulated anywhere. The small quantity of cotton exports from South Africa was therefore potentially GM. Cottonseed trade is the exception, as it is regulated in certain countries. We estimated that about 65 percent of the (small) total export quantity of cottonseed from South Africa went to non-GM countries between 1998 and 2006.
- In the case of soybeans, South Africa is a relatively large importer, especially of soy cakes. Its production of soybeans has been increasing but constrained by insufficient crushing capacity. In any given year, 90 to 100 percent of soy products imported by South Africa were likely derived from GM soybeans. Furthermore, more than three-quarters of the total soybean imports approved in 2001–06 were made up of mixed GM/non-GM products. Exports of soybeans were minimal, except in 2005, when South Africa exported mostly non-GM soybeans to Zimbabwe.
- Finally, South Africa is not a large producer, importer, or consumer of rapeseed (canola) products. Its imports of rapeseed came almost entirely from non-GM-producing countries. The country is therefore not concerned with GM-related regulatory issues in the international rapeseed market.

In conjunction with this outlook, we can also draw a few conclusions regarding the future dynamics of GM/non–GM trade for South Africa.

- As GM maize adoption increases, the constraints to GM exports may also multiply, but this could be compensated for by exports of processed maize products that do not face the same market access restrictions. In recent years, South Africa also seems to have imported maize and maize flour largely from GM-producing countries.
- As soybean consumption increases, even with increasing production, South Africa is likely to remain a large GM soybean importer, like many other countries.
- Cotton products are clearly not affected by trade considerations. Cottonseed exports may face some barriers in certain countries, but their effects seem to be limited.

Using this outlook as a baseline, we now consider more specifically the current and future regulatory situation for South Africa’s imports and exports.

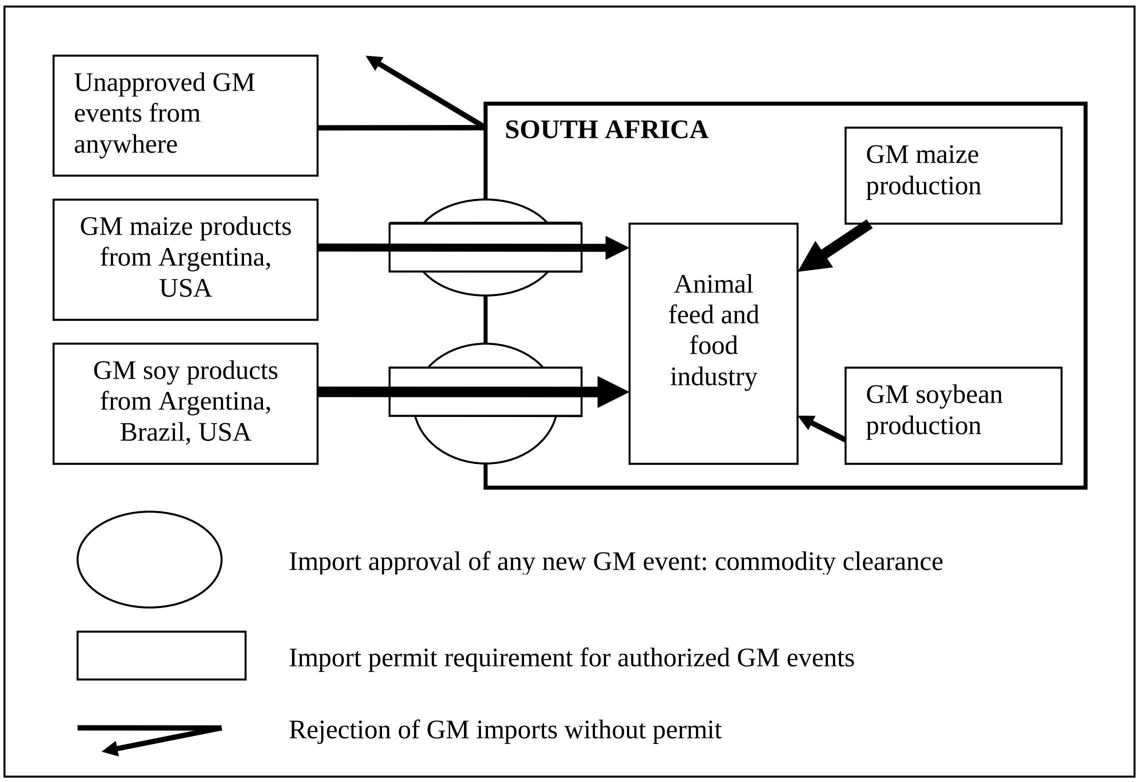
3. IMPORT REGULATORY ISSUES

From Commodity Clearance to General Clearance?

Regulations on imports of potentially GM products address three main issues. First, they indicate the required steps to follow for applicants seeking to have GM events approved for food or feed consumption (but not for planting). Second, they delineate potential management requirements for traders (exporters to the country and importers in the country) of GM commodity shipments that are cleared for import. Third, they provide rules for handling nonapproved commodity imports that could potentially enter the country, including a tolerance level for their accidental presence in shipments of approved GM imports.

South Africa is one of the few countries that included in its original biosafety system a specific regulatory process for imports, as opposed to release into the environment. Its regulatory framework includes rules to address the three elements listed above, as shown in Figure 8.

Figure 8. South Africa's regulatory framework for imports: GM event authorization, GM commodity import management, and rejection rules



The GMO Act of 1997 (South Africa, Republic of 1997), as amended on April 17, 2007 (South Africa, Republic of 2007), provides the general framework for commodity imports. Two institutional entities, the GMO Executive Council and the Advisory Committee, play a role in the decisionmaking process regarding GM import approval. Authorization of GM organisms for import but not for planting is called commodity clearance. Once a GM event is authorized for import, traders using it can request a GMO import permit. Import permits are delivered for each transaction but can be fast-tracked after the first permit. Imports of GM materials without a permit are forbidden. In other words, implicitly, the South African regulatory framework applies a 0 percent tolerance for unapproved GM events.

More specifically, applicants for commodity clearance have to provide a list of elements, including the description of products imported, information on the genetic transformation, human and animal health risk assessment, potential environmental and socioeconomic impacts, and risk management strategies. They also have to provide information regarding the risk assessment of the GM event, following the Biosafety Protocol common format, and pay a fee to the Registrar of the GMO Act. Upon verification by the Registrar, the application is sent to the Advisory Committee, which is composed of a group of experts who informs the GMO Executive Council (EC) of its opinion. The EC is composed of representatives from eight South African ministries: the Department of Agriculture, the Department of Environmental Affairs and Tourism, the Department of Science and Technology, the Department of Trade and Industries, the Department of Labour, the Department of Health (DOH), and since 2007, the Department of Arts and Culture and the Department of Water Affairs and Forestry (Jaffe 2007). The EC discusses various aspects of the application and then reaches a consensus decision either approving (with no further information) or rejecting the application (with explanations).

After this process, GMO permits can be obtained from the authorities for any imported products that contain or may contain GM events that have been cleared. The permit application is simpler, accompanied by a small fee and processed relatively more rapidly. Still, commodity clearance does not guarantee the issuance of import permits. Regulation R No. 1420 of November 26, 1999 (Department of Agriculture 1999) explains that several factors can enter into consideration, including socioeconomic impacts. This means that other issues (such as nonsafety-related concerns) can be sufficient reasons to decline a GMO permit.

Table 8. Total reported import permits and quantities of GM maize and soybeans under commodity import permits (1999–2007).

Year	Total number of import permits[a]	Total number of commodity import permits[b]	Quantity of GM maize under commodity import permits[c] (mt)	Quantity of GM soybeans under commodity import permits (mt)
1999	1	0	0	0
2000	69	7	0	0
2001	67	6	1,000	18,686
2002	102	36	999,400	27,922
2003	90	14	105,507	20,335
2004	104	27	430,460	16,000
2005	86	2	0	12,100
2006	209	114	1,219,180	51,000
2007	312	215	1,903,334	29,634
Total	**1,040**	**421**	**4,658,881**	**175,677**

Source: Documents from the Department of Agriculture, Genetic Resource Group, available at http://www.nda.agric.za/

[a] Includes commodity clearances.

[b] Including single permits for “use as commodity” (those that are not repetitions).

[c.] Quantity of maize permits noted as “GMO maize <1%,” reported at 10 million tons in 2002 (by far exceeding all official estimated imports) and 200,000 tons in 2003 and 2004, were excluded.

Table 8 shows the reported number of import and commodity import permits and quantities of maize and soybeans imported under permits between 1999 and 2007. These numbers show that as time goes by, South Africa has approved more and more permits for imports and has allowed the imports of larger quantities of GM maize and soybeans. It also confirms our findings in Section 2, by showing that in recent years, imports of soybeans and maize were largely GM. With this system, South Africa has imported significant amounts of approved GM products.

In the first years after the implementation of the GMO Act, South Africa issued commodity clearance for a variety of GM products. Four events of GM canola, one event of GM soybeans, and five events of GM maize have been approved for import only (see Table 3). Therefore the process worked well, with a different regulatory response to import and planting applications, based on the differences of risk. It also was consistent with the Biosafety protocol, which clearly distinguishes regulatory requirements for unprocessed GM commodities (defined as living modified organisms intended for food, feed, or processing [LMO-FFPs]) and GM material imports for planting.

Yet, in recent years the situation has changed. In 2004, based on an objection from Grain South Africa, a domestic farmers' group, South Africa decided to temporarily block the approval of a new GM maize event only for imports (Wolson and Gouse 2005). This GM maize had been released in the United States and is resistant to corn rootworms, a pest neither present nor endemic in South Africa. Because this pest is not a problem in South Africa, the developing company had no plans to apply for a full permit for this new product. Even if it did, the event would likely not be approved because it could not demonstrate any particular productivity advantages for growers in South Africa. The developing company just requested an import permit to allow imports of mixed GM maize, including this GM event, to be sold in South Africa. At a time when the world price of maize was relatively low, and with relatively large U.S. imports, maize producers supported the idea that this new GM maize should be blocked because of what they perceived as "unfair competition." Despite the fact that the GM event would not bring any benefit to South African farmers and therefore would not be grown in South Africa, they found it unfair that U.S. farmers could grow and export it to South Africa.

What seemed to be a temporary decision has in fact been in place since then. All new GM events approved have had to pass the full approval procedure for environmental release. In the meantime, the Executive Council requested a consultant report on the economic costs and benefits of this measure. The report was completed in 2007, submitted to the Department of Trade and Industries, and was to be circulated to members of the EC (Executive Council for GMO 2007a), but it has not been publicized. In its September 2007 meeting, the EC noted that the issue would be reconsidered after consultation with the World Trade Organization (WTO) Desk of the Department of Trade and Industries (Executive Council for GMO 2007b).

This issue has clearly divided the agricultural industry into two groups: the animal feed industry against the maize producer associations. Maize producers want to keep the requirement that any GM product should be imported only if it is approved for planting. In the context of a global competition and a relatively open market in South Africa, they perceive the U.S. exports as some kind of "dumping"—or sale below cost of production in South Africa.[18] In contrast, the animal feed industry opposes this position as a protectionist measure (Köster 2006). As a major consumer of yellow maize, the feed industry sees the rejection of imports from the United States as reducing the sources of yellow maize, perhaps increasing the price of their main input. Furthermore, with the large increase in world prices and the severe droughts that made South Africa a net importer of maize in 2007, they believe that the price issue for domestic growers has become irrelevant, and imports are even more important.

Beyond the debate about the validity of the measure, which has resulted in a virtual ban of maize imports from the United States (in favor of Argentina's imports, because Argentina only uses GM maize approved for planting in South Africa), the question now is whether imports of GM maize events not approved for planting should be allowed in the case of emergencies. But even on this issue, the two parties differ. The maize growers would prefer to define the threshold for this needs-only measure based on a quantity gap between consumption needs and harvests plus allowed imports. The feed manufacturers' association argues in favor of a broader definition that would include price considerations; in other words, when the price is too high, such maize would be imported.

During our meetings in South Africa, we met with several members or representatives of departments that are part of the Executive Council (EC). By discussing this issue, we noted two distinct justifications for a change in regulations. First, for some of the EC members, such as the one from the Department of Trade and Industry, the import rejection is directly related to unfair competition. They

18 Interestingly, unlike maize in the case of soybeans, the farmers' group Grain S.A agreed to temporarily support a tariff rebate proposed by the Sasol to develop biofuels, , because they saw it as an engine of growth for the South African soybean production sector (Köster 2006).

argue that maize imports from the United States, which are not subject to any type of traceability, are sold at a low price in the port, which threatens the domestic industry. Part of this price wedge comes from the fact that transport infrastructures linking the ports to the inner land are not competitive and make South African grains more expensive than imported grains for the animal industry in coastal areas. Second, some other stakeholders (the Department of Agriculture, for example) do not consider U.S. imports as dumping, but they argue that price differences for imports are absorbed by the feed industry and that they are not transmitted to consumers, which is an unfair practice. In other words, if there is to be a price difference, they feel that it should be transmitted to consumers. Without any differences, they argue, the price difference will simply translate into additional profit for the industry.

We did not obtain a copy of the consultant's report, but from what we heard during our visit, the report done by economists at the University of the Free State opposes the use of this new import barrier.[19] However, even with this report in hand, several EC members are adamant that this import ban on new GM maize events not approved for planting should stay in place, except potentially in a few specific situations. In so doing, they basically argue that the commodity clearance procedure should be eliminated in favor of a single full clearance system for any approval.

While we do not have all of the information to analyze fully the welfare consequences of these regulatory options, as economists, we can still draw lessons from basic international trade theory and use our knowledge of national import regulations and international agreements to judge its validity.

First, the measure in discussion is a selective ban of products not approved for planting, but none of the stakeholders seem to be considering it as a risk-related issue. In other words, it is clear that the GM event, if judged only on its safety, would likely be approved for consumption in South Africa. It is a trade concern, which would therefore classify it as a socioeconomic consideration.

Second, although this measure relates to one GM event, because the U.S. commodity channel is mostly composed of mixed events, it could be considered an effective trade barrier for U.S. maize imports.[20] The argument that, since other countries use traceability, this situation is entirely the fault of the U.S. system is not completely valid, because if Argentina did not have traceability, it would still be able to export to South Africa. Most important, it is the justification of unfair trade that makes all GM-related considerations completely irrelevant.[21] What matters to the strongest supporters of the measure is the price of imports relative to the price of domestic maize. Therefore, it is not a question of GM or not GM, the GM import regulatory system is taken as a means to install border protection for the domestic industry. Even those who argue that the conflict lies in the fact that the feed industry does not transmit price differences are only using a purely economic argument to justify a nonrelated biosafety measure. The next two sections analyze both claims from the perspective of their relationship to a biosafety approval decision on a new GM maize event.

"Unfair" Trade Practice: From New GM Event to Low Import Price?

Let us consider the first argument in favor of this measure: price competition in a partial equilibrium framework. Although South Africa as a whole can be a net exporter of maize (that is, it can have a lower price than countries in the regions that import its maize, the coastal area of South Africa is a net importer (the price is higher than the import price in Cape Town). This can be explained by the fact that the supply of maize in the coastal area is generally insufficient to respond to the demand of the feed industry, but

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19 According to a meeting participant, the report was "done by pro-GM academic professors....Ninety percent of the report is about the advantages of GM, not related to the trade issue studied, 10 percent is on trade issues and argues that there might be a price effect."

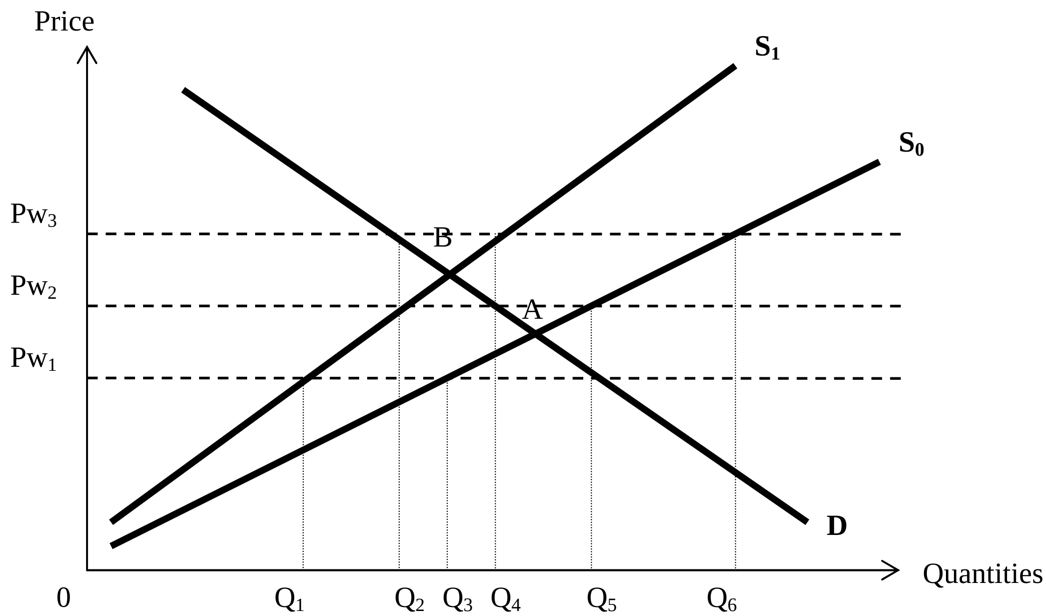
20 We cannot say that United States would have remained the dominant exporter in the absence of the moratorium, though past data suggest that it would have continued to be a significant exporter.

21 One person we met argued that importing new GM events planted in the United States but not available in South Africa, despite their potential (like triple-stack maize) could be considered unfair. But if the issue is productivity and competition, they should request the company to apply and obtain a permit for the targeted variety in South Africa. The delay or asynchronicity would be due to delayed process, not to unfair trade practices.

maize produced in the main productive areas, which are located inland, is also transported at a high cost to the coast; the world price is in-between the two market prices.

Figure 9 provides a graphical representation of this situation in partial equilibrium, focusing on the maize sector in the coastal area of South Africa. For simplicity, supply and demand curves are linear, and South Africa is assumed to be a price taker in the international market (reasonable assumptions close to the equilibrium). Let *D* be the demand for maize, mostly yellow maize from the animal feeding industry. S_0 is the supply of maize, assuming perfect integration and no transaction costs in the whole country. S_1 represents the actual supply of maize in the coastal area. Because transportation and other infrastructure are expensive, they add up to the marginal cost of production of maize, resulting in an upward shift of the supply curve from S_0 to S_1. Point *A* represents the market equilibrium with perfect integration, point *B* represents the market equilibrium, accounting for the transportation costs to reach the coastal area. We then consider three international prices: a low price Pw_1 (which is inferior to the autarky equilibrium price at point A, with perfect integration), a high price Pw_3 (that exceeds the autarky equilibrium price at point B), and an intermediate price Pw_2.

Figure 9. The price wedge argument in a partial equilibrium framework: the maize sector situation in the Western coastal area of South Africa.



At price Pw_1, the area would be a net importer of maize whether with or without transport costs. In the first case, it would be importing $M_1 = Q_5 - Q_3$; in the second it would import up to $M_1' = Q_5 - Q_1$. At a high price, Pw_3, even with imperfect transportation, the area would be a net exporter, with exports equal to $X_1 = Q_6 - Q_2$ or $X'_1 = Q_4 - Q_2$. But with an intermediate price Pw_2, the area will be a net exporter only if it does not incur any marginal transportation cost. With actual transport cost, it will be a net importer.

Before mid-2006, the price of maize was relatively low, making this region a net importer. But South Africa as a whole was a net exporter, which suggests that the world price was not that low. In all likelihood, international prices were intermediary, making the coastal area a net importer and the country as a whole a net exporter because of transportation costs.

Therefore, we can draw two basic conclusions. First, infrastructure and transportation costs, or the lack of market integration across provinces, or both, seem to be largely responsible for import surges in South Africa's coastal provinces. This does not reject the possibility of dumping, but it suggests that maize imports from the United States are unlikely to be unfair; they just reflect the domestic market constraints. Second, as Figure 9 illustrates, this configuration could change quickly with a price increase, supposing South Africa can still provide the same supply yearly. In 2006–07 and up until now, the world price of maize has surged dramatically. Because of a recurrent drought, South Africa's maize production has been low, making it a net importer, but assuming that production conditions return to normal, the country and the region could become a net exporter of maize with limited imports.

The argument for dumping, although hypothetically possible, would have to be proven. Under the General Agreement on Tariffs and Trade (GATT), WTO member countries can only demonstrate dumping (in anti-dumping disputes) in cases where there is a proven injury to a domestic industry and where there is evidence that the product was sold under its cost of production. If South Africa were to claim that U.S. maize was dumped on this grounds, it would need to demonstrate both the injury to the maize producers (such as economic losses) and compare the price of imports at the time of the claim to the actual costs of production in the United States. Although we do not have these data, given that South Africa is a minor market for U.S. grain (compared, for example, with North Africa or Asia), it is unlikely that U.S. exporters would take any such measure to force exports on South Africa. In any case, even a proven dumping case would have no effect whatsoever on the use of a new GM maize event.

Still, one producer representative argued that if new U.S. GM events are unapproved elsewhere but approved in South Africa, the United States could use South Africa to dump the maize, preferably at a lower price. This could become an issue if these events were approved only in the United States and in South Africa and nowhere else in the world, or if traders in the United States were effectively separating events in maize exports. But neither of these two preconditions is fulfilled. The particular GM event rejected by South Africa was already approved for import to Japan, Mexico, and South Korea. Furthermore, as demonstrated with the ban-like effect of the rejection of one GM maize event in South Africa, most maize varieties (and GM events) in the United States are commingled before being exported. Some exports are well identified, but the large majority of the bulk grains are not. Therefore, there is no significant risk of this type of dumping under current conditions.

This section's main conclusion is that a price difference is likely to be due to domestic market issues, not to unfair trade practices, and in any case it has absolutely no relationship to the use of a particular GM maize event, irrelevant to South Africa, in a specific exporting country. In a first best world This has a specific meaning in economics, dealing with this issue would require domestic intervention or transportation investment, not a biosafety decision on import of a new GM event. Based on the evidence and arguments we gathered, this "biosafety" measure seems to be nothing more than a nontariff barrier to trade at a time when maize prices were relatively low.

Imperfect Price Transmission Due to GM Maize Imports?

The second argument refers to the lack of transmission of low import prices to consumers. Those that support this argument may have gone a step further; they do not necessarily argue against unfair trade practices, but they note that the feed industry is not passing on its price changes to consumers.

First, even more than in the latter case, it is clear that this issue is only domestic, therefore it is not related to trade policies and even less to a biosafety decision on a single imported GM maize event.

Second, if this claim were correct, it would suggest possible price distortion on the markets. This signals the possibility of imperfect competition in the feed industry. Because the coastal region of South Africa is a small importer at the global scale, the industry could be considered a price taker. But under perfect competition, individual companies would compete in selling their products. Therefore, they would set their price equal to their marginal cost and a lower price of inputs would necessarily be reflected in the price. In contrast, if there was only one company (or corporate entity) selling feed, it could manipulate the price as a monopoly, by limiting its quantity (set up by equating the marginal price with marginal revenue).

These two extreme cases are unlikely to represent the market reality in South Africa, which is closer to a case of local or partial competition. If a decrease in the price of inputs is not transmitted to the seller price at all, everything else being equal, buyers could argue that there is foul play. This would call for measures to assure competition or to restrict anticompetitive pricing behaviors. But in any case, it would not be related to trade policy and even less to import approval of new biosafety events. The issue will clearly not be solved by any measure on GM imports.

Economic Consequences of a Change of Rule on Imports

To sum up, it is difficult to find any convincing economic argument against the approval of a new GM event for commodity import. If it aims to tackle what is called unfair practices, it is likely to be just the pretext for a protectionist measure largely or completely unrelated to safety. If the issue is competition, the appropriate regulatory agency should respond to it.

If the problem is traceability, then South Africa should also have a full traceability system in place for all its maize before requesting the same from importers (to be consistent with its WTO obligations). To our knowledge, this is not the case: most maize is mixed and only a partial share of the maize produced uses identity preservation in order to be sold as GM- free.[22] Traceability requirements would also potentially raise the cost of imports, to the detriment of consumers (animal industry and animal product consumers), not only because of its costs, but also because not all countries would agree to use it for a small market like South Africa.

Nonetheless, our meetings with various stakeholders suggest that South Africa will continue to reject GM events for imports and that it will require any new GM import to be approved for planting, except in cases of emergency. As explained above, the definition of what constitutes an emergency is still being debated, but the main stakeholders have adopted the rule almost de facto. One EC representative also supported strict traceability requirements, especially for an unapproved event, but with a continuous moratorium on commodity clearance. The relevant question therefore may be what will be the consequences of this new rule if it is confirmed?

Such a rule would require general clearance of all GM imports. It therefore goes beyond the Biosafety Protocol requirements for unprocessed GM commodities (officially denoted as “living modified organisms intended for direct use as food or feed, or for processing”) to request the submission of all the necessary data for living modified organisms for release into the environment (another category of living modified organism), even if there is absolutely no interest in planting the target imported crop. More important, it would take more time and cost more for the applicant to go through the process, ultimately encouraging large exporters (and applicants) to avoid the relatively small South African market.

A market like the European Union (EU), because of its size, can dictate rules regarding the type of GM events to be approved by exporters (as proven by the case of Argentina that initially only approved EU-authorized GM events. But South Africa is not a big importer and does not have much bargaining power. In this situation, as long as it keeps pace with the EU’s approval process, it will be able to import the necessary maize and soybeans for its own consumption needs, as long as exporters remain interested in accessing its market.

Still, there is a risk that it may not be able to follow up at a sufficient pace, because of the new steps required for all imports and the use of a zero percent acceptance of unapproved GM imports. A recent report conducted and published by the EU Commission (DG for Agriculture and Rural Development 2007) finds that the lengthy EU import approval system with no threshold level for unauthorized events, is likely to create serious economic problems, because of its delay of approval for

22 An industry specialist tracing a 6,000-ton load of non-GM maize with identity preservation said that he can only trace a lot back to a group of farmers, not back to a field or farm. According to him, a full traceability system would be impossible to set up under the current marketing system.

GM varieties approved more rapidly elsewhere. Because the EU relies on foreign sources of soybeans to feed its cattle and animal industry, it is dependent on supplies from Latin American countries or the United States, which mostly provide GM soybeans. In the eventuality that one new GM soybean event is approved for planting in their main source for purchasing soybeans, and that its process was taking one to three years to approve it, the report argues that the animal industry could largely lose to the point of abandoning part of their animal production.

South Africa is not in the same position, but this eventuality still has to be considered. If Latin American countries were increasing their soy exports to Asia, the United States were producing fewer soybeans, and new GM events would be introduced in these countries, how fast would basic imports be accepted in South Africa? What would be the consequence for the animal industry and the consumers, for example in a year of drought? Even in a normal year, would South Africa allow imports of soybeans or maize from a country testing a new GM event unapproved for planting in South Africa? If not, what if their main suppliers were all blocked from its market? What about new products such as the upcoming GM sugarcane or sugar beets in other countries?

We do not have sufficient information to respond to these critical questions; we can only raise the issues. South Africa has been an example of flexibility, which has allowed it to import, export, consume, and use approved GM products to the benefit of farmers. Giving up this flexibility, if only for imports, will have a cost for consumers. The benefits of this measure are not clear, neither for safety nor for the population. Especially when prices are very high, introducing additional rigidity to an import regulatory system that has proven to work is risky and may be detrimental to the country as a whole.

Lastly, one consequence that seems to be eluding the debate relates to spillover effects. South Africa does not approach issues of GM crops like any of its neighbors. But by adopting a stricter approach, it will also encourage these other countries that are prone to use a precautionary stance in their regulations to do the same and adopt a strict approach to imports. South Africa would then doubly lose, by raising its own consumer prices and losing market access or a technology that their farmers currently enjoy.

4. EXPORT AND TRANSIT ISSUES

In this section, we review how exports interact with biosafety policymaking and provide an analysis of the private-sector management related to exports of products in the Southern African region.

Export Policies and Export Considerations

Unlike imports, exports are largely outside of the scope of government regulation. Export permits are required for living modified organisms, intended for planting or contained use. Table 9 shows the number of permits issued by South Africa and the quantity under permit between 1999 and 2007. The number of permits has grown from a few to about 60 to 70 per year. Maize is the primary crop concerned. In particular, significant quantities of GM maize hybrid seeds for planting have been exported from South Africa to the Philippines, the only Asian country that has approved the planting of GM maize thus far. In 2005, the data include an export permit for 90,000 tons of maize for food, feed, or processing (FFP) going to Japan, but this seems to be the exception. There are no other quantities reported of commodity exports with potentially GM material, despite the fact that South Africa likely did export mixed commodities in this period (see Section 2). Cottonseeds for planting have also been exported to countries that have recently extended their own production of Bt cotton, such as Colombia.

Table 9. Reported export permits for GM material and quantities of GM export under these permits by crop and year in South Africa

	Number of export permits	GM maize exports under permit (mt)	GM soybean exports under permit (mt)	GM cotton exports under permit (mt)
1999	0	0	0	0
2000	3	0	0	0
2001	22	0	0	0
2002	41	3.5	0	234
2003	72	442	4	196
2004	67	654	15	121
2005	88	91,573[a]	0	249
2006	61	1,233	0	138
2007	51	1,571	0.2	152

Source: Annual data available from various issues of the publication of the Department of Agriculture, Genetic Resource Group. Available at: http://www.nda.agric.za/

[a] Includes 90,000 metric tons of maize for food, feed, or processing exported to Japan.

There is a policy that covers the transit and consignment (import and export) of GMO commodities in South Africa (Executive Council for GMO 2000). This policy indicates that such transit is allowed as long as specific information requirements and market conditions are met to make sure it does not enter South Africa's environment and the food or feed marketing channels. It is used for instance for the transit of food aid to countries in the region.

Even if export issues are mainly outside of the public sphere, they are slowly entering the decisionmaking process via the inclusion of socioeconomic considerations in deliberations of the GMO Executive Council. Socioeconomic considerations are explicitly mentioned in the law, but the regulations provide neither guidance nor criteria on the circumstances under which it should be considered in the decisions of the Council (Wolson and Gouse 2005). In the 2007 amendment to the GMO Act, the EC has the explicit authority to consider potential socioeconomic impacts before application process is pursued (Jaffe 2007). Regarding trade, the Department of Trade and Industry is using its role in the EC to express concerns over the planting or import of GMOs that could potentially jeopardize South African exports. If their concern is well motivated, it may result in a change in the consensus decision on biosafety and therefore the rejection of a particular application or the conditions of use for a new application.

So far, we have heard of only one recent case where exports were actually taken into consideration. It was an application for a GM malolactic wine yeast for general release with potential prospects for the winemaking industry. The wine industry of South Africa, which exports its products worldwide, including to the GM-averse European market, expressed its own concerns on the commercial risk associated with the potential use of GM material in South Africa and, despite acceptance by the Advisory Committee, the application was rejected by the EC (Executive Council for GMO 2007a).

To understand the implications of this measure, it is important to note that no country has any labeling requirement for the use of GM yeast in food or beverages. In Europe, GM yeasts are used on a daily basis in the production of cheese and beer. But the global wine industry has consistently and voluntarily rejected any attempt to use GM technologies for fear that it would affect its image and therefore its market in one or more consuming countries. Wine is mainly a high-priced agricultural cash commodity; it does not really look for means to increase productivity or efficiency but focuses on quality and image. Thus, this implicit private standard was adopted to fit the quality requirements of well-off consumers, located particularly in rich countries, who have expressed concerns about the use of transgenic technology in food.

Obviously, the EC rejection of this application satisfied the wine industry as a whole and can be seen by the Council as a positive way to apply socioeconomic considerations. Only the applicant was potentially worse off, because it faced a preemptive rejection of its technology, without being able to market it.

Still, it is not clear whether such a decision was useful or even necessary. If the application had passed, the applicant would not have found any company willing to buy it, domestically or internationally. Therefore, the use of the yeast would have been restricted to the lab. There was no real risk of any export loss. Unless intentionally and illegally introduced by a winery, the yeast would not have entered the marketing channel and South Africa's wine image would have been unaffected. So even though this decision will likely have no implications, it does not seem to be satisfactory.

Another similar case was evoked in our discussions, concerning a technology that has not been adopted yet. Several persons talked about the upcoming release of GM sugarcane in Australia and Brazil. Because South Africa imports sugar (despite being a net sugar exporter), it would face the issue of whether to accept it for import. Regardless of its own research on transgenic sugarcane, the South African sugar industry seems to be keen to remain GM-free. South Africa produces between 2.0 and 2.5 million tons of sugar annually, half of which is exported (Department of Agriculture 2007). Because one cannot detect GM material in the sugar, importing it separately would require full traceability. The Department of Trade and Industry representative we met argued that there would be a very strict evaluation of sugar in the EC because of this potential conflict of interest.

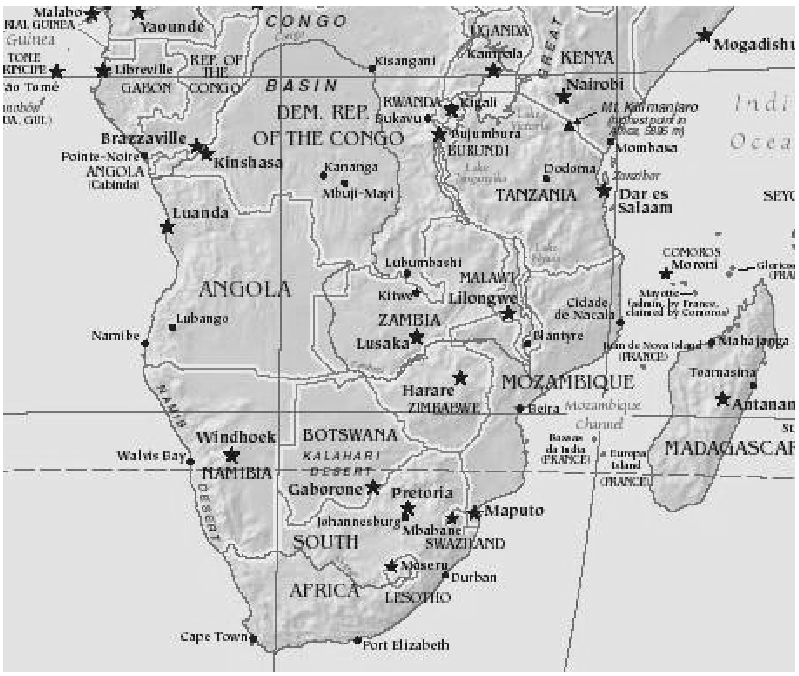
Although these are only two discrete cases, they provide some insights on the use of socioeconomic considerations in biosafety decisionmaking in South Africa. As in the rejection of GM maize imports, special interest producer groups seem to have found a way to enter into the decisionmaking process. This has been the case in other countries that have conferred more weight on these actors in the decision process, even in biosafety (Pray, Paarlberg, and Unnevehr 2008). Yet, all groups need to be well represented, including consumers/buyers, scientists, and the commercial agricultural sector to ensure that overall social welfare is maintained.

Besides, for export-related issues, the inclusion of socioeconomic considerations in a formal approval process is highly debatable, simply because if the future customer does not want the product, then the applicant will not succeed in selling it. In fact, large biotech companies conduct their own socioeconomic assessments before spending money on testing, approval, and commercialization. In this context what is the role of the State? Public authorities that require accounting for socioeconomic considerations, using pre-emptive measures for potential future risks, also contribute to the confusion around actual (proven) commercial risks with GMO in countries of the region, which could become detrimental to South Africa as a producer and exporter of GM commodities.

Maintaining Exports Within and Outside the Region

As explained in Section 2, South Africa is the only GM-producing country in the African continent; it is also surrounded by countries that have restrictions on the import of GM products. The map of the larger Southern Africa region in Figure 10 shows that the four main neighboring countries—Botswana, Mozambique, Namibia, and Zimbabwe—are also among the main agricultural trading partners of South Africa. Two small countries, Lesotho and Swaziland, are located inside South Africa and therefore largely exchange goods with their surrounding neighbors. Lastly, a second group of countries located further away, namely Angola, Madagascar, Malawi, and Zambia, remain preferred partners for South Africa. Of these 10 countries, at least 7 have implemented restrictions on GM maize imports (Table 5).

Figure 10. Political map of Southern Africa.



Source: U.S. Central Intelligence Agency URL: https://www.cia.gov/library/publications/the-world-factbook/reference_maps/africa.html

By meeting with grain producers and handlers, as well as other experts in South Africa and Namibia, we obtained information on how formal trade, particularly exports of maize, are handled at the borders for some of these countries. Table 10 provides a summary of the information we gathered from our discussions. Although all listed countries but Swaziland have non-GM requests for maize, the tolerance levels, specific requirements, and border control measures differ widely. Most countries in the region seem to request certificates assuring that maize shipments are non-GM. Testing is not systematic in all countries, and sometimes only a small sample out of large truckloads is tested. Testing is also rather basic in most countries. Several meeting participants involved in or knowledgeable about maize regional trade also noted that, although there are sometimes fines for GM maize detected at the border (possibly above a tolerance level),[23] they are not aware of any rejection of shipments or truckloads. Most experts also acknowledge the high likelihood of informal cross-border trade of GM maize. A recent unpublished

23 For instance, it was reported that fines of R5,000 were levied for 10 trucks of maize that did not comply with the requirements, which translates into about US$700.

but controversial report that tested for the presence of GM maize in the region found that it was present in most countries, which confirms the imperfect enforcement of border control.

Table 10. Reported information on border control of GM imports in the region.

Country	GM products	Import rule	Tolerance level	Border control
Angola	Maize	No GM imports (2004)	n.a.	Loose; possible tests, fines
Botswana	Maize	No GM imports, milled GM food aid	n.a.	Loose; certificate, possible tests, fines
Malawi	Maize	No GM imports, milled GM food aid	5%	Loose; no systematic test, fines over tolerance
Namibia	Maize	No GM imports	~0%	Strict; certificate, possible tests, possible rejection
Swaziland	Maize	Changing GM acceptance/rejection for food aid	n.a.	n.a.
Zambia	Maize	No GM imports, no GM food aid in 2002, milled GM food aid in emergency after	n.a.	Moderate; certificate, tests, fines
Zimbabwe	Maize, Soy blend	No GM imports, identity preserved requirements for non-GM, milled GM food aid in 2002, no GM food aid after	1%	Strict; certificate, testing with PCR, fines but no observed rejection, except for food aid

Source: Gouse (2006b); interviews with maize traders, experts, and representatives of the World Food Programme in Southern Africa

Food aid shipments are not always regulated in the same way; at least four of the eight countries accept or have accepted milled GM maize in case of emergency. The 2002 food shortage triggered a highly contentious debate in the region about the use or rejection of GM food aid that was resolved by the World Food Programme (WFP) on a case-by-case basis. It replaced GM maize with locally obtained non-GM maize for Zambia and organized the milling of 15,000 metric tons of maize in South Africa for Zimbabwe. Most countries in the region seem to have effectively implemented border control since that year. The WFP position is neutral, it has adapted to the specific demands of countries and supplies of donors. The U.S. program has adapted its supplies to the request of countries. European donors are ready to pay the premium for identity-preserved non-GM maize (which amounted to a bit less than $10 per ton during our visit). The problem is more the availability of sufficient non-GM maize stocks in the region, which varies from year to year.

In the group of eight countries listed in Table 10, three countries seem to have adopted higher standards, to a certain extent. First, Zimbabwe does request identity-preserved non-GM maize and pays a premium for it. It uses PCR. (See above in the texttesting.) Although a large quantity of milled GM maize was imported for food aid in 2002, the country has requested non-GM food aid since then. It has reportedly rejected shipments of food aid with GM soy blend. According to one observer, Zimbabwe's rejection of maize seems to be a political statement against the United States.

Zambia's rejection of GM food aid in 2002 was well publicized. Although multiple factors seem to have played a role, one person we met relates that during the crisis, a political representative talked about their fear of possible export loss to the EU with the introduction of GM maize in Zambia. Although these fears were clearly irrational, since they targeted green beans, the fact that they played a role illustrates how prominent trade issues are in the region.[24] One observer sees Zambia's GM rejection as a

24 For more on GM crops and perceived commercial risk in African countries, see Paarlberg 2006.

political statement of sovereignty and independence, motivated by certain Zambian ministers, although safety fears also play a role in its position.

Third, Namibia is reported to have a stricter policy, with an implicit zero percent threshold. Its policy was adopted to facilitate exports of high-quality beef to a few buyers in the European Union. The country as a whole still has to implement its biosafety law and therefore requests no GM imports. However, the pressure from the beef industry makes this control particularly important. Interestingly, beef is largely grass-fed in Namibia, and therefore the portion of maize in beef feed is minimal (probably under 0.1 percent) but still sufficient to support a strong policy against GM maize imports. A consultant report on this issue (Namibia Resource Consultants 2002) also clearly supports lifting this ban in the future, potentially by segregating non-GM maize for beef exports from other imports. In fact, other parts of the animal industry are much more supportive of allowing GM maize imports. With the high price of feed, an animal feed industry representative in Windhoek assured us that he would be very glad to get any maize from South Africa, Argentina, or the United States. The poultry industry also reportedly opposes the beef industry's position on GM maize. According to some, this import ban position may also have been motivated by the incentive to maintain a trade preferential agreement with Europe. Until the end of 2007, Namibia benefited from the Cotonou Agreement, which allowed it to export a certain quota of beef with no tariff. In 2008, when the agreement ends, things may change progressively for Namibia and other countries that are negotiating a bilateral trade agreement with Europe.

Outside of the region, only a few exported products are facing barriers related to the use of GM crops. South African Breweries are keen not to use GM starch, which is driving the starch main player to contract for and segregate about 600,000 tons of non-GM maize. Maize has been exported to Japan, but as shown in the permit data, some of this maize was GM. The meat industry is also starting to face demand for non-GM meat in its exports to the Middle East. Countries from the Arab peninsula do not want meat fed with GM feed. These meat exports seem to constitute a small but significant market share of total exports.[25] South African beef cannot access the EU market because of its negative classification on the risk of bovine spongiform encephalopathy (due to an administrative mistake). Thus, overall exports of meat remain limited. Due to a sanitary measure, Argentina cannot export meat to South Africa, which therefore remains its own main supplier. With the price of maize increasing and a surge in meat demand, meat is becoming more expensive, which is likely to limit the industry's interest in exports at least in the short run.

Outlook for the Region

Although the GM food issue is not as high on the political agenda as it once was, the region remains largely opposed to the use of GM crops. As countries move toward setting up biosafety systems, they tend to follow a precautionary stance on import and marketing of GM products, perhaps under the influence of the Biosafety Protocol. Most people do not see changes in the next five years in the static positions of regional countries. Even if drought-resistant maize was successfully developed and adopted in South Africa, it would likely face serious opposition in a number of countries in the region, because it comes from a U.S. company and because of strong political positions.

In fact, recent development suggests that if non-GM maize became scarcer in South Africa, it could be supplied by other countries in the region. In 2007, South Africa had a severe drought and therefore became a net maize importer. The same year, Zambia and Malawi (supported by input subsidies) had surpluses of non-GM maize and therefore were able to provide non-GM maize to Zimbabwe and other countries. This observed increase in production is reportedly partially attributed to the migration of skilled farmers from Zimbabwe to countries like Zambia. Some of these farmers would likely not oppose GM maize, but the politicians still remain largely opposed to it.

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25 In his study of GM food and trade issues in Southern Africa, Mupotola (2005) argues that the meat sector may be significantly affected by effective commercial risk with GM food.

South Africa's influence in the region is significant, but it is also moderated by other factors. According to several meeting participants, the only way to effectively advance in this area would likely be via decisions at the regional level, perhaps through the South African Development Community (SADC). The GM debate in each country of the region has moved beyond technical considerations to emotional and political dimensions, and it could only move if it is supported by an external force. Because national politicians are constrained to change a popular position in their own country, only a higher-level political body could help them alter their positions. In other words, a decision taken with other countries, far from the political games of the capital, could help willing politicians to advance a relatively constrained decision in their own countries. It helps to share the responsibility with other countries; thus a decision becomes more sellable if it is part of a regional agreement.

5. DOMESTIC MARKETING CONSIDERATIONS

Mixed GM/Non-GM Supply and Demand for Non-GM

The introduction of authorized GM crops and their derived products into various marketing channels is bound to result in mixed GM/non-GM products in most marketing systems. Yet, where specific demands for GM or non-GM exist, market differentiation can occur. Because of the demand for non-GM products by consumers in some countries, which are translated into specific requests by certain domestic and international companies, the current international marketing system for maize, soybeans, or canola distinguishes between a mixed GM/non-GM market channel and a pure non-GM market channel. Cotton is the exception, since pure non-GM cotton (organic and fair-trade cotton) represents an extremely small market niche.

The size of the pure non-GM market channel largely depends on products, their main markets, and the presence or absence of marketing regulations. In South Africa, the marketing channels for cotton and soybeans are largely GM,[26] but non-GM maize represents a significant share of the maize supply. According to an African Feed Manufacturers Association representative, the non-GM maize supply comprises about 1 million tons in South Africa in 2007. As the total maize production ranges from 6 to 10 million tons per year (7 million in 2007), the non-GM share represents 10 to 20 percent of total production, leaving 80 to 90 percent as mixed GM/non-GM.

Where does this demand come from? As explained in Section 4, some of the countries of destination for maize exports require only non-GM maize, so part of it comes from other countries in the region. But the domestic market also uses non-GM maize. The main domestic buyer of non-GM grains is the Tongaat-Hulett Starch Company (formerly called African Products). This company uses about 600,000 tons of non-GM maize annually to produce non-GM starch that is purchased by the beer industry, paper companies, and other food or domestic product companies. Another buyer is the Woolworth supermarket chain, which in 2006 stated that they would avoid GM food products. Based on interviews with representatives of the SENWES Company,[27] Tongaat-Hulett, and other participants, we will try to explain the management strategies employed in these non-GM marketing channels.

In South Africa, most commercial grain is traded in a pool, using the South African Exchange (SAFEX), but SAFEX does not have a quote for non-GM maize. In recent years, two main segregation systems have been used for non-GM maize. The first, called the reactive system, allows traders with specific demand for non-GM maize to procure and separate non-GM maize from farmers in their areas. It was the original system in South Africa at a time when only one buyer wanted non-GM. Under this system, traders identify non-GM maize growers who certify that they do not use GM seed. Basic ELISA testing[28] is done at the entry to the silo and the maize shipment is then separated from the rest of the marketing channel. The farmer is usually not paid a significant premium, but the trader will charge the farmer about \$3–5 per ton.[29]

This system has been successful so long as the share of GM adoption in the maize-producing area is small. In particular, it has been used in certain regions of countries that do not use Bt maize because of low pest infestations. But with herbicide-tolerant maize and with more pro-active marketing schemes by the big seed companies, more farmers have used the technology, and a non-GM supply has become more difficult to obtain in the commercial sector. In 2007, one observer estimated that only 5–10 percent of

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26 Approximately 85 percent of cottonseed sold is GM, but there is a small niche for fair trade and organic cotton.

27 SENWES is a trading company that provides input supply, grain handling, and storage. It is the only company to provide full services for non-GM grain segregation.

28 ELISA protein antibody tests are being used primarily to help farmers and elevators separate their GMO grain lots from non-GMO grain lots. ELISA or strip assays are limited to proteins expressed by specific events, they can't apply to processed products and have a larger threshold of detection than other more precise techniques like PCR.

29 Wolson and Gouse (2005) noted that there was no price premium for non-GM maize in 2005.

total commercial maize supply could have been separated with this system, with a relatively high risk of commingling. Furthermore, this system is likely to disappear in the next year or two.

The second system involves contract farming schemes. It was first set up in 2004/05. The arrangement first requires identifying farmers that do not purchase GM seeds (from data obtained at seed retailers). Then the trading company visits the farm, conducts a physical inspection, evaluates the size of the potentially GM maize fields. Tests are done on maize at the green stage to check for any presence of GM. If all tests are passed, the trader offers a contract to the farmers, guaranteeing that they will not use GM seeds and will provide the trader with non-GM maize. The whole marketing chain control is stricter, with isolation of the maize, separate handling, separate storage in the silo, and use of clean or new bins at every stage. Testing is conducted on every load at different levels, from the field to the silo to the storage facility, both with strip tests (at initial stages) and PCR at the final stage.[30]

This identity preservation procedure provides guarantees that the grains do not contain GM material above a threshold. In the early years, it was easy to get close to 0 percent, but the threshold may increase to less than 1 percent. This system has been used for maize procurements destined to the Tongaat-Hulett Company, and it is becoming more common because of the increased adoption of GM maize throughout the country. Naturally farmers that have non-GM contracts have to be remunerated. The customer price premium for non-GM maize is about $10 per ton (which is about 5 percent) for a total maize price of $200,[31] of which the farmer gets about $3 and the trader certifier $7, but it is believed that both prices will increase in the future as adoption rises. It is still possible to get clean non-GM maize, particularly for growers in the Eastern Free State, but one of the main upcoming difficulties will be how to handle maize dust.

The starch industry is the main buyer of this identity-preserved non-GM maize. In total, Tongaat-Hulett procures 600,000 tons of non-GM maize, which in 2007 represented about 8 percent of the total production in South Africa (Tongaat-Hulett 2006). The bulk of their modified starch production is used to brew beers that are exported to the European Union and elsewhere. Other main clients are the Nestle, Cadbury, the paper industry, and the corrogating industry. When the GM maize area started to be prominent in South Africa, the breweries (representing about 55 percent of Tongaat-Hulett's sales in 2006) insisted on starch made of non-GM maize to preserve their markets in Europe. But all the other clients (like Nestle[32] and the paper industry) did not have any GM- related requirements. At first, it was easy to get non-GM, as GM maize was only grown in small areas. Then, with the expansion of GM, procurement became more difficult.

Because starch production started long before the introduction of GM, the process they use is not adapted to a dual or parallel production chain. All products in the same region follow the same production chain, and segregation is not really feasible. As most clients of Tongaat-Hulett request non-GM, the company has continued to buy only non-GM for all its buyers, despite the fact that some of its clients do not request non-GM. The economic challenge associated with this situation came with the appearance of a price premium for non-GM identity-preserved (IP) maize. They have to pay the premium for all of their maize inputs (that is, they get 100 percent non-GM), even though only some of their clients (the brewery) are paying this extra charge (becoming virtual free riders). They recover only 40 percent of the IP premium from the brewery and a few food companies.

In total, they estimate that it costs about $8–10 million per year to maintain this situation at the current price premium. For each of the 600,000 tons of maize, priced at about 1,600 rand (R), R90–100 are spent on non-GM premiums. Of this premium, R50–60 goes to the growers, R25 goes for segregation

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30 Final testing costs about $10 for 3 tons, and it is sampled before it arrives in the silo because it takes a few days to get the results.

31 These numbers were provided by SENWES. Another observer cited price premiums of R100–150 ($14–20) for a maize price of R1,800 (~$250), which would turn into a premium of 5.5—8.0 percent. The Tongaat-Hulett representative estimated the premium at R90–100 for R1,600 maize—about 6 percent. Among all observers, the consensus is that the 2007 premium for identity-preserved non-GM maize is between 5 and 6.percent

32 Nestle requires non-GM starch for infant formula sold in New Zealand.

costs, R7–10 for tests, and R5 are used to pay for errors. Segregation is also costly and risky because it is not quoted in SAFEX; therefore there is no large storage capacity for non-GM maize. If they wanted to be efficient and segregate two channels, the company would have to reorganize their four factories, setting up two factories for GM and two for non-GM. They would also have to deal with differentiated demand for starch made of yellow and white maize. The total cost of this change could reach R130–150 million.

These adaptation costs are significant but seem to be inevitable, given that the company does not want to drop its customers who do not require non-GM, and the demand for non-GM starch is not expanding. It does not export starch to Europe because of the duty structure; starch exports go mostly to the East, including countries with no GM policy on starch such as Australia, Singapore, Sri Lanka, and Thailand. The IP process is satisfactory: it has even passed audits by Japan and Kraft, but it is becoming costly. Procurement of non-GM maize in the region (for Malawi and Zambia) is difficult because of the lack of transportation and the need to go through Zimbabwe, with all of the risk and duty associated with that.

The second largest domestic buyer of non-GM products is reported to be the Woolworth supermarket chain, which represents 10–15 percent of supermarket sales. Attempts to contact a representative of Woolworth failed, but we obtained information about their policy from other observers. Woolworth is a Scottish company. Its supermarket chain in South Africa focuses on high-income consumers. Their goal is to provide high-quality food, with less focus on prices. The nonprofit organization Biowatch, which opposes the use of GM food, is reported to have been a determinant in pushing Woolworth to increase its sale of organic and non-GM food. Woolworth is the only supermarket with a position on the use of GM food products.[33] In 2006, it started requiring non-GM inputs. But since their products come from different sources inside and outside the country, they do not rely on non-GM supplies from South Africa alone. Organic products in South Africa allow up to 1 percent of GM accidental presences, even if there is no formal policy. Despite Woolworth's acknowledged effort, their non-GM labeling claims have largely been inaccurate, as we will explain later.

To sum up, although GM crop area is increasing rapidly, there is still a market for non-GM products. Non-GM maize is sold for 5–6 percent more to a few domestic buyers and used for exports to sensitive countries. Although segregation is done according to the best standards, it still requires some of the main actors to adapt, at a cost. The lack of a quote for non-GM at SAFEX may increase the cost of the process. The lack of a national protocol for the identity preservation process is also seen as a potential weakness of the system, even if local traders maintain their own high-quality process. Observers also believe that it might become more difficult to locate pure non-GM maize in future years. If so, the premium will go up, which might encourage traders to find other sources elsewhere. Some growers might also go back to non-GM, but currently most of them seem to be enjoying the advantages of GM maize and are not willing to return to conventional maize.

Labeling Policy

Many countries have adopted some type of labeling for GM food, but the regulations vary widely across countries (Carter and Gruere 2003a; Gruere and Rao 2007). Like Canada and the United States, in 2004, South Africa introduced a labeling requirement for GM products that are non substantially equivalent to their conventional counterparts. (South Africa, Department of Health 2004). More specifically, GM products(1) with significantly different food composition than conventional, (2) whose nutrition value is significantly different from conventional counterparts, (3) that require significantly different storage preparation or cooking, (4) that contain a potential allergen, or (5) that use an animal or a human gene, have to be labeled as GM with clear notification of their specificities.

33 For instance, the Pick'n Pay company, another supermarket chain, which also targets high-income customers, has a much more open policy on the use of GM ingredients and products approved by the biosafety authorities (Pick'n Pay 2007).

None of the GM products currently commercialized in South Africa (or in any other country) fits any of these characteristics. Therefore, the only labeling that can currently apply to GM products is based on private claims. Companies like Woolworth have used non-GM labels on some of their products and publicized their claims. But a study using GM DNA testing has shown that these claims are not accurate and may even be misleading (Viljoen, Dajee, and Botha 2006). The problem is that there is no public regulation regarding the use of labeling claims for GM or non-GM food. In Canada (and in other countries, like Japan), the voluntary labeling regulation helps define what can be said, and how to define a GM or non-GM claim with a clear threshold level; it therefore sets the limit on what is acceptable to avoid deceiving consumers.

As a result, the rather pragmatic and science-based approach of South Africa on GM food labeling is highly contended. There is a debate between policymakers, the industry, and certain NGOs regarding additions to the labeling policy. Several representatives of the Executive Council support mandatory labeling on any type of GM food, for the sake of "consumer's right to know,, which is reported to be a general governmental policy. However, others disagree with that position on the basis of the costs and implications of the regulation and on the fact that only a small minority requests that such information be labeled.

The Department of Health (DOH) is in charge of this issue. According to the representative we met, the GM food labeling issue is not settled in South Africa. At the time of our visit, most efforts of the department were focused on setting up allergens and nutritional labeling requirements for food products, but the GM food labeling debate is bound to come back to the table. The industry is discussing the issue in consultation with the DOH.

The consumer base is divided; one side does not want GM food and tends to look for what they consider healthy products, regardless of the price. The other, much larger portion wants a good product at a low price. The National Consumer Forum is supporting mandatory labeling (Wolson and Gouse 2005), but other groups are opposed to it. Although the debate is contentious, most of the population is largely unaware of GM. A public perception study in 200405, led by the Department of Science and Technology, revealed that nearly 8 out of 10 people surveyed had little or no knowledge of biotechnology or genetic engineering (Department of Science and Technology 2005).

The retail industry is also not completely in agreement. If Woolworth is already avoiding GM food, Pick'n Pay has a clear position on labeling, stating that they will not provide claims unless there is a proper protocol to trace products. Their position also states that they are facing four dilemmas on GM food labeling: (1) the lack of consensus on labeling of products that do not contain GM material (like glucose); (2) the lack of a broad identity preservation system in South Africa; (3) the scarcity of laboratories with PCR, which makes testing difficult; and (4) the lack of sophistication in South Africa's domestic supplier base, which makes it difficult to set up a full segregation scheme, and it would be costly to change it all (Pick'n Pay undated). The company is open to selling organic and approved GM products and is trying to reconcile the two groups of consumers. It provides free brochures in stores to inform consumers about the issue, including official brochures from the Department of Agriculture and responds to any consumer questions (Pick'n Pay 2007).

Part of the debate relates to the use of positive or negative claims. Some stakeholders argue that a claim such as "GM-free" should not be allowed because of its negative connotation. The other side of the debate concerns the use of a voluntary protocol versus mandatory requirements. With mandatory requirements for GM food, there is a risk of information distortion in a country where many consumers are largely uninformed about and unaware of the technology. If consumers become confused, mandatory labeling could have the same effect as in OECD countries, with food companies avoiding GM products altogether, providing no choice or information to consumers and returning to a ban on GM production (Carter and Gruere 2003b).

The prospects for change may start with a proposal of a private labeling regime for non-GM that would benefit from governmental support. The food industry as a whole seems to agree on the need for a definition for claims. The DOH representative said that supermarkets will be the first to move on labeling and may even demand that the government sets up mandatory labeling, if consumer groups become vocal.

But at a later time, the DOH will also probably be willing to push on mandatory labeling, on the basis of consumer rights.[34] The DOH representative believes that the current system is inadequate and will have to be revisited. A past report from DOH reported that mandatory labeling of GM food could raise prices up to 10 percent (Wolson and Gouse 2005). But nonetheless, according to this representative, the cost of mandatory labeling may not be that high; companies can pay for it as they pay for advertising. Furthermore, the European Union's strict labeling and traceability regulation model is reported to be the preferred option, compared with other more pragmatic or less costly regulations (such as those in Australia, Japan, or Korea).

Of course any decision on that issue would have to be discussed in the Executive Council and approved by the South African legislation, but a stance on adopting the strictest model of labeling could have significant economic impacts on GM producers in South Africa. It could also result in price increases (for example, by encouraging companies to switch to non-GM, as observed in other countries) at a time when inflationary food prices are already largely constraining South African consumers. Mandatory labeling of GM food in a country that produces GM food is not just adding a sticker: it would require important changes in the marketing chain and clearly create significant implementation challenges.

Markets, Trade, And Innovation: What Is the Outlook for New GM Crops?

To complete our look at market and trade issues in South Africa, during our visits, we discussed the prospects of new transgenic crops entering the market, given the domestic and international context. Several cases were talked about: GM potatoes, GM sugar, GM sorghum, GM cassava, and the upcoming trials of drought-resistant maize.[35]

The case of GM potatoes has been the most debated in the last few years (Wolson and Gouse 2005). A Bt potato, resistant to the tuber moth, has been developed by a public–private consortium (Agriculture Research Consortium, Michigan State University, and USAID) and approved for field trials in South Africa. This institutional arrangement allowed the use of a gene belonging to the biotech company without a technology fee and was intended mostly for domestic production and consumption. Although certain experts we met contended that the utility of this GM crop would be limited both because the pest is not a major problem in South Africa, and because potato consumption is decreasing gradually to the benefit of rice and wheat products, the initiative was expected to derive positive outcomes. Yet its development has been constrained by multiple internal and external problems.

First, internally, the biotech company that provided the gene has requested that the public partnership should undertake a management plan for transboundary movements. They fear that any potential unintentional cross-border movement of products containing the gene (such as a potato chip) to countries with liability rules on GM crops (like Europe) could result in them being liable for a technology they delivered for free. This plan adds to the cost of biosafety assessment and constrains further movement of the technology. This type of concern is likely to become more frequent if the Biosafety Protocol approves a strict liability rule for living modified organisms in the next few years.

Second, externally, the announcement of field trials was met coldly by the market and cautiously by the EC. The potato industry is concerned about consumer reactions: potato consumption, already declining with the Westernization of diets, might decline even faster. McDonald's has taken a position against it, even if the targeted varieties considered (spunta) are not part of their inputs, which are mostly

34 The case for mandatory labeling may come sooner rather than later. In the May 2008 meeting of the Codex Alimentarius Committee on Food Labeling, the South African representative submitted a position paper in favor of comprehensive mandatory labeling of GM food. Interestingly, after a complaint by the United States to South Africa, the South African government said it was unaware of this paper and surprised by it, and the paper was quickly retracted. These internal conflicts seem to underline the disagreement between the DOH representative to Codex and the rest of the government on this issue.

35 Monsanto also sought approval of GM wheat in 2004 but retracted its own application for market reasons (Wolson and Gouse 2005).

obtained from contracted farmers. The nonprofit organization Biowatch has been active on the issue, asking companies to take a stand. The supermarket Pick'n Pay was misquoted in the press on the issue, in an article saying that they would not stock GM potatoes. Apparently, what they meant was that they would not stock GM potatoes that are not approved by government authorities.

On the government side, there is a fear of being the leader in a completely new technology. The potato is also exported regionally, and even if the variety is mostly a staple crop used by small-scale farmers, there are fears of the hypothetical risk of unlikely commingling in the commercial sector. At the time of our visit, the prospects for the GM potato moving forward were rather weak. The general feeling among stakeholders was that the Bt potato would not advance unless positive effects for small-scale farmers could be demonstrated and therefore strong support from the government obtained.[36]

In the case of GM sugar, similar concerns have arisen. The South African Sugar Research Institute (SASRI) has been conducting confined field trials of herbicide-tolerant sugarcane. But the sugar companies, which funded this research, have decided to stay put on this project because of potential consumer concerns. Changes may occur with the possible development and release of GM sugarcane in Australia or Brazil, or if South Africa adopts a strategy on biofuels that involves the use of sugarcane-based ethanol. At the time of our meetings both factors were undecided.

Apart from its work on the potato, the Agricultural Research Council, the only public department involved in research on transgenic crops, has also worked on the development of GM cassava. A cassava project is ongoing in collaboration with two U.S. institutions, Michigan State University and the Donald Danforth Plant Science Center. The GM cassava in question is resistant to the mosaic virus. However, there is not much cassava planted in South Africa and it is mostly used for starch, not for food. Although it may not face much market resistance, it may not have a large economic impact in the country. There is a project to encourage small-scale farmers in the dry region of the Makhatini Flats in KwaZulu-Natal to grow cassava on up to 10,000 hectares for starch, but at the time of our visit the project was still in the development phase. Cassava, which is drought resistant and labor intensive, could also be used for ethanol production.

Similarly, the project on GM sorghum is based on a public–private partnership and managed by a public institute, Council for Scientific and Industrial Research (CSIR), South Africa. But instead of market or commercial limitations, its main challenge is related to the management of potential environmental risks. Both drought-resistant sorghum and GM sorghum with increased digestibility are being developed and were part of an application for contained use and stage-three trials that was rejected by the EC in 2007. This rejection was based on a request of the advisory committee for more information. At the heart of the discussion is the possibility of pollen flow and consequences on wild relatives and the broader agricultural biodiversity. Sorghum is not as commonly used as major crops; there is a lack of knowledge about its biological effects and the risk of gene flow that could occur.

GM sorghum is also the first example of an indigenous GM crop, and it could be subject to additional requirements under new biodiversity-related regulations set up by the Department of Environmental Affairs and Tourism (Jaffe 2007). This would include a clear assessment of gene flows. Existing studies on sorghum have all focused on demonstrating the movement of pollen to wild relatives, but up until now, there has been no evidence that a particular transgene could be expressed in a wild relative. There is also debate about the relevance of gene flow risks for a more digestible or nutritionally enhanced crop, as any gene flow of such a crop would not change the competitiveness of wild relatives.

Lastly, drought-resistant maize was approved for a field trial to be launched in November 2007. Because the crop is well known and GM maize is widely planted, the market, commercial, or even environmental constraints may be smaller. Its economic potential for South Africa is probably larger than that of all of the other crops discussed in this section. South Africa has always been prone to drought, but

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36 In this particular context, it seems that a well-developed economic study on domestic considerations could help decisionmakers.

in recent years severe droughts have resulted in large declines in maize production. The drought-tolerant varieties would not provide a full recovery of yields, but in case of drought they would ensure that the crop is not completely destroyed before harvest. The biological mechanism is based on multiple gene insertions and various processes to control respiration and transpiration. Of course, multiple drought varieties have been developed through conventional breeding and have allowed South Africa to maintain a sizeable production even with drought. But by using genetic engineering, the developer is hoping to produce varieties with a new leap in productivity during droughts and therefore sell the technology as crop insurance. It is clear that, if successful and affordable, this new variety could become extremely relevant not only for South Africa but also potentially for other maize-producing countries in the region, if they decide to open their fields to GM crops.

To sum up, recent attempts to deliver new GM food crops have been constrained by market considerations. GM indigenous crops, considered by institutions like FAO as a goal for African development, have faced serious challenges in passing environmental assessments. In recent developments, only new traits of current crops, including the much-awaited drought-resistant maize, are likely to be part of South Africa's immediate future.

6. CONCLUSIONS: FROM REGULATION CHANGES TO ECONOMIC EFFECTS

In its management of GM crops and the products derived thereof, South Africa can be seen as a unique example, because it is the only country in Africa that has not only successfully adopted GM crops but also has a biosafety regulatory system in place. In this paper, we analyzed South Africa's marketing and trade policies for GM products. in South Africa, which allows the country to manage potential commercial and market risks while letting producers adopt GM maize, cotton, and soybeans.

We first showed that South Africa is both a significant exporter and importer of GM and non-GM products, but that the possible presence of GM depends on the product and year. These substantiated results contradict repetitive claims by groups opposing the technology, who affirm that GM and non-GM products cannot and will not coexist in any country, and that introducing GM products will always result in losses of exports because EU consumers do not want them. Despite the rejection of GM products in surrounding countries in the region, the rapid increase in GM crop adoption seems to have had no visible effect on South African trade, thanks to the flexibility and adaptation capacity of its agricultural sector.

Second, we analyzed regulatory issues related to imports and exports of GM products. Although GM imports are subject to comprehensive regulatory approval in South Africa, the process has allowed South Africa to adapt to global changes, which seem to be taking a step toward increased rigidity and the use of biosafety as an apparent nontariff barrier to trade. This poorly supported possible reform is likely to be costly for the industry, especially with the increase of new GM events in other markets and the rise in world commodity prices.

On the export side, despite a changing regional context and a mosaic of import restrictions on GM, depending on product and country, South Africa has been able to adapt to each specific demand. At the same time, potential export risks have entered the decisionmaking process as socioeconomic considerations are included in biosafety. So far, this has not had a significant effect, but observed decisions in this direction do not seem to provide much value added, given that market considerations tend to drive the developing companies' own decisions. At the same time, continuation of this trend runs the risk of introducing special-interest politics into public policy processes on safety and technology use. A capture of the biosafety system by special interests would be costly and detrimental to the general South African public.

Lastly, we reviewed market arrangements and regulations in South Africa, and showed that although non-GM maize segregation has been successful so far, it has generated some adjustment costs. After using an ad-hoc reactive system, the current trend is to use identity-preservation systems for non-GM maize. There is no formal protocol, and non-GM is not currently quoted on the South African exchange, thus creating marketing constraints. The price premium in June 2007 was estimated to be 5–6 percent of the total maize price, but it is bound to rise with increased GM adoption. The demand for non-GM maize seems to be stable but might increase if high-end supermarket consumers increase their demand for organic or non-GM products. At the same time, the labeling regulation in place only focuses on products not substantially equivalent or with animal or human genes, therefore excluding all current GM products. Voluntary labeling claims are being used by one supermarket but with limited success and some proven failures. The main actors are discussing changes in the labeling policy, but their goals vary, ranging from a rule defining non-GM for voluntary claims to a strict mandatory labeling policy for all GM products (with or without detectable GM material) as in Europe.

Therefore, we find that imports, exports, and marketing-related policies are subject to upcoming discussion and potential changes in South Africa. Table 11 summarizes some of the major issues being discussed, with the options suggested so far, and some of the possible implications they could have for South Africa. Generally speaking, most of the listed changes risk introducing more rigidity and therefore less flexibility into South Africa's biosafety and biotechnology regulatory system. This may follow from a general shift toward a more "precautionary" position for South Africa on GM crops.

Yet the past 10 years have demonstrated that the success of South Africa in taking advantage of biotechnologies under changing global conditions lay mainly in its adaptation capacity and the flexibility of its system. Of course, the regulations and policies in South Africa are not perfect, and they deserve to be improved. But introducing new rigidities unrelated to actual risks and increasing the role of special interests may not be the most needed measure and could be detrimental to the general public.

Table 11. Major issues, selected policy options, and likely consequences

Major issue	Options	Likely consequences for		
		Producers	**Consumers**	**Other countries**
Import approval	1. Allow commodity clearance	-Competition for grower -Usual input for animal feed industry	-Maintain acceptable prices	-Encourage flexible system
	2. Only general clearance	-Possible rent from protection for growers -Higher cost of feed for animal production	-Increase prices for food and animal products	-Encourage stricter import control for South Africa's exports
Socioeconomic considerations on commercial risks (exports)	1. Limited role unless clear commercial risks	-Potentially more R& D on new GM events	-Depends on R & D efforts and resulting products	-Discourage irrational fears abroad
	2. Any potential export issue matters and can trigger application rejection	-Restrict number of available GM events -Possible import restrictions: high input prices -Possible loss of competitiveness	-Possible price increases - Nutritionally enhanced products possibly unavailable in future	-Encourage special interest politics in biosafety abroad
Labeling of GM or non-GM food	1. No change	-No change	-Risk of inaccurate claims and confusion	-No effect
	2. Voluntary labeling rule for non-GM (protocol, threshold)	-Better visibility of what is GM, what is non-GM -Facilitate producer choice	-Facilitate consumer choice with verifiable claims -Prices reflect costs of segregation	-Possible example of labeling that is pragmatic for producer and consumer choice
	3. Strict mandatory labeling GM (EU like)	-Lower price and quantity of GM -Possibly serious diminution of GM buyers	-Likely cost paid by all -May encourage GM avoidance	-Encourage other countries to label and discriminate against South African products

Source: Authors.

Ultimately, South Africa's most important achievement may not be the rapid and successful introduction of productivity-enhancing biotechnologies, but the fact that these technologies have reached some of the poorer farmers in the country. Naturally, most of the small-scale producers are not exporters or commercial growers, but their access to the technology is intrinsically linked to the flexible biotechnology and biosafety policies and regulations adopted in South Africa. With stricter market and trade regulations and more attention paid to special-interest groups, fewer new products are likely to be approved and therefore available to these farmers. Passing up new technology can be costly for commercial farmers in a global competition, but small farmers' opportunity costs are even larger when that technology can help them grow more for less.

Similarly, import decisions or strict labeling policies are largely independent from smallholder farmers' decisions. But introducing higher requirements for imports at a time of drought-related shortages in South Africa, and with record high prices for grains, will inevitably result in price increases for consumers. Grain price increases will be reflected in prices for meat and animal products, which only recently entered the diet of middle-income people in Africa, and these products could be dropped once again from their consumer basket. Making all consumers pay for a strict labeling regulation demanded by certain special-interest groups when 80 percent of the population does not know what biotechnology means seems unreasonable. With any price increase, low-income consumers (particularly those in urban areas) are bound to be the first and most affected. A price increase could add up to record-high food prices, resulting in consumer welfare losses.

Finally, it is clear that , voluntarily or involuntarily, South Africa is a leader in the region. Setting stricter regulations would bring it closer to its neighbors, but it would also risk encouraging more scrutiny and ad-hoc bans of its products abroad. In particular, import regulations can act as double-edge swords: they may protect domestic growers from competition, but they may also encourage future market restrictions that will directly affect the growers. More important for Southern Africa, such a move would encourage these countries to continue to completely reject GM products. Although the benefits and level of use of current GM crops in the broader Southern Africa region still cannot be accurately measured, several ex ante economic studies have shown that they could have significant positive effects if they were introduced to farmers. Considering the future outlook for the region, with global warming and high food prices, rejection of all GM technologies, including drought-resistant crops, would be a risky strategy for Southern Africa.

In this context, we do not argue against any regulatory changes but support changes that improve rather than restrict, allowing South Africa to better adapt to global changes, manage risks rigorously but efficiently, and take advantage of safe new technologies. In this spirit, the following six broad recommendations should be considered.

1. Maintain commodity clearance as a separate option for GM commodity imports, based on rigorous scientific assessment; invest in transport and infrastructure to reduce the price gap between domestic and international maize prices; and address potential competition issues on maize domestically.
2. Diminish the weight of private export issues in the Executive Council decisionmaking process, except when justified by insider and outsider expertise. Let the market decide what technology is viable for the developer. More generally, in agreement with Jaffe (2007), make sure that the role of socioeconomic considerations in the decisionmaking process is clearly defined.
3. Support the setting up of a voluntary labeling rule that clearly defines what can be labeled GM or non-GM and encourage awareness programs and increased consumer information.
4. Encourage SAFEX to consider a quote for non-GM maize.
5. Support the creation (potentially partially funded by the industry) of a transparent monitoring system (for example, an internet-based system) to provide timely information and perspective on regulatory and market changes regarding GM production and trade in other countries.
6. Continue to encourage SADC to move forward on adopting clear, harmonized, case-by-case rules governing trade of GM maize and other products in the region.

APPENDIX A: LIST OF INSTITUTIONS CONSULTED IN JUNE 2007 IN SOUTH AFRICA

- AfricaBio.
- African Feed Manufacturers Association (AFMA) - CropLife Africa-Middle East.
- Department of Agriculture, South Africa
- Department of Environmental Affairs and Tourism, South Africa
- Department of Health, South Africa
- Department of Science and Technology, South Africa
- Department of Trade and Industries, South Africa
- Grain S.A.
- Monsanto, Inc.
- Pick'n Pay, Ltd.
- SENWES Input Supply, Ltd.
- South African Institute of International Affairs (SAIIA)
- Tongaat-Hulett Starch (formerly African Products)
- United States Department of Agriculture, Foreign Agricultural Services, Regional Office
- University of Pretoria
- United Nations World Food Programme, Johannesburg

APPENDIX B: ADDITIONAL TABLE AND FIGURES ON IMPORTS AND EXPORTS

Table B.1. Year of initial adoption of each GM crop in the 13 main GM-producing countries in 2006 (excluding South Africa)

	GM Canola	GM Cotton	GM Maize	GM Soybeans
Argentina		1998	1996	1996
Australia		1996		
Brazil		2005		2002[a]
Canada	1995		1996	1995
China		1997		
India		2002		
Mexico		1997		1998
Paraguay				2004
Philippines			2002	
Romania				2001
Spain			1998	
Uruguay			2003	2000
USA	1995	1995	1995	1996

Sources: AGBIOS database (www.agbios.com), ISAAA 2007.
[a]Brazil formally approved GM soybeans in 2003, but they had been introduced illegally before from Argentina.

Figure B.1. GM/non-GM imports of maize starch (1000mt)

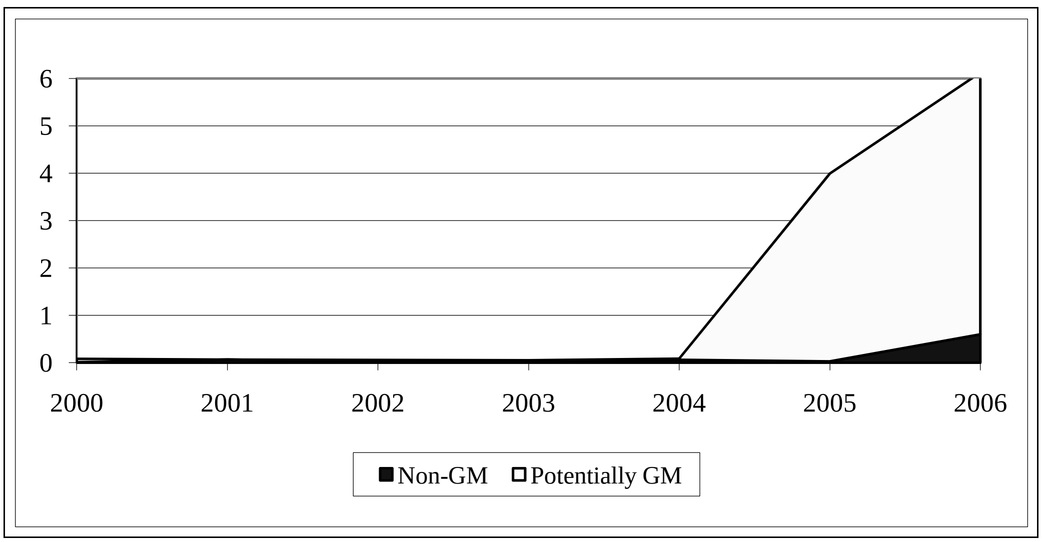


Figure B.2. GM/non-GM imports of maize starch (1000mt)

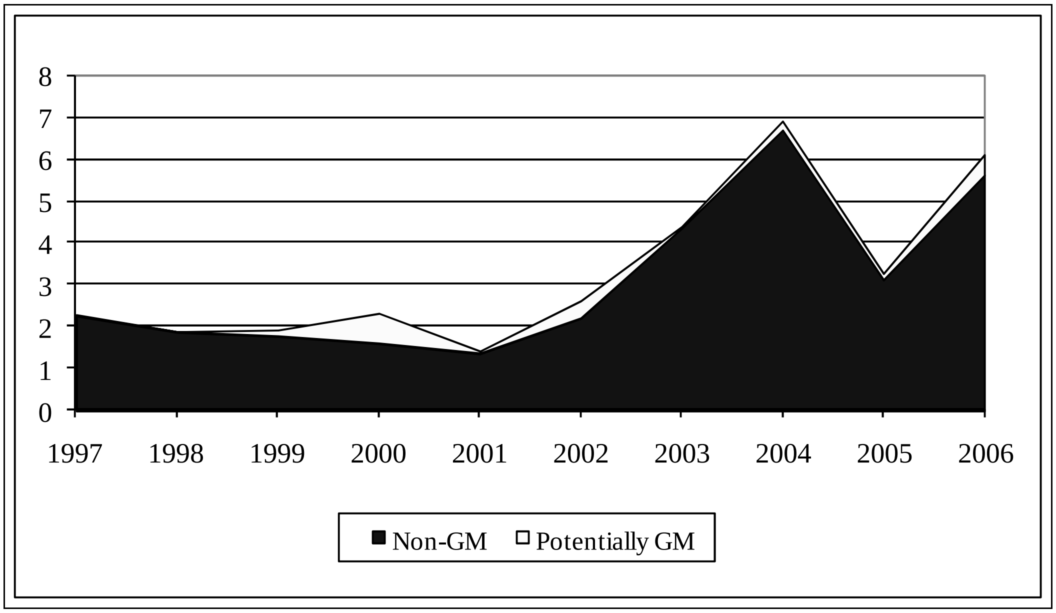


Figure B.3. GM/non-GM oil maize imports (mt)

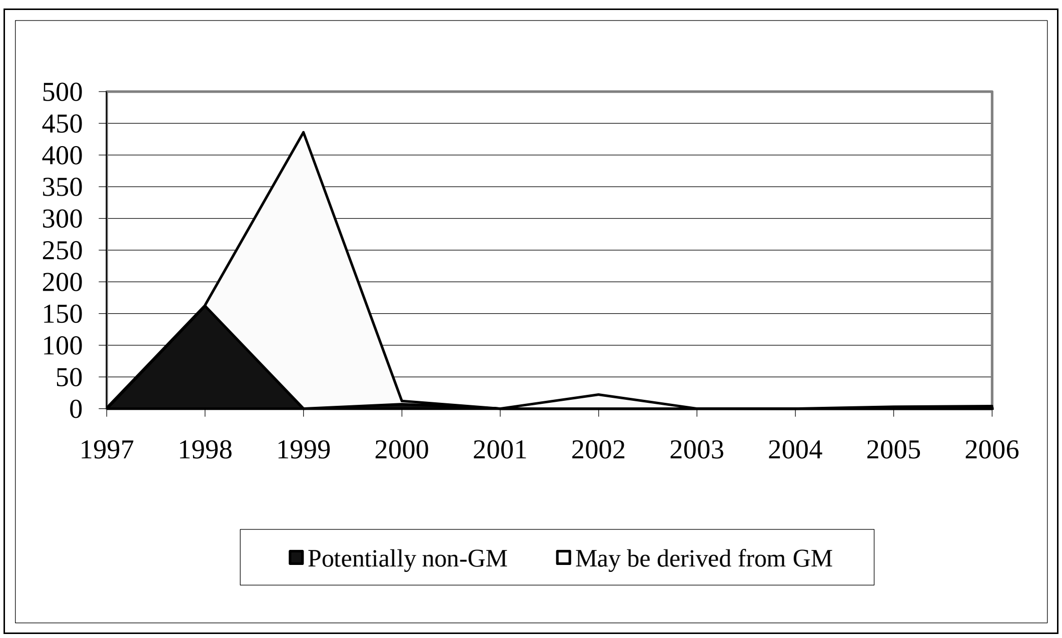


Figure B.4. GM/non-GM cotton imports (1000mt)

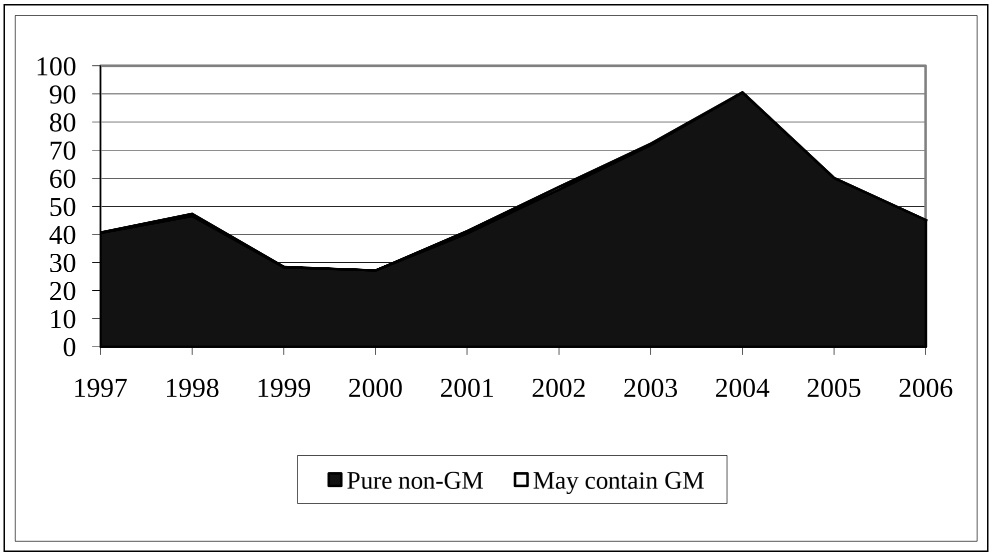


Figure B.5. GM/non-GM cottonseed oil imports (1000mt)

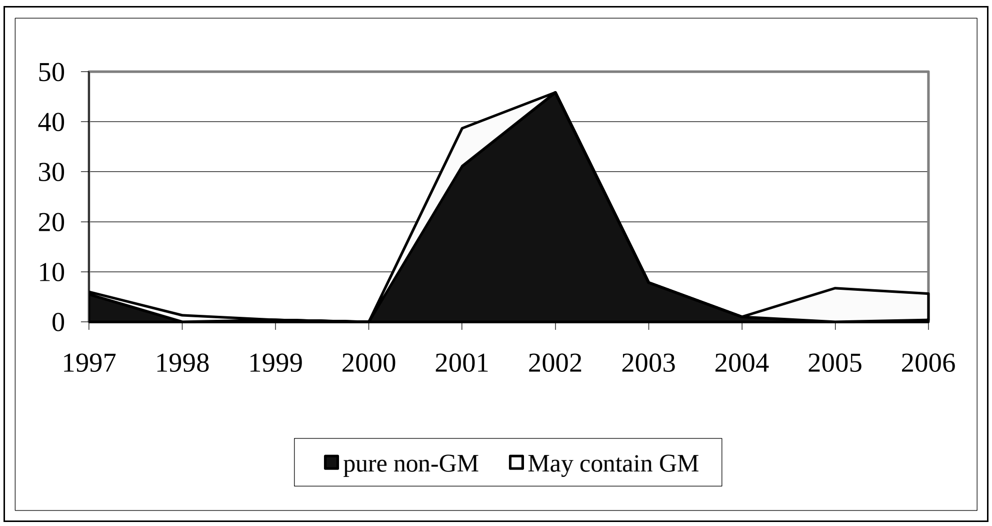


Figure B.6. GM/non-GM cottonseed cake imports (1000mt)

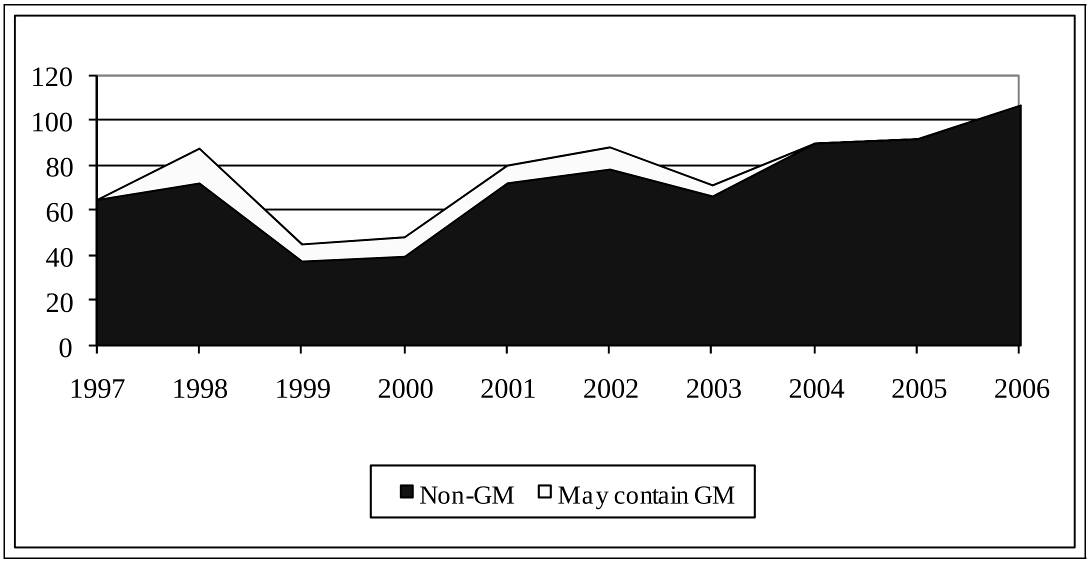


Figure B.7. GM/non-GM soybean imports (1000mt)

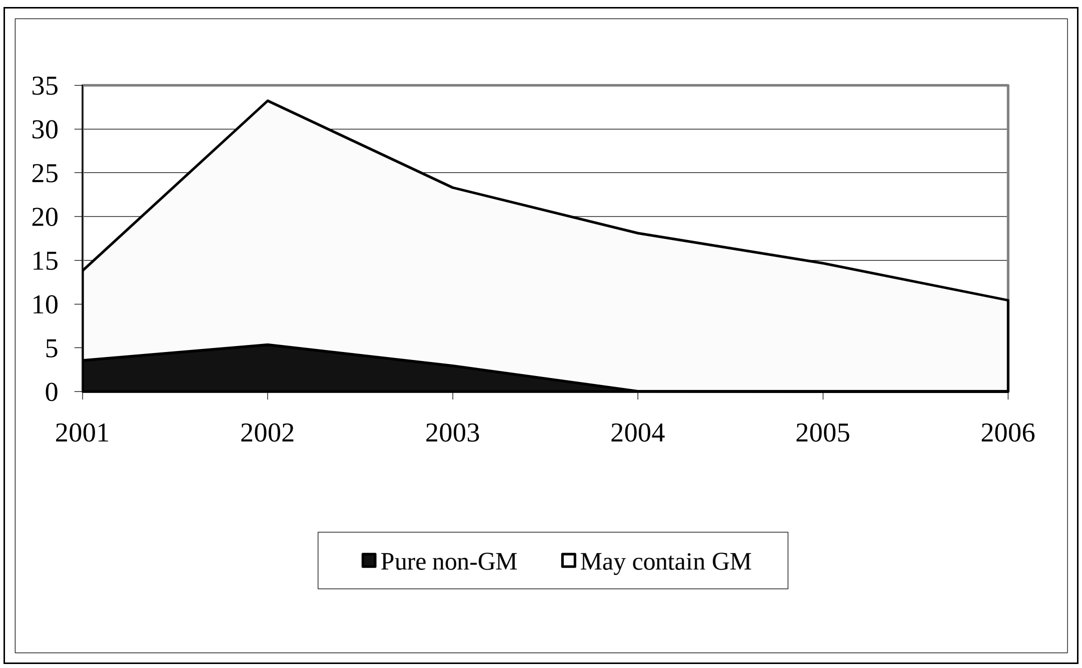


Figure B.8.GM/non-GM soy oil imports (1000mt)

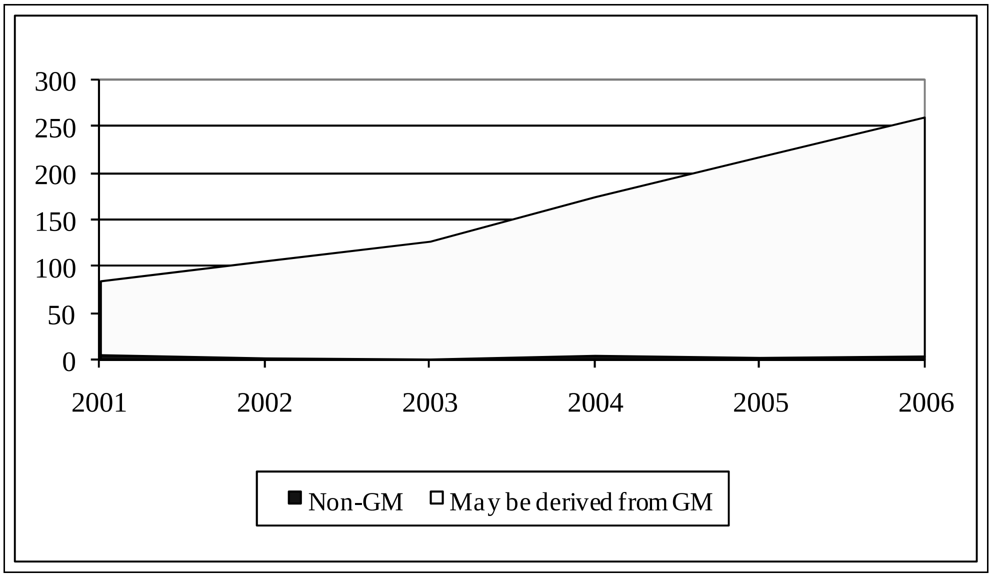


Figure B.9. GM/non-GM rapeseed oil imports (1000mt)

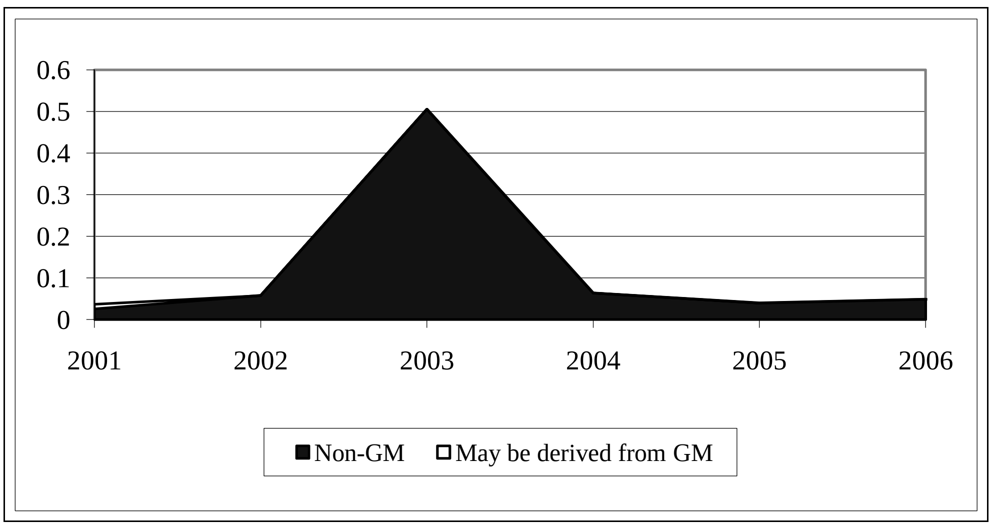


Figure B.10. GM. non-GM maize starch exports (1000mt)

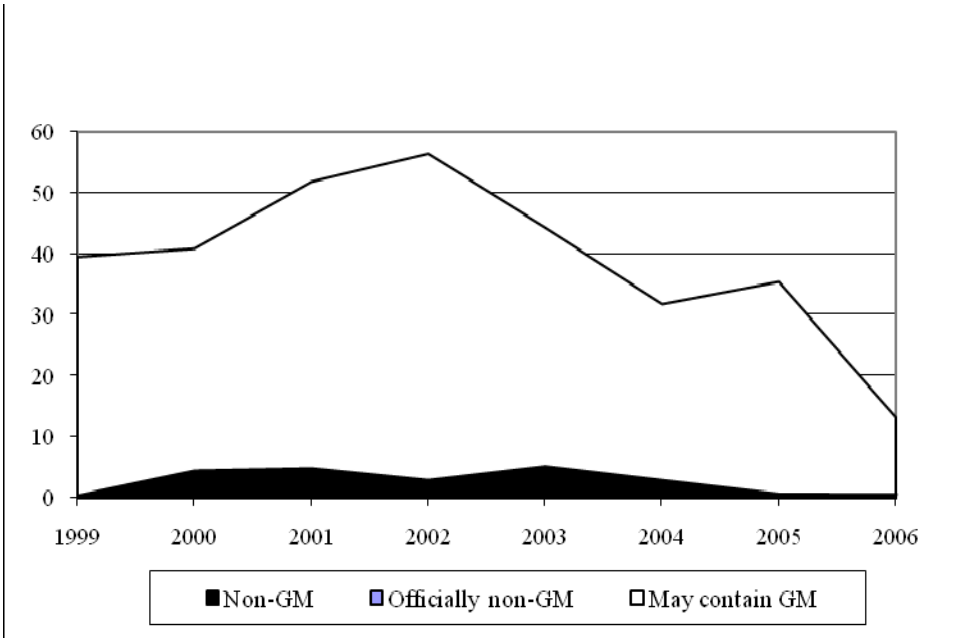


Figure B.11. GM. non-GM maize oil exports (1000mt)

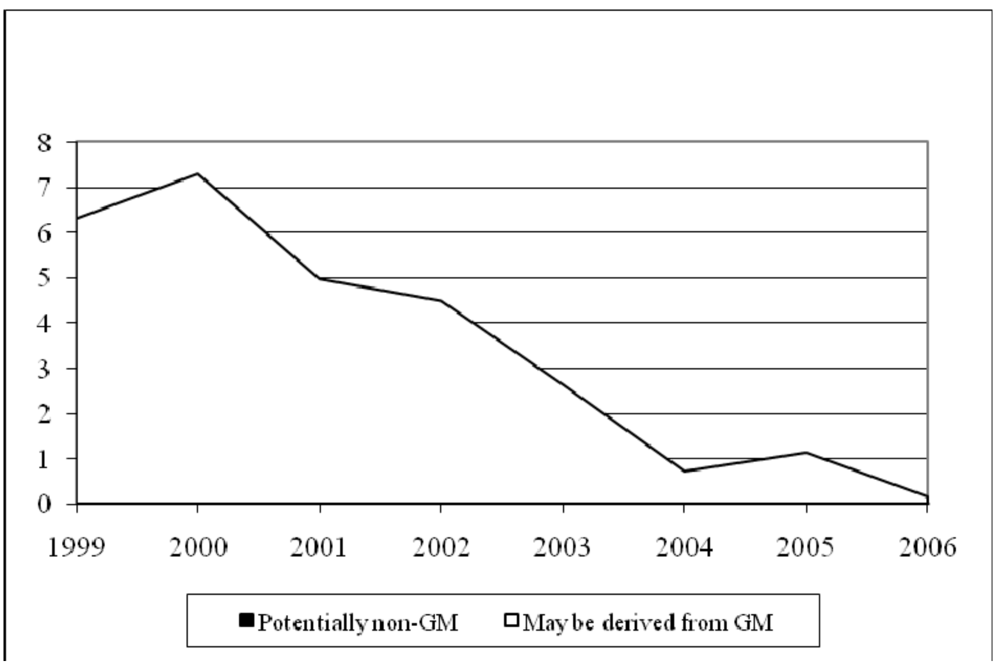


Figure B.12 . GM/non-GM exports of cotton (1000mt)

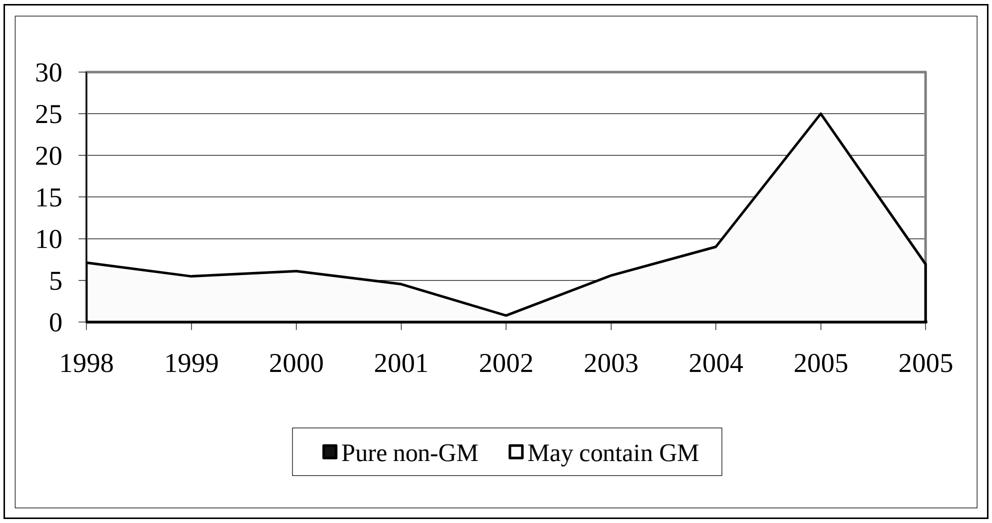


Figure B.13. GM/non-GM exports of cottonseeds (mt)

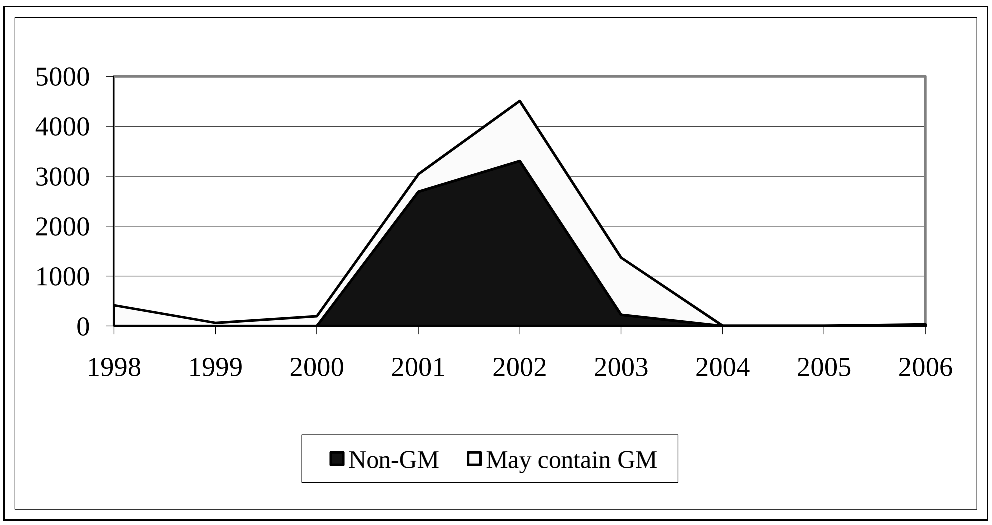


Figure B.14. GM/non-GM cottonseed oil exports (mt)

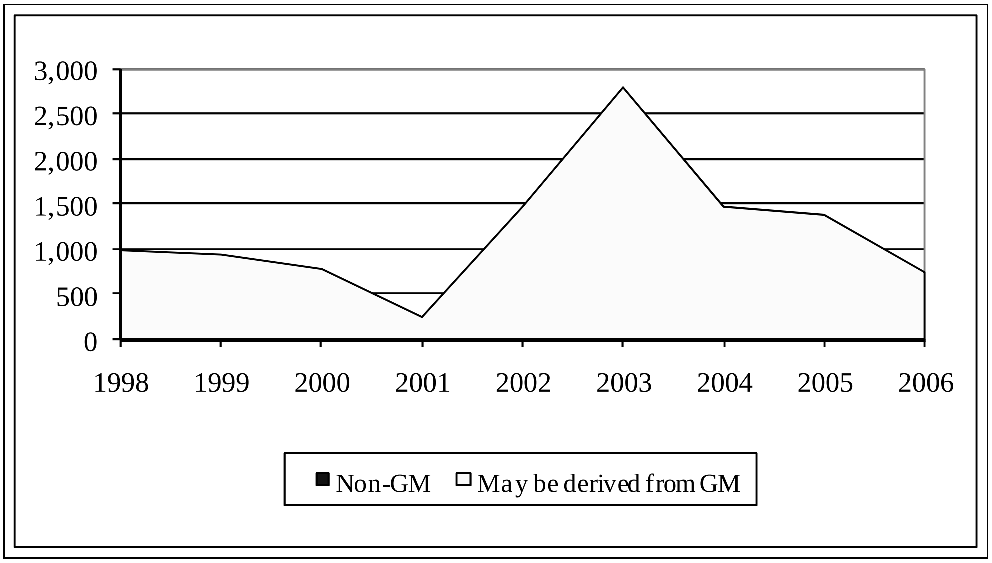


Figure B.15. GM/non-GM cotton cake exports

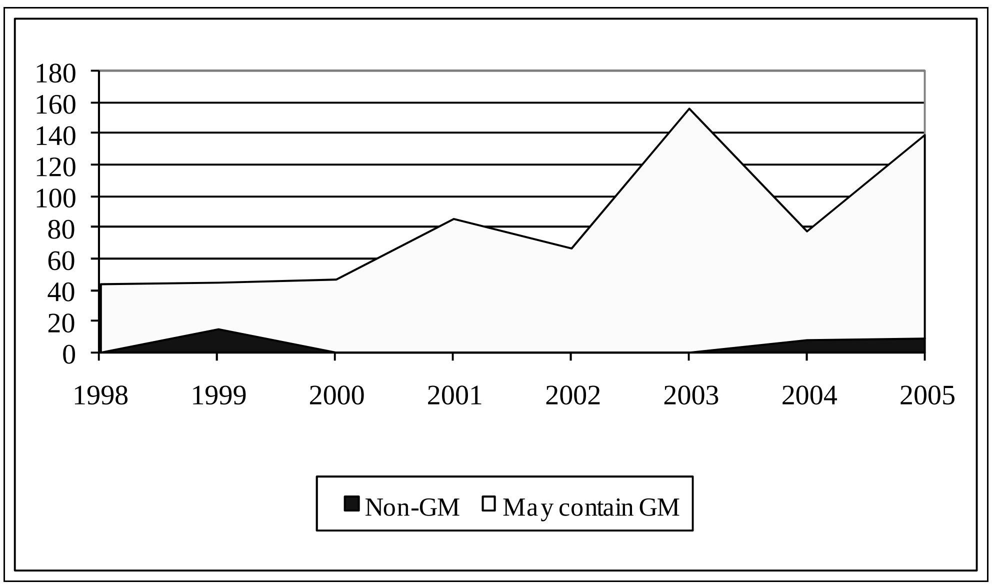


Figure B.16. GM/non-GM soy cake exports (1000mt)

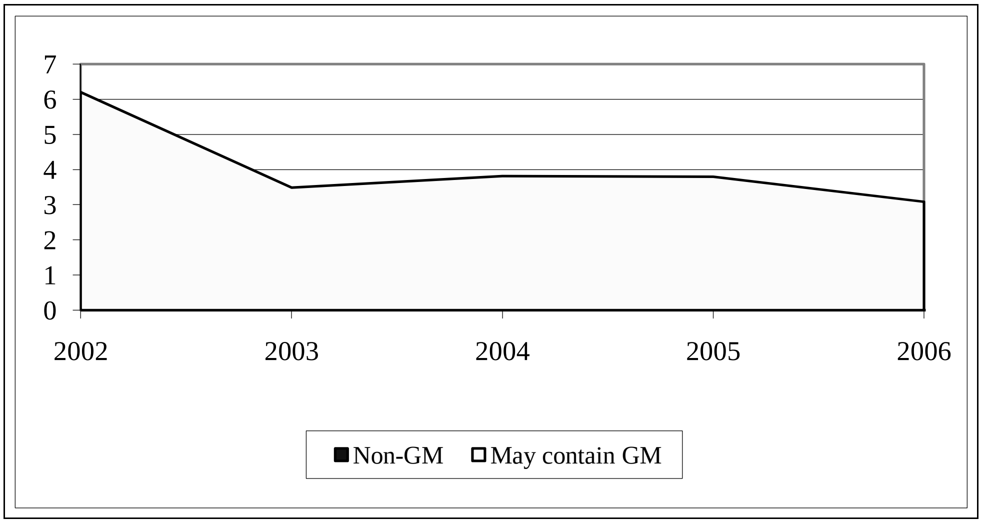
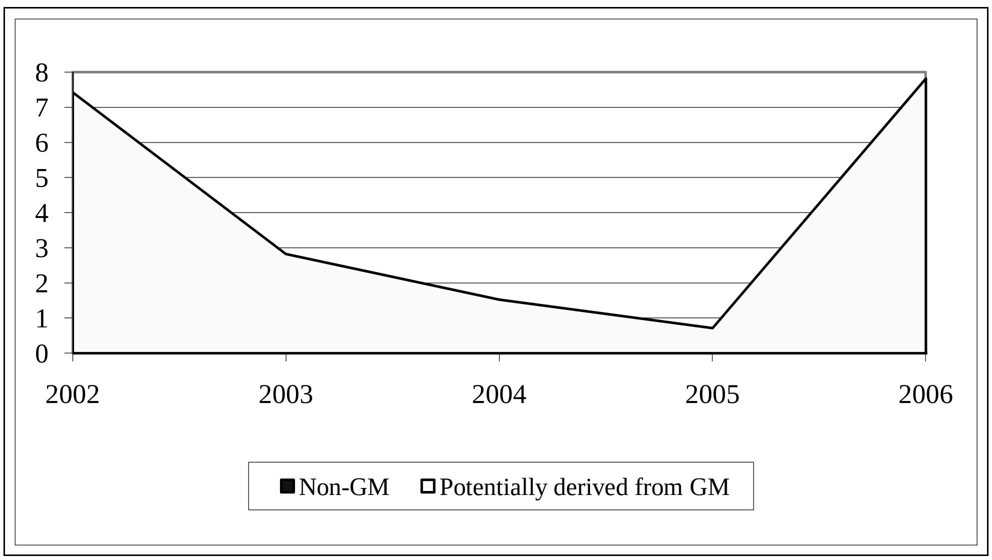


Figure B.17. GM/non-GM soy oil exports (1000mt)



Source: Authors calculations.

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