Agricultural Policy Reform in the WTO—The Road Ahead. Market and Trade Economics Division, Economic Research Service, U.S. Department of Agriculture. Agricultural Economic Report No. 802.

Editor. Mary E. Burfisher

Contributors. Xinshen Diao, Aziz Elbehri, Mark Gehlhar, Paul Gibson, Susan Leetmaa, Lorraine Mitchell, Frederick J. Nelson, R. Wesley Nimon, Mary Anne Normile, Terry Roe, Shahla Shapouri, David Skully, Mark Smith, Agapi Somwaru, Michael Trueblood, Marinos Tsigas, John Wainio, Daniel Whitley, C. Edwin Young

Abstract

Agricultural trade barriers and producer subsidies inflict real costs, both on the countries that use these policies and on their trade partners. Trade barriers lower demand for trade partners' products, domestic subsidies can induce an oversupply of agricultural products which depresses world prices, and export subsidies create increased competition for producers in other countries. Eliminating global agricultural policy distortions would result in an annual world welfare gain of $56 billion. High protection for agricultural commodities in the form of tariffs continues to be the major factor restricting world trade. In 2000, World Trade Organization (WTO) members continued global negotiations on agricultural policy reform. To help policymakers and others realize what is at stake in the global agricultural negotiations, this report quantifies the costs of global agricultural distortions and the potential benefits of their full elimination. It also analyzes the effects on U.S. and world agriculture if only partial reform is achieved in liberalizing tariffs, tariff-rate quotas (limits on imported goods), domestic support, and export subsidies.

Acknowledgments

Appreciation is extended to Mary Bohman, Praveen Dixit, Elizabeth Jones, Linwood Hoffman, and Mary Anne Normile for their roles in the oversight and review of this project's development, and to Aziz Elbehri for his valuable contributions as an economics editor. We wish to thank Roger Betancourt and Sherman Robinson for major conceptual contributions. Gene Hasha, Roy Hawkins, Wilma Davis, and Faith Carter provided technical support. Thanks also to John Weber, our technical editor, and Susan DeGeorge, Cynthia Ray, and Wynnice Napper, our graphics staff. We also want to express our appreciation to Thomas Hertel and the GTAP staff at Purdue University for their special efforts in developing the modeling database. The authors gratefully acknowledge the reviews of Phillip Abbot, David Blandford, Eugenio Diaz-Bonilla, Carol Goodloe, Harry de Gorter, Jason Hafemeister, Debra Henke, Thomas Hertel, Cathy Jabara, Timothy Josling, P. Lynn Kennedy, William Kost, Suchada Langley, Cathy McKinnell, Karl Meilke, Steven Neff, Karl Rich, Sharon Sheffield, Ian Sheldon, Wyatt Thompson, Stephen Vogel, and Linda Young.

Washington, DC 20036-5831 May 2001

Contents

Summary

Agricultural trade barriers and producer subsidies inflict real costs, both on the countries that use these policies and on their trade partners. Trade barriers lower demand for trade partners' products, domestic subsidies can induce an oversupply of agricultural products which depresses world prices, and export subsidies create increased competition for producers in other countries. In 2000, World Trade Organization (WTO) members continued global negotiations on agricultural policy reform. To help policymakers and others realize what is at stake in the global agricultural negotiations, this report quantifies the costs of global agricultural distortions and the potential benefits of their full elimination. It also analyzes the effects on U.S. and world agriculture if only partial reform is achieved in liberalizing tariffs, tariff-rate quotas (limits on imported goods), domestic support, and export subsidies.

Key findings include:

Global agricultural policy distortions impose substantial, long-term costs on the world economy; in the long term, the full elimination of these policy distortions would result in an annual world welfare gain of $56 billion, about 0.2 percent of global GDP. These projected welfare gains, or increased purchasing power, can be decomposed into the removal of distortions in production and consumption ($31 billion), the effects of policy reform on global savings and investment ($5 billion), and increased productivity gains, mainly in emerging and developing countries ($20 billion). Total, long-term welfare benefits to the United States from eliminating world agricultural policy distortions are $13.3 billion annually — about 24 percent of global gains. U.S. gains would mainly come from our trade partners' policy reforms.

Elimination of agricultural trade and domestic policy distortions could raise world agricultural prices about 12 percent. Import tariffs lower food demand, and domestic support and export subsidies encourage excess supply — all result in lower world agricultural prices. European Union (EU) agricultural policies account for 38 percent, and Japanese plus Korean policies combined account for 12 percent, of global price distortions. U.S. agricultural policies account for about 16 percent of global price distortions.

Tariffs and tariff-rate quotas account for more market distortions than domestic subsidies and export subsidies. Tariffs and tariff-rate quotas account for most of the agricultural price distortions (52 percent) from agricultural protection and support. Post-Uruguay Round agricultural tariffs remain high, with a global average rate of 62 percent and an industrial country average of 45 percent. Domestic subsidies (31 percent) and export subsidies (13 percent) have comparatively smaller, direct roles in reducing world prices. The remaining 4 percent measures the interaction effects of the three policies combined.

Continuing the Uruguay Round reductions (an additional 20 percent) in the Aggregate Measurement of Support (AMS) will have less of an impact than leveling domestic support across countries and commodities, an alternative, generic approach to reducing domestic support. An additional 20-percent reduction in the Uruguay Round ceilings on total support expenditure would affect a small number of OECD countries, because many countries' expenditures are already below their AMS limits, based on 1998 policies. Leveling and reducing domestic support on a commodity basis would engage more countries and commodities in the reform process. Commodity impacts would also differ under the two approaches.

Despite their relatively small aggregate price effects, export subsidies play an important role in the reform process. Tariffs and domestic support policies of many countries contribute to distorted global markets. The global effects of export subsidies, however, are mostly attributable to a single region, the EU. Export subsidies significantly affect trade in some markets, create increased competition that strains trade relationships, and are an integral part of related domestic price support programs.

Many trade and domestic policies operate interdependently, and options for reform of some policies are linked. A reduction in tariffs would reduce the problems related to TRQs by reducing over-quota tariffs. Trade policy reforms can help achieve reforms of domestic market price support, because price support programs generally rely on tariffs and export subsidies to be effective. Greater constraints on export subsidies can help some countries ease their reluctance to reduce their import barriers because of unfairly subsidized competition, and can create pressures for reducing related domestic price support that encourages surplus production.

Emerging and developing countries can benefit from further policy reforms. These countries have diverse, and sometimes divergent, interests in the negotiations. Global policy reform will lead to increased agricultural exports by many emerging and developing countries and improved terms of trade. Most of the potential benefits from policy reform will come from emerging and developing countries' reform of their own policies. Their full engagement in a global reform process could increase their welfare by $21 billion annually. Low-income developing countries' food aid needs will decline 6 percent as their domestic food production expands in response to higher world prices.

Overview

Mary E. Burfisher

Introduction

The Uruguay Round of the General Agreement on Tariffs and Trade (GATT) concluded in 1994 with an agreement that fundamentally changed the treatment of national agricultural policies under the multilateral rules of global trade. In the Uruguay Round Agreement on Agriculture (URAA, or the Agreement), members determined that trade-distorting policies are to be disciplined, or constrained, so that agricultural markets can be increasingly directed by market forces rather than government intervention. Members set the implementation period for these reform commitments at 1995-2000 for developed countries, and through 2004 for developing countries (table 1).

The URAA marked a first step in the process of global policy reform. The Agreement provided the starting point for further reform by including a provision that member countries resume negotiations on agriculture by December 31, 1999, one year before the end of the implementation period for developed countries. Although efforts at the WTO's November 1999 Seattle conference failed to initiate a full round of negotiations, agricultural negotiations ultimately began in March 2000. They are being conducted as special sessions of the WTO Committee on Agriculture in Geneva, Switzerland (table 2).

The new negotiations present an opportunity to further reduce policy distortions in global agriculture. Agricultural trade barriers and producer subsidies inflict real costs, both on the countries that use these policies and on their trade partners. Trade barriers help keep inefficient domestic producers in operation, result in forgone opportunities for a more efficient allocation of national resources, and lower demand for trade partners' products. Domestic subsidies may induce an oversupply of agricultural products and help to retain resources in agriculture that can be used more profitably in other sectors. The oversupply of agricultural commodities leads to lower prices and increased competition for producers in other countries and can create the need for export subsidies to dispose of excess domestic production. Consumers are harmed not just by trade barriers, which directly raise the cost of imports, but also by the effects of tariffs and subsidies, which lead to inefficiencies in their economy. When their country produces less than its potential, consumers' incomes and welfare are reduced.

The first objective of this report is to analyze and quantify the global costs of current trade and domestic policy distortions and the potential benefits from their full elimination. While the URAA mandate is to continue a process of reform, this report's hypothetical analysis of the full elimination of agricultural policy distortions helps us to understand what is at stake in global agricultural negotiations. We decompose the global costs and benefits of a full reform by country, commodity, and type of policy. We take into account both the direct effects of tariffs and subsidies in distorting production and consumption decisions, and the long-term effects of these policies on savings and investment decisions, and in slowing development and productivity growth, particularly in developing countries. We base our analysis on current levels of agricultural tariffs, tariff rate quotas (TRQ), domestic support, and export subsidies.[1] In particular, the analysis takes into account that many countries have recently adopted less distorting forms of farm support, and that differences exist in the effects of coupled and decoupled farm subsidies on production and trade.

As mandated in the URAA, the goal of further negotiations will be to continue the process of agricultural policy reform begun in the Uruguay Round. Defining a path toward partial reform can be more complicated than considering the full elimination of tariffs and subsidies. Partial reform requires making an informed choice among potential targets or strategies, and the alternatives are likely to imply different distributions of costs and benefits. Also, some domestic farm subsidies are operationally linked with trade policies, and

[1]Analyses summarized in this report use common agricultural policy data from 1998. See appendices 1 and 2 for data on agricultural policies.

Table 1—Main provisions of the Uruguay Round Agreement on Agriculture

Negotiated reduction	Implementation period	
	Developed countries (1995-2000)	Developing countries (1995-2004)
Market access	*Percent*	*Percent*
Average tariff cuts for all ag. products	-36	-24
Minimum tariff cuts per product	-15	-10
Domestic support		
Total cuts in aggregate measurement of support	-20	-13
Export subsidies		
Value cut	-36	-24
Volume cut	-21	-14

Least developed countries were required to bind their tariffs but are otherwise exempt from reduction commitments.
Source: WTO secretariat at www.wto.org

Table 2—WTO negotiations on agriculture: Process and objectives

Venue	Special sessions of WTO Committee on Agriculture, Geneva, Switzerland
Objectives	Continue the process of reform begun in Uruguay Round, taking into account the experience with URAA reductions, the effects of the URAA on world agricultural trade, nontrade issues such as environmental protection and food security, special and differential treatment of developing countries, and other concerns
Scheduled meetings	Meetings for Phase I are March, June, September, November 2000, February, March, June, September, and November 2001
Country proposals	To be submitted to the WTO by December 2000 (with some flexibility through March 2001). Proposals are available to the public at www.wto.org

Source: WTO Secretariat at www.wto.org

reforms of one policy can affect the costs and benefits of remaining policies. For example, market price support programs that attempt to support a domestic price level for commodities at above the world price can only be effective if there are insulating trade policies in place. Imports must be prevented from entering the high-priced market and export subsidies may be needed to help dispose of high-cost domestic production on world markets. Otherwise, the country will likely need to embark on costly stock holding programs to support prices. Reforming trade policies alone removes an important instrument of domestic support and implies that some domestic programs are likely to be effectively restrained by trade policy reforms. Understanding and quantifying these interrelationships whenever possible can help to clarify the choices to be made among options for policy reform.

The second objective of this report is to analyze alternative policy reform options that are defined as broad or generic, rather than specific options as proposed by WTO member countries. Our analysis of options for policy reform is organized to address these questions:

- What are the potential effects on U.S. and world agriculture of alternative approaches to improving market access, including options for making tariffs lower and more uniform, and for liberalizing tariff rate quotas?
- What are the potential effects on U.S. and world agriculture of alternative approaches to reducing distorting farm support, including options for making domestic support lower and more uniform, and for reducing domestic support through changes in border measures?
- What are the potential effects on U.S. and world agriculture of eliminating or reducing export subsidies?
- What are the potential effects of further agricultural policy reforms on less developed countries, particularly the least developed?

Provisions of the Uruguay Round Agreement on Agriculture: First Steps in the Reform Process

The URAA provided for disciplines, or global trade rules, governing three areas of national agricultural policies. These areas, sometimes called the three pillars of the Agreement, are market access (tariffs, quotas, and other trade barriers), domestic support, and export subsidies.

The URAA objectives in market access reform sought to reduce barriers to agricultural trade and to make them more transparent. Members committed themselves to convert most nontariff barriers, such as import quotas, to simple tariffs or to a two-stage tariff system called tariff rate quotas. TRQs allow imports at a relatively low tariff within a level, or quota, that was to be expanded over the implementation period. Over-quota tariffs and simple agricultural tariffs are to be reduced over the Agreement's implementation period of 1995-2000 for developed countries and 1995-2004 for developing countries.

The URAA provided for a 20-percent reduction of countries' aggregate levels of distorting domestic support during the implementation period. The Agreement defined an aggregate subsidy measure, the Aggregate Measurement of Support (AMS), as a means to quantify and compare countries' annual levels of domestic support that are subject to URAA disciplines. Reduction commitments during the URAA implementation period were made from a base AMS, defined for each country as the average of its total support for all commodities from 1986 to 1988. The URAA also differentiated domestic support policies according to their effects on production and trade (table 3). "Amber box" policies that directly subsidize production and influence the decision to produce were included in the calculation of the AMS and made subject to reductions. "Green box" policies, or domestic farm programs that meet certain criteria for causing minimal trade distortions, were exempted from any expenditure limits. The URAA made an exception for "blue box" policies, or distorting farm subsidies that are linked with supply limitations. The Agreement allowed these subsidies because the supply limits partially offset the subsidies' incentives to over-produce and disrupt global trade.

The URAA disciplined export subsidies by placing both the value and the volume of subsidized exports under limits that are scheduled to decline through the implementation period.

Other provisions of the URAA addressed the concerns of developing countries, and included "special and differential" treatment in addition to longer implementation periods. The URAA granted exemptions to their domestic support policies because of the subsidies' roles in supporting agricultural and rural development. The least developed countries received exemptions from any reduction commitments.

Table 3—Treatment of domestic agricultural support in the Uruguay Round Agreement on Agriculture

Category	General criteria	Examples of policies
Exempt support (green box)	Measures must be financed by the government rather than consumers and must not provide price support to producers Specific criteria are defined for general government services, public stockholding, domestic food aid, direct payments, and other programs	Green box programs include direct payments to farmers that do not depend on current production decisions or prices, disaster assistance, and government programs on research, extension, and pest and disease control
Exempt direct payments (blue box)	Direct payments under production-limiting programs must be based on fixed area or yields, and cover 85 percent or less of the base level of production or head of livestock	Blue box policies are direct payments to producers, linked to production of specific crops, but which impose offsetting limits on output
Nonexempt support (amber box)	Market price support, nonexempt direct payments and any other subsidies not specifically exempted are subject to reduction commitments	Amber box policies include market price supports, and output and input subsidies

Source: Uruguay Round Agreement on Agriculture, WTO.

The URAA set up a Committee on Agriculture to monitor implementation of the Agreement as well as the possible negative effects of the reform program on the least developed and food-importing countries. The Committee is now conducting agricultural policy reform negotiations in special sessions under the URAA's "built in" agenda. The negotiations take into account the experience during the URAA implementation period, the effects of the reduction commitments on world agriculture, nontrade concerns, special and differential treatment for developing countries, and the shared commitment to establish a fair and market-oriented agricultural trading system.

The URAA Reforms Prove Fragile

The experience to date from the URAA implementation period shows that agricultural policy reform is difficult to achieve:

- *Trade barriers remain high.* In the URAA, countries agreed to reduce their average agricultural tariffs, but the rates remain high. The global, unweighted average bound rate for agricultural commodities is 62 percent; the average bound rate of industrial countries is 45 percent. (The bound rate is the upper limit on tariffs allowed by the URAA.) Also, tariffs among countries and across commodities exhibit substantial disparities. Disparities across commodities, for example, tariffs that escalate from bulk to processed agricultural products, can increase the distorting effects of tariffs. TRQs have replaced many nontrade barriers, but some TRQs have complicated import regimes, often with procedures that are not transparent, and many have very high over-quota tariffs.
- *Domestic support recently increased.* Although domestic support levels declined early in the implementation period, and some countries shifted part of their domestic support into less distorting programs that are exempt from global trade disciplines, domestic support has recently increased in some countries in response to low world prices since 1998. Even though the URAA placed limits on total, nonexempt domestic support expenditures, there continues to be a disparity in support levels among countries and across commodities.
- *Unused export subsidy credits now brought forward.* The URAA placed constraining limits on export subsidies for individual commodities, but allowed for some flexibility. Lower usage levels early in the URAA implementation period, when prices were high, enabled some members to bring forward unused levels and apply the subsidies when prices were low and ceilings had been reached.

The Costs of Agricultural Policy Distortions

Global agricultural policy distortions impose substantial costs on the world economy. Agricultural tariffs, domestic support, and export subsidies leave world agricultural prices about 12 percent below levels otherwise expected. Over the long term (about 15 years), these distorting farm policies will reduce world welfare, or consumer purchasing power, by $56 billion annually, which represents about 0.2 percent of global GDP (table 4).

As measured by world price effects, a small number of countries cause most of the agricultural market distortions — developed economies account for nearly 80 percent of the distortions. The EU accounts for 38 percent of world price distortions, compared to Japan plus Korea (12), the United States (16), and Canada (2) (table 5). Countries typically use different mixes of policies. The EU accounts for over 90 percent of global export subsidy expenditures; these subsidies are an integral part of its domestic price support system. The EU and the United States account for most of the global distortions related to domestic producer support. Most other countries rely mainly on tariffs to support their farm sectors. Particularly in developing countries, tariffs are a more practical farm support policy because they raise government revenue, while domestic programs entail government expenditure. Tariffs are a potentially more distorting type of farm support than domestic producer subsidies, because they directly affect consumers as well as producers.

What is "welfare"?

Welfare is an aggregate indicator for the world and for individual countries. Trade policy reforms allow resources to shift into the production of commodities in which the country holds a comparative advantage, and allow consumption to shift toward goods desired by consumers. Increased production efficiency leads to higher incomes, lower prices, and increased purchasing power. Consumption changes reflect a better match of the availability of products with consumer preferences. Despite higher world prices for food, most consumers will still benefit because consumer prices will fall in countries where the removal of tariffs more than offsets the change in world prices. The measure of welfare is "equivalent variation," a measure of the dollar equivalent of an effective change in national income, or purchasing power, due to the policy reform.

Table 4—Welfare impacts from elimination of global agricultural tariffs and subsidies

	Static	Static plus dynamic	
	Resource allocation gains	Investment growth gains	Investment growth plus productivity gains
		US$ billion	
World	**31.1**	**36.3**	**56.4**
Developed country group	**28.5**	**29.7**	**35.1**
Australia and New Zealand	1.6	3.4	3.5
Canada	0.8	1.2	1.4
EFTA	1.7	0.1	0.2
European Union	9.3	8.2	10.6
Japan and Korea	8.6	5.1	6.2
United States	6.6	11.8	13.3
Emerging and developing country group	**2.6**	**6.5**	**21.3**
China	0.4	1.8	2.23
Latin America	3.7	4.7	6.1
Mexico	-0.2	0.1	1.6
Other Asian countries	1.5	0.3	5.11
Southern African countries	0.3	0.5	0.8
Rest of world	-3.1	-0.4	5.4

Static gains refer to the annual gains due to removing distortions to production and consumption decisions in 1997 $US billion. Dynamic gains include effects related to cumulative increases in savings, investment, and productivity over a 15-year post-reform period. Dynamic welfare impacts are the annual level about 15 years after reform. China is not assumed to reform its policies because it is not a WTO member.
Source: Diao, Somwaru, and Roe in this report.

Table 5—Effects on world agricultural prices of eliminating agricultural policy distortions, by country and policy

	World	U.S.	EU	Japan/Korea	LDCs
Elimination of:			*Percent change from base price*		
All policies	11.6	1.8	4.4	1.5	2.3
Tariffs	6.0	0.7	1.5	1.4	2.3
Domestic support	3.6	0.9	2.0	0.2	Na
Export subsidies	1.5	0.1	0.9	Na	0.0

Na = not applicable, no policy in use. Numbers do not sum to row and column totals because only selected countries are included and there are interaction effects among policies.
Source: Diao, Somwaru, and Roe in this report.

The Benefits from Eliminating Agricultural Policy Distortions

There are two dimensions in calculating the potential welfare gains following policy reform: static gains and dynamic gains. The first is related to removing distortions in consumption and production decisions. "Static" gains accrue after producers and consumers fully adjust to price changes when tariffs and subsidies are removed. These static welfare gains accrue over time and reflect changes in income (wages, land rents and returns on capital investments) due to increased economic efficiency. These static gains in welfare, or purchasing power, are worth about $31 billion to the world economy. Most of the static gains from trade liberalization accrue to countries with the largest initial policy distortions. Developed countries receive most of the global, static welfare gains from full policy reform ($28.5 billion), compared to the potential welfare gains for emerging and developing countries of about $2.6 billion. Despite higher world food prices, consumers in most countries would still benefit from the reforms because tariff elimination lowers the consumer price of imported foods, and the policy reforms produce overall economic efficiency gains in their economies. Some food-importing countries face static welfare losses from full trade liberalization because they do not have large initial policy distortions and they must pay higher world food prices.

Additional global benefits from full policy reform will come from the "dynamic," long-term effects from increased savings and investment as policy distortions are removed, and from the opportunities for increased productivity that are linked to more open economies. When these potential dynamic gains are taken into account, all countries can benefit from global policy reforms. Reforms lead to higher investments by increasing the potential returns. Higher investment increases the productive capacity of economies. The greater openness of economies can lead to higher productivity, especially in developing countries where there is substantial potential for productivity gains from increased training and the technological change that is embodied in investment goods imported from developed countries. Reflecting their greater dynamic potential for growth, developing countries stand to attract increased global investment, which will benefit developing countries by increasing their resource availability and benefit developed countries by creating investment opportunities. Investment growth and productivity gains due to agricultural policy reform account for 45 percent of the total benefits from full trade liberalization.

Whereas developed countries will accrue most of the static gains, emerging and developing countries will accrue most of the potential dynamic gains from full trade liberalization. Developing countries, even food-importing ones, can expect to benefit if the negotiations eliminate global policy distortions. But, it is developing countries' own, full participation in global reforms, especially the reduction of their own barriers to imports, that is their most important source of potential benefits from global agricultural negotiations. In the long term, developing countries' welfare could increase by $21 billion annually — nearly 40 percent of the potential world welfare gain from agricultural policy reform.

Nearly one-quarter of the global welfare benefits ($13.3 billion annually) would accrue to the United States. Because U.S. tariffs, domestic support, and export subsidies are relatively low, most of the benefits for the United States come from our trade partners' policy reforms. Although dynamic gains will not directly create many benefits for the United States, mainly because of its technological maturity, U.S. agriculture will benefit substantially from the dynamic gains in developing countries. These countries are important U.S. export markets whose demand for U.S. farm products will increase further if their economies realize their growth potential. In the long run, full poli-

cy reform could lead to an increase in the real value of U.S. agricultural exports of 19 percent each year, an increase in agricultural imports of 9 percent, and higher world prices for U.S. exports.

Tariffs Are the Most Distorting Policy, Compared to Domestic Support and Export Subsidies

The full elimination of agricultural tariffs, domestic subsidies, and export subsidies would increase world agricultural prices 12 percent above their expected level (table 5). Eliminating tariffs, which distort both consumers' choice and producers' decisions, would account for most (52 percent) of the potential price increase. Eliminating the agricultural tariffs of the EU alone accounts for 25 percent of the tariff-induced price effects. Agricultural tariffs in Japan plus Korea, and in the United States, account for 23 percent and 12 percent, respectively, of the tariff-linked price distortions. Tariffs in developing countries account for 38 percent of the tariff-linked effects on world agricultural prices.

The relatively large role of tariffs in global policy distortions should be interpreted in terms of tariffs' links with domestic support. Tariffs are a trade policy that provides a margin of protection to domestic producers. By restricting imports, tariffs are also an instrument of domestic support. Tariffs can help to support domestic prices at above world price levels without the need for government outlays on price support payments or stock building. Most countries' domestic price support programs have a greater reliance on tariffs, which increase government revenues, than on domestic subsidy expenditures, such as deficiency payments, which must be financed through government budgetary outlays. The AMS accounts for this link by including the effects of trade policies (measured as a price gap between an administered support price and the fixed world reference price) in the calculation of domestic support. Removing tariffs alone can therefore accomplish both trade liberalization as well as a reduction in the value of domestic support.

This analysis of domestic *subsidies* includes only budgetary outlays on output and input subsidies and farm payments. This is a more narrow measure of domestic *support* than the AMS, which also includes the effects of some trade policies. But to include the market price

Effects of assumptions about decoupling on the analysis

Since the Uruguay Round concluded, some countries have adopted less distorting farm programs that meet the criteria in Annex 2 of the URAA for being exempted from WTO disciplines. The U.S. Production Flexibility Contract (PFC) payments provided under the 1996 Fair Act are an example of exempt payments to farm households. These whole-farm payments are not linked to production of specific crops and so do not create inter-crop distortions. Farmers make their crop mix decisions in response to market price signals. But as experience with these programs grows, the extent to which farm household transfer payments may affect aggregate, total farm production has become the subject of debate. Tielu and Roberts (1998) describe several ways in which payments that are "decoupled" — meaning that they do not directly depend on or influence farmers' production decisions — may still stimulate aggregate production: Payments may lead to increased farm investment by increasing wealth and lowering risk. Payments can reduce farm exit by raising land values, and may encourage continued output by creating expectations of future payments. There is limited empirical research suggesting that the aggregate output effects linked to the effects of payments on investment and risk are likely to be small (Young and Westcott, 2000; Burfisher, Robinson, and Thierfelder, 2000). In this report, we assume that transfer payments to farm households have minimal output effects. We only account for the indirect effects that these payments may have on farm output through their effects on raising household income and aggregate demand for all commodities, including food. To see how important this assumption is, we analyze the effects on the aggregate world agricultural price due to the removal of all domestic subsidy expenditures by developed countries. We compare the effects when using our assumption that transfer payments have minimal output effects, with the extreme assumption that these payments are fully coupled output subsidies. They are assumed to directly stimulate increased output by increasing the returns to commodities, with our commodity allocation of whole farm payments based on their commodity-linked allocation in the OECD PSE database. We find that the assumption about coupling has small effects on the results of our analysis. The world agricultural price index from a full domestic subsidy removal by developed countries would increase 4.8 percent if the transfer payments are considered to be fully coupled, compared to an increase of 3.6 percent if they are minimally coupled. The small difference in effects due to extreme assumptions about the degree of coupling of household payments suggests that the potential benefits from reducing these kinds of programs may be quite small.

support component of the AMS would be to double-count the effects of tariffs and export subsidies. Domestic subsidies have a smaller role than tariffs in causing distortions from agricultural policies, accounting for 31 percent of the total agricultural price impacts of the three policies. One reason is because domestic production subsidies are less distorting than tariffs. They distort only the production decision and have only indirect effects on consumers. Also, there has been a shift in the way that some countries provide domestic subsidies to farmers. The provision of subsidies to farmers through output or input subsidies has declined, while the use of less distorting, green box policies such as direct transfer payments to farmers has increased. Transfer payments to farm households have smaller effects on farm output than production or input subsidies. Furthermore, we analyze the elimination of domestic subsidies in member countries of the OECD only, because data on domestic subsidies in other countries are not available. This does not bias the analysis very much, since the use of domestic subsidies in non-OECD countries is limited.

The EU has a relatively high level of distorting domestic agricultural subsidies. This characteristic, plus the EU's importance in world markets, accounts for its large role (56 percent) in causing the world price distortions due to domestic subsidies.[2] U.S. domestic programs account for 25 percent of the global price distortions caused by domestic subsidies.

[2]EU compensatory farm payments are linked to set-aside requirements. These requirements are represented in the model by increasing the agricultural land area by 10 percent when these blue box programs are removed. EU dairy subsidies are included in this global analysis, but excluded in the country study of EU export subsidy elimination described later in this report.

Export subsidies account for a relatively small share (13 percent) of the total price distortions caused by agricultural tariffs and subsidies. Most of the world price effects from eliminating export subsidies are due to EU liberalization, reflecting that the EU accounts for most of world export subsidy expenditures.

Despite their relatively small aggregate price effects, export subsidies play an important role in the reform process. Tariffs and domestic support policies of many countries contribute to distorted global markets. The global effects of export subsidies, however, are mostly attributable to a single region, the EU. Export subsidies significantly affect trade in some markets, create increased competition that strains trade relationships, and are an integral part of related domestic price support programs.

The separate roles of tariffs, domestic subsidies, and export subsidies in distorting world prices add up to less than 100 percent of the total price distortion of all policies; the simultaneous removal of all three policy types additionally takes into account their interactions.

Commodity Impacts of Full Agricultural Policy Reform

The aggregate agricultural price impact (12 percent) can be broken down by commodity and by policy type (table 6). The largest increases in world price, above trend levels, will occur in livestock and products (including dairy products), wheat, sugar, and other grains. Elimination of tariffs alone will have the greatest effect on livestock and sugar prices, while the elimination of domestic subsidies will affect mainly wheat and other grains. Export subsidies have depressed global prices mainly for sugar, livestock and products (including dairy products), fruits and vegetables, and wheat.

Table 6—Effects on world agricultural prices of eliminating all agricultural policy distortions, by commodity and policy

Commodity	Full policy elimination	Global tariff removal	OECD domestic subsidy removal	Global export subsidy removal
		Percent change from base		
Wheat	18.1	3.4	12.0	2.0
Rice	10.1	5.9	2.4	1.5
Other grains	15.2	1.4	12.2	0.6
Vegetables and fruits	8.2	4.9	-0.1	3.0
Oil and oilseeds	11.2	3.1	7.8	0.1
Sugar	16.4	10.9	1.6	3.3
Other crops	5.6	4.2	1.2	0.1
Livestock and products	22.3	12.2	5.5	3.1
Processed foods	7.6	4.8	1.8	1.0

Source: Diao, Somwaru, and Roe in this report.

Options for Market Access Reforms

There are no unambiguous rules for undertaking a process of reform. Planning reform requires making an informed choice among potential targets or strategies, and each option is likely to imply different distributions of costs and benefits. And, because trade and domestic policies are operationally linked, independent reforms of one pillar can be expected to have an effect on the costs and benefits of the others. WTO member countries have proposed numerous options for achieving further agricultural policy reform. Rather than analyze specific country proposals, we analyze generic options for achieving further, partial reforms of market access, domestic support, and export subsidies. Our framework takes into account the current structure of agricultural policies, differences in policies' effects on production and trade, and the interdependence of their operation and reform.

Options for Liberalizing Tariffs

In the Uruguay Round, members agreed to "bind" their tariffs, meaning that they would not raise their tariffs above a certain fixed, or bound, level subject to negotiating compensation to other countries. The bound rates became the base rates from which reduction commitments were calculated. Industrial countries bound most tariffs (including the over-quota tariffs of TRQ regimes) at the 1986-88 average levels of tariffs actually applied to imports, or "applied" tariffs. Many developing countries set their bound rates at levels well above their applied rates, creating "water" in their tariffs, a buffer zone that may allow the countries to raise their tariffs while remaining within their tariff reduction commitments. In the URAA, countries committed to reduce their simple (unweighted), bound average tariff by 36 percent (24 percent for developing countries), with a minimum cut of 15 percent (10 percent for developing countries) for each individual tariff line.

The URAA approach to agricultural tariff reduction kept in place two characteristics that describe the current profiles of global agricultural tariffs: differences among countries in their average agricultural tariff; and variation, or dispersion, in tariff rates across commodities within countries' tariff schedules. Dispersion of tariff rates, such as the escalation of tariffs with the degree of product processing, can lead to greater distorting effects than uniform tariff rates. Tariff escalation can result in a product's effective tariff protection exceeding its nominal tariff rate if tariffs on the imported intermediate goods used in its production are relatively low. Imposing higher tariffs on processed goods also impedes trade in high value products, the fastest growing segment of world agricultural trade, which tends to be highly sensitive to price. The occasional very high tariff, or "megatariff," which is sometimes called a tariff peak, also brings to light another

Modeling the impacts of policy reform on global agriculture

Four different models were used to develop the quantitative analyses of the potential effects of the agricultural negotiations: a dynamic, global computable general equilibrium (CGE) model, a static global CGE model, the European Simulation (ESIM) models, and the Food Aid Needs Assessment (FANA) model. Key features of these models are:

Base year. For the CGE models, the base year is 1997, for ESIM it is 1997/98, and for the FANA model it is the average of 1997-99. The base year is a "representative" year. The models describe how this representative year would change, either in a single long run end-point or annually, due to a controlled experiment in which specific policy reforms occur. The models are not projection models and do not capture the many other forces that are likely to determine what may actually occur in the economies in the long run.

Agricultural policies. The models use common agricultural policy data for 1998, the latest year for which a comprehensive policy database is available. Export subsidy data are from WTO notifications by member countries. Tariff data are from the Agricultural Market Access Database (www.amad.org). We developed a database on domestic support in OECD member countries that is consistent with the concept of the AMS. We include the amber box, domestic expenditure component from the 1998 OECD PSE database; and tariffs and export subsidies for commodities for which administered price support programs were notified to the WTO.

Economic behavior. The models incorporate assumptions about supply and demand responses to price changes in order to represent real world behavior and model results can vary depending on the chosen parameters.

dispersion-related issue. Tariff peaks create large relative price distortions within a country.

The average (simple, unweighted) post-Uruguay Round agricultural tariff rate for industrial countries is bound at 45 percent (fig. 1).[3] These bound tariff rates include the ad valorem equivalents of specific tariffs, which are in some cases very high, and whose values depend on current prices. They also include the over-quota tariffs in TRQ regimes. By including the over-quota tariff, the average bound rate may overstate actual rates of protection. Imports that enter a country within the quota limits are usually subject to a much lower tariff rate, and in some cases, over-quota tariff rates are not actually applied to imports. On the other hand, a country can levy additional fees and taxes on imports, which can lead to bound tariffs providing an underestimate of actual import costs.

The average U.S. agricultural tariff of 11.9 percent is relatively low in comparison with the average agricultural tariffs of the EU (21 percent), Canada (24 percent), Japan (33 percent), and Norway (152 percent).

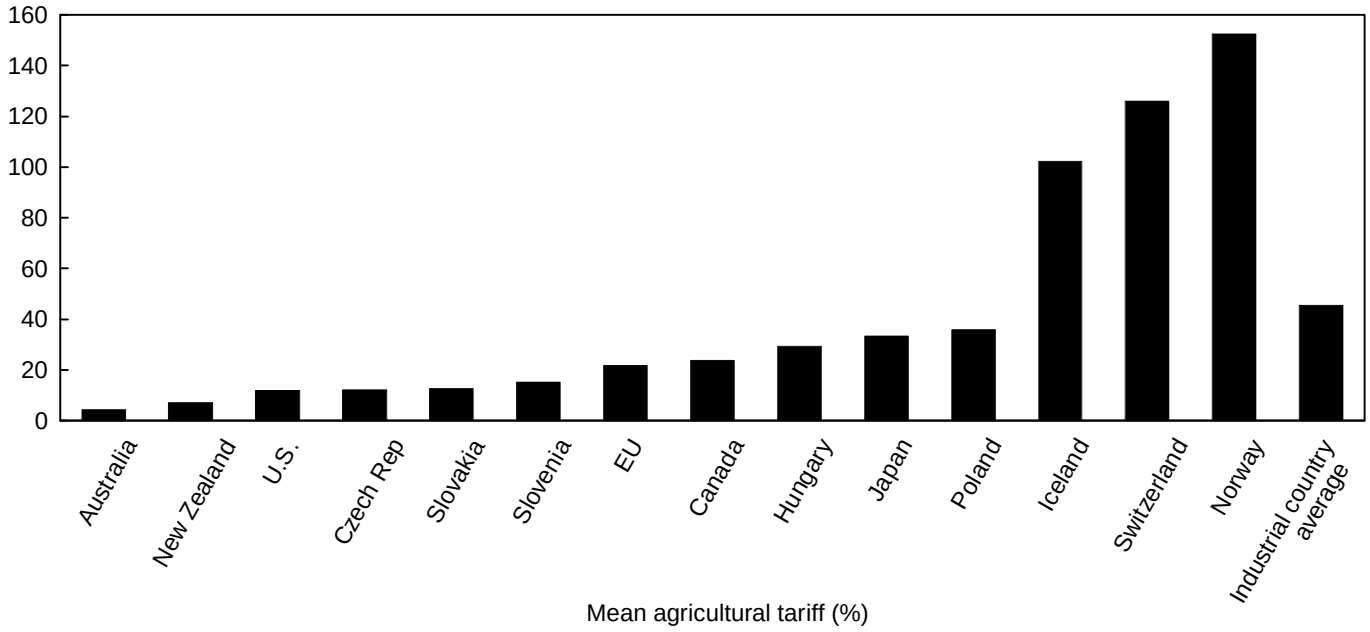
One way to measure and compare tariff dispersion is to analyze the frequency with which countries' tariff lines fall within specified ranges of tariff rates. Figure 2 shows a frequency distribution of selected countries. All of the industrial countries in this analysis have tariff schedules characterized by a relatively large number of low tariffs and a small number of very high tariffs. The United States differs from other industrial countries in that over 50 percent of its tariffs are extremely low, at 5 percent or less, while only a very small share are extremely high, at over 100 percent. All other industrial countries have a much larger proportion of tariffs over 5 percent. For the industrial countries as a whole, nearly 50 percent of tariffs are above 25 percent.

Historically, trade negotiations have taken two broad approaches to tariff reform: formula and sectoral approaches. The formula approach defines some general rule that applies to all tariffs, for example, "reduce all tariffs by 10 percent." Sectoral approaches have been conducted as either bilateral or multilateral negotiations. One bilateral approach is the request-offer

[3]This analysis of reduction formulas focuses on industrial countries only. For more information on world tariffs, see *Profiles of Tariffs in Global Agricultural Markets.* Gibson et al. (2001).

Figure 1

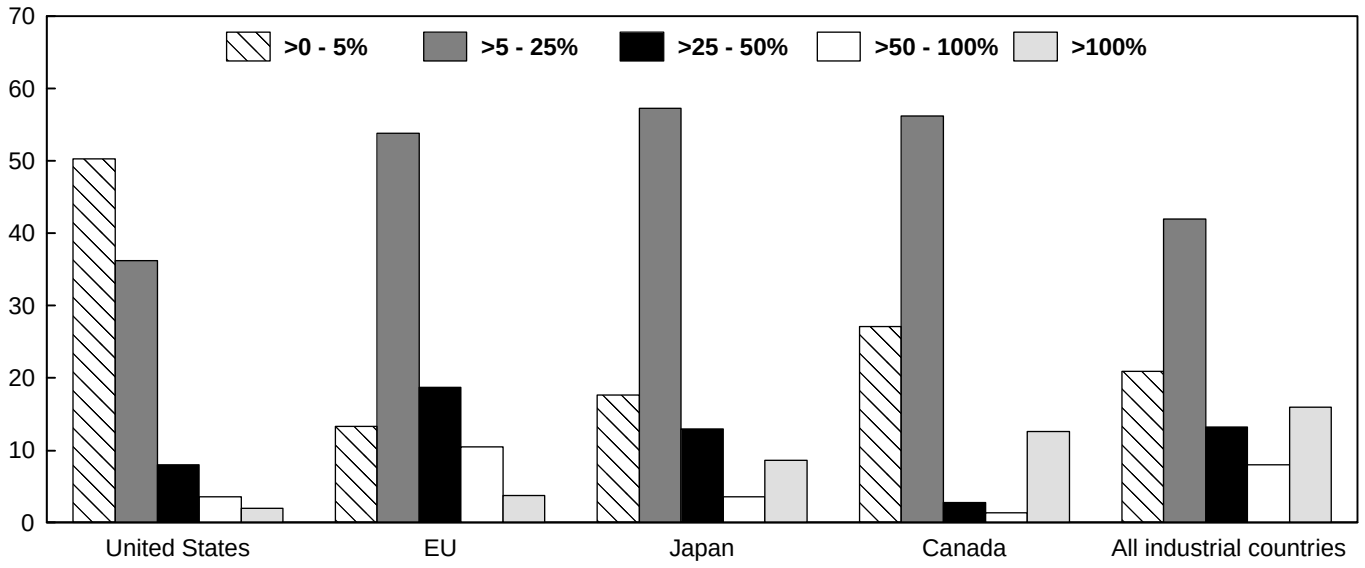
Post-Uruguay Round average agricultural tariffs of selected industrial countries



Source: Wainio, Gibson, and Whitley in this report.

Figure 2

Frequency distributions of agricultural tariffs—selected countries



Source: Wainio, Gibson, and Whitley in this report.

system in which countries draw up lists of the tariffs they want other countries to reduce and the tariffs they are willing to reduce in exchange. An alternative approach is to attempt to solve sectoral problems for a commodity or commodity group on a multilateral basis. A "zero-for-zero" agreement, in which all countries agree on a zero tariff on specific commodities, is an example of a successful multilateral approach. During the Uruguay Round, a zero-for-zero agreement was reached for beer. (A "super zero-for-zero" would address reforms of all three pillars in a sector.) Sectoral approaches can be more effective than formula approaches in achieving greater market access for specific commodities. On the other hand, sectoral approaches can leave protection in place for the least competitive industries, they can create cross-commodity distortions, and they may be unable to achieve deep enough cuts in the very high tariffs that abound in industrial countries' tariff schedules.

While a formula approach has some distinct advantages, it can produce very different outcomes depending on the type of formula that is adopted. There are two generic types of formulas for targeting the level and the dispersion of tariffs: linear reductions and harmonization. A linear reduction formula reduces the average tariff rate by reducing all tariffs proportionately (the dispersion of the tariff would also decline by the same proportion). For example, a country with a uniform tariff (it has zero tariff dispersion) undergoing a linear reduction of 10 percent would reduce its average tariff by 10 percent. Its tariff dispersion would remain unaffected, however, because its tariffs are already uniform. In contrast, harmonization formulas target tariff dispersion. Conceivably, a harmonization formula could require that all countries make all of their tariffs a uniform rate, equal to their average rate. This would leave the average tariff unchanged, but would reduce the dispersion to zero. In practice, many of the tariff reduction formulas proposed in past trade negotiations have included variants that address both tariff levels and tariff dispersion. Many combine some overall reduction of the average rate with harmonization, based on the progressively larger reduction of higher rates, or at least, a requirement that all tariffs be reduced so that the problem of tariff dispersion is not worsened.

What is the most effective formula in terms of achieving greater market access? From a global perspective, a linear formula may be sufficient when tariff dispersion is low. When there is high tariff dispersion, as is the case currently, some harmonization element is needed if the very high tariffs are to be effectively restrained. For individual countries, the effects of tariff reduction formulas will depend on their own tariff profile.

The structure of industrial countries' agricultural tariffs suggests that an effective tariff reduction strategy should address both the mean and the dispersion of tariffs. For illustrative purposes, we show the effects of three tariff reduction formulas on the mean and dispersion of tariffs in the United States, and the average of industrial countries: a linear reduction of 50 percent and two harmonization formulas targeting low tariffs and high tariffs. Table 7 illustrates that harmonization formulas are more effective than a linear approach in lowering the average tariff, because of the many very high tariff lines in the current structure of global tariffs. Formulas that focus on eliminating low, or "nuisance," tariffs have a relatively large effect on the average U.S. tariff, because most U.S. tariffs are low. Formulas such as the Swiss formula, which mandates proportionately larger cuts in high tariffs, have a relatively greater impact on other industrial countries' tariffs than on the United States because most other industrial countries' tariffs have a larger number of higher tariff rates.

Options for Liberalizing Tariff Rate Quotas

The URAA abolished all prior nontariff measures restricting agricultural trade, but allowed members to convert these restrictions into tariff rate quotas. A TRQ is a two-tiered tariff in which the rate charged depends on the volume imported. A limited volume can be imported at the lower tariff — this is the "quota" part of the TRQ — and imports in excess of the quota volume are charged a higher tariff. For most countries, the average in-quota tariff is substantially lower than the over-quota tariff rate. A TRQ, although it contains a quota, is not considered a quantitative restriction because it is always possible to import over the quota. In practice, if the over-quota tariff is set high enough, it effectively deters further imports and so can replicate a quota. An additional provision of the URAA defined a minimum access for commodities previously covered by import restrictions. The URAA set the minimum access, the quantity allowed to be imported at the lower tariff, at 3 percent of consumption in 1986-88 in the base period, to be increased to 5 percent of base consumption by 2000 (2004 for developing countries).

At the end of 1999, notifications to the WTO totaled over 1,300 TRQs (table 8). Of the 137 WTO members, 37 use TRQs. Three countries account for one-third of all TRQs: Norway, Poland, and Iceland together have 431. By comparison, the United States has notified 54 TRQs. Forty-seven percent of notified TRQs are actually administered as a simple tariff, that is, there is no over-quota tariff or effective quota. When the TRQs that behave as tariffs are excluded, the countries with the greatest number of enforced TRQs are the EU, Hungary, South Korea, and the United States.

The quota element of the TRQ creates the opportunity to earn excess profits, or "economic rents." If the quota places an effective limit on the volume of imports, the importer of goods at the within-quota tariff rate can earn an excess profit, or rent, based on the effects of scarcity in driving up the domestic price that consumers are willing to pay. If some over-quota imports can enter and be sold at the above-quota tariff rate,

Table 7—Alternative, tariff reduction: Levels of average tariffs and dispersion

Formula name	Formula	United States		All industrial countries	
		Average	Dispersion	Average	Dispersion
		Percent			
Base	- -	11.9	55.0	45.0	130.0
Linear	50% reduction in all tariffs	6.0	27.5	22.5	65.0
Sliding scale	Eliminate tariffs under 5%, 50% reduction in other tariffs, with a cap of 50% on tariff levels	4.2	8.9	11.3	16.6
Swiss	Progressively larger cuts on high tariffs, with a cap of 45% on tariff levels	5.5	7.4	11.0	12.3

Dispersion is measured as one standard deviation — the average distance of all tariffs from the mean tariff. In the Swiss formula, the reduction parameter is 45.
Source: Wainio, Gibson, and Whitley in this report.

Table 8—Notified and enforced TRQs, by country

Countries ranked by number of notified TRQs			Countries ranked by number of enforced TRQs		
Country	TRQs notified	TRQs enforced	Country	TRQs enforced	TRQs applied as tariff
Norway	232	19	EU	87	0
Poland	109	35	Hungary	68	2
Iceland	90	12	South Korea	63	1
EU	87	87	United States	54	0
Bulgaria	73	45	Bulgaria	45	28
Hungary	70	68	Poland	35	74
Colombia	67	34	Colombia	34	33
South Korea	64	63	South Africa	25	28
Venezuela	61	2	Czech Republic	24	0
United States	54	54	Slovakia	24	0
Subtotal	907	419	Subtotal	459	166
All others	461	307	All others	267	476
Total	1,368	726	Total	726	642

Source: Skully, in this report.

then agents with the right to import goods at the lower, within-quota tariff rate can earn rents because they can compete with higher-cost imports. TRQ administration is the process of rationing these profit opportunities. While the GATT established general rules governing how TRQs should be administered, in practice, there are widely varying interpretations and methods of administration. The most common forms of TRQ administration are "license on demand" and "first-come, first-served" (table 9). Many TRQs are allocated on the basis of historical market shares. In these cases, the importing agent, rather than the exporter, can capture the economic rent. Because TRQs create economic rents, they also make it profitable to import from other than the least-cost suppliers, leading to economic inefficiencies in resource allocation.

There Is No Simple Rule for Reforming TRQs

From a global perspective, there is no single best way to reform TRQs (table 10). One reason is that individual TRQs vary with respect to the component of the TRQ (under-quota tariff, quota, or over-quota tariff) that restricts trade. About one-quarter of TRQs are characterized by a low fill rate, that is imports are less than 20 percent of the quota level. For these TRQs, if the within-quota tariff is the binding constraint, reducing the within-quota tariff is likely to increase market access.

About one-half of TRQs have a high-fill rate, that is, imports are at least 80 percent of the quota level. For these TRQs, and for TRQs with over-quota imports, reducing the in-quota tariff would have little impact, and the effects of increasing the quota levels is uncertain. On one hand, increasing quota levels can have positive effects if it increases imports and reduces the domestic price, or if it results in the entry of more efficient suppliers. It can also result in the within-quota tariff becoming the binding constraint, an effective reform because the TRQ then becomes a simple tariff regime, and the problems of rents and inefficiencies of suppliers are eliminated. On the other hand, it can have negative effects if it increases the opportunities for economic rents and the entry of inefficient suppliers.

About 25 percent of TRQs consistently have imports that exceed quota levels. In many of these over-fill cases, the over-quota tariffs are very high. For these TRQs, the appropriate reform is to reduce the over-quota tariff. Furthermore, reducing the over-quota tariff may always be an appropriate reform, since it is the only policy option on TRQs that either achieves reform, or does no harm. Alternatively, the reform of over-quota tariffs can be approached through disciplines on tariffs in general, since the over-quota tariff is the same as the bound tariff that was made subject to tariff reduction commitments in the URAA.

Table 9—Methods of allocating right to import within quota

Method of TRQ administration	Explanation	Percent of all TRQs
Applied tariff	Unlimited imports are allowed at the in-quota tariff rate: that is, the quota is not enforced.	47
License on demand	Licenses are required to import at the in-quota tariff. If demand for licenses is less than quota, Q, the system operates like a first come, first served system. If demand exceeds Q, import volume requested is reduced proportionately among all applicants.	25
First come, first served	The first Q units of imports to clear customs are charged the in-quota tariff; all subsequent imports are charged the over-quota tariff.	11
Historical	Right to import at in-quota tariff is allocated in proportion to import market shares in a base period.	5
Auction	Right to import at in-quota tariff is auctioned.	4
State trader or producer group	Right to import in-quota is granted wholly or primarily to a state trading organization or an organization representing domestic producers of the controlled product.	2
Mixed	Describes a combination of two or more of the six methods above.	4
Other, or not specified	Includes methods that do not correspond to any of the seven methods above and are not specified in WTO notifications.	2

Source: Skully, in this report.

Table 10—Impacts of TRQ reforms on market access and quota rents

	Binding constraint in TRQ		
Policy reform	Within-quota tariff	Quota	Over-quota tariff
Lower within-quota tariff	+	-	-
Increase quota	0	?	-
Lower over-quota tariff	0	0	+

(+) denotes policy reform increases market access and/or reduces economic rents. (-) indicates the opposite impacts. (0) denotes no effect.
Source: Skully, in this report.

Fully eliminating one of the components of the TRQ (either reducing within or over-quota tariff to zero, or leaving the quota level open) is an alternative to reforming one or more components. An infinite expansion of the quota would eliminate the quota problem embedded in TRQs. If the quota is increased enough, the TRQ would then become a simple tariff regime, and the problems of rents and inefficiencies of suppliers would be eliminated. If the over-quota tariff is eliminated, the TRQ would become a free trade system, since importers of duty-free goods would be unlikely to choose to import within the quota system. If licensing is still required, removing the over-quota tariff would make the problems linked to the opportunity to import under an administered quota system more apparent. Eliminating the within-quota tariff may worsen the distortions of the TRQ if it increases quota rents and (without auctions) the potential for less efficient suppliers to enter the market.

The conditions imposed by tariff administration may act as the binding constraint on trade, in which case the administrative rules should be the target of reform. From a purely economic perspective, the most effective direction for reform of TRQ administration is auctions. Auctions in effect transform a TRQ system back into a simple tariff system. Auctions absorb all quota rents into the equivalent of government tariff revenue and rely on markets to allocate the rights to import or export. Auctions, however, are used for only 4 percent of TRQs, probably because governments would prefer to simply apply tariffs. Despite the inefficiencies of other types of TRQ administration, TRQs persist for many reasons, including their linkages to domestic farm support objectives and the underlying political economy of rent-seeking behavior. Market access could be enhanced if existing WTO disciplines on TRQ administration and import licensing were clarified and better enforced.

Options for Reforming Domestic Support

The URAA made an important distinction between domestic agricultural support that significantly distorts production and trade (amber box subsidies), and those subsidies that were agreed to have minimal or no distorting impacts (green box subsidies). Only amber box subsidies were made subject to reduction commitments. (Blue box subsidies were also exempted from reduction commitments because they are linked with offsetting production limits.) Reduction commitments during the URAA implementation period were made from a base AMS, defined for each country as the average of its total amber box support for all commodities during 1986-88.

In 1998 (the base year for this analysis), OECD countries provided levels of amber box domestic support below their ceilings (table 11). Some countries, including the United States and Mexico, achieved these levels by shifting some of their domestic support programs into less trade-distorting programs that satisfied the criteria for being exempt from URAA commitments. Higher world prices during the early implementation period also provided more or less automatic reductions in support levels, making it easier for countries to meet their WTO ceiling commitments.

The URAA left in place an uneven playing field of domestic support across countries and commodities. Those countries with relatively high support levels in the base period continue to have AMS ceilings that allow relatively high support levels, while countries with no support in the base period face constraints in introducing it. In addition to the disparity among countries in total levels of support, there is dispersion in the level of support provided to commodities. Many countries provide most of their support to a small number of commodities.

In the AMS framework, the measurement of domestic support includes both government subsidy expenditures on agriculture, as well as the value of trade policies (measured as the gap between domestic and fixed international reference prices) for commodities that receive administered or guaranteed price supports. Domestic subsidies include output subsidies and intermediate input subsidies. Output subsidies directly stimulate increased production by increasing the expected returns from the subsidized commodity. Subsidies can also be used to provide price support to the farmer through direct payments that achieve a guaranteed return. By not actually forcing market prices in the current period to be equal to the guaranteed price to farmers, these payments may be somewhat less distorting of consumer demand than when market prices are fixed by the government. Subsidies on intermediate and capital inputs raise output by lowering input costs.

Table 11—Reduction commitments if AMS is lowered an additional 20 percent from Uruguay Round ceiling

	AMS as percent of WTO ceiling in 1998	Cuts in AMS required to reach additional 20-percent reduction in WTO 1986-88 ceiling
Australia	23	0
Canada	9	0
European Union	75	-7
Japan	77	-10
Korea	80	-14
Mexico	7	0
Norway	88	-21
New Zealand	0	0
Poland	8	0
Switzerland	71	-3
United States	45	0

Only OECD countries represented in the CGE model are included in this table.
AMS = Aggregate Measurement of Support.
Source: Young et al., in this report.

The Link Between Trade Policies and Domestic Price Support in the AMS

The calculation of the AMS explicitly accounts for the operational linkage between trade policies and market price support. The AMS captures how these policies actually work: An effective market price support program requires trade policies to restrict imports and may require export subsidies. In the absence of such a program, domestic price support and storage programs would become too costly. If the new negotiations continue within the framework of the URAA, market access (tariffs and other trade barriers) and export subsidies will be addressed separately from domestic support, but reforms of the three policies are linked. Constraints on trade policies alone could either reduce the effectiveness and current subsidy value of market price support programs as domestic prices fall, or lead to a higher current subsidy value if countries respond with larger expenditures on stock building or price subsidies.[4] On the other hand, constraints on a domestic support program would not necessarily lead to a dismantling of trade barriers. Such barriers can be beneficial to the domestic sectors without the need for administered prices, although the administered prices provide an additional layer of short-run protection to producers. Administered prices create a strong incentive for governments to maintain effective trade barriers, and there can also be greater flexibility to lower trade barriers when administered price supports are constrained.

We analyze AMS reductions by proportionally reducing all amber box domestic subsidy expenditures as well as the applied tariffs and export subsidies whenever commodities benefit from administered market price support programs.[5] This approach is consistent with the AMS accounting framework, which incorporates the operational link between trade and price support policies. In effect, this approach implies that constraints on administered price support programs are achieved through lowering trade barriers.

[4]Technically, the calculation of the AMS as defined in the URAA would not change since it uses the gap between the administered price and a fixed base reference price, instead of the current market price, to calculate the effective level of support.

[5]In this report, we quantify domestic subsidies by applying the AMS concept of amber box domestic support to data from the OECD's PSE database. While the AMS and the PSE are both measures of domestic support, the concepts differ. The PSE is a more up-to-date and comprehensive measure of domestic support, but it includes policies exempt from URAA disciplines and has a broader measure of market support than the AMS. Without further manipulation, the PSE database cannot be used to analyze options for AMS reductions in the WTO. See appendix 2 for a more detailed discussion.

Lowering AMS Ceilings Versus Leveling the Playing Field

We analyze two approaches to further reform of domestic support policies. These are alternative, generic approaches to reform rather than specific WTO proposals. Similar to the analysis of tariffs, we analyze and compare the effects of reducing countries' overall levels of domestic support with the effects of reducing the dispersion of domestic support across countries and commodities. The first scenario is a continuation of the Uruguay Round's 20-percent reduction of AMS ceilings on aggregate domestic support from uneven 1986-88 base levels of support (to 40 percent below the base). A further cut in ceilings will affect countries differently, depending on the relationship between their current total AMS expenditures and their current commitment levels (table 11). Many countries would not be affected by a further 20-percent reduction in AMS ceilings, including the United States, Canada, Mexico, Australia, and New Zealand. This scenario also leaves in place a dispersion of support across commodities, since it assumes that all program and commodity benefits are reduced proportionally if their current AMS exceeds the new ceiling.

In the second scenario, we "level the playing field" by requiring countries to limit the level of commodity-specific support to no more than 30 percent of their value of production, which is approximately the same level of aggregate support that the EU would be allowed in the first scenario (table 12). Countries that provide less than the maximum levels of support are assumed not to increase their subsidies. Proportional cuts are assumed for all policies for a commodity if the overall subsidy for a commodity exceeds 30 percent of the value of production. Most countries have commodity programs that would be affected by this approach, including the EU, Japan, United States, Canada, and Mexico. This approach achieves significant liberalization in commodities that tend to be most protected, including sugar and dairy.

Tables 13 and 14 show the effects on U.S. bilateral trade under the two scenarios. A further reduction in AMS ceilings would affect the United States mostly through increased demand for U.S. agricultural products by those countries that would be affected by ceiling reductions. U.S. export growth would be largest in oilseeds, meats, wheat, and coarse grains, with most exports going to the EU and Japanese markets. Total U.S. agricultural exports would increase by $900 mil-

Table 12—Reduction needed to keep commodity-specific AMS less than 30 percent of the value of production

	Total	Wheat	Rice	Coarse grains	Oilseeds	Sugar
			Percent change from 1998 AMS			
Australia	0	0	0	0	0	0
Canada	0	0	0	0	0	0
European Union	0	0	0	0	0	-28
Japan	-19	-65	-64	-56	-17	-51
Korea	0	0	-57	-57	-61	0
Mexico	0	0	0	0	0	-9
Norway	0	-37	0	-31	0	0
New Zealand	0	0	0	0	0	0
Poland	0	0	0	0	0	0
Switzerland	-41	-35	0	-36	-52	-47
United States	0	0	0	0	0	-19

	Dairy products	Beef & sheep	Other meat	Wool	Fruits & vegetables	Miscella-neous
			Percent change from 1998 AMS			
Australia	0	0	0	0	0	0
Canada	-48	0	0	0	0	0
European Union	-44	-15	0	0	-16	0
Iceland	-63	0	-70	0	0	0
Japan	-62	-6	-11	0	0	0
Korea	0	-27	0	0	0	0
Mexico	0	0	0	0	0	0
Norway	-10	0	-20	0	0	0
New Zealand	0	0	0	0	0	0
Poland	0	0	0	0	0	0
Switzerland	-43	-36	-40	0	0	-40
United States	-49	0	0	0	0	0

Source: Young et al., in this report, based on WTO notifications, OECD PSE data, and ERS calculations.

lion, an increase of about 0.2 percent from 1999 exports. U.S. imports would decline by $20 million.

When commodity support is leveled across countries and commodities, the global reform becomes more broad-based, and the effects on U.S. agricultural trade are slightly larger. Assuming a 30-percent ceiling on commodity subsidies (with subsidies below that level assumed not to increase) the largest export gains for the United States will be for beef, rice, and dairy, mainly to Japan, the EU, and Canada. This analysis does not take into account the potential impacts of other policies, such as EU restrictions on hormone-treated beef. Total U.S. agricultural exports under this scenario will increase by $1 billion. Total U.S. imports will increase slightly ($245 million).

Most of the value of domestic farm support is provided through price support programs, and most price support programs are implemented through trade restraints and export subsidies rather than stock holding or payments to farmers. The dependence of domestic support on trade policies has led some to argue for a strategic approach to negotiations: focus on reducing tariffs and export subsidies, and let tighter trade policy rules force reforms on domestic farm programs. Assuming that countries respond to constraints on domestic price support by dismantling related import barriers and export subsidies, the trade policy component of both the AMS scenarios considered here accounts for 83 percent of their global trade effects. This suggests that targeting trade policies alone can implicitly lead to significant reform of domestic support.

Table 13—Changes in U.S. agricultural trade from a 20-percent reduction in URAA AMS ceilings

	Exports								
	Canada	Mexico	EU	EFTA	Japan	Korea	Other countries	Total exports	Total imports
	Change from base in US$ millions								
Rice	0.0	-0.1	6.1	0.1	17.0	0.0	0.7	23.9	-0.2
Wheat	0.1	1.6	55.8	3.1	15.0	1.6	63.2	140.5	-1.1
Coarse grains	1.0	-1.4	87.4	3.2	-6.7	-1.1	53.6	136.0	-13.9
Oilseeds	1.3	8.8	190.1	0.7	9.4	4.1	8.1	222.4	-0.2
Sugar	0.0	0.0	1.0	0.0	0.2	0.0	0.1	1.3	-0.4
Cotton and fiber	0.1	-0.1	0.1	0.0	0.6	0.4	0.7	1.8	0.0
Fruit and vegetables	0.0	-0.8	18.4	2.1	40.2	8.9	-3.8	65.1	7.8
Other crops	-0.8	-0.5	-12.6	0.4	3.6	3.4	-5.6	-12.1	11.3
Beef	2.0	-0.3	52.8	1.0	50.6	9.8	10.2	126.0	-13.4
Other livestock	5.2	0.9	17.0	1.4	37.8	14.3	68.4	145.0	-0.5
Dairy products	1.2	4.1	7.0	1.0	20.7	5.7	10.8	50.5	-0.6
Processed foods	3.1	1.5	16.6	0.0	-27.8	-2.7	12.6	3.3	-7.6
Total	13.3	13.8	439.6	13.0	160.5	44.3	219.0	903.5	-18.7

Source: Young et al., in this report.

Table 14—Changes in U.S. agricultural trade from reducing commodity-specific AMS to no more than 30 percent of the value of production

	Exports								
	Canada	Mexico	EU	EFTA	Japan	Korea	Other countries	Total exports	Total imports
	Change from base in US$ millions								
Rice	-0.3	-0.4	-1.7	0.6	265.4	0.3	-0.9	263.0	1.6
Wheat	0.1	-0.7	-5.7	9.2	87.9	1.4	41.7	134.0	3.7
Coarse grains	1.6	-0.4	-11.0	8.9	-18.5	-0.4	83.0	63.4	-25.4
Oilseeds	-0.1	-1.6	-19.1	4.2	29.7	21.3	7.3	41.6	0.0
Sugar	0.7	0.3	0.4	0.0	1.2	0.0	2.1	4.9	111.3
Fiber	0.4	0.2	1.1	0.1	2.5	1.6	10.0	15.9	-0.1
Fruit and vegetables	0.9	-0.3	75.0	5.0	-14.3	0.1	8.8	75.4	-2.1
Other crops	-0.2	-0.3	-15.4	-0.5	-2.4	-0.4	-1.5	-20.8	3.7
Beef	10.4	3.2	216.2	5.5	-4.4	23.7	31.5	286.2	-39.0
Other livestock	0.6	0.9	-2.0	1.1	9.5	4.9	8.4	23.5	-1.6
Dairy products	58.6	-21.4	40.0	2.2	164.6	-2.6	-44.4	197.0	173.8
Processed foods	-1.3	0.7	-19.0	-0.6	-19.7	-3.9	4.4	-39.5	18.1
Total	71.4	-19.6	259.0	35.9	501.4	45.9	150.5	1,044.5	244.0

Source: Young et al., in this report.

Options for Reducing Export Subsidies

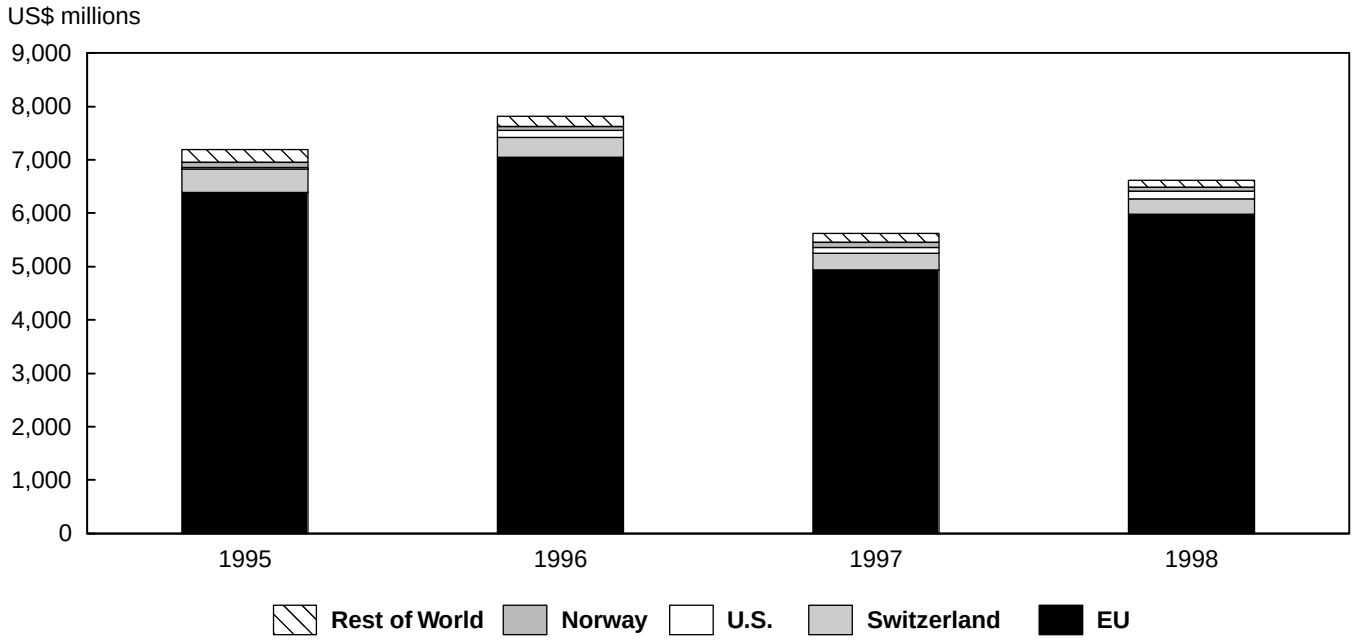
From a global perspective, agricultural export subsidies have smaller impacts than tariffs or domestic subsidies, accounting for 13 percent of world agricultural price distortions due to farm support policies. Export subsidies are nevertheless an important pillar of the reforms. Many countries' tariffs and domestic support policies contribute to distorted global markets; however, the global effects of export subsidies are mostly attributable to a single region, the EU. Export subsidies have significant impacts on trade in some markets and create increased competition that strains trade relationships. And, export subsidy reforms can have significant indirect effects because they help to set the stage for reforms in other areas. Constraints on export subsidies that are used to help dispose of surplus production can create pressures to restructure domestic subsidies in ways that are less distorting of production and trade. In negotiations, export subsidies are directly linked to tariffs because their reduction or elimination may encourage some countries to lower their import barriers.

A detailed analysis of the EU shows that when the links between export subsidies and domestic market price support are accounted for, EU export subsidies have significant effects on world markets and on U.S. production and trade of some commodities. Our analysis focuses on the EU because in 1998 it accounted for over 90 percent of the world's export subsidies (fig. 3). Switzerland accounted for 4.4 percent, the U.S. accounted for 2.2 percent, and all other countries accounted for about 3 percent of global export subsidies. From 1995 to 1998, the EU provided export subsidies on most agricultural exports, including nearly all of its exports of coarse grains, butter and butter oil, beef, and skim milk powder. The commodities included in this analysis are wheat, barley, corn, other coarse grains, oilseeds and their products, beef, pork, and poultry. (Dairy is not included in the model, mainly because dairy quotas in the EU limit any potential change in the sector.) These commodities account for just over 50 percent of EU *expenditures* on export subsidies (not accounting for subsidy expenditures on incorporated/processed products) and roughly 75 percent of the *volume* of subsidized exports.

In our analysis, the EU is assumed to adapt to export subsidy elimination on grains, oilseeds, and livestock by lowering its domestic intervention prices and reducing its exportable supply. This action will lead to changes in the relative rates of subsidies among crops.

Figure 3

Export subsidy expenditure by country, 1995-98



Source: Leetmaa, in this report.

The Common Agricultural Policy (CAP), the EU domestic farm program, provides a common price for all grains. Given world grain prices, this common price implies relatively high subsidies on barley and other coarse grains compared to wheat. Oilseed prices are not supported, although grain, oilseeds, and livestock producers all receive direct payments. This domestic price structure has encouraged barley and coarse grain production. Domestic reforms linked to export subsidy elimination will change this relative pricing and lead to a shift in production back to wheat. Lower feed prices will partially offset a major contraction in the EU livestock sector when export subsidies are removed.

The impact of EU export subsidy elimination on world prices would be felt most in the wheat and livestock sectors. In the case of wheat, the world price would decline due to increased EU production and exports. Conversely, world livestock prices would increase as EU exports decline. The expansion of EU wheat production and exports will create increased competition with U.S. wheat, while U.S. production and exports of other grains and meats, and exports of soybeans, will expand (table 15). EU imports are assumed fixed. If import barriers were also reduced, this would be a full reform of EU policies. See Diao et. al in this report for those effects.

Even if it fully eliminates export subsidies, the EU will still be able to competitively export grains and oilseeds, and some pork and poultry, but will continue to be uncompetitive in exports of beef. However, the EU beef industry could restructure in order to enter into the world's higher quality beef trade. Dairy, wine, horticulture, and some other commodities that benefit from EU subsidies are not included in the analysis.

Approaches to Reforming Export Subsidies: Value Versus Volume Constraints

The URAA approached the reform of export subsidies by placing restrictions on both the volume and the value of subsidized exports. Targeting both components creates effective constraints in times of both high and low prices. When world prices are low, both the value and the volume limits act as constraints. Volume limits help to prevent the disposal of excess supply onto export markets, in an effort to raise low domestic prices. Value limits become more binding as prices fall because the subsidy (the difference between the high internal support price and the declining world price) becomes larger. When world prices are high, the value constraint becomes less binding but the volume constraint can still set some limit on export subsidies. Both value and volume limits help to emphasize the link between export subsidies and fixed internal price support programs, since constrained export subsidies can now only partially offset the effects of falling world prices.

In 1995-96, when world prices were high, the EU was constrained more by its volume limits than its value limits. As world prices fell beginning in 1997, the EU's subsidy expenditures and value of subsidized exports increased. Through 1998, the volume limits were more binding on EU exports than value limits, with the exceptions of sugar, processed fruits and vegetables, tobacco, and alcohol. In 1998, the U.S. provided export subsidies on dairy and poultry meats, with dairy reaching 90 percent of U.S. volume limits.

Table 15—EU export subsidy elimination and related domestic price reforms: Effects on EU and U.S. production and exports

Commodity	EU		U.S.	
	Production	Exports	Production	Exports
	Percent change from baseline volume in 2007/8			
Wheat	.01	19.5	-1.3	-5.5
Corn	Na	Na	0.4	0.6
Barley	-3.2	-32.7	Na	Na
Soybeans	Na	Na	-0.1	0.02
Rapeseed	0.4	-5.5	Na	Na
Beef	-1.7	-100	1.2	5.7
Pork	-4.2	-44	0.5	3.1
Poultry	-4.8	-29.8	0.4	1.1

Na = not applicable.
Source: Leetmaa (2001).

The Impacts of Reform on Developing Countries

Less developed countries (LDC) are a diverse group. They include agricultural exporters and net food importers, countries with adequate or with limited natural and financial resources, and countries in which agriculture accounts for a large or small share of national economic activity. While the interests of an individual developing country are likely to reflect its own mix of characteristics, some developing countries have collaborated to present common positions at the WTO. Some resource-abundant, agricultural-exporting developing countries have joined the Cairns Group, including the MERCOSUR countries, Chile, and Thailand. The group of "like-minded countries" includes least-developed food-importing countries, such as Haiti and Cuba.

LDCs Affected by Both Their Own and Developed Country Reforms

Individually, developing countries are small, price-taking economies in world markets. The potential effects on developing countries from further global agricultural policy reforms can be decomposed into the impacts of reform by large, developed economies on world agricultural markets, and the effects of their own policy reforms (table 16). Unambiguously, further agricultural policy reforms by developed countries will lead to an increase in world agricultural prices relative to their trend levels, and greater market access and higher prices for developing country agricultural exports. If developed countries were to fully eliminate their own agricultural support policies, the value of agricultural exports by all developing countries would increase by about 24 percent. Rising world food prices due to reform in developed countries only would lead to a 2-percent decline in LDC agricultural imports.

Developing countries' reforms of their own policies will lead to increases in both agricultural exports and imports. If LDCs fully eliminate their own agricultural policy distortions, developing countries' agricultural exports will increase in value by 5.5 percent. Under the same scenario, agricultural imports will increase by 25 percent. The expected increase in imports is large because many LDCs have high import tariffs. (This level of import growth is likely overstated because the applied rates of developing countries are often lower than the bound rates used in this analysis.) Global policy reform will result in a 20-percent increase in the value of developing countries' agricultural imports and a 27-percent increase in the value of their exports, indicating the potential for a significant reallocation of production and expansion of trade in response to global reforms.

Developing countries that have the capacity to increase their agricultural export supply would account for much of the increase in exports, especially in products that compete with the temperate products of developed countries. Furthermore, some of the export growth can be expected to embody greater valued added. Many developed countries have escalating tariffs that impede the efforts of developing countries to capture more of the value added in their agricultural exports. Tariff reform or elimination by developed countries can help open up opportunities for agro-industrial development in LDCs that can help to offset the effects of long-term price declines for many primary commodities.

Table 16—Developed and developing country agricultural policy reforms: Effects on developing countries' agricultural trade

	Elimination of developed country agricultural policy distortions			Elimination of developing country agricultural policy distortions	Global elimination of agricultural policy distortions
	Percent change from base				
	Market access	Domestic support	Export subsidies	Market access	All policies
Imports					
Value	0.6	-1.5	-1.1	24.6	20.0
Volume	0.2	-4.7	-2.7	17.1	7.9
Exports					
Value	18.1	5.5	0.6	5.5	26.5
Volume	10.7	3.4	0.3	4.1	16.1

Source: Diao, Somwaru, and Roe in this report.

While lower tariffs in developed countries will benefit some LDC exporters, others will face an erosion of the margin of tariff preference enjoyed by their exports under special, concessional trade agreements. Preferential agreements, such as the Caribbean Basin Initiative between the United States and Caribbean countries, allow many products of least developed countries to enter duty free. The erosion of preferences due to multilateral tariff reductions is expected to have negative but modest effects on the agricultural export earnings of some developing countries. While loss of preferences may erode export earnings in the short term, it may benefit developing countries in the long run. These preferences have in some cases reinforced developing country dependence on the export of a small number of primary commodities, many characterized by long-term declines in price. Recent trends in export growth and commodity composition show that countries with a high dependence on primary commodity exports showed the lowest export growth, while countries that have been successful in diversifying their exports have had the highest export growth. Partner diversification also benefits developing countries.

Food Aid Needs Will Decline Slightly

We analyze the effects of global policy reform on the food aid needs of 67 low-income developing countries. These countries account for 40 percent of the global population. Almost all are food importers and have historically received food aid. The world price of food imports, the domestic supply response to higher world prices, and the availability of foreign exchange to pay for food imports jointly determine food aid requirements. On the import side, higher food import prices reduce the financial import capacity of these countries, but foreign exchange earnings from export growth increases it. On the production side, higher world prices are expected to outweigh the effects of low-income LDCs removal of their own tariffs, leading to a positive supply response. Food aid needs are projected by calculating the difference between per capita food supply (from domestic production and commercial imports) and projected per capita consumption (using either status quo or nutritional consumption targets).

The full global elimination of agricultural policy distortions is expected to reduce global food aid needs by 6 percent. In the absence of any global reforms, the food aid import needs of low-income developing countries (assuming status quo per capita consumption levels) are projected at 12.7 million tons of cereals by 2010 (table 17). If nutritional intake were to improve to recommended Food and Agriculture Organization (FAO) dietary levels, their food aid needs would be 21.9 million tons in 2010. Full global reform will reduce status quo and nutritional food aid needs to 12.0 and 20.5 million tons, respectively. Regionally, Sub-Saharan Africa will gain the most because of its low food import dependency and the high share of agriculture in total exports (fig. 4). The status quo food gap in Sub-Saharan Africa will decline 9 percent. There will be an increase in the food gap in North Africa.

Overall, several factors account for the relatively small impact of global policy reform on food security: In many low-income developing countries, food imports are a relatively small share of the food supply, agriculture's share in foreign exchange earnings is declining, and the food production response to change in world prices is low unless additional investments are made to improve agricultural productivity.

Developing Countries' Own Reforms Are Their Major Source of Gains from WTO

For LDCs, a key issue in the policy reform negotiations will be the flexibility the outcome will permit them in adjusting to more import competition. "Special and differential treatment" is a concept that provides for exemptions or special provisions in inter-

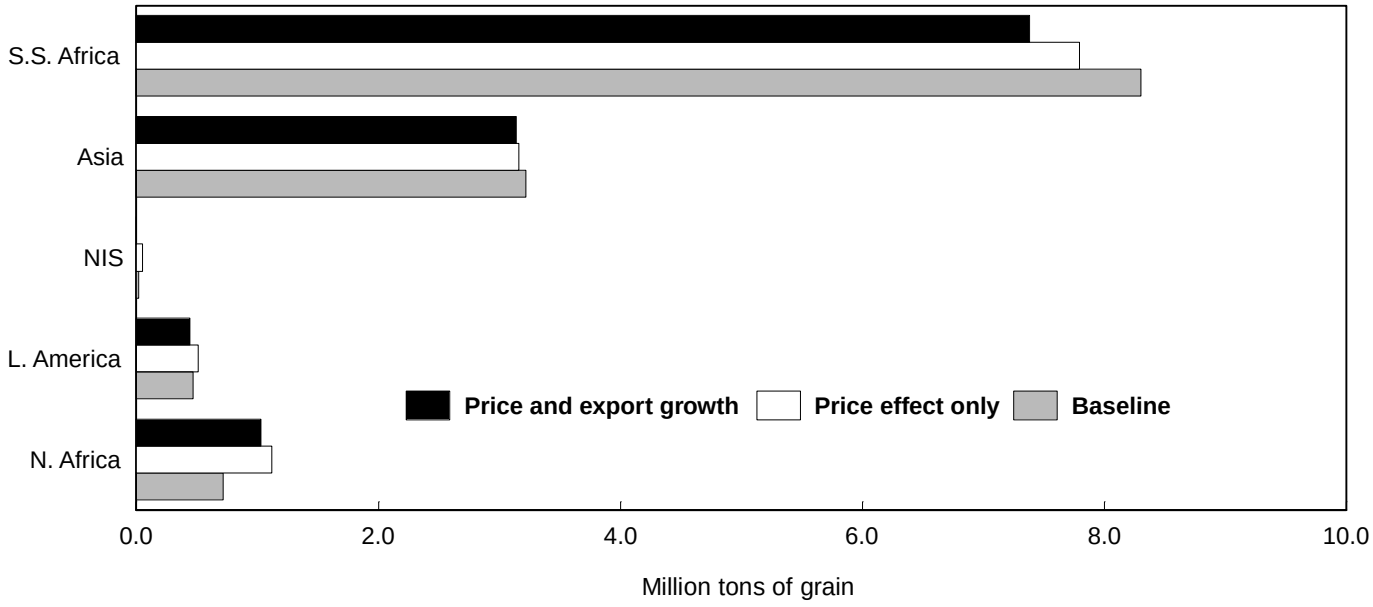
Table 17—Full agricultural trade liberalization: Effects on low-income developing countries' food aid needs in 2010

	Status quo nutritional intake	Adequate nutritional intake
Scenario	*Million tons of grain*	
Baseline	12.7	21.9
Global agricultural price increases	12.6	21.4
Developing country export growth plus price increases	12.0	20.5

Source: Shapouri and Trueblood in this report.

Figure 4

Effects of agricultural policy reform on food aid needs of low-income developing countries



Source: Shapouri and Trueblood, in this report.

national trade rules in recognition of the different economic, financial, and technological characteristics and needs of developing countries. In the URAA, special and differential treatment allowed a longer implementation period for developing countries' reforms and fully exempted the least developed countries from disciplines. Developing countries' proposals in the new negotiations include measures to exempt themselves from domestic support disciplines, higher *de minimis* support levels, and the right to raise tariffs above Uruguay Round bindings if import competition becomes too disruptive.

Special and differential treatment can be used to facilitate the adjustment of developing countries to more open global markets, based on the recognition that adjustment can be costly, but particularly so for the most vulnerable segments of the world population. In the short run, the global community's role is to provide food aid targeted to the food insecure and technical assistance to facilitate the development of competitive agricultural sectors. In the longer run, improvements in the economic growth and welfare of developing countries will depend on whether these countries' consumers have access to low cost and secure supplies of food, produced at home or abroad under fair market conditions. The supply response of farmers in developing countries will depend on the effective transmission of market price signals. Although import growth may require a managed transition, it is only through a full participation in reform in the long term that developing countries can fully achieve the potential dynamic gains from trade liberalization. The increased productivity and investment that have been shown to be linked with more open trade policies suggest the long-term benefits to developing countries from their own economic policy reforms can be significant.

Conclusions

The movement toward a more market-oriented and orderly global agricultural trading system is important for the United States because of the large and increasing role of trade in U.S. agricultural production and food consumption. Expanding export markets provides an outlet for U.S. agricultural producers as technological advances and increased productivity lead to higher levels of production. For consumers, trade rules help to ensure access to a safe, varied, and abundant year-round supply of food.

Global agricultural policy distortions impose substantial long-term costs on U.S. producers, consumers, and the world economy. U.S. agricultural tariffs and subsidies are relatively low, suggesting that U.S. domestic adjustments to its own reforms are likely to be small, relative to the potentially large benefits to the United States from global reform. Furthermore, U.S. reforms of its own policies within a global framework can help to ensure the overall, long-term competitiveness of the U.S. farm sector in world markets.

A Global Analysis of Agricultural Reform in WTO Member Countries

Xinshen Diao, Agapi Somwaru, and Terry Roe

Removing trade barriers, subsidies, and other trade-distorting forms of support will cause aggregate world prices of agricultural commodities to rise by almost 12 percent relative to an index of all other prices. Agricultural support and protection in developed countries is the major cause of low agricultural prices, and implicitly, a tax on net agricultural exporters in developing countries. The reform of agricultural policies would likely increase livestock product prices more than any other commodity. Reform increases world trade in agricultural commodities, but leaves the level of total agricultural production almost unchanged. In the short to medium term, some net agricultural importing countries suffer a welfare loss due to the adverse change in their terms of trade caused by reform. In the longer run, however, agricultural policy reform benefits almost all countries, and developing countries in particular, due to the change in the developing countries' investment pattern, growth in capital stock, and growth in total factor productivity.

Introduction

The Uruguay Round Agreement on Agriculture (URAA) brought agriculture under the discipline of the General Agreement on Tariff and Trade (GATT) for the first time. The signatories to the URAA Final Act (1994) committed themselves to reducing agricultural support and protection over the 6-year period 1995–2000 (and 1995–2004 for developing countries) under three disciplines: tariffs, domestic support, and export subsidies. Agricultural trade barriers and producer subsidies still distort global agriculture. The new negotiations on agriculture are expected to further reduce policy distortions in global agricultural markets. The growth in the world economy since the previous round of negotiations necessitates an evaluation of the costs of current agricultural trade and domestic policy distortions and the potential benefits from their full elimination both in a global context, and in the context of a world economy with increased capital flows.

This study assesses the possible global impacts of further agricultural liberalization in some sector detail from both a static-snapshot perspective, and in far less detail from a dynamic longrun perspective. Short- to medium-run effects of policy reform on well-being can differ from long-run effects due to reform-induced changes in the longrun pattern of investment and capital accumulation. A global analysis of profound policy reform (i.e., the elimination of agricultural support and trade protection throughout the world) provides insights into the costs of agricultural policy distortions and suggests the potentially greatest effects on countries, both positive and negative, of the new agricultural negotiations.

To understand the individual and complementary effects of the various policy reforms on the post-URAA global economy, this study focuses on three disciplines: market access (trade barriers), export subsidies, and domestic support. The study decomposes the global effects of a full reform by type of policy being used and by commodity (see box) and country.[1] Specifically, the study uses the following scenarios: (1) eliminating agricultural import barriers (tariff equivalents) throughout the world; (2) eliminating agricultural export subsidies throughout the world; (3) eliminating domestic support in the developed countries; and (4) combining these scenarios. Because impacts can vary from country to country, this study identifies specific country-region effects. As some countries are net

[1] Countries and regions included in the study include 1) Australia and New Zealand; 2) China, including Hong Kong; 3) Japan and Korea; 4) the other Asian countries; 5) Canada; 6) the United States; 7) Mexico; 8) Latin American countries; 9) the European Union; 10) the European Free Trade Area; 11) Southern African countries; 12) the rest of the world.

Agricultural sectoral aggregation in the study

Sectors in the model	*Sectors in GTAP data*
Rice	Paddy rice, processed rice
Wheat	Wheat
Corn and other cereal grains	Corn and other cereal grains
Vegetables and fruits	Vegetables, fruits, and nuts
Oilseeds and products	Oilseeds, vegetable oil
Sugar	Sugar cane and sugar beet, sugar processed
Other crops and products	Plant-based fibers, other crops
Livestock and products	Bovine cattle, sheep and goats and meats, other animal products, raw milk and dairy products, wool, and silk-worm cocoons
Other processed food products	Beverages and tobacco products, and other processed food products

exporters of agricultural goods and others are net importers, policies can affect countries differently. Also, the composition of agricultural exports from developed countries tends to vary from those of developing countries. Thus, to identify a country's/region's effects, the study further decomposes scenarios (1) through (4) by regional options. For example, the study addresses questions such as: what are the likely effects on world agricultural price and trade flows, and on the economy of other countries/regions, if the EU eliminates its agricultural support and trade protection?

The study uses four indicators to assess the effects of agricultural liberalization on the world economy, as well as on each country/region: changes in world agricultural prices, changes in world and countries' exports and imports, changes in the level of agricultural production, and changes in a measure of social well-being, or welfare.

The analysis is based on current (1998) levels of applied agricultural tariffs, domestic support and export subsidies, and tariff rate quotas (TRQ). When the applied tariff rates are not available, the bound tariff rates are used instead. Data on nontariff barriers, such as state trading agencies and effective TRQs, are also not available for many countries. For this reason, the study uses a calculated tariff equivalent rate to proxy the effects of all other import barriers based on ERS/USDA estimates.[2]

Other caveats are noteworthy. First, tariff rates and tariff equivalent rates are based on 1998 data. Because many countries underwent tariff reductions after 1998, and because the bound rates are much higher than the applied rates in many cases, the analysis may overestimate the extent of tariff reduction presumed to take effect after 2000 for some countries. Other countries and commodities still have various nontariff barriers in place, and hence, tariff reduction cannot represent the full elimination of import barriers. Thus, the analysis may underestimate the extent of all import barriers.

Second, the analysis focusing on the effect of domestic support on world agricultural markets considers the elimination of support only in Australia, New Zealand, Japan, Korea, the United States, Canada, the European Union (EU), and three countries in the European Free Trade Area (EFTA). The analysis does take into account that many countries have recently adopted less-distorting forms of farm support, and differences exist in the effects of coupled and decoupled government payments received by farmers on production and trade. For example, subsidizing intermediate inputs in grain production (coupled) would affect farmers' production decisions, and removing such subsidies would affect farmers' supply response. Eliminating such subsidies gives farmers incentives to adjust their planting structure, possibly allocating more land to other crops. On the other hand, direct payments to the owners of all farmland with no crop targeting (decoupled) would have little effect on the allocation of the land and, hence, the planting structure. Removing these subsidies would mainly reduce farmers' income and have relatively small effects on aggregate production.

Third, it is assumed that labor and capital are mobile between the agricultural and nonagricultural sectors of an economy. Without factor mobility, the supply

[2] See discussion of agricultural policies in the appendix to this report.

response from countries having a comparative advantage in world agricultural markets would slow, which may cause world agricultural prices to rise more than the levels predicted by this analysis. Moreover, the study assumes full employment. This assumption places upward pressure on prices, because if rural unemployed labor is available (which is likely in developing countries), supply response can occur at lower cost.

Full Reform Will Likely Cause World Prices of Agricultural Goods to Rise Significantly in the Short to Medium Term

World agricultural prices are sensitive to changes in tariff levels and domestic support. The study is based on GTAP database version 5 and calculates average tariff equivalent rates using the Agricultural Market Access Database (AMAD), while ERS provides the average rates of export subsidies and domestic support. The average world agricultural tariff equivalent rate is 22 percent. This rate, the trade-weighted average tariff rate, is calculated as the ratio of the total revenues of all countries' agricultural tariff equivalents to the value of their total agricultural imports.[3] The similarly computed average world export subsidy rate is 2.9 percent. The domestic support rate for the developed country group is 5.3 percent (table 1-1).

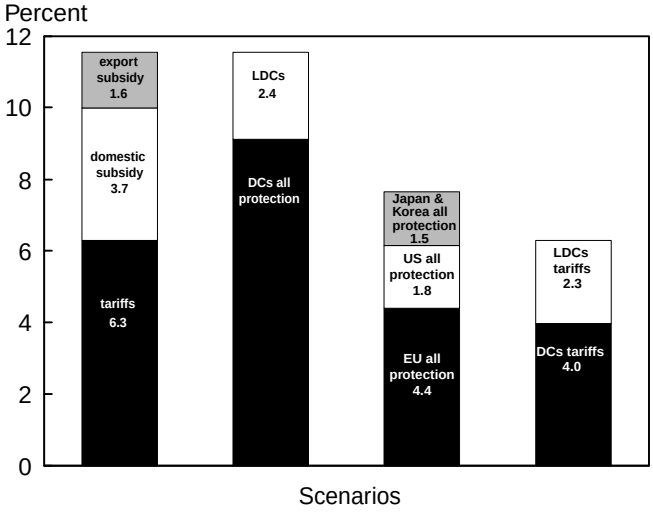
The elimination of all tariffs (and tariff equivalents) on agricultural imports, export subsidies, and domestic support, worldwide, results in an increase in world agricultural price levels of 11.6 percent relative to the level of world nonagricultural prices. This result does not take into account further agricultural liberalization in China, which at this time is not yet a participatory member of the WTO. If China liberalizes agriculture, the level of world agricultural prices would rise by 12.2 percent, an increase of about 0.6 percent over non-China predicted values. The following discussion assumes that China maintains current policies.

This study determines the global price effect of worldwide agricultural liberalization without accounting for investment response to price changes. Later, this assumption is relaxed. Given this consideration, eliminating tariffs, worldwide, accounts for more than 50 percent of the 11.6 percent increase in world agricultural prices, that is, when other policy variables remain constant and only agricultural import tariffs are eliminated, world agricultural prices rise 6 percent (relative to world nonagricultural prices) (fig. 1-1). This result occurs because import barriers protect domestic producers by restricting imports. In many *import*-protecting countries, import restrictions raise domestic food prices higher than world prices while at the same time inducing these countries to employ too many resources in agriculture. Eliminating import tariffs raises the demand for agricultural imported goods, while supply contracts, thus placing upward pressure on world agricultural prices. This pressure in turn induces agricultural exporting countries to increase production.

Eliminating domestic support in the developed countries, as mentioned earlier, contributes more than 30 percent to the rise in world agricultural prices. In other words, when other policy variables remain constant and only domestic support in the developed countries is eliminated, world agricultural prices rise about 4 percent. Farmers benefit from price support or, indirectly, from lowered production costs. Reducing or eliminating domestic support in the developed countries lowers farm income, or, more precisely, lowers returns to land, farm buildings and machinery, and owner-operator labor. Farmers in these countries respond to such policy changes by reducing produc-

Figure 1-1
Decomposition of price effects of global agricultural liberalization

Percentage change in world agricultural price index from the base year in the model



Source: Economic Research Service, USDA.

[3] The simple average world agricultural tariff rate is 62 percent. High tariffs for a specific sector usually restrict trade in this sector, lowering the sector's share in the world trade. Thus, the weighted trade tariff rate is lower than the simple average tariff rate.

Table 1-1—Summary of agricultural supports and protection data in the base year (1997)

	Rate of tariffs[1]	Rate of export subsidies[2]	Rate of domestic supports[3]
		Percentage	
World average	22.09	2.87	
Developed country group	23.67	4.79	5.25
Developing country group	19.62	0.13	
World sectoral average			
Wheat	22.75	2.78	
Rice	45.08	2.23	
Other grains	8.68	0.69	
Vegetable and fruits	12.13	1.01	
Oil and oilseeds	12.57	0.00	
Sugar	33.95	6.97	
Other crops	11.57	0.05	
Livestock and products	48.79	7.03	
Processed foods	14.90	0.00	
Developed country group			
Wheat	68.18	2.99	31.55
Rice	73.34	3.79	2.05
Other grains	11.02	0.84	21.84
Vegetable and fruits	10.22	1.92	0.00
Oil and oilseeds	9.50	0.00	9.94
Sugar	59.14	21.27	2.19
Other crops	9.85	0.17	2.75
Livestock and products	68.45	8.78	3.31
Processed foods	9.11	0.00	0.00
Developing country group			
Wheat	8.60	0.00	
Rice	10.75	0.00	
Other grains	6.56	0.13	
Vegetable and fruits	16.71	0.11	
Oil and oilseeds	15.67	0.01	
Sugar	14.50	0.16	
Other crops	15.82	0.00	
Livestock and products	23.23	0.58	
Processed foods	26.51	0.00	
Regional average			
Australia and New Zealand	5.12	0.01	0.19
Japan and Korea	47.49		2.43
United States	10.65	1.77	2.56
Canada	6.09		2.99
European Union	16.68	12.29	8.19
European Free Trade Area	48.72	43.96	19.29
China	26.47		
Other Asian countries	20.71		
Mexico	18.93		
Latin America	14.67	0.04	
Southern African countries	21.65		
Rest of the world	17.63	0.70	

[1]Rates of tariffs for sector, country, region, and the world are weighted average rates and the weights are values of sectoral or country's imports. Both tariff rates and import data are for 1997.
[2]Rates of export subsidies for sector, country, region, and the world are weighted average rates and the weights are values of sectoral or country's exports. Both subsidy rates and export data are for 1997.
[3]Rates of domestic supports for sector, country, region, and the world are weighted average rates and the weights are values of sectoral or country's outputs. The domestic support data are for 1998, while the output data are for 1997.
Source: Economic Research Service, USDA.

tion, thus an upward pressure is placed on world prices.

Eliminating total export subsidies worldwide has smaller direct effects than removing tariffs and domestic support. Eliminating these subsidies for sugar and livestock products, however, causes their prices to rise more than 3 percent (fig. 1-2). The main reason for this increase is that while world average export subsidies are much lower than the world import tariffs, they are relatively high for sugar and livestock (table 1-1). When other policy variables remain constant and only agricultural export subsidies worldwide are eliminated, the world agricultural price rises 1.5 percent relative to the price of nonagricultural goods.

Agricultural support and protection in developed countries is the major cause of low world agricultural prices

The decomposition of the increase in world prices by developed – developing country groups shows that agricultural liberalization in the developed countries accounts for about 80 percent of the rise in world agricultural prices. That is, eliminating agricultural support and trade protection only in the *developed* country group increases world agricultural prices 9 percent relative to nonagricultural prices (fig. 1-1). Eliminating trade protection in the developing country group increases world agricultural prices 2.3 percent.[4]

Three reasons help explain why liberalization in the developed countries causes world agricultural prices to rise. First, as a group, developed countries import more agricultural goods than developing countries. Excluding intra-regional trade among EU member countries and EFTA member countries, developed countries' imports account for about 57 percent of world agricultural trade. Moreover, the developed country group has an average agricultural tariff (equivalent) rate of 24 percent compared with a rate of 20 percent for the developing country group (table 1-1). This high rate is mainly due to the high rates for grain and livestock product imports by Japan, Korea, the EU, and EFTA (table 1-2). The tariff rates are low in other developed countries, such as Australia, New Zealand, Canada, and the United States. Second, the average export subsidy rate for the developed country group is 4.8 percent, and only 0.13 percent for the developing country group (table 1-1). Finally, developed countries mainly employ domestic support policies.

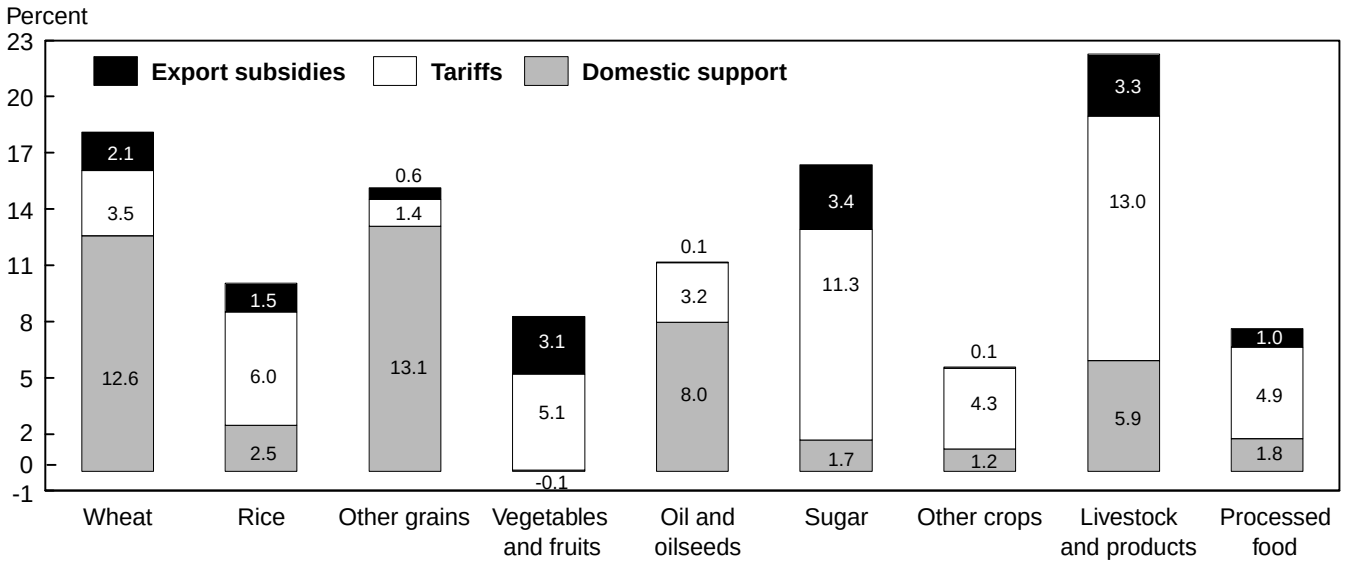
Because agricultural support and protection rates in the developed countries are higher than those in the devel-

[4] This group includes emerging markets, transition economies, and China.

Figure 1-2

Decomposition of price effects of global agricultural liberalization

Percent change in selected world commodity prices from the base year in the model



Source: Economic Research Service, USDA

Table 1-2—Regional agricultural tariff rates by sector in the base year (1997)

	Wheat	Rice	Other grains	Vegetable and fruits	Oil and oilseeds
			Percentage		
Australia and New Zealand	0.00	0.89	0.98	1.5	2.3
Japan and Korea	87.57	336.57	6.81	9.51	10.41
United States	2.60	5.28	0.60	4.70	6.74
Canada	50.24	0.00	0.08	0.27	0.00
European Union	42.98	47.66	38.60	10.86	5.68
European Free Trade Area	119.45	0.00	114.23	69.77	186.09
China	13.46	13.11	14.36	12.56	17.26
Other Asian countries	6.23	19.71	3.96	26.45	19.55
Mexico	13.40	15.00	0.77	17.90	6.89
Latin American countries	5.53	25.57	10.31	13.73	11.10
Southern African countries	20.20	5.55	21.62	15.46	24.72
Rest of the world	8.49	4.47	6.49	12.13	

	Sugar	Other crops	Livestock and products	Processed food
			Percentage	
Australia and New Zealand	10.27	2.83	4.43	7.11
Japan and Korea	81.02	7.51	132.39	8.41
United States	53.10	21.46	10.62	8.62
Canada	5.36	0.48	22.63	5.06
European Union	61.91	2.74	42.88	12.20
European Free Trade Area	100.67	55.11	123.57	3.71
China	22.22	25.62	33.28	35.22
Other Asian countries	26.69	21.72	16.38	28.17
Mexico	4.25	7.43	35.72	19.95
Latin American countries	18.68	8.34	17.89	17.29
Southern African countries	11.24	14.63	21.23	30.23
Rest of the world	12.10	9.67	21.59	24.93

Source: Economic Research Service, USDA.

oping countries, and because the developed countries are major players in world agricultural markets, it follows that liberalizing developed countries' agricultural support and trade policy causes world agricultural prices to rise. More specifically, removing import tariffs, domestic support, and export subsidies in the EU alone, holding the policy of other countries unchanged, causes world prices to rise 4.4 percent (fig. 1-1), or more than one-third of the world price increase that would result. When policy variables for the other countries remain constant and only the agricultural support and trade protection in the United States are eliminated, world agricultural prices rise 1.8 percent. Liberalization of Japan's plus Korea's agricultural trade policies causes world agricultural prices to rise about 1.5 percent (fig. 1-1).

Livestock product prices rise the most in response to liberalization

For the world as a whole, livestock and livestock product (including dairy) trade faces the highest level of import protection and export subsidies in comparison to the other agricultural commodity categories (table 1-1). Moreover, the value of world livestock product trade is almost twice the value of world trade in grain products. Consequently, world livestock product prices rise more than other commodity prices after liberalization. If all forms of domestic support and border protection in agriculture are removed, world livestock product prices would rise about 22 percent, while grain and other crop prices rise 6 percent to 18 percent (fig. 1-2). Again, the developed countries influence the rise in world livestock product prices because developed countries dominate world trade in this sector, as well as protect their domestic sectors from import competition (table 1-2).

The resulting higher agricultural commodity prices that are likely to prevail in this case affects agricultural importing countries differently. Those developing countries that are importers of grain and livestock products, and in which tariff rates on imports are not prohibitively high, face increased import costs with the result that consumer's interests are adversely affected. For those developed countries that are also grain and livestock product importers but in which tariff rates on imports are almost prohibitively high, such as Japan and Korea, the prices faced by their domestic consumers may not rise. Thus, consumers in these countries are likely to benefit from agricultural liberalization while their producers may be hurt due to competition from lower cost foreign producers.

Liberalization Enhances Trade, but Among Sectors, Affects Production Differently

In general, freer trade results in more trade. The model results indicate that world agricultural trade is likely to increase substantially after liberalization. Removing all agricultural support and protection worldwide results in an increase in the value of world agricultural trade of about 30 percent. The corresponding volume of world trade rises 15 percent (table 1-3).

Agricultural export value from *developed* countries rises 32 percent, while exports from *developing* countries increase 27 percent. However, the corresponding increase in the volume of exports from the developing countries (16 percent) is larger than the increase from the developed countries (14 percent). This result implies that the prices for the agricultural goods exported by the developed countries rise *more* than the prices of the agricultural goods exported by the developing countries. This result occurs because the developed country group exports more livestock products, accounting for 76 percent of world livestock product trade, while the developing country group exports more vegetables, fruits, oilseeds, sugar, and other crop products. While, as mentioned earlier, world livestock product prices could rise 22 percent, world prices for the nongrain crop product categories rise 6 percent to 11 percent (except for sugar, for which world prices rise 16 percent (fig. 1-2)).

The removal of import protection is a dominant factor in the increased growth in world agricultural trade. When only agricultural tariffs worldwide are eliminated, world trade rises 26 percent in value and 17 percent in volume. Exports and imports both rise more in

Table 1-3—Decomposition of world agricultural trade effects of global agricultural liberalization—Percentage change in total agricultural trade from the base year

	Value	Volume
Removing agricultural supports and protections by all regions		
World trade	29.71	14.66
Exports of developed country group	31.81	13.75
Imports of developed country group	35.93	19.03
Exports of developing country group	26.50	16.05
Imports of developing country group	20.02	7.85
Removing tariffs by all regions		
World trade	26.40	17.31
Exports of developed country group	31.28	20.79
Imports of developed country group	28.66	18.39
Exports of developing country group	18.93	11.97
Imports of developing country group	22.89	15.63
Removing domestic supports by developed regions		
World trade	2.70	-0.71
Exports of developed country group	0.85	-3.42
Imports of developed country group	5.43	1.82
Exports of developing country group	5.54	3.44
Imports of developing country group	-1.54	-4.70
Removing export subsidies by all regions		
World trade	-0.66	-1.76
Exports of developed country group	-1.43	-3.04
Imports of developed country group	-0.44	-1.25
Exports of developing country group	0.51	0.22
Imports of developing country group	-1.01	-2.54

Source: Economic Research Service, USDA.

the developed country group than agricultural exports and imports of the developing country group. The relatively high protection rates in the developed country group cause this disparity. Moreover, developed country group exports rise more than the increase in its imports, both in value and volume, while the developing country group imports rise more than the increase in its exports. This important result indicates that, when only tariffs are removed, the terms of trade improve in the *developed* country group relative to the *developing* country group.

Removing export subsidies or domestic support alone appears not to enhance world agricultural trade. When only agricultural export subsidies worldwide are eliminated, world agricultural trade falls 0.7 percent in value and 1.8 percent in volume. If only domestic support in the developed countries is eliminated, world agricultural trade rises 2.8 percent in value but falls slightly (0.7 percent) in volume (table 1-3). These results are consistent with the prediction of trade theory, that is, subsidies increase exports, albeit at the possible cost of reducing the exports of the nonsubsidized commodities. Removing subsidies can decrease total trade depending upon how consumers allocate the savings from taxes used to finance the subsidies and the extent to which the other nonsubsidized sectors respond to the slight increase in resources that are released from the formerly subsidized sector.

Even though world trade does not change much when export subsidies are removed worldwide, as the subsidy policies are mainly applied by the developed countries, the results suggest that exports from the developing country group would rise, while exports of the developed country group fall. If the export subsidies were removed worldwide, the developing country group exports would rise 0.5 percent in value and 0.2 percent in volume, while the developed country group exports fall 1.4 percent in value and 3 percent in volume. When the domestic subsidies are eliminated in the developed countries, the developing country group exports rise 5.5 percent in value and 3.4 percent in volume, while the developed country group exports rise 0.9 percent in value and fall 3.4 percent in volume. These results indicate that, by stimulating domestic production and enhancing exports, the developed countries' export subsidy or domestic support policies have lessened the market shares of some developing countries that are net exporters of the agricultural commodities on which the developed countries have applied supporting policies, but have benefited other developing countries that are net importers of these commodities. The net importers benefit because the subsidy and support policies lower the prices these countries would otherwise face if world markets were undistorted.

Grains, sugar, and livestock products trade more after liberalization

As grains, sugar, and livestock products have the highest import protection rates, it is not surprising that world agricultural trade reform causes world trade in grains, especially wheat and rice, sugar, and livestock products, to increase more than other agricultural products. Results suggest that trade liberalization would increase the value of world rice (78 percent), wheat (38 percent), sugar (44 percent), and livestock product trade (61 percent). These sharp rises stand out relative to the 14- to 24-percent rise for the other crop and processed food trade (table 1-4).

Again, the increase in both developed and developing regions' grain, sugar, and livestock product exports is mainly due to liberalization in the developed countries. Eliminating agricultural support and trade protection only in the developed countries increases world trade of rice (70 percent), wheat (30 percent), sugar (35 percent), and livestock products (50 percent). Conversely, when the developed country group is unchanged, the world trade in grains, other crops, and livestock products only rises 4 percent to 12 percent.

Production effects vary among the sectors

In contrast to the relatively large world trade effects of agricultural reform, the model results suggest that reform only slightly affects the level of world agricultural production, at least in the aggregate. For commodities such as wheat, however, the effect is relatively large. Moreover, the change in production does not always point in the same direction as the changes in trade. For example, the value of world rice trade increases almost 80 percent when all the agricultural support and trade protection are removed worldwide, while the worldwide production of rice falls 1.7 percent (table 1-5). In addition, rice production falls 8.4 percent in the developed country group, due to an almost 20-percent decline in Japan and Korea, while rice production rises 1 percent in the developing country group. Japan and Korea severely restrict rice imports, and domestic rice in the two countries is three

Table 1-4—Decomposition of world agricultural trade effects of global agricultural liberalization—Percentage change in world agricultural trade by sector from the base year

	EXP-1		*EXP-2*		*EXP-3*		*EXP-4*	
	Value	Volume	Value	Volume	Value	Volume	Value	Volume
Wheat	37.64	13.41	17.71	12.62	7.40	-3.56	-0.69	-2.16
Rice	78.12	47.21	76.70	52.72	1.66	-0.69	-0.68	-2.02
Other grains	24.19	3.87	7.24	4.80	9.02	-3.02	0.17	-0.40
Vegetable and fruits	14.15	8.23	15.27	9.60	-0.62	-0.56	-0.37	-0.68
Oil and oilseeds	23.50	11.38	11.66	8.05	11.11	3.45	0.00	-0.05
Sugar	44.43	23.24	43.57	27.72	1.72	0.10	-1.50	-4.12
Other crops	14.08	7.59	13.26	8.25	0.87	0.29	-0.13	-0.20
Livestock and products	61.42	28.96	56.62	35.75	3.76	-1.45	-1.60	-4.35
Processed food	18.27	9.61	18.59	12.80	0.45	-1.25	-0.61	-1.55

Experiment-1: Removing all agricultural supports and protections, worldwide
Experiment-2: Removing only tariffs, worldwide
Experiment-3: Removing only domestic supports in the developed countries
Experiment-4: Removing only export subsidies, worldwide
Source: Economic Research Service, USDA.

Table 1-5—Decomposition of agricultural production effects of global agricultural liberalization in the model—Percentage change in output of selected agricultural goods from the base year

	EXP-1			*EXP-2*			*EXP-3*			*EXP-4*		
	World	DCs	LDCs	World	DCs	LDCs	World	DCs	LDCs	World	DCs	LDCs
Wheat	2.12	1.23	2.70	1.20	5.02	-1.04	-0.04	-5.07	2.92	0.07	-1.03	0.71
Rice	-1.65	-8.42	0.91	-1.18	-6.05	0.59	-0.21	-1.19	0.15	-0.03	-0.34	0.09
Other grains	1.83	1.07	2.48	2.19	4.71	-0.27	-0.49	-3.18	2.13	-0.11	-0.43	0.20
Vegetable and fruits	0.25	0.60	0.10	0.39	0.56	0.28	-0.10	0.04	-0.20	0.02	-0.03	0.06
Oil and oilseeds	0.70	-5.28	4.84	1.04	2.02	0.32	-0.49	-6.99	4.28	-0.03	-0.03	-0.02
Sugar	-1.01	-10.09	3.21	-0.26	-6.18	2.32	-0.64	-2.72	0.27	-0.16	-1.68	0.50
Other crops	-0.28	-2.78	1.47	0.16	-1.37	1.22	-0.44	-1.44	0.27	-0.03	-0.04	-0.02
Livestock and products	-1.04	-2.53	1.38	1.28	1.96	0.17	-1.90	-3.47	0.67	-0.24	-0.61	0.36
Processed food	-0.09	-0.33	0.46	1.00	1.46	-0.02	-0.96	-1.51	0.26	-0.11	-0.23	0.16

Experiment-1: Removing all agricultural supports and protections, worldwide
Experiment-2: Removing tariffs, worldwide
Experiment-3: Removing domestic supports in the developed countries
Experiment-4: Removing export subsidies, worldwide
Source: Economic Research Service, USDA.

times more expensive than rice in the world market. When the protection afforded rice producers is removed worldwide, so that all farmers in different countries face essentially the same world prices, the uncompetitiveness of rice production in Japan and Korea becomes obvious and production falls in those two countries.

Besides rice, the production of sugar (including sugar crops and raw sugar), other crops, livestock products and processed food also falls slightly in the world after reform, due to the decline in production in the developed country group (table 1-5). While production of these commodities rises in the developing country group, the effect is not sufficient to cover the fall in production in the developed countries. For example, sugar production falls 1 percent in the world and 10 percent in the developed country group when all agricultural support and trade protection is removed worldwide, while sugar production rises 3.2 percent in the developing country group. Some developed countries, such as Japan, the EU, and EFTA, protect their domestic sugar sector through both high tariffs and export

subsidies. Eliminating agricultural protection worldwide strongly suggests that some of these countries have less of a comparative advantage in either growing or processing, and, hence, sugar production falls in these countries. For example, sugar production falls more than 20 percent in Japan and Korea, more than 10 percent in the EU and EFTA, and almost 10 percent in the United States.

Wheat production has the highest increase among agricultural commodities when all agricultural support and trade protection are removed worldwide. World wheat production is likely to rise almost 2 percent, and more than 1 percent in the developed country group, mainly due to increased production in Australia and New Zealand, Canada, and the United States. These countries appear to hold a strong comparative advantage in wheat production. Wheat production falls considerably in other developed countries, such as Japan plus Korea (30 percent) and the EU (18 percent). Under the same scenario, wheat production rises almost 3 percent in the developing countries.

Tariffs, export subsidies, and domestic support affect production levels differently among countries. Removing tariffs worldwide would stimulate production in most agricultural sectors (except for rice and sugar), though most sectors would experience only small gains. Other grains, which is mostly corn, is an exception, as production rises more than 2 percent in this aggregate sector. Under this scenario, wheat and corn and other grain production rises mainly in the developed country group (5 percent), while production falls slightly in the developing country group (1 percent). Sugar and other crops' production rises 2.3 and 1.2 percent, respectively, in the developing country group and falls 6.2 and 1.4 percent, respectively, in the developed country group. Under this scenario, production of U.S. wheat and other grains (primarily corn) both rise 5 percent, while U.S. livestock production rises 7 percent.

In contrast to removing tariffs, removing export subsidies worldwide or removing domestic support only in the developed countries would have a negative, negligible effect on most agricultural production, particularly on the developed countries. Under the same scenario, production rises in most sectors in the developing county group (table 1-5). For example, removing domestic supports in the developed countries causes production of oilseeds and vegetable oil to fall 0.5 percent in the world, but almost 7 percent in the developed country group, and rise more than 4 percent in the developing country group. The EU would experience the largest drop in oilseed and vegetable oil production, 19 percent, due to that region's high levels of support. U.S. wheat production would fall 5 percent and other grains production (primarily corn) would fall 1.2 percent.

Welfare Effects of Reforming Agricultural Policies Are Mixed

From a world perspective, more efficient allocation of resources yields higher global welfare. Typically, in a country with a high degree of agricultural support and trade protection, consumers pay relatively high prices for food and other agricultural goods, and/or their disposable income is taxed to cover the costs of agricultural policies. Removing support or trade protection is expected to benefit consumers; however, welfare effects across countries vary, from the global perspective, and particularly when the world price is affected by agricultural policies.

Consumers can be worse off if their country's terms of trade deteriorate following agricultural policy reform (table 1-6). That is, if the prices of the goods they export fall relative to the prices of goods they import, consumers can be made worse off because their expenditures on imported goods increase while their income from exported goods falls. Moreover, consumers in a country with a low tariff rate (e.g., Mexico) may not benefit by liberalization in high-tariff countries (e.g., Japan), as trade diversion may result. In other words, a country (i.e., Japan) may import more, following reform, from those trade partners (i.e., the United States) on whom, prior to reform, the country imposed high tariff rates. Post-reform, the country (i.e., Japan) may import less from trade partners (i.e., Mexico) on which, prior to reform, it imposed low tariff rates. In this case, consumers in countries like Mexico may experience negative effects from worldwide trade reform.

Small one-time welfare gains

This analysis uses the widely accepted equivalent variation (i.e., consumers' willingness to pay) to measure the social welfare gains or losses due to agricultural policy reform. Measurements consider both one-time welfare effects and welfare effects over time. The one-time effect measurements use the status-quo (pre-

reform) prices as the base and address the question: What income would be equivalent to the change brought about by agricultural policy liberalization (Varian, 1984)? The welfare effects over time are measured by summing the discounted value of this measure over time.

The one-time effects of agricultural policy liberalization on a nation's social welfare appear relatively small among all countries/regions. Relative to nonagricultural sectors, agriculture accounts for a small share of gross domestic product (GDP). Further, agricultural goods in consumers' consumption bundles in most countries, and particularly so in the developed economies of the EU, Canada, and the United States, are relatively small in proportion to their total expenditures. Agriculture (including processed food products) accounts for less than 5 percent of the GDP of developed countries and 15 percent of the GDP of developing countries. Consumption expenditures on food account for 5 percent of total expenditures for the developed country group and 17 percent for the developing country group. Thus, at a national level, agricultural policy reform alone is unlikely to have a large, one-time welfare effect on the aggregate economy in the short- to medium-term.

Nevertheless, these relatively small aggregate welfare effects for the case of developing countries can be misleading for two reasons. First, a majority of the poor in low-income countries reside in rural areas where primary agriculture is a major source of income, either directly or indirectly through rural labor markets and in value-added activities related to primary agriculture. Second, monetary returns to the market surplus from primary agriculture (i.e., farm production minus own consumption) are closely linked to foreign markets. Thus, the national-level effects of reform are likely to be small in proportion to the benefits received by rural households and, in particular, rural households whose disposable income ranks in the bottom quantile of a country's distribution of income.

Thus, the welfare effects are positive for the world aggregate. The sum of countries' equivalent variation due to worldwide agricultural policy reform is about $31 billion. This is equivalent to 0.1 percent of world aggregate GDP, and 1 percent of consumer expenditures on agricultural and agriculture-related goods. Such welfare gains, however, are not equally distributed among countries and regions in the world, and some countries even experience negative welfare effects. Developed countries experience a $28 billion welfare gain, which is equivalent to 0.16 percent of their GDP and 2 percent of consumer expenditures on agricultural goods. Moreover, all developed countries in the model gain, with the largest gains shown by the EU ($9.3 billion), Japan plus Korea ($8.6 billion), and the United States ($6.6 billion).

The welfare gain for the developing country group is much smaller, at $2.6 billion. This is equivalent to 0.05 percent of GDP and 0.2 percent of consumer expenditures on agricultural goods. Furthermore, some countries/regions experience negative welfare effects. Mexico would experience a $160 million welfare loss, which is equivalent to less than a 0.06 percent reduction of its GDP.

Most developing countries experience smaller total welfare gains than developed countries because agricultural production in developing countries is distorted by more than just agricultural policies. While the level of domestic support and trade protection in nonagricultural sectors is quite low among most developed countries, many developing countries still highly protect their import-competing manufacturing and service sectors. This protection tends to implicitly tax agricultural producers. In extreme cases, removing agricultural protection in such countries (such as Morocco) can actually lower social welfare because the implicit tax imposed on agriculture by policies in other sectors actually increases when protection is taken from agriculture. Thus, in these countries, agriculture is not only distorted by the agricultural protection policies in high-income countries, but also by domestic manufacturing policies and distortions in service sector markets.

The negative effect of world agricultural policy reform on some other countries is mainly caused by a post-reform deterioration in their terms of trade (table 1-6). For example, Mexico depends on the U.S. economy for most of its agricultural imports and exports, while the United States is more dependent on Japan, Korea, and the EU as export markets. Japan, Korea, and the EU have high levels of agricultural support relative to other countries. When world agriculture and agricultural trade are fully liberalized, increased import demand from Japan, Korea, and the EU on U.S. agricultural goods causes U.S. export prices to rise, in turn causing Mexico to pay higher prices for post-reform U.S. imports. On the other hand, the North American

Table 1-6—Decomposition of terms of trade effects of global agricultural liberalization in the model—Percentage change in terms of trade from the base year

	EXP-1	EXP-2	EXP-3	EXP-4
Developed country group	**0.08**	**-0.02**	**0.03**	**0.06**
Australia and New Zealand	1.82	1.40	0.37	0.03
Canada	0.35	0.16	0.22	-0.02
EFTA	0.12	-0.27	-0.21	0.56
European Union	0.24	0.02	0.01	0.16
Japan and Korea	-1.36	-0.84	-0.32	-0.14
United States	0.86	0.54	0.29	0.00
Developing country group	**-0.15**	**0.03**	**-0.07**	**-0.11**
China	0.26	0.36	-0.04	-0.06
Latin American countries	1.41	1.10	0.32	-0.03
Mexico	-0.43	-0.20	-0.15	-0.07
Other Asian countries	0.00	-0.02	0.05	-0.04
Southern African countries	-0.35	0.13	-0.20	-0.22
Rest of the world	-0.98	-0.43	-0.28	-0.23

Experiment 1: Removing all agricultural supports and protections, worldwide
Experiment-2: Removing tariffs, worldwide
Experiment-3: Removing domestic supports in the developed countries
Experiment-4: Removing export subsidies, worldwide
Source: Economic Research Service, USDA.

Free Trade Agreement (NAFTA) lowered trade barriers between the United States and Mexico. When world trade is fully liberalized, the level of U.S. imports from Mexico may not rise to the level of imports from non-NAFTA countries because prior to reform, the United States imposed relatively high barriers on goods imported from non-NAFTA countries. Mexico, however, depends on U.S. imports, as trade with the United States accounts for more than 70 percent of Mexico's exports. This implies that the price Mexico receives for its exports cannot rise to the same degree as the rise in price it must pay for imports, which results in a deterioration in Mexico's terms of trade. Thus, some member countries of a trade bloc may experience a welfare loss because of post-reform declines in demand for goods they export to former member countries and rises in world demand for the goods they import.

These results also attest to the fact that policies that distort agriculture in developed countries increase world supplies of these goods and thus indirectly subsidize consumers in countries that are net agricultural importers. Agricultural policy reform increases the world prices of most agricultural goods — some more than others. Nevertheless, even in those low-income and net agricultural importing countries that experience a decline in their terms of trade, returns to their agricultural resources (land, labor, farm machinery, and buildings) are biased downward from what would otherwise prevail in a distortion-free economy. Consequently, their agricultural households, defined as those rural households that are net suppliers of agricultural goods, are likely to be made better off as the result of trade reform.

Removal of tariffs leads to global welfare gains, while lowering domestic support and export subsidies leads to welfare losses

Among the three policy categories, removing tariffs generates positive welfare gains at the world level of aggregation and for most countries and regions, while removing domestic support and export subsidies has negative effects for most developing countries (table 1-7). Holding other policy variables constant, removing tariffs results in a $25 billion welfare gain worldwide, $19.6 billion of which accrues to the developed countries and $5.7 billion to the developing countries. Removing domestic support or export subsidies results in a much smaller welfare gain worldwide, as export subsidy rates are much lower than the tariff rates in all countries/regions and the domestic support policies are mainly employed by the developed countries. The world aggregate welfare gain is $2.8 billion from the removal of domestic support and $250 million from the removal of export subsidies. Developed countries gain $4.7 billion from domestic support removal and $2.5 billion from export subsidy removal. Developing countries, however, experience welfare loss of $1.9 billion and $2.3 billion in the two scenarios, respectively.

Table 1-7—Decomposition of static welfare effects of global agricultural liberalization in the model

	EXP-1			*EXP-2*		
	US$ billion	% in total expenditure	% of agr. consumption	US$ billion	% in total expenditure	% of agr. consumption
World	**31.06**	**0.13**	**1.21**	**25.22**	**0.11**	**0.98**
Developed country group	**28.48**	**0.16**	**2.04**	**19.56**	**0.11**	**1.40**
Australia and New Zealand	1.57	0.44	4.46	1.17	0.33	3.33
Canada	0.75	0.15	2.01	0.40	0.08	1.07
EFTA	1.73	0.58	7.34	0.20	0.07	0.87
European Union	9.28	0.14	1.81	0.14	0.00	0.03
Japan and Korea	8.59	0.27	2.41	13.81	0.43	3.87
United States	6.57	0.10	1.51	3.83	0.06	0.88
Developing country group	**2.60**	**0.05**	**0.22**	**5.66**	**0.11**	**0.48**
China	0.42	0.07	0.20	0.85	0.13	0.42
Latin American countries	3.65	0.28	1.64	2.71	0.21	1.22
Mexico	-0.16	-0.06	-0.24	0.19	0.06	0.27
Other Asian countries	1.52	0.14	0.53	1.71	0.16	0.60
Southern African countries	0.25	0.09	0.30	0.60	0.21	0.72
Rest of the world	-3.07	-0.18	-0.97	-0.39	-0.02	-0.12

	EXP-3			*EXP-4*		
	US$ billion	% in total expenditure	% of agr. consumption	US$ billion	% in total expenditure	% of agr. consumption
World	**2.80**	**0.01**	**0.11**	**0.25**	**0.00**	**0.01**
Developed country group	**4.74**	**0.03**	**0.34**	**2.53**	**0.01**	**0.18**
Australia and New Zealand	0.24	0.07	0.69	0.01	0.00	0.03
Canada	0.28	0.06	0.76	-0.09	-0.02	-0.25
EFTA	0.83	0.28	3.54	0.32	0.11	1.37
European Union	6.06	0.09	1.18	3.72	0.06	0.73
Japan and Korea	-3.66	-0.11	-1.02	-1.34	-0.04	-0.38
United States	0.97	0.01	0.22	-0.09	0.00	-0.02
Developing country group	**-1.94**	**-0.04**	**-0.16**	**-2.28**	**-0.04**	**-0.19**
China	-0.28	-0.04	-0.14	-0.21	-0.03	-0.10
Latin American countries	0.68	0.05	0.31	-0.05	0.00	-0.03
Mexico	-0.27	-0.09	-0.41	-0.11	-0.04	-0.17
Other Asian countries	-0.09	-0.01	-0.03	-0.25	-0.02	-0.09
Southern African countries	-0.22	-0.07	-0.26	-0.22	-0.08	-0.26
Rest of the world	-1.76	-0.10	-0.56	-1.43	-0.08	-0.45

Experiment-1: Removing all agricultural supports and protections, worldwide
Experiment-2: Removing tariffs, worldwide
Experiment-3: Removing domestic supports in the developed countries
Experiment-4: Removing export subsidies, worldwide
Source: Economic Research Service, USDA.

Most developing countries/regions in the model (except for the Latin American countries) experience a welfare loss when domestic subsidies are removed in the developed countries or export subsidies are removed in the world. This outcome is due to the resulting rise in the world prices for grain and livestock products of which most developing countries are net importers (except for the region of Latin American countries which is a net exporter for the livestock products as well as for the aggregation of the primary agricultural products). Thus, for most developing countries/ regions, welfare measures tend to deteriorate due to the hike in world agricultural prices.

The region of Japan plus Korea experiences the largest welfare decline ($3.7 billion) in the world when the developed countries remove their domestic support, even though the domestic support rate in Japan and Korea on average is much lower than that in Canada,

the United States, and the EU.[5] This result occurs because Japan and Korea are net agricultural importers, and agricultural prices rise in the world because agricultural supply declines in the United States and the EU due to the removal of domestic support. If only the United States or the EU eliminates its domestic support to agriculture, the social welfare falls $2.1 billion in Japan and $0.55 billion in Korea, while if Japan plus Korea eliminate their domestic support only, their welfare falls by $0.66 billion.

Relatively large dynamic welfare gains — Brief overview of method and assumptions

The earlier analysis ignored the effect of reform on savings, investment, and the pattern of growth in a country's capital stock. To analyze these effects requires assumptions regarding households' willingness to forgo consumption and invest, the functioning of capital markets and international capital flows, as well as the technological spillovers that seem to accompany growth in countries' trade. These assumptions may be closely approximated for developed countries, and only poorly approximated for many developing countries. Nevertheless, for the most part, the analysis suggests a direction of change in the long run that seems well within the realm of reason.

Numerous studies find empirically strong and positive linkages between growth and a country's total factor productivity (TFP) and the share of its economy involved in trade with more advanced nations (e.g., Coe and Helpman, 1995; Wang and Xu, 1997; and Coe et al., 1997). Thus, a dynamic model is used to capture not only consumer saving and producer investment decisions but also the effects of trade liberalization on a country's growth in factor productivity. Such effects are modeled by increases in technological spillovers embodied in the trade between developing and developed countries. Specifically, if a developing country eliminates trade protection, it then tends to increase its rate of learning new skills, organizational methods, and the more advanced product and process technologies embodied in its imports of investment goods from developed countries. This process helps to increase labor productivity and returns to land and social capital (Grossman and Helpman, 1991; Romer, 1994). The spillovers of the advanced technology embodied in trade can also result from developed countries' reduction of agricultural protection. As developed countries increase imports of agricultural goods, their exports of capital goods may be enhanced. Thus, this longer-run type of analysis allows for agricultural trade reform to yield broader economywide benefits, which, as shown next, is found to be higher for developing countries.

This study calculates the change in the regional equivalent variation for three different years as well as the intertemporal welfare index that measures the welfare gains in this dynamic setting. Changes in equivalent variation for the three different years are compared with the base year, while the intertemporal welfare index is the sum of the welfare change over time where future gains and losses are discounted relative to current gains and losses. The over-time welfare effects of the liberalization vary, depending on whether technological spillover-growth considerations are included in the analysis. Thus, welfare changes are specified under the different assumptions and, hence, the technological spillovers and growth effect of the policy reform on welfare can be told from the differences in the two groups of results.

Relatively large dynamic welfare gains — Results

Without taking into account the technological spillover-growth effects of liberalization, (that is, by considering only the investment incentives created by reform) the over-time welfare effect is still modest, especially in the short run, for instance, in the first 5 years (table 1-8). As production and investment adjustments take time, the welfare effect in a longer time period, for example, in the 15th year or after, is relatively large. The world welfare gain in year 10 doubles the gain accrued in year 5. More simply stated, this result suggests that the payoff to agricultural trade policy reform takes time.

If the technological spillover-growth effect of policy reform is taken into account for developing countries, the over-time welfare gains increase significantly, especially in developing countries. The developing countries are beneficiaries of the technological spillovers embodied in trade with developed countries. Such benefits are assumed to generate an additional annual growth rate of 0.02 percent in the developing countries. This annual growth rate further increases welfare gains among the developing countries. Moreover, all the developing countries/regions in the model are better off after agricultural support and trade

[5] However, market barriers are very high (Japan and Korea).

Table 1-8—Dynamic welfare effects of global agricultural liberalization in the model

	Without TFP growth						
	Year 5		Year 10		Year 15		Intertemporal effect
	$ billion	*%*	*$ billion*	*%*	*$ billion*	*%*	*%*
World	**15.94**	**0.07**	**30.19**	**0.13**	**36.26**	**0.16**	
Developed country group	**14.69**	**0.08**	**25.66**	**0.14**	**29.74**	**0.17**	
Australia and New Zealand	3.26	0.91	3.34	0.93	3.40	0.94	0.45
Canada	1.05	0.21	1.17	0.24	1.24	0.25	0.07
EFTA	-0.27	-0.09	0.02	0.01	0.09	0.03	-0.03
European Union	3.35	0.05	6.68	0.10	8.15	0.12	0.03
Japan and Korea	-1.40	-0.04	3.86	0.12	5.10	0.16	0.00
United States	8.72	0.13	10.60	0.16	11.76	0.18	0.11
Developing country group	**1.25**	**0.02**	**4.52**	**0.09**	**6.52**	**0.12**	
China	1.24	0.20	1.68	0.26	1.83	0.29	0.11
Latin America	3.94	0.30	4.27	0.33	4.66	0.36	0.16
Mexico	-0.40	-0.14	-0.22	-0.07	0.09	0.03	-0.04
Other Asian countries	-0.70	-0.06	0.54	0.05	0.93	0.09	-0.02
Southern African countries	0.16	0.06	0.33	0.11	0.50	0.17	0.05
Rest of the world	-3.00	-0.17	-2.07	-0.12	-1.49	-0.08	-0.18
	With TFP growth						
	Year 5		Year 10		Year 15		Intertemporal effect
	$ billion	*%*	*$ billion*	*%*	*$ billion*	*%*	*%*
World	**27.17**	**0.12**	**46.98**	**0.20**	**56.39**	**0.24**	
Developed country group	**17.00**	**0.10**	**29.59**	**0.17**	**35.14**	**0.20**	
Australia and New Zealand	3.32	0.92	3.43	0.95	3.52	0.98	0.46
Canada	1.13	0.23	1.27	0.26	1.37	0.28	0.07
EFTA	-0.18	-0.06	0.12	0.04	0.21	0.07	0.00
European Union	4.41	0.07	8.48	0.13	10.58	0.16	0.04
Japan and Korea	-0.85	-0.03	4.70	0.15	6.17	0.19	0.00
United States	9.18	0.14	11.59	0.17	13.30	0.20	0.12
Developing country group	**10.16**	**0.19**	**17.39**	**0.33**	**21.25**	**0.40**	
China	1.48	0.23	2.02	0.32	2.23	0.35	0.14
Latin America	4.62	0.35	5.36	0.41	6.11	0.47	0.19
Mexico	0.53	0.18	0.99	0.33	1.60	0.54	0.14
Other Asian countries	2.10	0.19	4.47	0.41	5.11	0.47	0.13
Southern African countries	0.35	0.12	0.59	0.20	0.81	0.28	0.08
Rest of the world	1.07	0.06	3.97	0.26	5.39	0.32	0.00

Source: Economic Research Service, USDA.

protection are totally removed worldwide, and the greater the volume of trade between developed and developing countries, the larger the welfare gain.

The developed countries benefit indirectly from the growth in productivity in the developing countries, even though the developed countries are presumed not to experience technological spillovers from an increase in trade and, hence, experience no additional productivity growth generated from trade liberalization. This benefit results from the growth in the returns to increased capital flows from developed to developing countries, induced by the increased investment demand of the developing countries, as most of the developing countries do not have sufficient domestic savings to fully finance their growth in investment demand. This growth in investment demand creates opportunities for the developed countries to invest abroad, either through international lending activities or foreign direct investment in the developing countries. These indirect effects generated from the growing demand for foreign capital inflows to the developing countries tend to be stronger if the economic adjustments in the developing countries due to agricultural trade policy reform in the world are expected to be larger.

Conclusions

This study focuses on the global perspectives of total reform in protection and subsidies, a process began by the URAA Final Act (1994), and analyzes the case of total reform of three disciplines: tariffs, domestic support, and export subsidies. The study finds that freer trade results in more trade (i.e., eliminating most agricultural support and trade protection increases world agricultural trade substantially). World agricultural production, however, increases only marginally, while the developed countries, as a group, experience the largest decrease in production. As agricultural support and protection rates are higher in most developed countries than in the developing countries, and as the developed countries are major players in world agricultural trade, developed countries appear to benefit more from agricultural trade policy reform than developing countries.

Nevertheless, worldwide agricultural liberalization would cause world prices to rise almost 12 percent. Of the three categories — tariffs, domestic support, and export subsidies—the results suggest that tariffs are the major cause of distortions in world agricultural prices. The elimination, worldwide, of import tariffs would cause world agricultural prices to rise about 6 percent.

Within the developed country group, the major contributors to distorted world agricultural prices are the EU, the United States, and Japan plus Korea. Consequently, these countries experience the largest social payoff from reform relative to the rest of the world, especially compared to the developing countries. As the protection levels and trade patterns vary among countries, some developing countries experience larger increases in the prices for imported goods than the increases in the prices for their exports. Such negative terms of trade effect may cause these developing countries to experience welfare losses. Furthermore, some member countries of a trade bloc may experience a welfare loss because they may suffer a post-reform decline in demand for the goods they export to former member countries, while world demand for the goods they import rises.

The study also finds that the payoff to reform takes time. Over time, worldwide agricultural liberalization generates larger gains than the short-time gains for most countries. For example, the discounted present value of world welfare gains in year 10 doubles the gain accrued in year 5. Moreover, if the technological spillover-growth effect of reform is taken into account, the welfare gains increase significantly for all countries in the world. While the developing countries are beneficiaries of the technological spillover embodied in trade with the developed countries, the results suggest that developed countries benefit indirectly from the growth in productivity in the developing countries. This benefit results from the growth in the returns to increased capital flows from developed to developing countries, induced by the increased investment demand of the developing countries.

References

Coe, D.T., and E. Helpman (1995). "International R&D Spillovers," *European Economic Review*. 39: 859-887.

Coe, D.T., E. Helpman, and A.W. Hoffmaister (1997). "North-South R&D Spillovers," *The Economic Journal*. 107: 134-149.

Grossman, G., and E. Helpman (1991). *Innovation and Growth in the Global Economy*: MIT Press.

McDougall, R., A. Elbehri, and T. Truong (1998). *Global Trade, Assistance, and Protection: The GTAP 4 Data Base*. Center for Global Trade Analysis, Purdue University. West Lafayette, IN.

Romer, P.M. (1994). "The Origins of Endogenous Growth," *Journal of Economic Perspectives*. 8(1): 3-22.

Varian, Hal R. (1984). *Microeconomic Analysis*, Second Edition. W.W. Norton & Company.

Wang, J., and B. Xu. (1997). "Trade, FDI, and R&D Spillovers in the OECD," University of Florida. Unpublished.

Environmental Issues in a Trade Context

R. Wesley Nimon and Mark E. Smith

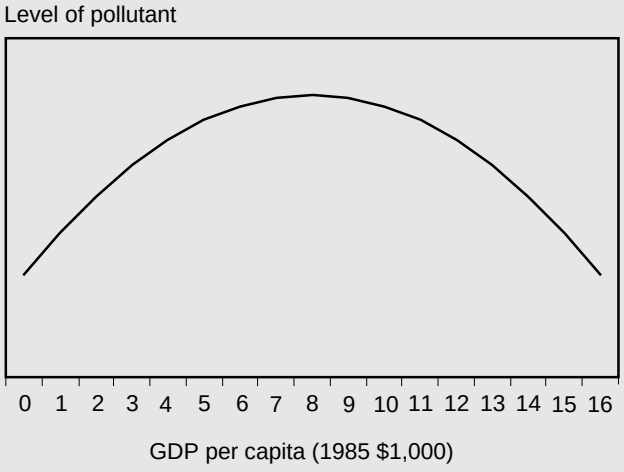
As trade and investment become increasingly globalized, conflicts between trade matters and environmental concerns gain in prominence. Economic efficiency occurs when trade distortions are eliminated and externalities are internalized. Multilateral trade negotiations seek to reduce trade distortions that may hinder economically efficient levels of production and consumption in world markets, and thus stimulate economic growth. Environmental policies attempt to internalize externalities and protect environmental goods and services (e.g., clean air, wetland water quality functions) for which there may not be readily observable market values. WTO trade rules may infringe on environmental policies, and likewise environmental policies may conflict with WTO trade rules. For example, the United States imposed a ban on imports of shrimp caught without turtle exclusion devices. Because some countries were given technical assistance and longer transition periods to alter their production technology than other countries, the WTO dispute settlement panel found this environmental regulation violated the United States' WTO obligations. The inherent tension between trade and environmental objectives raises two related issues: (1) to what extent does trade liberalization help or harm the environment, and (2) if harm results, what can be done to allow domestic environmental laws to satisfy national preferences for environmental protection without violating the country's WTO obligations?

The environmental effects of trade are commonly grouped into three categories — a "scale effect," a "technique effect," and a "composition effect." Greater economic growth, stimulated by greater trade, has the potential to harm the environment through a greater scale of resource use (Beghin and Potier, 1997). In other words, increased output may generate additional pollution and accelerate natural resource depletion. On the other hand, trade liberalization also has the potential to improve environmental outcomes through a technique effect (i.e., how goods are produced). For example, foreign direct investment may facilitate the diffusion of green technologies when advanced production techniques are transferred to LDCs. Similarly, trade liberalization may impact the environment through a composition effect (i.e., what goods are produced) (Farrentino and Linkins, 1999). For example, phasing out tariffs on textiles under the Multi-Fibre Agreement, as is scheduled under the Uruguay Round, may induce LDCs to shift production from heavy industries to less pollution-intensive textiles. This end result would tend to lower emissions in LDCs but the scale effect may more than offset these gains for five pollutants studied (Cole, Rayner, and Bates, 1998). For any given sector or pollutant, however, *a priori*, the net environmental impact of these short-run effects is ambiguous.

In the long run, the effect of economic growth on the environment, trade induced or not, follows a predictable pattern. The environmental Kuznets curve (EKC) reflects the hypothesis that as incomes rise from an initially low level, polluting emissions are likely to increase, but eventually, as incomes continue to rise, polluting emissions tend to decrease. In other words, the scale or negative composition and technique effects may dominate until incomes rise to the point where an increased demand for environmental amenities causes the positive technique and composition effects to dominate. Strengthened regulations and/or enforcement usually accomplish this change. Though the exact shape of the EKC varies by pollutant, most pollutants' mean air and water concentrations begin to decline before per capita incomes reach $8,000 (approximately that of South Korea) (Grossman and Krueger, 1995). Other studies, however, show quite a range of turning points, again varying by pollutant (e.g., Nordstrom and Vaughan, 1999). Per capita income clearly affects a nation's preferences for environmental regulations and these differences create the potential for conflict as countries strive to achieve divergent environmental goals while meeting their WTO obligations.

Voicing concerns over the effects of trade liberalization on the environment, 14 U.S. environmental organizations, including the Sierra Club, the World Wildlife Fund, and Greenpeace USA, presented the U.S. Trade Representative's Office with suggestions for the U.S. position in future WTO negotiations (Downs, 1999). In general, the groups' proposal opposes further trade liberalization, especially in sensitive sectors such as forest and fish products. Also, the organizations insist that environ-

Stylized Environmental Kuznets Curve



mental impacts of proposed trade liberalization should be assessed on a global basis, and if environmentally and socially beneficial outcomes are not anticipated, then the assessment must propose institutional, legal, and policy changes before trade negotiations may proceed. These environmental organizations call for reform of WTO rules and procedures, specifically for increased public input into more transparent decision-making processes.

The Declaration of Principles on Trade and Environment issued by the Office of the U.S. Trade Representative encapsulated the U.S. position. To promote sustainable development the United States will pursue trade negotiations through the following actions:

- Taking fully into account environmental implications throughout the course of the negotiations, including by performing a written environmental review.
- Promoting institutional reforms to ensure that the WTO and its processes, notably dispute settlement, are transparent and that the public may contribute to its work.
- Strengthening cooperation between the WTO and international organizations with respect to environmental matters.
- Identifying and pursuing "win-win" opportunities where opening markets and reducing or eliminating subsidies hold promise for yielding direct environmental benefits.
- Complementing U.S. trade policies with policies that provide for high levels of environmental protection and effective enforcement of U.S. laws.
- Ensuring that trade rules are supportive of and do not undermine the Nation's ability to maintain and enforce fully its environmental laws.
- Ensuring the appropriate inclusion on U.S. trade negotiation teams of environmental, health and safety officials, and encouraging U.S. trading partners to do likewise (USTR).

Coordination between trade and environmental strategies offers policymakers a means to garner the economic efficiency gains of trade liberalization while minimizing environmental degradation. A study of Mexican agriculture (Beghin, Roland-Holst, and van der Mensbrugghe, 1997) shows that trade liberalization alone may increase emissions of some pollutants but that if combined with domestic effluent taxes, these increases are greatly mitigated. Indeed, with this coordinated approach, a "win-win" result emerges in many sectors as pollution decreases while GDP increases from improved allocative efficiency. This coordination between trade and environmental policies "recognizes the fact that most environmental problems originate in production and consumption, but rarely in trade per se" (Beghin and Potier, 1997). Nonetheless, since trade may exacerbate domestic environmental externalities, anticipating those sources of environmental stress in order to internalize them with domestic policy instruments maximizes the net welfare gains from trade liberalization. The optimal policy instruments and stringency of environmental regulations, however, should be expected to vary across countries with different per capita incomes and initial environmental conditions. Reconciling WTO obligations with divergent national preferences for environmental protection poses substantial challenges for future trade negotiations.

References

Beghin, J., and M. Potier. "Effects of Trade Liberalisation on the Environment in the Manufacturing Sector." *The World Economy* (1997): 435-56.

Beghin, J., S. Dessus, D. Roland-Holst, and D. van der Mensbrugghe. "The Trade and Environment Nexus in Mexican Agriculture. A General Equilibrium Analysis." *Agricultural Economics* (1997): 115-131.

Cole, M., A. Rayner, and J. Bates. "Trade Liberalisation and the Environment: The Case of the Uruguay Round." *The World Economy*. (1998): 337-347.

Downs, D. Correspondence to Deputy U.S. Trade Representative Susan Esserman and Acting Deputy EPA Administrator Peter Robertson. July 16, 1999. Accessed at: www.sierraclub.org/trade/summit/letter.asp.

Farrantino, M. and L. Linkins. "The Effect of Global Trade Liberalization on Toxic Emissions in Industry." *Weltwirtschaftliches Archiv (Review of World Economics)* (1999): 128.

Grossman, G. and A. Krueger. "Economic Growth and The Environment." *The Quarterly Journal of Economics*. (1995): 353-77.

Nordstrom, H., and S. Vaughan. *Trade and Environment*. Special Studies 4. Geneva: World Trade Organization, 1999.

Office of the U.S. Trade Representative. "Declaration of Principles on Trade and Environment." November 1999. Accessed at: www.ustr.gov/environment/finpol.pdf.

WTO. "Communication from the Commission on the Precautionary Principle." Communication received by the WTO from the European Communities on March 8, 2000. G/SPS/GEN/168.

Options for Reducing Agricultural Tariffs

John Wainio, Paul Gibson, and Daniel Whitley

If past trade rounds are any indication, a topic of considerable debate during the next negotiations will be determining the nature of tariff cuts to be implemented. In initial negotiating proposals submitted to the WTO, countries have demonstrated a desire to reduce both the level and disparity of agricultural tariffs, as well as to confront the issue of tariff escalation. This study indicates that alternative tariff-cutting formulas address these objectives with varying results, depending on the initial height and distribution of a country's tariff schedule. Ranking formulas based on their ability to produce desired objectives can be difficult, since it depends on the criteria used to evaluate the outcomes. The conclusions reached here point to the need for negotiators to have detailed information on the tariffs their exports face in major markets, the post-liberalization tariff profiles they seek, and how close alternative formulas come to producing desired results.

Introduction

During the Uruguay Round of the General Agreement on Tariffs and Trade (GATT), the negotiating parties agreed to convert their agricultural nontariff barriers (NTB) to bound tariffs,[1] a process known as tariffication. The conversion of NTBs (which include embargoes, import quotas, and discretionary import licensing) to bound tariffs was a key achievement of the Uruguay Round Agreement on Agriculture (URAA). Since tariffs are more predictable and transparent in their application and do not establish maximum ceilings on imports, they are less trade-distorting than NTBs.

Developed countries agreed to reduce all agricultural tariffs, including those resulting from tariffication, from their base-period rates[2] by a total of 36 percent, on a simple-average basis, with a minimum cut of 15 percent for each tariff. The cuts were to take place in equal installments over 6 years, beginning with the first cut in 1995.[3] Countries were also to provide a minimum level of import opportunities for products previously protected by NTBs. This was accomplished by creating tariff-rate quotas (TRQ), which impose a relatively low in-quota tariff on imports up to a minimum access level, with imports above that level subject to a higher, over-quota tariff.

As a result of tariffication, tariffs and TRQs are now the main trade policy instruments used by governments to protect their domestic agricultural producers from foreign competition. But while the URAA began the process of liberalizing agricultural trade by reducing tariffs, protection for agricultural commodities continues to stand out as a major distorting feature of international trade. For manufactured goods, the industrial countries' import-weighted average tariff has been reduced from about 40 percent to under 4 percent since 1949 (Laird). For agricultural goods, in contrast, the simple average for industrial countries' post-Uruguay Round bound tariffs is estimated in this study to be 45 percent.[4] Clearly, substantial room exists for liberalizing agricultural tariffs, which are a highly visible and easily negotiable target for reductions (compared with NTBs) because of their generally transparent and quantifiable nature.

Among the main items in the next round of trade negotiations will be the manner and extent to which agri-

[1] Tariffs are considered legally "bound" within GATT/WTO when a country agrees not to raise them above a certain level, subject to a penalty.

[2] For tariffs that were already bound, the base was the current bound rate; for existing but unbound tariffs, the base was the 1986 tariff rate; and for duties that resulted from tariffication of NTBs, the base was the level of protection provided by NTBs during the 1986-88 period.

[3] Developing countries agreed to reduce their previously bound tariffs by 24 percent (with a 10 percent minimum cut) in equal installments over 10 years. For previously unbound tariffs only a ceiling binding was required, recognizing that the binding of these tariffs against increase was a concession equivalent to reducing them. Least developed countries were subject to tariffication and binding, but exempt from all reduction commitments.

[4] Using a slightly different methodology, Gibson et al. estimate the simple global average of post-Uruguay Round agricultural tariffs at 62 percent.

cultural tariffs will be reduced. Many have suggested that to achieve cuts in agricultural tariffs large enough to have significant trade liberalizing effects, countries should consider reducing tariffs on a formula basis (Josling, Tangermann, Anderson, et al.). In particular, there has been a considerable interest expressed in the Swiss formula, which was adopted during the Tokyo Round of trade negotiations to reduce tariffs on manufactured items. The objective here is threefold:

- to review some features of the main tariff-cutting formulas proposed in past rounds and summarize the key issues to consider when evaluating alternative formulas;
- to describe the tariff structures existing in the industrial countries, now that the Uruguay Round implementation period for these countries has drawn to a close and the last of the tariff cuts have been phased in;
- to apply standard examples of formulas to the post-Uruguay Round bound agricultural tariffs of industrial countries and illustrate how the formulas might alter the structure of tariff schedules.

Tariff-Cutting Formulas

Prior to the Kennedy Round (1963-67), tariff negotiations consisted of countries drawing up request-and-offer lists containing the tariffs they proposed that other countries reduce and/or bind as well as the concessions they were willing to make in exchange. Negotiations proceeded on a country-by-country and item-by-item basis, focusing on those items where one country was the principal import supplier of the other.

During the Kennedy Round, negotiators took a radically different approach by adopting a simple yet powerful formula to cut industrial tariffs across the board by 50 percent. One argument for a linear cut was that if all countries cut all tariffs by a fixed percent, then each would give and receive the same concession on total exports and imports, thus ensuring reciprocity in negotiations.[5]

During the Tokyo Round (1973-79), the United States proposed that tariffs be cut across the board by 60 percent. The European Economic Community (EEC), which had a fairly uniform set of moderate tariff rates across all industrial products, contended that a linear cut would not yield the reciprocity that all participants sought. Restating an argument it had made during the Kennedy Round, the EEC maintained that it would benefit less from equal, across-the-board tariff cuts than would countries with a high degree of dispersion in their tariff schedules (i.e., moderate tariff averages that were not uniform but that instead combined primarily low tariffs with occasional very high rates, or tariff peaks). The EEC argued that moderate rates, if reduced by 60 percent, would lose much of their protective effect, while high, prohibitive tariffs could remain very protective, leading to little or no trade liberalization for items subject to high rates. The EEC proposed to cut high tariffs proportionately more than low tariffs in order to reduce tariff disparity within countries' tariff schedules, contending that the greater the dispersion, the higher the level of economic and trade distortion.[6]

Two other principal participants in the negotiations, Japan and Canada, also proposed tariff-cutting formulas, and considerable time was spent debating the choice of formula. In the end, negotiators agreed to a comprehensive "harmonization" formula proposed by Switzerland, designed to result in a fairly deep overall reduction in tariffs while cutting high rates proportionately more than low ones.

The formulas analyzed here are extensions and combinations of the various approaches discussed during the Tokyo Round for cutting tariffs on manufactured goods. These formulas are intended to span the various classes of tariff-cutting formulas, which can be categorized as (1) strictly linear cuts; (2) harmonization formulas designed to cut high tariffs proportionately more than low tariffs; (3) formulas which combine linear cuts and some sort of harmonization element; (4) formulas with special treatment of tariffs below or above a certain level; and (5) "sectoral" formulas which place

[5] While the preamble to the General Agreement on Tariffs and Trade calls on members to enter into "reciprocal and mutually advantageous arrangements directed to the substantial reduction of tariffs," nowhere in the Agreement is there a definition of reciprocal or reciprocity. A number of studies cited here tie reciprocity to the pervasive belief that every dollar increase in imports should be balanced with a dollar increase in exports. Reducing one's trade barriers has traditionally been considered a concession that has to be compensated by equivalent concessions from other countries, a tenet that continues to influence today's negotiations.

[6] While a uniform tariff schedule is generally considered less distorting than one with high dispersion, the level of distortion caused by tariffs also depends on items such as relative size of import demand elasticities across commodities and the presence of economies of scale and imperfect competition. For a discussion on how factors such as these can impact the argument for uniform tariffs, see Panagariya and Rodrik.

a ceiling on tariffs based on a measure such as the global minimum or global mean for the product(s) in question.[7] The formulas used here have been modified to reflect that agricultural tariffs today are much higher than industrial tariffs were at the time of the Tokyo Round.[8]

Table 2-1 contains the four tariff-cutting formulas evaluated in this study. Formulas 1 and 2 are a variant of a harmonization formula, in that the depth of cut for the highest tariffs is generally larger than for smaller tariffs, with some exceptions. Formulas 3 and 4 are strictly harmonization formulas with the depth of cut being always larger the higher the initial tariff. All of the formulas incorporate a tariff ceiling to which all higher tariffs would have to be reduced, although the height of the ceiling differs by formula.[9] Thus each formula is designed to eliminate the megatariffs (tariffs over 100 percent) frequently found in each country's schedule.

Formula 1 is comprised of a linear component and special treatment for low and high duties. It eliminates all tariffs less than or equal to 5 percent, a concept adapted from one of the formulas submitted by Canada during the Tokyo Round, designed to eliminate low rates, sometimes referred to as "nuisance" tariffs (Laird and Yeats). It cuts all tariffs greater than 5 but less than or equal to 100 percent by half, replicating the 50-percent linear cut of the Kennedy Round. Finally, all tariffs over 100 percent are collapsed to 50 percent, thus incorporating a harmonization element in the formula.

Formula 2 combines a linear cut with a harmonization term, which reduces tariffs above 5 percent by a slightly deeper 60 percent compared with formula 1, but then adds a flat rate of 3 percent to the resulting calculation. For tariffs less than or equal to 5 percent, there is no cut; otherwise the 3-percent addition would result in a tariff above the initial rate. This tariff-cutting formula is similar to one proposed by Japan during the Tokyo Round. Japan believed that initial tariffs under 5 percent were already at satisfactorily low levels, so needed no further reduction. The effect of this formula was to cut low tariffs by small amounts, while subjecting high tariffs to essentially a linear cut of close to 60 percent. At an initial tariff of 105 percent, the calculation yields a new tariff of 45 percent, which is equal to the estimated mean of post-Uruguay Round agricultural tariffs for industrial countries. The Japanese formula is revised to include a ceiling of 45 percent for all tariffs initially above 105 percent. Thus, the ceiling in formula 2 is 5 percentage points lower than in formula 1, and assures that no new tariffs will exceed the simple agricultural tariff mean for industrial countries existing today.

Formula 3 is the compromise Swiss formula, which automatically includes a tariff ceiling equal to the parameter (a). An agreement to use this formula would also require negotiators to agree on the size of (a).

[7] The zero-for-zero tariff reduction approach is an example of a sectoral formula with a zero-tariff ceiling. This approach has resulted in elimination of certain countries' tariffs on pharmaceutical products; agricultural, medical and construction equipment; steel; furniture; beer; distilled spirits; toys; and paper (OECD, 1998a).

[8] Note that while the various formulas countries submitted for discussion during the Tokyo Round may have contained elements that were in the national interest when it came to cutting industrial tariffs, it is highly unlikely that these countries would submit the same formulas for cutting agricultural tariffs.

[9] This approach is discussed in Josling (1998).

Table 2-1—Tariff-cutting formulas

Formula number	Description	Mathematical expression
1	Sliding scale	If $t_0 \leq 5$ %, $t_1 = 0$; if t0 > 100 %, t1 = 50%; otherwise, t1 = t0 * (0.5)
2	Linear/harmonization term	If $t_0 \leq 5$ %, $t_1 = t_0$; if $t_0 > 105$ %, t1 = 45%; otherwise $t_1 = t_0 * (0.4) + 3$ %;
3	Swiss formula	$t_1 = (a \times t_0) / (a + t_0)$; a is a parameter = 45
4	Harmonization/low ceiling	If $t_0 \leq 50$ %, $t_1 = t_0 (1 - t_0)$; otherwise, $t_1 = 25$%

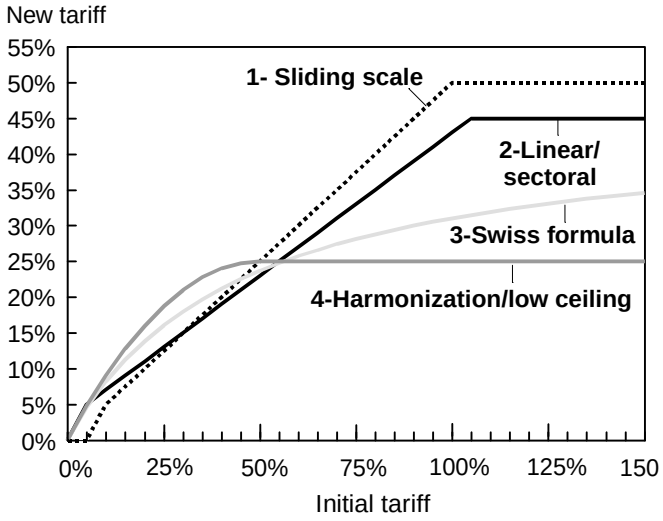
During the Tokyo Round it was proposed that this parameter be equal to 16, meaning that all industrial tariffs initially above 16 percent would be reduced to below that level. At the time of the Tokyo Round negotiations, the average of tariffs on dutiable nonagricultural imports for the industrial countries was estimated at 10.7 percent (Cline et al.), so a value for (a) equal to 16 was a reasonable choice. Because agricultural tariffs today are much higher than nonagricultural ones were during the Tokyo Round, this parameter is set here at 45, ensuring, as in formula 2, that no new tariffs will be above the industrial countries' post-Uruguay Round average. In this case, however, the ceiling is more restrictive since it is approached gradually (note in figure 2-1 that an initial tariff of 125 percent would be cut to 33 percent).

Formula 4 is based loosely on one of the harmonization formulas proposed by the EEC during the Tokyo Round, with the percentage cut in the tariff equal to the tariff itself. An initial rate of 40 percent would be cut by 40 percent, yielding a new tariff of 24 percent. Note that this formula works only for tariffs equal to or less than 50 percent. Above this level, the formula can yield rates that are significantly below those calculated for tariffs below 50 percent. As an example, consider an initial tariff of 80 percent. The formula would generate a new rate of 16 percent, which is below the above calculation for an initial 40-percent tariff. As a result, for tariffs above 50 percent, formula 4 generates the same rate that would result from cutting a 50-percent tariff. The effect is to leave low tariffs virtually untouched, while imposing a very low ceiling (25 percent) on high tariffs.

Figure 2-1 depicts the depth of cut associated with each formula, with the initial tariff shown on the x-axis and the new tariff on the y-axis. Formula 1 is the most trade-liberalizing for products subject to low tariffs, but contains the highest tariff ceiling, while formula 4 is the most trade-liberalizing for products subject to high tariffs, but tends to cut low tariffs by the least amount. In general, as we move from formula 1 to formula 4, the lower the formula number, the greater the cut to lower tariffs, while the higher the formula number, the greater the cut to higher tariffs.

There are numerous criteria that can be used when evaluating the impact of a formula on a country's tariff structure. The extent to which tariffs are reduced by the formula is perhaps the most important criteria.

Figure 2-1
Comparing the effects of alternative tariff-cutting formulas



Source: Economic Research Service, USDA

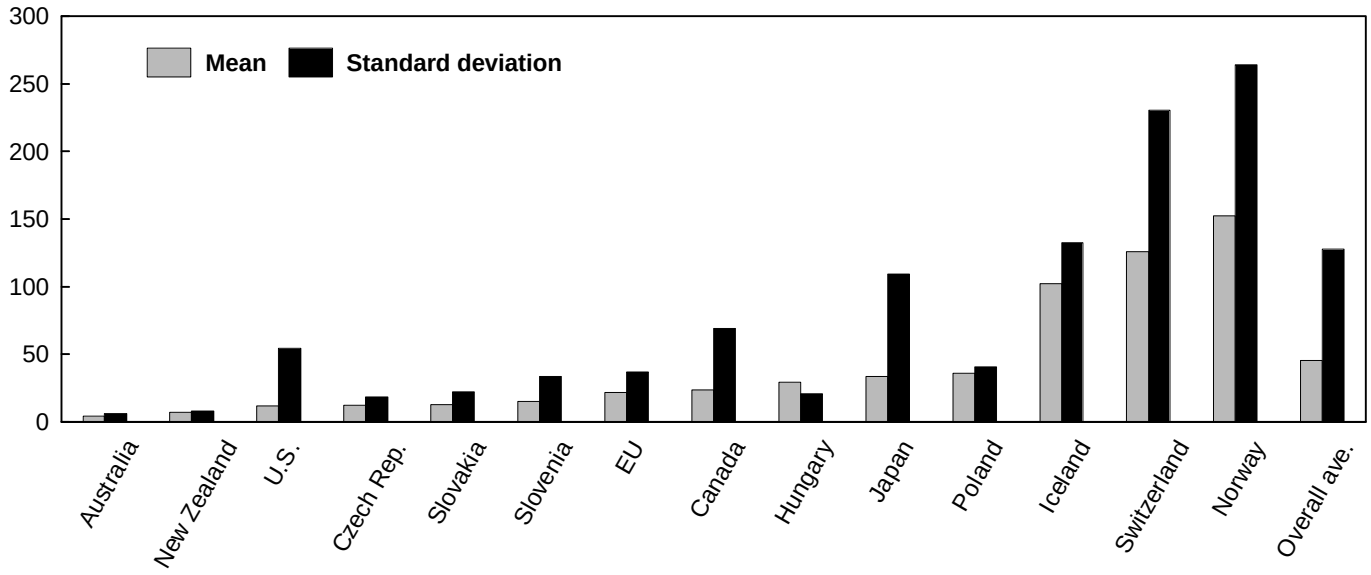
Because the economic and trade distortions associated with a country's tariff structure depend not only on the average size of its tariffs, but also on the distribution of tariffs across products, the level of dispersion is another criteria often used. Closely related to tariff dispersion within countries is the problem of tariff escalation, which refers to the situation where tariffs are low or zero on primary products, then increase or escalate as the product undergoes additional processing. Since tariff escalation can result in significant bias against trade of processed products, the ability of a formula to reduce escalation is also an important criterion. The next section presents tariff profiles for industrial countries' post-Uruguay Round bound agricultural tariffs, and serves as a useful point of departure and standard of comparison for the formula-generated tariffs presented later.

Post-Uruguay Round Agricultural Tariffs

The means and standard deviations found in figure 2-2 provide one backdrop against which to evaluate each of the four tariff-cutting formulas.[10] The means represent the simple, unweighted average of all bound agricultural tariffs in each country's schedule, with the notable exception of the in-quota tariffs associated with tariff-rate quotas. The URAA did not require that

[10] Please refer to the technical appendix, page 56, for a discussion of the biases associated with alternative methods of calculating tariff means.

Figure 2-2
Post-Uruguay Round tariff means and standard deviations



Source: Economic Research Service, USDA

reductions be made in these tariffs, only that they be set at a "low or minimal." While no numerical rule defined "low or minimal," the size of some in-quota rates suggests a need to negotiate some disciplines on these tariffs as well. However, we have chosen not to include them in this exercise.

The most striking characteristic of the tariff means is the broad range of average protection across countries. The means range from lows of below 10 percent for Australia and New Zealand to above 100 percent for three members of the European Free Trade Association (EFTA) — Norway, Switzerland, and Iceland. While we would caution against interpreting these means as indicative of the overall restrictiveness of a country's trade policy, clearly the EFTA countries apply tariff protection of a different magnitude than the others. Their agricultural tariffs are so high that they raise the overall industrial country mean to a level above that of all the other countries. The U.S. mean, at 11.9 percent, is the third lowest among these individual countries, followed by three Central and Eastern European (CEE) countries, each of which is in line for membership into the European Union (EU). The relatively low tariff means of these three countries implies that some alternative market access compensation may have to be offered when they join the EU and assume the generally higher tariffs found in the EU schedule. The EU and Canada have tariff means of 21.4 and 23.7, placing them in the middle of the ranking. Two other prospective EU members, Hungary and Poland, currently have tariff means higher than the EU. Finally, Japan, one of the world's largest agricultural importers, has a mean tariff of 33.4, among the highest of the countries being examined in this study.

Based on the standard deviations (SD) in figure 2-2, it is clear that a significant degree of tariff dispersion[11] characterizes the tariff schedules of almost all of these countries. At the highest and lowest levels, the SDs follow the pattern of the means, with Norway, Switzerland, and Iceland combining very high means with very high SDs, while Australia and New Zealand have both the lowest means and SDs. The United States, on the other hand, has one of the lowest means, but a high rate of dispersion across agricultural tariffs, as measured by the SD. Six of the countries have means higher than the United States, but have SDs that are lower.[12] Hungary, which has a fairly high mean, has one of the lowest levels of tariff dispersion.

[11] We use the term significant, not in the statistical sense, but rather because, with the exception of Hungary, all of the countries have a standard deviation that is greater than the mean. See the technical appendix for a discussion of what this implies.

[12] A comparison of the coefficients of variation (CV), which measure relative dispersion across countries by dividing the SD by the country mean, shows that the United States has the highest CV within this group.

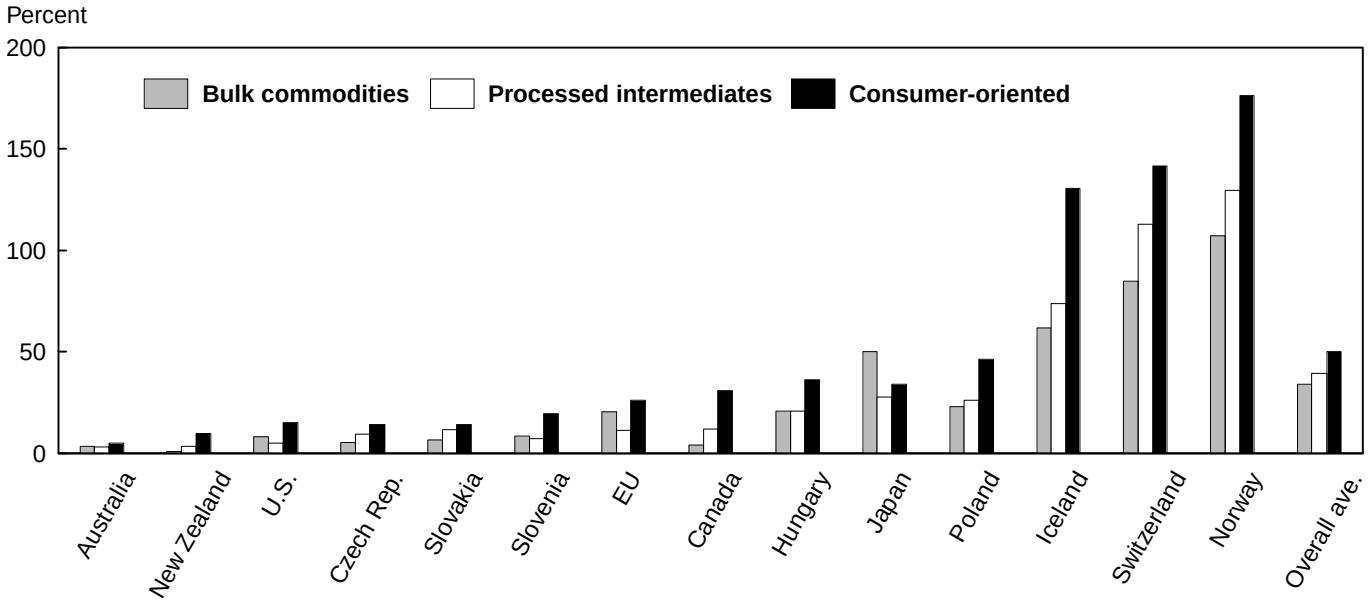
With regard to tariff escalation, the issue is addressed at an aggregate level by identifying the appropriate stage of processing for all tariffs, according to the USDA BICO categories.[13] Figure 2-3, which displays tariff means by BICO category, gives a rough indication of the extent to which escalation of tariffs along the processing chain exists in each country. When averaged over the group, the means demonstrate that modest escalation exists between the bulk level, 34.1, and the processed intermediates level, 37.9. For consumer-ready products, however, the mean jumps to 50.9. This observed tariff pattern, and the amplifying rates of protection it insinuates, has negative implications for processing raw materials in the country where they are produced. When tariffs on products escalate with the stage of processing, the effective rate of protection, or the tariff expressed as fractions of value-added after deducting intermediate inputs from the product value, also increases. In addition, there is ample evidence that demand import elasticities tend to increase as commodities undergo additional processing, thus increasing the trade restrictiveness of the tariff (Yeats).

[13] The BICO classifies agricultural products moving into world markets as bulk, processed intermediate, or consumer-oriented products. More information on the BICO is available at: http://www.fas.usda.gov/reports/bico/about.htm.

Looking at individual countries, there are signs of tariff escalation in some, while in others there is evidence of tariff de-escalation. With the exception of Japan, all countries have an overall mean for consumer-ready items higher than those for bulk and semi-processed items. In terms of percentage points, the escalation in average protection levels between bulk and consumer-ready products is most pronounced in the EFTA countries. Mean tariffs in each of these countries jump by over 60 percentage points as items undergo additional processing. In terms of relative magnitudes, New Zealand demonstrates the highest tariff escalation, with tariffs on consumer-ready items averaging over 12 times those of bulk commodities. Even though New Zealand's tariff on consumer-ready items is relatively small, the effective rate of protection for products in this category could be much higher than would be expected on the basis of the product's nominal tariff, given the even lower tariffs on raw materials.

In several countries, including the EU, Japan, and the United States, the mean tariff on bulk commodities is higher than on semi-processed products. Other studies of tariff escalation suggest that tariff de-escalation is particularly common in the case of multiple outputs (Lindland). Thus, while a tariff on vegetable oil might be higher than that on the raw material (the oilseed), the joint output (in this case, the oilmeal) may have a

Figure 2-3
Mean tariffs by BICO category[1]



[1]BICO refers to the USDA method of classifying traded agricultural products as bulk, processed intermediate, or consumer-oriented.
Source: Economic Research Service, USDA

lower tariff than the raw material. This is especially true when the processed import is itself an input. In agriculture, a pattern of tariff de-escalation might also be partially explained by the level of support provided by farm programs, which, to be effective, might require high border protection on primary products. The results suggest that even though there might be an indication of tariff escalation at an aggregate level, additional work is needed to identify the extent of escalation within individual agricultural processing chains.

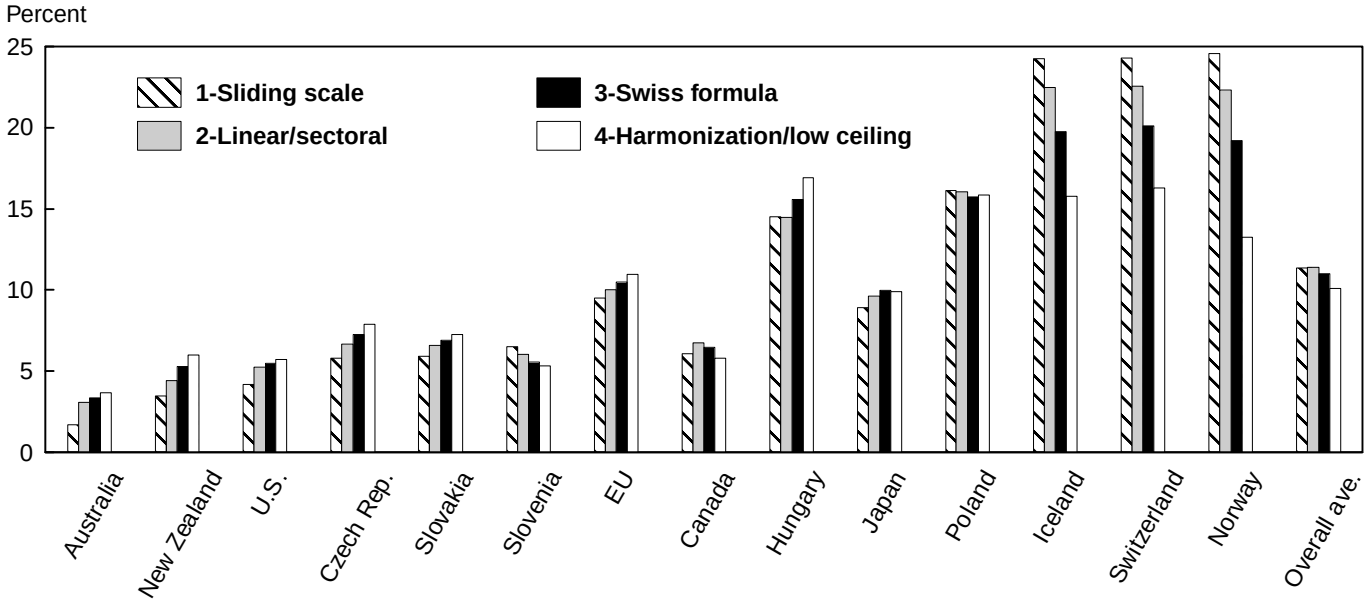
Overall, it is clear that, despite the many positive benefits of tariffication — most significantly that global agricultural protection is now predominantly tariff-based — many agricultural tariffs were set at extremely high levels in the Uruguay Round. In addition to being much higher on average than industrial tariffs, agricultural tariffs are also highly uneven across countries and commodities. The reductions in industrial tariffs seen in eight previous rounds of multilateral trade negotiations have only begun for agricultural tariffs. The following section examines alternative ways to begin reducing agricultural tariffs to levels that approach those of industrial products.

Effects of Alternative Tariff-Cutting Formulas on Uruguay Round Tariffs

Figure 2-4 presents the new tariff means calculated after applying the four tariff-cutting formulas to each country's post-Uruguay Round bound tariffs. All of the formulas do a good job of cutting the overall mean of industrial country tariffs, which was estimated at 45 percent before the formulas were applied. The new *overall* tariff means range from a high of 11.4 (a reduction of 75 percent) in the case of formula 2 to a low of 10.1 (a reduction of 78 percent) for formula 4. Although the formulas result in very similar overall means, some individual country means vary considerably depending on the formula used.

Fully half of the countries have their means reduced by the greatest amount under formula 1, even though we saw that this formula does not result in the lowest overall mean. These countries all have schedules containing a relatively high proportion of low tariffs (below 25 percent) and a low proportion of high tariffs (over 50 percent). Of the four formulas, number 1 tends to cut low tariffs by the greatest amount and high tariffs by the least amount, so the results are not surprising. Formula 4, which yielded the deepest cut in the overall mean, also provided the deepest cut in the means of five of the countries (Norway, Iceland,

Figure 2-4
Simple tariff means, by country, after applying tariff-cutting formulas



Source: Economic Research Service, USDA

Switzerland, Slovenia, and Canada). These five also happen to contain a high proportion of megatariffs which formula 4 subjects to the deepest cuts.[14] For only one country, Hungary, does formula 2 give the lowest mean, while Poland is the only country for which the Swiss formula (3) produces the deepest cut in its mean.

Figure 2-4 ranks countries from low to high, based on their post-Uruguay Round tariff mean (same order as figure 2-2). It is clear, however, that this ranking no longer holds. In particular, Canada and Japan, whose tariff means are initially higher than the EU, are lower after each of the tariff-cutting formulas is applied. To illustrate why this occurs, we need to understand how the distribution of tariffs in each country affects the formula outcomes. All of the countries in this analysis have tariff schedules characterized by a relatively large proportion of low tariffs and a small proportion of very high tariffs.[15]

This is illustrated in figure 2-5 for the United States, the EU, Canada, and Japan. Figure 2-5 contains frequency distributions of each country's dutiable, or nonzero tariffs.[16] Note that Canada and Japan have a larger proportion of tariffs in each tail of their distribution (>0-5 and >100 percent) than the EU. Thus, on the low end, fewer of the EU's tariffs are cut to zero under formula 1, while on the high end, fewer of the EU's tariffs undergo the severe cuts that the other three formulas impose on megatariffs. Because the EU already has a fairly uniform tariff schedule compared with Canada and Japan, none of these harmonization formulas cut the EU's tariff mean by as much as those of Canada and Japan. The deepest cut in the EU's mean occurs under formula 1, a reduction of 56 percent, while the range of cuts in Canada's and Japan's means, over all the formulas, is between 70 and 76 percent. Clearly, the impact of each formula on a country's tariff structure will vary depending on the initial height and distribution of the individual tariff rates making up the country's schedule.

How does the U.S. tariff mean fare under each of the formulas? The United States is one of seven countries that are subject to the deepest cut (65 percent) when formula 1 is applied, which is not surprising given its high proportion of tariffs at or below 5 percent (figure 2-5). Formula 4, on the other hand, imposes the smallest overall cut (52 percent) for the U.S. mean. Coincidentally, formula 4 also results in the sharpest cut (78 percent) to the overall tariff mean of the rest of the group. Thus the United States would see the gap between its mean and the overall mean of the other countries narrow by the largest amount when formula 4 is used.

Before turning to how the formulas fare in reducing tariff dispersion and tariff escalation, one final observation on tariff means is in order. Multilateral tariff negotiations tend to be first and foremost a quest for reciprocity, or an attempt to share the costs and benefits of tariff reductions. This is considered a necessity if a country's export opportunities are to expand along with the opening of its domestic market to increased imports.

With this in mind, the estimated cuts in the simple means are the most unevenly distributed under formula 4, which, at most, would require an average cut in Norway's tariffs of over 90 percent, while requiring Australia to cut its tariffs only by an average of 14 percent. This formula is designed to compress tariffs within a narrow range (zero to 25 percent), and most of Australia's tariffs are already in this range, while most of Norway's are considerably larger. The least disparate cuts would occur under formula 1, with Norway still subject to a deep overall tariff cut of 84 percent, but with Australia's tariff mean also reduced significantly, by 60 percent. New Zealand and Hungary would sustain the smallest cuts under this formula, with their means reduced by just over 50 percent.

Figure 2-6 contains frequency distributions for initial and new tariffs. In this case we include a category for duty-free tariffs on the left-hand side of the distribution while on the right-hand side the highest tariff after the formulas are applied will not exceed 50 percent. Even though the overall means were shown to be very similar across formulas, the overall distributions prove

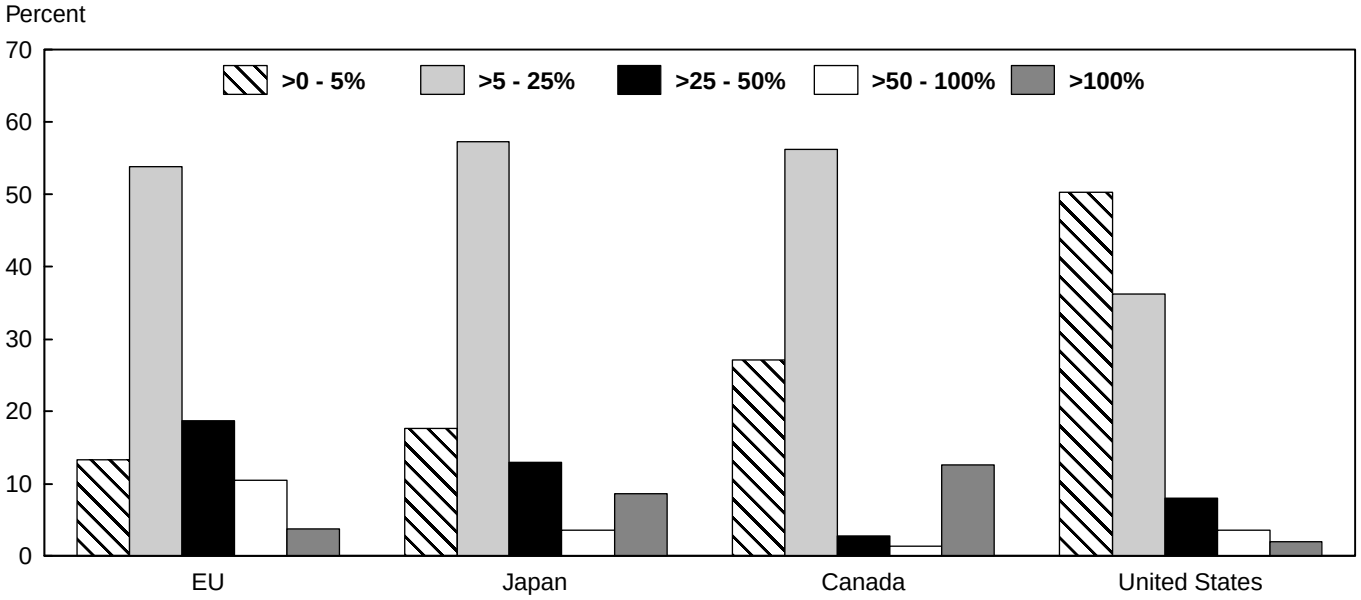
[14] How is it that Slovenia has a low tariff mean, but a high proportion of megatariffs? It's because 76 percent of its tariffs have been bound at zero. Of the remaining 24 percent (or, those that are being subject to cuts) over half are above 50 percent.

[15] As a result, they have tariff schedules whose distributions are skewed to the right, meaning that the tariffs continue much farther to the right of the mean than to the left. This explains why the standard deviations are so high, since they are distorted by a few very high rates.

[16] In figure 5, unlike the rest of the figures in this chapter, the focus is only on non-zero tariffs, since these are the tariffs being reduced by the formulas. Note, however, that each country's entire tariff schedule, including zero tariffs, was used in calculating the means and standard deviations.

Figure 2-5

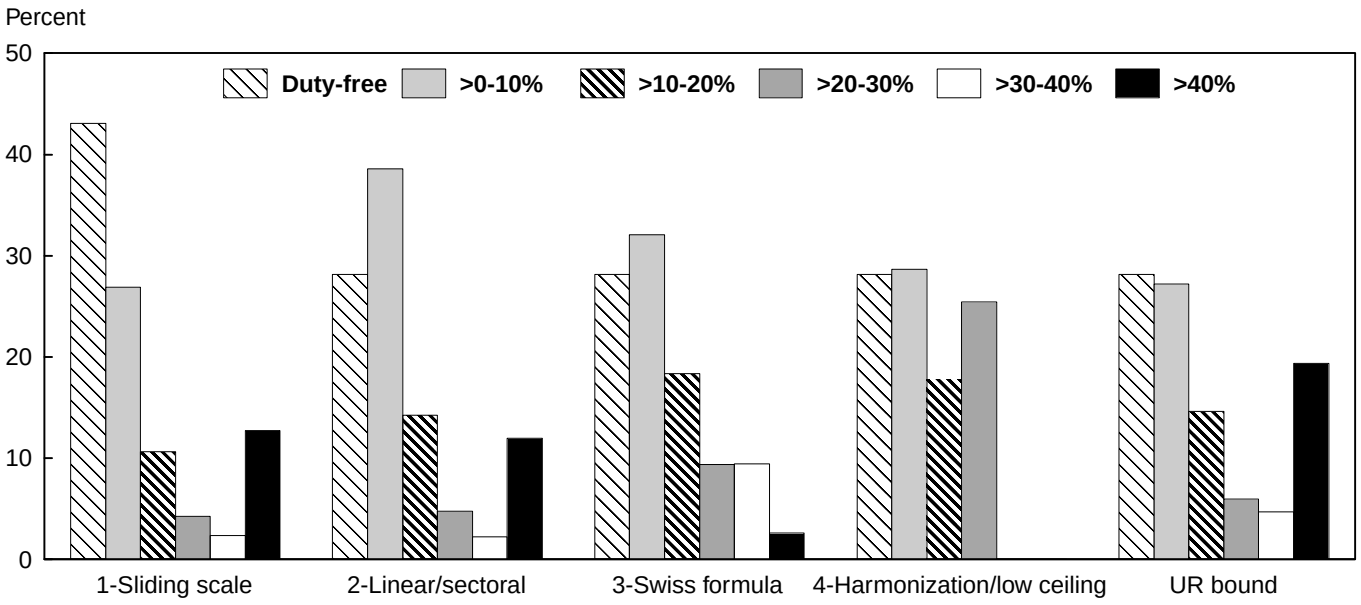
Frequency distributions of post-Uruguay Round dutiable tariffs—selected countries[1]



[1]Duty-free tariffs are not included in this chart.
Source: Economic Research Service, USDA

Figure 2-6

Frequency distributions for Uruguay Round rates and after applying tariff-cutting formulas



[1]Duty-free tariffs are not included in this chart.
Source: Economic Research Service, USDA

to be quite different. Initially, duty-free tariffs account for the largest proportion (28 percent) of tariffs in the six categories. This proportion increases to 43 percent when formula 1 (the only formula mandating some tariffs be reduced to zero) is applied. Formula 2, like 3 and 4, does not result in an increase in duty-free tariffs, but it does result in the greatest expansion in the proportion of tariffs in the >0-10 percent category, from an initial 27 percent to 39 percent.

At the other end of the distribution, however, the proportion of tariffs above 40 percent under formulas 1 and 2 remains fairly high, especially compared with formulas 3 and 4. Formula 3, the Swiss formula, results in a more even distribution across the various size categories than formula 2, with a smaller proportion in the >0-10-percent and >40-percent categories but a higher proportion in the middle categories. Finally, under formula 4 all tariffs get compressed to 25 percent or below, so the highest two categories are empty while the proportion of tariffs in the 20-30-percent range increases dramatically. Since formula 4 cuts low tariffs by the least amount, the proportion in the lower size categories, as well as the overall mean of tariffs in these categories, changes little.

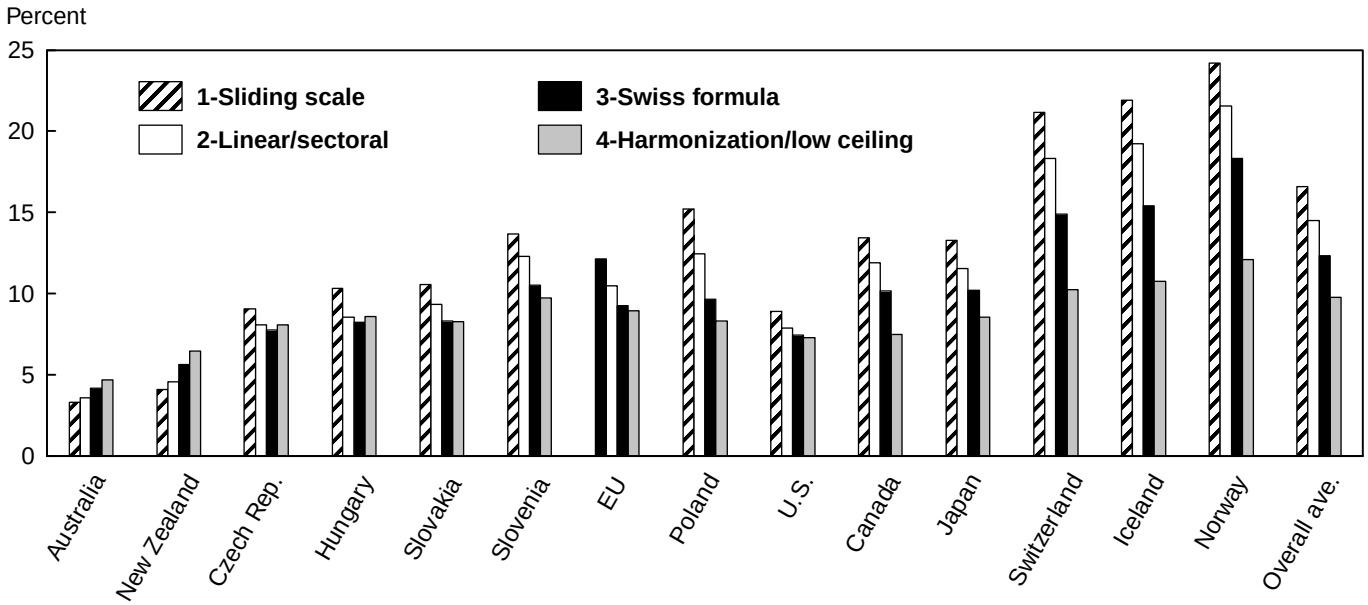
Figure 2-7 contains the standard deviations associated with the new tariff structures, ranked according to the size of the country's initial standard deviations. Formula 4, which results in the lowest SD in 10 of the countries, does the best overall job of cutting dispersion across the entire group. Formula 1 results in the lowest standard deviations in Australia and New Zealand, while in the Czech Republic and Hungary, formula 3 cuts dispersion by the greatest amount. In virtually every case, the cut in the SDs is greater than the cut in the mean. This, of course, is a characteristic of harmonization formulas, which are designed to produce deep cuts in tariff dispersion.[17] The dispersion over all tariffs within the group is reduced by impressive amounts, with the overall SD declining by between 92 percent under formula 4 and 87 percent using formula 1. Within individual countries, the deepest cut in dispersion occurs for Switzerland under formula 4, which results in a new SD 96 percent lower than the original. The smallest reduction, also when formula 4 is applied, occurs in New Zealand, which sees its SD cut by only 21 percent under that formula.

As with the means, the original rankings from low to high no longer hold in some cases. Nowhere is this more evident than for the United States, whose SD is initially among the highest. Under each formula, the U.S. SD drops from being ninth highest to third highest, exceeded only by Australia and New Zealand. The fact that each of these harmonization formulas cuts the U.S. SD by such a large amount is another indication of how effective they are in reducing dispersion, especially when the initial level is very high.

[17] A linear cut, on the other hand, results in an equal cut in the mean and the standard deviation; thus cutting all tariffs by 50 percent would reduce the mean and the standard deviation by 50 percent as well.

Figure 2-7

Standard deviations, by country, after applying tariff-cutting formulas



Source: Economic Research Service, USDA

It is not always the case, however, that the formula that yields the largest overall reduction in the mean also results in the lowest level of tariff dispersion. The rule is that when a country has both a low initial mean and SD, formula 1 will result in the deepest cuts in both measures, while for countries with high initial means and SDs, formula 4 delivers the deepest cuts. In the case of other countries it is harder to generalize. For the United States, the EU, and Japan, formula 1 results in the lowest mean but the highest SD.

Table 2-2 contains tariff means by BICO category for each country's initial tariffs and those calculated after applying each formula. As measured by nominal tariff wedges between categories, the wedge, averaged across all countries, between bulk and processed intermediate levels declines from an initial 3.9 percentage points to between 0.5 (formula 1) and 0.8 (formula 2) percentage points. The larger wedge existing between processed intermediate and consumer-oriented items narrows from 12.9 to between 2.1 (formula 1) and 3.7 (formula 4) percentage points. All of the formulas are effective in decreasing both tariff escalation and de-escalation (where the wedge is initially negative). Formula 4 results in the lowest overall mean in each category, but formula 1 compresses the three categories closest together. It is difficult, however, to say which formula would do the best job of reducing tariff escalation based on the aggregate results of table 2. In general, one would expect that when tariff escalation is extremely high (low tariffs on raw materials and high ones on finished products), formula 4 would be the most effective in reducing the spread between the tariffs. In other cases, the results are more ambiguous.

Conclusions

Among the main objectives of the next trade round will be to achieve further cuts in agricultural tariffs. High agricultural tariffs increase food prices to consumers and divert and waste resources by encouraging output in high-cost, protected countries (and commodities) while curtailing output in low-cost unprotected ones. It is in the interest of each country to reduce its tariff protection in order for its processors and consumers to obtain cheaper sources of supply and attain the higher level of economic activity permitted by more efficient allocation of resources.

If past rounds are any indication, a topic of considerable debate will be to determine the precise nature of the tariff cuts to be negotiated. In this analysis, we considered four harmonization formulas. The statistical measures presented here demonstrate that the effect of alternative tariff-cutting formulas on criteria such as the magnitude of tariffs, the level of tariff dispersion, and level of tariff escalation varies, depending on the initial height and distribution of a country's tariff schedule. We did not evaluate any strictly linear formulas in this analysis, primarily because the results are obvious — a 50-percent linear cut will cut a country's tariff mean and standard deviation by 50 percent. The great advantage of a linear cut, however, lies in its simplicity.

Perhaps most important is that, unlike a harmonization formula, a linear cut does not require that an ad valorem equivalent be provided for all specific tariffs, something that is not a trivial requirement. It has been suggested that a relatively simple alternative to protracted tariff negotiations would be to repeat the cuts of the Uruguay Round. These cuts have already been negotiated and accepted and they have the advantage that an ad valorem equivalent need not be calculated beforehand. The URAA allowed countries to cut tariffs on non-sensitive commodities by large amounts, even by 100 percent, while cutting tariffs on politically sensitive commodities by the minimum and still satisfy their URAA commitments. Obviously, any cuts of 100 percent would not be repeated a second time around, so the average tariff reduction would fall short of 36 percent. A straight 36 percent across-the-board linear cut would result in greater trade liberalization than a repeat of the URAA cuts even if it would still leave some very high tariffs. Only a harmonization formula, however, provides a means of getting megatariffs down to levels where trade can take place at the tariff-inclusive price.

Evaluating which formula is best for a particular country depends on the objective that a country hopes to achieve in the negotiations. Given the mercantilist view that most countries bring to tariff negotiations, one might expect that each country would tend to prefer that formula which produces the largest increase in its trade balance. The reality is, however, that for some countries to experience an increase in their trade balance, others must experience a decrease. But even if a country's tariffs and trade base are such that liberalization would result in a decrease in its trade balance, it may still pursue multilateral tariff cuts in order to

Table 2-2—Tariff means by BICO categories for post-Uruguay Round tariffs and tariffs after applying formula[1]

	1-Sliding scale	2-Linear/ sectoral	3-Swiss formula	4-Harmonization/ low ceiling	UR bound tariffs
			Percent		
Bulk commodities					
Australia	1.3	2.2	2.5	2.8	3.4
Canada	2.0	2.4	2.3	2.3	4.2
Czech Rep.	2.6	3.1	3.2	3.4	5.4
European Union	8.5	8.2	7.7	7.3	23.3
Hungary	10.4	10.7	11.4	12.4	21.1
Iceland	18.2	16.8	13.8	10.3	61.8
Japan	9.7	9.4	8.7	7.1	50.1
New Zealand	0.4	0.6	0.6	0.7	0.8
Norway	18.1	16.4	14.2	9.3	107.1
Poland	11.0	11.8	11.9	12.5	23.1
Slovakia	3.2	3.5	3.7	3.9	6.6
Slovenia	4.3	3.9	3.6	3.4	8.7
Switzerland	24.3	22.2	18.9	15.4	80.3
United States	3.6	4.2	4.2	4.3	8.3
Overall average	9.6	9.3	8.4	7.2	34.1
Processed intermediates					
Australia	1.0	2.3	2.4	2.6	3.1
Canada	3.1	4.0	4.0	4.0	11.8
Czech Republic	4.3	4.8	5.0	5.3	9.1
European Union	4.8	5.7	5.9	6.1	11.1
Hungary	10.0	10.8	11.5	12.4	20.7
Iceland	22.6	20.9	16.6	12.6	73.7
Japan	6.7	7.3	7.1	6.8	7.1
New Zealand	1.6	2.1	2.5	2.8	3.3
Norway	22.8	20.9	17.6	12.3	129.5
Poland	11.5	12.2	12.4	12.8	26.2
Slovakia	5.6	5.9	5.8	6.0	11.5
Slovenia	3.6	3.3	3.3	3.4	7.1
Switzerland	25.5	23.3	19.8	15.5	114.0
United States	1.9	2.9	2.9	2.9	5.0
Overall average	10.1	10.1	9.1	7.9	37.9
Consumer-oriented					
Australia	2.2	3.7	4.1	4.5	5.1
Canada	7.8	8.4	8.0	7.0	31.1
Czech Republic	6.7	7.8	8.6	9.3	14.1
European Union	11.7	12.1	12.7	13.4	25.9
Hungary	18.0	17.4	18.8	20.5	36.1
Iceland	26.7	24.8	23.2	19.2	130.6
Japan	9.8	10.6	11.3	11.6	43.0
New Zealand	4.8	6.0	7.3	8.2	9.8
Norway	26.9	24.4	21.2	14.7	176.3
Poland	20.9	20.0	19.2	19.0	46.5
Slovakia	6.4	7.4	7.8	8.3	14.0
Slovenia	8.5	7.8	7.1	6.8	19.5
Switzerland	23.7	22.3	20.6	16.9	141.6
United States	5.1	6.3	6.6	7.0	15.1
Overall average	12.2	12.4	12.3	11.6	50.9

[1]BICO refers to the USDA method of classifying traded agricultural products as bulk, processed intermediate, or consumer-oriented.

obtain the economic efficiency gains from tariff liberalization.

The analysis presented here reveals little about the realization of economic benefits from tariff reductions. To be able to say something about this would require consideration of a host of factors, including commodity and cross-commodity responses to price changes, the structure of markets, time lags in the adjustment process, and even the positive social value that governments may attribute to protection. This work should be viewed as only the initial step in analyzing the effects of reducing or eliminating agricultural tariffs. The next phase in analyzing tariff reduction would be to use these formulas in world trade models in order to be able to rank them based on criteria such as trade creation and estimated welfare effects.

References

Anderson, K., B. Hoekman, and A. Strutt. "Agriculture and the WTO: Next Steps," paper prepared for the Conference on Global Economic Analysis, Helnaes, Denmark, June 1999.

Baldwin, R E. "Multilateral liberalization," in *The Uruguay Round: A Handbook on the Multilateral Trade Negotiations*, World Bank, Washington, DC, 1987.

Baldwin, R E. and T. Murray. "MFN Tariff Reductions and Developing Country Trade Benefits under the GSP," *Economic Journal* 87: 30-46, March 1977.

Brown, F. and J. Walley. "General Equilibrium Evaluations of Tariff-Cutting Proposals During the Tokyo Round," *Economic Journal* 90: 838-66, December 1980.

Bureau, J.C., L. Salvatici, and L. Fulponi. "Measuring Trade Liberalization: European Commitments Under the Uruguay Agreement on Agriculture," paper presented at the IX European Congress of Agricultural Economists, Warsaw, Poland, August 1999.

Cline, W.R., N. Kawanabe, T.O.M. Kronsjo, and T. Williams. *Trade Negotiations in the Tokyo Round - A Quantitative Assessment*, The Brookings Institution, Washington, D.C., 1978.

Corden, W.M. *Trade Policy and Economic Welfare*, Oxford: Clarendon Press, 1974.

Daly, M. and H. Kuwahara. "The Impact of the Uruguay Round on Tariff and Non-Tariff Barriers to Trade in the 'Quad'," *World Economy* 21(2): 207-34, December 1998.

Evans, J.W. *The Kennedy Round in American Trade Policy*, Harvard University Press, Cambridge, 1971.

Finger, J. M. and A. Olechowski, ed. *The Uruguay Round: A Handbook on the Multilateral Trade Negotiations*. World Bank, Washington, DC, 1987.

Finger, J.M., M. D.Ingco and U. Reincke. *The Uruguay Round: Statistics on Tariff Concessions Given and Received*. World Bank, Washington, DC, 1996.

Gibson, P., J. Wainio, D. Whitley, and M. Bohman. *Profiles of Tariffs in Global Agricultural Markets, AER-796.* Economic Research Service, U.S. Department of Agriculture. Jan. 2001.

Golub, S.S. and J.M. Finger. "The Processing of Primary Commodities: Effects of Developed Country Tariff Escalation and Developing Country Export Taxes," *Journal of Political Economy* 87(31): 559-77, 1979.

Hatta T. "A Recommendation for a Better Tariff Structure," *Eonometrica* 45(8): 1859-69, Nov. 1977.

Ingco, M. *Agricultural Liberalization in the Uruguay Round*. World Bank Working Paper No. 1500, World Bank, Washington, DC, 1995.

Ingco, M. "How Much Trade Liberalization was Achieved under the Uruguay Round," *World Economy* 19: 425-46, June 1996.

Josling, T. *Agricultural Trade Policy: Completing the Reform*. Institute for International Economics, Washington, DC, 1998.

Josling, T. and A. Rae. "Multilateral Approaches to Market Access negotiations in Agriculture," paper presented at The Conference on Agriculture and the New Trade Agenda in the WTO 2000 Negotiations, Geneva, October 1999.

Josling, T. and S. Tangermann. "The Significance of Tariffication in the Uruguay Round Agreement on Agriculture." Paper for the North American Agricultural Policy Research Consortium Workshop, Vancouver, Canada, May 14, 1994.

Laird, S. "Multilateral Approach to Market Access Negotiations," WTO Staff Working Paper TPRD-98-02, May 1998.

Laird, S. and A.Yeats. "Tariff-Cutting formulas – and complications," in *The Uruguay Round: A Handbook on the Multilateral Trade Negotiations*, World Bank, Washington, DC, 1987.

Lindland, J. "The Impact of the Uruguay Round on Tariff Escalation in Agricultural Products," *Food Policy* 22(6): 487-500, 1997.

OECD. *Review of Tariffs Synthesis Report.* Trade Directorate, Trade Committee, TD/TC(99)7/Final, July 1999.

Panagariya, A. and D. Rodrik. "Political Economy Arguments for a Uniform Tariff," *International Economic Review* 34(3): 685-703, September 1989.

Stern, R.M. "Evaluating Alternative Formulae for Reducing Industrial Tariffs," *Journal of World Trade Law* 10: 50-64, 1976.

Wainio, J. P.Gibson, and D. Whitley. "Implementation of Uruguay Round Tariff Reductions," *Agricultural Outlook*, AGO-266. Economic Research Service, U.S. Department of Agriculture. November 1999.

Wainio, J. "Agriculture & the Evolution of Tariff Bargaining," *Agricultural Outlook, AGO-263.* Economic Research Service, U.S. Department of Agriculture, August 1999.

Wainio, J., G.Hasha, and D.Skully. "Market Access Issues," in *Agriculture in the WTO, WRS-98-4*. Economic Research Service, U.S. Department of Agriculture, December 1998.

Yeats, A.J. "On the Analysis of Tariff Escalation," *Journal of Development Economics* 15: 77-88, 1984.

Technical Appendix - Data and Methodology

The data used are from the Agricultural Market Access Database (AMAD). The AMAD was developed jointly by several organizations, including USDA's Economic Research Service, the Organization for Economic Cooperation and Development, Agriculture and AgriFood Canada, the European Commission, the United Nations Conference on Trade and Development, and the Food and Agriculture Organization of the United Nations. AMAD contains data at the tariff-line[18] level on market access commitments (Uruguay Round base and bound tariffs and tariff-rate quotas) for about 50 WTO members, as well as all available information on TRQ implementation, trade, applied tariffs, and commodity production and consumption. In this analysis, country coverage is limited to 14 industrial countries/regions (the United States, the EU, Canada, Japan, Australia, New Zealand, Switzerland, Norway, Iceland, the Czech Republic, Slovakia, Hungary, Poland, and Slovenia). The analysis assumes full implementation of each country's Uruguay Round commitments.

Almost three-fourths of the agricultural tariffs in the countries analyzed are expressed in ad valorem terms, with a number of countries denominating all or most of their agricultural tariffs as ad valorem rates.[19] In all but a few cases, ad valorem equivalents (AVE) of specific duties were approximated for Uruguay Round tariffs, generally using an average of 1995-97 import value and volume data.[20]

Where available, a country's own trade data were used to calculate the import unit values needed to approxi-

[18] The term tariff-line refers to the product or products to which the legally established tariff applies.

[19] Since most countries tended to express their in-quota tariffs as ad valorem rates, this figure would be even higher if these tariffs had been included.

[20] Not all countries registered imports for every commodity over each year. In these cases, the average might be made up of less than three years.

mate the AVEs. When this information was not available, world import unit values were used.[21] In some cases, tariffs were expressed in both ad valorem and specific terms, with the higher of the two determining which rate applies. In these cases, when import unit values were not available, the ad valorem rate was used. In some cases it was not possible to approximate an AVE, either because import unit values were not available, or because the tariff was structured in a way that made calculation of an AVE impossible.

Once AVEs are calculated, relevant comparisons of tariffs across countries require the calculation of a tariff mean. There are a number of ways to compute tariff means, none of which is without bias. The most common — a simple (unweighted) arithmetic average — was used. Some consider applying no weighting scheme inferior to weighting, since a "simple average" gives equal weight to kumquat imports and wheat imports, if each enters as a single tariff-line item under the national tariff nomenclature. Unfortunately, there is no ideal weighting scheme.

Import-weighted averages were used in past rounds to determine overall reductions in countries' industrial tariffs. Weights based on import values, however, tend to bias average tariff estimates downward, because items with the highest tariffs will receive virtually no weight, as little or no imports will enter under these tariffs. Weights based on shares of the value of production would be preferable, since highly protected commodities produced in large amounts would get large weights. But production data at the tariff-line level are rarely available. Because of this, tariffs are often aggregated in the form of simple (unweighted) averages to a level where data on appropriate production weights are available to calculate a national average.

Tariffs used in this study were only those bound as most favored nation (MFN) rates during the Uruguay Round. A great deal of trade takes place at tariff levels below the bound rate (including preferential rates under trade agreements such as the NAFTA). If the applied tariffs at which trade took place were used, many of the statistics would be considerably lower. If previous negotiations are an indication, countries' bound MFN tariffs, not their applied rates, will be the focus of future negotiations. In past rounds, when bound tariffs were higher than applied rates, countries rarely consolidated the reduced rate into their GATT tariff schedule without extracting the maximum compensation they could through negotiation (Evans).

One additional observation should be mentioned. In order to measure the effects of alternative tariff-cutting formulas with some precision, it is necessary to use data at the actual tariff-line level for each country, rather than broader average tariffs for commodity groupings. Most industrial countries bound their tariffs at the HS 8-digit level. In many cases, however, we find tariffs bound at either a more aggregate (e.g., HS 6-digit) or a more detailed (e.g., HS 10-digit) level. While we could have, for the sake of consistency, aggregated all tariffs to an HS 6-digit level, a formula applied to an average tariff can yield substantially different results from that obtained by applying the formula to the individual tariff-lines.

[21] There are a number of different ways to calculate AVEs. In the Gibson, et al. analysis, world import unit values were used rather than calculating import unit values with a country's own trade data.

The Economics of Animal Welfare Issues

Lorraine Mitchell

Animal welfare issues are becoming more prominent in the international trade arena. While many nations and cultures have norms for the treatment of animals, industrialized nations have recently begun to take more of an interest in animal welfare. As their consumers grow wealthier, and are able to afford an adequate quantity of food, they are able to devote more resources to meeting consumer preferences for both food quality and the methods through which food is produced. While most industrialized nations have laws and regulations about animal welfare, the EU has, over the last decade, enacted a number of laws that create very specific obligations for livestock producers.

Animal welfare laws generally impose restrictions on the conditions under which producers may keep their animals, how often the animals must be fed, or how the animals must be slaughtered. Livestock producers, like most other farm owners, generally use the lowest cost technology available to produce a product of a given quality. In some cases, high standards for animal welfare are part of the lowest cost technology, and some livestock producers note that treating animals well is a profit-maximizing practice. In other cases, requiring producers to change production methods to adapt to animal welfare strategies increases costs. For example, larger space requirements mean that either more land must be purchased or fewer animals must be kept. This increase in per animal resource requirements increases the per animal production costs.

How much will costs rise? Various studies indicate that costs could rise anywhere from 5 percent to 30 percent depending on the exact animal welfare law enacted (Blandford and Fulponi, 1999, 2000, Bennett, 1997). Increased production costs raise consumer food prices. Evidence suggests that some consumers in the EU are willing to pay more, even enough to cover higher costs, for some "animal-friendly products", like free-range eggs (Bennett, 1997, MORI, 1995). However, the magnitudes of consumer willingness to pay and the increase in producer costs, will vary from regulation to regulation and from income group to income group. Any policy that imposes costs on domestic firms but not foreign firms can put domestic firms at a disadvantage. Because the domestic goods will be costlier, some consumers are likely to purchase inexpensive imported goods instead of domestic goods (Blandford and Fulponi, 1999).

Because domestic producers understand the consequences of differences in regulation among countries, they sometimes apply political pressure to block imports from countries that don't have similar regulations. When the restrictive legislation benefits consumers, the domestic firms are frequently joined by consumer groups in their lobbying efforts (Vogel, 1995).

If countries with stringent animal welfare laws impose trade restrictions, such restrictions could have an effect on imports from countries that don't have similar animal welfare laws. The reduced demand from the import-restricting country could reduce the prices of animal products in the exporting country. The domestic prices in the country restricting trade could rise, because supply is restricted to more expensive domestic production. The size of the impact depends on the volume of trade that would occur in animal products in the absence of such regulations, and the response of consumers and producers to changes in prices.

The EU has submitted a proposal to the WTO on animal welfare that stresses three main points. The EU believes that each country should have the right to its desired animal welfare standards, and it is concerned about the effects of having higher animal welfare standards on domestic producers, noting that consumers might not be informed about "the welfare standards to which imported products are produced." The EU also notes that it is not interested in protectionism, or imposing domestic animal welfare standards on imports. The EU believes that animal welfare should be addressed in the WTO through a multilateral agreement, labeling, and/or minimally trade-distorting subsidies for producers who produce with humane methods.

References

———- European Community, Council Directive 98/58/EC of 20 July 1998 concerning the protection of animals kept for farming purposes.

———- *Index to International Public Opinion*, Greenwood Press, Westport, 1997/1998,

Bennett, R.M., "Farm Animal Welfare and Food Policy," *Food Policy*, Vol. 22, No. 4, 1977, pp. 281-288.

Blandford, David and Fulponi, Linda, "Emerging Public Concerns in Agriculture: Domestic Policies and International Trade Commitments," European Review of Agricultural Economics, Vol 26, No. 3, 1999, pp. 409-424.

Blandford, David and Fulponi, Linda, conference presentation, Symposium on Global Food Trade and Consumer Demand for Quality, IATRC, June 26-27, 2000.

Vogel, David, *Trading Up*, Harvard University Press, Cambridge, 1995.

Liberalizing Tariff-Rate Quotas

David W. Skully

TRQ liberalization, or reform, can increase market access and reduce the risk of trade bias. The analysis derives rules for liberalizing TRQs when expanding market access is the objective. It then considers TRQ "rents" and the risk of trade bias. Reducing the risk of biased trade complicates the "market access only" reforms. Tailoring reforms to individual TRQ fill-rates can expand market access and reduce trade bias.

Introduction

The Uruguay Round Agreement on Agriculture (URAA) created over 1,300 tariff-rate quotas (TRQ) for agricultural products. The new TRQs replaced quantitative trade restrictions—that is, bans and absolute quotas. Quantitative restrictions can result in rationing and cause greater trade distortions than tariffs. TRQs have tariff and quota elements and can be viewed as an intermediate step in converting quantitative restrictions into tariffs. Ideally, the URAA would have converted quantitative restrictions directly into tariffs, as tariff reform is relatively straightforward. In contrast, liberalizing quantitative restrictions is complicated, particularly if it causes rationing. Because TRQs combine tariffs and quotas, TRQ liberalization can be problematic.

Liberalizing TRQs is generally viewed as a means of increasing market access; little or no attention is paid to the increasing risk of biased trade that results in the entry of relatively inefficient suppliers. This paper explains how TRQ liberalization, or reform, can increase market access *and* reduce the risk of trade bias. It first provides background information on TRQs, particularly related to the tariff and quota elements of a TRQ. It examines how liberalizing the tariff and quota elements of a TRQ can expand market access. The analysis leads to a set of simple rules for liberalizing TRQs when market access is the only concern. The paper then shows how TRQs can create "rents," how rents provide incentives for trade bias, and how TRQ administrative methods influence the distribution of rents and the risk of trade bias. It also surveys the various TRQ administrative methods. Including the risk of biased trade in the analysis complicates the simple "market access only" rules for TRQ liberalization.

What Is a TRQ?

A tariff-rate quota is a quota for a volume of imports at a particular tariff rate. Once the quota is filled, a higher tariff is applied on additional imports. At first glance the TRQ differs little from the earlier "absolute" quota. Under an absolute quota, however, it is legally impossible to import more than the applied quota level. Under a TRQ, imports can exceed the TRQ level but a higher, over-quota tariff is applied on the excess. In principle, a TRQ provides more market access to imports than a quota. In practice, however, many over-quota tariffs are so high that they effectively exclude imports in excess of the quota. Thus, it is possible to design a TRQ so that it reproduces the volume of trade of an absolute quota.

A TRQ has four components: an in-quota tariff; a quota defining the maximum volume of imports charged the in-quota tariff; an over-quota tariff; and a method of quota administration. WTO member country tariff schedules define the values of the first three components. If the TRQ is scheduled for reform, the schedule also specifies the rates at which the quota is to increase or the tariffs are to decrease. Tariff schedules do not typically define the method of quota administration. Considerable differences exist among WTO member countries concerning the interpretation of "good" TRQ administration.

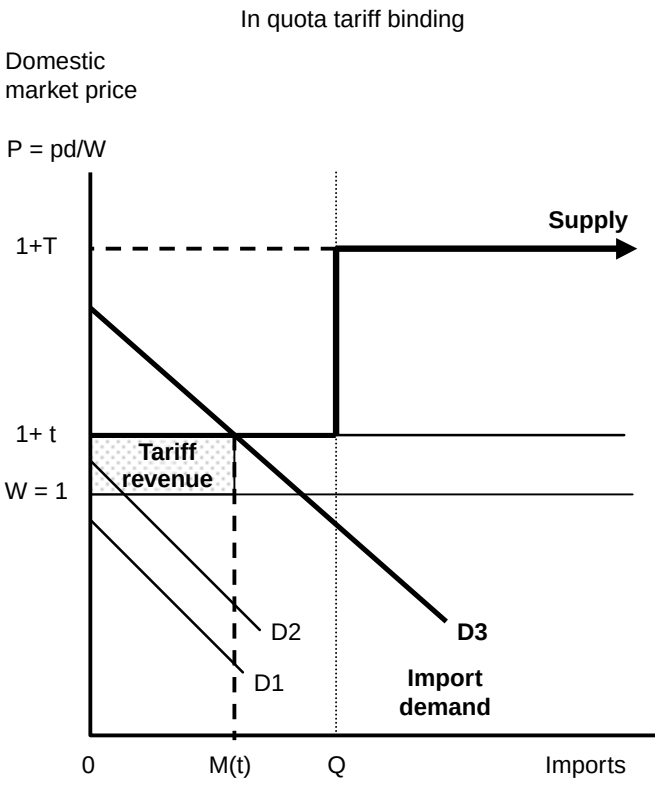
Figures 3-1, 3-2, and 3-3 illustrate how TRQs affect the incentives faced by importers. The two-level tariff results in a stepped import supply function. Imports within the quota are charged the lower tariff (t), and over-quota imports are charged the higher tariff (T). This results in a vertical step when the quota volume (Q) is filled.

The level of domestic demand for imports and the world price jointly determine which of the TRQ elements constrains imports.[1] Figure 3-1 plots three import demand curves. If there is no demand for imports at the world price, none of the TRQ elements constrains imports: there would be no imports even with free trade — D1. Similarly, if there is no import demand at the in-quota tariff rate (1+t), domestic demand remains the binding constraint — D2. A small reduction in the in-quota tariff will not increase imports, but a large reduction could make the in-quota tariff binding. When import demand intersects the in-quota tariff — illustrated by D3 — a volume of M(t) is imported and the domestic market price equilibrates at 1+t. In-quota tariff revenue equals t times the volume of imports, as shown in the shaded rectangle.

[1] The figures and text express all prices in terms of the world price. All prices are divided by the world price (W). Thus, the world price always equals 1=W/W, and the domestic price (Pd) is expressed as P = Pd/W. This normalization assumes that all tariffs are ad valorem tariffs.

Figure 3-1

TRQ and import demand



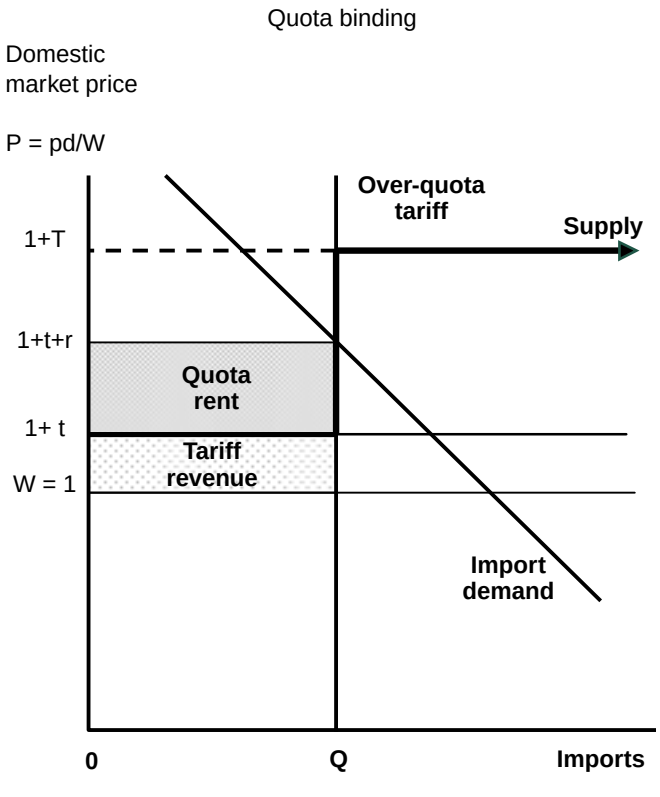
Source: USDA, Economic Research Service

Figure 3-2 illustrates import demand constrained by the quota. When the quota determines imports, the import volume is Q and the domestic price is 1+t+r (r represents the unit quota rent). The rent is the difference between the domestic price (the price an importer can sell the product in the domestic market) and the world price inclusive of the in-quota tariff (what it costs an importer to purchase the product on the world market and pay the tariff).

Figure 3-3 illustrates over-quota imports. The over-quota tariff determines the volume of imports at M(T) and the domestic price equals 1+T. When there are over-quota imports, imports within the quota are charged the in-quota tariff and imports beyond the quota are charged the over-quota tariff. Thus there are two shaded rectangles of tariff revenue in figure 3-3. In-quota imports can be imported for (1+t) and sold on the domestic market for (1+T) so the per unit quota rent equals (T-t). The shaded rectangle labeled “quota rent” represents the total value of quota rents.

Figure 3-2

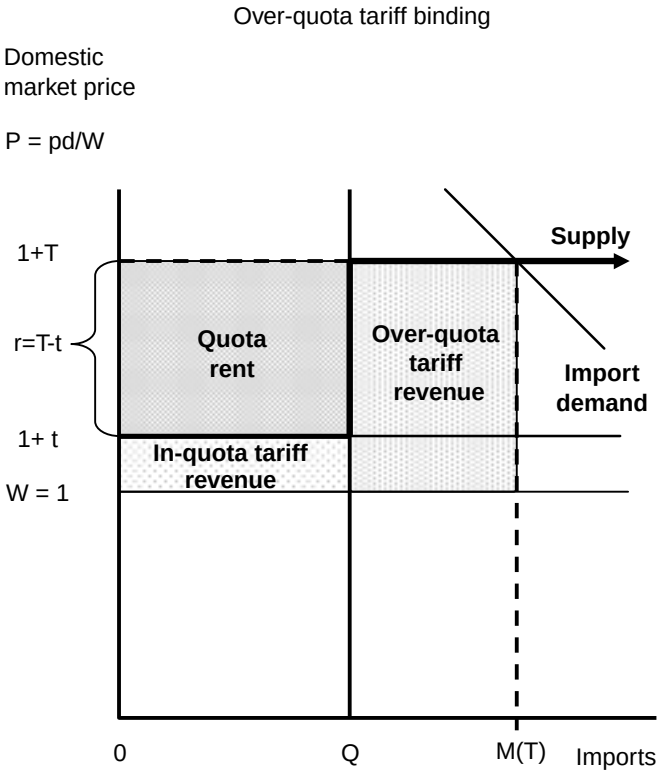
TRQ and import demand



Source: USDA, Economic Research Service

Figure 3-3

TRQ and import demand



Source: USDA, Economic Research Service

Liberalization and Market Access

What is the best way to liberalize TRQs? That is, which TRQ element or elements should be reformed so as to effect the greatest increase in nondiscriminatory market access? The three elements (t, T, Q) largely determine market access. Producing the greatest gain in market access depends on which of the three elements currently constrains imports and which element or elements are likely to constrain imports in the future.

Table 3-1 shows the links between the binding constraint and TRQ liberalization actions. The table includes one row for each potential liberalization action, and one column for each of the four potential binding constraints. For example, reducing t increases market access when t is binding, thus "+"; otherwise it has no effect, thus "0." Relaxing any one of the three elements, alone or in combination with the other elements, either increases market access or has no effect. In no case does liberalization reduce market access. Figures 3-1, 3-2, and 3-3 verify this result: A shift of the tariff or quota constraint reveals how it changes (or does not change) the intersection with the demand curve. TRQ liberalization from a market-access perspective is an uncomplicated process.

Quota Rents, Biased Trade, and TRQ Administration

From the perspective of a trader, a quota rent is a profit opportunity; but from the perspective of economic efficiency and unbiased trade, rent is a four-letter word. Quota rents bias trade by providing incentives for relatively inefficient suppliers to enter the market and displace more efficient suppliers. This section explains how quotas can create rents and how rents distort market incentives.

Rents and biased trade

TRQ administration involves distributing the rights to import at the in-quota tariff. Whoever obtains such rights can make a risk-free profit equal to the domestic price less the world price inclusive of the in-quota tariff. Rents indicate that the demand to import within the quota is greater than the supply of quota: thus the necessity to ration or administer the TRQ.

The risk that TRQ administration can bias trade requires an examination of the supply side of the rationing problem. For example, two types of firms can supply a market: least-cost and higher-cost. Least-cost firms have a cost of production less than or equal to P_L. Higher-cost firms have a cost of production greater than P_L. If there is no quota on trade, least-cost firms supply the entire market at the price P_L. Higher-cost firms will not enter the market; they either shut down or re-employ their resources. When a binding quota is imposed the demand price increases to P_H. At P_H, it is profitable for higher-cost firms to enter the market. The administration of market access determines which firms supply the quota-rationed market. If access restrictions allow only least-cost firms to supply the market, then a subset of least-cost firms would fill the quota and gain a rent of P_H-P_L on each unit sold. If

Table 3-1—TRQ liberalization and market access

Action	Binding constraint on imports			
	Demand	In-quota tariff	Quota	Over-quota tariff
Reduce t	0	+	0	0
Increase Q	0	0	+	0
Reduce T	0	0	0	+

Source: Economic Research Service, USDA.

market access is granted to whoever sells first, that is, on a first-come, first-served basis, the distribution of sales by type of firm will depend on being "early" rather than on being least-cost. In terms of economic efficiency, production by higher-cost firms is an inefficient use of resources and reduces global welfare. Global economic welfare is higher when only low-cost firms supply the market.

In terms of welfare analysis, it does not matter which least-cost firms or countries gain market access within the TRQ. *Random* displacement of one least-cost supplier by another does not reduce global welfare. In an international trade context, displaced least-cost suppliers can export to other markets at the world price. If rents are not fully absorbed through auction, tariff, or other means, higher-cost suppliers have an incentive to enter the market and can displace lower-cost suppliers.

TRQ liberalization and rent creation

Any TRQ reform that increases quota rents can also increase the risk that high-cost suppliers will displace low-cost suppliers. Table 3-2 shows the displacement risks. Reducing the in-quota tariff t has a positive influence on market access and competition when the in-quota tariff is binding (fig. 3-1). But when Q or T are binding, reducing t increases displacement risk (figs. 3-2 and 3-3). Similarly, increasing the quota Q increases the probability that the in-quota tariff will be the binding constraint. This improves market access and import competition. However, when Q or T are binding, increasing the in-quota volume can increase rents and risk trade bias. When Q is binding, expanding the quota can increase rents if import demand is sufficiently elastic. If import demand is inelastic, quota expansion can reduce rent. When T is binding, quota expansion must increase rents. The one unambiguously positive action is reducing the over-quota tariff. If T is the binding constraint, that is, if there are over-quota imports, then reducing T increases market access and does not further bias trade shares. If Q is binding, a large reduction in T can make T the binding constraint. Even a small reduction in T reduces the size of potential future rents and reduces the probability that Q will be binding in the future. Similarly, if t is the binding constraint, a reduction in T has no immediate effect, but it reduces the size and of future rents and thus the probability of future displacement of low-cost suppliers. Thus, a reduction in T is either an immediate improvement or a potential future improvement, but, importantly, it can do no harm.

Table 3-2—TRQ liberalization and rent creation

Actions	Change in quota rents		
	In-quota tariff	Quota	Over-quota tariff
Reduce t	0	+	+
Increase Q	0	?	+
Reduce T	0	0	-

Source: Economic Research Service, USDA.

TRQ administration

TRQ administration can influence trade. The WTO has identified several generic methods of TRQ administration. Table 3-3 defines these administrative methods along with the percentage distribution of TRQs by administrative method.

Of the 137 WTO members, 37 countries notified a total of 1,368 TRQs to the WTO Secretariat in 1999.[2] Forty-seven percent of notified TRQs are administered as simple applied tariffs, that is, the over-quota tariff is not applied and there is no effective quantitative limitation on imports at the in-quota tariff. TRQs administered as applied tariffs do not pose a current administration problem. But they pose a potential trade problem because the member country can, at any time, choose to enforce them.

Norway, Poland, and Iceland have notified 431 TRQs, or one-third of all notified TRQs. Over 85 percent are applied as tariffs — many at high in-quota rates; but only 63 are actually enforced as TRQs (table 3-4). In terms of enforced TRQs, countries with relatively developed economies with historically protectionist agricultural policies — the EU, Hungary, South Korea and the United States — account for over one-third of the total.

TRQ administration and biased trade

The most common forms of applied TRQ administration are "license on demand" and "first-come, first-served." The license on demand method requires potential traders to apply for a license to import in-quota. If demand for licenses exceeds supply, licenses are rationed. Many countries reduce all license requests proportionately until supply equals demand. The first-come, first-served method charges the in-

[2] The data reported here and in tables 3-3 and 3-4 are from country notifications to the WTO for 1999. All data are from WTO (2000).

Table 3-3—Methods of allocating right to import within quota

Method of TRQ administration	Explanation	Percent of all TRQs
Applied tariff	Unlimited imports are allowed at the in-quota tariff rate: that is, the quota is not enforced.	47
License on demand	Licenses are required to import at the in-quota tariff. If demand for licenses is less than quota, Q, the system operates like a first come, first served system. If demand exceeds Q, import volume requested is reduced proportionately among all applicants.	25
First come, first served	The first Q units of imports to clear customs are charged the in-quota tariff; all subsequent imports are charged the over-quota tariff.	11
Historical	Right to import at in-quota tariff is allocated in proportion to import market shares in a base period.	5
Auction	Right to import at in-quota tariff is auctioned.	4
State trader or producer group	Right to import in-quota is granted wholly or primarily to a state trading organization or an organization representing domestic producers of the controlled product.	2
Mixed	Describes a combination of two or more of the six methods above.	4
Other, or not specified	Includes methods that do not correspond to any of the seven methods above and are not specified in WTO notifications.	2

Source: WTO (2000).

Table 3-4—Top ten countries notifying and enforcing TRQs

Countries ranked by number of notified TRQs			Countries ranked by number of enforced TRQs		
Country	TRQs notified	TRQs enforced	Country	TRQs enforced	TRQs applied as tariff
Norway	232	19	EU	87	0
Poland	109	35	Hungary	68	2
Iceland	90	12	South Korea	63	1
EU	87	87	United States	54	0
Bulgaria	73	45	Bulgaria	45	28
Hungary	70	68	Poland	35	74
Colombia	67	34	Colombia	34	33
South Korea	64	63	South Africa	25	28
Venezuela	61	2	Czech Republic	24	0
United States	54	54	Slovakia	24	0
Subtotal	907	419	Subtotal	459	166
All others	461	307	All others	267	476
Total	1,368	726	Total	726	642

Source: WTO (2000).

quota tariff on the first Q units to clear customs. All subsequent imports are charged the over-quota rate. This method can create a surge of imports when the quota period opens. Both of these methods of TRQ administration can attract high-cost suppliers, and both risk generating a biased distribution of trade.

Many politically sensitive TRQs are allocated based on historical market shares and are nontransferable (e.g., the sugar TRQs of the United States and the European Union). Many high-cost suppliers are guaranteed a market for their exports under this system, but this guarantee comes at the price of denying market access to lower-cost, more efficient suppliers.

Table 3-5—Additional conditions on TRQ allocation

Additional condition	Total number	License on demand	Mixed	Applied tariff	All others
Limits on TRQ shares	119	91	14	1	13
Past trading performance	78	71	3	0	4
Domestic purchase requirement	48	35	11	1	1
Export certificates	24	19	0	0	5
Past trading performance and limits on TRQ shares	3	2	1	0	0
Export certificates and past trading performance	1	0	0	0	1
Total	273	218	29	2	24

Source: WTO (2000).

"Additional conditions" are placed on many TRQs. The WTO identifies four basic types of additional conditions, which are usually enforced singly but in a few cases jointly. Table 3-5 shows the number of TRQs with additional conditions. Of the 273 TRQs, 80 percent are administered by license on demand and 10 percent by mixed methods. Only 2 of the 273 are for applied tariffs.

Limiting the market share of the TRQ that a particular trader (or sometimes supplying country) may obtain is the most common restriction. Such limitations prevent one trader or a ring of traders from cornering the market.

Past trading performance is the second most common additional restriction. The general rationale for allocation by past trading performance is twofold. It perpetuates the traditional distribution of trade and it disciplines quota use. If a trader obtains quota rights but fails to use them, the rights can be reallocated to other traders.

The two remaining additional conditions — domestic purchase and export certificate — may face some challenges, either in the WTO or in bilateral disputes. A domestic purchase requirement makes the right to import in-quota contingent on purchasing a specified amount of a domestic product. For example, to import 1 ton of beef in-quota, a trader must purchase X tons of domestic beef.

Export certificates are usually employed to ensure that the product imported is the domestic product of the exporting country. For example, an export certificate ensures that sugar exported from Barbados is actually produced in Barbados and not in some third country. Of the 24 export certificate TRQs, the EU accounts for 21, the United States for 2 — raw cane sugar and flue-cured tobacco — and Canada for 1 — beef and veal. Export certificates allow the importing country to determine which exporting countries gain in-quota access as well as individual in-quota market shares. This provides a means of discriminating among competing exporters not on the basis of price or the quality of the traded good, but rather on the basis of country of origin, which is not in keeping with the WTO principle of nondiscrimination.

Despite the TRQ administration methods' obvious inefficiencies, with and without additional conditions, they persist. Historical allocation, for example, is often defended as a form of foreign assistance or compensation. The apparently conflicting goals of transferring rents to foreign governments and unbiased trade are not necessarily incompatible. One may allocate the right to import within the quota arbitrarily, but if the right can be sold, a secondary market will emerge. Low-cost suppliers will have the opportunity to purchase the quota rights from higher-cost suppliers who received the initial allocation. Allowing the resale of quota rights creates a decentralized market. Some high-cost suppliers may persist in exporting within the quota, but risk of displacing low-cost suppliers is substantially reduced.

The importing country creates a primary market in quota rights if it auctions TRQ rights. Auctioning relies on markets to allocate scarce rights and it is the administrative method most favored by economists. An auction absorbs all quota rents, and the winning bid or bids are prices. If there are no quota rents there is no risk of higher-cost suppliers displacing least-cost sup-

pliers. Thus, auctioning quota rights means that TRQ liberalization cannot increase the risk of biased trade. Auctions result in a liberalization matrix identical to table 3-1. Few countries employ auctions, in fact, only 4 percent of all TRQs are allocated by auction.

Adding It All Up

It is possible to determine the trade-off that might exist between greater market access and a higher risk of biased trade discrimination, at least in theory.

One interpretation of the General Agreement on Tariffs and Trade (GATT) — particularly of Article XIII — is that policies that bias trade violate the principle of nondiscrimination, one of the fundamental pillars of the GATT. Three ways of dealing with the conflict between market access and nondiscrimination have been identified. The two polar cases are (1) market access is all that matters, violations of nondiscrimination should be ignored; and (2) nondiscrimination must not be violated, any action that increases the risk of discrimination must not be taken. The third approach is to accept a trade-off between the two factors — market access and nondiscrimination — after first determining the appropriate weights for the two factors.

Table 3-6 summarizes these three interpretations. The market access-only interpretation reproduces the market access matrix. Similarly, the strict nondiscrimination interpretation reproduces the rent creation matrix. The signs are now reversed on the rent creation matrix. An increase in rent increases the incentive for higher-cost suppliers to enter the market and increases the likelihood of biased trade and a reduction in global welfare. The market access and nondiscrimination matrixes can be combined by adding corresponding cells.

To evaluate the impact of a particular reform action, one reads *across the relevant row*. For example, evaluation by both factors of reducing the in-quota tariff results in one plus and two minuses. These pluses and minuses are qualitative measures, not quantitative measures. Without some quantitative information (and the trade-off weights) it cannot be determined whether the plus outweighs the minuses. These signs or values must also be weighted by the probability of each of the constraints being binding. This weighting is further complicated because changes in the tariff quota instruments cause the probabilities to change. So, beyond

Table 3-6—How TRQ reforms affect market access and nondiscrimination

Actions	Binding constraint		
	In-quota tariff	Quota	Over-quota tariff
	Market access only		
- t	+	0	0
+ Q	0	+	0
- T	0	0	+
	Nondiscrimination only		
- t	0	-	-
+ Q	0	?	-
- T	0	0	+
	Both factors		
- t	+	-	-
+ Q	0	?	-
- T	0	0	+

Source: Economic Research Service, USDA.

the fact that lowering the over-quota tariff always leads to a welfare improvement or at least causes no harm, little can be said about the other two instruments without considerable empirical research, a formidable if not intractable task.

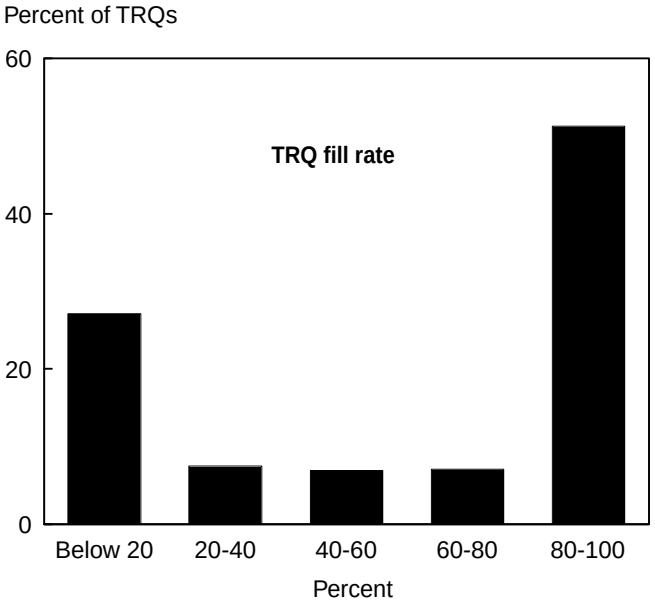
The problem may be much less formidable than it seems. The search has been for simple rules to liberalize all TRQs, a “one size fits all” approach. Because TRQs come in different sizes, the only universal prescriptions are to reduce over-quota tariffs and to employ auctions or allow resale of quota rights. As shown in the next subsection, custom tailoring TRQ liberalization may provide an attractive option.

TRQs come in three sizes

The distribution of TRQ fill is bimodal: Most TRQs fill at either a high level or a low level. Figure 3-4 shows the distribution of fill rates for all TRQs reported to the WTO in 1995-99. There were a total of 4,152 TRQ fill rate notifications. Over half of all TRQs reported are high-fill — at least 80 percent, and over one-quarter are low-fill rate — less than 20 percent. Thus, less than one-quarter are medium-fill — between 20 percent and 80 percent.

TRQ fill rates may be treated as a “Markov Process.” The basic idea is that year-to-year changes in fill rates are, in part, random. They result from a combination of changes in supply and demand in the importing country and the sum of changes in supply and demand in all other countries. For agricultural commodities,

Figure 3-4
Distribution of TRQ fill rates



Reported to WTO 1995-99, N=4152.
Source: WTO (2000).

weather is a significant and random source for changes in supply. Demand tends to be relatively steady but is subject to macro-financial and exchange rate shocks.

The TRQ fill notifications filed with the WTO provide 3,026 observations of TRQs reporting fill rates for 2 consecutive years. These 3,026 pairs of fill rates can be classified by whether they are low-, medium-, or high-fill the first year and low-, medium-, or high-fill the second year (table 3-7A). The probability that a low-fill TRQ in the first year remained low-fill the second year is 610/796, or 77 percent. This is calculated by dividing the number of observations in the low-low cell by the total of observations in the "low" row. The row sum is the number of TRQs that were low-fill in the first year. The probabilities that a low-fill TRQ "migrates" to medium-fill or high-fill status can be calculated by dividing the relevant cell by 796. The probabilities for the other rows are calculated in the same manner. A low-fill TRQ this year has a 77-percent chance of remaining low-fill next year, a 15-percent chance of being medium-fill, and a 9-percent chance of being high-fill (table 3-7B).[3]

[3] The probabilities reported in table 3-7.B are based on the changes in fill rates observed in 1995-99. The probabilities for 2001 will only resemble past rates to the extent that the future is not dramatically different from the recent past. A second caveat is that the probabilities are for the entire set of TRQs; they do not necessarily apply to any single TRQ.

Table 3-7—The relative stability of TRQ fill rates: 1995-99

A: Observations

	Fill rate next year			
A	Low	Medium	High	Sum
Low	610	117	69	796
Medium	138	368	183	689
High	82	179	1,280	1,541
Sum	830	664	1,532	3,026

B: Probabilities

	Fill rate this year			
B	Low	Medium	High	Sum
Low	0.77	0.15	0.09	1.00
Medium	0.20	0.53	0.27	1.00
High	0.05	0.12	0.83	1.00

Low < 20%; 20% < Medium < 80%; 80% < High

Source: WTO (2000).

Because low-filling TRQs are likely to remain low filling and unlikely to be high filling in the subsequent year, reducing the in-quota tariff rate for low-filling TRQs is not likely to create rents. Such a discipline allows a potential increase in market access with a low risk of rent creation. Similarly, increasing the quota for a low-fill TRQ will not increase rents, particularly if there is no accompanying in-quota tariff reduction.

Table 3-7B also shows that high-fill TRQs have an 83-percent chance of remaining high filling in the next year, so a large reduction in the in-quota tariff for consistently high-fill TRQs is likely to increase rents. Similarly, increasing the quota for a high-fill TRQ is likely to increase rents.[4]

Middle-fill TRQs tend to remain middle-fill 53 percent of the time. The probability that they migrate to high-fill is 27 percent, and the probability that they migrate to low-fill is 20 percent. So, there is at least a 73-percent chance that a small reduction in the in-quota tariff will not create rents and a less than 27-percent chance that it will. Requiring medium-fill TRQs to reduce moderately the in-quota tariff will increase market

[4] Fill rates above 80 percent are commonly viewed as "filled" TRQs because it is often practically impossible to reallocate all unused import licenses to willing importers. There is little incentive for the holder of the unused portion of an import license to surrender it earlier than absolutely necessary. Thus it is possible for there to be quota rents when the fill rate is less than 100 percent. Clearly, stronger enforcement of existing disciplines on licensing allocation and reallocation would, by itself, liberalize many TRQs.

access with a minor risk of rent creation. A moderate increase in the quota volume would reduce the already minor risk of rent creation.[5]

The three types of TRQs, as measured by fill rates, lead to three distinct liberalization prescriptions (table 3-8). The liberalization actions for low-fill and medium-fill can increase market access with very little risk of rent creation and trade bias.

Table 3-8—Individual TRQ reform prescriptions based on fill rates

	TRQ fill rate		
TRQ reform	Low	Medium	High
In-quota tariff	Large reduction	Modest reduction	Small or no reduction
Quota	Increase	Modest increase	0

Source: Economic Research Service, USDA.

Conclusion

Liberalizing TRQs within the framework and spirit of the GATT-WTO requires consideration of two areas: market access and trade bias. If the right to import in-quota is allocated by auction or if unrestricted re-sale of in-quota rights is allowed, then there is little risk of trade bias. Thus, any of the three liberalizing actions — reducing t or T or increasing Q — leads to an unbiased expansion of market access. If in-quota import rights are allocated by other means, then only one liberalization action that can be applied to all TRQs leads to an unambiguous expansion of potential market access with no increased risk of bias: the reduction of the over-quota tariff T. The other liberalizing actions cannot be applied universally: Reducing the in-quota tariff t or increasing the quota Q, can increase quota rents and the risk of discrimination.

The bimodal distribution of TRQ fill rates presents an opportunity for creating additional market access with little or no risk of trade bias. One may reduce in-quota tariffs and increase quota volumes for TRQs that exhibit persistent low-fill rates. The same liberalization prescription could also be applied to TRQs with persistent medium-fill, but with some risk of rent creation.

Finally, market access could be enhanced if existing WTO disciplines on TRQ administration and on import licensing were better enforced. If the lack of current enforcement stems from a lack of clarity in existing disciplines, then clarification of the rules is needed.

[5] In theory, the percentage increase in quota needed to prevent an in-quota tariff reduction from creating quota rent is proportional to the price elasticity of import demand.

References

Skully, David (2001). "Economics of Tariff-Rate Quota Administration." USDA, Economic Research Service, Technical Bulletin No. 1893.

Skully, David (2000). "Five Years of Tariff-Rate Quotas—A Status Report," *Agricultural Outlook*, November, pp. 22-25.

WTO Committee on Agriculture. "Tariff Quota Administration Methods and Tariff Quota Fill." G/AG/NG/S/8, May 26, 2000.

Welfare Implications of Liberalizing Preferential Quotas

Aziz Elbehri

Many TRQ policies are country-specific, that is, importers designate TRQ quantities to specific exporting countries. The exporting countries often enjoy preferential access, allowing them to receive higher domestic prices in quota-restricted import markets and therefore capture either all or part of the quota rent generated by the difference between domestic and world prices. Assessing liberalization options for these country-specific TRQs requires sorting out the effects of potential quota rent losses, changes in tariff revenues and their transfer to exporters in the form of quota rents, and the effects of expanded trade under a liberalized trade regime. The implications of tariff cuts, quota expansion, or the combination of both will differ for importing and exporting countries. The trade and welfare impacts must factor in quota rent changes (on the exporter side), tariff reductions (on the importer side) and welfare gains from improved resource allocation (Elbehri et al., 2000).

An examination of partial liberalization of sugar TRQs by the EU and the United States helps illustrate the effects of country-specific TRQ liberalization. EU sugar quotas are targeted mostly to the African, Caribbean, and Pacific (ACP) countries and India. Because imports exceed the quota, high over-quota tariffs are in force. These exporters gain quota rents because they export sugar duty-free to the EU and receive the same support price as internally produced EU sugar. The U.S. sugar TRQs are allocated to selected exporting countries on the basis of their average historical market shares of U.S. sugar imports, and exporters benefit from quota rents resulting from the difference between the domestic and world prices. This analysis is based on a modeling framework for TRQ regimes developed by Elbehri and Pearson (2000) and assumes that in the case of sugar, all quota-holding exporters are assumed to capture the entirety of quota rents. Three sugar TRQ liberalization scenarios are considered: over-quota tariff cuts (by one-third), quota expansion (by one-third) and the combination of both. Since in-quota tariffs are small in the United States and zero in the EU, they are not varied.

Reducing over-quota tariffs for EU sugar by one-third results in a net welfare gain for the EU but a net welfare loss for countries exporting sugar to the EU. Quota-holding exporters experience a loss of quota rents as over-quota tariffs are cut, reducing the per-unit quota rent. The importer (EU), however, shows a net gain of tariff revenues as total imports expand in response to lower tariffs. Under this scenario, the EU expands sugar imports by 5.1 percent, reduces sugar exports by 12.1 percent, and reduces domestic sugar output by 4.1 percent. The increased exports result largely from quota-holding sugar exporters from Africa, Caribbean, and Latin America, but export growth does not fully offset the effects of declining quota rents.

When the EU expands the sugar quota by one-third, changes in trade volume (compared to over-quota tariff reduction) are smaller because the quota is initially well below current imports in the benchmark equilibrium. Furthermore, as imports from quota-holding exporters

Welfare effects of sugar import liberalization (US$ million, 1995 constant)

	EU sugar TRQ liberalization			U.S. sugar TRQ liberalization		
Scenarios	1/3 tariff cut (A)	1/3 quota increase (B)	(A) + (B)	1/3 tariff cut (C)	1/3 quota increase (D)	(C) + (D)
European Union	822.5	-168.3	474.7	3.7	1.0	1.0
United States	-5.3	-7.8	-10.3	312.5	147.6	147.6
Exporters:						
Brazil	1.2	-0.2	0.7	-22.7	0.6	0.6
Caribbean Americas	-57.7	81.8	25.2	-68.9	-5.1	-5.1
Rest of Latin America	-46.3	45.9	3.4	-44.8	-7.2	-7.2
Philippines	0.3	0.2	0.4	-15.9	-0.2	-0.2
Thailand	-1.1	0.0	-0.9	-1.8	-1.8	-1.8
South Africa	-33.1	35.2	4.2	-5.7	-1.0	-1.0
Rest of Africa	-135.0	133.7	0.3	-9.7	-1.5	-1.5

Source: Elbehri et al. (2000).

rise, so, too, does their price, limiting the growth in demand. Expanding the EU's sugar quota transfers EU tariff revenue to exporters in the form of higher quota rents. Consequently, expanding quotas by one-third leads to net welfare gains by the quota-holding exporters while the liberalizing country (EU) shows a net welfare loss from reduced tariff revenues. However, the combination of tariff reductions and quota expansion results in welfare improvement for both the importing and the exporting countries. This welfare gain reflects both the increase in exporters' quota rents and the increase of importer's tariff revenue.

The United States imports little sugar over the quota, thus, there is much less scope for transferring over-quota tariff revenues to exporters as is the case with the EU. Increasing the U.S. sugar TRQ means all sugar import expansion in the United States occurs within the quotas. In this case, per-unit quota rents fall sharply, and the welfare of the quota-holding sugar exporters declines. The exporters' welfare declines less if over-quota tariffs are cut. The United States shows a welfare gain under both tariff cuts and quota expansion due to expanded imports under either case.

The trade and welfare implications from this empirical analysis of sugar TRQ liberalization lead to two important results. First, in those country-specific TRQ cases where imports exceed quotas and where some exporters capture quota rents as a result of preferential access, the welfare effects of liberalization depend on what happens to both over-quota tariffs and quota volumes. Second, developing countries that export to industrialized markets under preferential access can suffer welfare losses under over-quota tariff reductions due to a loss of quota rents. At the same time, exporters that do not benefit from allocated quotas are poised to benefit from a more liberalized trading regime, as they are likely to expand exports without having to withstand an erosion of preferential margins or quota rents.

Since country-specific TRQs by importing industrialized economies are justified as a form of foreign assistance, one policy implication is that tariff cuts negotiated as part of a multilateral agreement could also be complemented with higher quotas, therefore minimizing the welfare losses on those exporting developing countries with preferential treatment. In the long run, however, high-cost producers from developing countries would benefit less from foreign assistance than from shifting their economic activities toward areas in which they enjoy competitive advantage. A move toward a more liberalized trade regime would strongly encourage these adjustments of economic activities, which would benefit developing economies.

References

Elbehri, A., and K.R. Pearson (2000), "Implementing Bilateral Tariff Rate Quotas in GTAP using GEMPACK," Global Trade Analysis Project (GTAP) Technical Paper No. 18.

Elbehri, A., T.W. Hertel, M. Ingco, and K.R. Pearson (2000), "Partial Liberalization of the World Sugar Market: A General Equilibrium Analysis of Tariff-Rate Quota Regimes," Presented at the AAEA Annual Meetings, July 30-August 2, Tampa, Florida.

Options for Reducing the Aggregate Measurement of Support in OECD Countries

C. Edwin Young, Mark Gehlhar, Frederick Nelson, Mary E. Burfisher, and Lorraine Mitchell

The URAA left in place uneven levels of domestic farm support across countries and commodities. This analysis examines two generic approaches to reducing domestic support in the World Trade Organization negotiations. The ceiling-reduction scenario reduces the URAA limits on countries' overall levels of domestic support. This approach leaves in place the uneven base support ceilings established by the URAA. The more restrictive support-leveling scenario places commodity-specific limitations on the level of support relative to total value of production, thereby reducing dispersion of relative support across commodities and countries. Potential adjustments in global and bilateral trade under these scenarios are discussed for selected countries and commodities. U.S. agricultural exports expand by similar amounts under both scenarios, even though the individual commodity adjustments are quite different.

Introduction

The Uruguay Round Agreement on Agriculture (URAA) created new global rules for the treatment of domestic farm support by distinguishing support policies on the basis of their market-distorting potential (table 4-1). The URAA placed "ceilings," or limits, on support from programs presumed to be the most trade distorting (amber box support) while exempting other, more market-oriented, programs from any limitations under a set of special conditions (green box support). Another exempt category (blue box) was devised for payments related to production-limiting programs (U.S. deficiency and European Union compensatory payments), on the assumption that the limits offset at least some production and trade distortions.

The URAA also defined a single, quantifiable national indicator of trade and production-distorting support, the "aggregate measurement of support" (AMS), which includes the estimated value of only amber box policies. Developed countries agreed to reduce their AMS levels by 20 percent from a ceiling calculated as their average annual level of overall support provided in the base years, 1986-88. Thus, under the URAA, countries with the highest level of amber support in the base years were granted the highest support ceilings (fig. 4-1). By using an aggregate measurement of domestic support instead of commodity-specific support limits, countries could comply with their overall WTO ceiling and avoid a binding limit on support to specific, highly protected commodities such as dairy, rice, and sugar (fig. 4-2).

WTO member countries have proposed a variety of alternatives for further reducing domestic support. Two generic scenarios are evaluated here: [1]

- a "ceiling reduction scenario" that reduces overall levels of domestic support ceilings from a 1986-88 base, allowing support levels to remain uneven across countries and commodities, and
- a "support-leveling scenario" which levels the dispersion of domestic support across commodities and countries.

These options were developed to illustrate the implications for world and U.S. agricultural trade of two general approaches to reducing domestic support. As such, these scenarios do not represent specific proposals under consideration in future negotiations.

Potential adjustments in global and bilateral trade under these scenarios are discussed for selected countries and commodities. In addition, reform of policies on raw agricultural products can change input costs for domestically processed agricultural products, affecting countries' competitiveness in processed products.

[1] This analysis evaluates amber box policies and does not evaluate the impacts of blue box programs such as European Union compensatory payments or green box programs such as U.S. production flexibility contract payments.

Table 4-1—Treatment of domestic agricultural support in the Uruguay Round Agreement on Agriculture

Category	General criteria	Examples of policies
Exempt support (green box)	Measures must be financed by the government rather than consumers and must not provide price support to producers Specific criteria are defined for general government services, public stockholding, domestic food aid, direct payments, and other programs	Green box programs include direct payments to farmers that do not depend on current production decisions or prices; disaster assistance, and government programs on research, extension, and pest and disease control
Exempt direct payments (blue box)	Direct payments under production-limiting programs must be based on fixed area and yields, or cover 85 percent or less of the base level of production or head of livestock	Blue box policies are direct payments to producers, linked to production of specific crops, but which impose offsetting limits on output
Nonexempt support (amber box)	Market price support, nonexempt direct payments, and any other subsidies not specifically exempted are subject to reduction commitments	Amber box policies include market price supports, and output and input subsidies

Source: Uruguay Round Agreement on Agriculture, WTO.

The AMS as a Starting Point

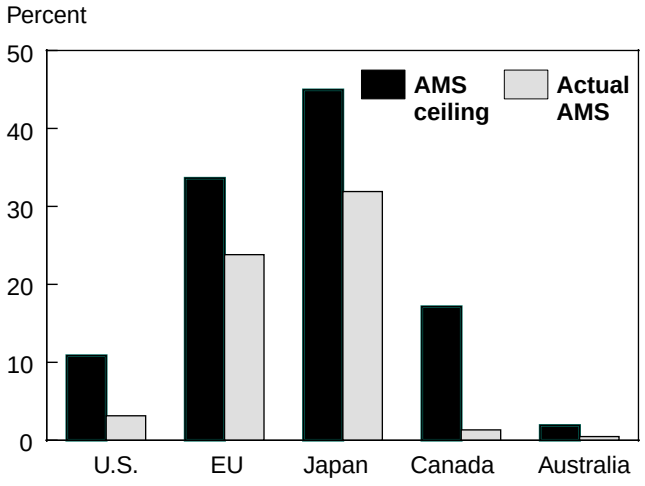
The AMS concept is a measure of production and trade-distorting domestic support that includes:

- government subsidy expenditures on agriculture
- the value of market price support (measured as the gap between domestic and fixed international reference prices) for commodities that receive administered or guaranteed price supports.

All domestic support policies included in the AMS have some effect on production and trade, but the magnitude of effects varies considerably among different types of policies (Young and Westcott, 2000; Rude, 2000).

This analysis uses a framework that recognizes that different types of amber box programs affect production and trade differently.[2] Output subsidies and market price support create the largest trade distortions by raising producer returns and thereby creating direct production incentives (table 4-2). Output subsidies directly stimulate increased production by increasing the expected returns from the subsidized commodity. Subsidies on variable inputs such as seeds and fertilizer, and on fixed inputs such as capital equipment and buildings, raise output by lowering input costs. Subsidies can also provide income support to the farmer through direct payments intended to achieve a guaranteed return. These payments affect only producers' returns and may be somewhat less distorting of consumer demand than market price support programs that fix market prices.

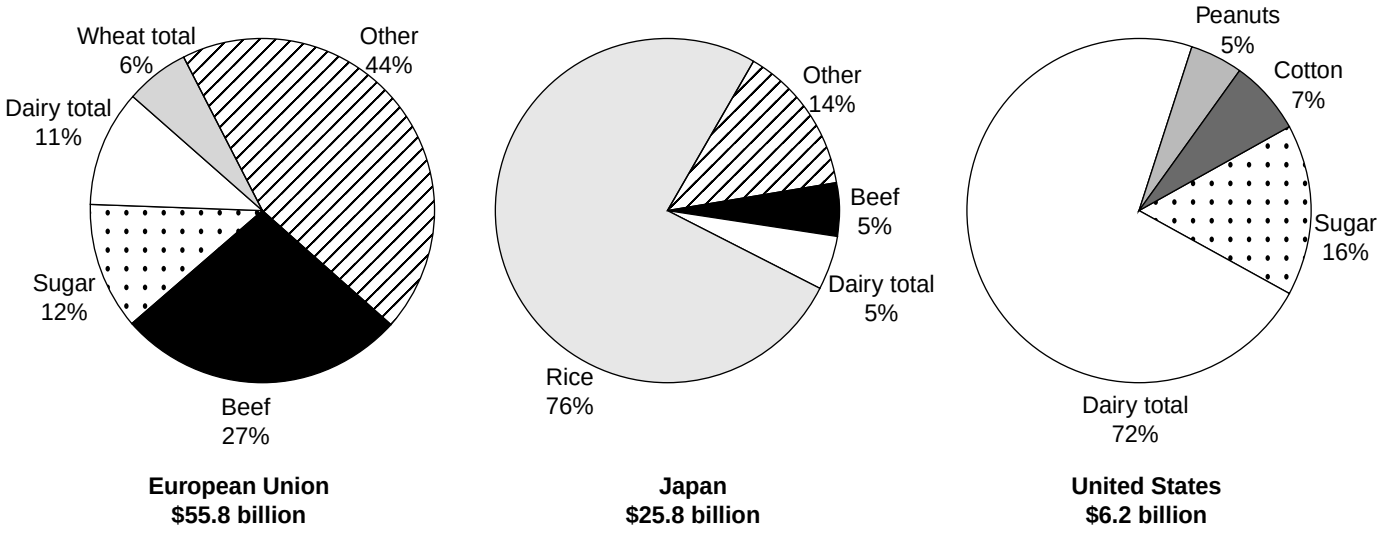
Figure 4-1
AMS ceilings and actual AMS as a percent of value of production, 1997



Source: 1997 WTO notifications.

[2] Domestic support is measured in this study using (1) the OECD's producer support equivalent (PSE) measures of direct payments that are defined as amber box payments in the AMS concept, along with (2) tariffs and export subsidies as a measure of market price support for commodities that are supported using domestic administered price programs to guarantee minimum prices to producers. See appendix 2 for a more detailed discussion. Thus, the AMS market price support (administered price) programs are included, but they are measured in a way more consistent with the PSE concept, which emphasizes current market value of the internal-external price difference in the world, than with the AMS concept, which fixes the external reference price at 1986-88 levels.

Figure 4-2
Composition of AMS, 1997



Source: 1997 WTO Notifications.

Market price support programs create a single price for producers and for consumers that is higher than the free market or world price of a commodity. The calculation of the market price support measure in the AMS explicitly accounts for the operational linkage between price support and trade policies. In order to maintain a domestic price that differs from the world price, most market price support programs rely on trade policies to restrict imports and may require export subsidies. In the absence of such trade policies, domestic price support and storage programs would become costly.

If the new negotiations continue within the framework of the URAA, market access limitations (tariffs and other trade barriers) and export subsidies will be addressed separately from domestic support, but reforms of the three policies are linked. Reductions in trade intervention alone could either reduce the effectiveness and current subsidy value of market price support programs as domestic prices fall, or lead to a higher current subsidy value if countries respond with larger expenditures on stock building or price subsidies.[3] On the other hand, constraints on a domestic support program would not necessarily lead to a dismantling of trade barriers. Such barriers can be beneficial to the domestic sectors without the need for administered prices, although the administered prices provide an additional layer of intermediate support.

In this analysis, reductions in the AMS are assumed to be achieved by proportionally reducing all domestic subsidy expenditures as well as the related tariffs and export subsidies whenever commodities benefit from administered market price support programs.[4] Trade policies not related to administered prices are unchanged. In effect, tariff and export subsidy reductions lower domestic price levels and are used to represent market price support reductions, because further WTO constraints on domestic support would be difficult to achieve without reforming the related trade barriers that help keep domestic prices high. By reducing trade policies, we may overestimate the effects of reducing a domestic price support program, since in practice the domestic program could be administratively removed while leaving the trade policy in place.

Agricultural policy data are for 1998, the most recent year for which a comprehensive policy database could

[3] The WTO AMS calculation excludes support that does not exceed 5 percent of the member's total value of production (10 percent for developing countries.) But this *de minimis* support is included in our estimates of the AMS on the assumption that trade distortions do not begin or end when a threshold is reached. For example, the estimates in this analysis include U.S. support for programs such as crop insurance and irrigation subsidies that are considered *de minimis* for reporting to the WTO. This approach overstates domestic support.

[4] Technically, the calculation of the AMS as defined in the URAA would not change since it uses the gap between the administered price and a fixed base reference price, instead of the current market price, to calculate the effective level of support.

Table 4-2—Amber programs used in OECD countries[1]

Category	Production effects	Examples of amber policies	Expenditures ($ billion)
Market price support (administered prices)	Raises producer and consumer prices above world levels	U.S. sugar program	152[2]
	This price control can be implemented through government purchase and storage programs, whereby the government agrees to acquire domestically produced commodities at the announced minimum administered price	EU intervention price support	
	Administered prices in combination with trade policies, however, provide greater control over domestic prices, minimizing costs of purchase and storage programs		
Output subsidies	Production incentives are greatest when subsidies are tied directly to specific commodities, since production decisions are based on the level of government payments in addition to expected returns from the marketplace; resulting increases in production tend to reduce domestic prices, leading to some increased domestic use and higher exports or lower imports	U.S. loan deficiency payments	9
		Mexico's former guaranteed producer prices	
Capital subsidies	Use of capital inputs increases, leading to a longrun increase in production of capital-intensive products	Investment tax credits	3
		Interest subsidies	
Other input subsidies	Output increases for commodities that use subsidized input	Irrigation and insurance subsidies	7
Transfer payments	Whole-farm payments increase land values, raise wealth and investment, and reduce risk aversion; aggregate output increases slightly, but cross-commodity distortions are not created, so these subsidies are assumed to have a smaller impact on production than other forms of domestic support	Canada's NISA	4

[1]Countries of the Organization for Economic Cooperation and Development are Australia, Canada, Czech Republic, European Union, Hungary, Iceland, Japan, South Korea, Mexico, Norway, New Zealand, Poland, Switzerland, Turkey, and United States.
[2]OECD PSE measure of price support. This analysis uses actual tariffs and export subsidies as a measure of market price support for commodities that have administered price programs.

be assembled. AMS support levels were estimated for 11 of the 15 Organization for Economic Cooperation and Development (OECD) countries for 1998 (see appendix 2).[5] Three OECD members — the European Union (EU), Japan, and the United States — account for over 80 percent of all WTO domestic support ceilings. Appendix 3 documents the global computable general equilibrium model used to estimate scenario impacts.

[5] Australia, Canada, European Union, Japan, Korea, Mexico, Norway, New Zealand, Poland, Switzerland, and United States.

Reform Options

WTO member countries have proposed a variety of alternatives for reducing domestic support. Two generic scenarios are evaluated here.

The "ceiling reduction scenario" extends URAA limits on the overall, aggregate levels of domestic support by imposing an additional 20-percent reduction in support level ceilings — down to 60 percent of the 1986-88 base. This leaves the base support ceilings established under the URAA in place, which are uneven across countries. It also continues to allow countries maximum flexibility to concentrate support on individual commodities (table 4-3). Although reductions in ceilings may cause countries to restructure the commodity allocation of their support, they are assumed in this analysis to achieve lower ceilings by reducing all types of amber box support among all of the supported commodities by the same percentage. Countries are thereby assumed to maintain the relative allocation of subsidies among crops from the model base year (1998).

The EU would be required to reduce 1998 AMS support by a moderate 7 percent across all subsidized commodities, while Japan would be required to reduce support by 10 percent. Many countries, including the United States, Canada, Mexico, Australia, and New Zealand, would not be affected by a further 20-percent reduction in AMS ceilings, since their 1998 level of support was already below the new ceilings.

The support-leveling scenario requires countries to limit commodity-specific support to no more than 30 percent of their 1998 value of production. This is a more restrictive scenario that reduces the dispersion of relative support across commodities and countries. The 30-percent value of production was selected because it permits the EU to maintain approximately the same level of aggregate support as in the first scenario. This provides a degree of comparability between the two scenarios. Countries that provide less than the maximum commodity-specific levels of support are assumed not to increase their subsidies. Proportional cuts are assumed for all policies for a commodity if the overall subsidy for a commodity exceeds 30 percent of the value of production.

Most countries have commodity programs that this approach would affect, including the EU, Japan, the United States, Canada, and Mexico (table 4-4). This approach achieves significant trade liberalization in commodities that tend to be most protected, including sugar and dairy.

In both scenarios, countries are assumed to continue to use the same types of policies as in 1998. In actuality, some countries have altered their programs in the interim, or AMS reform could lead to further policy change. If WTO domestic support ceilings are further reduced (scenario 1), countries will likely have opportunities for alternative ways to provide support to their producers. The use of blue and green box types of support may increase, or countries may elect to change the mix of allowable commodity-specific support to focus

Table 4-3—Reduction commitments required to lower AMS another 20 percent from Uruguay Round ceiling

	AMS as percent of WTO ceiling in 1998	Cuts in AMS required to reach additional 20-percent reduction in WTO 1986-88 ceiling
	Percent	
Australia	23	0
Canada	9	0
European Union	74	-7
Japan	77	-10
Korea	80	-14
Mexico	7	0
Norway	88	-21
New Zealand	0	0
Poland	8	0
Switzerland	71	-2
United States	45	0

Only OECD countries represented in the CGE model are included in this table (excludes Czech Republic, Hungary, Iceland, and Turkey).
AMS = Aggregate Measurement of Support.
Source: ERS estimates using OECD PSE data and WTO notifications.

Table 4-4—Reduction commitments required to put commodity-specific AMS at 30 percent or less of value of production

	Wheat	Rice	Coarse grains	Oilseeds	Sugar
	Percent change from 1998 AMS				
Australia	0	0	0	0	0
Canada	0	0	0	0	0
European Union	0	0	0	0	-28
Japan	-65	-64	-56	-17	-51
Korea	0	-57	-57	-61	0
Mexico	0	0	0	0	-9
Norway	-37	0	-31	0	0
New Zealand	0	0	0	0	0
Poland	0	0	0	0	0
Switzerland	-35	0	-36	-52	-47
United States	0	0	0	0	-19

	Dairy products	Beef & sheep	Other meat	Wool	Fruits & vegetables	Miscella-neous
	Percent change from 1998 AMS					
Australia	0	0	0	0	0	0
Canada	-48	0	0	0	0	0
European Union	-44	-15	0	0	-16	0
Japan	-62	-6	-11	0	0	0
Korea	0	-27	0	0	0	0
Mexico	0	0	0	0	0	0
Norway	-10	0	-20	0	0	0
New Zealand	0	0	0	0	0	0
Poland	0	0	0	0	0	0
Switzerland	-43	-36	-40	0	0	-40
United States	-49	0	0	0	0	0

Source: ERS estimates using WTO notifications and OECD PSE data.

on “favored” commodities, such as dairy and rice. Likewise, if commodity-level support were constrained to 30 percent of the value of production (scenario 2), countries might elect to increase support for those commodities currently under the 30-percent ceiling. Clearly, it is not possible to predict which areas of support might increase.

Finally, unless otherwise constrained by a new WTO agreement, countries might substitute other policies such as tariffs or nontariff barriers (labeling requirements, phytosanitary constraints, etc.) for AMS domestic support. As a result, the trade adjustments presented in this paper should be viewed as indicative of the pressures for market adjustments that might occur if domestic support were further constrained. Rather than allowing trade adjustments, countries may respond to these market pressures by adjusting the mix of policy support provided to their farmers.

Leveling of Support Produces Larger Trade Impacts

The analysis indicates that world trade expands more when support is leveled across commodities than when ceilings on overall support are lowered. World agricultural trade expands by 0.3 percent under the ceiling-reduction scenario, while under the support-leveling case it increases by 1.2 percent.

U.S. agricultural exports increase 1.3 percent when AMS ceilings are lowered, and rise 1.7 percent when commodity support is leveled (table 4-5). In the ceiling-reduction scenario, U.S. export growth is mostly to the EU, with an annual increase of $440 million (table 4-6). In the leveling scenario, most U.S. export growth is to Japan, with an annual increase of $500 million (table 4-7). U.S. imports decline negligibly when ceilings are reduced and increase by 0.5 percent in the support-leveling scenario.

Table 4-5—Changes in U.S and world agricultural trade resulting from reductions in support

	Scenario: Ceiling reduction Change from base		Scenario: Support-leveling Change from base	
	US$ million	*Percent*	*US$ million*	*Percent*
U.S. exports	904	1.3	1,045	1.7
U.S. imports	-19	0.0	244	0.5
World trade	1,402	0.3	5,422	1.2

See tables 13 and 14, page 18, for breakdown by country.
Source: ERS estimates.

Table 4-6—Changes in U.S. agricultural trade from a 20-percent reduction in URAA AMS ceilings

	Exports								
	Canada	Mexico	EU	EFTA	Japan	Korea	Other countries	Total exports	Total imports
	Change from base in US$ million								
Rice	0.0	-0.1	6.1	0.1	17.0	0.0	0.7	23.9	-0.2
Wheat	0.1	1.6	55.8	3.1	15.0	1.6	63.2	140.5	-1.1
Coarse grains	1.0	-1.4	87.4	3.2	-6.7	-1.1	53.6	136.0	-13.9
Oilseeds	1.3	8.8	190.1	0.7	9.4	4.1	8.1	222.4	-0.2
Sugar	0.0	0.0	1.0	0.0	0.2	0.0	0.1	1.3	-0.4
Cotton and fiber	0.1	-0.1	0.1	0.0	0.6	0.4	0.7	1.8	0.0
Fruit and vegetables	0.0	-0.8	18.4	2.1	40.2	8.9	-3.8	65.1	7.8
Other crops	-0.8	-0.5	-12.6	0.4	3.6	3.4	-5.6	-12.1	11.3
Beef	2.0	-0.3	52.8	1.0	50.6	9.8	10.2	126.0	-13.4
Other livestock	5.2	0.9	17.0	1.4	37.8	14.3	68.4	145.0	-0.5
Dairy products	1.2	4.1	7.0	1.0	20.7	5.7	10.8	50.5	-0.6
Processed foods	3.1	1.5	16.6	0.0	-27.8	-2.7	12.6	3.3	-7.6
Total	13.3	13.8	439.6	13.0	160.5	44.3	219.0	903.5	-18.7

Source: ERS estimates.

Table 4-7—Changes in U.S. agricultural trade from reducing commodity-specific AMS to 30 percent or less of the value of production

	Exports								
	Canada	Mexico	EU	EFTA	Japan	Korea	Other countries	Total exports	Total imports
	Change from base in US$ million								
Rice	-0.3	-0.4	-1.7	0.6	265.4	0.3	-0.9	263.0	1.6
Wheat	0.1	-0.7	-5.7	9.2	87.9	1.4	41.7	134.0	3.7
Coarse grains	1.6	-0.4	-11.0	8.9	-18.5	-0.4	83.0	63.4	-25.4
Oilseeds	-0.1	-1.6	-19.1	4.2	29.7	21.3	7.3	41.6	0.0
Sugar	0.7	0.3	0.4	0.0	1.2	0.0	2.1	4.9	111.3
Fiber	0.4	0.2	1.1	0.1	2.5	1.6	10.0	15.9	-0.1
Fruit and vegetables	0.9	-0.3	75.0	5.0	-14.3	0.1	8.8	75.4	-2.1
Other crops	-0.2	-0.3	-15.4	-0.5	-2.4	-0.4	-1.5	-20.8	3.7
Beef	10.4	3.2	216.2	5.5	-4.4	23.7	31.5	286.2	-39.0
Other livestock	0.6	0.9	-2.0	1.1	9.5	4.9	8.4	23.5	-1.6
Dairy products	58.6	-21.4	40.0	2.2	164.6	-2.6	-44.4	197.0	173.8
Processed foods	-1.3	0.7	-19.0	-0.6	-19.7	-3.9	4.4	-39.5	18.1
Total	71.4	-19.6	259.0	35.9	501.4	45.9	150.5	1,044.5	244.0

Source: ERS estimates.

Trade impacts in the support-leveling scenario are somewhat larger for two reasons. Limiting support for individual commodities reduces large market distortions for the most heavily protected commodities. For example, in the ceiling-reduction scenario, Japan lowers its agricultural support by 10 percent for all supported commodities including rice, while in the leveling scenario rice support must shrink by 64 percent to reach 30 percent of the value of production. Second, since countries can no longer focus support on "favored" commodities, more countries are drawn into the reform process in the leveling scenario, including NAFTA countries, which increases bilateral trade opportunities.

Over 80 percent of the global trade effects for both scenarios result from reducing the market price support and related import barriers and export subsidies. Most amber box domestic farm support is provided through market price support programs, and most price support programs are implemented through trade restraints and export subsidies rather than government commodity stock holding. This suggests that only negotiating tariff reductions would create significant pressures for reductions in related domestic support programs. The use of market price support compared with other types of domestic support varies by commodity. Dairy support in OECD countries relies heavily on border measures in order to transfer income to producers. Wheat and coarse grains in these countries rely more heavily on direct payments to producers.

U.S. Exports Gain in Both Scenarios

The two approaches have the potential to affect world commodity markets differently. As a large diversified sector, U.S. agriculture benefits from both approaches. While the value of total U.S. export gains is similar under both scenarios, commodity impacts differ (tables 4-6 and 4-7). The export gains illustrate the directions and relative magnitudes of the pressures that are likely to result from policy reform.

Under the ceiling-reduction scenario, changes in U.S. exports are concentrated in bulk grains and oilseeds destined for the European Union (almost $300 million). The analysis assumes that the EU cuts amber box domestic support for all commodities included in the AMS by 7 percent. These cuts lead to decreased EU domestic production and exports, which has the direct effect of increasing U.S. exports to the EU and the indirect effect of increasing U.S. sales to EU markets.

Under the support-leveling scenario, the largest U.S. impacts are on rice exports to Japan. In this case, Japan cuts domestic support for rice by 64 percent. This leads to a potential annual increase in total U.S. rice exports of almost 30 percent, a significant increase for U.S. rice exports, since Japan imports mostly japonica rice grown almost exclusively in California. In order to expand U.S. exports of rice to Japan by 30 percent, japonica acreage in California would need to remain at near-record levels, while part of current exports to the Middle East and domestic processing use would need to be diverted to the higher priced Japanese market. U.S. dairy exports also increase by about 30 percent in this scenario, with Japan being the leading market.

Under both scenarios, annual U.S. exports of meat (beef, pork, and poultry) increase by about 4 percent (about $300 million). In the ceiling-reduction scenario, all types of meat exports increase. In the support-leveling scenario, most of the meat export growth occurs in beef exports to the EU. This analysis does not account for nontariff barriers such as the beef hormone ban, which could limit potential U.S. export growth.

U.S. wheat exports increase about 3 percent (about $140 million) in both scenarios. When the aggregate ceiling is reduced, EU cuts in domestic support for wheat lead to a decrease in its wheat exports. This creates an opportunity for U.S. wheat exports to expand and to capture a larger share of the world wheat market. However, when support is leveled, EU domestic support for wheat is assumed not to be reduced, and wheat imports from the United States are nearly unchanged. Instead, U.S. wheat exports to Japan expand, as Japan is required to cut support to all grains by about 60 percent.

U.S. fruit and vegetable exports increase by about $70 million in both scenarios. The increase in fruit and vegetable exports are mainly to the EU and Japan when ceilings are reduced and mainly to the EU when support is leveled. The EU reports an administered price program to the WTO for fruit and vegetable products. This support is assumed to be cut by 7 percent in the ceiling-reduction scenario and by 16 percent in the support-leveling scenario, which creates export opportunities for U.S. products. U.S. fruit and

vegetable exports to Japan decline in the second scenario, because the cut in Japan's support to grains and oilseeds is large enough to free up land for increased domestic production of fruit and vegetable products, thereby reducing imports.

Adjustments in world dairy trade under the two scenarios reflect two characteristics of this complex sector. First, dairy is one of the most highly supported sectors in world agriculture. Second, dairy trade is a multiproduct sector with highly differentiated products — cheese, for example. Consequently, many countries, including the United States, import some dairy products while exporting other products. With this two-way trade, reductions in foreign and domestic support can lead to simultaneous growth in exports and imports.

Liberalization can have positive benefits for U.S. dairy. In the ceiling-reduction scenario, the U.S. is not required to reduce any domestic support, including dairy, while the EU, Norway, Switzerland, and Japan cut dairy support. As a result, U.S. exports expand somewhat while imports are almost unchanged (table 4-6).

In the support-leveling scenario, U.S. dairy support is cut by 49 percent. In comparison, Japan reduces domestic support by 62 percent, Canada by 48 percent, and the EU by 44 percent. Reductions in world dairy support help expand U.S. annual dairy product net exports.

Japan is a key market for world dairy trade. Japanese dairy imports from all sources increase by about $1 billion when support is leveled. Though not a major supplier, the U.S. is currently a supplier of frozen dairy products to Japan. In the support-leveling scenario, Japan represents the most important market for increased U.S. dairy exports. Canada is another potential destination for U.S. dairy exports with the reduction in support levels.

Domestic Support Reforms Could Have Spillover Effects

The two scenarios analyzed here have direct impacts on commodities that receive amber box support. Spillover impacts in related sectors may also occur if the policy reforms affect input costs or if they free up labor and capital for use in other sectors.

While no policy changes are assumed for processed agricultural products, these products are likely to be significantly affected by AMS policy reforms. Processed agricultural products include a wide range of oilseed products as well as processed foods and beverages. The main spillover effects are changes in input costs (raw agricultural products) as countries reduce domestic support.

Prices of raw agricultural products are expected to decline in countries that relied on market price support, permitting countries to expand production of processed agricultural products. As a result the EU, European Free Trade Association (Iceland, Norway, Switzerland, and Liechtenstein), and Japan can expand exports of processed products, and the EU, Japan, and Korea reduce their imports of processed products. Japan in particular increases exports of processed products by $280 million while decreasing imports of processed products by nearly $700 million. These changes in Japan's processed product trade illustrate the potential problem of tariff escalation.[6] If processed foods are protected by a high tariff, lowering trade barriers (market price support) for raw materials can increase the effective rate of protection for processed foods.

Other Direct and Indirect Impacts of Reform

A small number of countries have WTO domestic support reduction commitments. Of these countries, the EU, Japan, and the United States account for over 80 percent of all WTO domestic support ceilings. Most of the growth in U.S. trade resulting from the two scenarios occurs among countries assumed to reduce domestic support. Increased U.S. exports to two countries — the EU and Japan — account for about 70 percent of U.S. export gains under both scenarios.

In addition to the direct benefits of policy reform affecting U.S. exports to the EU and Japan, indirect benefits to U.S. exports result from reduced competition in third markets. Changes in world wheat trade illustrate these impacts. The EU relies heavily on non-OECD markets as a destination. Reductions of 7 percent in the EU's amber box support under the ceiling-

[6] Tariff escalation refers to the situation where tariffs are zero or low on primary (unprocessed) products, then increase, or escalate, as the product undergoes additional processing. Tariff escalation can result in a significant bias against trade of the processed product.

reduction scenario lowers all forms of EU support, including domestic subsidies and administered price-related export subsidies for wheat. As a result, EU wheat exports to non-OECD countries decline by $300 million, leaving a gap for other suppliers to fill. The United States, Canada, and Australia increase wheat exports, filling about one-third of the gap, leaving production and trade by non-OECD countries to fill the remainder.

Summary and Conclusions

Two generic scenarios were selected for this study. In one case the overall AMS ceiling is reduced to 60 percent of the historical base, while the alternative requires a leveling of support by commodity to levels that do not exceed 30 percent of the 1998 value of production. The ceiling-reduction scenario permits countries to maintain maximum flexibility to protect individual commodities. The support-leveling scenario constrains high levels of support among countries and across commodities.

The results show that the aggregate impacts for the United States are similar under both scenarios. In the ceiling-reduction scenario, export gains are largest for wheat, feed grains, oilseeds, and meats. In the support-leveling scenario, export gains are largest for rice, meats, dairy, and wheat.

The market adjustments presented in this paper should be viewed as indicative of the types of adjustments that might occur if domestic support were further constrained as a result of WTO negotiations. The discussion assumes that only domestic support is disciplined and that countries do not alter the mix of domestic policies that they provide to meet the new policy constraints.

References

Rude, James (2000). *Green Box Criteria: A Theoretical Assessment, Economic and Policy Analysis*, Directorate, Agriculture and Agri-Food Canada, Publication No. 2007/E.

Young, C. Edwin, and Paul C. Westcott (2000). "How Decoupled is U.S. Agricultural Support for Major Crops?" *American Journal of Agricultural Economics* 83:762-67.

Multifunctionality: Options for Agricultural Reform

Mary Anne Normile

Multifunctionality is an issue that has arisen in the new WTO negotiations on agriculture as part of the continuing discussions of distortions affecting agricultural markets and trade. Multifunctionality refers to the concept that, besides producing food and fiber, agriculture creates nonfood joint or spillover—multifunctional—benefits such as open space, wildlife habitat, biodiversity, flood prevention, cultural heritage, viable rural communities, and food security. While the basic concept appears uncontroversial, multifunctionality has become the subject of debate in international forums because some countries seek to use multifunctionality to justify exemptions from WTO commitments to reduce their governments' production-related support to agriculture.

The new agricultural trade negotiations will continue the reform process with the long-term objective of achieving "substantial progressive reductions in support and protection resulting in fundamental reform." As part of the built-in agenda of the Uruguay Round Agreement on Agriculture (URAA), WTO members agreed that the new negotiations would take into account "non-trade concerns," including certain multifunctional issues like food security and the need to protect the environment.

The WTO disciplines policies based on their effects on production and trade. In the URAA, countries agreed to reduce spending on domestic policies that distort production or trade, while policies that do not distort trade or are minimally trade distorting were exempt from reduction commitments. Some countries propose using policy *objectives* (i.e., whether the policy's aim is to achieve a desired nonfood output) rather than its *effects*, as criteria for determining which policies to discipline. This approach could weaken WTO rules regulating domestic agricultural policies that distort international markets. On the other side of the debate, some countries maintain that objectives can be met with different policies, including many that are non- or minimally trade-distorting, and that the most efficient way to meet policy objectives is to target the policy to the objective.

Arguments for multifunctionality can be made clearer by examining the economic issues that underlie the arguments for production-linked support.

Jointness. Some countries have argued that production of food and nonfood outputs are closely linked in terms of the economic principle of "joint products." Joint products, or jointness, characterizes a production relationship where two (or more) outputs are produced from the same production process. For example, hides and meat are joint products of cattle. Proponents of this view maintain that the socially desired nonfood outputs, such as scenic farmland vistas, are produced jointly with agricultural production which is necessary to obtain the nonfood output. Some claim further that production-linked support for agriculture is necessary to achieve multifunctional benefits.

Opponents of this view argue that joint production relationships are not immutably fixed and can change over time with changes in technology. The jointness defense of production-linked agricultural support is argued to be inconsistent with the current WTO criteria that any policies exempt from disciplines be only minimally trade distorting. An alternative consistent with the reform process is to produce the desired nonfood outputs independently of agriculture through a range of policy instruments and private actions. For example, scenic vistas and open land can be produced through parkland or land used for recreational purposes (such as golf courses). These uses could be undertaken by government or by private associations, and could be encouraged through favorable tax treatment.

Externalities and market failure. Agricultural production activities can have positive (and negative) side effects, or externalities, that may not be accounted for in the market. For example, a positive externality of agricultural production might be flood protection, while the harmful effects of agricultural runoff on water quality would constitute a negative externality. In the multifunctionality debate, the existence of positive externalities is frequently cited as justification for government intervention in agriculture. Similarly, some countries contend that some of these nonfood "outputs," such as cultural heritage and scenic vistas, are public goods that require government support to ensure their supply. (Public goods are a certain class of goods or services, like national defense, from which all citizens benefit and are therefore usually supplied by the government.) Countering this view is the fact that multifunctional services need not originate in agricultural support policies.

Efficient policy design. Efficient policies target the specific objective associated with the nonfood output, and are less likely to result in trade distortions. Production-linked policies that target the nonfood objective indirectly are more likely to have spillovers that distort production and trade. The principle of efficient policy design—that policies should be targeted to the objective—is inconsistent with the jointness rationale for production-linked support.

Proponents of the joint production argument favor pursuing the desired nonfood output *indirectly* by supporting agricultural production, while efficient policy design suggests that the policy be targeted *directly* to nonfood objectives themselves, such as environmental or rural development goals. For example, preservation of agricultural land need not be accomplished indirectly through price support. Alternative public policy instruments include specific programs for protecting farmland, conservation easements, and purchase of development rights. Private alternatives include land buyouts by private entities.

Options for Reform

The issue for the multifunctionality debate is how to accommodate demand for nonfood benefits of agriculture while respecting fundamental principles of the GATT and the guidelines agreed to in the URAA. Options include the following:

Use minimally trade distorting government (green box) policies to address non-trade concerns. The green box contains specific provisions for addressing nontrade concerns, including support for rural communities and amenities and payments for environmental programs. Countries seeking to preserve and increase multifunctional benefits can adopt policies that are among the wide range of options provided in the green box.

Use trade-distorting (blue and amber box) policies within agreed-upon WTO limits to achieve domestic policy objectives. Shifting some other expenditures to exempt (green box) programs would provide greater flexibility for a country to use trade-distorting support to achieve objectives linked with multifunctionality.

Private actions can increasingly be used to address a number of nonfood objectives. Private groups can be encouraged to undertake these actions through tax policies and other inducements.

For more information, see *The Use and Abuse of Multifunctionality* (Bohman et al.) in the ERS WTO Briefing Room: http://www.ers.usda.gov/briefing/wto/pdf/multifunc1119.pdf

Effects of Eliminating EU Export Subsidies

Susan Leetmaa

In the Uruguay Round Agreement on Agriculture (URAA) 25 GATT contracting parties agreed to reduce the volume and value of subsidized exports. The current WTO negotiations on agriculture may impose further disciplines on export subsidies. Export subsidies amounted to over US$ 27 billion from 1995 to 1998, and the European Union (EU) accounts for nearly 90 percent of expenditures. This study analyzes the impact of eliminating EU export subsidies either by bringing EU domestic intervention prices in line with world prices or by reducing domestic production to match domestic consumption (eliminating exports). The impact on world markets would be felt mainly in the wheat and pork sectors. In the case of wheat, world prices would decline as EU exports increased following production shifts out of less competitive crops. Conversely, world pork prices would increase as EU exports decline.

Introduction

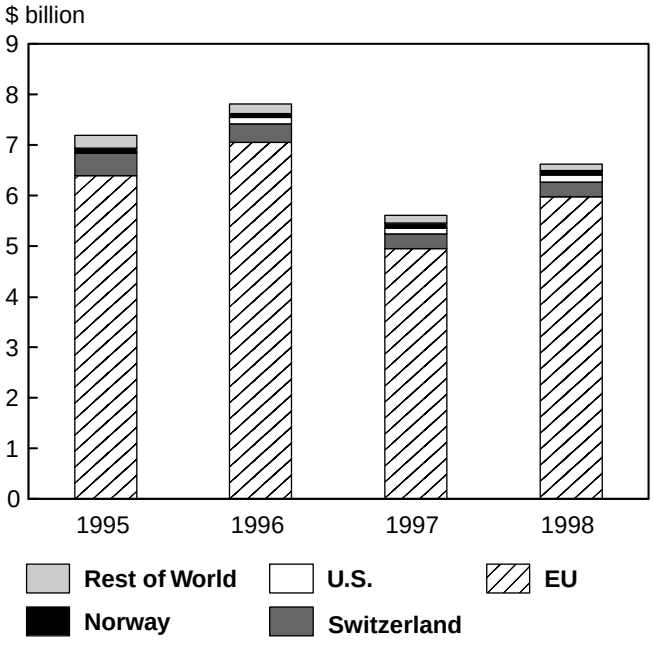
In the Uruguay Round Agreement on Agriculture (URAA), members of the General Agreement on Tariffs and Trade (GATT), the predecessor to the World Trade Organization (WTO), committed to reducing the volume of their export subsidies by 21 percent and the value of the subsidies by 36 percent over 6 years, from 1995 to 2000 (14 and 24 percent over a 10-year period for developing countries). Members also agreed to continue agricultural negotiations starting in the year 2000. Though the negotiations in Seattle in December 1999 did not result in the start of a new comprehensive trade round, negotiations on agriculture are progressing under the URAA's built-in agenda. In these negotiations, the United States has proposed reducing export subsidies to zero.

Twenty-five countries have made WTO export subsidy reduction commitments. The European Union (EU) is the largest user of export subsidies, accounting for roughly 90 percent of all export subsidy expenditures (fig. 5-1). Because the EU is the dominant user of export subsidies, this discussion will focus on the impact of EU export subsidy elimination on U.S. agriculture.

This analysis includes the following topics:

- an overview of EU export subsidy expenditures;
- explanation for the EU's reliance on export subsidies;
- the types of domestic policy reforms that would be necessary for the EU to eliminate export subsidies, and what past EU agricultural reforms have accomplished; and
- quantitative analyses of the effects of EU export subsidy elimination.

Figure 5-1
Export subsidy expenditure by country, 1995-98



Source: Economic Research Service, USDA

Agricultural Policies Force Reliance on Export Subsidies

Export subsidies are typically used by countries (such as EU member states) whose domestic prices are supported above world price levels. Price supports stimulate production, often resulting in a production surplus. Export subsidies are employed to bring the price of the commodities down to world price levels, in order to export surpluses. Because export subsidies increase the world supply of commodities, they depress world prices.

The EU is the largest user of export subsidies in both value and volume. According to its official notifications to the WTO of export subsidy use, the EU spent an average of $6 billion annually from 1995 to 1998 subsidizing exports. Over the same period, the EU's volume of subsidized exports averaged about 28 million tons a year plus 3.6 million hectoliters (95 million gallons) of liquids (wine and alcohol). From 1995 to 1998 the EU subsidized nearly all of its exports of coarse grains, butter and butter oil, beef, and skim milk powder[1] (fig. 5-2). The majority of wheat and other dairy exports also required subsidies.

For most commodities, the EU supports high internal prices and employs import barriers to keep cheaper imported products out of the domestic market. The size of EU export subsidies change with world price and exchange rate fluctuations, as the price gap between the domestic and world price is the per-unit export subsidy. In the case of grains and beef, the EU employs intervention systems that purchase domestic products at guaranteed prices which act as price floors. There is one intervention price for all grains, which is currently set at 110.25 euro/ton (US$102/ton) and is to be reduced to 101.21 euro/ton (US$93.7/ton) for the period 2001/02 to 2006. Given world grain prices, this common price implies relatively high subsidies on barley and other coarse grains compared to wheat. This domestic price structure has encouraged barley and other coarse grains production. Grain and beef producers also receive direct payments.[2] Oilseed prices are not supported; producers receive world prices for oilseeds, as well as direct payments. Sugar and dairy production are supported by high guaranteed prices, and production is fixed by quotas. The EU is a net exporter of dairy and sugar, both of which require subsidies for export.

WTO members are required to reduce their export subsidies on a product-by-product basis. This ensures that a country cannot reduce subsidization of one commodity while increasing subsidies for another. The single largest EU export subsidy expenditure has been for beef, accounting for 22 percent of EU export subsidy expenditures from 1995 to 1998, although its expenditure share has been declining over time. Other commodities that have required large EU subsidy expenditures are other milk products (yogurt, ice cream, etc.), sugar, coarse grains, and incorporated products (processed products produced from other EU agricultural products). Grains have accounted for the majority of the EU's volume of subsidized exports, averaging 67 percent of subsidies from 1995 to 1998.

High world grain prices kept the EU's use of export subsidies well below WTO commitments in 1995 and 1996. For some time, the EU even imposed taxes on wheat exports to keep domestic supplies from falling and prices from rising. But when world wheat prices fell in 1997 and 1998, subsidy expenditures and the volume of subsidized exports increased. The EU has carried over unused portions of its 1995 commitments to make up for overruns in later years. The URAA has been interpreted to allow the use of "rollover" of the additional amount not used in earlier years to any of the years up to 1999/00, after which "rollover" is no longer possible.

EU Volume Commitment Has Been More Binding Than Value

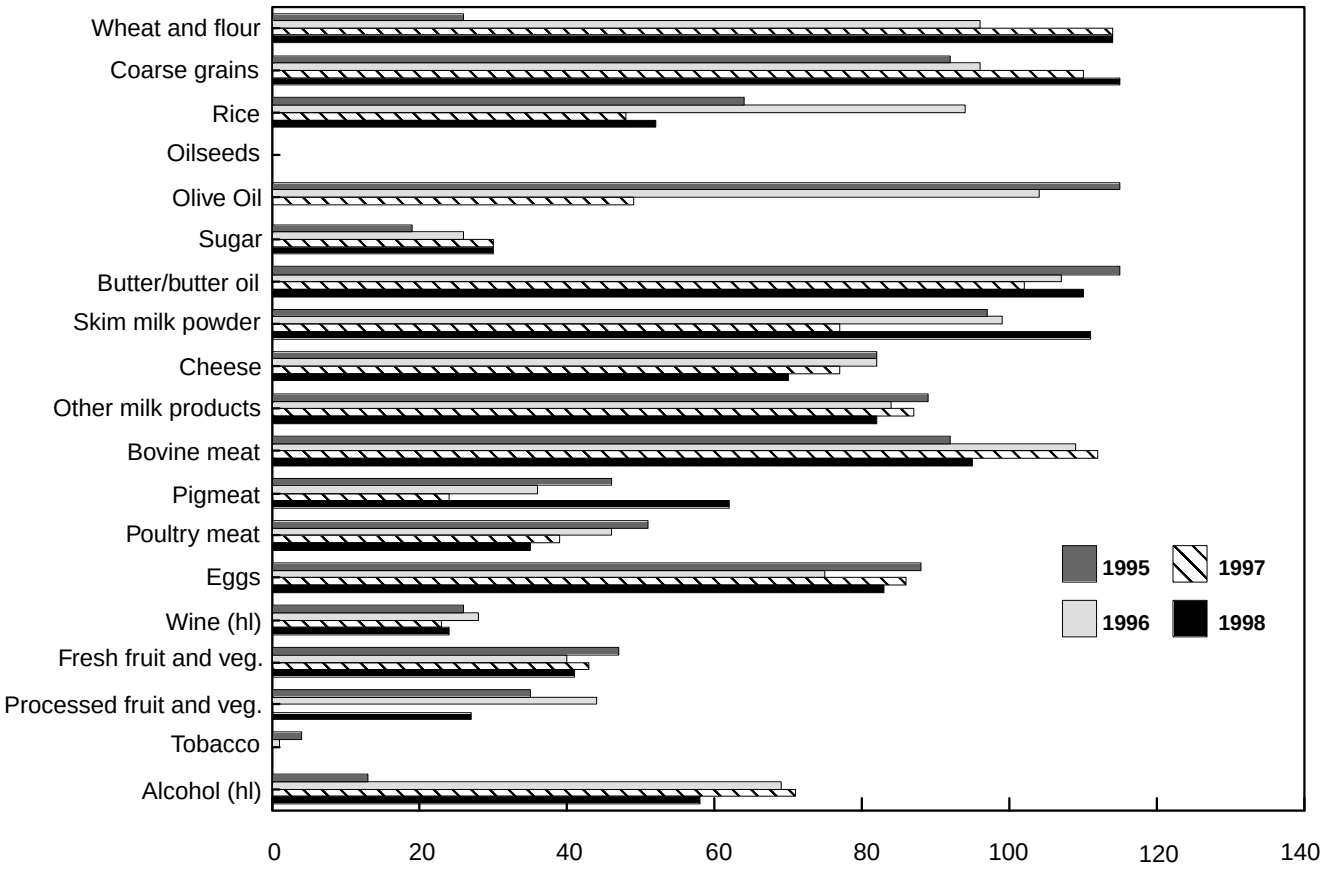
From 1995 to 1998, the EU has come closer to filling its volume commitments than its expenditure commitments. The only expenditure commitments that have been consistently more binding than the EU's volume commitments from 1995 to 1998 have been for sugar,

[1] The EU uses export statistics from July-June expressed in product weight for their notification of total exports and export certificates issued during the marketing year in question in equivalent weight, irrespective of actual date of export. Therefore, notifications of subsidized exports may exceed total exports notified, and the percent of total exports subsidized as seen in figure 5-2 can exceed 100 percent.

[2] The payments to grain and oilseed producers are partially decoupled (i.e., although they are tied to area planted up to a maximum fixed area, yields are fixed at historical levels). The payments to beef producers are fully coupled as they are tied to production, though are only available for a fixed herd size.

Figure 5-2

Percent of total EU export volume subsidized, 1995-98



Source: Economic Research Service, USDA

processed fruits and vegetables, tobacco, and alcohol, none of which are included in the model in this analysis. If the average of only 1997 and 1998 is taken, only sugar and alcohol expenditure commitments have been closer to their expenditure bounds than their volume commitments. This is because the EU at the time was carrying-over unused sugar subsidies from 1995 and 1996 to increase its subsidized sugar exports, and because the per-unit subsidy expenditure is by far the highest for the EU's alcohol products.

It is likely that the EU's value commitments became more binding for grains in 1999 than in past notifications, because world grain prices were low in 1999. Value commitments become more binding as world prices fall, because the gap between the EU support prices and world prices increases; volume limits also constrain exports when prices are low. Therefore, even though past WTO notifications have shown that the value limit has been less restrictive than the volume limit, that could change in the future if world prices remain low.

This situation highlights the importance of both volume and value restrictions. Targeting both constrains exports in times of both high and low prices. When prices are low, the value limit becomes more constraining because the wedge between the domestic support price and the competitive export price becomes larger. Volume limits prevent export of excess supply in response to low domestic prices. When world prices are high, the value constraint becomes less binding but the volume constraint can still be effective. Limits on value and volume weaken the ability of export subsidies to maintain fixed internal price support programs.

Agricultural Reform Necessary to Eliminate EU Export Subsidies

The EU could employ a number of options to limit or eliminate the need for subsidized exports. It could apply production controls such as production quotas to eliminate surplus production. Through the Common Agricultural Policy (CAP), the EU already employs production controls for arable crops, dairy, sugar, and beef, in the form of a mandatory land set-aside program, and quotas. It also limits acreage and herd size eligible for direct payments. However, most producers dislike the existing production controls. Additionally, production controls would have to be very limiting in order to eliminate subsidized exports. The dairy quota would have to be cut by over 30 percent, as the majority of diary products require subsidies for export. However, the EU dairy quota is currently in the process of being increased 2.4 percent due to the Agenda 2000 reforms. Therefore, it is doubtful that reducing production quotas would be a practical solution for EU export subsidy elimination.

If the EU elected to eliminate export subsidies without changing agricultural policies, it would build unmanageable stocks of beef, coarse grains, and dairy products. Building stocks is costly to the government, which would incur great losses if the stocks had to be disposed of on the domestic market. Stockholding, then, is not a likely method the EU would employ to reduce or eliminate the need for export subsidies.

Another policy option the EU could employ to eliminate reliance on export subsidies would be to reduce support prices. This would increase domestic consumption, possibly reduce domestic production, and decrease the need for export subsidies. The EU's past two agricultural reforms have reduced support prices and compensated producers by increasing direct payments, but not by the full amount of the price decrease, such that total support falls. Policymakers would most likely follow a similar path of reform in the future.

Until the EU's 1992 reform of the CAP, high internal prices provided the majority of income support to farmers. The 1992 reform lowered EU support prices, instead supplementing farmers' income with direct payments, and imposed a land set-aside for supply control. Agenda 2000 built on the 1992 reforms by further reducing prices for some commodities while compensating producers for half of the price decline through direct payments.

The Agenda 2000 policy reforms addressed the following areas:

- **Support prices**. These were reduced for grains (15 percent) and beef (20 percent), and will be reduced for dairy (15 percent) over 3 years beginning in 2006.
- **Compensatory payments to producers**. These increased, except to oilseed producers whose payments were cut by 33 percent over 3 years in order to equal the grains payment by 2002. After 2002, compensatory payments will no longer play a role in arable crop producers' production decisions, as they will be the same across commodities (except durum wheat).
- **Land set-aside**. Policy is maintained and the base rate[3] of the required set-aside is set at 10 percent from 2000 to 2006.
- **Dairy quota**. Quota was raised 2.4 percent over the period of the Agenda 2000 reforms.
- **EU agricultural spending**. Total was fixed for 2000-06 at 40.5 billion euros (US$37.5 billion) in real terms.

Developing a Scenario for Export Subsidy Elimination

This study analyzes the impact of eliminating EU export subsidies by reducing internal EU prices until domestic supply equals domestic demand, or until world prices are equaled — whichever point is reached first. If EU price declines bring domestic supply and demand into balance before world price levels are met, the EU would have no need to export. If prices fall to world price levels, excess EU production is exported because it does not require subsidies.

Two external factors affect EU reliance on export subsidies: world prices and exchange rates. The per-unit export subsidy for a commodity is the gap between EU and world prices. As world prices change, the gap between EU and world prices changes, altering the value of the subsidy and often the percentage of

[3] The base rate is the default set-aside rate. To change the set-aside rate from the base rate, EU member countries would have to agree on a new rate.

exports requiring subsidies. If world prices increase, the EU's reliance on export subsidies decreases, and if world prices decrease, the EU becomes more reliant on export subsidies.

Similarly, changes in the value of the euro alter the gap between EU internal prices and world prices. If the euro increases in value, the EU perceives world prices in euros to be lower and the need for subsidies increases. Conversely, if the euro falls in value, world prices faced by the EU appear to be higher, reducing the need for subsidies.

Scenarios

In this study, two export subsidy scenarios are examined. One scenario reflects USDA's 2000 baseline exchange rates, with the euro's value greater than US$1. The second scenario assumes a U.S. dollar/euro parity exchange rate. As of January 2001, the euro was worth just less than US$1 ($0.96); however, the baseline assumes a euro stronger than the dollar and appreciating over time. The inclusion of two scenarios provides some sensitivity analysis on how changes in exchange rates can alter dependence on export subsidies.

The commodities included in this analysis are wheat, barley, corn, other coarse grains, oilseeds and their products, beef, pork, and poultry. These account for just over 50 percent of EU *expenditures* on export subsidies (not accounting for subsidy expenditures on incorporated/processed products), and roughly 75 percent of the *volume* of subsidized exports. The results of this analysis are applicable to other EU commodities, in that the general direction of price movements would be similar.

Dairy has been omitted from this analysis due to model constraints. However, analysis of the EU's WTO export subsidy notifications suggests that current dairy prices are too high to allow the EU to export most dairy products without a subsidy. The EU export subsidy for skim milk powder (SMP) has declined over 80 percent from the January 2000 level (810 euro/ton to 150 euro/ton), though it is unclear whether current market conditions will continue to allow for such a small export subsidy. Currently, the world SMP price is high, due to high demand, and subsidies are low due to a relatively weak euro.

EU dairy price reforms under Agenda 2000 will begin to be phased in in 2005 (a 15-percent decline over 3 years). However, the EU milk production quota will increase 1.2 percent in 2001 and by an additional 1.2 percent from 2005 to 2007. It is likely that the EU will need to subsidize most dairy exports until at least 2005, and perhaps longer. From 1995 to 1998, the EU subsidized over 90 percent of its butter exports, nearly all SMP and other dairy exports, and over 82 percent of cheese exports. The Agenda 2000 15-percent reductions in support prices are far smaller than the average 1995-98 export subsidies for both butter and SMP. Therefore, if market conditions are similar, the EU will probably need to subsidize much of its exports even after the dairy reforms are implemented. While there is no EU support price for cheese, both butter and SMP are components in cheese production. Dairy reform is thus not likely to make EU cheese competitive in most markets.

Key assumptions that drive the results of the analysis include the following:

- The economic model used in this analysis includes a very complete feed sector, including nongrain feedstuffs (such as corn gluten and manioc) which are important components of EU feed, given existing EU policy pricing. It is important to examine how EU demand for all foodstuffs will change with the elimination of grain price distortions the CAP has induced.
- As is consistent with actual trade flows, the model assumes that pork and poultry exports are partially price competitive; not all exports require subsidies.
- Imports do not respond to price changes.
- The milk production quota remains in place for the duration of the analysis, as do livestock headage limits and area bindings for arable crops.

As in the official USDA baseline projections[4] for the EU, it was assumed that:

- the set-aside rate is fixed at 10 percent of arable land,
- total farmland is fixed with only yields changing,
- the EU's Blair House limits on oilseed area are maintained,
- the EU dairy quota would remain in place through the projection period 2001-09,

[4] The official USDA projections for EU agricultural production, consumption, and trade for the period 2000-09. See *USDA Agricultural Baseline Projections to 2009*, WAOB-2000-1.

- the dairy quota also constrains EU beef production as more than half of the beef produced is a product of the dairy herd,
- stocks are held constant, and
- compensatory payments will stay at the Agenda 2000 rates for the period analyzed.

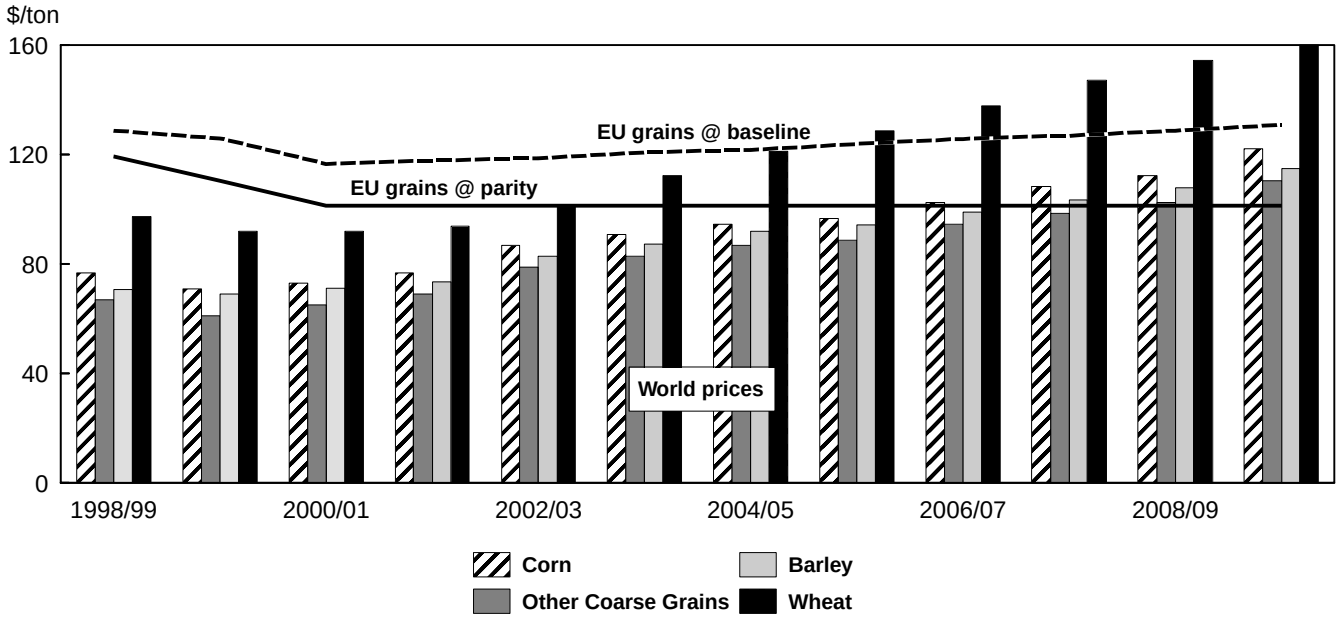
The EU will be able to export commodities without subsidy when domestic EU prices are lower than or equal to world prices. The base world prices for this analysis are the prices used for the official 2000 USDA baseline projection exercise.

Scenario One: Export Subsidies Eliminated and Euro Stronger Than Dollar

Arable Crops: With a relatively stronger euro, even if EU internal prices equal world price levels, the EU would have exportable surpluses of all grains. Grain prices would fall from a common internal price under the CAP for all grains to different world prices for each of the grains. The world price of wheat is higher than for barley and other coarse grains (fig. 5-3); consequently, EU wheat production increases at the expense of other grains (table 5-1). The EU would export more wheat as production shifts out of less lucrative crops.[5] At much lower internal prices, barley and rye feeding would increase while wheat feeding would decline, as wheat would became a more costly feed relative to other grains and would be exported. Total area planted to grains would decrease, even though wheat area would increase slightly. Oilseed area would increase slightly as well, as EU oilseed producers already receive world prices for their products and the relative decline in oilseed prices, due to cross-price effects, would be less than that for coarse grains. A slight decline in the world price of rapeseed would result in a slight decline in yields and a minimal increase in feeding of rapeseed, reducing EU exports slightly.

[5] The other studies included in this report use a 1997 base year and policies from 1998, when the EU was using export subsidies for wheat. This study uses a time-path model that accounts for changes likely to occur between our 1997 base year and future years. One of these changes is that the world wheat price is expected to increase, while the EU domestic support price is expected to decrease, eliminating the need for EU export subsidies. Additionally, this analysis holds imports constant at a fixed level, whereas the other analysis allows imports to vary.

Figure 5-3
World and EU grain prices



Source: *USDA Agricultural Baseline Projections* to 2009.

Table 5-1—Elimination of EU export subsidies: Changes from 2000 baseline under two scenarios, 2007/08

Commodity		Euro stronger than dollar	Euro/dollar parity
		Percent change	
Wheat	EU price	-8.6	+14.9
	World price	-6.1	-5.4
	Area	+0.6	+1.6
	Production	+0.1	+2.6
	Consumption	-4.4	-6.5
	Exports	+19.5	+42
Barley	EU price	-16.6	+3.1
	World price	+7.3	+6.3
	Area	-1.8	-2.9
	Production	-3.2	-2.6
	Consumption	+1.3	+1.0
	Exports	-32.7	-26.3
Other coarse grains	EU price	-13.2	+8.2
	World price	+4.9	+4.8
	Area	+0.1	-0.9
	Production	-0.9	-0.2
	Consumption	+0.3	+0.5
	Exports	-17.3	-10.4
Rapeseed	EU/World price	-4.9	+19.4
	Area	+1.2	+0.3
	Production	+0.4	+3.4
	Consumption	+0.8	+2.8
	Exports	-5.5	+12
Beef	EU price	-59.7	-39.3
	World price*	N/A	N/A
	Production	-1.7	-0.9
	Consumption	+8.3	+9.1
	Exports	-100	-100
Pork	EU price	-13.9	-0.1
	World price	+10.1	+9.9
	Production	-4.2	-4.5
	Consumption	-2.0	-2.3
	Exports	-44	-44
Poultry	EU price	-12.0	+2.8
	World price	+3.3	+3.2
	Production	-4.8	-6.0
	Consumption	-2.0	-3.6
	Exports	-29.8	-27.2

*EU beef exports do not compete with other world beef exports; hence there is no impact on the world beef price.
Note: All euro-to-U.S. dollar conversions assume an exchange rate of US$1 = 1.08 Eu

Meats: If export subsidies were eliminated, the EU would continue to be noncompetitive in exports of beef, as the domestic price decline would drive up EU beef consumption sufficiently to eliminate the need for exports prior to reaching the world price. Direct payments constitute a large portion of the support beef producers receive and much of the EU's beef supply is a by-product of the dairy herd; therefore, EU beef production is not very responsive to price declines. The model assumes that only 25 percent of any producer price decline reaches consumers, as this has been true of past price declines (which have not been as large as in this scenario). Thus, the EU internal beef price would have to decline nearly 60 percent to drive up consumption sufficiently to absorb excess EU production. However, even such a large price decline is not quite enough to eliminate the need for export subsidies for the type of beef the EU tends to export. As most of EU beef is a by-product of the dairy herd, consequently much of it is used for ground beef. Additionally, due to current EU policies, much EU beef has been in frozen storage for many months (sometimes years), which is undesirable to most consumers and significantly reduces its value. The "world" price of EU beef

is therefore much lower than the world price of standard beef.

The EU does produce a relatively small quantity of "premium" beef — grain-fed beef not produced from dairy animals — which could be exported at a higher price. However, it is unlikely that it would be exported, as there is excess demand for high-quality beef in the EU which cannot be fully met by U.S. or Canadian beef, due to the EU beef hormone ban. Therefore it is doubtful that the EU would begin to export higher quality beef even if able to do so without subsidy. However, the EU beef industry could restructure in order to enter into the world's higher quality beef trade.

Smaller price declines than for beef would be necessary to bring EU pork and poultry supply in line with consumption. This is due to reduced feed costs and narrower gaps between internal and world prices than is the case with beef. The EU would be able to export more pork and poultry without subsidy than they currently do. The EU is highly competitive in exports of whole birds (most are exported to the Middle East and North Africa) and Danish pork exports. However, it would take a 12-percent decline in the EU poultry price to bring EU poultry supply and demand into balance. To make EU poultry parts competitive with U.S. poultry parts on the world market, EU poultry prices would have to fall further. The U.S. is highly competitive in the parts market since U.S. consumers are willing to pay a premium for boneless chicken breasts; therefore, the export price of U.S. dark meat (which is preferred by consumers in many countries) is very competitive.

Scenario Two: Export Subsidies Eliminated and Exchange Rates at Parity

A weaker euro than in the baseline scenario would help the EU achieve export subsidy elimination. If the euro remains at or near parity with the U.S. dollar, EU prices would not have to fall as far as under the baseline exchange rate scenario in order for the EU to eliminate export subsidies. For most commodities, EU internal price levels would be higher than those under the baseline exchange rate scenario.

Under exchange rate parity, the EU would have been able to export wheat without subsidies starting even in 2000. The EU would experience a more pronounced increase in wheat area, production, and exports than under baseline exchange rates, since the internal EU wheat price decline would be minimal and the wheat price would be higher than prices for other grains. As under baseline exchange rates, barley feeding would increase, as wheat would command a higher price on world markets and thus be exported. Consumption of other coarse grains and oilseeds would be up as well, but barley would capture the bulk of displaced wheat feeding.

A euro/dollar parity would have little impact on the livestock sector, as producers are less responsive to price changes. As under baseline exchange rates, no beef would be exported, since domestic supply and demand would balance before EU export prices would equal world prices. Pork and poultry exports would be only slightly higher than under baseline exchange rates.

Impact on U.S. Agricultural Sector

For most commodities, the impact of both scenarios on the U.S. agricultural sector would be minimal. The commodity most affected would be wheat, as EU exports would increase under both scenarios, lowering world prices. The larger the EU exports, the more they would drive down the world price of wheat. The lower the world price falls, the more U.S. wheat production declines and consumption increases, decreasing exports. If EU export subsidies were eliminated, the world price would decline by about 6 percent and U.S. exports could decline roughly 5 percent. There would be little impact on other U.S. grain or oilseed exports, with most changes around 1 percent.

Declines in EU livestock exports would drive up world prices of livestock products. This would slightly increase U.S. production, and consequently exports. The largest impact would be in the beef sector, where EU exports would be severely limited or eliminated. U.S. pork exports could increase as well.

These results are similar to those in an OECD study of global export subsidy elimination. That study also finds that export subsidy elimination results in fairly modest world price impacts. The largest impacts in the OECD study were on world dairy markets, which were omitted from this study. A substantial share of trade in world dairy markets occurs with subsidy. The OECD study found that EU exports of butter and skim milk powder would be severely reduced by 2005, while EU cheese exports would increase. In the case of cheese,

the EU internal price would fall by 5 percent and the world price would increase 10 percent on average. They also found that EU milk price changes would not be large enough to cause EU milk producers to underfill their quotas, so the production quota would continue to be binding. One slight drawback of the OECD study is that the analysis does not include nongrain feeds and consequently eliminates a new source of demand for feed that would lead to an increase in both food and feed grains with the elimination of export subsidies.

Conclusions

The current WTO negotiations on agriculture may impose further disciplines on export subsidies, which would have the most direct consequences for the EU, as the world's largest user of export subsidies. Past EU agricultural reforms have reduced support prices and increased farmers' direct payments. This study finds that if the EU employed similar reforms to eliminate export subsidies or to bring domestic supplies in line with domestic demand (which would eliminate exports), the EU would continue to have exportable surpluses of all grains, while the EU would remain uncompetitive in beef exports. The impact on world markets would be felt most in the wheat and livestock sectors. In the case of wheat, world prices would decline due to increased EU exports as production shifts out of less competitive crops. Conversely, world livestock prices would increase as EU exports decline due to the reduction in EU livestock prices necessary to reduce or eliminate subsidies.

References

Leetmaa, Susan. "An Analysis of Agenda 2000," in *The European Union's Common Agricultural Policy: Pressures for Change, USDA*, WRS-99-2, 1999.

Organization for Economic Co-operation and Development. *A Forward-Looking Analysis of Export Subsidies in Agriculture*, 2000.

USDA. *USDA Agricultural Baseline Projections to 2009*, 2000.

World Trade Organization. Export subsidy notifications.

Impacts of Agricultural Policy Reform on Low-Income Countries

Shahla Shapouri and Michael Trueblood

This article considers how global trade liberalization affects the food security of 67 low-income, food-deficit countries. In the baseline scenario, food gaps based on recent per capita availability levels are projected to reach 12.73 million tons. The first trade liberalization scenario isolates the impact of rising food prices and the second scenario examines the additional effect of an increase in foreign exchange. The overall results show a slight decline in food gaps of about 0.74 million tons. Regionally, Sub-Saharan Africa will gain the most because of its low food-import dependency and high share of agriculture in total exports.

Introduction

Despite improvements in global food availability over time, many developing countries remain vulnerable to food insecurity. Food security is defined as access by all people at all times to enough food for an active and healthy life. Three conditions must be fulfilled to ensure food security: food must be available, each person must have access to food, and the food must fulfill consumption requirements. Many factors affect a country's food security position, including the natural resource endowment of the country, the level and variability of food production, population growth, income distribution, and foreign exchange availability to import food. Performance of these factors, in turn, is affected by adoption of agricultural technology, environmental degradation, domestic policies, employment, barriers to trade, export earnings, import prices, political environment, and the state of the world economy.

This article highlights briefly how trade liberalization may affect food security of low-income developing countries. The global trade modeling results in Chapter 1 of this report are used as input to USDA's *Food Security Assessment* model to show how such outcomes affect baseline food supply projections for these countries (USDA, 1999). The projections of food gaps, which exclude food aid, show that the food gaps are reduced in varying degrees, depending on the trade liberalization scenario considered.

Background

The developing countries account for the majority of the world's population (about 80 to 90 percent, depending on definitions) as well as the majority of the world's countries. Characterizing these many different countries and economies is difficult. This article focuses on 67 developing countries monitored in the USDA's *Food Security Assessment* report.[1] These countries account for about 40 percent of the global population. Almost all are net food importers and historically have received food aid. Forty-eight of the 67 countries are considered "least developed countries" by the United Nations classification system. This analysis excludes all high middle-income food-exporting countries, such as Brazil, Argentina and Thailand.[2]

To help classify these developing countries by economic characteristics, macroeconomic, trade partner, and agricultural trade flow data were compiled in separate tables (for additional geographic discussions, see Box). Table 6-1 shows the macroeconomic structures of these countries compared to all countries. In 1996, per capita

[1] The countries are Afghanistan, Algeria, Angola, Armenia, Azerbaijan, Bangladesh, Benin, Bolivia, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Colombia, Congo (Dem. Rep.), Côte d'Ivoire, Dominican Republic, Ecuador, Egypt, El Salvador, Eritrea, Ethiopia, Gambia, Georgia, Ghana, Guatemala, Guinea, Guinea-Bissau, Haiti, Honduras, India, Indonesia, Jamaica, Kenya, Korea (D.P.R.), Kyrgyzstan, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Morocco, Mozambique, Nepal, Nicaragua, Niger, Nigeria, Pakistan, Peru, Philippines, Rwanda, Senegal, Sierra Leone, Somalia, Sri Lanka, Sudan, Swaziland, Tajikistan, Tanzania, Togo, Tunisia, Uganda, Vietnam, Zambia, and Zimbabwe.

[2] This analysis excludes the People's Republic of China.

Table 6-1—Macroeconomic indicators for 67 low-income countries compared to all countries, 1996

Region	Average GNP per cap.	Pop.	Agri.	Indus.	Serv.	Open-ness	Share of global FDI	Aid/ GNP
	U.S. dollars	*Mil.*	*Percent of GNP*			*Ratio*[1]	*Percent*	*Ratio*
67 low-income countries, by region								
North Africa	1,302	124	15.8	36.3	47.9	55.0	0.4	2.0
Sub-Saharan Africa	261	547	32.5	28.1	39.4	72.9	0.9	9.0
Asia	520	1,622	24.2	31.6	44.2	43.3	3.7	0.9
Latin America	1,768	127	12.7	30.8	56.5	43.5	2.3	1.7
NIS	495	27	30.5	25.8	43.8	78.5	0.2	8.9
All countries, by income[2]								
High income	26,527	893	2.0	34.4	63.6	41.4	63.4	0.0
Medium income	2,560	1,550	10.1	34.2	55.7	55.8	22.1	0.5
Low income	444	3,272	24.5	39.2	36.3	45.1	14.5	1.7

[1]Exports plus imports, divided by GNP.
[2]High income: > $10,000/cap.; medium: $700-$10,000/cap.; low income: < $700/cap.
Source: Author calculations, based on World Bank, *World Bank Indicators* 2000 CD-ROM database.

income ranged from $261 in Sub-Saharan Africa to $1,768 in Latin America. The largest population share is in Asia, which includes India and Indonesia. Sub-Saharan Africa and the New Independent States (NIS) of the former Soviet Union are the most dependent on foreign aid. Each geographic region has a low global share of foreign direct investment (FDI), ranging from 0.2 percent in NIS to 3.7 percent in Asia. All low-income countries account for only 14.5 percent of global investment, which is quite low considering China alone accounts for 12 percent. With the exception of the NIS countries, almost all of the countries are members of the World Trade Organization (WTO).

Most of these countries' trade goes to developed countries, often due to historical ties and geographic proximity (table 6-2). For example, the largest share of Latin American countries' trade is with the United States, while both North Africa and Sub-Saharan Africa trade mostly with the European Union (EU). The Asian countries have relatively equal trade shares with the United States, EU, and Japan. An exception is the NIS countries, which are still interdependent on trade with other NIS countries, in particular Russia.

Table 6-3 shows the different agricultural trade structures for these low-income countries. All regions are net food importers, although Sub-Saharan Africa, Asia, and Latin America are net agricultural exporters.[3] All regions are net importers of cereals, meats (except Asia), and dairy products, and all are net exporters of fruits and vegetables. Sub-Saharan Africa, Asia, and Latin America are net exporters of beverage crops (coffee, cocoa, tea, and spices).

A review of the historical export performance and structure of different regions can provide insights to the countries' potential gains from trade liberalization. Export growth data of 61 low-income countries during 1980-90 and 1990-97 show that Sub-Saharan Africa is the only region that experienced a slowdown in export growth between the two periods (from 3.0 percent to 1.6 percent per year). A simple comparison of trends in export growth and commodity composition in different regions demonstrates the likely linkages between these two factors. Sub-Saharan Africa, with a high dependency on primary commodity exports, experienced the lowest export growth of all the regions. About 29 of 41 countries in the region depend on only three primary commodities to provide at least 50 percent of their export revenues. In contrast, low-income countries in Latin America, which have a similar share of agricultural exports, have been successful in recent years in expanding the share of manufactured exports, which tend to have higher demand than agricultural goods.

The low-income Asian countries have the largest and fastest growing markets. These countries have achieved a high level of export diversification (for example, the share of manufacturing grew from 54 percent in 1980 to 74 percent in 1997). Their

[3] Agricultural exports include nonfood commodities such as rubber, fiber crops (including cotton), tobacco, and hides and skins.

Table 6-2—Trade partners for 67 low-income countries by region, 1996

Region	U.S.	Japan	EU15	Other developed	Other	World
Exports, value ($ million):						
North Africa	2,763	488	16,787	871	6,359	26,397
Sub-Saharan Africa	9,734	1,105	18,721	1,180	15,130	44,690
Asia	24,357	21,432	26,948	4,378	54,378	127,115
Latin America	12,011	1,186	6,933	1,359	14,652	34,782
NIS	38	1	423	97	1,934	2,396
Export shares (percent):						
North Africa	10.5	1.8	63.6	3.3	24.1	100.0
Sub-Saharan Africa	21.8	2.5	41.9	2.6	33.9	100.0
Asia	19.2	16.9	21.2	3.4	42.8	100.0
Latin America	34.5	3.4	19.9	3.9	42.1	100.0
NIS	1.6	0.0	17.7	4.0	80.7	100.0

Source: IMF, *Direction of Trade Statistics*, 1999 Yearbook.

Table 6-3—Composition of agricultural trade, 67 countries, 1995-1997 average (US$ billion)

Region	Total merch.	Total agri.	Total food	Cer.	Meats	Dairy	Fruit & veg.	Bev. crops	Oil-seeds	Sugar	Other
Exports:											
North Africa	26.1	1.9	1.5	0.2	0.0	0.0	0.9	0.1	0.0	0.0	0.7
Sub-Saharan Africa	76.2	10.5	4.8	0.2	0.1	0.0	0.7	4.7	0.2	0.4	4.1
Asia	128.5	17.3	9.1	2.6	0.3	0.0	1.9	3.6	0.3	0.5	7.9
Latin America	31.4	9.8	4.5	0.2	0.1	0.0	2.5	4.3	0.1	1.0	1.5
NIS	2.4	0.5	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.4
Imports:											
North Africa	38.2	9.1	7.4	3.6	0.3	0.7	0.5	0.5	0.2	0.8	2.6
Sub-Saharan Africa	61.1	7.0	6.0	2.8	0.2	0.6	0.4	0.2	0.0	0.7	2.2
Asia	146.8	16.2	11.7	4.2	0.2	0.9	1.4	0.4	0.6	1.0	7.5
Latin America	45.4	6.3	5.0	2.4	0.2	0.5	0.5	0.1	0.1	0.3	2.1
NIS	3.8	1.2	1.0	0.4	0.1	0.1	0.0	0.0	0.0	0.2	0.2
Net exports:											
North Africa	-12.0	-7.2	-5.9	-3.4	-0.3	-0.7	0.5	-0.4	-0.2	-0.7	-1.9
Sub-Saharan Africa	15.1	3.5	-1.2	-2.6	-0.1	-0.6	0.4	4.6	0.2	-0.3	1.9
Asia	-18.3	1.1	-2.6	-1.6	0.1	-0.9	0.5	3.2	-0.2	-0.4	0.4
Latin America	-13.9	3.5	-0.5	-2.2	-0.1	-0.4	2.0	4.2	0.0	0.6	-0.6
NIS	-1.3	-0.7	-0.9	-0.4	-0.1	-0.1	0.0	-0.0	-0.0	-0.2	0.1

Source: UNFAO, *FAOSTAT* website database, June 2000.

economies are rich in resources, in particular human resources, and their markets are highly protected. As a result, they can achieve significant export gains with increases in global trade. During the last two decades, the average growth rate of export earnings in low-income Asian countries was almost double that of the other developing regions.

Despite the variety of economic and trade structures, low-income developing countries have some common interests in the "three pillar" agricultural trade issues (market access, domestic support, and export subsidies), which affect import prices and market access. These countries are also concerned with the projected food price rises, food price volatility, and donor food aid budgets, which declined throughout most of the 1990s. Many low-income developing countries also are concerned about eroding trade preference arrangements. For example, in Sub-Saharan Africa, there is concern about the erosion of special preferences of the EU's Lomé Treaty, which gives countries in the region preferential access to the EU market. Currently, the

African countries face almost no tariffs for most of their products exported to Europe (but the reverse is not true), so there is not much room for further negotiation.[4] As developed countries have lowered their tariffs to other developing countries (especially Asian countries), however, the relative competitive edge of Sub-Saharan African countries has eroded. Tariff escalation is another area of concern for developing countries, which typically face tariff rates in developed countries that rise for products involving higher levels of value-added processing.

Understanding the Link Between Trade and Food Security

To improve food security by increasing food availability on the national level, countries have two options: accelerate domestic agricultural production or increase imports. The first option is possible for many of the low-income countries that have performed below their potential. In some countries, however, the agricultural sectors have been performing well and yet the countries continue to face food gaps. For these countries, as well as those where potential for agricultural growth is limited, commercial imports have played a major role in improving their food security position.[5]

For developing countries, global agricultural trade liberalization can affect food security through (1) world price levels, which can have a strong influence on domestic producer prices; (2) export earnings (incomes); and (3) availability of food aid. This article focuses on world prices and export earnings.[6]

The most important components of agricultural trade negotiations are the three pillars — domestic support, export subsidies, and market access. These issues are not equally important for all countries. In a scenario in which major exporters would eliminate trade barriers, domestic price support and export subsidies, the expected effect would be a decline in exports of staple foods and an increase in world prices (other market conditions being constant). Those developing countries that have adequate agricultural resources face a higher price incentive to produce. For resource-poor countries, increasing the prices of food means that there would be lower food imports and a reduction in foreign exchange availability for alternative uses. Improvement in market access for exporters of restricted commodities could mean higher foreign exchange earnings due to increases in world prices. Besides financing imports, high rates of export growth can indirectly affect a country's creditworthiness and attract foreign investment. On the other hand, countries that have benefited from nonreciprocal market access preference schemes provided by their trading partners will experience little or no gain.

Elimination of domestic support and export subsidies and increase in global food prices

Trade liberalization leading to a removal of domestic support in the developed countries can be expected to unambiguously raise world food prices, other policies held constant. This occurs because lower prices induce farmers in the protected developed countries to reduce their variable inputs, which leads to a contraction of global output. Similarly, removing developed countries' export subsidies unambiguously raises the prices to the food-importing countries. In both cases, rising food prices would hurt consumers in developing countries, especially in the short run (assuming no protection in developing countries). Rising prices, however, would send signals to expand output for domestic producers, which may be beneficial in the long run in terms of productivity and rural incomes.[7]

Market access and export earnings of low-income countries

Trade liberalization is expected to accelerate global trade, improve economic efficiency, and increase economic growth. The gain, however, depends on how much trade is enlarged. The gain also will not be uniform among regions and countries. On the import side, some developing countries with high tariff levels will

[4] About 95 percent of agricultural exports from the African, Caribbean and Pacific (ACP) countries enter the EU duty-free (McQueen, 1998). However, trade barriers exist for commodities that are sensitive for the EU's common agricultural policy (CAP) or for commodities that have separate trade protocols.

[5] This has been the case for many countries in North Africa, Latin America, and Asia, which have become more reliant over time on commercial grain imports for their food supplies.

[6] For low-income countries, food aid has been a supplement to commercial imports. Food aid donations, however, are made at the discretion of donor countries and the recipient countries have little impact on the decision-making process regarding allocations. Also, food aid is not likely to grow, given budgetary policies in many donor countries and the expected decline in surplus food production by donor countries. This means that commercial imports will be the key to increasing food supplies in countries where production growth is lagging.

[7] These dynamic gains from liberalization may be substantial, given the importance and size of agriculture in developing economies and the likely multiplier effects (Delgado et al., 1998; Bonilla-Diaz and Reca, 2000).

be forced to compete internationally, which will lower domestic prices. This will reduce costs to consumers and lower returns to producers. If tariff rates are relatively low, however, world prices would be expected to pass through the domestic economy, leading to higher prices (recall that market access liberalization modeling scenarios in chapter 1 raise world prices as the initial lowering of producer prices induces shifts in supply and demand that ultimately lead to higher world prices). On the export side, improved market access to developed country markets should lead to an increase in export earnings for developing countries. This result is tempered, however, by the fact that many low-income, food-importing countries already receive preferential trade treatment through multilateral agreements such as the Lomé Agreement and Caribbean Basis Initiative, not to mention separate bilateral treaties with developed countries.

Currently, industrial countries are the main trading partners of all low-income countries. Most low-income countries' exports to industrial countries fall under nonreciprocal preference schemes. In 1968, the international community adopted the concept of nonreciprocal trade preferences to help developing countries increase their export earnings. This concept served as the basis for different Generalized Systems of Preferences (GSP) schemes supported by the industrial countries. These programs are determined unilaterally by the preference-giving countries, and the programs vary in terms of preference margins, commodity coverage, and beneficiary countries. The GSP schemes provide preferential market access in the form of zero tariffs or tariffs significantly lower than normal rates to exports of low-income countries. The nonreciprocal trade preferences have increased trade ties between developing and industrial countries. Therefore, interregional trade remains limited, with the exception of Latin American countries in the last decade. Poor transportation systems and lack of export complementarity are among factors that impede interregional trade growth.

The results of pre-Uruguay Round Agreement on Agriculture (URAA) studies measuring the benefits from preferential schemes differ, depending on the degree of aggregation and commodity coverage. A study examining the impact of preference erosion in Sub-Saharan Africa concludes that African countries would probably experience net trade losses as a result of URAA tariff cuts (Yeats, 1994). Another study estimates that losses due to the erosion of preferences would be 1.5 percent of the export earnings of all African countries (Weston, 1995). Another study estimates that the total potential value of the main three preference givers (United States, EU, and Japan) was $1.9 billion in 1992. About 33 percent went to Africa, 40 percent to Latin America and the Caribbean, and the rest to countries in the Far East and Oceania (Yamazaki, 1996). For African countries, the estimated value of preferences was about 1.2 percent of their export earnings.

Overall, the loss of low-income countries' preferences, or competitive edge, in the markets of industrial countries relative to other suppliers is significant but not large. The final gain from global liberalization, however, depends on the degree to which trade is enlarged from trade liberalization, in particular how world demand changes for commodities that low-income countries export. Global trade liberalization is projected to increase the demand for developing countries' exports. Countries with more diversified market structures and trading partners are likely to adjust quickly and take advantage of incentive signals, while countries with weak market infrastructures that rely on few export commodities will show limited gains (World Bank, 1987; Shapouri and Rosen, 1989).

The growth in demand and trade in agricultural products among developing countries will be a critical factor in boosting exports of these commodities, while trade with developed countries is expected to grow at a slower pace. As one study indicates, there are low price and income elasticities of import demand by developed countries for most primary commodities exported by low-income countries (Bond, 1987).[8] Similarly, a study of demand and supply elasticities found that the income responsiveness to agricultural exports from developing countries was lower than that found for minerals and energy (Goldstein and Khan, 1984). Among agricultural commodities, the income responsiveness to exports of beverages, tobacco, and agricultural raw materials was lower than for food. The results also indicate that the price response of export supply generally is lower than corresponding price

[8] An elasticity typically measures the degree of responsiveness to prices or incomes, which is free of particular monetary units. For example, a price elasticity of -0.20 (typical of necessity foods like wheat or sugar) means that if prices were to increase by 10 percent, demand would decrease by only 2 percent.

elasticities of demand in the short run, but is higher over the long term.

Modeling Food Imports and Gaps Under Alternative Scenarios

The Food Security Assessment (FSA) model determined the *direct* impact of changes in the growth paths of food prices and foreign exchange earnings, food imports, and food gaps in 67 low-income countries in 5 regions (Shapouri and Rosen, 1999). Economywide effects are not considered. A baseline scenario was developed for these countries for later comparisons. According to this baseline forecast, long-run food gaps will grow over the next decade. To maintain recent per capita availability levels (status quo), the gaps are estimated at 12.7 million tons; nutrition-based food gaps are 21.9 million tons (table 6-4).[9] In each scenario, Sub-Saharan Africa has the largest food gaps, which are disproportionately large compared to the region's population share.[10]

The first scenario focuses on the price impacts of full agricultural trade liberalization (removing domestic support, export subsidies, and market access). Chapter 1 of this report finds real-world food prices rise by about 12 percent in the long run.[11] The direct implication of higher prices is twofold. On the import side, higher food import prices will reduce the import capacity of the low-income developing countries, thereby reducing imports. On the production side, higher international prices outweigh relatively low protection levels (by the pass-through effects) and increase incentives to producers.[12] Over the long run, higher prices reduce commercial food imports slightly compared with the baseline scenario, but induce a positive supply response. The net result for all countries is a small decline in both status quo (12.63 million tons) and nutritional gaps (21.39 million tons). The results, however, vary by region. Food gaps will increase in regions that are highly dependent on imports for their staple food consumption (e.g., North Africa). This increase occurs because the decline in commercial imports cannot be offset by the increase in domestic production. In contrast, in Sub-Saharan Africa, where import dependency is low, the gains from the production response will lead to lower food gaps. It should be noted that estimates are based on the parameters of price responsiveness used in the model (i.e., any technological changes due to an increase in investment influenced by market liberalization are not included in the estimated results).

In the second scenario, in addition to the price effects listed previously, developing countries' exports increase in nominal terms by about 30 percent.[13] It is important to note that the loss of preferences due to global agricultural trade reform is not taken into account in the model. Again, the results indicate that the impact is small. Total status quo food gaps decline from 12.63 to 11.99 million tons while nutrition needs decline from 21.39 to 20.53 million tons. In each case, this is a slight additional reduction from the baseline scenario.

Three factors account for the relatively small impact on food security of the additional export growth in a full-liberalization scenario. First, in low-income countries, the food production response to the increase in prices is low unless investments are increased to improve agricultural productivity. Second, agriculture's share of total exports in the developing countries is declining (similar to developed countries). In fact, in the base period, agricultural shares of total exports are 13 percent for Asian countries and 7 percent for North African countries. Thus, even with high agricultural export growth (31.3 percent cumulatively), total export earnings increase only by 4 percent (Asia) and 2 percent (North Africa) over the 10-year projected period (assuming no growth in other sectors).

[9] The status quo food gap is calculated by comparing projected availability of per capita food supplies against a recent 3-year average per capita consumption target. The nutritional food gap is calculated by comparing projected per capita food supplies with minimal nutritional requirements.

[10] Food aid generally has not been sufficient to meet food needs around the world. Cereal food aid donations have fluctuated over the years, averaging about 11.2 million tons over the 1980-98 period (FAO, 2000). Food aid has exceeded 15 million tons twice, once in 1987 and again in 1992. However, for the 1996-98 period (before the effects of the Asian and Russian financial crises), food aid donations averaged only 6.8 million tons.

[11] For the modeling purposes here, the 12-percent price increase is treated as a 1.2-percent increase per year over a 10-year horizon. The FSA model uses the USDA baseline food price forecasts, which are projected to decline for the next decade, so an increase in the growth rate of prices still implies that prices are declining.

[12] Chapter 1 of this report shows that tariff rates are relatively low in developing countries, so this result should not be too surprising. However, it needs to be emphasized that much of the tariff data are unavailable for many of the 67 low-income food-importing countries analyzed here. This model assumes that protection levels are similar to those that are available for the other developing countries in chapter 1.

[13] Like the first scenario, this additional real export growth is phased in over a 10-year period as an increase over the trend forecast of real export growth.

Table 6-4—Summary of food gaps in 67 low-income countries under different modeling scenarios (million tons)

Region	Baseline	Scenario 1	Scenario 2
North Africa			
Production	32.01	32.35	32.33
Commercial imports	24.04	23.10	23.30
Status quo food gap	0.72	1.12	1.03
Nutritional food gap	0.91	1.31	1.22
Sub-Saharan Africa			
Production	145.51	148.15	148.06
Commercial imports	12.06	11.63	12.49
Status quo food gap	8.30	7.79	7.38
Nutritional food gap	16.57	15.63	15.07
Asia			
Production	405.69	409.24	409.21
Commercial imports	22.70	21.05	21.56
Status quo food gap	3.22	3.16	3.14
Nutritional food gap	3.45	3.44	3.42
Latin America			
Production	16.19	16.61	16.53
Commercial imports	16.17	15.39	16.85
Status quo food gap	0.47	0.51	0.44
Nutritional food gap	0.89	0.91	0.82
NIS			
Production	5.96	6.04	6.03
Commercial imports	1.93	1.82	1.87
Status quo food gap	0.02	0.05	0.00
Nutritional food gap	0.07	0.10	0.00
Total, 67 countries			
Production	605.36	612.39	612.16
Commercial imports	76.89	72.99	76.07
Status quo food gap	12.73	12.63	11.99
Nutritional food gap	21.89	21.39	20.53

[1] This scenario considers only the price effects of agricultural trade liberalization.
[2] In addition to the price effects in the first scenario, this scenario also considers changes in exchange earnings.

Third, total food imports are a small component of overall food availability in many low-income countries. Therefore, even a relatively high growth rate in agricultural exports that leads to an increase in commercial imports has a small impact on overall food availability. In these countries, many in Sub-Saharan Africa but also in other regions, food aid comprises a large share of total imports (about 20 percent on average in Sub-Sahara Africa in recent years). It is also important to note that the regional results of agricultural market liberalization mask the differences at the country level. For example, countries such as Ethiopia and Nicaragua, which have a large share of agricultural exports (94 percent and 50 percent during 1995-97) and a low level of food imports, will gain the most from market liberalization. Nutritional gaps are projected to decline by 25 percent (Ethiopia) and 50 percent (Nicaragua) over the projected period. In contrast, for a country like Algeria, which has no agricultural exports and high food import dependency, the nutritional gap is projected to increase by 44 percent.

In sum, agricultural trade liberalization will slightly reduce the food insecurity of low-income, food-deficit countries on average, but the impact will vary depending on the country. For most food-insecure countries, however, domestic food production is the most important factor influencing food security position. Domestic food production contributes to about 90 percent of availability in food-insecure countries. In these countries, an increase in investment to expedite the adoption of new technologies, in addition to market liberalization, is the key to improving food security.

Improved market access leading to higher export earnings also falls short of solving the food security prob-

Regional economic structures and concerns

Sub-Saharan Africa
- Very low per capita income; high dependency on foreign and food aid
- Exports mostly primary commodities, imports grains and dairy products
- EU is the largest trade partner; intra-regional trade is very low
- Low productivity growth
- Nonreciprocal preferences are important (GSP, Lomé)
- Weak infrastructure inhibits trade

North Africa
- Mostly middle-income countries
- Arable land and water resources are very limited, leading to highly volatile production
- Share of food imports is increasing
- EU is the largest trade partner; recently signed EU trade preference agreement

Low-Income Latin American Countries
- Relatively high per capita incomes
- Exports beverage crops and fruits and vegetables; imports grains and dairy products
- United States is the largest trade partner; intra-regional trade is very high and growing
- Trade protection has been substantially reduced in last decade
- Nonreciprocal preferences important for most countries (GSP, Lomé, CBI)

Low-Income Asian countries
- Most populous region
- Relatively low, but growing, per capita incomes
- Exports beverage crops and fruits and vegetables; imports grains and oilseeds
- EU, United States, Japan equally large trade partners; intra-regional trade is very limited
- Trade protection has been substantially reduced in last decade, but is still high
- Nonreciprocal preferences important for most countries (GSP)
- Multifiber Arrangement (MFA) very important to region

lems in low-income countries. In many cases, the export growth needed to boost the import capacity to the level necessary to close the food gaps is simply unrealistic. For example, in Sub-Saharan Africa, commercial food imports must grow nearly 10 percent annually to close the average nutritional gap by 2010. The parameters used in the model assume that the response of food imports to changes in foreign exchange availability is not one-to-one. Thus, in order to achieve a 1-percent growth in commercial food imports, foreign exchange availability must grow by 1.2 percent to 1.4 percent, depending on the country. Consequently, the export growth requirement would be more than 12 percent to 14 percent per year to achieve the 10-percent growth requirement. Clearly, achieving such high growth in total export earnings based on agricultural reforms is unlikely. Eradicating food insecurity in poor countries is a complicated task that requires a comprehensive strategy to increase export earnings in both the agricultural and nonagricultural sectors, as well as increase domestic food production.

Conclusion

This article considers how global trade liberalization affects the food security of 67 low-income, food-deficit countries. In the baseline scenario, food gaps based on recent per capita availability levels are projected to reach 12.73 million tons, while nutrition-based food gaps are 21.89 million tons in the next decade. Two scenarios were used to assess the impact of the global market liberalization. The first scenario focused on the impact of rising food prices, and the second scenario studied the impact of full agricultural trade liberalization on foreign exchange earnings. The results indicate that the impacts are positive but relatively small in both scenarios. Several factors explain this relatively modest result, including low production response, small food import or export shares, and low initial export growth rates.

To put these food gaps in perspective, it is helpful to compare these projections with recent food aid volumes. Global food aid donations twice have reached a peak of 15 million tons, once in 1987 and again in 1992 (UNFAO, 2000). Based on this historical experience, it is possible that the status quo food gaps could

be met with food aid donations. It should be noted, however, that food aid volumes have not exceeded 10 million tons since 1994, partly due to donors' budget pressures. In addition, food aid is not necessarily allocated based on needs, which means that an increase in quantities may not reduce food insecurity in these 67 low-income, food-importing countries.

Although international agriculture market liberalization is an important factor affecting food security, reform is not sufficient to alter the situation significantly. Most studies show much larger gains in developing countries resulting from economywide market liberalization. The experience of developing countries, in particular Latin American countries, shows that market liberalization and implementation of structural adjustment policies improves the performance of the agricultural sector, including both food and export crops. Improving export performance has enhanced the financial condition and creditworthiness of these countries and thereby has attracted foreign investment. For the low-income, net food-importing countries, increasing export earnings will increase the capacity to import not only food products, but also capital goods that are essential for long-term growth.

The baseline projection of food availability indicates a decline in per capita food availability for Sub-Saharan Africa and some Latin American and Asian countries. For these countries, accepting a decline in per capita availability from already low levels could have severe nutritional consequences. Increased food aid alone, however, will not solve the problem. Further global market liberalization aimed at diversifying exports will help stimulate earnings growth. Commodity diversification would improve export performance because a decline in the price or the volume of one commodity would have a less disruptive impact on a country's overall receipts. For the resource-poor countries where poverty and agricultural resource degradation are growing, such as Haiti, Bangladesh, and many countries in Sub-Saharan Africa, the situation is expected to deteriorate unless external investment and assistance are provided.

Agricultural market liberalization can improve another important dimension of food security in low-income countries — the disparity in purchasing power within countries. In low-income countries, most of the food-insecure people live in rural areas. Any increase in the prices of agricultural commodities because of increases in world prices or increases in earnings resulting from improvement in market access can reduce income disparity between rural and urban population. In countries such as India, Pakistan, Dominican Republic, El Salvador, Sudan, Cote d'Ivoire, and Nigeria, if available food were distributed equally, everyone would meet nutritional requirements. Unfortunately, the insufficient incomes of the poorest segment of these populations do not allow them to gain access to available food.

References

Bond, Marian E. "An Econometric Study of Primary Commodity Exports from Developing Countries," *International Monetary Fund Staff Papers*, Vol. 34, No. 2 (June 1992): 192-227.

Delgado, Christopher et al. *Agricultural Growth Linkages in Sub-Saharan Africa*. Washington, D.C.: International Food Policy Research Institute, Research Report No. 107, 1998.

Díaz-Bonilla, Eugenio and Lucio Reca, "Trade and Agroindustrialization in Developing Countries: Trends and Policy Impacts," *Agricultural Economics,* Vol. 23, No. 3 (2000): 219-229.

Goldstein, Morris and Mohsin S. Khan. "Income and Price Effects in Foreign Trade," *Handbook of International Economics (Vol. II),* Eds. R Jones and P. Kenen. New York: North-Holland, 1984: 1041-1105.

McQueen, Matthew, "Lomé Versus Free Trade Agreements: The Dilemma Facing the ACP Countries," *World Economy*, Vol. 21, No. 4 (June 1998): 421-43.

Shapouri, Shahla and S. Rosen. "Export Performance in Africa," Staff Report No. AGES 89-16. Washington, DC: USDA, Economic Research Service, 1989.

Shapouri, Shahla and S. Rosen. "Food Security Assessment: Why Countries Are At Risk." Agriculture Information Bulletin, No. 754. Washington, DC: USDA, Economic Research Service, 1999.

United Nations Food and Agriculture Organization. FAOSTAT database, http://www.fao.org, June 2000.

U.S. Department of Agriculture. *Food Security Assessment: Situation and Outlook Report.* Washington, DC: Economic Research Service, GFA-11, 1999.

Weston, Ann. *The Uruguay Round – Costs and Compensation for Developing Countries.* Geneva: United Nations Conference on Trade and Development, 1995.

World Bank. *Adjustment in Africa: Reforms, Results, and the Road Ahead.* Washington, DC: World Bank, 1994.

World Bank. *Exports of Developing Countries: How Direction Affects Performance* (ed. Oli Havrylyshyn). Washington, DC: World Bank, 1987.

World Bank. *Global Economic Prospects and the Developing Countries*. Washington, DC: World Bank, various issues.

Yamazaki, F. "Potential Erosion of Trade Preferences in Agricultural Products," *Food Policy*, Vol. 21 (1996): 409-417.

Yeats, Alexander J. *What Are OECD Trade Preferences Worth to Sub-Saharan Africa?* washington, DC: World Bank Policy Research Working Paper No. 1254, 1994.

Data on Tariffs, TRQs, and Export Subsidies

Appendix table 1-1—Uruguay Round Most-Favored-Nation (MFN) agricultural tariffs of selected OECD countries

	UR tariffs		UR tariffs Simple average mean		Tariff dispersion			
	Average Base	Average Bound	Average Base	Average Bound	0-5	5-25	25-100	100.0
Australia	86.0	98.0	7.7	3.9	74.0	24.0	1.0	0.0
Canada	70.0	72.0	27.2	21.8	57.0	34.0	2.0	8.0
Czech Republic	100.0	100.0	17.5	12.2	48.0	40.0	11.0	1.0
EU	66.0	67.0	31.6	21.1	30.0	46.0	20.0	3.0
Hungary	100.0	100.0	44.1	29.3	13.0	28.0	59.0	1.0
Iceland	81.0	81.0	156.5	102.3	29.0	14.0	18.0	39.0
Japan	82.0	82.0	44.0	33.4	37.0	44.0	13.0	6.0
New Zealand	91.0	99.0	13.9	7.3	51.0	46.0	3.0	0.0
Norway	40.0	46.0	196.4	152.0	45.0	4.0	6.0	44.0
Poland	100.0	100.0	56.1	35.9	17.0	42.0	35.0	6.0
Slovakia	100.0	100.0	17.6	12.6	55.0	33.0	10.0	2.0
Slovenia	76.0	76.0	18.5	15.3	76.0	5.0	15.0	5.0
Switzerland	8.0	15.0	159.1	126.1	24.0	20.0	24.0	32.0
United States	49.0	53.0	16.6	11.9	63.0	27.0	9.0	1.0
All above	71.0	74.0	61.4	45.0	41.0	31.0	16.0	13.0

Source: Wainio, Gibson, and Whitley in this report, based on AMAD.

Appendix table 1-2—Tariff rate quota regimes: Numbers of tariff quotas and average fill rate for selected countries

	Cereals		Oilseeds		Sugar		Dairy		Meat	
	Number of TRQ lines	Simple average fill rate	Number of TRQ lines	Simple average fill rate	Number of TRQ lines	Simple average fill rate	Number of TRQ lines	Simple average fill rate	Number of TRQ lines	Simple average fill rate
Canada	4	53	1	6			11	98	4	100
EU15	15	62			3	100	12	92	28	76
Japan	4	92	1	57			12	59		
United States	1	14	2	100	6	100	24	72	1	71
Korea	15	93	5	67	2	50	5	58	7	54
Norway	37	55	2	98	2	97	14	54	32	56
Switzerland	3	82					2	61	6	88
Hungary	7	20	4	35	2	53	4	24	8	60
Iceland	17	64	22	75	3	100	4	67	13	26
Poland	12	99	4		2		8	-	14	58
Colombia	13	93	20	75	4	71	5	100	17	64
Philippines	2	100			1	100			9	33
Thailand	2	50	6	50	1		2	46		
South Africa	11	70	8	82	3	96	6	40	5	98
Venezuela	19	56	19	63	3	78	6	57	10	39

	Beverages		Fruit and vegetables		Fibres		Total	
	Number of TRQ lines	Simple average fill rate	Number of TRQ lines	Simple average fill rate	Number of TRQ lines	Simple average fill rate	Number of TRQ lines	Simple average fill rate
Canada							21	85
EU15	1	2	25	94			87	66
Japan			1	94	1	45	20	67
United States			5	44	7	33	54	66
Korea	1	100	20	73	2	31	67	70
Norway	1	100	116	74			232	65
Switzerland	3	97	9	96			28	90
Hungary	4	30	33	51			70	43
Iceland	1	100	18	84			90	70
Poland	5	2	37	16	3	na	109	41
Colombia			4	100	2	100	67	79
Philippines			1	7			14	50
Thailand			5	40	1		23	48
South Africa	1	75	12	54	1	100	53	71
Venezuela			1	100			61	58

All fill rate values are for 1998 except for Iceland and Venezuela, where the reported fill rates are from 1995-97 average.
Source: WTO (2000).

Appendix table 1-3—Summary data on export notifications to the WTO: 1995-1998

	1995	1996	1997	1998	1995	1996	1997	1998	1995	1996	1997	1998
	Value of notified subsidy (US$ million)				Percent value of WTO commitments				Percent volume of WTO commitments			
Wheat												
European Union	155.3	402.6	201.5	560.3	5.1	15.1	9.3	29.5	13.6	75.0	72.4	83.3
Hungary	6.0	0.0	0.0	0.0	39.4	0.0	0.0	0.1	45.9	0.0	0.0	0.1
South Africa	0.2	0.0	0.0	0.0	0.7	0.0	0.0	0.0	2.3	0.0	0.0	0.0
Rice												
European Union	39.6	91.5	37.0	28.7	55.5	141.3	68.6	58.3	54.4	144.2	50.2	99.0
Other grains												
European Union	396.9	493.3	309.8	855.8	18.9	26.0	19.8	60.1	48.2	90.3	69.9	123.3
Hungary	4.9	0.0	0.0	9.8	281.6	0.0	0.0	412.6	42.7	0.0	0.0	81.3
Oilseeds												
Hungary	0.3	0.4	0.0	0.0	11.3	13.8	0.0	0.0	5.4	4.9	0.0	0.0
Vegetable oilmeal												
European Union	81.2	49.5	8.8	0.0	77.8	52.2	11.2	0.0	96.4	103.7	72.6	0.0
Turkey	1.3	0.0	0.2	1.0	--	0.0	--	--	--	0.0	0.7	5.1
Sugar												
Columbia	5.0	4.6	4.9	4.4	--	--	--	--	--	33.6	170.2	80.6
European Union	495.8	665.7	883.5	890.2	51.7	76.5	121.8	134.1	55.0	80.1	117.8	111.5
Poland	0.1	15.8	8.8	13.0	0.2	35.8	21.4	34.2	0.7	116.4	149.2	119.0
Slovakia	0.1	0.0	0.6	0.6	3.5	0.0	23.6	24.3	4.2	0.0	100.0	100.0
South Africa	4.8	10.7	7.9	7.9	--	--	--	--	--	5.1	5.0	3.3
Turkey	2.5	0.0	0.0	0.0	97.3	0.0	0.0	0.0	100.0	0.0	0.0	0.0
Dairy												
Canada	37.5	4.2	0.0	0.0	117.6	15.7	0.0	0.0	--	2.0	0.0	0.0
Czech Republic	40.1	43.7	50.0	59.4	--	--	--	--	101.9	69.0	71.2	41.6
European Union	2043.6	4123.4	2495.0	2271.7	--	--	--	--	--	457.9	84.0	73.9
Norway	63.7	64.9	84.1	80.0	--	--	--	--	--	85.2	101.2	121.5
Slovakia	6.3	7.0	11.8	11.7	--	--	--	--	--	54.4	63.6	76.7
Switzerland	285.8	269.6	305.3	275.6	81.0	78.1	80.8	78.8	86.5	82.0	81.7	79.7
United States	0.0	0.1	110.2	145.3	0.0	--	--	--	0.0	45.4	72.4	90.3
Bovine livestock												
Hungary	9.9	12.4	6.0	0.0	--	--	--	0.0	--	118.8	--	0.0
Switzerland	26.1	15.1	0.1	0.3	93.9	55.5	0.3	1.1	110.9	80.1	0.8	4.0
Non-bovine livestock												
European Union	1970.7	1935.9	953.4	720.0	--	85.4	50.8	42.3	94.9	116.5	93.7	76.1
Iceland	5.5	7.3	0.1	0.0	26.5	39.4	0.8	0.0	61.4	10.4	--	0.0
Norway	3.1	2.5	13.1	14.2	--	--	--	--	--	15.9	82.1	808.6
Non-bovine meat												
European Union	2815.7	4877.7	3005.0	3662.2	--	--	--	--	--	9.2	9.5	11.0
Hungary	9.2	6.8	11.8	18.0	--	--	--	--	--	--	--	--
Switzerland	0.0	0.0	0.0	0.0	--	0.0	--	--	100.0	0.0	67.7	78.2
United States	0.0	0.0	0.9	1.4	0.0	0.0	--	--	0.0	0.0	--	--
Fruits and vegetables												
Colombia	8.4	12.9	17.1	14.8	--	--	--	--	--	75.9	105.3	126.7
European Union	92.1	78.4	29.5	35.4	90.7	85.1	38.4	50.4	98.8	98.6	98.1	93.0
South Africa	12.8	30.7	11.8	0.0	--	--	--	--	--	23.8	15.2	0.0
Switzerland	14.4	0.0	6.6	21.3	--	--	--	--	--	0.0	25.9	69.1
Turkey	0.3	17.6	14.0	5.2	--	--	--	--	--	46.4	38.9	10.5
Other food products												
Colombia	1.4	1.4	0.8	0.9	33.0	--	--	--	--	1.2	0.6	91.4
Cyprus	--	--	--	--	76.9	81.5	53.9	91.7	68.4	73.9	231.2	181.5
European Union	791.0	956.3	795.6	815.8	--	--	--	--	--	81.1	61.6	56.8
Hungary	5.7	1.2	0.1	1.1	90.6	17.3	1.3	12.9	9.4	6.6	0.2	1.5
Norway	3.9	5.7	7.3	6.2	--	--	--	--	--	--	--	--
South Africa	9.5	16.8	9.6	0.0	--	--	--	--	--	101.0	52.4	--
Switzerland	120.3	118.0	132.6	141.8	84.3	84.5	86.8	--	--	--	--	--

Source: WTO notifications.

Appendix table 1-4—Effective export subsidy rate (ratio of export outlays over value of exports), 1998

	EU	Colombia	Czech Republic	Hungary	Norway	Poland
Paddy rice	13.8					
Wheat	9.1					
Cereal grains n.e.c.	34.2					
Vegetables, fruit, nuts	0.8	2.7		2.3		
Crops n.e.c.	0.4				26.9	
Bovine cattle, sheep, goats, and horses				7.4		
Animal products n.e.c.						
Meat from bovine cattle, sheep and goats, horses	27.1		65.4	0.5	32.6	
Meat products n.e.c.	4.2			1.8	56.9	
Dairy products	24.2		28.0		97.4	
Sugar	54.4	1.6				6.2
Food products n.e.c.	4.5	0.2	0.4		0.3	

	Slovakia	South Africa	Switzerland	Turkey	United States
Paddy rice					
Wheat					
Cereal grains n.e.c.					
Vegetables, fruit, nuts		1.0	65.6	0.9	
Crops n.e.c.				0.1	
Bovine cattle, sheep, goats, and horses			3.9		
Animal products n.e.c.					
Meat from bovine cattle, sheep and goats, horses	45.2				
Meat products n.e.c.				0.3	0.0
Dairy products	26.7		80.1	0.1	18.6
Sugar	1.9	2.6			
Food products n.e.c.	0.6	1.3	10.4	2.0	

Source: ERS calculations based on WTO export subsidy notifications and UN FOB trade data from 1998. Subsidy data for the EU and United States are from 1997 because they better match the 1998 trade data. EU sugar subsidy expenditures include subsidies for ACP countries, which were not included in their WTO notification.

Measuring Agricultural Policies

Measuring Domestic Support

To develop a consistent measure of 1998 domestic support, we organize data from the 1998 OECD Producer Support Estimates (PSE), Agriculture Market Access Data (AMAD) tariffs, and WTO export subsidy notifications into a policy database that is consistent with the concept of domestic support as defined in the AMS (app. table 2-1). We do not use AMS data, since countries' AMS notifications to the WTO have been sporadic. PSE data are also not comprehensive: They are only available for OECD members.[1] However, three OECD countries, the European Union, Japan, and the United States, account for over 80 percent of WTO domestic support reduction commitments.

While both the PSE and the AMS are measures of domestic support, their concepts differ. Thus, without further manipulation, the PSE database cannot be used for analyzing options for domestic policy reform using current WTO criteria. The PSE is a broad concept designed to measure overall developments in agricultural policies, across countries, based on a measure of current benefits to farmers (or costs to consumers and taxpayers). The PSE has two components: market price support and budgetary outlays. It includes the effects of trade policies (import barriers and export subsidies) in its measure of market price support, which is calculated as the gap between the domestic producer price and a current world reference price for each commodity. It also includes all government budget expenditures on farm programs, including exempt

[1]AMS equivalents were estimated for 11 of the 15 OECD countries for 1998. Poland was selected to represent the transition economies. Turkey was excluded since it does not have any WTO domestic support reduction commitments. Iceland was excluded because it is not represented in the economic models used in this report.

Appendix table 2-1—Domestic subsidy expenditure in OECD countries, categorized by production impacts (excludes market price support programs)

	Australia	Canada	EU	Iceland	Japan	Korea	Mexico
	Percentage of value of production net of subsidies						
Fixed payment per unit of output[1]							
Unlimited/amber	0.3	0.8	0.0	0.0	0.1	0.0	0.0
Limited							
Amber	0.0	0.0	1.3	17.8	1.4	0.0	0.0
Blue	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fixed payment per unit of intermediate input[2]							
Unlimited/amber	0.0	2.1	0.5	0.0	0.0	0.8	0.3
Limited							
Amber	0.0	0.0	0.0	1.3	1.2	0.0	0.2
Blue[3]	0.0	0.0	9.5	0.0	0.0	0.0	0.0
Direct and whole-farm payments[4]							
Unlimited/amber	0.0	1.3	0.0	0.0	0.0	0.0	0.0
Limited/amber	0.0	0.0	0.0	0.0	0.0	0.5	0.0
Green	0.8	0.3	1.6	9.8	0.0	0.0	4.0
Capital-based payments[5]							
Unlimited/amber	0.0	1.0	0.0	2.4	2.6	1.9	0.0
Limited/amber	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Green	0.1	0.0	1.7	0.0	0.0	0.0	1.0
Other policies with minimal impacts[6]	1.3	0.1	2.9	1.2	0.2	0.0	0.5
Total green	2.2	0.4	6.3	11.0	0.2	0.0	5.5
Total amber (excl. market price support)	0.3	5.2	1.8	21.5	5.3	3.2	0.5
Total blue	0.0	0.0	9.5	0.0	0.0	0.0	0.0

Continued

Appendix table 2-1—Domestic subsidy expenditure in OECD countries, categorized by production impacts (excludes market price support programs) —*continued*

	Norway	New Zealand	Poland	Switzerland	U.S.
	Percentage of value of production net of subsidies				
Fixed payment per unit of output[1]					
Unlimited/amber	0.0	0.0	0.0	0.0	1.8
Limited					
Amber	0.0	0.0	0.0	0.0	0.0
Blue	29.5	0.0	0.0	0.0	0.0
Fixed payment per unit of intermediate input[2]					
Unlimited/amber	0.0	0.3	1.7	0.3	1.7
Limited					
Amber	0.0	0.0	0.0	0.2	0.0
Blue[3]	0.2	0.0	0.0	0.0	0.0
Direct and whole-farm payments[4]					
Unlimited/amber	0.0	0.0	0.0	0.0	1.8
Limited/amber	0.0	0.0	0.0	0.0	0.0
Green	0.5	0.0	0.0	8.9	2.8
Capital based payments[5]					
Unlimited/amber	2.2	0.0	0.9	1.7	0.0
Limited/amber	0.0	0.0	0.0	0.0	0.0
Green	0.0	0.0	0.0	0.0	0.0
Other policies with minimal impacts[6]	5.4	0.0	0.7	13.4	3.3
Total green	5.9	0.0	0.7	22.3	6.1
Total amber (excl. market price support)	2.2	0.3	2.6	2.2	5.3
Total blue	29.7	0.0	0.0	0.0	0.0

1/ Includes variable and fixed payments per unit of output. 2/ Includes variable and fixed payments per unit of input. Includes crop insurance and payments on area or animal numbers if these affect relative returns and crop mix. Excludes disaster payments and credit subsidies. Environmental and conservation-oriented are assumed to be exempt as defined by Annex 2 of the URAA and are not included here.3/ Includes programs in EU, Iceland, and Norway with offsetting supply controls. The EU has some blue policies with unique regulations that are not necessarily supply control but which are included here. 4/ Includes payments assumed to accrue jointly to land, labor, and or/capital--or to just land. Includes payments based on area (but not animal numbers) if these do not affect crop mix. Includes long-term real estate subsidies.There are no "blue land based payments," as blue box programs are usually commodity specific.5/ Includes some exempt policies, reflecting that some of these payments are possibly production distorting.Includes payments based on specific nonland assets. May include short-term credit subsidies. 6/ Includes all other PSE data not included elsewhere. Includes URAA Annex 2 exempt policies except those assumed to accrue to land, such as decoupled direct payments. Includes environmental and conservation payments, disaster payments, and credit subsidies.

(green box programs), nonexempt (amber box), and blue box forms of domestic support (see box).

The AMS is a narrower measure. In contrast to the PSE, the AMS measures only the domestic support that is subject to URAA disciplines (amber box policies). In general, the AMS excludes explicit trade policies (import barriers and export subsidies) that are covered by the PSE because these policies have separate conditions placed on them by the URAA. The AMS calculation also excludes support that does not exceed 5 percent of the member's total value of production (10 percent for developing countries). Trade policies are included in the market price support component of the AMS only for commodities for which there is an administered price support program. In contrast to the PSE, the AMS calculation of market price support is measured as the gap between the current administered price and a fixed reference price for each commodity. The reasoning is that the gap then reflects only those variables over which policymakers have control, rather than current market conditions.

For our analysis, we define "domestic support" as an economic concept based on the AMS. To calculate the PSE-based AMS, we reorganized and augmented the PSE data in four steps. First, we decomposed PSE data on budgetary outlays into green, amber, and blue box forms of support based on WTO notifications, when available, and ERS calculations.

Next, we identified commodities for which there are administered price support programs (app. table 2-2). For these commodities, we include a measure of market price support in our calculation of the AMS. Because our objective is to model production and consumption responses to changes in relative prices under policy

Classification of policy measures included in the OECD Producer Support Estimate

Producer Support Estimate (PSE) Sum of A to H	*Examples of programs*
A. Market Price Support	
1. Based on unlimited output	U.S. milk and sugar programs
2. Based on limited output	EU and Canadian milk programs
B. Payments based on output	
1. Based on unlimited output	Norway deficiency payments program
2. Based on limited output	Japanese rice payment, U.S. and Canadian crop insurance programs
C. Payments based on area planted animal numbers	
1. Based on limited area or numbers	
2. Based on unlimited area or numbers	EU compensatory payments
D. Payments based on historical entitlements	
1. Based on historical plantings, animal numbers or production	Mexico PROCAMPO
2. Based on historical support programs	U.S. production flexibility contracts
E. Payments based on input use	
1. Based on use of variable inputs	Input subsidies, interest concessions
2. Based on use of on-farm services	Extension services, pest and disease control
3. Based on use of fixed inputs	Capital grants, interest, and tax concessions
F. Payments based on input constraints	
1. Based on constraints on variable inputs	Limits on fertilizer and pesticides
2. Based on constraints on fixed inputs	U.S. CRP
3. Based on constraints on a set of inputs	Organic farming
G. Payments based on over-all farming income	
1. Based on farm income level	Income tax concessions, Canadian NISA
2. Based on established minimum income	
H. Miscellaneous payments	
1. National payments	
2. Subnational payments	
General Services Support Estimate	
Consumer Support Estimate	

Source: OECD (2000).

Appendix table 2-2—Commodities with administered market price support programs

	Wheat	Rice	Course grains	Oilseeds (includes soybeans)	Sugar (refined)	Milk	Beef and sheep	Other meat (pigs, etc.)	Wool	Miscellaneous
Australia										
Canada						x				
European Union	x	x	x		x	x	x			horticulture
Iceland						x	x	x		
Japan	x	x	x		x	x	x	x		potatoes
Korea		x	x	x			x			
Mexico					x					
Norway	x		x			x	x	x		potatoes
New Zealand										
Poland	x					x		x		
Switzerland	x		x	x		x	x	x		
Turkey										
United States					x	x				peanuts

Source: WTO notifications.

Appendix table 2-3—Links between OECD PSE data, WTO notifications, and effects of policies on production

	WTO "color"	Australia	Canada	EU	Japan	Korea	Mexico
Fixed $/unit of output							
Unlimited	Amber	B1	B1	B1	B1		B1
Limited							
Nonexempt	Amber		B2	B2	B2		
Blue	Blue			B2			
Fixed $/unit of intermediate input							
Unlimited	Amber		C1, E1	C1 (except livestock),		C1, E1	C1, E1
Limited				E1 (livestock)			
Nonexempt	Amber				F2		C2
Blue[3]	Blue			C2			
Direct, whole-farm payments							
Unlimited	Amber		(1 - .17) x G1				
Limited	Amber						
Exempt 5/	Green	G	.17 x G1	D1, D2, F1, G1, G2, F2 (except beef)		G	D1+G2
Capital based payments							
Unlimited	Amber		E3		E1 + E3	E3	
Limited	Amber					F2	
Exempt	Green	E3		E3			E3
Other minimal impacts	Green	E2	H	C1 (lvstck), E1 (ex. lvstck), E2, F2(ex. beef), F3,H	E2	E2	E2

Continued—

reform, we attempt to measure the actual price wedges implied by the trade policies that are linked to a market price support program. Therefore, we incorporate the actual applied tariffs from the AMAD database and export subsidies based on WTO notifications. We do not use the broader measure of market price support as calculated in the OECD PSE, or the more narrow measure used in the AMS. In effect, we use tariff elimination to represent market price support elimination, recognizing that they are not fully equivalent. By eliminating the tariff, we may be overstating the effects of eliminating a domestic price support program, since in practice, the domestic program could be administratively removed while leaving tariffs in place. Such barriers can be beneficial to the domestic sectors without the need for administered prices, but the administered prices provide an additional layer of short-run protection to producers and also a strong incentive for the government to maintain effective barriers.

Third, we differentiate and model the impacts that different types of domestic subsidies can have on production and trade. Domestic subsidy expenditures are conceptualized as being separable into five generic types: subsidies linked to output; subsidies linked to inputs; whole-farm transfer payments that do not distort relative returns among sectors and which are often capitalized in land values; sector-specific subsidies to capital inputs; and subsidies with minimal trade impacts (app. table 2-3). The categorization of countries' policies according to their production effects is based on the new OECD PSE classification system and descriptions of the operation of specific policies and programs in the WTO notifications and other sources.

The AMS calculation also excludes support that does not exceed 5 percent of the member's total value of production (10 percent for developing countries). This *de minimis* support is included in our analysis on the

Appendix table 2-3—Links between OECD PSE data, WTO notifications, and effects of policies on production—*continued*

	WTO "color"	Norway	New Zealand	Poland	Switzerland	US
Fixed $/unit of output						
Unlimited	Amber					B1
Limited						
Nonexempt	Amber					
Blue	Blue	B1, B2, C2 + 0.86*E1				
Fixed $/unit of intermediate input						
Unlimited	Amber		E1	E1	C1 (corn), E1 (wheat)	Part of C1 & E1
Limited						
Nonexempt	Amber		F1,F3		F2 (beef)	
Blue[3]	Blue	C1				
Direct, whole-farm payments						
Unlimited	Amber					G1, part D2
Limited	Amber					
Exempt	Green				D, G, F1, F2 (except beef)	E3, part D2
Capital-based payments						
Unlimited	Amber	0.14*E1 + F2 + F3		E3	E3	
Limited	Amber					
Exempt	Green	F3				
Other minimal impacts	Green	E2 + E3	G	E2	B2+C1 (except corn)+C2+E2 +H2 +F3	E2,F,H2, & Part (C1&E1,E3)

Notes: Colors refer to whether the policies are subject to WTO disciplines. Letters refer to OECD PSE classification codes.
Source: ERS calculations.

assumption that trade distortions do not begin or end when a threshold is reached.[2]

Domestic subsidies are incorporated into the computable general equilibrium models (CGE) used in this report based on their linkage to production. Output subsidies directly stimulate output. Subsidies on intermediate and capital inputs raise output by lowering input costs. Some output and input subsidies (blue box) are offset with supply limitations; we incorporate these limitations explicitly as increases in aggregate land area or land productivity when the blue box programs are removed. The most important program modeled this way is the EU compensatory and set-aside payments program, which is modeled as an input subsidy linked to the production of specific crops, with explicit supply constraints to capture the set-aside requirements. Direct, whole-farm payments to farm households do not affect the crop mix or directly affect aggregate production levels, but are capitalized in aggregate land values. We represent whole-farm programs in the CGE models as government transfers to households. These programs include the U.S. Production Flexibility Contracts, the Canadian National Income Stabilization Accounts (NISA), Mexican PROCAMPO payments, and some green box programs in the EU and EFTA countries, including landscape maintenance payments, environmental schemes, and disaster payments.

Direct, whole-farm payments are assumed to have minimal effects on production and trade; they are incorporated into the CGE models as payments to the farm household that increase aggregate consumption of all goods, including agricultural products. The extent to which farm household transfer payments may affect production is the subject of debate. Tielu and Roberts (1998) describe how decoupled payments may stimulate aggregate production through their effects on increasing farm investment by increasing wealth and lowering risk, reducing farm exit by raising land val-

[2] This overstates domestic support. For example, it includes U.S. support for programs such as crop insurance and irrigation subsidies that are considered de minimis for reporting to the WTO.

Appendix table 2-4—Sensitivity test: Effects of removing domestic subsidies in developed countries under alternative assumptions about coupling of direct payments to farm households

	World	Australia/ New Zealand	Japan/Korea	U.S.	Canada	EU	EFTA
			Percentage change from the base year				
			Remove all domestic subsidies, no direct payments removed				
World agricultural price	3.55						
Returns to farmland		4.11	-1.28	-1.38	1.93	-7.26	-21.43
Total social welfare ($ billion)		0.24	-3.66	0.97	0.28	6.06	0.82
			Remove all domestic subsidies, with direct payments assumed mostly decoupled				
World agricultural price	3.6						
Returns to farmland		3.65	-1.3	-8.71	-1.52	-14.49	-32.58
Total social welfare ($ billion)		0.25	-3.89	1.04	0.31	5.92	0.83
			Remove all domestic subsidies, with direct payments assumed fully coupled				
World agricultural price	4.78						
Returns to farmland		5.09	-0.63	-4.31	6.43	-7.2	-22
Total social welfare ($ billion)		0.37	-6.5	1.23	0.34	5.52	0.81

Source: Diao, Somwaru, and Roe in this report.

ues, and encouraging continued output by creating expectations of future payments. The effects linked to wealth and risk are likely to be small (Young and Westcott, 2000; Burfisher, Robinson, and Thierfelder, 2000). We conduct a sensitivity experiment to test the importance to our analytical results of our assumption that whole-farm, land-based payments have minimal output effects. We analyze and compare the effects on production and trade of the full elimination of decoupled domestic subsidy payments, under the two assumptions that they have minimal effects on production, and that they behave as fully coupled output subsidies (app. table 2-4). We find that the assumption about the coupling of direct payments has relatively small effects on the results of our analysis. The change in the world agricultural price index from a full domestic subsidy removal by developed countries would be 4.8 percent if the direct payments are considered to be *fully* coupled, compared to 3.6 percent if they are minimally coupled. When direct payments are assumed to be fully coupled, welfare gains would be larger for the United States and Canada but slightly smaller for the EU and EFTA. Returns to farmland would be larger (or less negative) because higher world prices would help offset farmers' loss of the transfer payments. The relatively small effects from even an extreme assumption about the rate of coupling suggest that the potential benefits from reducing these kinds of programs may be quite small.

Finally, we estimate countries' 1998 support levels relative to their 1998 ceilings under the URAA by assuming that the change in AMS levels, based on each country's most recent WTO notification, would be the same as the changes in PSE level, if there are missing years of AMS data. We then compare the implied AMS expenditures to their URAA ceiling commitments. To estimate support as a percent of ceiling in the final year of the URAA implementation, we assume 1998 levels of support are continued through 2000.

Tariff and Export Subsidy Data

Data on import tariffs are from the AMAD database. In order to analyze supply and demand responses to relative price changes, we use applied tariff data when available for developing countries, because there is often a substantial difference between their bound rates and the tariffs that they actually apply to imports. We use Uruguay Round bound rates for developed countries; their bound and applied rates are generally the same. The AMAD data include the over-quota tariff rates from TRQ regimes in its tariff database. This approach can lead to an overestimate of the tariff in the cases where imports are below the quota (and enter at lower, within quota rates) or where over-quota tariffs are not enforced. We adjusted AMAD tariffs in our analysis in those cases where the tariff represented an unenforced TRQ. The countries and commodities for which tariff rates were reduced from AMAD rates include imports of coarse grains and oilseeds by Japan, and imports of wheat and corn by Mexico.

Export subsidy rates were calculated using UN trade data and export subsidy value data from the WTO.

Model Documentation

Introduction

The model-based analyses in this report use computable general equilibrium (CGE) models and partial equilibrium models. Descriptions of each model follow, including discussion of sectoral structure, factor markets, macro closure, data sources, and any innovative features of the model, such as dynamic behavior.

Dynamic Global CGE Model (Xinshen Diao, Agapi Somwaru, Terry Roe)

The model is based on neoclassical growth theory. It is a global intertemporal (dynamic) GE model with 10 countries/regions and 7 production sectors. The data used for calibrating the base-run are GTAP database, version 5.2. The dynamic model is different from a static CGE model in which firms only make a production decision for one period at a given level of factor endowments. In the intertemporal dynamic model, firms of each region have intertemporal optimization behavior (i.e., besides employing labor, capital and land, as well as intermediates to conduct production, firms also make investment decisions to maximize firm's intertemporal profits). Thus, capital accumulates over time endogenously. On the other hand, the representative consumer of each region maximizes an intertemporal utility function by making consumption and savings decisions. Thus, another difference from a static CGE model is that a country's savings are endogenously determined. This implies that the model captures not only bilateral commodity trade flows, but also financial capital flows among countries/regions over time. The intertemporal budget constraint for each country/region is equivalent to the so-called macro-closure in the static model, but along transition, international borrowing/lending, trade deficits/surplus, and hence the accumulation of foreign debt/assets in each region are endogenously determined. Thus, economic adjustments due to policy reform take time and the entire transitional path to the steady state can be solved from the model.

The model also captures the linkage between trade and total factor productivity (TFP) growth by introducing *technological spillovers*. That is, if a country becomes more open in trade to other countries, it is more likely to learn and adopt advanced technologies embodied in international trade, which will improve its factor productivity, so that more outputs can be produced using the same amount of productive resources. The technological spillover elasticity is borrowed from econometric studies (Coe and Helpman, 1995; Coe, Helpman and Hoffmaister, 1997; and Wang and Xu, 1997). The detailed description of the model can be found in Diao and Somwaru (1997).

Global CGE Model (C. Edwin Young et al.)

This analysis uses the GTAP model. GTAP is a global trade applied general equilibrium framework documented in Hertel (1997). Our model is calibrated to 1997 macro and trade data. We aggregated global data into a model with OECD countries and the rest of the world, and 16 traded commodities. The GTAP version 5.2 data have tariffs and export subsidies from the AMAD database and domestic support data from the USDA/ERS's database on the AMS (see appendix 2 in this report).

GTAP is a comparative static model with price-taking behavior for all economic agents and full employment of resources. Land is employed in agriculture only, and it is imperfectly mobile across sectors. All sectors employ labor and capital, which are perfectly mobile across sectors in a region. Households maximize utility derived from consumption and savings subject to regional income, which consists of primary factor payments and net tax collections. International trade clears commodity markets, with each commodity being differentiated by its place of origin. Regional investment is financed by domestic savings and net capital inflow from all other regions. A price index for global savings is the numeraire.

ESIM Model (Susan Leetmaa)

The European Simulation models (ESIM) are linear, time-dependent, constant elasticity, partial equilibrium models. ERS currently has five individual country/region ESIM models (EU15, the Czech Republic, Hungary, Poland, and Slovakia) and the EU-

18 model used for this analysis (EU15 plus the Czech Republic, Hungary, and Poland). ESIM covers 18 major commodities in the agricultural sector: wheat, corn, barley, other coarse grains, soybeans, rapeseed, sunflowerseed, soymeal, rapemeal, sunmeal, soyoil, rapeoil, sunoil, other oils, fluid milk, beef and veal, pork, and poultry. ESIM also includes 12 feeds and a detailed feeding scheme (developed by Jan Blom of LEI/DLO in the Netherlands).

Food Aid Needs Assessment Model (Shahla Shapouri and Michael Trueblood)

The Food Security Assessment model used in this report was developed at the USDA/ERS for use in projecting food consumption and access, and food gaps in 67 low-income countries through 2010. The model database is an average of 1997-99. The reference to food includes grains, root crops, and a category "other," which includes all other commodities consumed, thus covering 100 percent of food consumption. All of these commodities are expressed in grain equivalent.

Food gaps are projected using two consumption criteria: (1) status quo target, where the objective is to maintain average per capita consumption of the recent past; and (2) nutrition-based target, where the objective is to maintain the minimum daily caloric intake recommended by the UN's Food and Agriculture Organization (FAO).

Projection of Food Availability. The simulation framework used for projecting aggregate food availability is based on partial equilibrium recursive models of 67 lower-income countries. The country models are synthetic, meaning that the parameters that are used are either cross-country estimates or estimates from other studies. Each country model includes three commodity groups: grains, root crops, and other. The production side of the grain and root crops are divided into yield and area response. Crop area is a function of 1-year lag return (real price times yield), while yield responds to input use. Commercial imports are assumed to be a function of domestic price, world commodity price, and foreign exchange availability. Foreign exchange availability is a key determinant of commercial food imports and is the sum of the value of export earnings and net flow of credit. Foreign exchange availability is assumed to be equal to foreign exchange use, meaning that foreign exchange reserves are assumed to be constant during the projection period. Countries are assumed to be price takers in the international market, meaning that world prices are exogenous in the model. However, producer prices are linked to the international market. The projections of consumption for the "other" commodities are simply based on a trend that follows the projected growth in supply of the food crops (grains plus root crops). Although this is a very simplistic approach, it represents an improvement from the previous assessments where the contribution to the diet of commodities such as meat and dairy products was overlooked.

Glossary

Agreement on Agriculture. Part of the Uruguay Round agreement covering issues related to agriculture (e.g., market access, export subsidies, and internal support).

AMS (Aggregate Measurement of Support). An index that measures the monetary value of the extent of government support to a sector. The AMS, as defined in the Agreement on Agriculture, includes both budgetary outlays as well as revenue transfers from consumers to producers as a result of policies that distort market prices. The AMS includes actual or calculated amounts of direct payments to producers (such as deficiency payments), input subsidies (on irrigation water, for example), the estimated value of revenue transferred from consumers to producers as a result of policies that distort market prices (market price supports), and interest subsidies on commodity loan programs. The AMS differs from the broader agricultural support measure, the Producer Subsidy Equivalent, by excluding estimated benefits (or costs) of certain noncommodity specific policies (e.g., research and environmental programs), and by using special WTO-defined measures of deficiency payments and market price supports. Furthermore, the final AMS for the WTO implementation period (1995-2000) is adjusted to exclude deficiency payments under WTO special provisions, even though they are included in the WTO base period.

Bound tariff rates. Tariff rates resulting from GATT negotiations or accessions that are incorporated as part of a country's schedule of concessions. Bound rates are enforceable under Article II of GATT. If a GATT contracting party raises a tariff above the bound rate, the affected countries have the right to retaliate against an equivalent value of the offending country's exports or receive compensation, usually in the form of reduced tariffs of other products they export to the offending country.

Cairns group. A group formed in 1986 in Cairns, Australia, that seeks the removal of trade barriers and substantial reductions in subsidies affecting agricultural trade. The group includes Argentina, Australia, Bolivia, Brazil, Canada, Chile, Colombia, Costa Rica, Fiji, Guatemala, Indonesia, Malaysia, New Zealand, Paraguay, the Philippines, Thailand, South Africa, and Uruguay. The Cairns Group was a strong coalition in the Uruguay Round of multilateral trade negotiations.

Ceiling binding. In cases where an existing tariff was not already bound, developing countries were allowed to establish ceiling bindings. These ceiling bindings could result in tariffs that were higher than the existing applied rate. The ceiling bindings took effect on the first day of implementation of the Agreement.

Country schedules. The official schedules of subsidy commitments and tariff bindings as agreed to under GATT for member countries.

De minimis rule. The total AMS includes a specific commodity support only if it equals more than 5 percent of its value of production. The noncommodity-specific support component of the AMS is included in the AMS total only if it exceeds 5 percent of the value of total agricultural output.

EFTA (European Free Trade Association). An international organization with four member countries: Iceland, Liechtenstein, Norway, and Switzerland. The purpose of EFTA is to monitor and manage relationships among the EFTA States. Iceland, Liechtenstein, and Norway also participate in the EU common market through an Agreement on the European Economic Area (EEA).

EU (European Union). Established by the Treaty of Rome in 1957 and known previously as the European Economic Community and the Common Market. Originally composed of 6 European nations, it has expanded to 15. The EU attempts to unify and integrate member economies by establishing a customs union and common economic policies, including CAP (Common Agricultural Policy). Member nations include Austria, Belgium, Denmark, Germany, Greece, Finland, France, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom.

GATT (General Agreement on Tariffs and Trade). Originally negotiated in Geneva, Switzerland, in 1947, among 23 countries, including the United States, GATT is an agreement to increase international trade by reducing tariffs and other trade barriers. The agreement provides a code of conduct for international commerce and a framework for periodic multilateral negotiations on trade liberalization and expansion.

In-quota tariff. The tariff applied on imports within the quota. The in-quota tariff is less than the over-quota tariff.

"Like-minded" developing country group. A group of least developed, developing countries that presented a joint proposal at the WTO. The group includes Cuba, Dominican Republic, Honduras, Pakistan, Haiti, Nicaragua, Kenya, Uganda, Zimbabwe, Sri Lanka, and El Salvador.

Market access. The extent to which a country permits imports. A variety of tariff and nontariff trade barriers can be used to limit the entry of foreign products.

Megatariffs. Extremely high tariffs that effectively cut off all imports other than the minimum access amounts granted under the agreement. Some well-known examples of megatariffs resulting from tariffication include the base tariffs calculated for EU tariffs on grains, sugar and dairy products; U.S. sugar, peanuts, and dairy products; Canadian tariffs on dairy products and poultry; and Japanese tariffs on wheat, peanuts, and dairy products.

MERCOSUR. The Common Market of the South (Mercado Comun del Sur) created by the Treaty of Asunción signed by Argentina, Brazil, Paraguay, and Uruguay in 1991. Chile and Bolivia became associate members in 1996 and 1997, respectively.

NAFTA (North American Free Trade Agreement). A trade agreement involving Canada, Mexico, and the United States, implemented on January 1, 1994, with a 15-year transition period. The major agricultural provisions of NAFTA include (1) the elimination of nontariff barriers — immediately upon implementation, generally through their conversion to tariff-rate quotas or ordinary quotas; (2) elimination of tariffs — many immediately, most within 10 years, and some sensitive products gradually over 15 years; (3) special safeguard provisions; and (4) country-of-origin rules to ensure that Mexico does not serve as a platform for exports from third countries to the United States.

Nontariff trade barriers. Regulations used by governments to restrict imports from, and exports to, other countries, including embargoes, import quotas, and technical barriers to trade.

Notifications. The annual process by which member countries report to the WTO information on commitments, changes in policies, and other related matters as required by the various agreements.

OECD (Organization for Economic Cooperation and Development). An organization founded in 1961 to promote economic growth, employment, a rising standard of living, and financial stability; to assist the economic expansion of member and nonmember developing countries; and to expand world trade. The member countries are Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States

Over-quota tariff. The tariff applied on imports in excess of the quota volume. The over-quota tariff is greater than the in-quota tariff.

PSE (Producer Subsidy Equivalent). A broadly defined aggregate measure of support to agriculture that combines into one total value aggregate, direct payments to producers financed by budgetary outlays (such as deficiency payments), budgetary outlays for certain other programs assumed to provide benefits to agriculture (such as research and inspection and environmental programs), and the estimated value of revenue transfers from consumers to producers as a result of policies that distort market prices.

Round. Refers to one of a series of multilateral trade negotiations held under the auspices of GATT for the purposes of reducing tariffs or other trade barriers. There have been eight trade negotiating rounds since the adoption of GATT in 1947.

Special and differential treatment. The provision allowing exports from developing countries to receive preferential access to developed markets without hav-

ing to accord the same treatment in their domestic markets.

Tariff. A tax imposed on commodity imports by a government. A tariff may be either a fixed charge per unit of product imported (specific tariff) or a fixed percentage of value (ad valorem tariff).

Tariff-rate quota. Quantitative limit (quota) on imported goods, above which a higher tariff rate is applied. A lower tariff rate applies to any imports below the quota amount.

Tariffication. The process of converting nontariff trade barriers to bound tariffs. This is done under the UR agreement in order to improve the transparency of existing agricultural trade barriers and facilitate their proposed reduction.

UR (Uruguay Round) agreement. The Uruguay Round of multilateral trade negotiations, conducted under the auspices of the GATT, is a trade agreement designed to open world markets. The Agreement on Agriculture is one of the 29 individual legal texts included in the Final Act under an umbrella agreement establishing the WTO. The negotiation began at Punta del Este, Uruguay, in September 1986 and concluded in Marrakesh, Morocco, in April 1994.

WTO (World Trade Organization). Established on January 1, 1995, as a result of the Uruguay Round, the WTO replaces GATT as the legal and institutional foundation of the multilateral trading system of member countries. It provides the principal contractual obligations determining how governments frame and implement domestic trade legislation and regulations. It is the platform on which trade relations among countries evolve through collective debate, negotiation, and adjudication.

Recommended Readings

Agricultural Market Access Database (AMAD). www.amad.org

Beghin, J., and M. Potier (1997). "Effects of Trade Liberalisation on the Environment in the Manufacturing Sector." *The World Economy*. 20: 435-56.

Beghin, J., S. Dessus, D. Roland-Holst, and D. van der Mensbrugghe (1997). "The Trade and Environment Nexus in Mexican Agriculture. A General Equilibrium Analysis." *Agricultural Economics*. 16: 115-131.

Bennett, R.M. (1977). "Farm Animal Welfare and Food Policy," *Food Policy*, 22: 281-288.

Blandford, David and Linda Fulponi (1999). "Emerging Public Concerns in Agriculture: Domestic Policies and International Trade Commitments," *European Review of Agricultural Economics.* 26: 409-424.

Blandford, David and Fulponi, Linda (2000). Conference presentation, Symposium on Global Food Trade and Consumer Demand for Quality, IATRC, June 26-27.

Burfisher, Mary, Sherman Robinson, and Karen Thierfelder (2000). "North American Farm Programs and the WTO," *American Journal of Agricultural Economics.* 82: 768-774.

Coe, D.T. and E. Helpman (1995). "International R&D Spillovers," *European Economic Review*. 39: 859-887.

Coe, D.T., E. Helpman, and A.W. Hoffmaister (1997). "North-South R&D Spillovers," *The Economic Journal.* 107: 134-149.

Cole, M., A. Rayner, and J. Bates (1988). "Trade Liberalisation and the Environment: The Case of the Uruguay Round." *The World Economy*. 11: 337-347.

Diao, X. and A. Somwaru (2000). "An Inquiry on General Equilibrium Effects of MERCOSUR — An Intertemporal World Model," *Journal of Policy Modeling.* 22: 557-558.

Downs, D. Correspondence to Deputy U.S. Trade Representative Susan Esserman and Acting Deputy EPA Administrator Peter Robertson. July 16, 1999. Accessed at: www.sierraclub.org/trade/summit/letter.asp.

European Community, Council Directive 98/58/EC of 20 July 1998 concerning the protection of animals kept for farming purposes.

Farrantino, M. and L. Linkins (1999). "The Effect of Global Trade Liberalization on Toxic Emissions in Industry." *Weltwirtschaftliches Archiv (Review of World Economics.* 135: 128.

Gibson, Paul, John Wainio, Daniel Whitley, and Mary Bohman (2001). *Profiles of Tariffs in Global Agricultural Markets.* USDA, Economic Research Service. Agriculture Economic Report No. 796.

Grossman, G. and A. Krueger (1995). "Economic Growth and The Environment." *The Quarterly Journal of Economics.* 110: 353-77.

Hertel, T.W., editor (1997). *Global Trade Analysis: Modeling and Applications.* Cambridge University Press.

Index to International Public Opinion, Greenwood Press, Westport, 1997/1998.

Nordstrom, H., and S. Vaughan (1999). *Trade and Environment.* Special Studies 4. Geneva: World Trade Organization.

Organization for Economic Co-operation and Development (OECD) (1999). *Agricultural Policies in OECD Countries.* Paris: OECD.

Tielu, Apelu and Ivan Roberts (1998). "Farm Income Support: Implications For Gains From Trade of Changes in Methods of Support Overseas," in *ABARE Current Issues*, No. 98.4.

U.S. Trade Representative. "Declaration of Principles on Trade and Environment." November, 1999. Accessed at: www.ustr.gov/environment/finpol.pdf.

Vogel, David. *Trading Up.* Harvard University Press, Cambridge, 1995.

Wang, J. and B. Xu (1997) "Trade, FDI, and R&D Spillovers in the OECD," University of Florida, October, mimeo.

WTO. "Communication from the Commission on the Precautionary Principle." Communication received by the WTO from the European Communities on March 8, 2000. G/SPS/GEN/168.

Young, C. Edwin, and Paul C. Westcott (2000). "How Decoupled is U.S. Agricultural Support for Major Crops?" *American Journal of Agricultural Economics.* 82: 762-767.