The Softest Subsidy

Agricultural Subsidy Cuts, New Biotechnologies, Developing Countries, and Cotton

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When the World Trade Organization (WTO) was created from the existing General Agreement on Tariffs and Trade (GATT) on 1 January 1995 and the Uruguay Round Agreements were implemented, developing countries initially looked forward to greater access to rich-country markets through reduced agricultural subsidies and lowered trade barriers. The commitments made in the Uruguay Round delivered little reform during the six-year implementation period, but hopes were buoyed by the launch of the WTO's Doha Development Round (DDA) in 2001.

Six years later, bitter wrangling over agriculture policy has brought the DDA to an impasse, and it may be several years before it is concluded or replaced with a new initiative. This delay, however, does not mean that no progress can be made for agricultural subsidy cuts in the meantime. Unilateral policy reform, encouraged by WTO dispute settlement procedures, could lead to significant subsidy cuts.

Moreover, new agricultural biotechnologies have emerged in the last decade that hold potential income-boosting opportunities for farmers in developing countries. If governments permit their adoption, these new technologies could complement subsidy and trade reforms. A change in technology policy in developing countries would boost the welfare gain from forthcoming agricultural policy reforms.

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Cotton provides a clear example of such an opportunity. For many developing countries, especially in Africa, Central Asia, and Pakistan, it is a vitally important cash crop. It has received attention of late because four poor, cotton-exporting, West African countries—Benin, Burkina Faso, Chad, and Mali (Cotton-4)—have demanded removal of cotton subsidy and import tariffs as part of DDA reforms. Cotton subsidies are primarily provided by governments in high-income countries, for example, the United States. Part of the U.S. cotton subsidy program has been ruled illegal following a WTO dispute settlement case brought by Brazil. Hence, some subsidy reform is expected soon.

This paper will demonstrate the magnitude of the gains that developing countries experience following a removal of all cotton subsidies and tariffs. It will also show how the gains from full reform compare with the gains that could be expected if and when: (a) the United States responds to the WTO's dispute settlement Panel and Appellate Body reports, and (b) the DDA implements the partial reforms proposed at the Hong Kong Trade Ministerial meeting in December 2005.[1] Furthermore, the article will compare the estimated gains from cotton subsidy and tariff reform with the potential gains earned by developing countries if they adopted new varieties of cotton emerging from the biotechnology revolution, specifically genetically modified (GM) cotton. Finally, it will show the dangers of global cotton market distortion created by subsidies and trade taxes.

These empirical results are generated using the so-called Global Trade Analysis Project (GTAP) model.[2] This is a public, fully documented simulation model of the global economy that is widely used for quantitative analysis of trade-related policies, including those influencing technological changes. Its database simulates the interactions between the world's input and product markets as of 2001, subdivided into eighty-six countries and country groups, four sets of primary factors—land, unskilled labor, skilled labor, and capital—and fifty-seven products and product groups. It is often used to analyze the effect of international trade policy changes on national and global economic welfare and on the production and trade of different industries.

The Global Cotton Market. Cotton production is highly concentrated in a few countries. As of 2006, nearly half is produced by China and the United States; the total volume rises to more than two-thirds when India and Pakistan are added, and to more than three-quarters if Brazil and Uzbekistan are included. Exports of cotton lint are also highly concentrated; the United States, Australia, Uzbekistan, and Brazil account for almost two-thirds of the world's exports. In addition, many low-income countries depend heavily on cotton for earning foreign exchange.

Cotton usage, on the other hand, is distributed across countries roughly in proportion to their volumes of textile production. Because of high domestic usage by exporters of textiles and clothing in developing Asian countries—and Mexico, due to its preferential access to the U.S. and Canadian markets under NAFTA—even relatively large cotton producers such as China, Pakistan, and India export only a small fraction of their crop. This is in contrast to sub-Saharan Africa, where textile production is relatively minor and thus the cotton industry is heavily export focused (columns 2 and 3 of the table).

The Global Cost of Cotton Subsidies and Tariffs. Using the GTAP database and model of the global economy, we estimate that the removal of all cotton subsidies and import tariffs would boost global economic welfare by $283 million per year and would raise the price of cotton in international markets by an average of 13 percent. The price rise ensures that all cotton-exporting countries would benefit while net importers of cotton would be worse off, as shown in the right-hand columns of the table.[3]

The welfare effects are striking in their distribution among developing countries. Especially noteworthy is the relatively large benefit bestowed on sub-Saharan Africa—$147 million per year. About two-fifths of that amount would go to the Cotton-4 and another one-fifth to other West African countries. This is driven by an estimated increase in sub-Saharan African cotton output and net farm income of nearly one-third, and in the real value of the region's cotton exports by more than 50 percent. By contrast, removal of subsidies and tariffs would cause cotton output and exports to fall by one-quarter in the United States and by one-half in the EU, as shown in the middle columns of the table. This would consequently raise sub-Saharan Africa's share of global cotton exports from 12 to 17 percent, and the share of all developing countries from 52 to 72 percent. The region's welfare gain of $147 million per year is no less than one-fifth of the estimated gain for the region from the freeing of *all* goods markets globally, according to our GTAP model results. It is therefore not surprising that some African trade negotiators had been threatening to walk out of the WTO's Doha round of talks if substantial reforms to cotton policies were not included in the final Doha agreement.

Turning to the impacts of such reform on cotton farmers' incomes, we estimate incomes would decline by one-sixth in the United States and by just over half in the EU. In virtually all other regions, however, they are estimated to rise. Crucially, they would rise by a massive 30 percent in sub-Saharan Africa and around 40 percent in West Africa in particular—more than three-quarters of which is due to cuts in domestic support programs.

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Both the U.S. and the EU economies would be better off without those subsidies, even though their individual cotton farmers would be worse off. The net gain to the EU is very small, reflecting the tiny size of this primary industry in Western European agriculture. For the United States, however, the estimated annual gain in net economic welfare from removing those subsidies is $429 million per year.

Effects of Partial Reform of Cotton Subsidies and Tariffs. While the full reform results presented

Table 1: Cotton net farm income and net export positions in 2001, and impact of removing cotton subsidies and tariffs[a] on cotton output, exports, net farm income, and economic welfare.
(Percent and 2001 U.S. dollars)

	2001 data		
		Net exports[b] *($ billion):*	
	Cotton production specialization index[c]	*Cotton*	*Clothing & Textiles*
High-income countries	**0.3**	**1**	**-92**
Australia	3.8	1.1	-2.6
United States	0.6	2.2	-60.7
EU25	0.1	-1	-28.8
Japan	0	-0.4	-14.1
Korea-Taiwan	0.1	-0.7	22.5
Developing countries	**3.8**	**-1**	**92**
E. Europe & C. Asia	***4.3***	***0.3***	***7.4***
Turkey	11.6	-0.4	8.7
Other ECA	2.1	0.7	-1.3
East Asia	***3***	***-1.4***	***60.4***
China	4	-0.1	41.9
South Asia	***14.5***	***-1***	***24.5***
Bangladesh	14.2	-0.3	3.8
India	13.7	-0.6	11.9
Pakistan	29.9	-0.1	6.8
M. East & North Africa	***2.5***	***0.4***	***-3.3***
Sub-Saharan Africa	***5.8***	***1.1***	***-1.8***
South Africa	0.3	0	-0.2
Mozambique	6.1	0	0
Zambia	11.6	0	0
Uganda	6.8	0	0
Other S. & E. Africa	7.5	0.2	0.7
Nigeria	2.2	0	-0.7
Other Sub-Sah. Africa	12.6	0.8	-1.6
Latin America & Car.	***1.1***	***-0.4***	***4.8***
Argentina	1.1	0.1	-0.4
Brazil	1.5	0.1	0
Mexico	0.8	-0.5	4
World	**1**	**0**	**0**

(a) Removal of those distortions left after the phase-out of the quotas at the end of 2004. (b) Exports minus imports, both valued at f.o.b. prices as in the GTAP database 6.05. (c) Cotton's national share in GDP relative to cotton's share of global GDP. In the GTAP database the sector is 'plant-based fibres' and so includes such products as flax (important only for Bangladesh in the above countries) *Source:* *Authors' GTAP model simulation results.*	GTAP model simulation results				
	Change in (%):			Welfare change ($ million):	
	Cotton output	Net cotton farm income	Cotton export value	TOTAL	Due to trade terms change
High-income countries	**-20**	**-15**	**-18**	**465**	**275**
Australia	25	22	38	137	125
United States	-25	-18	-29	429	443
EU25	-54	-53	-49	14	-109
Japan	1	2	62	-24	-49
Korea-Taiwan	12	7	34	-61	-84
Developing countries	**6**	**4**	**46**	**-182**	**-275**
E. Europe & C. Asia	***7***	***3***	***36***	***-14***	***-36***
Turkey	2	2	37	-86	-80
Other ECA	10	9	35	72	44
East Asia	***2***	***2***	***72***	***-83***	***-127***
China	2	2	76	50	45
South Asia	***2***	***1***	***55***	***-96***	***-99***
Bangladesh	8	5	68	-11	-21
India	-1	0	31	-85	-79
Pakistan	5	3	61	-7	-5
M. East & North Africa	***6***	***6***	***37***	***19***	***26***
Sub-Saharan Africa	***32***	***31***	***55***	***147***	***113***
South Africa	19	21	47	-1	-2
Mozambique	19	18	29	2	1
Zambia	4	4	11	0	0
Uganda	27	26	45	4	3
Other S. & E. Africa	21	20	46	17	14
Nigeria	23	21	47	-1	0
Other Sub-Sah. Africa	39	37	60	126	97
Latin America & Car.	***11***	***9***	***54***	***-155***	***-152***
Argentina	14	11	66	7	6
Brazil	10	10	58	13	12
Mexico	13	11	42	-128	-136
World	**-1**	**-2**	**8**	**283**	**0**

above are not likely to materialize in the immediate future, they provide a useful benchmark against which to compare the estimated effects of partial reforms. Consider two partial reform scenarios: liberalization in the United States alone, as a possible response to the outcome of the WTO dispute settlement case brought against it by Brazil; and a broader liberalization consistent with what was agreed at the Hong Kong Trade Ministerial in December 2005 as part of the Doha Development Agenda (see endnote 1); namely, a multilateral reduction in all agricultural subsidies and in tariffs and other barriers to trade in goods and services.

Will the results of the WTO's dispute settlement Panel and Appellate Body's noncompliance with the United States's WTO obligations bring forth significant cotton reform in the United States? The WTO ruled that the U.S. policies of export credit guarantees and the Step 2 program, which is effectively a subsidy to domestic textile producers, were types of subsidies prohibited by organization membership. In response, the U.S. Congress agreed in February to repeal its Step 2 program. If U.S. expenditure on cotton support is reduced by the full amount of the Step 2 payments, this would be equivalent to a one-seventh reduction in the aggregate subsidy to U.S. cotton production.

The complaining country (Brazil) may also expect a reduction in U.S. cotton farm subsidies, which in 2000-2002 averaged $3 billion per year, while in 1992 they were just $2 billion.[4] To simulate a U.S. reform that could be interpreted as full compliance with the WTO rulings, we ran a scenario in which not only the Step 2 program is removed, but also domestic cotton subsidies are cut by one-third, from $3 billion to $2 billion.[5]

The WTO's Hong Kong Trade Ministerial meeting of the DDA in December 2005 went even further. The members came to a number of agreements: all cotton export subsidies will be eliminated during 2006; least-developed countries will get duty-free access for their cotton exports to high-income countries by the time the DDA conclusions are implemented; and domestic cotton subsidies will be reduced faster and more ambitiously than other agricultural domestic support programs. With the DDA now in limbo, that offer is on hold, but it is still worthy of consideration if the DDA is rejuvenated.

Another partial liberalization scenario demonstrates how far the offer will go for duty-free access for least-developed countries. This scenario would cut domestic cotton supports by one-third in all high-income countries, not just in the United States. The impacts of these partial reform simulations are four-fold. First, the national welfare gains and boost to cotton farmers' incomes from partial reform are still concentrated in sub-Saharan Africa and Central Asia, although less so than under full reform. Second, sub-Saharan Africa's cotton output and exports would rise only one-quarter as much under full reform as under the Doha partial reform scenario. Third, compared with what sub-Saharan Africa can expect from Doha cotton reform, U.S.-only partial reform would generate only around three-fifths of the estimated net welfare and net cotton income effects and just two-fifths of the export effects. Finally, the average price of cotton in international markets is estimated to rise by 12.9 percent under full reform, but by just 4.4 and 3.2 percent in the Doha and U.S.-only scenarios, respectively.

Adoption of GM cotton and Gains from Trade. The WTO's Doha Cotton Initiative involves two parts: in addition to trade and subsidy reform, importance has been attached to boosting the international competitiveness of cotton production in low-income countries. One way to do that is for governments of those countries to allow the adoption of new varieties of cotton emerging from the biotechnology revolution, following the example of early adopting countries like the United States, Australia, China, and South Africa. The development of agricultural technology has produced genetically modified cottonseeds, leading to higher yield and stronger natural pest resistance.

Many governments have been cautious about approving the use of such seeds, however, because of uncertainty regarding their environmental and food safety effects. In the case of cotton, the food safety risk is very small due to limited use of cottonseed oil within the food chain.

To simulate the economic effect of global adoption of GM cotton varieties, a complementary study by Anderson, Valenzuela, and Jackson assumes productivity in cotton production would rise. [6] Specifically, it assumes there would be less of all inputs needed to produce one ton of cotton; it cuts the use of inputs by 5 percent in all adopting countries, except India and sub-Saharan Africa, excluding South Africa. For India and sub-Saharan Africa, whose yields have been well below half the global average, the reduction in input use following GM seed adoption is assumed to be 15 percent.

If all countries adopt GM cotton, the value of cotton output in the four early-adopting countries would fall in response to the output expansion in newly adopting regions. Global welfare, however, would jump $2.3 billion. Asian developing economies would gain even if they grow little or no cotton, because the international price would be lower by an average of 4.1 percent. The economic welfare gains to Central Asia, sub-Saharan Africa, and South Asia are estimated to be, respectively, ten, thirteen and twenty-three times greater than the global welfare gains when expressed as a percentage of regional income. South Asia's gains are especially large because it is a large producer *and* user of cotton.

The estimate of the global benefits of full GM cotton adoption for developing countries is eight times larger than the above estimate of the global economic welfare gain from complete removal of all cotton subsidies and tariffs, and twelve times larger than the global gain from the Doha partial cotton reform simulation. The differences are less marked for sub-Saharan Africa; even so, the estimated welfare gain to sub-Saharan Africa from adopting GM cotton varieties is well above the gain from full removal of all trade-distorting cotton policies. Additionally, this gain is nearly six times that from the Doha partial reform simulation considered above.

The gains to developing countries from GM adoption would be slightly greater in the absence of distortionary cotton policies—12 percent greater, in the case of sub-Saharan Africa. But if these two reforms—GM catch-up and subsidy removal—were to occur simultaneously in sub-Saharan Africa, they would each expand the region's cotton production and exports and thus reinforce each other to create an even larger net gain. The gain to sub-Saharan Africa alone would be $370 million.

Furthermore, while some cotton-importing developing countries lose

from subsidy reform alone, they gain when they combine that reform with the spread of productivity-enhancing GM cotton varieties. This example clearly illustrates the symbiosis between the subsidy and trade policies on the one hand and technology policies on the other for developing countries.

Adaptation and adoption of new genetically modified cotton varieties are within the powers of developing countries themselves. Unlike the Cotton Initiative in the WTO's Doha Development Agenda, governments in sub-Saharan Africa and elsewhere do not need to wait until the round concludes to boost the incomes of their cotton farmers. Those developing countries with well-developed public agricultural research and extension systems are well positioned to benefit from new biotechnology by working in partnership or in parallel with private biotech and seed companies.

Approving investments in those activities by the private sector will allow the process of adaptation and adoption to move forward. The experiences in China, India, and South Africa all indicate that rapid and widespread adoption is possible, even by small farmers—despite poorly developed public agricultural research and unattractive investment climates.[7] As those systems and associated intellectual property rights are improved, however, the payoff from research and development spending will be enhanced to adapt appropriate local crop varieties. The potential benefits shown above from this new biotechnology will make such expenditure even more affordable.

Moreover, the fear of adverse environmental or food safety issues has not yet been justified, in part because scientists and regulators have found ways to manage those risks. Embracing GM cotton could help developing country governments streamline the process of approving the release of GM food, because of the steady flow of scientific reports concluding that there is no evidence that GM foods are harmful either to the environment or to human or animal health.[8] These economies could potentially multiply the existing $2 billion gain from GM cotton adoption.[9]

Conclusion. The extent to which unilateral reforms will generate the benefits of full liberalization hinges heavily on U.S. and EU commitments; those governments must be willing to cut their applied domestic subsidies. Partial reforms, of the sort discussed in Hong Kong, could deliver roughly twice the gains to cotton-exporting developing countries as the current WTO reforms, which were imposed on the United States as a result of the Brazilian WTO dispute.

Embracing GM cotton could help developing country governments streamline the process of approving the release of GM food.

Even excluding Doha Round results, there are other policies that may increase the incomes of cotton farmers in developing countries. Adaptation and adoption of new genetically modified cotton varieties are one clear contribution. This is within the powers of developing countries to regulate themselves. Freeing up

that investment opportunity is not dependent on a Doha round conclusion.

The above results suggest that GM cotton adoption would enhance the economy of a developing country more substantially than would the removal of all cotton subsidies and tariffs. Cotton subsidy reductions by developed countries like the United States and those of the EU would actually enhance the capacity of poor farmers in low-income countries, encouraging the purchase of more expensive GM cottonseeds. Such commitment is necessary for the global cotton economy to reach its full potential, and governments of developing and developed countries alike must work together to achieve it.

DISCLAIMER: *The views expressed are the authors' alone and not necessarily those of the World Bank and its Executive Directors, or the countries they represent, nor of the British and Dutch Governments that provided the trust funds for the research projects on which this paper draws.*

NOTES

1 The Panel's findings in the case Brazil brought against the United States are in WTO, "United States - Subsidies on Upland Cotton: Report of the Panel," WT/DS267/R, Geneva: World Trade Organization, 8 September 2004. The United States appealed, and the Appellate Body's findings are reported in WTO, "United States - Subsidies on Upland Cotton: Report of the Appellate Body," WT/DS267/AB/R, Geneva: World Trade Organization, 3 March 2005. At the end of the WTO Trade Ministerial meeting in Hong Kong in late 2005, the cotton initiative was emphasized yet again, see WTO, 'Ministerial Declaration: Doha Work Programme', WT/MIN(05)/DEC, Geneva: World Trade Organization, 22 December 2005, www.wto.org/english/thewto_e/minist_e/min05_e/final_text_e.htm. The original response to the West African demand for a cotton initiative as part of the DDA is reported in WTO, 'Agriculture: The Cotton Sub-Committee', Geneva: World Trade Organization, 19 November 2004, www.wto.org/english/tratop_e/agric_e/cotton_subcommittee_e.htm.

2 For details see www.gtap.org, T.W. Hertel, *Global Trade Analysis: Modeling and Applications*, New York: Cambridge University Press (1997) and B.V. Dimaranan, "Global Trade, Assistance, and Protection: The GTAP 6 Data Base," Center for Global Trade Analysis, Purdue University, West Lafayette (2006).

3 For more on the global modeling methodology used and details of the empirical results, see K. Anderson and E. Valenzuela, "The World Trade Organization's Doha Cotton Initiative: A Tale of Two Issues", *The World Economy* 30(8): 1281-1304, August 2007.

4 That $3.0 billion is equivalent to a 40 percent production subsidy to cotton farmers. By way of comparison, the subsidy in the EU is 39 percent, but because the industry is so much smaller in the EU than the United States, the value of that subsidy is 'just' $430 million.

5 The WTO's compliance panel in this case ruled in October 2007 that indeed the United States had not reformed enough to comply with its WTO obligations.

6 Anderson, K., E. Valenzuela and L.A. Jackson, "GM Cotton Adoption, Recent and Prospective: A Global CGE Analysis of Economic Impacts," *Economic Development and Cultural Change* 56(2), January 2008 (forthcoming).

7 Sithole-Niang, I., J.I. Cohen and P. Zambrano, "Putting GM Technologies to Work: Public Research Pipelines in Selected African Countries", *African Journal of Biotechnology* 3(11): 564-71, 2004 and Cohen, J.I., "Poorer Nations Turn to Publicly Developed GM Crops", *Nature Biotechnology* 23(1): 27-33, 2005.

8 King, D.K., *GM Science Review: First Report*, Prepared by the GM Science Review Panel under the chairmanship of Sir David King for the UK Government, London, 2003.

9 Anderson, K. and L.A. Jackson, "Some Implications of GM Food Technology Policies for Sub-Saharan Africa", *Journal of African Economies* 14(3): 385-410, 2005, and Anderson, K., L.A. Jackson and C.P. Nielsen, "GM Rice Adoption: Implications for Welfare and Poverty Alleviation", *Journal of Economic Integration* 20(4): 771-88, 2005.