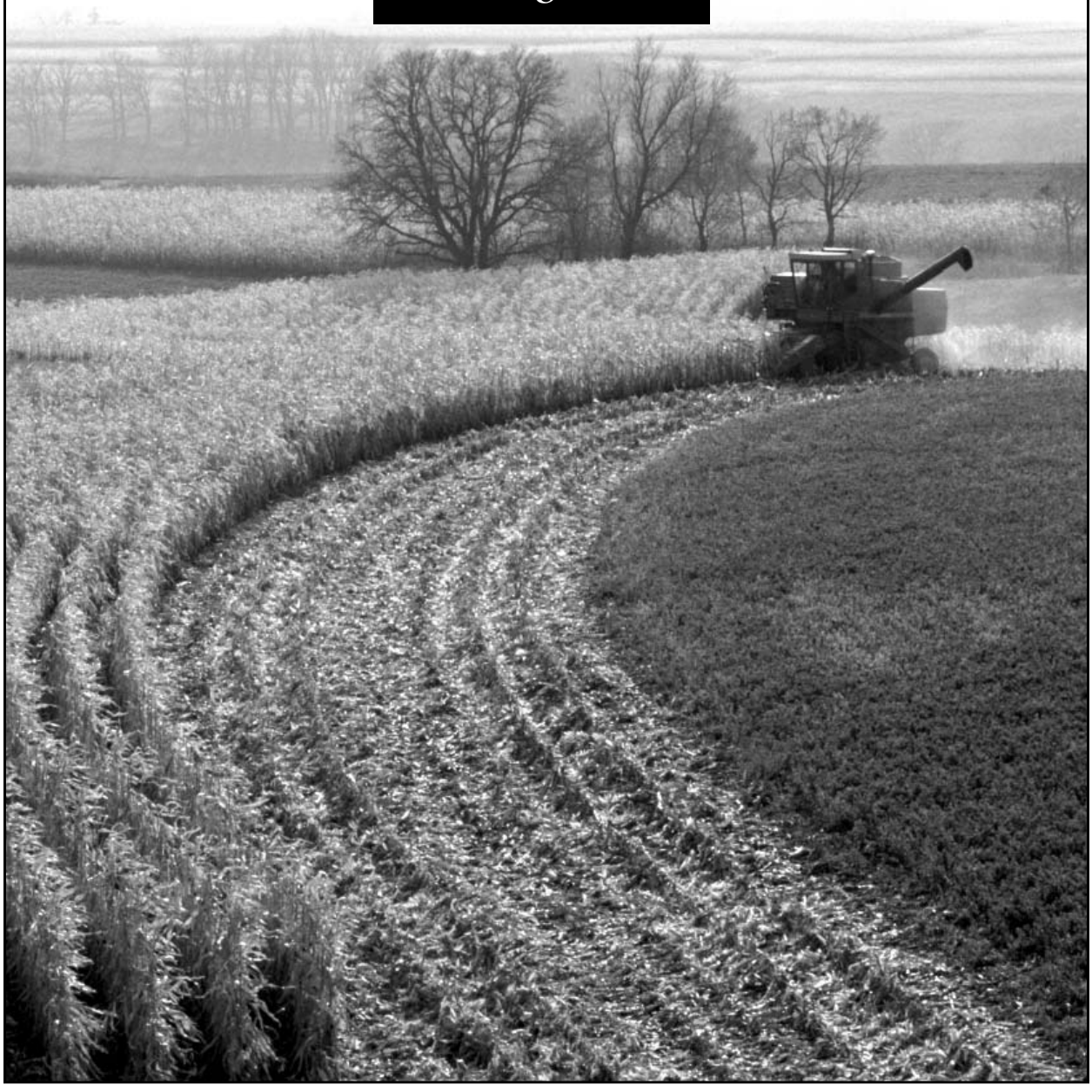
CONGRESS OF THE UNITED STATES
CONGRESSIONAL BUDGET OFFICE

A
CBO
PAPER

JUNE 2006

The Effects of Liberalizing World Agricultural Trade: A Review of Modeling Studies



Pub. No. 2771

A

CBO

PAPER

The Effects of Liberalizing World Agricultural Trade: A Review of Modeling Studies

June 2006

The Congress of the United States ■ Congressional Budget Office

Notes

Numbers in the text and tables of this paper may not sum to totals because of rounding.

The following country groups, organizations, and corresponding acronyms appear throughout the text and tables:

- **The African, Caribbean, and Pacific Group of States (ACP Group of States, or ACP Group)** is an organization of countries created by the Georgetown Agreement in 1975 with objectives that include sustainable development of its member states and their gradual integration into the global economy. Its members include 76 developing countries in Africa, the Caribbean, and the Pacific.

- **The Association of Southeast Asian Nations (ASEAN)** was formed in 1967 with goals of (1) accelerating economic growth, social progress, and cultural development in the region and (2) promoting regional peace and stability through respect for justice and the rule of law in relations among countries and adherence to the principles of the United Nations. Its members are Brunei Darussalam, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam.

- **The Cairns Group** is a coalition of agriculture-exporting countries formed in 1986. Its members are Argentina, Australia, Bolivia, Brazil, Canada, Chile, Colombia, Costa Rica, Guatemala, Indonesia, Malaysia, New Zealand, Paraguay, the Philippines, South Africa, Thailand, and Uruguay.

- **The European Free Trade Association (EFTA)** was established in 1960. Its members are Iceland, Norway, and Switzerland-Liechtenstein.

- For purposes of international trade, the **European Union (EU)** is a customs union of European countries and is effectively one country. There is free trade among its members, its members have a common trade policy toward the rest of the world, and the union itself (rather than its individual member countries) is a member of the World Trade Organization. Its original members were Belgium, Germany, Luxembourg, France, Italy, and the Netherlands. Denmark, Ireland, and the United Kingdom joined in 1973; Greece in 1981; Spain and Portugal in 1986; and Austria, Finland, and Sweden in 1995. In 2004, the EU added Cyprus, Malta, and eight Eastern European countries, increasing its total membership from 15 to 25 countries. Because of the change over time in the number of member countries, some studies reviewed in this paper put in parentheses the number of member countries analyzed, for example, European Union (25), EU(25), or EU(15).

- **The Organisation for Economic Co-operation and Development (OECD)** is an international organization of democratic countries with market economies. Created in 1960, it currently has 30 member countries, most of them developed countries.

- **The Southern African Customs Union (SACU)** was created in 1969. Its members are Botswana, Lesotho, Namibia, South Africa, and Swaziland.

The photograph on the front cover is courtesy of Lynn Betts, U.S. Department of Agriculture.

Preface

A major issue on the agenda of the ongoing Doha Round of multilateral negotiations by members of the World Trade Organization concerns how and to what extent policies that affect agricultural trade should be liberalized. For most of the postwar period, the series of multilateral negotiating rounds under the auspices of the General Agreement on Tariffs and Trade allowed policies that distort agricultural trade to continue in large part while tariffs and other policies that distort trade in other sectors were progressively reduced or eliminated. The Uruguay Round, which took place from 1986 through 1994, began the liberalization of agricultural trade; yet tariffs remain much higher, and the use of subsidies remains much more prevalent, in agriculture than in other goods-producing industries.

In August 2005, in response to a request by the Chairman of the House Ways and Means Committee, the Congressional Budget Office (CBO) published a paper that presented statistics on policies around the world that distort agricultural trade. In December 2005, in response to the same request, CBO published a paper that surveyed the results of studies that estimate the economic effects of liberalizing those policies. The December paper was brief, focusing on the general conclusions that could be drawn from the studies and selected numerical results to illuminate them. This paper gives a more complete presentation of the numerical results as well as additional explanation concerning their interpretation. In keeping with CBO's mandate to provide objective, nonpartisan analysis, the paper makes no recommendations.

Bruce Arnold of CBO's Microeconomic Studies Division prepared this paper under the supervision of Roger Hitchner (who has since left CBO), Joseph Kile, and David Moore. Paul Burnham, Douglas Hamilton, Gregory Hitz, Arlene Holen, and Tom Woodward provided comments on a draft of the paper. Outside of CBO, Ron Babula, Roger Corey, and William Deese of the U.S. International Trade Commission, Robert Stern of the University of Michigan, and Mary Burfisher of the U.S. Naval Academy also provided comments. (The assistance of external reviewers implies no responsibility for the final product, which rests solely with CBO.)

Janey Cohen and Loretta Lettner edited the paper, and John Skeen proofread it. Angela McCollough and Allan Keaton formatted the tables. Maureen Costantino designed the cover and prepared the paper for publication. Lenny Skutnik printed the initial copies, and Simone Thomas produced the electronic version for CBO's Web site (www.cbo.gov).

Donald B. Marron

Donald B. Marron
Acting Director

June 2006

Contents

Tables

Tables (Continued)

Tables (Continued)

Tables (Continued)

CHAPTER

1

Introduction

The current round of multilateral trade negotiations under the auspices of the World Trade Organization (WTO), known as the Doha Round, was initiated by the Doha Ministerial Declaration on November 14, 2001; and a framework agreement to govern the talks was reached on July 31, 2004. A major focus of the Doha Round is the so-called Doha Development Agenda to promote development of Third World countries.

A contentious issue in that agenda is the liberalization of policies that distort agricultural trade. To illuminate the issue, the Congressional Budget Office (CBO) published a paper in August 2005 that presented statistics on such policies around the world, and in December 2005 it published a report surveying the results of a number of economic studies that examine the likely effects of liberalizing the policies.[1] The latter paper was selective in its presentation of numerical results from the studies it covered, presenting only an overview of the major results and conclusions. This paper gives a more comprehensive presentation of the numerical results that served as the basis for the December 2005 paper, as well as additional discussion of their interpretation. Because the December 2005 paper is essentially a summary of this paper, no summary is included here.

Studies of agricultural liberalization address many questions that are relevant to the Doha Round negotiations. First are questions relating to the motivation for addressing agricultural policies in the Doha Round:

- What is the total economic cost to the world of policies that distort trade in agricultural products, and how does it compare with the cost of policies that distort trade in other goods?
- Which countries would gain from worldwide elimination of those agricultural trade distortions, which would lose, and by how much?
- Which of the policies are most costly to world welfare?

Second are questions relating to the likely features of any agreement that might be reached in the round. Full liberalization (that is, complete elimination) of policies that distort agricultural trade is not under consideration in the negotiations—only partial liberalization—and the partial liberalization that resulted from the Uruguay Round Agreement on Agriculture ended up being less than had been expected by many people at the time that agreement was reached. In addition, liberalization of other sectors is being negotiated along with the liberalization of agriculture. Hence, some questions that have been addressed by modeling studies include:

- What are the most likely effects of the types and degrees of agricultural liberalization that are under discussion?
- Are the effects of agricultural liberalization influenced by liberalization of other economic sectors?

Third are questions concerning who gains and who loses within individual countries from liberalization:

- Which countries' agricultural sectors would gain and which countries' would lose under likely liberalization scenarios?
- What would be the effects of agricultural liberalization on the income of unskilled labor, skilled labor, and owners of capital and land?

1. Congressional Budget Office, *Policies That Distort World Agricultural Trade: Prevalence and Magnitude* (August 2005), and *The Effects of Liberalizing World Agricultural Trade: A Survey* (December 2005).

Fourth is a question relevant to a major theme of the negotiating round—the Doha Development Agenda:

- Which countries' policies harm developing countries the most?

Liberalization will not affect producers of all agricultural products equally, so a final question of interest is:

- What would be the effects of liberalization on U.S. producers of particular agricultural products?

A Qualitative Discussion of the Effects of Liberalization

The effects of trade liberalization fall into two broad categories: *static effects* and *dynamic effects*.

Static Effects

Liberalization can be expected to increase the efficiency of total world production—which would tend to benefit all participating countries—and to affect each country's terms of trade beneficially or detrimentally depending on the country's specific circumstances. For reasons that will be discussed shortly, such effects are called *static effects*.

Effects on Efficiency. When policies that affect trade are liberalized, all countries involved reallocate their factors of production—labor, capital, and land—so as to produce more of the goods and services that they are relatively more efficient at producing than are other countries and less of those that they are relatively less efficient at producing.[2] They then trade away some of the increased output of the former (exports) in exchange for other countries' increased output of the latter (imports). Because each country increases the fraction of its resources devoted to products for which it is relatively most efficient, world output increases to the benefit of all countries involved. In some industries, economies of scale may lead to further efficiency gains as countries increase their scales of production to serve a world market rather than only their own, smaller internal markets.

Effects on Terms of Trade. Another effect of liberalization is changes in terms of trade. A country's terms of trade is the relative price of its exports compared with its imports, which may be thought of as the quantity of goods it must export to earn proceeds sufficient to purchase a given quantity of imports. All else being the same, an improvement in a country's terms of trade (that is, a reduction in the quantity of goods it must export to purchase a given quantity of imports) makes it better off economically, and a deterioration renders it worse off.

Liberalization of agriculture can be expected to change countries' terms of trade for at least two reasons. First, the elimination of domestic and export subsidies will reduce the quantities of agricultural commodities supplied to world markets, and the reduction of tariffs will increase the quantities demanded from those markets. The combination of reduced supply and increased demand will cause prices in international trade to rise. The rise in prices will improve the terms of trade of countries in proportion to the magnitudes of their agricultural exports. Conversely, it will worsen the terms of trade of countries in proportion to the magnitudes of their agricultural imports.

Second, members of the WTO are generally required to charge the same array of tariffs—called most-favored-nation (MFN) tariffs—on imports from all other WTO members with two exceptions. One is that countries are allowed to enter into free-trade agreements in which they eliminate tariffs on all imports from the other parties to the agreements. The other is that developed countries are allowed to charge lower-than-MFN rates on imports from some developing countries. Such exceptions are called *tariff preferences*. If countries granting tariff preferences lower their MFN rates in accordance with a liberalization agreement, then prices of the affected products in those countries' home markets will decline. Consequently, the recipients of the tariff preferences will see declines in the prices their exports command, resulting in deteriorations in their terms of trade. Currently, the United States and the European Union (EU) have preferential tariffs on many agricultural products of developing countries. Given the high MFN tariffs imposed by the EU especially, an agricultural liberalization agreement could reduce the terms of trade of some developing countries that export agricultural products.

2. In the sense used here, greater efficiency does not necessarily mean that the country has, for reasons of better technology and organization, a more efficient production process that uses lesser quantities of resources and factors of production to produce a given quantity of output. The country might instead have better access to needed natural resources or possess relatively greater supplies of a factor of production that is needed in great quantities to produce the goods or services—anything that allows the country to produce the goods or services at a lower cost than other countries can.

Total Static Effects. All of the effects of liberalization just discussed—efficiency gains from reallocation of resources and factors of production and from increasing returns to scale, and changes in terms of trade—are permanent, one-time effects. They may phase in over many years—particularly the reallocation of capital. However, the changes eventually cease, with the economy remaining at the new equilibrium brought on by the changes. Ignoring for the moment any ongoing growth or economic fluctuations unrelated to the liberalization being modeled, the effects represent the differences between the static, unchanging equilibrium of the economy before the liberalization of policies and the static, unchanging equilibrium that the economy eventually reaches a number of years after the liberalization. As such, the (fully phased-in) effects themselves are static and unchanging—the reason they are called static effects.

Whether a country gains or loses from the static effects of agricultural liberalization depends on the sum of the efficiency effects for that country and the change in its terms of trade. The efficiency effects are generally positive for all countries, but changes in the terms of trade can be either positive or negative for a given country depending on the relative magnitudes of its agricultural exports and imports and on whether it is a recipient of tariff preferences on its agricultural exports. When countries charge the same tariffs against all other countries—that is, there are no tariff preferences—it can be rigorously proved under fairly general conditions that all countries gain in terms of total static effects (efficiency plus terms-of-trade) from the reduction or elimination of tariffs. In the presence of tariff preferences, however, the tariff reduction or elimination can sometimes result in trade diversion, in which one country's exports to the tariff-reducing country are replaced by another country's exports. Trade diversion increases the likelihood that one or more countries will experience negative total static effects from liberalization. A country can also be harmed when another country reduces or eliminates subsidies of a product that it (the first country) imports. Because tariff preferences exist and the reduction or elimination of subsidies occurs in agricultural liberalization, it is possible that some countries will be harmed in terms of static effects. The ones most likely to be harmed are developing countries that are net agricultural importers.

Of course, not all people and industries in a country will fare equally well from liberalization. Some will gain and some will lose. A country is considered by trade analysts to gain from liberalization if the gain to the winners is larger in dollar value than the loss to the losers. Thus, in principle (if not actual practice), it is possible for the winners to compensate the losers, with the result that everyone is better off. Of particular note regarding winners and losers, it is entirely possible—in fact, it is likely in some cases, as with the European Union—that a country could experience overall gain from agricultural liberalization while its agricultural sector loses. In general, a country's agricultural tariffs and subsidies help its agricultural sector at the expense of the rest of the country and at the expense of other countries. Further, the benefit of the tariffs and subsidies to the country's agricultural sector is generally smaller in magnitude than the cost to the rest of the country, let alone the cost to other countries.

Effects of Liberalizing Other Sectors. The static effects of agricultural liberalization would most likely be increased in size by liberalization of other sectors. For example, a number of developing countries have agricultural sectors that are sufficiently competitive that the exports from those sectors would increase under agricultural liberalization; but because their manufacturing sectors are uncompetitive, their imports of manufactured goods would increase under manufacturing trade liberalization. Increased imports of manufactured goods would increase demand within the country for the foreign currency necessary to purchase those imports. That increase in demand would cause a depreciation of the country's currency relative to the foreign currency. The depreciation would reduce the foreign-currency price of the country's agricultural exports, which in turn would lead to increased demand for those exports from abroad and therefore greater benefit to the developing country and its agricultural sector than would occur with agricultural liberalization alone.

For the same reason, developed countries with uncompetitive agricultural sectors would most likely see their exports of manufactured goods increase as a result of agricultural liberalization. Such liberalization would cause their agricultural imports from developing countries to increase, which would increase the demand for developing countries' currencies. The increased demand would drive up the values of those currencies relative to the values of the developed countries' own currencies, which would make the developed countries' manufactured goods less expensive to the developing countries. As a result, developed countries' exports of manufactured goods

would increase beyond what they would with manufacturing trade liberalization alone.

Dynamic Effects

Dynamic effects of trade liberalization are effects on and through rates of investment and productivity growth. Trade liberalization in general can be expected to increase the rate of capital investment. To give a simple example, assume for the purpose of argument that a country saves a specified amount in dollar value each year and that all of that saving ends up purchasing capital goods for one industry or another. Suppose further that the country, as part of a general liberalization program, reduces the tariffs it imposes on imports of capital goods. Such a reduction would cause the price of capital goods in the country to decline, and as a consequence, the given dollar value of saving would purchase a larger quantity of capital goods. Liberalization might affect rates of investment in other ways as well.

Any increase in investment would boost the rate of growth of the aggregate capital stock of the country for a period of time. Eventually, depreciation of the increasing capital stock would start to increase as well until net investment—investment minus depreciation—returned to what it was before liberalization.[3]

Increased imports of capital goods could bring improved technology incorporated in the goods, which in turn could cause the rate of productivity growth to increase over the period that the rate of net investment remained elevated. In addition, some analysts argue that liberalization can be expected to increase the rate of productivity growth indefinitely. Thus, one study contends that productivity growth is linked to the ratio of exports to output:

> As firms' exports grow and they increase their penetration of world markets, they learn new technologies (through comparison with their competitors' products); they improve production processes to match international standards (such as safety, health, packaging, style, and others); and they can benefit from scale economies as they produce for a larger market.[4]

Any increases in rates of productivity growth that might stem from such causes would not eventually be choked off by anything analogous to increased depreciation. Hence, their effect on output would continue to increase indefinitely.

The dynamic effects of liberalization increase the size of the static effects over time. As previously noted, static effects derive from reallocation of each country's resources, factors of production, and technology to reflect the new trading environment. Dynamic effects increase the capital stock—which is one of the factors of production whose reallocation is the source of the static effects—and improve the productivity of the factors of production. Consequently, the effects of reallocation also become progressively larger.

Dynamic effects tend to make all countries better off over time. Therefore, even if the net static effect of liberalization on a given country is negative, one might expect the dynamic effects to partially offset that negative effect and perhaps, given enough time, more than offset it, resulting in a positive net total effect of liberalization on the country.

Some Important Modeling Concepts and Qualifications

To properly understand and interpret the modeling results presented in subsequent chapters, it is necessary to know and understand a few basic facts and concepts concerning the relevant modeling and studies and some consequent qualifications of their results.

3. Because net investment eventually returns to its preliberalization level, some studies classify such effects as static rather than dynamic. This paper does not do that, preferring a definition of static effects that corresponds with the effects measured by static general-equilibrium models. Such models do not measure investment effects. Often such effects are imposed in ad hoc fashion in those models by assuming some specified increase in the aggregate capital stock of countries for the post-liberalization equilibrium. See the discussion of static models that follows.

4. See page 167 in World Bank in the bibliography. Some of the reasons presented in this quotation are more relevant to manufacturing than to agriculture. The study in question allows for effects of trade on productivity growth in both manufacturing and agriculture. Another study allows for such effects only in manufacturing. Even changes in the manufacturing sector, however, affect agricultural trade because some countries export manufactured goods in exchange for imports of agricultural products.

Measuring the Aggregate Benefits of Liberalization

Most modeling studies give at least one measure of the aggregate benefit or harm resulting from liberalization. One possible measure is the change in real (inflation adjusted) gross domestic product (GDP). A better measure, however—and one that is used frequently—is the change in economic welfare. The concept of economic welfare requires some explanation.

Liberalization of an economy leads to changes in relative prices as well as real GDP. Consequently, real GDP does not fully reflect the total benefit of liberalization. To understand why, imagine breaking down the combined change in real GDP and relative prices into two distinct changes: the change in real GDP with relative prices kept constant at their initial values, and then the change in relative prices with real GDP kept constant at its new higher level. Suppose that the change in real GDP is 5 percent. The increased GDP would mean that the country could increase the value of the market basket of goods that its people purchase and consume by 5 percent, and the fact that relative prices remain fixed would mean that the proportion of the market basket devoted to the various goods would remain the same.[5] Now impose the change in relative prices. Because real GDP remains fixed at the new higher level, the value of the market basket of goods will remain unchanged; however, its composition will not. People will purchase lesser quantities of goods that go up in price and greater quantities of goods that go down in price. The change in the mix of goods makes the people better off; otherwise they would not change the mix. Consequently, the change in economic well-being—what economists call economic welfare—from the combined change in real GDP and relative prices is greater than that indicated by the change in real GDP alone.

Economists have two similar measures of changes in economic welfare that can be applied in practice: equivalent variation and compensating variation. As applied to liberalization, the equivalent variation is the increase in income that would be required without liberalization to make people as well-off economically as they as they would be with the liberalization. The compensating variation is the reduction in income that would be necessary with liberalization to keep people at the same level of economic well-being that they have without the liberalization. It can be shown theoretically that the actual improvement in economic welfare is at least as large as the equivalent variation and no larger than the compensating variation. All of the studies surveyed in this paper that give estimates of welfare effects use equivalent variation as the measure.

Partial-Equilibrium Versus General-Equilibrium Models

Except for the studies in the last section of Chapter 4, which discusses product-specific effects of liberalization, almost all of the studies discussed in this paper use general-equilibrium models to produce their estimates. General-equilibrium models simulate the behavior of the entire economies of the countries at issue, not just the parts of the economies that are of interest (in this case, agriculture). Some parts of the economies may not be modeled in great detail. In some of the studies, all nonagricultural goods sectors are lumped into one big industry sector. Nevertheless, the entire economies are modeled. Some of the studies that present estimates of product-specific effects also use general-equilibrium models, but others use partial-equilibrium models. Partial-equilibrium models simulate the behavior of only the economic sectors that are of interest—in this case, agriculture or some narrow component of agriculture—and ignore other sectors of the economy, usually assuming that prices in those sectors (or perhaps some other key variables relating to how those sectors interact with the sector of interest) remain constant.

Partial-equilibrium models have both advantages and disadvantages relative to general-equilibrium models. They often can treat the industry of interest in greater detail and complexity than is feasible in a general-equilibrium model, and that fact can be beneficial in accurately modeling narrowly defined industries and sectors. Such models cannot, however, capture some effects that are inherently general equilibrium in nature—for example, the effect that liberalizing manufacturing trade is likely to have on the benefits from liberalizing agricultural trade, as discussed above. In general, the larger and more widespread in the economy the policy changes are, the more important general-equilibrium effects are likely to be. Economists generally agree that a trade agreement encompassing all goods trade requires a general-equilibrium model for accurate modeling. However, for many countries individually and for the world as a whole, agriculture

5. This argument abstracts from the fact that some goods are luxury goods (that is, goods which constitute an increasingly large fraction of the market basket as people get richer) and some are inferior goods (that is, goods which constitute an increasingly small fraction of the market basket as people get richer).

contributes only a small percentage of GDP, so the general-equilibrium effects of liberalization limited to agriculture are likely to be small. Consequently, if the analyst is interested only in one or more of those countries or in the world as a whole (but not in other countries for which agriculture is more important), and if the liberalization at issue is limited to agriculture (or is much more substantial for agriculture than for other sectors), the benefits that partial-equilibrium models can bring in terms of more-detailed treatment of the agricultural sector might outweigh the general-equilibrium effects that they ignore.

Static and Dynamic Models

Some models incorporate and predict only static effects of a policy change such as liberalization and make no predictions about the economy's path of adjustment to the change or even the length of time that the adjustment takes. The models are solved for the static equilibrium before the policy change and again after the change. The differences between the two equilibria are the static effects of the change in policy. Such models are called, appropriately, static models.

Other models, in addition to predicting the static effects of a policy change, also make predictions about the economy's path of adjustment over time. Such models are called dynamic models. Unlike static models, dynamic models can be designed (although not all of them are) to incorporate the dynamic effects of liberalization on investment and productivity growth rates as discussed above, as well as growth in the economy for other reasons over time. Dynamic models are more complicated than static models, and their solution is more complicated and computation-intensive. Rather than being solved for two equilibria—one before the policy change and one after—such models must be solved for a series of equilibria over time.

When CBO surveyed modeling studies of the North American Free Trade Agreement in 1993, most of the studies surveyed used static models.[6] The large computational power required to solve dynamic models made them problematic if they had more than a few countries/regions and economic sectors. Over time, the increasing computational speed of computers has eased that problem, and dynamic models have become more common and have come to incorporate larger numbers of countries/regions and economic sectors.

The additional effects that can be incorporated in dynamic models can make them more realistic and accurate, but they complicate the comparison of results among modeling studies. For example, all else the same, the inclusion of the previously discussed dynamic effects on investment and productivity leads to the prediction of greater benefits and larger effects generally from liberalization than would otherwise be predicted. Therefore, if two models predict different dollar values of benefits from a liberalization agreement, the analyst must determine whether one of the models includes dynamic effects on investment or productivity and the other does not before deciding that there is a conflict. It might be the case that the models are in agreement concerning the static effects.

A second complication stems from the fact that the benefits (and effects on trade and other variables) resulting from the inclusion of dynamic effects on investment and productivity grow over time. The results of two modeling studies that do not include such effects are comparable as long as the two studies model the same or similar liberalization scenarios and use the same base year for the preliberalization economic values (such as the GDP, imports, and exports of each country) and for the policies to be liberalized. In that case, different estimates by the two models reflect different assessments of the effects of liberalization on the economy. When dynamic effects on investment and productivity are included, however, the two studies must also estimate the effects of liberalization at the same or nearly the same interval of time after the date that the liberalization is assumed to occur for their results to be comparable. If the intervals are not the same, then different results from the two studies may reflect merely that one of the studies gave the effects more time to grow in size than the other did.

A third complication arises with dynamic models that incorporate exogenously imposed rates of growth over time—growth that has nothing to do with liberalization—in some variables such as population and some components of productivity. That growth causes the projected sizes of the economies of the countries modeled to grow over time even in the absence of liberalization. One would expect the dollar value of the benefits of liberalization to increase with the sizes of the economies of the

6. Congressional Budget Office, *Estimating the Effects of NAFTA: An Assessment of the Economic Models and Other Empirical Studies* (June 1993).

countries in question. Therefore, one would expect studies using models with such exogenous growth components to predict larger effects in dollar-value terms than studies using models without such components. Further, for the results of two studies using models with such components to be comparable, the studies not only must estimate effects at similar intervals after liberalization but also must assume that liberalization occurs at roughly the same time. Otherwise, the fact that one study estimates a larger benefit in dollar-value terms may simply reflect that the study assumed liberalization to occur at a later time when the economy had grown larger.

Data Problems

Modeling multilateral liberalization of policies affecting agricultural trade requires data on trade protection (tariff and nontariff), domestic subsidies, export subsidies, trade, and output, and all of the data must be for the same (or close to the same) year. The task of compiling such an array of data is vast, and many of the numbers one would like to have for a modeling study are simply unavailable for some (or even many) countries.

Most studies of agricultural trade liberalization make use of the set collected by the Global Trade Analysis Project (GTAP) at Purdue University for some or all of their data needs. Periodically, new versions of the GTAP database are released with various improvements. The most recent, version 6.05, was released in December 2004. It improves on earlier versions by, among other things, updating the data to 2001 (previous versions had economic data for 1997 or earlier and trade policy data for 1998 or earlier); including both bound and applied tariffs; including tariff preferences; and including the ad valorem equivalents of specific tariffs. Even so, version 6.05 itself is not perfect, and data sets for trade modeling will probably always be inferior to what modelers would like.

Of the studies surveyed in this paper, the 2006 World Bank study is the only one that is recent enough to use version 6.05 of the GTAP database.[7] Most of the others use data from 1998 or earlier. As a result, their estimates of the effects of liberalization include the effects of eliminating or reducing policies that have already been eliminated or reduced since those early base years. One study notes that its liberalization scenario assumes no liberalization by China because it was not a member of the WTO at the time of the study.[8]

The Doha Round tariff negotiations concern reductions in bound tariffs, not applied tariffs, and many countries' bound tariffs are significantly higher than their applied tariffs. Consequently, as will be discussed in more detail in Chapter 3, a given percentage reduction in bound tariffs will in most cases result in a much smaller reduction in applied tariffs and hence a smaller effect on trade than might otherwise be expected. For most of the studies not using version 6.05 of the GTAP database, lack of data on bound tariffs means that their modeling exercises cannot account for the effects of that slack. Moreover, some earlier versions did not even have a complete set of applied tariffs and included bound tariffs in place of the missing applied tariffs.

Of the studies included in this survey, the 2006 World Bank study is clearly the most up to date and detailed, and the new GTAP data set allows it to take into account more complicating factors than do the other studies. Therefore, it is treated prominently. However, problems with data are only one of many possible sources of error in a large general-equilibrium modeling study. Such models and the studies using them are complicated and require judgment calls about model design, values of parameters, and many other factors that can affect the models' solutions. Consequently, the results of even the best studies should be treated with caution unless supported by similar results from other, independent studies. Further, no one study answers all the questions one might have about agricultural liberalization. Hence, surveying a number of modeling studies is necessary for a confident evaluation of the various effects of multilateral liberalization of the agricultural sector. Such a survey is the task of this paper.

Lack of Independence Among Studies

Not only is there overlap in the data sets used in the studies surveyed in this paper, but the studies also overlap in other ways as well. Three of the studies use versions of the

7. This study is the same as the 2005 World Bank study referred to in CBO's December 2005 paper. At the time that paper was issued, the 2006 World Bank study had not yet been published, but CBO was able to include it because prepublication drafts were available from the World Bank's Web site. The forecast date of publication was 2005, so CBO referred to the study as the 2005 World Bank study. The study has since been published with a copyright date of 2006. Therefore, it is referred to here as the 2006 World Bank study.
8. China joined the World Trade Organization in 2001.

World Bank's LINKAGE model. Two of those were published by the World Bank and at least one of the coauthors of the third is an employee of the World Bank. Several studies make use of some variant of the GTAP static general-equilibrium model. The more that two studies have in common in terms of data, model, and authors, the more one would expect their results to be similar. The result of such overlap is to reduce the level of independent confirmation of results to something less than it would appear on the surface from the number of studies surveyed. Each of the tables of results in this paper identifies the model and data used in the study, the liberalization scenario simulated, and the authors of the study to help the reader assess the extent to which the results presented are independent of those in other tables.

CHAPTER

2

Economywide Effects of Full Liberalization

Estimates from a number of modeling studies are generally consistent with an annual welfare benefit to the world of roughly $50 billion to $185 billion (measured in 2001 dollars) by 2015, or 0.1 percent to 0.4 percent of world gross domestic product, from the static and investment effects of full agricultural liberalization by all countries beginning in 2005. That benefit can be considered the cost of keeping in place current policies that distort agricultural trade. Some estimates indicate that the cost of those policies is roughly two-thirds of the total cost of all policies distorting trade in goods. Estimates for the United States indicate an annual welfare gain from the same liberalization scenario that would most likely be in the range of $8 billion to $27 billion, or less than 0.1 percent to about 0.2 percent of GDP. All other developed countries would most likely benefit as well. Developing countries as a group would most likely benefit, although some individual developing countries might be harmed. Over time, the number of countries harmed should decline as the dynamic effects of liberalization on investment and productivity begin to overcome the negative static effects on some countries. Roughly 80 percent to 90 percent of the benefit would stem from elimination of tariffs. The welfare cost to the world of domestic subsidies and export subsidies is considerably smaller. Part of the reason may be that such subsidies benefit countries that import the subsidized goods, offsetting the harm that the subsidies inflict on the countries that grant them.

The Total Worldwide Cost of Policies That Distort Agricultural Trade

At first glance, the estimated total world (or global) welfare cost of policies that distort agricultural trade—tariffs, domestic subsidies, and export subsidies—varies considerably from study to study (see Table 2-1 on page 24). However, closer inspection reveals that some of the variation results from differences in timing, liberalization modeled, and methodology used. When rough adjustments are made to the estimates to account for those differences, the resulting estimates are closer together. Specifically, the estimates adjusted to reflect the increase in annual economic welfare in 2015 resulting from the static and investment effects of liberalization beginning in 2005 are generally in the range of $50 billion to $185 billion, or 0.1 percent to 0.4 percent (see Table 2-2 on page 26). Depending on the model and data set, the inclusion of productivity effects of liberalization can raise the estimate by 50 percent to 100 percent or more. Static-effect estimates are lower.

The reader is cautioned that the adjustments made to produce the estimates in Table 2-2 are crude, and therefore, the adjusted estimate for any one study should not be used alone as an estimate of what that study predicts for the common full-liberalization scenario that all of the studies are revised to reflect. Rather, conclusions should be drawn only from the group of adjusted results from all of the studies taken together, as was done in the previous paragraph. The following discussion presents important methodological details of the various studies and explains the adjustments the Congressional Budget Office made to produce Table 2-2.

Studies of Full Liberalization of All Agricultural Policies

The most-direct estimates of the total cost of all policies that distort agricultural trade come from studies that run simulations of the total elimination of such policies.

2006 Study by the World Bank, LINKAGE Model Analysis. The LINKAGE model analysis of the 2006 World Bank study estimates that the increase in world welfare in 2015 from the static and investment effects of fully liberalizing agriculture (that is, completely phasing out all tariffs, domestic subsidies, and export subsidies) in equal increments from 2005 through 2010 would be $182 billion

(in 2001 dollars).[1] The study does not give the percentage form of that estimate, but it gives both the dollar-value and percentage forms for other estimates; from those, it is possible to determine that the baseline world GDP in 2015 in the analysis is roughly $43 trillion.[2] Thus, the $182 billion estimate is 0.43 percent of baseline GDP. The analysis actually simulates the full liberalization of *all* goods sectors, not just agriculture, and the result presented here is the component of the resulting welfare effect that the study attributes to liberalization of agriculture. As noted in Chapter 1, liberalization of other goods sectors can be expected to increase the effects of agricultural liberalization.

The analysis uses a version of the World Bank's LINKAGE model with 27 countries/regions and 25 economic sectors. Agriculture and food comprise 13 of the 25 sectors. The model can produce estimates incorporating static effects, investment effects, and effects on productivity growth rates. The simulations producing the estimate presented here include the first two but not the third.

The analysis uses version 6.05 of the Global Trade Analysis Project database, which has a base year of 2001, but it effectively updates the base year in approximate fashion to 2005. With regard to the policies liberalized, it does so by including major changes in trade policy through 2005 in its baseline simulation, most notably the final stages of implementation of the Uruguay Round Agreement, tariff reductions made by China and Taiwan as conditions of their accession to the World Trade Organization, and the enlargement of the European Union to 25 members. With regard to economic variables, the model includes growth unrelated to trade liberalization in certain variables, such as population and productivity, and economy-wide productivity growth for each country is calibrated to make the model achieve a specified GDP growth target for that country. Therefore, even though the simulations start from the 2001 base year of GTAP version 6.05, the simulated size of each country's economy in 2005 when liberalization begins to phase in should approximate its true value in 2005.

Although the analysis does not give an estimate of the world welfare effect of full liberalization of agriculture that includes effects on productivity growth, it does give estimates of the world welfare effect of full liberalization of *all* goods sectors both with and without effects on productivity growth. The estimate without productivity-growth effects is $287.3 billion, and the estimate with such effects is $461.2 billion—60.5 percent larger. If one assumes as an approximation that including productivity effects increases the $182 billion welfare-effect estimate for full agricultural liberalization by roughly the same percentage, then that estimate would rise to $292 billion, or 0.69 percent of world GDP.[3]

2006 Study by the World Bank, GTAP-AGR Model Analysis. The GTAP-AGR model analysis of the 2006 World Bank study estimates the static welfare increase from full agricultural liberalization at $55.658 billion (in 2001 dollars).[4] Like the LINKAGE model analysis, the GTAP-AGR model analysis actually simulates the full liberalization of all goods sectors, and the result presented here is the component of the resulting welfare effect that the study attributes to liberalization of agriculture.

The GTAP-AGR model is a special-purpose variant of the standard GTAP static general-equilibrium model that is tailored to the analysis of agricultural policy issues. Like the LINKAGE model analysis, the GTAP-AGR model analysis uses version 6.05 of the GTAP database with a base year of 2001. The analysis first runs a preliminary simulation incorporating all liberalization that had been committed to in the WTO but not yet actually implemented by 2001, which includes the final stages of implementation of the Uruguay Round Agreement and the commitments made by China in its accession to the

1. See Anderson, Martin, and van der Mensbrugghe (a) in the bibliography.

2. Specifically, in Tables 12.14a and 12.14b on pages 370-373 of the study, the improvement in world welfare in 2015 for a scenario labeled "scenario 8" is reported to be $119.3 billion and 0.28 percent of the baseline. It follows that the baseline in 2015 is equal to $119.3 billion/0.28 percent = $42,607 billion, which must be rounded to $43 trillion because 0.28 percent has only two significant digits. Notwithstanding the rounding of the number in the text, all calculations based on it throughout the paper use the exact number.

3. The reasonableness of that assumption is supported by the fact that the $182 billion attributable to agricultural liberalization is 63.3 percent of the $287.3 billion attributable to liberalization of all goods sectors. Moreover, in the 2002 World Bank study, which also uses the LINKAGE model, the inclusion of productivity effects increases the welfare effect from full liberalization of all goods trade by 134.4 percent and increases the effect from full agricultural liberalization by a nearly identical 136.7 percent.

4. See Hertel and Keeney in the bibliography.

WTO. The analysis then uses the end point of that simulation as the starting point for the simulation of the full liberalization of agriculture. That procedure avoids attributing the benefits from liberalization that had already been committed to but not yet implemented in the base year to full liberalization of agriculture.

An appendix in the World Bank study examines the reasons that the estimate from the LINKAGE model is so much larger than the estimate from the GTAP-AGR model.[5,6] It finds that the difference is largely attributable to three factors. First, because the GTAP-AGR model is a static model, it has no provision for growth of countries' economies. Therefore, the GTAP-AGR model effectively measures the effects of liberalization on countries' economies at the sizes they had in 2001, whereas the LINKAGE model measures the effects on them at the sizes the model projects them to have in 2015. Economic growth over the intervening 14-year interval—growth not caused by the liberalization—makes for a factor of 1.8397 difference in the estimates. Second, the investment effects in the LINKAGE model cause a factor of 1.2283 difference. Finally, the LINKAGE model has longer-term elasticities of substitution between imports and competing domestically produced products, which cause a factor of 1.4270 difference.[7,8]

One could argue about which set of elasticities is appropriate. However, it is clearly appropriate to include investment effects, and proper comparison of modeling results clearly requires that the effects of liberalization be estimated for similarly sized economies. Hence, applying the first two factors to the GTAP-AGR estimate gives $55.658 billion x 1.8397 x 1.2283 = $125.78 billion—a little over two-thirds of the LINKAGE model estimate. Applying the elasticity factor to that brings the estimate up to $179.48 billion, which is very close to the LINKAGE model estimate.

The adjusted estimate in Table 2-2 on page 26 is obtained by applying the economic-growth factor to the 2001 estimate: $55.658 billion x 1.8397 = $102.40 billion. That amount is 0.24 percent of the $43 trillion baseline from the LINKAGE model analysis.

2002 Study by the World Bank. The World Bank published an earlier study of liberalization in 2002.[9] That study estimates that the same scenario evaluated in the LINKAGE model analysis of the 2006 study—fully liberalizing agricultural policy in equal increments from 2005 through 2010—would increase world economic welfare in 2015 by $248 billion (in 1997 dollars), or 0.64 percent of GDP, when static and investment effects but no productivity effects are included, and by $587 billion, or 1.47 percent of GDP, when all three kinds of effects are included.[10] Like the analyses in the 2006 World Bank study, the 2002 study actually simulates the full liberal-

5. "Comparison of Versions 5 and 6.05 of the GTAP Protection Database and of LINKAGE Model Results With Those from the GTAP-AGR Model," Appendix 12A to Anderson, Martin, and van der Mensbrugghe (a) in the bibliography.

6. Actually, the appendix examines the reasons for a similarly large difference between the two models in their estimates of the world welfare effect of full liberalization of *all* goods sectors—not just agriculture. However, the same reasons hold for full liberalization of agriculture, and the magnitudes of the effects stemming from those reasons are undoubtedly similar.

7. Elasticities of substitution are parameters in a model that reflect the sensitivity of consumers' and businesses' choices between imports and competing domestic products to changes in price. A high elasticity for a product means that a small reduction in the price of an import relative to the price of the competing domestic product will lead consumers and businesses to substantially increase the quantities of the import they purchase at the expense of the domestic product. A low elasticity means that the reduction in price must be much larger to induce them to do that. Elasticities of substitution for long time frames tend to be higher than those for shorter time frames.

8. More precisely, the appendix found that scaling the LINKAGE model result for full liberalization of all goods sectors to account for the smaller economy in 2001 reduced the result from $287 billion down to $156 billion, a factor of 1.8397 reduction. Removing the dynamic investment effects reduced the result further from $156 billion down to $127 billion, a factor of 1.2283 reduction. Finally, imposing the shorter-term elasticities reduced the result further from $127 billion down to $89 billion, a factor of 1.4270 reduction.

9. See World Bank in the bibliography.

10. The percentage forms presented here are not given directly in the study. Rather, Figure 6.2 on page 168 of the study indicates that the benefits from static-plus-investment effects of full liberalization of *all* goods sectors would be 0.91 percent, and the benefits from static-plus-investment-plus-productivity effects would be 2.09 percent. Table 6.1 on page 171 of the study indicates that the benefits from static-plus-investment effects of full liberalization of agriculture would be $248 billion and that those from full liberalization of all goods trade would be $355 billion. The corresponding numbers for static-plus-investment-plus-productivity effects would be $587 billion and $832 billion. It follows that the percentage benefit from the static-plus-investment effects of full liberalization of agriculture would be 0.91 percent x ($248/$355) = 0.64 percent. The benefits from static-plus-investment-plus-productivity effects would be 2.09 x ($587/$832) = 1.47 percent.

ization of all goods sectors, and the results presented here are the components of the resulting welfare effects that the study attributes to liberalization of agriculture—a fact that may increase the size of the estimated effect.

The study uses a version of the World Bank's LINKAGE model with 15 regions and 20 economic sectors. However, it uses version 5 of the GTAP data set, which has a base year of 1997 and does not include most tariff preferences. The earlier base year and lack of tariff preferences explain why the estimates from the 2002 study are higher than those in the LINKAGE analysis of the 2006 study: the 2002 study includes the benefits from liberalizing policies that were eliminated or reduced between 1997 and 2005, which are not included in the 2006 study's estimates, and it includes benefits from liberalizing most-favored-nation tariffs on imports from countries that face lower, preferential tariffs.[11]

One can conclude that the more-updated policy data and the inclusion of tariff preferences lower the estimated benefit from liberalization by a factor of roughly \$182 billion/\$248 billion = 0.7339.[12] That factor can be used to adjust the estimates from the 2002 study and other studies discussed below (which also use older policy data and do not account for tariff preferences) to make them more nearly comparable with the estimates from the 2006 study. Applying the factor to the static-plus-investment-effects estimate from the 2002 study gives \$182 billion (by definition), or 0.47 percent. Similarly, applying it to the static-plus-investment-plus-productivity-effects estimates gives \$430.8 billion, or 1.08 percent.

Study by the Economic Research Service. A study published in 2001 by the Economic Research Service (ERS) of the U.S. Department of Agriculture gives three estimates of the effect on world welfare of full agricultural liberalization by all WTO members.[13,14] It estimates the static welfare effect at \$31.06 billion (in 1997 dollars), or 0.13 percent. When it includes investment effects along with the static effects, its estimate rises to \$36.26 billion, or 0.16 percent, 15 years after liberalization. When it includes productivity effects as well, the estimate rises still further to \$56.39 billion, or 0.24 percent of GDP (also 15 years after liberalization).

The study uses trade data from version 5.2 of the GTAP database, which has a base year of 1997. It uses 1998 levels for agricultural tariffs, domestic support, and export subsidies, with tariffs obtained from the Agricultural Market Access Database, domestic support numbers obtained from the producer support estimates published by the Organisation for Economic Co-operation and Development, and export subsidy data obtained from member-country reports to the WTO.

The study uses ERS's own general-equilibrium model with 12 countries/regions, nine production sectors relating to agriculture and food, and one combined sector for the rest of the economy. Unlike the World Bank's LINKAGE model, ERS's model has no provision for economic growth independent of that attributable to the agricultural liberalization being modeled, which is part of the reason the welfare-effect estimates from the ERS study are so much smaller in dollar-value terms than the estimates from the LINKAGE model analysis of the 2006 World Bank study. (It is not the entire reason, as is evident from the fact that the ERS estimates expressed in terms of percentages are smaller than the World Bank estimates similarly expressed.) The depressing effect of the model's lack of provision for growth on the ERS's dollar-value estimates is particularly significant because of the 1997 base year for the economic data in the analysis. (Even the GTAP-AGR model analysis, which also has no exogenous growth, has a 2001 base year for such data.)

The percentage forms of the ERS estimates can be used to make approximate dollar-value estimates for the world economy at its projected size in 2015. Applying the per-

11. Some of the difference between the dollar values of the estimates from the 2002 and 2006 studies may also be attributable to updated projections of the sizes of countries' economies in 2015.

12. Contributing to the roughness of this factor is the fact that updated data undoubtedly led the World Bank to modify slightly its projections of the sizes of countries' economies in 2015. Any such modification would affect the estimated welfare effect and thereby affect the factor as calculated here.

13. See the Burfisher "Overview" and Diao, Somwaru, and Roe in the bibliography.

14. Although the "full liberalization" modeled by the ERS study includes elimination of all tariffs, tariff equivalents of nontariff barriers, and export subsidies by all WTO members, it includes elimination of domestic support only for Australia, New Zealand, Japan, Korea, the United States, Canada, the European Union, and three countries in the European Free Trade Area (EFTA). However, those countries account for between 90 percent and 92 percent (depending on which three of the four EFTA countries had subsidies eliminated by the study) of the total domestic support reported to the WTO by member countries.

centage form of the ERS static-effects estimate to the baseline GDP for 2015 from the LINKAGE model analysis gives 0.13 percent x $43 trillion = $55.4 billion. Applying the percentage form of the ERS static-plus-investment-effects estimate to the LINKAGE model baseline gives 0.16 percent x $43 trillion = $68.2 billion. Applying the ERS static-plus-investment-plus-productivity-effects estimate to the LINKAGE model baseline gives 0.24 percent x $43 trillion = $102.3 billion.

For final comparability with the LINKAGE model estimates, it is necessary to step those adjusted ERS estimates down to reflect the fact that the ERS study uses 1998 policy data with no recognition of tariff preferences, whereas the 2006 World Bank study uses approximate 2005 policy data that includes tariff preferences. The step-down can be accomplished in approximate fashion by multiplying the ERS estimates as adjusted so far by the ratio of the 2006 World Bank estimate to the 2002 World Bank estimate.[15] Thus, the final adjusted ERS static-effects estimate is $55.4 billion x $182 billion/ $248 billion = $40.7 billion. The final adjusted static-plus-investment-effects estimate is $68.2 billion x $182 billion/$248 billion = $50.0 billion. The final adjusted static-plus-investment-plus-productivity-effects estimate is $102.3 billion x $182 billion/$248 billion = $75.0 billion.

The adjusted ERS estimates are smaller than the estimates from the two World Bank studies. Part of the reason (although clearly not all of the reason) may be that the liberalization modeled in the ERS study is restricted to WTO members. In accordance with that restriction, China and Taiwan were assumed not to liberalize because they were not WTO members at the time the study was published.

Studies of Equal Partial Liberalization of All Agricultural Policies

More-indirect estimates of the total cost of trade-distorting policies can be obtained from studies that reduce all such policies in a balanced fashion, such as a 50 percent reduction in all tariffs (including tariff equivalents of nontariff barriers), domestic support, and export subsidies. The results of such studies must be scaled up to make them comparable with the results of the studies of full liberalization. The question is by how much. The cost of trade-distorting policies is an increasing function of the magnitude of those policies, although the precise form of that function is unknown. Because it is unknown, the precise amount by which the results should be scaled up is unknown.

CBO chose to scale the results up by a range of values. The upper end of the range was calculated on the basis of the assumption that the cost of trade-distorting policies is strictly proportional to the magnitude of those policies. It follows from that assumption that the benefit of reducing the magnitude of the policies is strictly proportional to the percentage reduction in the policies. Thus, if a study provides an estimate of the benefit from a 25 percent reduction in trade-distorting policies, the benefit from full liberalization—a 100 percent reduction—would be four times the estimate for the 25 percent reduction given in the study.

The lower end of the range was calculated on the basis of the assumption that the cost of trade-distorting policies is proportional to the square of the magnitude of the policies. That assumption is based on the fact that (as will be shown later in this chapter) most of the cost of trade-distorting policies stems from tariffs (which are taxes) and on a result from economic theory according to which the cost of a tax is proportional to the square of the tax rate. It can be shown that if the assumption is true, then $B_{FULL} = B_P / [P \times (2 - P)]$, where B_{FULL} is the benefit from full liberalization and B_p is the benefit estimated by a study for a scenario in which trade-distorting policies are reduced by a percentage equal to P.

Study by Brown, Deardorff, and Stern. A study by Drusilla K. Brown, Allan V. Deardorff, and Robert M. Stern that was published in December 2002 examines the effects of a 33 percent reduction in agricultural import tariffs, domestic support, and export subsidies. The study is the only one CBO surveyed that does not find a world welfare benefit from such liberalization. Instead, the study estimates a welfare loss of $3.1 billion.

The loss results from the reduction in export subsidies. The study finds that the reduction in tariffs increases world welfare by $9.5 billion, and the reduction in domestic subsidies increases it by $10.6 billion. However, the reduction in export subsidies reduces it by $23.2 billion, bringing the total to the net loss of $3.1 billion. The

15. Strictly speaking, the ratio of the 2006 World Bank estimate to the 2002 World Bank estimate corrects for policy liberalization between 1997 and 2006 plus tariff preferences rather than for policy liberalization between 1998 and 2006 plus tariff preferences as is needed here, but the error introduced should be small.

reduction in export subsidies benefits the countries that grant the subsidies, but the resulting increase in the international prices of agricultural products harms countries that import those products even more, resulting in the net loss for the world.

The study uses the Michigan Model of World Production and Trade, which has 21 countries/regions and 18 production sectors, of which agriculture is one. The model incorporates aspects of the "New Trade Theory," such as increasing returns to scale, monopolistic competition, and product heterogeneity. The study uses version 4 of the GTAP database, which has a base year of 1995, but it updates the base year in a very rough fashion to 2005. To estimate what the values of major economic variables would have been in 2005 in the absence of the Uruguay Round Agreement, the study makes projections on the basis of growth rates contained in the 1999 edition of *World Development Indicators* and the 1998-1999 edition of *World Development Report*, both published by the World Bank. The study then simulates the liberalization agreed to in the Uruguay Round Agreement. The end point of that simulation is used as the starting point for the simulation that produced the estimate presented here. As such, the policies that are liberalized to produce that estimate presumably do not reflect the admission of China and Taiwan into the WTO and the expansion of the European Union to 25 countries.

Assuming that the loss from liberalization is strictly proportional to the percentage reduction in import tariffs, domestic support, and export subsidies, the welfare loss from full liberalization—that is, a 100 percent reduction—would be $9.4 billion. In the results of this study, tariffs impose an economic cost, whereas the net effect of all agricultural trade-distorting policies is positive. Moreover, the magnitude of the effect of tariffs on economic welfare is smaller than the magnitude of the effect of subsidies. Therefore, justification for the assumption that the cost of trade-distorting policies is proportional to the square of the magnitude of those policies does not hold, and the adjustment based on that assumption is not calculated here.

The Brown, Deardorff, and Stern study does not give the world welfare effect in percentage form. Therefore, it is not possible to step it up to account for economic growth through 2015. For that reason, and because the study's estimate is fundamentally different from the other studies' estimates in that it is negative, no adjusted estimate is presented in Table 2-2 on page 26.

Study by Roberts and Others. A study by Ivan Roberts and others that was published in 1999 examines the effects of a 36 percent reduction in restrictions on agricultural market access (in tariff equivalents for nontariff barriers), domestic support, and export subsidies. It estimates the static world welfare effect at $34.3 billion (in 1995 dollars).

The study uses the GTAP static general-equilibrium model with 24 countries/regions and 22 commodities. It uses version 4 of the GTAP database (modified slightly to improve the data representation of policies where necessary), which has a base year of 1995. That was the first year of the Uruguay Round Agreement, and the liberalization scenario modeled is similar to the liberalization contained in that agreement, although a little more aggressive in its subsidy liberalization.[16]

Under the assumption that the cost of trade-distorting policies is strictly proportional to the magnitude of the policies, the welfare benefit from full liberalization would be $95.3 billion. Under the assumption that the cost is proportional to the square of the magnitude of the policies, the benefit from full liberalization would be $58.1 billion.

The $95.3 billion and $58.1 billion figures are for the world economy of 1995. To make the results comparable with those from the LINKAGE model analysis in the 2006 World Bank study, they must be scaled up to reflect the growth in the world economy through 2015. Recall from the discussion of the GTAP-AGR model analysis that historical and projected growth of the world economy from 2001 through 2015 increases the size of the effect of liberalization in the LINKAGE model analysis by a factor of 1.8397. If one assumes as an approximation that the rate of growth from 1995 through 2001 was the same as the

16. The Uruguay Round Agreement required an average 36 percent reduction in tariffs. It further required that developed countries reduce their "amber box" subsidies (a category of subsidies considered distorting to trade and therefore limited and reduced by the agreement) by 20 percent and that developing countries reduce theirs by 13 percent. Finally, it required that developed countries reduce their export subsidies by 36 percent and the volume of subsidized exports by 21 percent and that developing countries reduce their export subsidies by 24 percent and the volume of subsidized exports by 14 percent.

rate from 2001 through 2015, then growth from 1995 through 2001 would increase the effect of liberalization by a factor of 1.2986.[17] Applying that number to the $95.3 billion estimate gives $123.7 billion for 2001. Applying it to the $58.1 billion estimate gives $75.4 billion for 2001. Further applying the factor of 1.8397 to those two estimates gives $227.6 billion and $138.8 billion for 2015.

Finally, the estimates must be stepped down to reflect the fact that the study by Roberts and others uses 1995 policy data with no recognition of tariff preferences, whereas the 2006 World Bank study uses approximate 2005 policy data with recognition of tariff preferences. Multiplying the estimates by the factor of $182 billion/$248 billion, as was done for the ERS study and the 2002 World Bank study, partially adjusts for this fact.[18] Thus, the final adjusted upper estimate for 2015 is $227.6 billion x $182 billion /$248 billion = $167.0 billion, and the final adjusted lower estimate for 2015 is $138.8 billion x $182 billion/$248 billion = $101.9 billion. Those estimates are 0.39 percent and 0.24 percent, respectively, of the $43 trillion baseline GDP in the LINKAGE model analysis of the 2006 World Bank study.

Studies of Unequal Liberalization of Agricultural Policies

Some studies model liberalization scenarios that do not liberalize all agricultural policies equally. For example, they may model liberalization by only a subset of all countries, or they may model liberalization of only certain types of policies (such as tariffs). Determining from such studies the cost of all policies that distort agricultural trade is a bit more problematic than it is with the studies discussed to this point, generally requiring the use of information from other sources relating to the cost of the policies not liberalized in the study and resulting in what must be considered rougher estimates of the benefit from liberalization.

Study by Buetre and Others. A study by Benjamin Buetre and others that was presented at a conference in June 2004 examines the effects of a 50 percent reduction in all merchandise tariffs (not just agricultural tariffs) but no reductions in domestic support or export subsidies. Assuming the reduction takes place over the years 2005 to 2014 (the study does not state the time pattern of the reduction any more precisely than that), it estimates the resulting increase in world gross national product (GNP)—not welfare—in 2014 to be $61.0 billion.

The study uses the Global Trade and Environment Model (GTEM), developed by the Australian Bureau of Agricultural and Resource Economics, which has 18 countries/regions and 26 economic sectors, of which 16 are agriculture and food (excluding forestry, fisheries, and wool). The model includes investment effects of liberalization. Economies grow even in the absence of liberalization, so the effects of liberalization are determined as deviations from a baseline simulation.

For trade and other economic data, the study uses version 5 of the GTAP database, which has a base year of 1997. The applied tariffs from which liberalization is assumed to begin are from the 2003 Integrated Tariff Database of the World Trade Organization; the largest numbers of them apply to the years 2002, 2001, and 2000, in that order, with the oldest tariffs being for 1998.

As will be discussed in more detail later in this chapter, three other studies place the welfare cost of tariffs in the range of 80 percent to 100 percent of the total cost of all policies that distort agricultural trade. By itself, that fact would suggest that the estimate from the study by Buetre and others might be as much as 20 percent lower than the benefit from reducing *all* policies that distort agricultural trade by 50 percent. However, that study looks at the benefit from reducing all tariffs—not just agricultural tariffs—by 50 percent, a fact that would offset that error to a greater or lesser degree. Therefore, taking the study's $61.0 billion estimate as an approximation of the effect on world GNP of a 50 percent reduction in all policies distorting agricultural trade would not be likely to introduce substantial error: that estimate would probably be a little low but probably less than 20 percent too low. Under the assumption that the cost of trade restrictions is strictly proportional to their magnitude, the effect of full liberalization on world GNP would then be $122.0 billion. Under the assumption that the cost of trade restrictions is proportional to the square of their magnitude, the effect of full liberalization on world GNP would be $81.3 billion.

17. The factor of 1.2986 is calculated by raising 1.8397 to the (6 years/14 years) power.

18. The adjustment is only partial because the factor in question accounts for policy liberalization between 1997 and 2005 plus tariff preferences, whereas the adjustment that is needed is for policy liberalization between 1995 and 2005 plus tariff preferences.

For final comparability with the 2006 World Bank study, the estimates must be stepped down to reflect the fact that the tariffs that are liberalized in the study by Buetre and others are mostly those prevailing in 2000 through 2002 as described above, whereas the policies liberalized in the 2006 World Bank study are for 2005. (It is not clear whether the study by Buetre and others includes tariff preferences in its data set.) The only factor available for accomplishing the necessary reduction is the $182 billion/$248 billion factor used with the other studies above, which adjusts for tariff preferences and the differences in policies between 1997 and 2005 rather than for tariff preferences and differences between the 2000-2002 time frame and 2005 and is therefore too large. Applying that factor gives $122.0 billion x ($182 billion/$248 billion) = $89.5 billion and $81.3 billion x ($182 billion/$248 billion) = $59.7 billion.

The final adjusted range of estimates is obtained by taking the lower of the two estimates after the final stepping down—$59.7 billion—and the higher of the two estimates before the stepping down—$122.0 billion. The study by Buetre and others does not give estimates in percentage form and gives no information about its baseline world GDP in 2014. The best that can be done is to express the final adjusted estimates as a percentage of the baseline GDP from the 2006 World Bank study, which gives 0.14 percent and 0.29 percent, respectively.

Study by Beghin, Roland-Holst, and van der Mensbrugghe. A study by John C. Beghin, David Roland-Holst, and Dominique van der Mensbrugghe that was published in 2002 examines full liberalization of agricultural policies by high-income countries only, with liberalization occurring in equal increments from 2005 through 2010. That is the same scenario as the one used in the 2002 World Bank study and the LINKAGE analysis of the 2006 World Bank study except for the restriction of liberalization to high-income countries and the fact that the World Bank study eliminates policies distorting *all* trade and reports the component of the benefit arising from the liberalization of agricultural trade.[19] The study estimates the resulting improvement in world welfare in 2015 at $82.1 billion (in 1997 dollars), or 0.21 percent.

The study uses a version of the World Bank's LINKAGE model with 14 countries/regions and 25 sectors. Agriculture and food comprise 17 of the 25 sectors. In addition to static effects and investment effects, the study includes productivity effects in the manufacturing and services sectors. The study uses version 5.3 of the GTAP database, which has a base year of 1997 for economic variables and 1998 for policy variables. Thus, the main technical differences between this study and the 2002 World Bank study would appear to be the different liberalization scenario and the use of a GTAP version with a policy base year that is one year more recent.

Full liberalization by *all* countries would have a larger welfare effect. The LINKAGE model analysis of the 2006 World Bank study estimates that full liberalization of agriculture by all countries would have 1.35 times the world welfare effect of full liberalization of agriculture by high-income countries alone, and the 2002 World Bank study estimates that same factor at 2.38 when productivity effects are not included and 2.42 when they are.[20] Applying those factors to the estimate by Beghin, Roland-Holst, and van der Mensbrugghe gives a welfare effect of $110.7 billion to $198.3 billion, or 0.283 percent to 0.507 percent, for full liberalization of agriculture by all countries.

Those estimates must be stepped down to reflect the different policy base years used by the 2006 World Bank study and the study by Beghin, Roland-Holst, and van der Mensbrugghe. Multiplying each of the estimates by the same ratio as for the other studies—$182 billion/$248 billion—gives a final adjusted welfare effect of $81.2 billion to $145.5 billion, or 0.21 percent to 0.37 percent.[21]

19. "High-income countries" are defined in the study as Australia and New Zealand, Canada, the European Union, the European Free Trade Area, high-income Asia, and the United States.

20. Specifically, the 2006 World Bank study estimates that the world welfare effect from full liberalization of all goods trade by all countries would be $182 billion, whereas the same liberalization by high-income countries only would be $135 billion. The corresponding numbers for the 2002 World Bank study are $248 billion and $104 billion when effects on productivity growth are not included and $587 billion and $243 billion when such effects are included.

21. As was the case with the ERS study, the $182 billion/$284 billion factor slightly overcorrects since it is appropriate for the correction for tariff preferences plus the difference in policies between 1997 and 2005, whereas what is needed is correction for tariff preferences plus the difference in policies between 1998 and 2005; however, the error introduced should be small.

Comparison with the Cost of Trade-Distorting Policies in Other Goods Sectors

The World Bank studies look not only at policies that distort agricultural trade but also at policies that distort trade in all other goods sectors. The studies find that the vast bulk of the cost of policies that distort trade in goods results from policies that distort agricultural trade.

According to the LINKAGE model analysis in the 2006 study, 63.4 percent of the benefit derived from phasing out all policies that distort trade in goods—$182 billion out of a total of $287 billion—would stem from the elimination of policies in the agricultural sector (see Table 2-3 on page 27). That estimate includes static effects and investment effects. According to the GTAP-AGR model analysis in the same study, 66.1 percent of the static benefits—$55.7 billion out of $84.3 billion—would derive from agricultural liberalization (see Table 2-4 on page 28).

The earlier 2002 World Bank study using the LINKAGE model presents two estimates for the same liberalization scenario as that used in the 2006 study: one including static and investment effects but no productivity effects and one including all three types of effects (see Table 2-5 on page 29). The former attributes 69.9 percent of the total benefits—$248 billion out of $355 billion—to agricultural liberalization. The latter attributes 70.6 percent to agricultural liberalization—$587 billion out of $832 billion.

The estimates presented here are particularly noteworthy because agriculture constitutes only a little more than 4 percent of world GDP and only 9 percent of goods trade.[22] It is not surprising, however, in light of CBO's finding in August 2005 that average tariffs are much larger in the agricultural sector than in other goods sectors in the vast majority of countries and that domestic subsidies are equal to roughly one-sixth of the total value added in agriculture.[23]

22. See page 348 of Anderson, Martin, and van der Mensbrugghe (a) in the bibliography.

23. Congressional Budget Office, *Policies That Distort World Agricultural Trade*.

Gains and Losses to Individual Countries from Liberalization

The modeling studies are almost unanimous in predicting that the United States and all other industrialized countries would benefit in terms of economic welfare from global elimination of all policies that distort agricultural trade. They similarly almost all agree that developing countries as a group would gain, but by a smaller amount, and that some developing countries would lose. However, some or all of those that initially lost would eventually see gains as the investment and productivity effects of liberalization overtook the negative static effects on those countries.

The United States

Seven of the studies that CBO surveyed present estimates of the welfare effects of agricultural liberalization on the United States. All except one indicate that the United States would gain from global elimination of policies that distort agricultural trade (see Table 2-6 on page 30). After very rough adjustments to make the estimates comparable, most of the estimates are consistent with a welfare benefit to the United States of roughly $8 billion to $27 billion in 2015 from the static and investment effects of full liberalization phased in from 2005 through 2010 (see Table 2-7 on page 32). One estimate indicates a much larger benefit. The benefits from static effects alone are lower. Adjusted to the year 2015, all estimates except one are in the range of $9 billion to $18 billion annually. The exception is the estimate from the study by Brown, Deardorff, and Stern, which, once again, predicts a welfare loss.

Studies by the World Bank. The LINKAGE model analysis of the 2006 World Bank study estimates that full liberalization of all goods sectors (not just agriculture) worldwide in equal increments from 2005 through 2010 would increase U.S. economic welfare in 2015 by $16.2 billion (in 2001 dollars), or 0.1 percent. Agricultural liberalization accounts for 63.7 percent of the benefit to high-income countries from liberalization of all goods industries (see Table 2-3 on page 27). Assuming as a rough approximation that the same number holds for the United States, the $16.2 billion estimate should be scaled down to

$10.3 billion.[24] It can be determined from other results presented in the LINKAGE model analysis that the baseline GDP projected for the United States for 2015 is between $12.0 trillion to $14.7 trillion.[25] It follows that the $10.3 billion benefit to the United States from full liberalization is between 0.07 percent to 0.09 percent.

Neither the GTAP-AGR model analysis of the 2006 World Bank study nor the 2002 World Bank study provides estimates of the welfare effect of liberalization on the United States.

Study by the Economic Research Service. The ERS study places the static welfare benefit to the United States from full agricultural liberalization at $6.57 billion, or 0.10 percent. Its static-plus-investment-effects estimate is $11.76 billion, or 0.18 percent, 15 years after liberalization; its static-plus-investment-plus-productivity-effects estimate is $13.30 billion, or 0.20 percent, 15 years after liberalization. Interestingly, those estimates are not as far below the estimates from the LINKAGE model analysis of the 2006 World Bank study as was the case for the world welfare effects discussed previously.

For comparability with the estimates from 2006 World Bank study, the estimates from the ERS study must be scaled up to reflect the fact that the World Bank's estimates are for 2015 rather than 1997, the year that characterizes the ERS estimates. The scaling can be done by multiplying the percentage forms of the ERS estimates by the $12.0 trillion-$14.7 trillion range of baseline numbers for 2015 from the World Bank study. Applying the ERS static-effects estimate of 0.10 percent to that range gives a dollar value of $12.0 billion to $14.7 billion. Applying the static-plus-investment-effects estimate of 0.18 percent to the baseline range gives a dollar value of $21.6 billion to $26.4 billion. Applying the static-plus-investment-plus-productivity-effects estimate of 0.20 percent to the baseline range gives a dollar value of $24.0 billion to $29.3 billion.

The adjusted static-plus-investment-effects estimate from the ERS study is considerably higher than the corresponding estimate from the World Bank study. If the ERS study's world-welfare-effect estimates were not considerably lower than those of the World Bank study, the ERS study's use of a policy data set with an earlier base year than that of the 2006 World Bank study would lead one to expect a higher welfare-effect estimate for the United States, but not that much higher. Unfortunately, unlike the case for world welfare effects, it is not possible to correct for the use of the earlier base year for the policy data set because the 2002 World Bank study does not provide estimates of the welfare effect on the United States.

Study by Brown, Deardorff, and Stern. The study by Brown, Deardorff, and Stern estimates that the static welfare effect on the United States of a global 33 percent reduction in all tariffs and subsidies in the agricultural sector would be a loss of $11.1 billion, or 0.122 percent. The study is the only one surveyed by CBO that predicts a welfare loss for the United States. Interestingly, the loss does not stem from harm to U.S. agriculture. On the contrary, U.S. agriculture gains. The reason for the U.S. welfare loss is that the expansion of agriculture draws capital, labor, and resources generally away from the manufacturing sector, causing it to shrink. The model incorporates increasing returns to scale for manufacturing, so shrinkage of the sector causes its productivity to decline.

For comparability with the World Bank's estimate, the estimate from the Brown, Deardorff, and Stern study must be scaled up to reflect full liberalization rather than only a 33 percent reduction in trade-distorting policies. Assuming that the welfare effect is strictly proportional to the percentage reduction in tariffs and subsidies, the estimated loss to the United States would rise to $33.6 billion, or 0.37 percent. As was the case for the world-welfare-effect estimate from this study, the justification for the assumption that the cost of trade-distorting policies is proportional to the square of the magnitude of those policies does not hold, and the adjustment based on that assumption is therefore not calculated here.

24. One might be concerned about the possibility that the category of high-income countries is dominated by countries such as the European Union, the European Free Trade Association, and Japan, which are much more protective of agriculture than is the United States, and that therefore the percentage of benefits to the world as a whole might be a better indicator of the percentage of benefits to the United States than is the percentage of benefits to high-income countries. However, the two percentages are very nearly the same. The percentage for high-income countries is 63.7, whereas the percentage for the world is 63.4.

25. The study reports one liberalization scenario for which the welfare benefit is $6.6 billion, or 0.05 percent of the baseline. Taking rounding into account, that means the benefit is between 0.045 percent and 0.055 percent of the baseline. Dividing $6.6 billion by those two percentages gives $14.7 trillion and $12.0 trillion, respectively.

For final comparability, the estimate must be stepped up to reflect the economy's size in 2015 rather than in 2005. That can be achieved by applying the percentage form of the estimate to the $12.0 trillion-$14.7 trillion baseline GDP for 2015 from the World Bank study to give a loss of $44.4 billion to $54.2 billion.

Study by Roberts and Others. The study by Roberts and others estimates the static welfare gain to the United States from a global 36 percent reduction in restrictions on market access (in tariff equivalents), domestic support, and export subsidies at $3.247 billion. Under the assumption that the cost of trade-distorting policies is strictly proportional to the magnitude of those policies, the welfare benefit from full agricultural liberalization would be $9.0 billion, or 0.12 percent of the 1995 U.S. GDP of $7.4005 trillion. Under the assumption that the cost of trade-distorting policies is proportional to the square of the magnitude of the policies, the welfare benefit from full agricultural liberalization would be $5.5 billion, or 0.07 percent of GDP.

Those estimates must be scaled up to reflect economic growth from 1995 through 2015. Applying the 0.12 percent estimate to the 2015 baseline GDP range of $12.0 trillion to $14.7 trillion gives $14.6 billion to $17.9 billion. Applying the 0.07 percent estimate to the baseline range gives $8.9 billion to $10.9 billion. Hence, the final adjusted estimate for the study by Roberts and others is $8.9 billion to $17.9 billion, or 0.07 percent to 0.12 percent.

Study by Buetre and Others. The study by Buetre and others examines the effects of a global 50 percent reduction in all merchandise tariffs (not just agricultural tariffs) but no reductions in domestic support or export subsidies. Assuming the reduction to take place over the years 2005 to 2014, it estimates the resulting increase in U.S. GNP—not welfare—in 2014 to be $6.2 billion.

As will be discussed in more detail in the next section of this chapter, other studies place the welfare cost of tariffs in the range of 80 percent to 85 percent of the total cost to the United States of all policies that distort agricultural trade. That fact by itself would lead to the conclusion that the result from the study by Buetre and others is a little lower than the benefit from a 50 percent reduction in all policies distorting agricultural trade. However, that estimate is for a 50 percent reduction in all tariffs, not just agricultural tariffs, which by itself would lead to the estimate being higher than the benefit from a 50 percent reduction in agricultural tariffs. Those two facts tend to cancel each other out, leading to the conclusion that the study's estimate of $6.2 billion may be a reasonable estimate of the benefit from a 50 percent reduction in all policies distorting agricultural trade.

Finally, the estimate must be scaled up to provide an estimate of the benefit from full liberalization. Under the assumption that the cost of trade-distorting policies is strictly proportional to the magnitude of the policies, the estimated effect of full liberalization of agriculture on U.S. GNP is $12.4 billion. Under the assumption that the cost is proportional to the square of the magnitude of the policies, the estimated effect of full liberalization of agriculture on U.S. GNP is $8.3 billion.

The study by Buetre and others does not give estimates in percentage form and gives no information about its baseline U.S. GDP in 2014. The best that can be done is to express those final adjusted estimates as a percentage of the baseline GDP of $12.0 trillion to $14.7 trillion from the 2006 World Bank study. Doing so gives a range of 0.06 percent to 0.07 percent for the $8.3 billion estimate and 0.08 percent to 0.10 percent for the $12.4 billion estimate.

Study by Fontagne, Guerin, and Jean. A study by Lionel Fontagne, Jean-Louis Guerin, and Sebastien Jean that was published in September 2003 models a 35 percent reduction in all tariffs—not just agricultural tariffs—at the six-digit level under the Harmonized System (HS) classification scheme. The study estimates a welfare benefit of 0.2 percent to the United States 14 years after the liberalization agreement. As noted in the discussion of the study by Buetre and others, other studies place the welfare cost of tariffs in the range of 80 percent to 85 percent of the total cost to the United States of all policies that distort agricultural trade. That fact by itself would lead to the conclusion that the result from the study by Fontagne, Guerin, and Jean is a little lower than the benefit from a 35 percent reduction in all policies distorting agricultural trade. However, that estimate is for a 50 percent reduction in all tariffs, not just agricultural tariffs, which by itself would lead to the estimate's being higher than the benefit from a 35 percent reduction in agricultural tariffs. Those two facts tend to cancel each other out, leading to the conclusion that the study's estimate of 0.2 percent may be a reasonable estimate of the benefit from a 35 percent reduction in all policies distorting agricultural trade.

Under the assumption that the cost of trade-distorting policies is strictly proportional to the magnitude of the policies, the benefit from full liberalization would be 0.57 percent. Under the assumption that the cost of trade-distorting policies is proportional to the square of the magnitude of the policies, the benefit from full liberalization would be 0.35 percent.

Applying the first of those percentages to the $12.0 trillion-$14.7 trillion baseline GDP for 2015 from the LINKAGE model of the 2006 World Bank study gives $68.6 billion to $83.8 billion. The higher of those two values is the upper end of the range indicated in Table 2-7 on page 32. Applying the second percentage to the baseline GDP gives $41.6 billion to $50.8 billion. The lower of those two values is the lower end of the range given in Table 2-7.

Study by Beghin, Roland-Holst, and van der Mensbrugghe. The study by Beghin, Roland-Holst, and van der Mensbrugghe places the static-plus-dynamic real income gain to the United States from complete liberalization by high-income countries at $5.0 billion, or 0.05 percent. The benefit from complete liberalization by all countries would undoubtedly be higher. However, by how much is not clear. Multiplying the result presented here by the factor used earlier for the world-welfare result from this study is probably not valid because the relative benefit to the United States of liberalization by high-income countries and liberalization by other countries is likely to be different from the relative benefit to the world of those two liberalizations. In fact, the relative benefit to high-income countries generally is likely to be different from the relative benefit to other countries generally, and the relative benefit to the world (in percentage terms) is likely to be an average of those two relative benefits. That is particularly true because many high-income countries grant substantial subsidies, and many of the other countries are the recipients of subsidized agricultural products in the form of imports. Getting rid of those subsidies would help the high-income countries and hurt the other countries that import agricultural products.

Other Countries

In addition to the United States, all other major industrialized countries and groups of countries are also predicted to gain from liberalization by almost all of the studies (see Tables 2-8 through 2-16). Once again, the study by Brown, Deardorff, and Stern is the sole exception, predicting welfare losses for all developed countries and regions modeled except the European Union plus EFTA (see Table 2-12 on page 39).

Developing countries gain as a group, as do most individual developing countries and groups of countries modeled, although some lose for the reasons given in Chapter 1: increases in world agricultural prices resulting from liberalization increase the welfare of countries in proportion to their agricultural exports and harm them in proportion to their agricultural imports; and reductions of MFN tariffs by industrialized countries hurt developing countries that are the recipients of tariff preferences from the industrialized countries.

The static-modeling studies tend to show more welfare losses for developing countries than do the studies that include investment or productivity effects of liberalization. The reason is as explained in Chapter 1. The negative effects to be expected are terms-of-trade effects, which are static. Investment and productivity effects are generally positive for most if not all countries, and over time they tend to offset and even overcome any negative static effects.

Breakdown of Costs by Type of Policy

Breaking down the cost of trade-distorting policies by type of policy reveals two significant facts: the vast bulk of the cost arises from trade restrictions, and many developing countries would be harmed by the elimination of domestic support and especially export subsidies.

Tariffs Are the Most Costly Trade-Distorting Policy

Five of the studies CBO surveyed present welfare results by type of policy. Of those five, four agree that tariffs (and tariff-rate quotas) are by far the most costly of the policies distorting agricultural trade.

The GTAP-AGR model analysis of the 2006 World Bank study estimates the total static welfare cost of all policies that distort agricultural trade at $55.7 billion (see Table 2-17 on page 44). It estimates the cost of tariffs at $51.8 billion, or 93.1 percent of the total. Domestic support is second at $2.8 billion, or 5.0 percent of the total. Last are export subsidies at $1.0 billion, or 1.9 percent of the total.

The ERS study places the costs in the same order (see Table 2-18 on page 46). It estimates the total static welfare cost of all trade-distorting policies in agriculture at

$31.1 billion. It attributes $25.2 billion of that cost, or 81.2 percent, to tariffs. Domestic support comes in second at $2.8 billion, or 9.0 percent. Last are export subsidies at $0.3 billion, or 0.8 percent.

Looking only at the trade-distorting policies of high-income countries, the study by Beghin, Roland-Holst, and van der Mensbrugghe actually attributes slightly more than 100 percent of the $82.1 billion total cost of such policies to "border protection," in which it includes tariffs and export subsidies (see Table 2-18 on page 46). That result implies that domestic support by high-income countries actually benefits the world very slightly—which conflicts with the World Bank and ERS studies just discussed.

A study by Bernard Hoekman, Francis Ng, and Marcelo Olarreaga addresses the question of whether tariffs or domestic subsidies are more detrimental to trade between developed and developing countries and consequently to the economic welfare of the two groups of countries. Looking only at tariff lines of agricultural products that receive domestic subsidies by at least one country (158 tariff lines out of 900 at the six-digit HS level), the study estimates that a 50 percent cut in tariffs would increase developed countries' exports 10 times as much, their imports 63 times as much, and their economic welfare almost 27 times as much as would a 50 percent cut in domestic subsidies (see Table 2-20 on page 49). For developing countries, the cut in tariffs is estimated to increase exports over eight times as much as the cut in subsidies. The cut in subsidies reduces developing-country imports and economic welfare, making ratio calculations problematic, but the *magnitude* of the effects of the tariff cut on imports and economic welfare is much larger than is the magnitude of the effects of the subsidy cuts.

The only study CBO examined that does not find tariffs to be the most costly of the policies distorting agricultural trade is that of Brown, Deardorff, and Stern. As noted earlier, that study (which examines static effects only) finds that a 33 percent reduction in tariffs increases world welfare by $9.5 billion annually; a 33 percent reduction in domestic subsidies increases it by a slightly larger $10.6 billion; and a 33 percent reduction in export subsidies reduces it by a still larger $23.2 billion.

Eliminating Subsidies Harms Many Developing Countries

As a matter of economic theory, subsidies harm the countries that grant them and benefit the countries that purchase the subsidized products. They do so because they result in the subsidized products' being sold at prices that are less than the cost of producing them. The effect is more pronounced for export subsidies than for domestic subsidies because many of the sales of products receiving domestic subsidies are to domestic customers. High-income countries grant more than 90 percent of the domestic subsidies and more than 95 percent of the export subsidies reported to the WTO by member countries. Therefore, one would expect that eliminating those subsidies would benefit many high-income countries and harm many developing countries and that the effect would be more pronounced for export subsidies than for domestic subsidies.[26]

Results from the GTAP-AGR model analysis of the 2006 World Bank study and the ERS study back up that theory (see Tables 2-17 and 2-18). The GTAP-AGR model analysis indicates that eliminating export subsidies would increase the economic welfare of high-income countries by $2.6 billion and reduce that of developing countries by $1.0 billion. Moreover, it indicates that 14 of the 17 individual developing countries and developing-country regions modeled would see their welfare decline. Similarly, the ERS study indicates that the economic welfare of developed countries would increase by $2.5 billion and that the welfare of developing countries would decline by $2.3 billion. Moreover, the study indicates harm to all six of the individual developing countries and developing-country regions examined.

As would be expected from the theory just described, the results are less pronounced for domestic subsidies. The GTAP-AGR model analysis indicates a benefit to developing countries as a group from eliminating such subsidies; however, the benefit is small, and a number of developing countries are harmed. The ERS study indicates harm to developing countries as a group and to five of the six individual developing countries and developing-country regions examined. Both studies indicate that

26. However, eliminating domestic and export subsidies would benefit those developing countries that are net agricultural exporters because such subsidies give a competitive advantage to the agricultural sectors of the (primarily) developed countries that grant them.

high-income countries benefit from the elimination of such subsidies.

The difference between the two scenarios in the study by Beghin, Roland-Holst, and van der Mensbrugghe is the liberalization of domestic subsidies (see Table 2-19 on page 48). Therefore, the differences in the estimates from the two scenarios constitute estimates of the effects of eliminating those subsidies. Comparison of the results from the two scenarios indicates that eliminating domestic subsidies benefits developing (low- and middle-income) countries as a group, with China the only modeled developing country that is harmed. Contrary to expectation from theory, the comparison indicates that eliminating domestic subsidies harms developed (high-income) countries as a group. Among developed countries, the harm occurs to Western Europe and high-income Asia—not to the United States, which gains.

Although it does not give the actual numbers, the study by Brown, Deardorff, and Stern reports that its underlying modeling results show that when export subsidies are eliminated, "welfare increases in the EU/EFTA and declines in all of the countries/regions in the model, except Thailand." It further reports that "the EU/EFTA region benefits the most when its agricultural production subsidies are reduced, whereas welfare declines for most developing countries/regions."[27]

27. See pages 14-15 in Brown, Deardorff, and Stern in the bibliography.

Table 2-1.

Estimated Welfare Effects on the World of Agricultural Liberalization—All Surveyed Studies

Study	Types of Liberalization Effects Included	Exogenous Baseline Growth?[a]	Base Years for Economy/ Trade Policies[b]	Year(s) of Liberalization	Year of Estimated Welfare Effect	Estimated Welfare Effect	
						Billions of Dollars[c]	Percent
Full Liberalization of All Agricultural Policies							
2006 World Bank Study							
LINKAGE model analysis[d,e]	S, I	Yes	2001/2005[f]	2005–2010	2015	182	0.43
GTAP-AGR model analysis[g,e]	S	No	2001/2005[f]	h	h	55.7	i
2002 World Bank Study[j]							
Result 1[e]	S, I	Yes	1997/1997	2005–2010	2015	248	0.63
Result 2[e]	S, I, P	Yes	1997/1997	2005–2010	2015	587	1.47
Economic Research Service[k]							
Result 1	S	No	1997/1998	h	h	31.1	0.13
Result 2	S,I	No	1997/1998	1998[l]	2013[l]	36.3	0.16
Result 3	S, I, P	No	1997/1998	1998[l]	2013[l]	56.4	0.24
Equal Partial Liberalization of All Agricultural Policies							
Brown, Deardorff, and Stern[m,n]	S	No	2005/2005[o]	h	h	-3.1	i
Roberts and Others[p,q]	S	No	1995/1995	h	h	34.3	i
Unequal Liberalization of Agricultural Policies							
Buetre and Others[r,s]	S,I	Yes	1997/2002[t]	2005–2014	2014	61.0[u]	i
Beghin, Roland-Holst, and van der Mensbrugghe[v,w]	S, I, P	Yes	1997/1998	2005–2010	2015	82.1	0.21

Source: Congressional Budget Office based on the studies cited.

Notes: S = static effects; I = investment effects; P = productivity effects.

Welfare effects are measured by equivalent variation. For additional details on the studies listed in this table, see the notes that accompany Tables 2-8 through 2-16.

a. Some models have exogenously imposed rates of growth for certain variables such as population, the labor force, and productivity (or some component of productivity) of each country. Those models predict deviations of variables from baseline values for the year in question, whereas other models predict deviations from the values that the variables had in the base year. Models with such baseline economic growth over time tend to produce larger estimates of welfare effects many years after liberalization than do other models.

b. The first year is the base year for economic variables such as imports, exports, and the production of various goods. The second year is the base year for policy variables such as tariffs and subsidies.

c. Dollar estimates in each study are based on the value of the dollar in the base year for economic variables used in that study. Thus, dollar estimates in the 2006 World Bank study are in 2001 dollars, and those in the study by Beghin, Roland-Holst, and van der Mensbrugghe are in 1997 dollars.

d. Kym Anderson, Will Martin, and Dominique van der Mensbrugghe, "Market and Welfare Implications of Doha Reform Scenarios," Chapter 12 in Kym Anderson and Will Martin, eds., *Agricultural Trade Reform and the Doha Development Agenda* (New York: Palgrave Macmillan and the World Bank, 2006).

e. The 2006 and 2002 World Bank studies simulate full liberalization of all goods sectors, not just agriculture. The welfare-effect estimates presented in this table are the components of the welfare-effect estimates from that scenario that the studies attribute to liberalization of the agriculture and food sectors.

f. Both projections in the 2006 World Bank study start with a base year of 2001 for both economic and policy variables but effectively update the base year for policy variables to 2005. Specifically, in the case of the LINKAGE model, the baseline projection incorporates major changes in protection that occurred between 2001 and 2005 (the final stages of the Uruguay Round implementation, tariff-reduction commitments made by China and Taiwan as conditions of their accession to the World Trade Organization, and enlargement of the European Union to 25 members). In the case of the GTAP-AGR model, a preliminary simulation was run incorporating any liberalization that had been committed to in the WTO but not yet implemented by 2001. The end point of that simulation was then used as the starting point for the simulation that produced the estimates given in this table.

g. Thomas W. Hertel and Roman Keeney, "What's at Stake: The Relative Importance of Import Barriers, Export Subsidies, and Domestic Support," Chapter 2 in Kym Anderson and Will Martin, eds., *Agricultural Trade Reform and the Doha Development Agenda* (New York: Palgrave Macmillan and the World Bank, 2006).

h. The year(s) of liberalization and the year of the welfare-effect estimate are not relevant for a projection from a static model because there is no growth—of the labor force, the capital stock, or productivity—in such models.

i. The study in question does not give an estimate of the welfare effect as a percentage of income.

j. World Bank, "Envisioning Alternative Futures: Reshaping Global Trade Architecture for Development," Chapter 6 in *Global Economic Prospects and the Developing Countries, 2002* (Washington, D.C.: World Bank, 2002).

k. Mary E. Burfisher, ed., *Agricultural Policy Reform in the WTO—The Road Ahead,* Agricultural Economic Report No. 802 (U.S. Department of Agriculture, Economic Research Service, Market Trade Economics Division, May 2001).

l. The ERS study does not indicate calendar years of liberalization and the welfare-effect estimate. Rather, the estimates presented here are those estimated by the study for 15 years after liberalization. Because the study assumes no baseline growth, the year of liberalization is irrelevant just as it is in static modeling studies.

m. Drusilla K. Brown, Alan V. Deardorff, and Robert M. Stern, "Computational Analysis of Multilateral Trade Liberalization in the Uruguay Round and Doha Development Round," Discussion Paper No. 489 (Ann Arbor, Mich.: University of Michigan, School of Public Policy, Research Seminar in International Economics, December 8, 2002).

n. The study by Brown, Deardorff, and Stern models a 33 percent reduction in post-Uruguay Round agricultural import tariffs, domestic production subsidies, and export subsidies.

o. The study by Brown, Deardorff, and Stern starts with a data set with a base year of 1995. To estimate what the values of major economic variables would have been in 2005 in the absence of the Uruguay Round Agreement, the study makes projections based on growth rates contained in the 1999 edition of *World Development Indicators* and the 1998-1999 edition of *World Development Report,* both published by the World Bank. The study then simulates the liberalization agreed to in the Uruguay Round Agreement. The end point of that simulation is used as the starting point for the simulation that produced the estimate given in this table. As such, the policies that are liberalized to produce the estimate presumably do not reflect the admission of China and Taiwan into the WTO and the expansion of the European Union to 25 countries.

p. Ivan Roberts and others, *Reforming World Agricultural Trade Policies,* Australian Bureau of Agricultural and Resource Economics Research Report 99.12 and Rural Industries Research and Development Corporation Publication No. 99/96 (September 1999).

q. The study by Roberts and others models a 36 percent reduction in all forms of agricultural protection and support.

r. Benjamin Buetre and others, "Agricultural Trade Liberalization: Effects on Developing Countries' Output, Incomes, and Trade," Australian Bureau of Agricultural and Resource Economics Project 110039 (paper presented to the Seventh Annual Conference on Global Economic Analysis, Trade, Poverty, and the Environment, Washington, D.C., June 17-19, 2004).

s. The study by Buetre and others models a 50 percent reduction in all tariffs—agricultural and nonagricultural.

t. The year with the largest number of applied tariffs in the database is 2002. The years with the second- and third-largest numbers are 2000 and 2001, while the oldest tariffs date to 1998.

u. The estimate for the study by Buetre and others is for the effect on gross national product, not the effect on welfare.

v. John C. Beghin, David Roland-Holst, and Dominique van der Mensbrugghe, *Global Agricultural Trade and the Doha Round: What Are the Implications for North and South?,* Working Paper 02-WP 308 (Ames, Iowa: Iowa State University, Center for Agricultural and Rural Development, June 2002).

w. The study by Beghin, Roland-Holst, and van der Mensbrugghe removes all agricultural trade-distorting policies in high-income countries only (Australia and New Zealand, Canada, the European Union, the European Free Trade Area, high-income Asia, and the United States).

Table 2-2.

Estimated Effects on the World of Agricultural Liberalization, as Adjusted by CBO for Approximate Comparability—All Surveyed Studies

	Static Effects Only		Static Plus Investment Effects		Static Plus Investment Plus Productivity-Growth Effects	
Study	Billions of Dollars	Percent	Billions of Dollars	Percent	Billions of Dollars	Percent
2006 World Bank Study						
LINKAGE model analysis[a]			182	0.43	292	0.69
GTAP-AGR model analysis[b]	102	0.24				
2002 World Bank Study[c]			182	0.47	431	1.08
Economic Research Service[d]	41	0.13	50	0.16	75	0.24
Brown, Deardorff, and Stern[e]	f					
Roberts and Others[g]	102–167	0.24–0.39				
Buetre and Others[h]			60–122	0.14–0.29		
Beghin, Roland-Holst, and van der Mensbrugghe[i]			81–146	0.21–0.37		

Source: Congressional Budget Office based on the studies cited.

Notes: Welfare effects are measured by equivalent variation.

A blank space indicates that the study presents no estimate for the effect in question.

Estimates given for the LINKAGE model analysis of the 2006 World Bank study are for the welfare benefit to the world in 2015 (in 2001 dollars) from fully liberalizing agriculture (that is, completely phasing out all tariffs, domestic subsidies, and export subsidies) in equal increments from 2005 through 2010. Estimates given for the other studies are the estimates from those studies as adjusted by CBO for approximate comparability with that scenario as described in the text of the paper. In the case of estimates of static effects only, the effects are scaled up to reflect economic growth through 2015.

a. Kym Anderson, Will Martin, and Dominique van der Mensbrugghe, "Market and Welfare Implications of Doha Reform Scenarios," Chapter 12 in Kym Anderson and Will Martin, eds., *Agricultural Trade Reform and the Doha Development Agenda* (New York: Palgrave Macmillan and the World Bank, 2006).

b. Thomas W. Hertel and Roman Keeney, "What's at Stake: The Relative Importance of Import Barriers, Export Subsidies, and Domestic Support," Chapter 2 in Kym Anderson and Will Martin, eds., *Agricultural Trade Reform and the Doha Development Agenda* (New York: Palgrave Macmillan and the World Bank, 2006).

c. World Bank, "Envisioning Alternative Futures: Reshaping Global Trade Architecture for Development," Chapter 6 in *Global Economic Prospects and the Developing Countries 2002* (Washington, D.C.: World Bank, 2002).

d. Mary E. Burfisher, ed., *Agricultural Policy Reform in the WTO—The Road Ahead*, Agricultural Economic Report No. 802 (U.S. Department of Agriculture, Economic Research Service, Market Trade Economics Division, May 2001).

e. Drusilla K. Brown, Alan V. Deardorff, and Robert M. Stern, "Computational Analysis of Multilateral Trade Liberalization in the Uruguay Round and Doha Development Round," Discussion Paper No. 489 (Ann Arbor, Mich.: University of Michigan, School of Public Policy, Research Seminar in International Economics, December 8, 2002).

f. It is not possible to adjust the estimate from the study by Brown, Deardorff, and Stern for comparability.

g. Ivan Roberts and others, *Reforming World Agricultural Trade Policies,* Australian Bureau of Agricultural and Resource Economics Research Report 99.12 and Rural Industries Research and Development Corporation Publication No. 99/96 (September 1999).

h. Benjamin Buetre and others, "Agricultural Trade Liberalization: Effects on Developing Countries' Output, Incomes, and Trade," Australian Bureau of Agricultural and Resource Economics Project 110039 (paper presented to the Seventh Annual Conference on Global Economic Analysis, Trade, Poverty, and the Environment, Washington, D.C., June 17-19, 2004).

i. John C. Beghin, David Roland-Holst, and Dominique van der Mensbrugghe, *Global Agricultural Trade and the Doha Round: What Are the Implications for North and South?,* Working Paper 02-WP 308 (Ames, Iowa: Iowa State University, Center for Agricultural and Rural Development, June 2002), Table 2, p. 12.

Table 2-3.

Estimated Welfare Effects of Full Liberalization of All Goods, by Industry Sector and Benefiting Region—2006 World Bank Study, LINKAGE Model Analysis

(Billions of 2001 dollars)

	Industry Sector Liberalized			
Benefiting Region	Agriculture and Food	Textiles and Clothing	Other Merchandise	Total
High-Income Countries	128	16	57	201
Developing Countries	54	22	10	86
World total	182	38	67	287

Source: Kym Anderson, Will Martin, and Dominique van der Mensbrugghe, "Market and Welfare Implications of Doha Reform Scenarios," Chapter 12 in Kym Anderson and Will Martin, eds., *Agricultural Trade Reform and the Doha Development Agenda* (New York: Palgrave Macmillan and the World Bank, 2006), Table 12.6, p. 349.

Notes: Welfare effects are measured by equivalent variation. Small interaction effects are distributed proportionately, and numbers are rounded to sum to 100 percent.

Model: A version of the World Bank's LINKAGE model with 27 regions and 25 economic sectors. Agriculture and food comprise 13 of the 25 sectors. Exogenously imposed growth in populations, labor forces, and productivity causes countries' economies and trade to grow over time even with no liberalization. The simulations include static effects plus investment effects resulting from the influence of liberalization on household saving and on the prices of investment goods.

Data: Release 6.05 of the Global Trade Analysis Project (GTAP) data set, which has a base year of 2001. However, the baseline simulation also includes major changes in trade policy through 2005, including the final stages of implementation of the Uruguay Round Agreement, tariff reductions made by China and Taiwan as conditions of their accession to the World Trade Organization, and the enlargement of the European Union to 25 members. Unlike previous GTAP releases, version 6.05 includes bilateral and unilateral trade preferences.

Liberalization scenario simulated: The phased elimination from 2005 through 2010 of all subsidies, tariffs, and other trade-distorting measures in all goods sectors. The welfare-effect estimates are for the year 2015.

Table 2-4.

Estimated Static Welfare Effects of Full Liberalization of All Goods, by Industry Sector and Benefiting Region—2006 World Bank Study, GTAP-AGR Model Analysis

(Billions of 2001 dollars)

	Industry Sector Liberalized			
Benefiting Region	Agriculture and Food	Textiles and Clothing	Other Merchandise	Total
High-Income Countries	41.6	1.3	16.5	59.4
Transition Economies	2.2	-0.3	0.9	2.8
Developing Countries	11.9	8.8	1.4	22.1
World total	55.7	9.8	18.9	84.3

Source: Thomas W. Hertel and Roman Keeney, "What's at Stake: The Relative Importance of Import Barriers, Export Subsidies, and Domestic Support," Chapter 2 in Kym Anderson and Will Martin, eds., *Agricultural Trade Reform and the Doha Development Agenda* (New York: Palgrave Macmillan and the World Bank, 2006), Table 2.9, p. 54.

Notes: Welfare effects are measured by equivalent variation. GTAP = Global Trade Analysis Project.

Model: The GTAP-AGR model. The model is a special-purpose variant of the GTAP static general-equilibrium model that is tailored to analysis of global agricultural trade policy issues.

Data: Release 6.05 of the GTAP data set, which has a base year of 2001. However, before running the simulation of the liberalization scenario, the study runs a preliminary simulation incorporating liberalization that had been committed to in the World Trade Organization (WTO) but not yet implemented by 2001, such as the final stages of implementation of the Uruguay Round Agreement (including the phasing out of textile and apparel quotas) and tariff-reduction commitments made by China and Taiwan in connection with their accession to the WTO. The end point of that simulation is then used as the starting point for the main simulation that produces the estimates given in this table. Unlike previous releases of the GTAP data set, version 6.05 includes bilateral and unilateral trade preferences.

Liberalization scenario simulated: The elimination of all subsidies, tariffs, and other trade-distorting restrictions in all goods sectors.

Table 2-5.

Estimated Welfare Effects of Full Liberalization of All Goods, by Industry Sector and Benefiting Region—2002 World Bank Study

(Billions of 1997 dollars)

	Industry Sector Liberalized			
Benefiting Region	Agriculture and Food	Textiles and Clothing	All Other Sectors	Total
	Simulations Without Productivity Effects			
High-Income Countries	106	17	50	171
Low- and Middle-Income Countries	142	24	20	184
World total	248	41	70	355
	Simulations with Productivity Effects			
High-Income Countries	196	66	35	293
Low- and Middle-Income Countries	390	123	27	539
World total	587	189	62	832

Source: World Bank, "Envisioning Alternative Futures: Reshaping Global Trade Architecture for Development," Chapter 6 in *Global Economic Prospects and the Developing Countries, 2002* (Washington, D.C.: World Bank, 2002), Table 6.1, p. 171.

Note: Welfare effects are measured by equivalent variation.

Model: A version of the World Bank's LINKAGE model with 15 regions and 20 economic sectors. Exogenously imposed growth in populations, labor forces, and productivity causes countries' economies and trade to grow over time even with no liberalization. The simulations without productivity effects include static effects plus investment effects resulting from the influence of liberalization on household saving and on the prices of investment goods. The simulations with productivity effects include those same effects plus effects of liberalization on productivity.

Data: Version 5 of the Global Trade Analysis Project data set, which has a base year of 1997. Hence, the starting point for liberalization is the policies that existed in that year.

Liberalization scenario simulated: In each year from 2005 through 2010, all tariffs, domestic production subsidies, and export subsidies in all goods sectors are reduced by one-sixth of their preliberalization levels, ending with their complete elimination.

Table 2-6.

Estimated Welfare Effects on the United States of Agricultural Liberalization—All Surveyed Studies

Study	Types of Liberalization Effects Included	Exogenous Baseline Growth?[a]	Base Years for Economy/ Trade Policies[b]	Year(s) of Liberalization	Year of Estimated Welfare Effect	Estimated Welfare Effect	
						Billions of Dollars[c]	Percent
Full Liberalization of All Agricultural Policies							
2006 World Bank Study							
LINKAGE model analysis[d]	S, I	Yes	2001/2005[e]	2005–2010	2015	16.2[f]	0.1[f]
Economic Research Service[g]							
Result 1	S	No	1997/1998	h	h	6.6	0.10
Result 2	S, I	No	1997/1998	1998[i]	2013[i]	11.8	0.18
Result 3	S, I, P	No	1997/1998	1998[i]	2013[i]	13.3	0.20
Equal Partial Liberalization of All Agricultural Policies							
Brown, Deardorff, and Stern[j,k]	S	No	2005/2005[l]	h	h	-11.1	-0.122
Roberts and Others[m,n]	S	No	1995/1995	h	h	3.2	o
Unequal Liberalization of Agricultural Policies							
Buetre and Others[p,q]	S, I	Yes	1997/2002[r]	2005–2014	2014	6.2[s]	o
Fontagne, Guerin, and Jean[t,u]	S, I	v	1997/1999	2000–2009[v]	2013[v]	w	0.2
Beghin, Roland-Holst, and van der Mensbrugghe[x,y]	S, I, P	Yes	1997/1998	2005–2010	2015	5.0	0.05

Source: Congressional Budget Office based on the studies cited.

Notes: S = static effects; I = investment effects; P = productivity effects.

Welfare effects are measured by equivalent variation. For additional details on the studies listed in this table, see the notes that accompany Tables 2-8 through 2-16.

a. Some models have exogenously imposed rates of growth for certain variables such as population, the labor force, and productivity (or some component of productivity). Those models predict deviations of variables from baseline values for the year in question, whereas other models predict deviations from the values that the variables had in the base year. Models with such baseline economic growth over time tend to produce larger estimates of welfare effects many years after liberalization than do other models.

b. The first year given is the base year for economic variables such as imports, exports, and production of various goods. The second year is the base year for policy variables such as tariffs and subsidies.

c. Dollar estimates in each study are based on the value of the dollar in the base year for economic variables used in that study. Thus, dollar estimates in the 2006 World Bank study are in 2001 dollars, and those in the study by Beghin, Roland-Holst, and van der Mensbrugghe are in 1997 dollars.

d. Kym Anderson, Will Martin, and Dominique van der Mensbrugghe, "Market and Welfare Implications of Doha Reform Scenarios," Chapter 12 in Kym Anderson and Will Martin, eds., *Agricultural Trade Reform and the Doha Development Agenda* (New York: Palgrave Macmillan and the World Bank, 2006).

e. The projection in the LINKAGE model analysis of the 2006 World Bank study starts with a base year of 2001 for both economic and policy variables but effectively updates the base year for policy variables to 2005. Specifically, the baseline projection incorporates major changes in protection that occurred between 2001 and 2005 (the final stages of the Uruguay Round implementation, tariff-reduction commitments made by China and Taiwan as conditions of their accession to the World Trade Organization, and enlargement of the European Union to 25 members).

f. The estimate reported for the 2006 World Bank study is for full liberalization of all goods sectors, not just agriculture. The study does not report an estimate for liberalization of agriculture and food only.

g. Mary E. Burfisher, ed., *Agricultural Policy Reform in the WTO—The Road Ahead,* Agricultural Economic Report No. 802 (U.S. Department of Agriculture, Economic Research Service, Market Trade Economics Division, May 2001).

h. The year(s) of liberalization and the year of the welfare-effect estimate are not relevant for a projection from a static model because there is no growth—of the labor force, capital stock, or productivity—in such models.

i. The ERS study does not indicate calendar years of liberalization and the welfare-effect estimate. Rather, the estimates presented here are those estimated by the study for 15 years after liberalization. Because the study assumes no baseline growth, the year of liberalization is irrelevant just as it is in static modeling studies.

j. Drusilla K. Brown, Alan V. Deardorff, and Robert M. Stern, "Computational Analysis of Multilateral Trade Liberalization in the Uruguay Round and Doha Development Round," Discussion Paper No. 489 (Ann Arbor, Mich.: University of Michigan, School of Public Policy, Research Seminar in International Economics, December 8, 2002).

k. The study by Brown, Deardorff, and Stern models a 33 percent reduction in post-Uruguay Round agricultural import tariffs, domestic production subsidies, and export subsidies.

l. The study by Brown, Deardorff, and Stern starts with a data set with a base year of 1995. To estimate what the values of major economic variables would have been in 2005 in the absence of the Uruguay Round Agreement, the study makes projections based on growth rates contained in the 1999 edition of *World Development Indicators* and the 1998-1999 edition of *World Development Report*, both published by the World Bank. The study then simulates the liberalization agreed to in the Uruguay Round Agreement. The end point of that simulation is used as the starting point for the simulation that produces the estimate given in this table. As such, the policies that are liberalized to produce the estimate presumably do not reflect the admission of China and Taiwan into the WTO and the expansion of the European Union to 25 countries.

m. Ivan Roberts and others, *Reforming World Agricultural Trade Policies,* Australian Bureau of Agricultural and Resource Economics Research Report 99.12 and Rural Industries Research and Development Corporation Publication No. 99/96 (September 1999).

n. The study by Roberts and others models a 36 percent reduction in all forms of agricultural protection and support.

o. The study does not give an estimate of the welfare effect as a percentage of income.

p. Benjamin Buetre and others, "Agricultural Trade Liberalization: Effects on Developing Countries' Output, Incomes, and Trade," Australian Bureau of Agricultural and Resource Economics Project 110039 (paper presented to the Seventh Annual Conference on Global Economic Analysis, Trade, Poverty, and the Environment, Washington, D.C., June 17-19, 2004).

q. The study by Buetre and others models a 50 percent reduction in all tariffs—agricultural and nonagricultural.

r. The year with the largest number of applied tariffs in the database is 2002. The years with the second- and third-largest numbers are 2000 and 2001, while the oldest tariffs date to 1998.

s. The estimate for the study by Buetre and others is for the effect on gross national product, not the effect on welfare.

t. Lionel Fontagne, Jean-Louis Guerin, and Sebastien Jean, *Market Access Liberalisation in the Doha Round: Scenarios and Assessment,* Working Paper No. 2003-12 (Paris: Centre d'Etudes Prospectives et d'Informations Internationales, September 2003).

u. The study by Fontagne, Guerin, and Jean models a 35 percent reduction in all tariffs—not just agricultural tariffs—at the six-digit Harmonized System level. Results presented are for 14 years after the liberalization agreement.

v. The study by Fontagne, Guerin, and Jean is unclear as to whether its model contains baseline growth. Nor does it specify the calendar years in which liberalization takes place or the calendar year of the estimate, specifying instead the number of years after the liberalization agreement over which liberalization occurs and the number of years after the agreement that the estimate is for. The liberalization is phased in in equal increments over six years for developed countries and over 10 years for developing countries. The calendar years and whether there is exogenous growth in the model do not matter because the estimate is in percentage rather than dollar value. Whereas the dollar value of the effect of liberalization is proportional to the size of the economy and therefore is a function of any exogenous growth that might occur with time, the percentage effect is not.

w. The study by Fontagne, Guerin, and Jean does not give a dollar-value estimate of the welfare effect.

x. John C. Beghin, David Roland-Holst, and Dominique van der Mensbrugghe, *Global Agricultural Trade and the Doha Round: What Are the Implications for North and South?* Working Paper 02-WP 308 (Ames, Iowa: Iowa State University, Center for Agricultural and Rural Development, June 2002).

y. The study by Beghin, Roland-Holst, and van der Mensbrugghe models the elimination of all agricultural-trade-distorting policies in high-income countries only (Australia and New Zealand, Canada, the European Union, the European Free Trade Association, high-income Asia, and the United States).

Table 2-7.

Estimated Welfare Effects on the United States of Agricultural Liberalization, as Adjusted by CBO for Approximate Comparability—All Surveyed Studies

	Static Effects Only		Static Plus Investment Effects		Static Plus Investment Plus Productivity-Growth Effects	
Study	Billions of Dollars	Percent	Billions of Dollars	Percent	Billions of Dollars	Percent
2006 World Bank Study						
LINKAGE model analysis[a]			10.3	0.07 to 0.09		
Economic Research Service[b]	12.0 to 14.7	0.10	21.6 to 26.4	0.18	24.0 to 29.3	0.20
Brown, Deardorff, and Stern[c]	-44.4 to -54.2					
Roberts and Others[d]	8.9 to 17.9	0.07 to 0.12				
Buetre and Others[e]			8.3 to 12.4	0.06 to 0.10		
Fontagne, Guerin, and Jean[f]			41.6 to 50.8	0.35 to 0.57		
Beghin, Roland-Holst, and van der Mensbrugghe[g]			h			

Source: Congressional Budget Office based on the studies cited.

Notes: Welfare effects are measured by equivalent variation.

A blank space indicates that the study presents no estimate for the effect in question.

Estimates given for the LINKAGE model analysis of the 2006 World Bank study are for the welfare benefit to the United States in 2015 (in 2001 dollars) that would result from fully liberalizing all goods sectors (that is, completely phasing out all tariffs, domestic subsidies, and export subsidies) in equal increments from 2005 through 2010, adjusted by CBO as described in the text to approximate only the full liberalization of the agriculture and food sectors. Estimates presented for the other studies are adjusted by CBO for approximate comparability with the adjusted World Bank estimates. In the case of estimates of static effects only, the estimates are scaled up to reflect economic growth through 2015.

a. Kym Anderson, Will Martin, and Dominique van der Mensbrugghe, "Market and Welfare Implications of Doha Reform Scenarios," Chapter 12 in Kym Anderson and Will Martin, eds., *Agricultural Trade Reform and the Doha Development Agenda* (New York: Palgrave Macmillan and the World Bank, 2006).

b. Mary E. Burfisher, ed., *Agricultural Policy Reform in the WTO—The Road Ahead,* Agricultural Economic Report No. 802 (U.S. Department of Agriculture, Economic Research Service, Market Trade Economics Division, May 2001).

c. Drusilla K. Brown, Alan V. Deardorff, and Robert M. Stern, "Computational Analysis of Multilateral Trade Liberalization in the Uruguay Round and Doha Development Round," Discussion Paper No. 489 (Ann Arbor, Mich.: University of Michigan, School of Public Policy, Research Seminar in International Economics, December 8, 2002).

d. Ivan Roberts and others, *Reforming World Agricultural Trade Policies,* Australian Bureau of Agricultural and Resource Economics Research Report 99.12 and Rural Industries Research and Development Corporation Publication No. 99/96 (September 1999).

e. Benjamin Buetre and others, "Agricultural Trade Liberalization: Effects on Developing Countries' Output, Incomes, and Trade," Australian Bureau of Agricultural and Resource Economics Project 110039 (paper presented to the Seventh Annual Conference on Global Economic Analysis, Trade, Poverty, and the Environment, Washington, D.C., June 17-19, 2004).

f. Lionel Fontagne, Jean-Louis Guerin, and Sebastien Jean, *Market Access Liberalisation in the Doha Round:* Scenarios and Assessment, Working Paper No. 2003-12 (Paris: Centre d'Etudes Prospectives et d'Informations Internationales, September 2003).

g. John C. Beghin, David Roland-Holst, and Dominique van der Mensbrugghe, *Global Agricultural Trade and the Doha Round: What Are the Implications for North and South?,* Working Paper 02-WP 308 (Ames, Iowa: Iowa State University, Center for Agricultural and Rural Development, June 2002), Table 2, p. 12.

h. It is not possible to adjust the U.S. welfare effect from the study by Beghin, Roland-Holst, and van der Mensbrugghe for comparability.

Table 2-8.

Estimated Welfare Effects of Full Liberalization of All Goods Trade, by Country or Region—2006 World Bank Study, LINKAGE Model Analysis

	Simulations Without Productivity Effects		Simulations with Productivity Effects	
Country or Region	Billions of Dollars	Percent	Billions of Dollars	Percent
Australia and New Zealand	6.1	1.0		
EU(25) Plus EFTA	65.2	0.6		
United States	16.2	0.1		
Canada	3.8	0.4		
Japan	54.6	1.1		
South Korea and Taiwan	44.6	3.5		
Hong Kong and Singapore	11.2	2.6		
Argentina	4.9	1.2		
Bangladesh	0.1	0.2		
Brazil	9.9	1.5		
China	5.6	0.2		
India	3.4	0.4		
Indonesia	1.9	0.7		
Mexico	3.6	0.4		
Russia	2.7	0.6		
South Africa	1.3	0.9		
Thailand	7.7	3.8		
Turkey	3.3	1.3		
Vietnam	3.0	5.2		
Rest of South Asia	1.0	0.5		
Rest of East Asia	5.3	1.9		
Rest of Latin America and the Caribbean	10.3	1.2		
Rest of Europe and Central Asia	1.0	0.3		
Middle East and North Africa	14.0	1.2		
Selected Sub-Saharan African Countries	1.0	1.5		
Rest of Sub-Saharan Africa	2.5	1.1		
Rest of the World	3.4	1.5		
High-Income Countries	201.6	0.6	261.1	0.8

Continued

Table 2-8.

Continued

Country or Region	Simulations Without Productivity Effects		Simulations With Productivity Effects	
	Billions of Dollars	Percent	Billions of Dollars	Percent
Developing Countries—WTO Definition[a]	141.5	1.2	258.7	2.2
Developing Countries—World Bank Definition[a]	85.7	0.8	200.1	2.0
Middle-income countries	69.5	0.8	145.1	1.8
Low-income countries	16.2	0.8	55.0	2.8
East Asia and Pacific	23.5	0.7		
South Asia	4.5	0.4		
Europe and Central Asia	7.0	0.7		
Middle East and North Africa	14.0	1.2		
Sub-Saharan Africa	4.8	1.1		
Latin America and the Caribbean	28.7	1.0		
World total	287.3	0.7	461.2	1.1

Sources: Kym Anderson, Will Martin, and Dominique van der Mensbrugghe, "Global Impacts of the Doha Scenarios on Poverty," Chapter 17 in Thomas W. Hertel and L. Allan Winters, eds., *Putting Development Back into the Doha Agenda: Poverty Impacts of a WTO Agreement* (New York: Palgrave Macmillan and the World Bank, 2006), Table 17.3, p. 509; and Kym Anderson, Will Martin, and Dominique van der Mensbrugghe, "Market and Welfare Implications of Doha Reform Scenarios," Chapter 12 in Kym Anderson and Will Martin, eds., *Agricultural Trade Reform and the Doha Development Agenda* (New York: Palgrave Macmillan and the World Bank, 2006), Table 12.4, p. 346 and Table 12.20, p. 384.

Notes: Welfare effects are measured by equivalent variation. Dollar values are in 2001 dollars. WTO = World Trade Organization.

A blank space indicates that the study presents no estimate of the effect for the country or region in question.

Model: A version of the World Bank's LINKAGE model with 27 regions and 25 economic sectors. Agriculture and food comprise 13 of the 25 sectors. Exogenously imposed growth in populations, labor forces, and productivity causes countries' economies and trade to grow over time even with no liberalization. The simulations without productivity effects include static effects plus investment effects resulting from the influence of liberalization on household saving and on the prices of investment goods. The simulations with productivity include those same effects plus effects of liberalization on productivity.

Data: Release 6.05 of the Global Trade Analysis Project (GTAP) data set, which has a base year of 2001. However, the baseline simulation also incorporates major changes in trade policy through 2005, including the final stages of implementation of the Uruguay Round Agreement, tariff reductions made by China and Taiwan as conditions of their accession to the World Trade Organization, and the enlargement of the European Union to 25 members. Unlike previous GTAP releases, Release 6.05 includes bilateral and unilateral trade preferences.

Liberalization scenario simulated: The phased elimination from 2005 through 2010 of all tariffs, subsidies, and other trade-distorting measures in all goods sectors. The welfare-effect estimates are for the year 2015.

a. The WTO's definition of developing countries includes Hong Kong, South Korea, Singapore, and Taiwan, whereas the World Bank's definition, which is based on income levels, does not.

Table 2-9.

Estimated Static Welfare Effects of Global Agricultural Liberalization—2006 World Bank Study, GTAP-AGR Model Analysis

(Millions of 2001 dollars)

Benefiting Country or Region	Estimated Welfare Effect
High-Income Countries	41,569
Transition Economies	2,160
Developing Countries	11,930
China	560
Indonesia	85
Philippines	-85
Vietnam	-7
Other East Asia	2,135
India	1,275
Bangladesh	-50
Other South Asia	231
Argentina	1,137
Brazil	5,039
Other Latin America and the Caribbean	1,079
Morocco	92
Other North Africa and the Middle East	-190
SACU	529
Mozambique	-6
Other Southern Africa	275
Other Sub-Saharan Africa	-167
World total	55,658

Source: Thomas W. Hertel and Roman Keeney, "What's at Stake: The Relative Importance of Import Barriers, Export Subsidies, and Domestic Support," Chapter 2 in Kym Anderson and Will Martin, eds., *Agricultural Trade Reform and the Doha Development Agenda* (New York: Palgrave Macmillan and the World Bank, 2006), Tables 2.7 and 2.8, pp. 49, 52, and 53.

Notes: Welfare effects are measured by equivalent variation.

GTAP = Global Trade Analysis Project.

Model: The GTAP-AGR model. The model is a special-purpose variant of the GTAP static general-equilibrium model that is tailored to analysis of global agricultural trade policy issues.

Data: Release 6.05 of the GTAP data set, which has a base year of 2001. However, before running the simulation of the liberalization scenario, the study runs a preliminary simulation incorporating liberalization that had been committed to in the World Trade Organization (WTO) but not yet implemented by 2001, such as the final stages of implementation of the Uruguay Round Agreement (including the phasing out of textile and apparel quotas) and tariff-reduction commitments made by China and Taiwan in connection with their accession to the WTO. The end point of that simulation is then used as the starting point for the main simulation that produces the estimates given in this table. Unlike previous releases of the GTAP data set, Release 6.05 includes bilateral and unilateral trade preferences.

Liberalization scenario simulated: The elimination of all subsidies, tariffs, and other trade-distorting policies in all goods sectors. The welfare-effect estimates presented are those attributed by the study to agricultural liberalization.

Table 2-10.

Estimated Welfare Effects of Full Trade Liberalization—2002 World Bank Study

Benefiting Region	Simulations Without Productivity Effects	Simulations with Productivity Effects
	Billions of 1997 Dollars	
High-Income Countries	106	196
Low- and Middle-Income Countries	142	390
World total	248	587
	Percent	
High-Income Countries	0.4	0.7
Low- and Middle-Income Countries	1.2	3.4
World total	0.6	1.5

Source: Dollar figures are from World Bank, "Envisioning Alternative Futures: Reshaping Global Trade Architecture for Development," Chapter 6 in *Global Economic Prospects and the Developing Countries 2002* (Washington, D.C.: World Bank, 2002), Table 6.1, p. 171. Percentage figures are by Congressional Budget Office based on the dollar figures and on Figure 6.2, p. 168, of the World Bank study.

Notes: Welfare effects are measured by equivalent variation.

Model: A version of the World Bank's LINKAGE model with 15 regions and 20 economic sectors. Exogenously imposed growth in populations, labor forces, and productivity causes countries' economies and trade to grow over time even with no liberalization. The simulations without productivity effects include static effects plus investment effects resulting from the influence of liberalization on household saving and on the prices of investment goods. The simulations with productivity effects include those same effects plus effects of liberalization on productivity.

Data: Version 5 of the Global Trade Analysis Project data set, which has a base year of 1997. Hence, the starting point for liberalization is the policies that existed in that year.

Liberalization scenario simulated: In each year from 2005 through 2010, all tariffs, domestic production subsidies, and export subsidies in all goods sectors are reduced by one-sixth of their preliberalization levels, ending with their complete elimination. The numbers presented are the components of the resulting welfare effects in 2015 attributed by the study to the liberalization of the food and agriculture sector.

Table 2-11.

Estimated Welfare Effects of Global Elimination of Agricultural Tariffs and Subsidies—Economic Research Service Study

	Static Effects		Static Plus Investment Effects		Static Plus Investment Plus Productivity Effects	
Benefiting Country or Region	Billions of Dollars	Percent	Billions of Dollars	Percent	Billions of Dollars	Percent
Developed Countries	28.5	0.16	29.7	0.17	35.1	0.20
Australia and New Zealand	1.6	0.44	3.4	0.94	3.5	0.90
Canada	0.8	0.15	1.2	0.25	1.4	0.28
EFTA	1.7	0.58	0.1	0.03	0.2	0.07
EU	9.3	0.14	8.2	0.12	10.6	0.16
Japan and Korea	8.6	0.27	5.1	0.16	6.2	0.19
United States	6.6	0.10	11.8	0.18	13.3	0.20
Emerging Economies and Developing Countries	2.6	0.05	6.5	0.12	21.3	0.40
China	0.4	0.07	1.8	0.29	2.2	0.35
Latin America	3.7	0.28	4.7	0.36	6.1	0.47
Mexico	-0.2	-0.06	0.1	0.03	1.6	0.54
Other Asian countries	1.5	0.14	0.3	0.09	5.1	0.47
Southern African countries	0.3	0.09	0.5	0.17	0.8	0.28
Rest of world	-3.1	-0.18	-0.4	-0.08	5.4	0.32
World total	31.1	0.13	36.3	0.16	56.4	0.24

Source: Xinshen Diao, Agapi Somwaru, and Terry Roe, "A Global Analysis of Agricultural Reform in WTO Member Countries," Chapter 1 in Mary E. Burfisher, ed., *Agricultural Policy Reform in the WTO—The Road Ahead,* Agricultural Economic Report No. 802 (U.S. Department of Agriculture, Economic Research Service, Market Trade Economics Division, May 2001), Table 1-7, p. 37, and Table 1-8, p. 39.

Notes: Welfare effects are measured by equivalent variation. Dollar values are in 1997 dollars.

Model: The Economic Research Service's own model with 12 countries/regions, nine production sectors relating to agriculture and food, and other production sectors aggregated together. The model does not have exogenously imposed growth in populations, labor forces, or productivity. The only growth in countries' economies and trade over time is that resulting from the liberalization being modeled. Consequently, the results of liberalization simulations are compared with corresponding values in the base year before liberalization instead of with a baseline.

Data: The model is calibrated using data from version 5.2 of the Global Trade Analysis Project database, which has a base year of 1997. The study is based on 1998 levels of applied agricultural tariffs, domestic support and export subsidies, and tariff-rate quotas. Tariffs are from the Agriculture Market Access Database. Bound tariffs are used where applied rates are not available. Domestic support numbers are from the producer support estimates published by the Organisation for Economic Co-operation and Development. Export subsidies are from member countries' reports to the World Trade Organization (WTO).

Liberalization scenario: All tariffs and tariff equivalents of nontariff barriers are eliminated for all WTO members as are all export subsidies. (Notably, this liberalization excludes China, which was not a WTO member when the study was published.) Domestic support is eliminated in Australia, New Zealand, Japan, Korea, the United States, Canada, the European Union, and in three countries in the European Free Trade Association (EFTA). Those countries provided between 90 percent and 92 percent of the domestic support reported by members to the WTO for 1998, depending on which three of the four members of the EFTA are referred to. The dynamic results presented are those for the 15th year after liberalization. (Because there is no exogenous growth in the model, the year that the liberalization occurs is irrelevant. All that matters are the starting point for the simulation—the size of the economy and trade in the base year, 1997—and the length of time after liberalization that the effects are estimated.)

Table 2-12.

Estimated Static Welfare Effects of a 33 Percent Reduction in Agricultural Import Tariffs, Domestic Support, and Export Subsidies, by Country or Region—Study by Brown, Deardorff, and Stern

Country or Region	Millions of Dollars	Estimated Welfare Effect
Developed Countries		
Australia and New Zealand	-320.7	-0.063
Canada	-368.4	-0.051
EU and EFTA	28,328.0	0.258
Japan	-2,826.4	-0.044
United States	-11,081.1	-0.122
Developing Countries		
Asia		
India	1,617.4	0.384
Sri Lanka	-455.7	-2.734
Rest of South Asia	362.1	0.310
China	-3,932.0	-0.434
Hong Kong	-379.0	-0.294
South Korea	-1,311.4	-0.230
Singapore	-181.4	-0.244
Indonesia	-3,185.5	-1.259
Malaysia	-315.8	-0.264
Philippines	-1,179.1	-1.336
Thailand	92.4	0.045
Other		
Mexico	-425.6	-0.121
Turkey	-871.4	-0.414
Central Europe	-1,695.6	-0.457
Central and South America	-4,988.0	-0.285

Source: Drusilla K. Brown, Alan V. Deardorff, and Robert M. Stern, "Computational Analysis of Multilateral Trade Liberalization in the Uruguay Round and Doha Development Round," Discussion Paper No. 489 (Ann Arbor, Mich.: University of Michigan, School of Public Policy, Research Seminar in International Economics, December 8, 2002), Table 4.

Notes: Model: The Michigan Model of World Production and Trade, which is a static general-equilibrium model that has 21 countries/regions and 18 production sectors, of which agriculture is one sector. The model incorporates some aspects of the "New Trade Theory," including increasing returns to scale, monopolistic competition, and product heterogeneity.

Data: Version 4 of the Global Trade Analysis Project database, which has a base year of 1995. The study updates the base year in a very rough fashion to 2005. To estimate what the values of major economic variables would have been in 2005 in the absence of the Uruguay Round Agreement, the study makes projections based on growth rates contained in the 1999 edition of *World Development Indicators* and the 1998-1999 edition of *World Development Report*, both published by the World Bank. The study then simulates the liberalization agreed to in the Uruguay Round Agreement. The end point of that simulation is used as the starting point for the simulation that produces the estimate given in this table. As such, the policies that are liberalized to produce the estimate presented here presumably do not reflect the admission of China and Taiwan into the World Trade Organization and the expansion of the European Union to 25 countries. Moreover, they would not reflect any other changes in applied tariffs that occurred between 1995 and 2005 that were not required by the Uruguay Round Agreement.

Liberalization scenario: A 33 percent reduction in agricultural import tariffs, domestic production subsidies, and export subsidies.

Table 2-13.

Estimated Static Welfare Effects of a Global 36 Percent Reduction of All Policies That Distort Agricultural Trade—Study by Roberts and Others

(Millions of 1995 dollars)

Country or Region	Estimated Welfare Effects
Australia	1,025
New Zealand	632
South Africa	168
Japan	4,050
South Korea	305
European Union	17,005
United States	3,247
China	705
India	171
Asian Cairns Group	2,292
American Cairns Group	2,001
Total Cairns Group[a]	6,117
Rest of the World	2,666
Global[b]	34,266

Source: Ivan Roberts and others, *Reforming World Agricultural Trade Policies*, Australian Bureau of Agricultural and Resource Economics Research Report 99.12 and Rural Industries Research and Development Corporation Publication No. 99/96 (September 1999), Table 2, p. 37.

Notes: Welfare effects are measured by equivalent variation.

Model: The Global Trade Analysis Project (GTAP) static general-equilibrium model, with 24 countries/regions and 22 commodities.

Data: Version 4 of the GTAP database (modified slightly to improve the data representation of policies where necessary), which has a base year of 1995.

Liberalization scenario: The liberalization modeled is a 36 percent reduction in all forms of agricultural support, restrictions on market access (in tariff equivalents), export subsidies, and domestic support.

a. Excludes South Africa, Fiji, and Papua New Guinea.

b. Includes regions outside those shown.

Table 2-14.

Estimated Effects on Gross National Product of a 50 Percent Reduction in Applied Merchandise Tariffs, by Country or Region—Study by Buetre and Others

(Millions of 1995 dollars)

Country or Region	Estimated Increase in Gross National Product
Australia	873
New Zealand	716
Japan	7,522
ASEAN	3,270
China	2,620
Rest of North Asia	3,760
India	2,457
Rest of South Asia	738
Canada	1,443
United States	6,210
Latin America and the Caribbean	2,114
Argentina	825
Brazil	2,048
EU(15) Plus EFTA	18,590
Non-European Union	1,379
Middle East	2,470
Africa	3,779
Rest of the World	160
Total	60,973

Source: Benjamin Buetre and others, "Agricultural Trade Liberalization: Effects on Developing Countries' Output, Incomes, and Trade," Australian Bureau of Agricultural and Resource Economics Project 110039 (paper presented to the Seventh Annual Conference on Global Economic Analysis, Trade, Poverty, and the Environment, Washington, D.C., June 17-19, 2004), Table 6, p. 15.

Notes: Model: The Global Trade and Environment Model, developed by the Australian Bureau of Agricultural and Resource Economics from the MEGABARE model and the static Global Trade Analysis Project (GTAP) model. It is a dynamic general-equilibrium model with 18 countries/regions and 26 economic sectors, of which 16 are agriculture and food (excluding forestry, fisheries, and wool). According to the study, "The reference case provides projections of growth of labor and capital in each country or region, and the associated changes throughout the rest of the economy in the absence of the policy measures to be examined." The model includes investment effects. Economies grow even in the absence of liberalization, so the effects of liberalization are determined as deviations from a baseline simulation.

Data: Numbers for trade and other economic variables are from version 5 of the GTAP database, which has a base year of 1997. Starting applied tariffs from which liberalization is assumed to begin are from the 2003 Integrated Tariff Database of the World Trade Organization (WTO). Starting bound rates are from the Consolidated Tariff Schedule of the WTO. According to the study, "Many of the applied tariffs taken from the WTO database apply for calendar year 2002....The years with the second and third most numerous observations on applied tariffs are 2000 and 2001, while the oldest observations are for 1998. For bound tariffs, most of the information is based on concessions made in 1996, with the latest countries to accede to the WTO having the latest information—for example, China, which committed to tariff bindings in 2001."

Liberalization scenarios: Policy changes are assumed to occur from 2005 through 2014, with no greater detail on the timing of the changes reported in the study. Estimated effects are for 2014.

Table 2-15.

Estimated Welfare Effects of a 35 Percent Reduction in All Merchandise Tariffs, by Country or Region—Study by Fontagne, Guerin, and Jean

(Percent)

Country or Region	Estimated Welfare Effect
EU(25)	0.4
United States	0.2
Japan	0.9
Cairns Group	0.3
Developing Asia	0,8
ACP Group	0.4
Rest of the World	0.5

Source: Lionel Fontagne, Jean-Louis Guerin, and Sebastien Jean, *Market Access Liberalisation in the Doha Round: Scenarios and Assessment,* Working Paper No. 2003-12 (Paris: Centre d'Etudes Prospectives et d'Informations Internationales, September 2003), Table 5.1, p. 29.

Notes: Model: The MIRAGE (Modelling International Relationships in Applied General Equilibrium) model, which is a dynamic general-equilibrium model. The model includes investment effects but no productivity effects. The model includes growth unrelated to trade, and therefore results are compared to a baseline.

Data: The model is calibrated using version 5 of the Global Trade Analysis Project database, which has a base year of 1997. The study uses actual tariffs—not bound and not most-favored-nation tariffs. The reference year for tariffs is 1999, and that for all other distorting policies is 1997. Hence, any changes in policy since those years are not reflected in the results.

Liberalization scenarios: A 35 percent reduction in all tariffs at the six-digit Harmonized System level is phased in in equal increments over six years for developed countries and over 10 years for developing countries. Results presented are for 14 years after the liberalization agreement.

Table 2-16.

Estimated Welfare Effects of Full Agricultural Liberalization in High-Income Regions, by Country or Region—Study by Beghin, Roland-Holst, and van der Mensbrugghe

Country or Region	Billions of 1997 Dollars	Percent
United States	5.0	0.05
Western Europe	17.0	0.17
High-Income Asia	22.1	0.34
Canada	4.2	0.55
Australia and New Zealand	7.7	0.12
Argentina	3.6	0.79
Brazil	3.2	0.32
China	-0.7	-0.04
India	1.6	0.23
Rest of East Asia	0.6	0.07
Rest of Latin America and the Caribbean	9.2	0.72
Eastern Europe and Central Asia	3.2	0.57
Sub-Saharan Africa and SACU	1.8	0.57
Rest of the World	3.6	0.22
Low- and Middle-Income Countries	26.0	0.27
High-Income Countries	56.1	0.20
Cairns Group	28.5	0.57
World total	82.1	0.21

Source: John C. Beghin, David Roland-Holst, and Dominique van der Mensbrugghe, *Global Agricultural Trade and the Doha Round: What Are the Implications for North and South?* Working Paper 02-WP 308 (Ames, Iowa: Iowa State University, Center for Agricultural and Rural Development, June 2002), Table 2, p. 12.

Notes: Welfare effects are measured by equivalent variation.

Model: A version of the World Bank's LINKAGE model with 14 countries/regions and 25 sectors. Agriculture and food comprise 17 of the 25 sectors. Exogenously imposed growth in populations, labor forces, and productivity causes countries' economies and trade to grow over time even with no liberalization.

Data: Version 5.3 of the Global Trade Analysis Project database, which has a base year of 1997 for economic variables and 1998 for policy variables.

Liberalization scenario: The liberalization scenario involves the removal of all distortions—output subsidies, input subsidies, land and capital subsidies, export subsidies, and import tariffs—in high-income countries, which are defined to include Australia and New Zealand, Canada, the European Union, the European Free Trade Association, high-income Asia, and the United States. The liberalization is phased in from 2005 through 2010, with one-sixth of the relevant benchmark policy eliminated in each year. The numbers presented are the welfare effects in 2015.

Table 2-17.

Estimated Static Welfare Effects of Global Agricultural Liberalization, by Type of Policy Liberalized—2006 World Bank Study, GTAP-AGR Model Analysis

(Millions of 2001 dollars)

	Trade-Distorting Policies Removed			
Benefiting Country or Region	Import Market Access	Domestic Support in High-Income Countries[a]	Export Subsidies in High-Income Countries[a]	Total Agricultural Liberalization
High-Income Countries	36,566	2,450	2,554	41,569
Transition Economies	2,571	76	-488	2,160
Developing Countries	12,669	284	-1,023	11,930
China	1,066	-428	-78	560
Indonesia	148	-43	-19	85
Philippines	17	-67	-36	-85
Vietnam	-56	51	-2	-7
Other East Asia	2,098	66	-29	2,135
India	1,189	72	13	1,275
Bangladesh	-10	-31	-9	-50
Other South Asia	236	4	-9	231
Argentina	558	503	75	1,137
Brazil	4,366	649	24	5,039
Other Latin America and the Caribbean	1,218	-26	-112	1,079
Morocco	177	-32	-55	92
Other North Africa and the Middle East	885	-528	-547	-190
SACU	499	46	-17	529
Mozambique	-5	1	-1	-6
Other Southern Africa	284	23	-33	275
Other Sub-Saharan Africa	1	22	-189	-167
World total	51,806	2,809	1,043	55,658

Source: Thomas W. Hertel and Roman Keeney, "What's at Stake: The Relative Importance of Import Barriers, Export Subsidies, and Domestic Support," Chapter 2 in Will Martin and Kym Anderson, eds., *Agricultural Trade Reform and the Doha Development Agenda* (New York: Palgrave Macmillan and the World Bank, 2006), Tables 2.7 and 2.8, pp. 49, 52, and 53.

Note: Welfare effects are measured by equivalent variation. GTAP = Global Trade Analysis Project.

Model: The GTAP-AGR model. The model is a special-purpose variant of the GTAP static general-equilibrium model that is tailored to analysis of global agricultural trade policy issues.

Data: Release 6.05 of the GTAP data set, which has a base year of 2001. However, before running the simulation of the liberalization scenario, the study runs a preliminary simulation incorporating liberalization that had been committed to in the World Trade Organization (WTO) but not yet implemented by 2001, such as the final stages of implementation of the Uruguay Round Agreement (including the phasing out of textile and apparel quotas) and tariff-reduction commitments made by China and Taiwan in connection with their accession to the WTO. The end point of that simulation is then used as the starting point for the main simulation that produces the estimates given in this table. Unlike previous releases of the GTAP data set, Release 6.05 includes bilateral and unilateral trade preferences.

Liberalization scenario simulated: The elimination of all subsidies, tariffs, and other trade-distorting policies in all goods sectors. The welfare-effect estimates presented here are those attributed by the study to agricultural liberalization

a. High-income countries provide more than 90 percent of what the Uruguay Round Agreement on Agriculture classifies as amber-box subsidies and more than 95 percent of the export subsidies reported by member countries to the World Trade Organization.

Table 2-18.

Estimated Static Welfare Effects of Global Agricultural Liberalization, by Type of Policy Liberalized—Economic Research Service Study

Benefiting Country or Region	Trade-Distorting Policies Removed			
	All Tariffs Worldwide	Domestic Support in Developed Countries	All Export Subsidies Worldwide	All Support and Protection Worldwide
	Welfare Effects (Billions of 1997 dollars)			
Developed-Country Group	19.56	4.74	2.53	28.48
Australia and New Zealand	1.17	0.24	0.01	1.57
Canada	0.4	0.28	-0.09	0.75
EFTA	0.2	0.83	0.32	1.73
EU	0.14	6.06	3.72	9.28
Japan and Korea	13.81	-3.66	-1.34	8.59
United States	3.83	0.97	-0.09	6.57
Developing-Country Group	5.66	-1.94	-2.28	2.6
China	0.85	-0.28	-0.21	0.42
Latin American group	2.71	0.68	-0.05	3.65
Mexico	0.19	-0.27	-0.11	-0.16
Other Asian countries	1.71	-0.09	-0.25	1.52
Southern African countries	0.6	-0.22	-0.22	0.25
Rest of the world	-0.39	-1.76	-1.43	-3.07
World	25.22	2.80	0.25	31.06

Continued

Table 2-18.

Continued

Benefiting Country or Region	Trade-Distorting Policies Removed			
	All Tariffs Worldwide	Domestic Support in Developed Countries	All Export Subsidies Worldwide	All Support and Protection Worldwide
	Effects on Export Values (Percent)			
Developed-Country Group	31.28	0.85	-1.43	31.81
Developing-Country Group	18.93	5.54	0.51	26.50
	Effects on Import Values (Percent)			
Developed-Country Group	28.66	5.43	-0.44	35.93
Developing-Country Group	22.89	-1.54	-1.01	20.02

Source: Xinshen Diao, Agapi Somwaru, and Terry Roe, "A Global Analysis of Agricultural Reform in WTO Member Countries," Chapter 1 in Mary E. Burfisher, ed., *Agricultural Policy Reform in the WTO—The Road Ahead,* Agricultural Economic Report No. 802 (U.S. Department of Agriculture, Economic Research Service, Market Trade Economics Division, May 2001), Table 1-7, p. 37, and Table 1-3, p. 31.

Note: Welfare effects are measured by equivalent variation.

Model: The Economic Research Service's own model with 12 countries/regions, nine production sectors relating to agriculture and food, and other production sectors aggregated together. The model does not have exogenously imposed growth in populations, labor forces, or productivity. The only growth in countries' economies and trade over time is that resulting from the liberalization being modeled. Consequently, the results of liberalization simulations are compared with corresponding values in the base year before liberalization instead of with a baseline.

Data: The model is calibrated using data from version 5.2 of the Global Trade Analysis Project (GTAP) database, which has a base year of 1997. The study is based on 1998 levels of applied agricultural tariffs, domestic support and export subsidies, and tariff-rate quotas. Tariffs are from the Agriculture Market Access Database. Bound tariffs are used where applied rates are not available. Domestic support numbers are from the producer support estimates published by the Organisation for Economic Co-operation and Development. Export subsidies are from member countries' reports to the World Trade Organization.

Liberalization scenario: All tariffs and tariff-equivalents of nontariff barriers are eliminated for all WTO members, as are all export subsidies. (Notably, this liberalization excludes China, which was not a WTO member when the study was published.) Domestic support is eliminated in Australia, New Zealand, Japan, South Korea, the United States, Canada, the European Union, and in three countries in the European Free Trade Association (EFTA). Those countries provided between 90 percent and 92 percent of the domestic support reported by members to the WTO for 1998, depending on which three of the four members of the EFTA are referred to.

Table 2-19.

Estimated Welfare Effects of Agricultural Liberalization in High-Income Countries, by Type of Policy Liberalized—Study by Beghin, Roland-Holst, and van der Mensbrugghe

(Billions of 1997 dollars)

Benefiting Country or Region	Removal of Border Protection	Removal of All Agricultural Distortions
United States	4.3	5.0
Western Europe	21.4	17.0
High-Income Asia	25.8	22.1
Canada	3.0	4.2
Australia and New Zealand	6.2	7.7
Argentina	2.0	3.6
Brazil	1.8	3.2
China	1.5	-0.7
India	1.1	1.6
Rest of East Asia	0.5	0.6
Rest of Latin America and the Caribbean	8.2	9.2
Eastern Europe and Central Asia	2.2	3.2
Sub-Saharan Africa and SACU	1.6	1.8
Rest of the World	3.4	3.6
Low- and Middle-Income Countries	22.3	26.0
High-Income Countries	60.6	56.1
Cairns Group	21.6	28.5
World total	82.9	82.1

Source: John C. Beghin, David Roland-Holst, and Dominique van der Mensbrugghe, *Global Agricultural Trade and the Doha Round: What Are the Implications for North and South?*, Working Paper 02-WP 308 (Ames, Iowa: Iowa State University, Center for Agricultural and Rural Development, June 2002), Table 2, p. 12.

Notes: Welfare effects are measured by equivalent variation.

Model: A version of the World Bank's LINKAGE model with 14 countries/regions and 25 sectors. Agriculture and food comprise 17 of the 25 sectors. Exogenously imposed growth in populations, labor forces, and productivity causes countries' economies and trade to grow over time even with no liberalization.

Data: Version 5.3 of the Global Trade Analysis Project database, which has a base year of 1997 for economic variables and 1998 for policy variables.

Liberalization scenarios: The "Removal of All Protection" scenario involves the removal of all distortions—output subsidies, input subsidies, land and capital subsidies, export subsidies, and import tariffs—in high-income countries, which are defined to include Australia and New Zealand, Canada, the European Union, the European Free Trade Association, high-income Asia, and the United States. The "Removal of Border Protection" scenario involves the removal of export subsidies and import tariffs of those countries. In both scenarios, the liberalization is phased in from 2005 through 2010, with one-sixth of the relevant benchmark policy eliminated in each year. The numbers presented are the welfare effects in 2015.

Table 2-20.

Estimated Static Effects of a 50 Percent Cut in Domestic Subsidies and of a 50 Percent Cut in Tariffs on Only Those Items That Also Have Domestic Subsidies—Study by Hoekman, Ng, and Olarreaga

	Tariff Cut		Cut in Domestic Subsidies		Change in Welfare	
Country Group	Change in Export Value	Change in Import Value	Change in Export Value	Change in Import Value	Tariff Cut	Domestic Subsidies Cut
			Millions of Dollars			
Industrial Countries	3,262	7,677	314	121	14,464	541
Developing Countries	4,146	4,136	504	-92	2,293	-273
Least-Developed Countries	116	118	64	-4	52	36
			Percent			
Industrial Countries	4.7	9.8	0.5	0.2	18.37	0.69
Developing Countries	6.7	6.0	0.8	-0.1	0.56	-0.07
Least-Developed Countries	3.7	5.3	2.0	-0.2	0.12	0.08

Source: Bernard Hoekman, Francis Ng, and Marcelo Olarreaga, *Reducing Agricultural Tariffs Versus Domestic Support: What's More Important for Developing Countries?* Policy Research Working Paper 2918 (Washington, D.C.: World, Bank, October 2002), Table 8, p. 33.

Notes: The study includes only the tariff lines for which there are domestic subsidies for the product in at least one country. There are 158 such tariff lines out of a total of 900 at the six-digit Harmonized System level.

Model: Study authors' own partial-equilibrium model.

Data: Initial tariff rates, export values, and import values are all averages for 1998 based on data from the World Bank's WITS database. Domestic subsidy levels are averages of total aggregate measures of support (amber-box subsidies) for 1995 to 1998, as reported to the World Trade Organization by members (obtained from WTO document G/AG/NGIS/1, April 13, 2000).

CHAPTER

3

Considerations Concerning Partial Liberalization

Full agricultural liberalization is not on the table in the Doha Round—only partial liberalization. Assessment of partial liberalization is complicated by a number of factors that are not relevant to the assessment of full liberalization. Important considerations include the distinction between bound and applied tariffs and between bound and applied domestic support, exceptions made for sensitive and special products, the effects of liberalization of other goods sectors, special and differential treatment for developing countries, and the effects of different ways of partially liberalizing tariff-rate quotas. Some of those considerations have the potential to make a liberalization agreement much less beneficial than it may initially appear.

The Need for Large Reductions in Tariff and Subsidy Bindings

The Doha Round negotiations regarding reductions in tariffs and domestic subsidies are framed in terms of reductions in tariff bounds and subsidy bounds—not reductions in actual tariffs and subsidies. The idea is that the reductions in bounds will cause reductions in actual applied values. However, most tariff and subsidy bounds are significantly higher than the actual applied tariffs and subsidies they are meant to constrain. Consequently, reductions in the bounds will not begin to reduce many actual tariffs and subsidies until substantial slack between bound and actual values is eliminated.

Tariff Bindings

The Congressional Budget Office's August 2005 paper on policies that distort agricultural trade presented statistics showing that the most-favored-nation agricultural tariffs imposed by most countries are significantly lower than their bound values: 19 percent lower on average for developed countries and far lower for developing countries, ranging from 42 percent in Africa to 65 percent in the Middle East. The framework agreement for the Doha Round stipulates that "[t]ariff reductions will be made from bound rates" and that "[s]ubstantial overall tariff reductions will be achieved as a final result from negotiations." Because of the first stipulation, the second will indeed have to be accomplished to have even a small effect on actual tariffs and therefore on trade, since actual tariffs will not begin to be affected until the bound rates are reduced enough to eliminate the gap between bound and actual rates. As a corollary, the reductions in applied tariffs will be much smaller on average than the reductions negotiated in the Doha Round.

That conclusion is strengthened by the fact that many countries' average applied tariffs are lower than their average MFN tariffs. Some developed countries, such as the United States and the European Union, have preferential tariffs for imports from some developing countries, and members of free-trade agreements generally charge no tariffs at all on imports from other countries that are partners in the agreements. Consequently, the differences between average tariff bounds and average applied rates are larger than the differences between average tariff bounds and average MFN rates (see Table 3-1 on page 60). Worldwide, the average bound tariff for agricultural products is 37.4 percent, whereas the average MFN tariff is 24.0 percent and the average applied tariff is 17.0 percent. Thus, the average applied rate is 54.5 percent (not percentage points) lower than the average bound rate.

In the Uruguay Round Agreement, developed countries were generally required to set their bound rates equal to their current MFN rates, whereas developing countries were allowed to set their bound rates significantly higher than their current MFN rates. That is the reason for the larger difference noted above for developing countries, which is evident in the numbers in Table 3-1. The average developed-country tariff rate of 22.1 percent is 18.1 percent lower than the average developed-country bound

rate of 27.0 percent.[1] For developing countries, the average MFN rate is 44.5 percent lower than the average bound rate, and for least-developed countries, the average MFN rate is 81.6 percent below the average bound rate.

However, preferential tariff rates are a bigger factor in developed countries' policies than in developing countries' policies. Consequently, the percentage differences between average bound and average applied rates are closer to equal for developed and developing countries—and are a good bit larger—than are the percentage differences between average bound and average MFN rates. For developed countries, the average applied rate is 47.4 percent lower than the average bound rate. For developing and least-developed countries, the average applied rates are 57.2 percent lower and 82.7 percent lower, respectively, than the average bound rates.

A negotiated cut in tariff bounds does not have to exceed the percentage difference between a country's average tariff bound and its average applied tariff to have an effect on the country's average applied tariff rate. The reason is that some tariffs are closer to their bounds than others. To take a simple example, suppose that half of a country's tariffs are equal to their bounds and half are 50 percent below their bounds. Then the country's average applied tariff is 25 percent below its average bound. Now suppose that a cut of 20 percent in all tariff bounds is negotiated. The result would be a 20 percent cut in the half of tariffs that are equal to their bounds and no cut in the tariffs that are 50 percent below their bounds. Averaging together the 20 percent cut for half of the tariffs and no cut for the other half would give a 10 percent cut in the average applied tariff—despite the fact that the 20 percent cut in tariff bounds is less than the 25 percent difference between the average tariff bound and the average applied tariff.

Of course, if all of the country's applied tariffs were 25 percent below their bound values, then a 20 percent cut in bounds would have no effect at all on the average applied tariff. Thus, to determine the effect on average applied tariffs of a particular formula for cutting bound tariffs, it is necessary to examine every applied tariff individually to determine if the formula cut in that tariff's bound will require a cut in the applied tariff and, if so, by how much. The 2006 World Bank study does that for a number of possible tariff-cutting formulas to determine how they might affect the average tariffs of countries around the world.[2]

The framework agreement for the Doha Round calls for the negotiation of a tiered tariff-reduction formula in which deeper cuts are made in higher tariffs so as to reduce the disparity in tariffs across products. It also calls for special and differential treatment for developing countries, meaning that developing countries are not required to liberalize as much as developed countries are. In accordance with those two requirements, one of the tariff-cutting formulas analyzed in the World Bank study is a fairly aggressive tiered formula with one set of tiers and cuts for developed countries and a less severe set for developing countries. The formula applies to agricultural tariffs a marginal bracket formula of the sort used in the U.S. federal income tax system, with different marginal rates and inflection points for developed and developing countries. The brackets and required marginal cuts are as follows:

1. Readers who are especially alert may note that the percentage difference between average bound and average MFN tariffs for developed countries given here, which is based on the tariff averages in Table 3-1, is slightly different from that given at the beginning of the section, which is taken from CBO's August 2005 paper. The reason is that the two numbers are based on tariff averages taken from different sources. As noted in Appendix A of the August paper, several difficulties arise in the calculation of tariff averages, and analysts handle those difficulties in different ways that can result in slight differences in the calculated averages.

2. See Jean, Laborde, and Martin in the bibliography.

Developed Countries		Developing Countries	
Tariff Rate Bracket	Marginal Cut	Tariff Rate Bracket	Marginal Cut
0-15	45	0-20	35
15-90	70	20-60	40
Above 90	75	60-120	50
		Above 120	60

Thus, for a 100 percent tariff by a developed country, the cut would be:

45 x 15 + 70 x (90 - 15) + 75 x (100 - 90) = 66.75 percentage points.

Despite the seeming aggressiveness of the cuts in the formula, with marginal cuts in bound rates ranging from 35 percent to 75 percent, the resulting cuts in applied tariffs are only moderate on average and are small to nonexistent for a number of developing countries (see the first two columns of Table 3-2 on page 62). The average tariff worldwide before the cut is 15.8 percent. The formula cuts that average by 5.5 percentage points, or 34.8 percent.

The 14.1 percent average applied tariff for developed countries is cut by 6.6 percentage points, or 46.8 percent. However, in the case of developing and least-developed countries, the higher percentage difference between average bound and average applied tariffs combines with the less aggressive tariff-cutting formula in accordance with special and differential treatment to result in much smaller cuts in average applied tariffs. The 17.9 percent average of developed countries is cut by 4.3 percentage points, or 24.0 percent; and the 13.3 percent average of least-developed countries is not cut at all.

Domestic Support Bindings

The framework agreement for the Doha Round stipulates that the negotiations to reduce domestic support, like the tariff-reduction negotiations, proceed with bound values as their starting point. Specifically, it mandates the negotiation of reductions in levels of *trade-distorting domestic support*, where that term is defined as amber-box support plus de minimis support plus blue-box support. Further, the agreement stipulates that the negotiations take as their starting point for each country an amount equal to the country's amber-box bound plus its maximum permitted level of de minimis support plus either its level of blue-box support in a recent historical period to be agreed upon or 5 percent of the value of its production in that historical period, whichever is greater. In addition, the agreement mandates negotiation of reductions in amber-box support alone and stipulates that those negotiations take each country's amber-box bound as their starting point.

CBO's August 2005 paper presented statistics showing that actual amber-box support is significantly lower than its bound value for most countries—more than 50 percent lower for many countries. Consequently, the same issue arises as in the tariff-reduction negotiations: that substantial reductions will have to be negotiated to have even a small effect on the domestic subsidies that countries actually grant.

In an extensive discussion of domestic support limits in the World Trade Organization, the 2006 World Bank study argues that the necessary reductions may be even larger because of an unintended consequence of the way amber-box support is calculated—unless the Doha Round Agreement changes the method of calculation.[3] In particular, one component of amber-box support is market price support (MPS). MPS programs typically involve tariff protection of the product in question accompanied by some kind of support payments to maintain the country's internal market price for the product at a target level—called the administered price—that is higher than the price that would otherwise prevail. In the calculation of amber-box support, the value of market price support is calculated by multiplying the quantity of the product whose price is being supported by the difference between the administered price and a fixed external reference price, where the fixed external reference prices for the various agricultural products were set on the basis of international prices in a historical period.

3. See the references by Hart and Beghin and by Jensen and Zobbe in the bibliography.

Not all of the difference between the administered price and the external reference price arises from the MPS payments. Part of it arises from the tariff protection, and that is what gives rise to the unintended consequence. A country can reduce the MPS component in its amber-box support to zero and maintain substantial support for the agricultural sector in question by eliminating its administered price and MPS payments while leaving the tariff protection in place. If there is enough slack between its tariff on the product and the bound value for that tariff, the country can even raise the tariff to make up for the elimination of the MPS payments; or it might find other ways to make up for the elimination that do not count in the amber-box calculation.

According to the 2006 World Bank study, Japan has reduced its reported amber-box support by abolishing its official price for rice with little, if any, reduction in the actual support received by rice farmers. If support bounds are reduced sufficiently in the Doha Round negotiations to actually restrain countries' amber-box support, other countries may follow suit with their own MPS programs, thus substantially reducing the effect that the negotiated reductions have on the actual support that countries grant to agriculture.

The Doha framework agreement calls for substantial reductions in trade-distorting domestic support using a tiered formula by which members with higher levels of such support must make larger reductions. The 2006 World Bank study contains an analysis to determine how much such a formula could be undercut by the current difference between bound and actual levels of support in combination with the elimination of MPS programs to reduce calculated amber-box support without substantially reducing the benefit to the agricultural sectors the MPS programs support.

The analysis assumes that countries do not reduce their calculated amber-box support until the formula cut in the trade-distorting support bound forces them to. It also assumes that the first thing a country does to accommodate the cut is eliminate its MPS programs in such a manner as to avoid eliminating the benefit to the agricultural sectors those programs support. Only after a country has completely eliminated its MPS programs does it begin cutting non-MPS amber-box support. The purpose of the analysis is to determine how much non-MPS amber-box support must be cut.

The formula analyzed requires 75 percent cuts in the trade-distorting and amber-box support bounds of each developed country whose trade-distorting support bound is greater than or equal to 20 percent of the value of its agricultural production, 60 percent cuts for other developed countries, and 40 percent cuts for developing countries. Further, the limit on de minimis support is reduced from the current 5 percent of the value of production for developed countries and 10 percent for developing countries to 2.5 percent for developed countries and 5 percent for developing countries.

Take the United States as an example. Trade-distorting domestic support in the United States is equal to 20 percent of the value of production, so the formula prescribes a 75 percent cut in the U.S. trade-distorting support bound (see Table 3-3 on page 64). Because of the current difference between U.S. trade-distorting support and its bound, the 75 percent reduction requires only a 55.2 percent reduction in actual trade-distorting domestic support. Eliminating MPS programs would accomplish 27.2 percentage points of that cut, leaving 28.1 percentage points of cuts that would have to take the form of non-MPS trade-distorting domestic support.

More generally, despite the aggressiveness of the cuts in the formula, countries' levels of support are so far below their bounds that only 10 countries must make cuts in their actual levels of trade-distorting domestic support. Of those 10, four can accommodate the entire required cut by reducing or eliminating their MPS programs. Only six countries must make cuts in non-MPS support, and those cuts are not anywhere near as large as the cuts in the formula: Thailand at 30.4 percent of trade-distorting domestic support, the United States at 28.1 percent, Norway at 18.4 percent, the European Union at 15.9 percent, Australia at 10.4 percent, and Iceland at 0.9 percent.[4] Of those countries, Thailand, Australia, and Iceland are insignificant in terms of the total dollar value of their trade-distorting support, and Norway is of borderline significance.

4. Members of the European Union have no barriers to trade and investment with other members. Moreover, all members have the same policy regarding trade and investment with nonmembers, and that policy is determined by the governing bodies of the European Union—not the individual members' governments. Thus, for purposes of trade policy, the European Union is effectively one country and is treated as such in this paper.

The calculation presented here represents the maximum degree to which eliminating MPS might be used to reduce amber-box support without harm to the agricultural sector supported. Especially if tariff protection does not currently provide a large fraction of the calculated MPS support, a country might not have other methods at its disposal to offset the reductions in MPS payments when the MPS program is eliminated (for example, tariff bounds may prevent it from raising its tariffs enough to offset the reductions). Moreover, the authors of the study note that it is doubtful that the European Union would eliminate administered prices because they have been the backbone of the Common Agricultural Policy since its foundation in 1960. However, as mentioned earlier, they also note that Japan has already eliminated its administered price for rice.

Effects on the Economy

Two studies present results showing the influence of the gap between bound values and actual values on the economic benefits from partial liberalization. The first, the 2006 World Bank study, presents simulation results for a scenario characterized by the tiered tariff-cutting formula used in Table 3-2 on page 62 and the tiered formula for cuts in trade-distorting domestic support used in Table 3-3 on page 64 (assuming that countries eliminate their MPS programs as a means of mitigating actual cuts in support). The cuts in the formulas appear aggressive—marginal cuts of 35 percent to 75 percent in tariff bounds with the highest tariffs (which are the ones most costly to economic welfare) getting the largest cuts, and cuts of 40 percent to 75 percent in support bounds, with 75 percent cuts applied to the two countries granting by far the most subsidies (the European Union and the United States). Nevertheless, the welfare benefit to the world from the cuts is only one-quarter of the estimated welfare benefit from full liberalization of all merchandise trade (see the first two columns of results in Table 3-4 on page 66). More to the point, recall from Chapter 1 that the component of the benefit from full merchandise trade liberalization that is attributable to agricultural policies is $182 billion. The $74.5 billion benefit from the tiered formula is only 41 percent of that.

The second study is the one by Buetre and others. It finds that a reduction in bound tariffs of 15 percent would increase world GDP by $2.2 billion, whereas a reduction of 50 percent would increase world GDP by $12 billion (see Table 3-5 on page 69). Thus, increasing the reduction in bound tariffs by a factor of 3.3 increases the effect on world GDP by a factor of 5.5. That happens because a significant portion of the initial 15 percent reduction is devoted to taking up the slack between the bound tariffs and actual tariffs and does not affect the actual tariffs at all. After that initial reduction, the slack has already been taken up on many tariffs, so less of the subsequent 35 percent reduction gets taken up by slack and more of it reduces actual tariffs.

The study further finds that a 50 percent reduction in *all* applied tariffs (not just agricultural tariffs) would increase world GDP by $61.0 billion—five times as much as the 50 percent reduction in bound agricultural tariffs. The reason for that result is not merely that tariffs are reduced for more products. Recall from Chapter 2 that policies distorting agricultural trade produce the vast bulk of the cost of all policies distorting goods trade and that agricultural tariffs produce the vast bulk of the cost of all policies distorting agricultural trade. It would seem unlikely, therefore, that applying the same tariff cut to nonagricultural goods that is applied to agricultural goods would multiply the increase in world GDP five times.

Rather, the explanation—or at least part of it—lies in the difference between bound and applied tariffs. The 50 percent reduction in all applied tariffs results in a much larger increase in agricultural trade than does the 50 percent reduction in bound agricultural tariffs (see Table 3-6 on page 70). It does so because the 50 percent reduction in actual agricultural tariffs (a component of the 50 percent reduction in all actual tariffs) is a much larger reduction in those tariffs than would be caused by the 50 percent reduction in bound agricultural tariffs.

It might also be the case that the reduction in nonagricultural tariffs increases agricultural trade through general-equilibrium effects on the exchange rate as described in Chapter 1. The possible magnitude of such effects will be discussed later in this chapter.

Allowance for Sensitive and Special Products

Extremely high tariffs are a common feature in the agricultural sector.[5] A number of countries—particularly, a number of developing countries and high-income food-importing countries—want to protect some of those high

5. See Congressional Budget Office, *Policies That Distort World Agricultural Trade*, pp. 10-12.

tariffs from the reduction that would otherwise occur under the tiered reduction formula required by the framework agreement. Consequently, the agreement also contains provisions for *sensitive products* and *special products*. With regard to sensitive products, it states:

> Selection
> 31. Without undermining the overall objective of the tiered approach, Members may designate an appropriate number, to be negotiated, of tariff lines to be treated as sensitive, taking account of existing commitments for these products.
>
> Treatment
> 32. The principle of "substantial improvement" will apply to each product.
>
> 33. "Substantial improvement" will be achieved through combinations of tariff quota commitments and tariff reductions applying to each product. However, balance in this negotiation will be found only if the final negotiated result also reflects the sensitivity of the product concerned.
>
> 34. The extent of MFN-based tariff quota expansion and any required tariff reduction for all such products will be determined in the negotiations. A base for tariff quota expansion will be established, taking account of coherent and equitable criteria to be developed in the negotiations. In order not to undermine the objective of the tiered approach for all such products, MFN-based tariff quota expansion will be provided under specific rules to be negotiated taking into account deviations from the tariff formula.[6]

With regard to special products, it states:

> 41. Developing country Members will have the flexibility to designate an appropriate number of products as Special Products, based on criteria of food security, livelihood security and rural development needs. These products will be eligible for more flexible treatment. The criteria and treatment of these products will be further specified during the negotiation phase and will recognize the fundamental importance of Special Products to developing countries.[7]

It is unclear from that language exactly how much liberalization of extremely high tariffs will occur. The issue is important because such tariffs are the cause of a substantial portion of the cost of all policies that distort agricultural trade. Moreover, if care is not taken to ensure that the number of such tariffs exempted from the tiered reduction formulas is indeed extremely small, the exemptions will eliminate almost all of the benefit from liberalization.

Results from the study by Fontagne and others show the significance of extremely high tariffs. The study estimates the effects on welfare, GDP, and trade of several different trade liberalization scenarios that differ primarily in how they treat extremely high tariffs. A "uniform" scenario consists of a 35 percent reduction in all tariffs (not just agricultural tariffs) at the six-digit HS level. A "uniform, except peaks" scenario consists of a 35 percent reduction in all tariffs at the six-digit HS level except for nonagricultural tariffs that are higher than 15 percent and agricultural tariffs that are higher than 85 percent, both of which are left unreduced. An "evening out" scenario consists of a 35 percent reduction in all tariffs at the six-digit HS level except for nonagricultural tariffs that are higher than 15 percent and agricultural tariffs that are higher than 85 percent. The higher tariffs are reduced by a formula that results in a more substantial reduction of the higher tariff rates than occurs in the uniform scenario, thereby evening out the higher tariffs to bring them more in line with the lower ones. All scenarios eliminate tariffs below 2 percent.

The results indicate that the effects of the peak tariffs are substantial (see Table 3-7 on page 71). For many countries, the evening-out scenario increases GDP by twice as much as the uniform-except-peaks scenario. The picture is similar with regard to economic welfare and trade.

The importance of keeping the number of sensitive and special products small is demonstrated by some results in the 2006 World Bank study. In addition to examining the

6. World Trade Organization, *Framework for Establishing Modalities in Agriculture*, Annex A to "Doha Work Programme Draft General Council Decision of 31 July 2004," WTO document number WT/GC/W/535 (July 31, 2004), p. A-6.

7. Ibid., p. A-7.

effects of a tiered tariff-cutting formula on tariff averages, the study also calculates the effects of the same tiered tariff-reduction formula but with allowance for sensitive and special products. All countries are allowed to select 2 percent of their tariff lines as sensitive products, and all developing countries are allowed to select an additional 2 percent of their tariff lines as special products. Tariff bounds on sensitive and special products are exempted from the tiered reduction formula applicable to the bounds for other products and instead are cut by 15 percent. Countries are assumed to select as sensitive and special products those tariff lines that would cause the biggest reduction in tariff revenues if the tiered formula was applied, ensuring that the tariff lines chosen involve both high tariffs and significant import volumes.

The results show that the effects of the allowance are substantial (see Table 3-2 on page 62). Whereas the straight tiered tariff-reduction scenario reduces the trade-weighted average world tariff by 5.5 percentage points, the scenario with allowance for sensitive and special products reduces it by only 1.1 percentage points. Thus, the allowance eliminates 80 percent of the reduction in the world average.

Allowing for sensitive and special products has a large effect in part because the 2 percent of tariff lines chosen cover a disproportionately large amount of trade. If sensitive and special products are limited to tariff lines covering 2 percent of the value of imports instead of to 2 percent of tariff lines, the reduction in the world average is 4.5 percentage points. Thus, over 80 percent of the reduction from the tiered formula is maintained.

The framework agreement calls for further evaluation of a tariff cap in connection with sensitive products. If a 200 percent tariff cap is added to the scenario in which countries are allowed to designate 2 percent of tariff lines as sensitive and special products—that is, after the cuts in that scenario are made, all tariffs over 200 percent are cut to 200 percent—the resulting cut in the world tariff average is 3.2 percentage points. Thus, almost 60 percent of the reduction from the tiered formula without provision for sensitive and special products is maintained.

The welfare effects of allowing for sensitive and special products and of a 200 percent tariff cap are what one would expect from the effects on tariff averages (see Table 3-4 on page 66). Without the allowance for sensitive and special products, the tiered agricultural formula results in a welfare benefit to the world of $74.5 billion. With countries allowed to select 2 percent of tariff lines as sensitive products (and developing countries to select an additional 2 percent of lines as special products), the welfare benefit drops to only $17.7 billion. Adding a 200 percent tariff cap raises the benefit back to $44.3 billion.

The Effects of Liberalizing Other Goods Sectors

Agricultural liberalization is not the only item on the agenda of the Doha Round negotiations—liberalization of trade in other goods is as well. In fact, one of the major fault lines among the countries participating in the round is between, on the one hand, a number of developing countries that want the developed countries to liberalize their agricultural policies but are resistant to reducing their own barriers to imports of manufactured goods and, on the other hand, developed countries that want developing countries to reduce barriers to imports of manufactured goods markets but are resistant to liberalizing their own agricultural policies. Participants are attempting to strike a deal between the two sides, with the developed countries liberalizing their agricultural sectors in exchange for developing countries opening their manufactured-goods markets to increased competition from imports.

However, as was discussed in Chapter 1, developed countries' exports of manufactured goods to developing countries would be increased by the developed countries' liberalization of their own agricultural markets, and developing countries' exports of agricultural products to developed countries would be increased by developing countries' reducing barriers to imports of manufactured goods. Moreover, simulation results from the 2006 World Bank study indicate that the gain to developing countries from reducing barriers to imports of manufactured goods is greater in percentage terms than is the gain to developed countries.

In addition to the tiered agricultural formula scenario already discussed, the World Bank study also presents results for a scenario identical to that one except that it includes additional cuts in tariffs on manufactured goods: 50 percent for developed countries, 33 percent for developing countries, and 0 percent for least-developed countries (see the fifth column of results in Table 3-4). Both developed (or high-income) countries and developing countries benefit in terms of economic welfare from the

additional tariff cuts on manufactured goods—developed countries by $14.3 billion and developing countries (as defined by the World Bank) by $7.1 billion. The gain to developed countries represents a 0.04 percent increase, whereas the gain to developing countries represents a 0.07 percent increase.

The Effects of Special and Differential Treatment

The framework agreement for the Doha Round calls for *special and differential treatment* for developing countries, which means that they will not be required to make cuts in their tariffs and subsidies that are as deep as those required of developed countries. That provision, which has been a feature in previous negotiating rounds as well, is a concession by the developed countries to the developing countries. However, additional simulation results in the 2006 World Bank study indicate that special and differential treatment is more harmful to developing countries than it is to developed countries, and it is especially harmful to low-income developing countries.

The 2006 World Bank study presents results for a scenario identical to the one discussed in the previous section—that is, the tiered agricultural formula plus cuts in tariffs on nonagricultural products—except that it contains no special and differential treatment for developing countries and instead requires them to make the same cuts required of developed countries (see the final column of Table 3-4 on page 66). Elimination of special and differential treatment increases the annual welfare benefit to developed countries from $79.9 billion to $96.4 billion—a 20.7 percent increase. The annual benefit to middle-income developing countries rises from $12.5 billion to $17.1 billion—an increase of 36.8 percent. The annual benefit to low-income developing countries grows by 63.9 percent—from $3.6 billion to $5.9 billion.

Tariff-Rate Quotas: Quota Expansion Versus Tariff Reduction

Tariff-rate quotas (TRQs) are another area in which the effects of partial liberalization can be quite different from what might be expected.[8] The reason is that the effect of a given kind of liberalization depends on the quantity of the imports coming in under the TRQ relative to the quota. If the quota is either substantially overfilled or substantially underfilled, then increasing the quota will not have any effect on imports. However, if the quota is exactly 100 percent filled and binding, then increasing the quota will increase imports by the same amount as the increase in the quota (up to the point that the quota ceases to be binding). Thus, depending on the relative amounts of trade regulated by TRQs that are overfilled, underfilled, or exactly filled, an increase in quotas could have anywhere from no effect to an increase in trade by the same percentage as the percentage increase in quotas. Similarly, the effect of reductions in within-quota tariffs and over-quota tariffs also depends on the relative amounts of trade regulated by overfilled, underfilled, and exactly filled TRQs.

The issue is important because TRQs are a major feature of protection in agriculture. As shown in CBO's August 2005 study, TRQs protect 13 percent of agricultural output in Japan, 26 percent in the United States, 39 percent in the European Union, and 50 percent in Eastern Europe. Two studies that CBO surveyed for this paper examine that question using two different methodologies. Both reach the conclusion that reductions in the over-quota tariff are likely to be more beneficial than are increases in the quotas unless the increases in the quotas are very large.

A chapter in the 2006 World Bank study identifies eight regimes into which the various TRQs around the world fall:[9]

Regime 1a: The quota is overfilled, but the country nevertheless imposes the in-quota tariff on all imports.

Regime 1b: The quota is underfilled, so the in-quota tariff applies to all imports.

Regime 2a: The quota is 100 percent filled. The quota is binding, and the tariff equivalent of the quota is less than the over-quota tariff.

Regime 2b: The quota is less than 100 percent filled, but the quota is binding anyway because administrative inefficiency makes it difficult or costly for some firms to receive quota allot-

8. A TRQ consists of a tariff on imports up to a given quota level and a higher tariff on imports above that level.

9. See de Gorter and Kliuga in the bibliography.

ments for the in-quota rate and the tariff equivalent of the quota is less than the over-quota tariff rate.

Regime 3a: The quota is exactly filled, and the tariff equivalent of the quota is equal to the over-quota tariff rate. Thus, the over-quota tariff is binding.

Regime 3b: The quota is underfilled, but there are imports coming in at the over-quota rate because administrative inefficiency makes it difficult or costly for firms to receive quota allotments for the in-quota rate.

Regime 3c: The quota is overfilled and the over-quota tariff is binding.

Regime 4: The official quota is overfilled, but the actual quota is effectively larger than the official quota so that all imports face the in-quota tariff and the tariff equivalent of the actual quota is less than the over-quota tariff rate.

For TRQs in regimes 1a and 1b, the within-quota tariff is binding. Consequently, lowering that tariff rate will increase imports, but neither lowering the over-quota tariff nor raising the quota will have any effect. For TRQs in regimes 2a and 2b, the quota is binding. Consequently, raising the quota will increase imports, but neither lowering the within-quota tariff nor lowering the over-quota tariff will have any effect provided the over-quota tariff remains above the tariff equivalent of the quota. However, if the over-quota tariff is lowered below the tariff equivalent of the quota, then the regime changes to regime 3a, 3b, or 3c.

For regimes 3a, 3b, and 3c, the over-quota tariff is binding. Consequently, lowering the over-quota tariff will increase imports, but neither lowering the within-quota tariff nor raising the quota will have any effect. Finally, for regime 4, the quantity of imports is determined by the administrators of the quota and is not affected by either the within-quota tariff, the over-quota tariff, or the quota.

The study tallies up the TRQs that fall into each regime and the values of trade involved. It assumes that for each TRQ in regimes 2a and 2b, the tariff equivalent of the quota is halfway between the within-quota tariff and the over-quota tariff. It assumes further that the sensitivity of import demand to prices is equal to the average of the sensitivities that are incorporated into the LINKAGE model.[10] On the basis of those assumptions and the trade tally, the study determines the total dollar-value effect on imports under each regime of changes in the over-quota tariff and changes in the quota, and totals up those effects for all regimes (see Table 3-8 on page 72). It concludes that a 35 percent reduction in over-quota tariffs would increase trade under TRQs by $18.2 billion, or 51.5 percent, whereas a 50 percent increase in quotas would increase it by only $5.1 billion, or 14.5 percent.

A study by Tsigas and Ingco uses a static general-equilibrium model to reach a similar conclusion about the welfare effects resulting from tariff reductions and increases in quotas. It finds that a 15 percent reduction in the tariffs that make up the quotas would increase economic welfare of the world as a whole by five-and-a-half times as much as a 15 percent expansion of the quota levels would (see Table 3-9 on page 73). For the United States, the welfare ratio is closer to three-and-a-half times.

10. In technical terminology, the assumption is that the elasticity of excess demand is equal to -4.63.

Table 3-1.

Trade-Weighted Average Bound, Most-Favored-Nation, and Applied Agricultural Tariff Rates in 2001, by Country—2006 World Bank Study

(Percent)

Country	Average Bound Tariff	Average Most-Favored-Nation Tariff	Average Applied Tariff[a]	Percentage by Which Average Applied Rate Is Lower Than Average Bound Rate
Australia	5.9	3.6	3.0	49.2
Bangladesh	156.7	14.4	14.4	90.8
Canada	19.6	19.3	9.7	50.5
China[b]	16.2	51.3	38.9	-140.1
Japan	62.1	52.1	34.6	44.3
South Korea	103.5	119.8	93.9	9.3
Mexico	49.4	31.9	10.7	78.3
Pakistan	107.7	30.0	30.4	71.8
India	153.4	55.4	55.1	64.1
Turkey	50.1	16.1	14.0	72.1
United States	6.2	6.0	2.7	56.5
MERCOSUR	34.0	12.9	12.9	62.1
EFTA	70.8	48.2	28.6	59.6
ASEAN	59.7	12.1	11.2	81.2
Sub-Saharan Least-Developed Countries	62.8	14.8	13.1	79.1
Other Sub-Saharan Africa	104.4	26.5	25.6	75.5
Maghreb	38.0	18.9	17.6	53.7
SACU	51.5	13.8	13.0	74.8
EU	20.5	17.2	11.8	42.4
Developed Countries	27.0	22.1	14.2	47.4
Developing Countries	48.1	26.7	20.6	57.2
Least-Developed Countries	77.6	14.3	13.4	82.7
World	37.4	24.0	17.0	54.5

Source: Sebastien Jean, David Laborde, and Will Martin, "Consequences of Alternative Formulas for Agricultural Tariff Cuts," Chapter 4 in Kym Anderson and Will Martin, eds., *Agricultural Trade Reform and the Doha Development Agenda* (New York: Palgrave Macmillan and the World Bank, 2006), Table 4.2, p. 91.

Note: MERCOSUR is a customs union whose members at the time that the study was published were Argentina, Brazil, Paraguay, and Uruguay.

a. Average applied rates are lower than average most-favored-nation (MFN) rates because of free-trade agreements and tariff preferences granted to developing countries.

b. The average bound tariff rate given for China is lower than the average MFN rate because the average bound rate includes the effects of tariff reductions committed to by China in its accession agreement to the World Trade Organization but not yet in effect in 2001.

Table 3-2.

Base-Level and Percentage-Point Cuts in Trade-Weighted Average Applied Duties for Various Agricultural Reform Scenarios, by Country or Region—2006 World Bank Study

		Percentage-Point Cut in Average Applied Tariffs			
Country or Region	Base-Level Average Applied Tariff Rate (Percent)	Tiered Agricultural Formula	Tiered Agricultural Formula Excluding Sensitive Products (2 Percent of Tariff Lines)	Tiered Agricultural Formula Excluding Sensitive Products (2 Percent of Tariff Lines) Plus Tariff Cap	Tiered Agricultural Formula Excluding Sensitive Products (2 Percent of Import Value)
Australia	3.0	0.9	0.3	0.4	0.8
Bangladesh	14.4	0	0	0	0
Canada	9.7	4.4	0.1	1.0	3.3
China	10.0	2.3	0.9	1.3	1.8
Japan	34.5	16.6	2.1	8.5	13.1
South Korea	90.1	44.5	12.2	43.0	39.2
Mexico	9.5	1.5	0.2	0.2	1.5
Pakistan	30.4	0.5	0	0	0.5
India	54.5	4.4	1.7	1.7	4.4
Turkey	13.9	1.5	0.2	0.4	1.3
United States	2.7	0.9	0.1	0.3	0.8
MERCOSUR	12.8	0.4	0	0	0.4
EFTA	28.6	11.5	0.8	7.1	9.4
ASEAN	10.9	0.9	0.3	1.2	0.7
Sub-Saharan Least-Developed Countries	13.1	0	0	0	0
Other Sub-Saharan Africa	25.4	2.8	0.6	0.8	2.7
Maghreb	16.9	2.6	0.8	1.0	2.1
SACU	12.6	0.7	0.2	0.2	0.7
EU	11.8	6.1	1.3	2.5	4.9
Developed Countries	14.1	6.6	0.9	3.1	5.3
Developing Countries	17.9	4.3	1.3	3.5	3.8
Least-Developed Countries	13.3	0	0	0	0
World	15.8	5.5	1.1	3.2	4.5

Source: Sebastien Jean, David Laborde, and Will Martin, "Consequences of Alternative Formulas for Agricultural Tariff Cuts," Chapter 4 in Kym Anderson and Will Martin, eds., *Agricultural Trade Reform and the Doha Development Agenda* (New York: Palgrave Macmillan and the World Bank, 2006), Table 4.5, pp. 98 and 99.

Notes: MERCOSUR is a customs union whose members at the time that the study was published were Argentina, Brazil, Paraguay, and Uruguay.

Tariffs used are at the six-digit Harmonized System level for 2001 and updated to account for reduction commitments made by countries newly acceded to the World Trade Organization (among them, China), the phasing in of remaining commitments from the Uruguay Round Agreement on Agriculture, and the accession of 10 new members to the European Union in April 2004.

The "Tiered Agricultural Formula" scenario applies to agricultural tariffs a marginal bracket formula of the sort used in the U.S. federal income-tax system, with different marginal rates and inflection points for developed and developing countries. *Developed countries:* For tariff rates from zero to 15 percent, the marginal cut is 45 percent. For tariffs from 15 percent to 90 percent, the marginal cut is 70 percent. For tariffs above 90 percent, the marginal cut is 75 percent. *Developing countries*: For tariffs from zero to 20 percent, the marginal cut is 35 percent. For tariffs from 20 percent to 60 percent, the marginal cut is 40 percent. For tariffs from 60 percent to 120 percent, the marginal cut is 50 percent. For tariffs above 120 percent, the marginal cut is 60 percent. Thus, for a 100 percent tariff by a developed country, the cut would be 45 x 15 + 70 x (90 - 15) + 75 x (100 - 90) = 66.75 percentage points.

The "Tiered Agricultural Formula Excluding Sensitive Products (2 Percent of Tariff Lines)" scenario allows each country—developed or developing—to designate 2 percent of its tariff lines as "sensitive products" for which the tariff cut will be only 15 percent. Developing countries may also designate an additional 2 percent of their tariff lines as "special products" for which the tariff cut will also be only 15 percent. The tiered agricultural formula is applied to all other tariffs. For sensitive and special products, countries are assumed to choose the tariff lines for which application of the tiered formula would cause the greatest reduction in tariff revenue because of a combination of high tariff rates, high import values to which they apply, and closeness of the bound rate to the applied rate so that the tiered formula would cause a substantial cut.

The "Tiered Agricultural Formula Excluding Sensitive Products (2 Percent of Tariff Lines) Plus Tariff Cap" scenario is the same as the "Tiered Agricultural Formula Plus Sensitive Products (2 Percent of Tariff Lines)" scenario with the additional requirement that any tariffs exceeding 200 percent after applying that scenario are cut to 200 percent.

The "Tiered Agricultural Formula Excluding Sensitive Products (2 Percent of Import Value)" scenario is the same as the "Tiered Agricultural Formula Excluding Sensitive Products (2 Percent of Tariff Lines)" scenario except that sensitive and (for developing countries) special products are each limited to 2 percent of each country's import value rather than 2 percent of its tariff lines.

Table 3-3.

Effects of a Tiered Formula Cut in Domestic Agricultural Support, Assuming Market Price Support Is Cut Before Other Support—2006 World Bank Study

		Resulting Required Reduction in Trade-Distorting Support			
	Current Allowable Trade-Distorting Support (Percentage of Production Value)	Formula Reduction in Trade-Distorting Support Bound (Percent)	Total (Percent)	MPS Component (Percentage of Total Trade-Distorting Support)	Non-MPS Component (Percentage of Total Trade-Distorting Support)
Developed Countries					
Norway	114	75	71.8	53.4	18.4
Iceland	132	75	71.8	70.9	0.9
Switzerland-Liechtenstein	68	75	67.5	67.5	0
EU(15)	42	75	62.1	46.2	15.9
United States	20	75	55.2	27.2	28.1
Australia	11	60	10.4	0	10.4
Canada	24	75	9.7	9.7	0
Japan	54	75	0	0	0
New Zealand	12	60	0	0	0
Developing Countries					
Argentina	n.a.	40	43.5	43.5	0
South Korea	n.a.	40	38.0	38.0	0
Thailand	n.a.	40	30.4	0	30.4
Venezuela	n.a.	40	0	0	0
Tunisia	n.a.	40	0	0	0
South Africa	n.a.	40	0	0	0
Morocco	n.a.	40	0	0	0
Mexico	n.a.	40	0	0	0
Jordan	n.a.	40	0	0	0
Israel	n.a.	40	0	0	0
Costa Rica	n.a.	40	0	0	0
Colombia	n.a.	40	0	0	0
Bulgaria	n.a.	40	0	0	0
Brazil	n.a.	40	0	0	0
Taiwan	n.a.	40	n.a.	n.a.	n.a.
Papua New Guinea	n.a.	40	n.a.	n.a.	n.a.

Source: Congressional Budget Office based on Hans G. Jensen and Henrik Zobbe, "Consequences of Reducing AMS Limits," Chapter 9 in Kym Anderson and Will Martin, eds., *Agricultural Trade Reform and the Doha Development Agenda* (New York: Palgrave Macmillan and the World Bank, 2006), Tables 9.5, 9.6, and 9A.1, pp. 254-260 and 265-268.

Notes: MPS = Market price support; n.a. = not applicable.

The tiered formula cuts total distorting support by 75 percent or 60 percent for each developed country, depending on whether the current allowable amount of such support is greater or less than 20 percent of the value of the country's agricultural production. It cuts such support by 40 percent for each developing country.

Countries listed include all those that currently have amber-box bounds from subsidy-reduction commitments made in the Uruguay Round Agreement on Agriculture or in accession agreements except for countries that were admitted to the European Union when it was expanded in 2004.

Percentage reductions in actual support are based on countries' reports of such support to the World Trade Organization. Most such reports are for 2002 or earlier.

Table 3-4.

Estimated Welfare Effects of Alternative Doha Liberalization Scenarios, by Country or Region—2006 World Bank Study, LINKAGE Model Analysis

(Billions of 2001 dollars)

Country or Region	Full Merchandise Trade Liberalization	Tiered Agricultural Formula	Tiered Agricultural Formula Excluding Sensitive Products	Tiered Agricultural Formula Excluding Sensitive Products Plus Tariff Cap	Tiered Agricultural Formula Plus Tariff Cuts for Non-agricultural Products	No S&D: Same Agricultural Formula and Non-agricultural Tariff Cuts for All Countries
Australia and New Zealand	6.1	2.0	1.1	1.2	2.4	2.8
EU(25) plus EFTA	65.2	29.5	10.7	10.9	31.4	35.7
United States	16.2	3.0	2.3	2.1	4.9	6.6
Canada	3.8	1.4	0.5	0.4	0.9	1.0
Japan	54.6	18.9	1.8	12.9	23.7	25.4
South Korea and Taiwan	44.6	10.9	1.7	15.9	15.0	22.6
Hong Kong and Singapore	11.2	-0.1	-0.1	-0.2	1.5	2.2
Argentina	4.9	1.3	1.0	1.0	1.3	1.6
Bangladesh	0.1	0	0	0.0	-0.1	-0.1
Brazil	9.9	3.3	1.1	1.1	3.6	3.9
China	5.6	-0.5	-1.5	-1.1	1.7	1.6
India	3.4	0.2	0.2	0.2	2.2	3.5
Indonesia	1.9	0.1	0.2	0	1.0	1.2
Mexico	3.6	-0.2	-0.3	-0.3	-0.9	-0.2
Russia	2.7	-0.3	-0.7	-0.7	0.8	1.5
South Africa	1.3	0.1	0.3	0.3	0.4	0.7
Thailand	7.7	0.9	0.6	0.8	2.0	2.7
Turkey	3.3	0.6	0	0	0.7	1.4
Vietnam	3.0	-0.1	0	-0.1	-0.5	-0.6
Rest of South Asia	1.0	0.2	0.1	0.2	0.3	0.7
Rest of East Asia	5.3	0.1	0	1.0	0.3	0.6
Rest of Latin America and the Caribbean	10.3	3.7	0.5	0.4	3.9	4.0
Rest of Europe and Central Asia	1.0	-0.2	-0.3	-0.2	-0.6	-0.7
Middle East and North Africa	14.0	-0.8	-1.2	-1.2	-0.6	0.1
Selected Sub-Saharan African Countries	1.0	0.1	0	0.0	0.1	0.2
Rest of Sub-Saharan Africa	2.5	0	-0.3	-0.3	-0.1	0.3
Rest of the World	3.4	0.4	0	0.0	0.6	0.6

Continued

Table 3-4.

Continued

Country or Region	Full Merchandise Trade Liberalization	Tiered Agricultural Formula	Tiered Agricultural Formula Excluding Sensitive Products	Tiered Agricultural Formula Excluding Sensitive Products Plus Tariff Cap	Tiered Agricultural Formula Plus Tariff Cuts for Non-agricultural Products	No S&D: Same Agricultural Formula and Non-agricultural Tariff Cuts for All Countries
High-Income Countries	201.6	65.6	18.1	43.2	79.9	96.4
Developing Countries—WTO Definition[a]	141.5	19.7	1.2	16.8	32.6	47.7
Developing Countries—World Bank Definition[a]	85.7	9.0	-0.4	1.1	16.1	22.9
Middle-Income Countries	69.5	8.0	-0.5	1.0	12.5	17.1
Low-Income Countries	16.2	1.0	0.1	0.0	3.6	5.9
East Asia and Pacific	23.5	0.5	-0.8	0.6	4.5	5.5
South Asia	4.5	0.4	0.3	0.4	2.5	4.2
Europe and Central Asia	7.0	0.1	-0.9	-0.9	0.8	2.1
Middle East and North Africa	14.0	-0.8	-1.2	-1.2	-0.6	0.1
Sub-Saharan Africa	4.8	0.3	0	-0.1	0.4	1.2
Latin America and the Caribbean	28.7	8.1	2.3	2.1	7.9	9.2
World total	287.3	74.5	17.7	44.3	96.1	119.3

Source: Kym Anderson, Will Martin, and Dominique van der Mensbrugghe, "Market and Welfare Implications of Doha Reform Scenarios," Chapter 12 in Kym Anderson and Will Martin, eds., *Agricultural Trade Reform and the Doha Development Agenda* (New York: Palgrave Macmillan and the World Bank, 2006), Tables 12.4 and 12.14, pp. 346 and 370-373.

Notes: Welfare effects are measured by equivalent variation; WTO = World Trade Organization; S&D = special and differential treatment.

Model: A version of the World Bank's LINKAGE model with 27 regions and 25 economic sectors. Agriculture and food comprise 13 of the 25 sectors. Exogenously imposed growth in populations, labor forces, and productivity causes countries' economies and trade to grow over time even with no liberalization. The simulations include static effects plus investment effects resulting from the influence of liberalization on household saving and on the prices of investment goods; they do not include effects on productivity growth rates.

Data: Version 6.05 of the Global Trade Analysis Project (GTAP) data set, which has a base year of 2001. However, the baseline simulation also includes major changes in trade policy through 2005, including the final stages of implementation of the Uruguay Round Agreement, tariff reductions made by China and Taiwan as conditions of their accession to the World Trade Organization, and enlargement of the European Union to 25 members. Unlike previous GTAP releases, version 6.05 includes bilateral and unilateral trade preferences.

Liberalization scenarios: For each scenario, the liberalization is phased in from 2005 through 2010, and the welfare-effect estimates are for the year 2015.

The "Full Merchandise Trade Liberalization" scenario eliminates all tariffs, subsidies, and other trade-distorting measures in all goods sectors.

All other scenarios abolish all agricultural export subsidies and reduce domestic agricultural subsidies by the amounts shown in the final column of Table 3-3: the United States, 28 percent; Norway, 18 percent; the European Union, 16 percent; Australia, 10 percent; all other countries, zero. In addition:

The "Tiered Agricultural Formula" scenario applies to agricultural tariffs a marginal bracket formula of the sort used in the U.S. federal income tax system, with different marginal rates and inflection points for developed, developing, and least-developed countries. *Developed countries:* For tariff rates from zero to 15 percent, the marginal cut is 45 percent. For tariffs from 15 percent to 90 percent, the marginal cut is 70 percent. For tariffs above 90 percent, the marginal cut is 75 percent. *Developing countries*: For tariffs from zero to 20 percent, the marginal cut is 35 percent. For tariffs from 20 percent to 60 percent, the marginal cut is 40 percent. For tariffs from 60 percent to 120 percent, the marginal cut is 50 percent. For tariffs above 120 percent, the marginal cut is 60 percent. *Least-developed countries:* No tariffs are cut. Thus, for a 100 percent tariff by a developed country, the cut would be 45 x 15 +70 x (90 - 15) + 75 x (100 - 90) = 66.75 percentage points.

The "Tiered Agricultural Formula Excluding Sensitive Products" scenario allows each country—developed or developing—to designate 2 percent of its agricultural tariff lines as "sensitive products" for which the tariff cut will be only 15 percent. Developing countries may also designate an additional 2 percent of their tariff lines as "special products" for which the tariff cut will also be only 15 percent. The tiered formula is applied to all other agricultural tariffs. For sensitive and special products, countries are assumed to choose the tariff lines for which application of the tiered formula would cause the greatest reduction in tariff revenue because of a combination of high tariff rates, high import values to which they apply, and closeness of the bound rate to the applied rate so that the tiered formula would cause a substantial cut.

The "Tiered Agricultural Formula Excluding Sensitive Products Plus Tariff Cap" scenario is the same as the "Tiered Formula Excluding Sensitive Products" scenario with the additional requirement that any tariffs exceeding 200 percent after applying that scenario are cut to 200 percent.

The "Tiered Agricultural Formula Plus Tariff Cuts for Nonagricultural Products" scenario is the same as the "Tiered Agricultural Formula" scenario except that it additionally cuts all nonagricultural tariffs by 50 percent for developed countries, 33 percent for developing countries, and zero for least-developed countries.

The "No S&D: Same Agricultural Formula and Nonagricultural Tariff Cuts for All Countries" scenario eliminates special and differential treatment for developing and least-developed countries by applying to all countries—developed, developing, and least-developed—the cuts applied to developed countries in the "Tiered Agricultural Formula Plus Tariff Cuts for Nonagricultural Products" scenario.

a. The WTO's definition of developing countries includes Hong Kong, South Korea, Singapore, and Taiwan, whereas the World Bank's definition, which is based on income levels, does not.

Table 3-5.

Estimated Effects on Gross National Product of Various Liberalization Scenarios, by Country or Region—Study by Buetre and Others

(Millions of dollars)

Country or Region	Cut in Bound Agricultural Tariffs		50 Percent Cut in Applied Merchandise Tariffs
	15 percent	50 percent	
Australia	67	355	873
New Zealand	47	306	716
Japan	452	2,129	7,522
ASEAN	63	190	3,270
China	60	130	2,620
Rest of North Asia	166	213	3,760
India	-42	-177	2,457
Rest of South Asia	-16	-71	738
Canada	93	357	1,443
United States	90	770	6,210
Latin America and the Caribbean	146	594	2,114
Argentina	48	199	825
Brazil	111	391	2,048
EU(15) Plus EFTA	450	2,890	18,590
Non-EU	201	993	1,379
Middle East	89	858	2,470
Africa	148	1,683	3,779
Rest of the World	44	190	160
Total	2,217	12,000	60,973

Source: Benjamin Buetre and others, "Agricultural Trade Liberalization: Effects on Developing Countries' Output, Incomes, and Trade," Australian Bureau of Agricultural and Resource Economics Project 110039 (paper presented to the Seventh Annual Conference on Global Economic Analysis, Trade, Poverty, and the Environment, Washington, D.C., June 17-19, 2004), Table 6, p. 15.

Notes: Model: The Global Trade and Environment Model, developed by the Australian Bureau of Agricultural and Resource Economics (ABARE) from the MEGABARE model and the static Global Trade Analysis Project (GTAP) model. It is a dynamic general-equilibrium model with 18 countries/regions and 26 economic sectors, of which 16 are agriculture and food, excluding forestry, fisheries, and wool). According to the study, "The reference case provides projections of growth of labor and capital in each country or region, and the associated changes throughout the rest of the economy in the absence of the policy measures to be examined." The model includes investment effects. It is unclear whether it includes productivity effects. Economies grow even in the absence of liberalization, so the effects of liberalization are determined as deviations from a baseline simulation.

Data: Numbers for trade and other economic variables are from version 5 of the GTAP database, which has a base year of 1997. Starting applied tariffs from which liberalization is assumed to begin are from the 2003 Integrated Tariff Database of the World Trade Organization (WTO). Starting bound rates are from the Consolidated Tariff Schedule of the WTO. According to the study, "Many of the applied tariffs taken from the WTO database apply for calendar year 2002....The years with the second and third most numerous observations on applied tariffs are 2000 and 2001, while the oldest observations are for 1998. For bound tariffs, most of the information is based on concessions made in 1996, with the latest countries to accede to the WTO having the latest information—for example, China, which committed to tariff bindings in 2001."

Liberalization scenarios: Policy changes are assumed to occur from 2005 through 2014, with no greater detail on the timing of the changes reported in the study. Estimated effects are for 2014.

Table 3-6.

Estimated Effects on Aggregate Trade of Various Liberalization Scenarios—Study by Buetre and Others

(Billions of dollars)

	Importer					
	Value of Agricultural Trade			Value of Total Trade		
Exporter	Developed Countries	Developing Countries	Total	Developed Countries	Developing Countries	Total
			15 Percent Cut in Bound Tariffs			
Developed Countries	2.1	0.7	2.8	3.1	1.6	4.7
Developing Countries	3.2	0.0	3.2	1.9	-0.4	1.5
Total	5.3	0.7	6.0	5.1	1.2	6.3
			50 Percent Cut in Bound Tariffs			
Developed Countries	12.4	7.0	19.4	15.3	9.4	24.7
Developing Countries	12.8	1.1	13.9	10.1	0.2	10.2
Total	25.3	8.1	33.4	25.3	9.5	34.9
			50 Percent Cut in Applied Tariffs on Merchandise Commodities			
Developed Countries	21.7	22.3	44.0	88.5	101.8	190.3
Developing Countries	17.5	11.2	28.7	111.2	77.2	188.4
Total	39.2	33.5	72.6	199.7	179.1	378.7

Source: Benjamin Buetre and others, "Agricultural Trade Liberalization: Effects on Developing Countries' Output, Incomes, and Trade," Australian Bureau of Agricultural and Resource Economics Project 110039 (paper presented to the Seventh Annual Conference on Global Economic Analysis, Trade, Poverty, and the Environment, Washington, D.C., June 17-19, 2004), Table 9, p. 18.

Notes: Model: The Global Trade and Environment model, developed by the Australian Bureau of Agricultural and Resource Economics (ABARE) from the MEGABARE model and the static Global Trade Analysis Project (GTAP) model. The model is a dynamic general-equilibrium model with 18 countries/regions and 26 economic sectors, of which 16 are agriculture and food (excluding forestry, fisheries, and wool). According to the study, "The reference case provides projections of growth of labor and capital in each country or region, and the associated changes throughout the rest of the economy in the absence of the policy measures to be examined." The model includes investment effects. Economies grow even in the absence of liberalization, so the effects of liberalization are determined as deviations from a baseline simulation.

Data: Numbers for trade and other economic variables are from version 5 of the GTAP database, which has a base year of 1997. Starting applied tariffs from which liberalization is assumed to begin are from the 2003 Integrated Tariff Database of the World Trade Organization (WTO). Starting bound rates are from the Consolidated Tariff Schedule of the WTO. According to the study, "Many of the applied tariffs taken from the WTO database apply for calendar year 2002....The years with the second and third most numerous observations on applied tariffs are 2000 and 2001, while the oldest observations are for 1998. For bound tariffs, most of the information is based on concessions made in 1996, with the latest countries to accede to the WTO having the latest information—for example, China, which committed to tariff bindings in 2001."

Liberalization scenarios: Policy changes are assumed to occur from 2005 through 2014, with no greater detail on the timing of the changes reported in the study. Estimated effects are for 2014.

Table 3-7.

Comparison of Estimated Aggregate Effects of Various Tariff-Reduction Scenarios—Study by Fontagne, Guerin, and Jean

(Percent)

Scenario	EU(25)	United States	Japan	Cairns Group	Developing Asia	ACP Group	Rest of World
				Welfare			
Uniform	0.4	0.2	0.9	0.3	0.8	0.4	0.5
Uniform, Except Peaks	0.3	0.1	0.3	0.1	0.3	0.3	0.2
Evening Out	0.4	0.2	1.5	0.4	1.1	0.4	0.8
				Gross Domestic Product			
Uniform	0.1	0.1	0.3	0.1	0.3	0.5	0.5
Uniform, Except Peaks	0	0.1	0.2	0.1	0.1	0.2	0.3
Evening Out	0.1	0.2	0.4	0.1	0.4	0.4	0.6
				Exports			
Uniform	6.4	6.0	6.6	7.0	13.1	9.3	8.7
Uniform, Except Peaks	4.3	4.5	4.4	3.5	4.7	2.9	4.3
Evening Out	7.3	6.8	7.7	8.8	18.8	10.9	12.3
				Imports			
Uniform	7.4	5.2	7.6	6.8	12.6	7.8	8.8
Uniform, Except Peaks	4.8	3.8	5.0	3.4	4.6	2.4	4.4
Evening Out	8.6	6.0	8.9	8.6	18.0	9.2	12.4

Source: Lionel Fontagne, Jean-Louis Guerin, and Sebastien Jean, *Market Access Liberalisation in the Doha Round: Scenarios and Assessment,* Working Paper No. 2003-12 (Paris: Centre d'Etudes Prospectives et d'Informations Internationales, September 2003), Tables 5.1-5.4, pp. 29, 30, 32, and 33.

Notes: Model: The MIRAGE (Modelling International Relationships in Applied General Equilibrium) model, which is a dynamic general-equilibrium model. It includes investment effects but no productivity effects.

Data: The model is calibrated using version 5 of the Global Trade Agreement Project (GTAP) database, which has a base year of 1997. Study uses actual tariffs—not bound or most-favored-nation tariffs. The reference year for tariffs is 1999, and that for all other distortions is 1997. Hence, any changes in policy since those years are not reflected in the results.

Liberalization scenarios: All scenarios are phased in in equal increments over six years for developed countries and over 10 years for developing countries. Results presented are for 14 years after the liberalization agreement.

The "Uniform" scenario consists of a 35 percent reduction in all ad valorem tariff equivalents (of ad valorem tariffs, specific duties, tariff-rate quotas, prohibitions, and antidumping duties) at the six-digit Harmonized System level. All tariffs below 2 percent are eliminated.

The "Uniform, Except Peaks" scenario consists of a 35 percent reduction in all ad valorem tariff equivalents at the six-digit Harmonized System level except for nonagricultural tariffs that are higher than 15 percent and agricultural tariffs that are higher than 85 percent. All tariffs below 2 percent are eliminated.

The "Evening Out" scenario consists of a 35 percent reduction in all ad valorem tariff equivalents at the six-digit Harmonized System level except for nonagricultural tariffs that are higher than 15 percent and agricultural tariffs that are higher than 85 percent, and reduction of those higher tariffs to a level of $a * t / (a + t)$, where t is the starting tariff rate and a is chosen so as to make the result continuous with the lower tariff rates reduced by 35 percent ($a = 28$ in manufacturing, and $a = 158$ in agriculture). This scenario results in a more substantial reduction of the higher tariff rates than does the uniform scenario, thereby "evening out" the higher tariffs to bring them more in line with the lower ones. All tariffs below 2 percent are eliminated.

Table 3-8.

Effects of Tariff-Rate Quota Liberalization on the Value of Trade—2006 World Bank Study

Regime[a]	Number of Tariff-Rate Quotas	Value of Trade (Millions of dollars)	Change in Trade Value Resulting from a 35 Percent Reduction in Over-Quota Tariffs (Millions of dollars)	(Percent)	Change in Trade Value Resulting from a 50 Percent Increase in Quotas (Millions of dollars)	(Percent)	Minimum (Millions of dollars)
In-Quota Tariff							
Regime 1a	216	1,953	493	25.2	n.a.	n.a.	493
Regime 1b	224	1,104	426	38.6	n.a.	n.a.	426
Total	440	3,057	919	30.0	n.a.	n.a.	919
Quota Binding							
Regime 2a	16	362	149	41.1	680	187.9	149
Regime 2b	86	1,706	97	5.7	920	53.9	97
	102	2,068	246	11.9	1,600	77.4	246
Out-of-Quota Tariff							
Regime 3a	74	7,271	5,274	72.5	85	1.2	85
Regime 3b	386	13,543	9,128	67.4	1,115	8.2	1,115
Regime 3c	32	1,914	1,468	76.7	129	6.8	129
Total	492	22,729	15,870	69.8	1,329	5.8	1,329
Over-Quota Imports							
Regime 4	87	7,560	1,215	16.0	2,203	29.1	1,215
Total	1,121	35,414	18,249	51.5	5,132	14.5	3,709

Source: Harry de Gorter and Erika Kliuga, "Reducing Tariffs Versus Expanding Tariff Rate Quotas," Chapter 5 in Kym Anderson and Will Martin, eds., *Agricultural Trade Reform and the Doha Development Agenda* (New York: Palgrave Macmillan and the World Bank, 2006), Table 5.4, p. 130.

Notes: Calculated increases are based on the assumptions that the elasticity of excess demand equals -4.63 and that the tariff equivalent of the quota for each tariff-rate quota in regimes 2a and 2b is halfway between the within-quota tariff rate and the over-quota tariff rate.

n.a. = not applicable.

a. The regimes are as follows:
Regime 1a: The quota is overfilled, but the country nevertheless imposes the in-quota tariff on all imports.
Regime 1b: The quota is underfilled, so the in-quota tariff applies to all imports.
Regime 2a: The quota is 100 percent filled. The quota is binding and the tariff equivalent of the quota is less than the over-quota tariff.
Regime 2b: The quota is less than 100 percent filled, but the quota is binding anyway because administrative inefficiency makes it difficult or costly for some firms to receive quota allotments for the in-quota rate, and the tariff equivalent of the quota is less than the over-quota tariff rate.
Regime 3a: The quota is exactly filled, and the tariff equivalent of the quota is equal to the over-quota tariff rate, so that tariff is binding.
Regime 3b: The quota is underfilled, but there are imports coming in at the over-quota rate because administrative inefficiency makes it difficult or costly for firms to receive quota allotments for the in-quota rate.
Regime 3c: The quota is overfilled, and the over-quota tariff is binding.
Regime 4: The official quota is overfilled, but the actual quota is effectively larger than the official quota so that all imports face the in-quota tariff, and the tariff equivalent of the actual quota is less than the over-quota tariff rate.

Table 3-9.

Estimated Static Welfare Effects of Tariff-Rate Quota Liberalization—Tsigas and Ingco Study

(Millions of dollars)

Country or Region	Total Gains	15 Percent Reduction in TRQ Tariffs and Export Taxes	15 Percent Expansion of TRQ Quota Levels
Canada	322	315	7
United States	634	453	130
Mexico	82	82	0
Argentina	425	436	30
Brazil	632	534	119
Chile	64	49	11
Australia and New Zealand	829	888	17
Japan	6,411	5,488	787
South Korea	331	18	272
Indonesia	72	33	31
Malaysia	287	269	16
Philippines	-65	-80	11
Thailand	268	195	67
India	13	-5	13
EU(15)	5,629	5,471	227
Middle East and North Africa	-1,109	-1,127	19
Rest of the World	-1,589	-1,920	312
Total	13,236	11,099	2,069

Source: Marinos E. Tsigas and Merlinda Ingco, *Market Access Liberalization for Food and Agricultural Products: A General Equilibrium Assessment of Tariff-Rate Quotas,* Working Paper No. 2001-10-A (Washington, D.C.: U.S. International Trade Commission, Office of Economics, October 2001), Table 3, p. 15, and Table 4, p. 16.

Notes: TRQ = tariff-rate quota.

Model: The Global Trade Analysis Project (GTAP) static general-equilibrium model extended to allow analysis of tariff-rate quotas. The model has 17 regions and 10 trade commodities. Four of the 10 are primary agricultural commodities, and two are processed food products.

Data: The study begins with GTAP data for 1995 and 1996 and runs a simulation for the reforms agreed to in the Uruguay Round Agreement that were implemented from 1995 through 2000: (1) increase quota levels by about 66 percent to simulate the increase in quotas from 3 percent of domestic production to 5 percent of domestic consumption; (2) cut the over-quota tariffs imposed by developed regions by 36 percent and the over-quota tariffs imposed by developing regions by 24 percent; and (3) cut export subsidies by the same percentages that over-quota tariffs are cut in an attempt to equalize the domestic prices of imported and exported commodities (as in initial equilibrium). The end point of that simulation is then used as the starting point for the simulation that produces the results in this table. Thus, the effective base year for tariff-rate quotas for the simulation for this table is 2000.

Liberalization scenarios: Trade liberalization scenarios consist of a 15 percent quota expansion and a 15 percent reduction both in the within-quota tariffs and over-quota tariffs of tariff-rate quotas and in export taxes for agricultural and food commodities from their 2000 estimated levels.

CHAPTER

4

Other Effects of Agricultural Liberalization

A final group of questions addressed by many studies of agricultural liberalization relates to distributional effects:

- Which countries' agricultural sectors are helped by liberalization and which are hurt?
- What are the effects on wages, the returns to capital, and the returns to land?
- Which countries' liberalization would help developing countries the most?
- Which sectors of U.S. agriculture are most likely to benefit from liberalization, and which are most likely to be harmed?

This chapter addresses each of those questions in turn.

Effects on Countries' Agricultural Sectors

To say that a country benefits from liberalization does not necessarily mean that its agricultural sector benefits; nor does harm to a country from liberalization necessarily mean that the country's agricultural sector is harmed. Agricultural policies often are implemented for the purpose of benefiting a country's agricultural sector, not the country as a whole. Hence, the question arises as to the effect of agricultural liberalization on agricultural output and value added.

The two studies that present estimates of the effects on world agricultural output both predict that it would decline slightly from the baseline as a result of liberalization. Those studies use the same general-equilibrium model but use policy data sets for different years and analyze different liberalization scenarios. Four of the five studies that present estimates of effects on U.S. output or value added, or from which such effects can be inferred, predict that the U.S. agricultural sector as a whole will benefit from liberalization. The one study that predicts a negative effect nevertheless predicts continued growth of the sector, but at a slower rate. The results of the five studies are broadly consistent with the proposition that reducing tariffs is likely to benefit the U.S. agricultural sector as a whole, whereas reducing domestic support is likely to harm it. Of course, domestic support could always be converted from forms that distort production decisions to forms that do not. The result of that could be a reduction in output without harm to farmers.

Among other countries, the studies are largely in agreement that agricultural sectors benefiting substantially from liberalization would most likely include those of Brazil, Argentina, Australia, New Zealand, Canada, and Latin America and the Caribbean. Viewed from the standpoint of development, the agricultural sectors of middle-income developing countries as a group would gain, but there would most likely be little effect on those of low-income developing countries.

The World

The LINKAGE model analysis of the 2006 World Bank study estimates that the rate of growth of world agricultural output would decline slightly as a result of liberalization (see Table 4-1 on page 84). From the baseline average of 3.2 percent per year, the growth rate would decline to an average of 2.9 percent per year under its "full goods trade liberalization" scenario and to an average of 3.0 percent per year under the "tiered agricultural formula plus tariff cuts for nonagricultural products" scenario (discussed in Chapter 3). Similarly, the study by Beghin, Roland-Holst, and van der Mensbrugghe, which also uses the LINKAGE model but uses an older data set for trade policies, predicts that if full liberalization of all goods trade by high-income countries was phased in from 2005 through 2010 in equal annual increments, world

agricultural output in 2015 would be reduced by 0.6 percent from its baseline value. Oddly, nominal rural value added would be increased by 1.0 percent under that scenario, although it would be reduced under a scenario that removes all tariffs and export subsidies.

The United States

The LINKAGE model analysis of the 2006 World Bank Study—alone among the studies that the Congressional Budget Office surveyed—predicts that liberalization would reduce the average annual growth rate of U.S. agricultural output from 2005 through 2015, with the result that agricultural value added would be lower in 2015 than it would be in the absence of liberalization (see Table 4-1). Growth would remain positive, however, at 1.3 percent per year under the "full goods trade liberalization" scenario and a slightly higher 1.9 percent per year under the more realistic "tiered agricultural formula plus tariff cuts for nonagricultural products" scenario. As a result of the reduced growth rate, agricultural value added would be 15 percent lower in 2015 under full liberalization of all goods trade than it would be in the absence of liberalization, and 5.2 percent lower under the scenario of the tiered agricultural formula plus tariff cuts for nonagricultural products.

The study by Brown, Deardorff, and Stern predicts that a 33 percent reduction in all policies distorting trade in agricultural products, other goods, and services would result in a static increase in agricultural output of 1.86 percent (see Table 4-2 on page 86). Note that the liberalization scenario for this result is more comprehensive than the one that produced the various results from that study presented in Chapter 2. The scenario for those results involved a 33 percent reduction in only those policies distorting trade in agriculture.

The study by Beghin, Roland-Holst, and van der Mensbrugghe estimates a 0.7 percent positive effect on U.S. agricultural output from full liberalization by high-income countries only (see Table 4-3 on page 87). It further estimates a 4.8 percent increase in nominal rural value added from full liberalization and a 6.6 percent increase from removal of border protection (import tariffs and export subsidies). Presumably, the study would predict even larger increases in output if the liberalization scenarios were extended to developing countries as well.

The study by Fontagne, Guerin, and Jean does not present estimates of effects on either agricultural output or value added. It does, however, present data on factor returns indicating that all three of the tariff-reduction scenarios discussed in Chapter 3 in relation to that study—the uniform scenario, the uniform-except-peaks scenario, and the evening-out scenario—would result in increases in the returns to land in the United States (see Table 4-6 on page 91). The increases imply that the model predicts that the U.S. agricultural sector would benefit under the tariff-reduction scenarios. As would be expected from the discussion in Chapter 3 concerning the importance of peak tariffs, the increase in the return to land is lowest for the uniform-except-peaks scenario, at 1.0 percent, and highest for the evening-out scenario, at 1.8 percent.

Finally, a study by Cooper, Johansson, and Peters that uses a partial-equilibrium model of the agricultural sector estimates that full agricultural liberalization globally would cause a static increase of 0.27 percent in U.S. agricultural output volume and a 4.23 percent increase in output value (see Table 4-13 on page 100).

The results of the five studies taken together are consistent with the proposition that agricultural tariff liberalization benefits U.S. agriculture as a whole and that reduction or elimination of domestic support harms U.S. agriculture as a whole. In particular, the study by Beghin, Roland-Holst, and van der Mensbrugghe estimates a larger increase in rural value added from removal of border protection than from full liberalization. In addition, one of the three studies that model tariff and subsidy reduction or elimination together—the LINKAGE model analysis of the 2006 World Bank study—is the only one of the five studies to predict a negative effect on U.S. agriculture. A second—the study by Brown, Deardorff, and Stern—finds the static effect to be small in magnitude, suggesting that the effects of the two liberalizations may be offsetting each other. The third—the study by Cooper, Johansson, and Peters—finds the effect on output volume to be very small.

Other Countries

Notwithstanding the different liberalization scenarios examined, the studies are largely in agreement concerning which other countries' agricultural sectors would gain and which would lose from liberalization. According to the LINKAGE model analysis in the 2006 World Bank study, the big winners under full goods trade liberalization and the scenario of the tiered agricultural formula plus tariff cuts for nonagricultural goods are the agricultural sectors of Brazil, Argentina, Australia and New

Zealand, Canada, and Latin America and the Caribbean generally. The agricultural sectors of developing countries as a group gain, but that gain is almost entirely among middle-income developing countries. The agricultural sectors of low-income developing countries as a group are almost unaffected. The study estimates no effect on Chinese agriculture. Full liberalization would cause a very small loss for India's agricultural sector, and the tiered agricultural formula plus tariff cuts for nonagricultural goods would lead to a very small gain.

The study by Beghin, Roland-Holst, and van der Mensbrugghe predicts that the agricultural sectors benefiting from liberalization by high-income countries would be those of Australia and New Zealand, Argentina, Canada, and Latin America and the Caribbean. Brazil's and India's agriculture would see small gains, and Chinese agriculture would see a *very* small gain. The factor-returns results from the study by Fontagne, Guerin, and Jean imply that tariff reduction would benefit the agricultural sectors of members of the Cairns Group and members of the African, Caribbean, and Pacific Group of States (ACP).

The agricultural sectors experiencing the biggest declines under the two liberalization scenarios of the LINKAGE model analysis of the 2006 World Bank study are those of the European Union (25), the European Free Trade Association, and Japan, which actually experience negative growth from 2005 through 2015. Also registering declines are the agricultural sectors of Korea and Taiwan, which have almost no growth over those years under the scenario for full goods trade liberalization and slower growth than that of the U.S. agricultural sector under the more realistic scenario of the tiered agricultural formula plus tariff cuts for nonagricultural goods.

Sectors experiencing declines as a result of full liberalization by high-income countries in the study by Beghin, Roland-Holst, and van der Mensbrugghe include those of Western Europe and high-income Asian countries (Japan, South Korea, Taiwan, Singapore, and Hong Kong). In the tariff-reduction scenarios in the study by Fontagne, Guerin, and Jean, the agricultural sectors of Japan, the European Union, developing Asia (excepting under the evening-out scenario), and the rest of the world (that is, other than the European Union, the United States, Japan, the Cairns Group, developing Asia, and the ACP countries) see declines.

Effects on Factor Returns

Four of the studies that CBO surveyed present estimates of the effects of liberalization on returns to factors of production (such as wages, rents, and returns to capital). Such effects are of interest because of their implications for equality of income among and within countries. Three of the four studies show the same patterns of effects to varying degrees. Those patterns and their implications are clearest in the results from the 2006 World Bank study, so the following discussion treats that study's results in some detail and follows with briefer discussions of the other studies.

2006 Study by the World Bank

The LINKAGE model analysis of the 2006 World Bank study presents estimates of the effects of full liberalization of all goods trade on real factor returns (see Table 4-4 on page 88). Recall from Chapter 2 that policies distorting agricultural trade are by far the most significant of the policies distorting trade in goods, so the results from that study should reflect primarily the effects of agricultural liberalization. The estimates exhibit four overall patterns overlaid upon one another.

First, for the world as a whole and for almost all countries and regions individually, the wages of both unskilled and skilled labor and the returns to capital increase. Skilled-labor wages increase in all countries and regions modeled. The wages of unskilled labor increase in all countries and regions except one comprising the European Union and European Free Trade Area, where those wages remain flat. Returns to capital increase in 22 countries/regions, decline in four, and remain flat in one.

Second, the percentage increases in wages and returns to factors tend to vary inversely with the level of development of the country, thereby reducing inequality of incomes among countries. For unskilled labor, the average wage increases by 4.2 percent for low-income developing countries, by 3.2 percent for middle-income developing countries, and by 0.6 percent for high-income countries. For skilled labor, the average wage increases by 3.9 percent for low-income developing countries, by 2.6 percent for middle-income developing countries, and by 1.1 percent for high-income countries. Returns to capital increase by 1.9 percent for low- and middle-income developing countries and by 0.5 percent for high-income countries.

Third, for the world as a whole and for the vast majority of the individual countries and regions modeled, the percentage increases in wages are larger than the percentage increases in returns to capital. Assuming that owners of capital tend to be wealthier on average than either unskilled or skilled labor, which is likely to be the case in most countries, the larger increase in wages should tend to reduce income inequality within countries.

Fourth, in countries and regions where growth of agricultural output increases, the wages of unskilled labor rise more than those of skilled labor, and returns to land rise. In countries and regions where growth of agricultural output declines (or actual output declines), the wages of unskilled labor rise by smaller amounts than those of skilled labor, and returns to land decline.

As an example, as was noted in the previous section, the LINKAGE model analysis estimates that a slight decline in the annual rate of growth of agricultural output for the world as a whole—from 3.2 percent to 2.9 percent—would result from full liberalization of all goods trade. Correspondingly, the world average return to land declines by 0.8 percent, and the 1.2 percent rise in the average wage of unskilled labor is slightly less than the 1.5 percent rise in the average wage of skilled labor.

Developing countries see their annual rate of agricultural output growth increase to 4.2 percent from the baseline rate of 3.9 percent. Correspondingly, the returns to land rise by 0.9 percent, and the 3.5 percent rise in unskilled wages is larger than the 3.0 percent rise in skilled wages. Conversely, high-income countries as a group see their output growth decline to -0.1 percent from the baseline rate of 1.6 percent. Correspondingly, returns to land fall by 20.0 percent, and the 0.6 percent rise in the wages of unskilled labor is less than the 1.1 percent rise in the wages of skilled labor.

For the United States, the analysis estimates that growth in agricultural output would decline from the baseline rate of 2.2 percent per year to 1.3 percent per year under full liberalization of all goods trade. Correspondingly, the return to land declines by 11.0 percent, and the 0.1 percent rise in unskilled wages is less than the 0.3 percent rise in skilled wages. As noted in the previous section, however, this study is the only one among the studies CBO surveyed for this paper that shows a reduction in growth of U.S. agricultural output resulting from liberalization.

The correlations between the effects of liberalization on agriculture and the effects on returns to land and the wages of unskilled labor relative to those of skilled labor result from the fact that agriculture is land- and unskilled-labor-intensive relative to other industries. As a result of that relative factor intensity, in countries where agriculture expands, the demands for unskilled labor and land rise, causing their prices to rise. Conversely, in countries where the agricultural sector shrinks (or grows more slowly), the demands for unskilled labor and land decline, causing their prices to decline.

The effect on land prices is much more pronounced than that on wages of unskilled labor because agricultural land generally has few or no alternative uses. Thus, when the agricultural sector of a country declines, reducing what the producers are willing and able to pay in rent and wages, the owners of land generally must accept a decline in rent, whereas unskilled labor can seek employment at better wages in another sector of the economy. As a result, in no country or region does contraction of the agricultural sector do more than reduce the rise in the wages of unskilled labor, whereas the returns to land decline substantially in a number of countries.

2002 Study by the World Bank

Because the 2002 World Bank study also uses the LINKAGE model, it is not surprising that the same general patterns emerge from its estimates of effects on factor returns (see Table 4-5 on page 90). Correlating the effects of liberalization on factor prices with the effects on agricultural output is problematic because the study does not present estimates of effects on output. However, the effects on output should be similar to those in the study by Beghin, Roland-Holst, and van der Mensbrugghe, which uses the same model and almost the same data set (version 5.3 of GTAP with policy data for 1998 rather than version 5 with policy data for 1997). The main difference between the two studies is that the 2002 World Bank study models full liberalization by all countries whereas the study by Beghin, Roland-Holst, and van der Mensbrugghe models full agricultural liberalization by high-income countries only.

The results for most countries are similar in character, even if different in magnitude, to those from the 2006 study. One country whose results are different is the United States. Its agricultural output is estimated to grow more rapidly instead of more slowly as a result of liberal-

ization; hence, the wages of unskilled labor rise slightly more than those of skilled labor.

Study by Fontagne, Guerin, and Jean

The study by Fontagne, Guerin, and Jean presents estimates of the effects of various tariff-reduction scenarios on factor returns (see Table 4-6 on page 91). Like the World Bank studies, it estimates that the effects on wages and returns to capital are generally positive around the world. It also estimates that those effects are larger for developing countries (developing Asia and the ACP countries) than for high-income countries (the United States, the European Union, and Japan). Finally, it also appears to weakly and somewhat inconsistently exhibit the same correlation between the effects on output and the relative effects on the wages of unskilled and skilled labor.

Thus, the negative effect predicted for the return to land in the European Union under the evening-out scenario indicates that the effect on EU output growth (or possibly output itself) is negative. Correspondingly, the rise in the average wage of skilled labor is higher than that for unskilled labor. The same is true for Japan. The positive effect on the return to land for the Cairns Group indicates a positive effect on output, as would be expected. Correspondingly, the rise in the average wage of unskilled labor is higher than that for skilled labor in both the uniform and uniform-except-peaks scenarios. Some countries do not show the correlation for some scenarios; and in the case of the ACP countries, the correlation goes the wrong way. Nevertheless, the results are more supportive of than contradictory to the World Bank results.

Study by Brown, Deardorff, and Stern

In its estimates of factor returns—as in its estimates of welfare effects—the study by Brown, Deardorff, and Stern is unique among the studies that CBO surveyed (see Table 4-7 on page 93). The study incorporates only one type of labor and therefore has only one wage. Moreover, the study predicts that a 33 percent reduction in agricultural subsidies and tariffs would cause the average wage to decline in all countries except South Korea and Malaysia.

Countries Whose Liberalization Would Most Help Developing Countries

Developing countries as a group would benefit more from liberalization of their own policies that distort agricultural trade than they would from liberalization of developed countries' policies. However, that does *not* mean that developing countries' exports would increase more as a result of developing-country liberalization than they would as a result of developed-country liberalization. On the contrary, they would increase more as a result of developed-country liberalization. The seeming contradiction is explained by the fact that countries benefit economically from imports as well as exports, and developing countries' imports would increase significantly as a result of liberalization. To the extent that developing countries are harmed by developed countries' policies that distort trade, the evidence points to the European Union and high-income Asian countries as much larger sources of harm than the United States.

High-Income Countries' Policies Versus Developing Countries' Policies

Results from the LINKAGE model analysis of the 2006 World Bank study indicate that in terms of welfare effects, developing countries would gain slightly more from full liberalization of their own policies distorting goods trade (not just agricultural trade) than they would from full liberalization by high-income countries—$28 billion versus $26 billion (see Table 4-8 on page 94). In the earlier 2002 World Bank study, the results had been more lopsided, with developing countries gaining $114 billion in economic welfare from their own full liberalization of all goods trade and only $31 billion from such liberalization by high-income countries (see Table 4-9 on page 95).

Benefits from liberalization result both from exports and from imports. Whereas competing domestic producers may be harmed by imports, consumers generally benefit by a greater total amount. Consequently, the likelihood that developing countries would benefit more from their own liberalization than from that of high-income countries does not necessarily mean that their own liberalization would increase their exports more than would liberalization by high-income countries. In fact, estimates from two studies indicate that they would not.

The LINKAGE model analysis of the 2006 World Bank study estimates that full liberalization of all goods trade by developing countries would increase the value of developing countries' exports by $77 billion, whereas the same liberalization by high-income countries would increase developing countries' exports by $133 billion (see Table 4-10 on page 96).

Results from the study by the Economic Research Service support the same conclusion. They indicate that elimination of developing countries' policies that distort agricultural trade would increase the value of developing countries' exports by 5.5 percent, whereas trade liberalization alone (leaving aside subsidy liberalization) by developed countries would increase developing countries' exports by 18.1 percent (see Table 4-11 on page 97). However, developing-country liberalization would increase developing countries' imports by 24.6 percent.

U.S. Policies Versus Those of Other High-Income Countries

CBO's August 2005 paper on policies that distort agricultural trade presented statistics indicating that Western Europe and high-income Asian countries generally have the most substantial agricultural trade restrictions and other distortions. That fact would seem to suggest that those countries' policies are more detrimental to developing countries than are those of the United States. Stronger evidence for that proposition comes from the study by Beghin, Roland-Holst, and van der Mensbrugghe. Its results indicate that for the products for which the productive output by low- and middle-income countries increases the most as a result of agricultural liberalization, productive outputs by Western Europe and high-income Asia decline by substantial amounts (see Table 4-12 on page 98). For the United States, however, productive outputs of most of those products (notable exceptions being raw and refined sugar and, to a lesser extent, oil seeds) increase slightly.[1]

Product-Specific Effects on U.S. Agriculture

Not all of U.S. agriculture can be expected to fare equally well from a liberalization agreement. Assessing the product-specific results of the studies that CBO surveyed is difficult because of differences in how the studies divide agriculture into sectors and because of conflicts among the studies' predictions of how some sectors would fare under liberalization. Product-specific effects appear to be among the least reliable predictions of the modeling studies. Overall, it would appear that more sectors within U.S. agriculture would benefit than would be harmed by liberalization. Among the likely gainers are beef and, to a lesser degree of certainty, rice. Sugar would most likely lose. Given the difficulties and the conflicts among the studies, it is hard to justify much confidence in predictions one way or the other for most other individual sectors.

Some Background for Examining and Interpreting the Estimates

Of the studies that CBO surveyed, 10 present product-specific effects of agricultural liberalization. Seven of the 10 are broad examinations of liberalization of all agricultural products (see Tables 4-13 through 4-19), and three are narrow partial-equilibrium studies of individual product sectors (see Tables 4-20 through 4-22). Of the seven that examine all agricultural products, four (Tables 4-13 through 4-16) examine balanced liberalization of all three of the major types of policies that distort agricultural trade—trade barriers, domestic subsidies, and export subsidies—although one of them (Table 4-14 on page 102) also presents estimates for liberalization of only border measures (tariffs and export subsidies). The other three present estimates for liberalization of only one kind of policy: tariff-rate quotas (Table 4-17 on page 106), domestic subsidies (Table 4-18 on page 107), and export subsidies (Table 4-19 on page 108).

Product-Specific Effects That Are of Interest. Ideally, the product-specific effects one would like to know are those on either output volume or output value. The former is the change in the quantity of output produced by the sector—measured either in terms of some nonmonetary unit, such as tons of grain, or in terms of value calculated at constant prices. The latter is the change in the value of

1. Although strongly suggestive, the results presented here do not completely prove the case. To do that would require output numbers expressed in actual value changes rather than percentage changes. It is always possible that a product with a high percentage increase in output has a small base from which to increase and therefore has a smaller dollar-value increase in output than another product with a smaller percentage increase. Moreover, the data set used in the study by Beghin and others does not include tariff preferences, such as those granted by the United States and the European Union to a number of developing countries. In principle, the inclusion of such preferences could change the results.

output produced by the sector—measured as the difference between the value of the output after liberalization calculated at the new prices that prevail after liberalization and the value of output before liberalization calculated at the old prices that prevailed before liberalization. The change in output volume is of interest as an indicator of effects on employment and use of resources such as agricultural land, fertilizer, and farm equipment. The change in output value is of interest as an indicator of effects on the income of farmers.

Several of the studies that CBO surveyed present estimates of product-specific effects on either output volume or output value (one of them presents both). For those that do not, a second-best alternative is estimates of the effects on trade volumes or values presented in terms of changes in actual volumes or values rather than percentage changes. If liberalization causes the trade balance in a product to increase (in volume or in value), it probably causes output of the product to increase (in volume or in value), although quite likely by a smaller amount than the trade balance increases. An increase in the trade balance would represent an increased demand for U.S. output. The increased demand would put upward pressure on the price, which in turn would tend to reduce domestic demand for the product. The consequent reduced output going to domestic consumption would offset to some extent the increased output going to exports.

A distinctly inferior third-best alternative is estimates of effects on trade volumes or values given in percentage terms. That alternative is inferior because it can be misleading if one is not careful. For example, the study by Beghin, Roland-Holst, and van der Mensbrugghe estimates that full agricultural liberalization would increase U.S. exports of refined sugar by 213.7 percent and U.S. imports of it by only 133 percent. On its face, that would appear to be beneficial to the U.S. sugar industry, but it is not. Current U.S. exports of sugar are very small in comparison with current U.S. imports, so the increase in exports is much less significant than the increase in imports. The study predicts declines of 45.4 percent and 45.6 percent, respectively, in U.S. production of raw and refined sugar.

Difficulty Drawing Reliable Conclusions. Assessing the modeling results for particular agricultural products is difficult for a number of reasons. First, the different studies divide the agricultural and food sector into different numbers of products and groups of products, so one-for-one comparisons cannot always be made for each agricultural product.

Second, the studies do not all agree on the effects on all agricultural sectors. A notable example is rice. At one end of the range is a study by the Food and Agricultural Policy Research Institute (FAPRI), which predicts that full liberalization of agriculture by all countries would cause a large decline in U.S. rice output over the next 10 years (see Table 4-14 on page 102). At the other end of the range, the study by Beghin, Roland-Holst, and van der Mensbrugghe; the study by Roberts and others; and the study by the ERS all predict large increases in output (see Tables 4-15, 4-16, and 4-18). In the middle is the study by Cooper, Johansson, and Peters, which predicts a small loss (see 4-13). The studies offer conflicting predictions not just about rice but also about dairy products such as nonfat dry milk, butter, and cheese.

Part of the reason for the different results among studies is different liberalization scenarios. The estimates from the Tsigas and Ingco study are for partial liberalization of tariff-rate quotas only, and those from the ERS study are for amber-box subsidy liberalization only. Moreover, the ERS study gets substantially different results for different amber-box liberalization scenarios, with a large increase in output for rice in one scenario and a much smaller increase in another. However, even excluding all studies except those with balanced liberalization by all countries, one is still left with the FAPRI study predicting a large loss; the study by Cooper, Johansson, and Peters predicting a small loss; and the study by Roberts and others predicting a large gain. The study by Beghin, Roland-Holst, and van der Mensbrugghe, which gives estimates for balanced liberalization for high-income countries only, sides with the study by Roberts and others in predicting a large gain.

Several factors can cause differences in studies' predictions. One is that some studies report changes in values whereas others report changes in volumes. The results of the study by Cooper, Johansson, and Peters, which reports both volume and value changes, indicate that the two can be very different. Not only are the magnitudes different, but for some products the predicted effect on output volume is negative while the predicted effect on output value is positive.

A second reason is that different studies have different base years for the policies whose liberalization they

model. Policies change over time, and not necessarily equally for all agricultural sectors in a given country. Even if the changes over time *were* equal for all sectors in a given country, that would not make the changes equal for all products worldwide because different countries produce different distributions of agricultural products.

A third reason is differences in the models. Several of the studies in this section use general-equilibrium models, whereas others use partial-equilibrium models. As noted in Chapter 1, partial-equilibrium models can treat the sector they examine with more realistic complexity and detail, but they cannot include effects that are inherently general equilibrium in nature.

Moreover, general-equilibrium models in particular require assumptions about the values of many parameters (for example, the elasticities of substitution between domestic products and imported products for the various industries). The correct values for many of the parameters are not known with much accuracy. Whereas errors in the assumed values might cancel each other out to some extent in their effects on aggregate predictions of the models, such as welfare effects, an incorrect elasticity for a given product might have a sizable effect on the prediction of output for that product.

Effects of Balanced Liberalization

In general, it would appear from the results of the studies that more U.S. agricultural sectors would gain from balanced liberalization than would lose. However, given the previously noted differences in the breakdown of agriculture into sectors and the conflicting results among the studies, it is difficult to have much confidence in either gains or losses for most individual sectors.

One exception is beef, for which all four of the balanced liberalization studies predict output gains. Another likely, although less certain, beneficiary is rice. Although the studies are in disagreement with regard to rice, as noted above, the balance of their results—three indicating large gains, one a small loss, and one a large loss—would seem more supportive of gains than of losses.

Sugar would most likely lose. The two balanced liberalization studies that single it out for estimates both predict substantial losses (see Tables 4-15 and 4-16). Those results are supported by the results of two partial-equilibrium studies focused specifically on sugar, which predict losses to varying degrees. None of the studies contradicts that conclusion.

Effects of Liberalization of Particular Types of Policies

Four studies present estimates of sector-specific effects of liberalizing particular types of policies. However, each of the types of policies is examined by only one or two studies, and the variability in results demonstrated by the larger number of studies of balanced liberalization discussed above indicates that one should not place high confidence in the sector-specific results of only one or two studies.

Border Protection. The FAPRI study presents results for the removal of border protection, which means trade barriers and export subsidies. Most of the sectors for which the study presents results experience gains. (The study does not present results for all sectors in all countries.) The biggest gains are to nonfat dry milk and peanuts. Soybeans, rice, and cotton have small losses.

Tariff-Rate Quotas. The Tsigas and Ingco study examines a 15 percent reduction in the tariffs of tariff-rate quotas in combination with a 15 percent increase in the quotas (see Table 4-17 on page 106). Its estimates show all agricultural sectors increasing output, with the largest gain being a 1.6 percent increase for rice and the smallest being a 0.5 percent increase for livestock. The study breaks down agriculture into only six sectors, however, so the numbers could be hiding more sizable gains and losses in more-narrowly defined sectors.

Domestic Subsidies. Two studies present sector-specific estimates relating to liberalization of domestic subsidies.

The ERS study gets significantly different results depending on the specifics of the liberalization scenario (see Table 4-18 on page 107). In both scenarios, most of the sectors gain (11 out 12 sectors for one scenario and nine out of 12 for the other), but the products that benefit most differ between the scenarios. With a 20 percent reduction in all amber-box bounds, the biggest gainers in terms of the total dollar value of trade balance are oilseeds, followed by coarse grains, other livestock, wheat, and beef. The gains for other products are significantly smaller. With a reduction of amber-box bounds to no more than 30 percent of production value, the biggest gainers (again in terms of total dollar value of trade balance) are beef,

rice, and wheat. The gains for other products are significantly smaller.

The FAPRI study does not simulate the effects of domestic subsidy liberalization directly. Rather, the difference between its scenario of full agricultural liberalization and its scenario of removing only border protection is the elimination of domestic subsidies. Comparison of the two scenarios indicates that by far the biggest effect of adding liberalization of domestic subsidies to liberalization of border measures is to substantially increase the loss to rice. All other effects are fairly small. Small gains for wheat and cheese are turned into even smaller losses, and the gains for peanuts are reduced. The gains for nonfat dry milk, butter, corn, soybean oil, and soybean meal are slightly increased.

Export Subsidies. A study by the Organisation for Economic Co-operation and Development examines the effects of global elimination of export subsidies in equal steps from 2001 through 2005 (see Table 4-19 on page 108). It predicts that the resulting effects on the United States in 2005 would be a 100 percent decline in exports of butter, a 46 percent decline in exports of skimmed milk powder, a 5 percent decline in exports of cheese, and a 1 percent decline in exports of milk.

Table 4-1.

Growth Rates of Agricultural Output and Effects on Agricultural Value Added Under Various Scenarios, by Country or Region—2006 World Bank Study

(Percent)

	Average Annual Percentage Growth in Agricultural Output Under Various Scenarios, 2005-2015			Effects of Liberalization on Agricultural Value Added in 2015	
Country or Region	Baseline	Full Goods Trade Liberalization	Tiered Agricultural Formula Plus Tariff Cuts for Nonagricultural Products	Full Goods Trade Liberalization	Tiered Agricultural Formula Plus Tariff Cuts for Nonagricultural Products
Australia and New Zealand	3.5	5.2	4.3	25.6	9.8
EU(25) plus EFTA	1.0	-1.5	-0.3	-26.4	-13.8
United States	2.2	1.3	1.9	-15.0	-5.2
Canada	3.5	5.2	4.0	23.3	5.8
Japan	0.5	-4.3	-1.4	-39.5	-16.6
South Korea and Taiwan	2.2	0.1	1.5	-33.3	-12.1
Hong Kong and Singapore	2.8	3.3	2.9	7.5	1.4
Argentina	2.9	5.1	3.5	33.8	9.4
Bangladesh	4.2	4.4	4.2	-4.4	0.4
Brazil	3.3	6.1	4.4	46.3	16.7
China	4.3	4.3	4.3	0.1	0.4
India	4.3	4.1	4.4	-8.1	0.2
Indonesia	3.0	2.9	3.0	2.7	1.7
Mexico	3.9	4.1	4.0	2.5	3.2
Russia	1.5	1.0	1.4	-6.5	-0.8
South Africa	2.5	3.3	2.6	9.6	1.2
Thailand	-0.1	1.3	0.4	25.0	7.2
Turkey	3.0	2.6	3.0	-7.2	-0.3
Vietnam	5.8	6.1	5.9	13.6	0.3
Rest of South Asia	4.8	4.8	4.9	-1.3	1.8
Rest of East Asia	3.7	3.5	3.8	-0.7	1.9
Rest of Latin America and the Caribbean	4.4	6.6	5.3	30.2	11.1
Rest of Europe and Central Asia	3.3	3.3	3.3	-1.8	-0.2
Middle East and North Africa	4.0	4.0	4.0	0.3	0.9
Selected Sub-Saharan African Countries	5.3	5.7	5.4	9.1	1.7
Rest of Sub-Saharan Africa	4.6	4.8	4.8	5.4	1.9
Rest of the World	5.0	6.4	5.5	16.4	5.4
High-Income Countries	1.6	-0.1	0.8	-19.4	-8.9

Continued

Table 4-1.

Continued

	Average Annual Percentage Growth in Agricultural Output Under Various Scenarios, 2005-2015			Effects of Liberalization on Agricultural Value Added in 2015	
Country or Region	Baseline	Full Goods Trade Liberalization	Tiered Agricultural Formula Plus Tariff Cuts for Nonagricultural Products	Full Goods Trade Liberalization	Tiered Agricultural Formula Plus Tariff Cuts for Nonagricultural Products
Developing Countries	3.9	4.2	4.1	2.9	2.0
Middle-Income Countries	3.7	4.1	3.9	5.3	2.4
Low-Income Countries	4.4	4.5	4.5	-2.5	1.0
East Asia and the Pacific	4.0	4.0	4.0	1.1	0.8
South Asia	4.4	4.2	4.4	-6.8	0.5
Europe and Central Asia	3.0	2.9	3.1	-4.0	-0.3
Middle East and North Africa	4.0	4.0	4.0	0.3	0.9
Sub-Saharan Africa	4.5	4.9	4.7	6.7	1.8
Latin America and the Caribbean	3.8	5.8	4.6	27.4	10.2
World total	3.2	2.9	3.0	-2.4	-0.6

Source: Kym Anderson, Will Martin, and Dominique van der Mensbrugghe, "Market and Welfare Implications of Doha Reform Scenarios," Chapter 12 in Kym Anderson and Will Martin, eds., *Agricultural Trade Reform and the Doha Development Agenda* (New York: Palgrave Macmillan and the World Bank, 2006), Tables 12.11 and 12.17, pp. 358, 359, 378, and 379.

Notes: Welfare effects are measured by equivalent variation.

Model: A version of the World Bank's LINKAGE model with 27 regions and 25 economic sectors. Agriculture and food comprise 13 of the 25 sectors. Exogenously imposed growth in populations, labor forces, and productivity causes countries' economies and trade to grow over time even with no liberalization. The simulations include static effects plus investment effects resulting from the influence of liberalization on household saving and on the prices of investment goods but no productivity effects.

Data: Release 6.05 of the Global Trade Analysis Project (GTAP) data set, which has a base year of 2001. However, the baseline simulation also includes major changes in trade policy through 2005, including the final stages of implementation of the Uruguay Round Agreement, tariff reductions made by China and Taiwan as conditions of their accession to the World Trade Organization, and enlargement of the European Union to 25 members. Unlike previous GTAP releases, Release 6.05 includes bilateral and unilateral trade preferences.

Liberalization scenarios: For each scenario, the liberalization is phased in from 2005 through 2010, and the welfare-effect estimates are for the year 2015.

The "Full Goods Trade Liberalization" scenario eliminates all tariffs, subsidies, and other trade-distorting measures in all goods sectors.

The "Tiered Agricultural Formula Plus Tariff Cuts for Nonagricultural Products" scenario is the same as the scenario of the same name in Table 3-4: All agricultural export subsidies are abolished and domestic agricultural subsidies are reduced by the amounts shown in Table 3-3: the United States, 28 percent; Norway, 18 percent; the European Union, 16 percent, Australia, 10 percent; all other countries, zero. Nonagricultural tariffs are cut by 50 percent for developed countries, 33 percent for developing countries, and zero for least-developed countries. Agricultural tariffs are cut by a marginal bracket formula of the sort used in the U.S. federal income-tax system, with different marginal rates and inflection points for developed, developing, and least-developed countries. *Developed countries:* For tariff rates from zero to 15 percent, the marginal cut is 45 percent. For tariffs from 15 percent to 90 percent, the marginal cut is 70 percent. For tariffs above 90 percent, the marginal cut is 75 percent. *Developing countries:* For tariffs from zero to 20 percent, the marginal cut is 35 percent. For tariffs from 20 percent to 60 percent, the marginal cut is 40 percent. For tariffs from 60 percent to 120 percent, the marginal cut is 50 percent. For tariffs above 120 percent, the marginal cut is 60 percent. Least developed countries: No tariffs are cut.

Table 4-2.

Estimated Static Effects on Output of a 33 Percent Reduction in All Merchandise and Services Trade Barriers and All Agricultural Domestic Support and Export Subsidies, by Economic Sector and Country—Study by Brown, Deardorff, and Stern

(Percent)

	United States	India
Agriculture	1.86	-0.19
Mining	0.61	2.68
Food, Beverages, and Tobacco	0.27	0.40
Textiles	-1.29	1.82
Wearing Apparel	-4.30	9.30
Leather Products and Footwear	-4.56	6.63
Wood and Wood Products	0.50	0.03
Chemicals	0.67	-0.65
Nonmetallic Mineral Products	0.25	0.55
Metal Products	0.44	-2.15
Transportation Equipment	0.39	-0.03
Machinery and Equipment	0.48	-3.04
Other Manufactures	0.49	-0.51
Electricity, Gas, and Water	0.42	0.71
Construction	0.42	0.63
Trade and Transport	0.44	0.26
Other Private Services	0.59	0.58
Government Services	0.25	1.22
Average	0.42	0.50

Source: Drusilla K. Brown, Alan V. Deardorff, and Robert M. Stern, "Computational Analysis of Multilateral Trade Liberalization in the Uruguay Round and Doha Development Round," Discussion Paper No. 489 (Ann Arbor, Mich.: University of Michigan, School of Public Policy, Research Seminar in International Economics, December 8, 2002), Tables 5 and 6.

Notes: Model: The Michigan Model of World Production and Trade, which is a static general-equilibrium model that has 21 countries/regions and 18 production sectors, of which agriculture is one sector. The model incorporates some aspects of the "New Trade Theory," including increasing returns to scale, monopolistic competition, and product heterogeneity.

Data: Version 4 of the Global Trade Analysis Project (GTAP) database, which has a base year of 1995. The study updates the base year in a very rough fashion to 2005. To estimate what the values of major economic variables would have been in 2005 in the absence of the Uruguay Round Agreement, the study makes projections based on growth rates contained in the 1999 edition of *World Development Indicators* and the 1998-1999 edition of *World Development Report*, both published by the World Bank. The study then simulates the liberalization agreed to in the Uruguay Round Agreement. The end point of that simulation is used as the starting point for the simulation that produces the estimates given in this table. As such, the policies that are liberalized to produce the estimates presented here presumably do not reflect the admission of China and Taiwan into the World Trade Organization and the expansion of the European Union to 25 countries. Moreover, they would not reflect any other changes in applied tariffs that occurred between 1995 and 2005 that were not required by the Uruguay Round Agreement.

Liberalization scenario: A 33 percent reduction in agricultural import tariffs, domestic production subsidies, and export subsidies, a 33 percent reduction in all tariffs on imports of manufactures, and a 33 percent reduction in the ad valorem equivalents of services barriers.

Table 4-3.

Estimated Effects of Agricultural Reform in High-Income Regions on Agriculture and Food Output and Nominal Rural Value Added—Study by Beghin, Roland-Holst, and van der Mensbrugghe

(Percent)

	Agriculture and Food Output	Nominal Rural Value Added	
	Removal of All Protection	Removal of All Protection	Removal of Border Protection
Western Europe	-13.4	-15.5	-18.6
United States	0.7	4.8	6.6
High-Income Asia	-6.7	-36.6	-37.2
Canada	0.2	15.4	11.1
Australia and New Zealand	25.4	41.5	34.9
Argentina	5.5	15.5	8.9
Brazil	2.9	7.0	4.0
China	0.2	2.0	1.1
India	1.3	3.3	2.4
Rest of East Asia	0.3	1.4	0.4
Rest of Latin America and the Caribbean	9.1	15.2	12.2
Eastern Europe and Central America	7.4	10.8	6.2
Sub-Saharan Africa and SACU	4.0	6.3	4.8
Rest of the World	3.9	6.8	4.1
Low- and Middle-Income Countries	3.4	5.5	3.6
High-Income Countries	-5.7	-11.2	-12.6
Cairns Group	5.8	10.8	7.7
World total	-0.6	1.0	-0.8

Source: John C. Beghin, David Roland-Holst, and Dominique van der Mensbrugghe, *Global Agricultural Trade and the Doha Round: What Are the Implications for North and South?,* Working Paper 02-WP 308 (Ames, Iowa: Iowa State University, Center for Agricultural and Rural Development, June 2002), Table 8, p. 26.

Notes: Loss in value is net of agriculture subsidies.

Model: A version of the World Bank's LINKAGE model with 14 countries/regions and 25 sectors. Agriculture and food comprise 17 of the 25 sectors. Exogenously imposed growth in populations, labor forces, and productivity causes countries' economies and trade to grow over time even with no liberalization.

Data: Version 5.3 of the Global Trade Analysis Project (GTAP) database, which has base years of 1997 for economic variables and 1998 for policy variables.

Liberalization scenarios: The "Removal of All Protection" scenario involves the removal of all distortions—output subsidies, input subsidies, land and capital subsidies, export subsidies, and import tariffs—in high-income countries, which are defined to include Australia and New Zealand, Canada, the European Union, the European Free Trade Association, high-income Asia, and the United States. The "Removal of Border Protection" scenario involves the removal of export subsidies and import tariffs of those countries. In both scenarios, the liberalizations are phased in between 2005 and 2010, with one-sixth of the relevant benchmark policy eliminated in each year. The numbers presented are the effects in 2015.

Table 4-4.

Estimated Effects on Real Factor Returns of Full Liberalization of All Goods Sectors—2006 World Bank Study, LINKAGE Model Analysis

(Percent)

	Unskilled Labor	Skilled Labor	Capital[a]	Land[a]
Australia and New Zealand	3.1	1.1	-0.3	17.4
EU(25) plus EFTA	0.0	1.3	0.7	-45.4
United States	0.1	0.3	0.0	-11.0
Canada	0.7	0.7	0.4	22.8
Japan	1.3	2.2	1.1	-67.4
South Korea and Taiwan	6.5	7.1	3.8	-45.0
Hong Kong and Singapore	3.2	1.6	0.3	4.4
Argentina	2.9	0.5	-0.7	21.3
Bangladesh	1.8	1.7	-0.2	1.8
Brazil	2.7	1.4	1.6	32.4
China	2.2	2.2	2.8	-0.9
India	2.8	4.6	1.8	-2.6
Indonesia	3.3	1.5	0.9	1.0
Mexico	2.0	1.6	0.5	2.8
Russia	2.0	2.8	3.5	-2.2
South Africa	2.8	2.5	1.8	5.7
Thailand	13.2	6.7	4.2	11.4
Turkey	1.3	3.4	1.1	-8.1
Vietnam	25.3	17.6	11.0	6.8
Rest of South Asia	3.7	3.2	0.1	0.1
Rest of East Asia	5.8	4.2	5.2	-0.9
Rest of Latin America and the Caribbean	5.7	1.4	-0.4	17.8
Rest of Europe and Central Asia	2.3	4.2	2.1	-0.3
Middle East and North Africa	4.1	4.1	2.6	2.4
Selected Sub-Saharan African Countries	6.0	1.6	0.0	4.6
Rest of Sub-Saharan Africa	8.2	6.5	2.2	5.2
Rest of the World	4.4	2.7	1.1	6.3

Continued

Table 4-4.

Continued

	Unskilled Labor	Skilled Labor	Capital[a]	Land[a]
High-Income Countries	0.6	1.1	0.5	-20.0
Developing Countries	3.5	3.0	1.9	0.9
Middle-Income Countries	3.2	2.6	1.9	2.2
Low-Income Countries	4.2	3.9	1.9	-1.0
World total	1.2	1.5	0.8	-0.8

Source: Kym Anderson, Will Martin, and Dominique van der Mensbrugghe, "Market and Welfare Implications of Doha Reform Scenarios," Chapter 12 in Kym Anderson and Will Martin, eds., *Agricultural Trade Reform and the Doha Development Agenda* (New York: Palgrave Macmillan and the World Bank, 2006), Table 12.10, p. 356.

Notes: Nominal factor prices are deflated by the consumer price index.

Model: A version of the World Bank's LINKAGE model with 27 regions and 25 economic sectors. Agriculture and food comprise 13 of the 25 sectors. Exogenously imposed growth in populations, labor forces, and productivity causes countries' economies and trade to grow over time even with no liberalization. The simulations include static effects plus investment effects resulting from the influence of liberalization on household saving and on the prices of investment goods.

Data: Release 6.05 of the Global Trade Analysis Project (GTAP) data set, which has a base year of 2001. However, the baseline simulation also includes major changes in trade policy through 2005, including the final stages of implementation of the Uruguay Round Agreement, tariff reductions made by China and Taiwan as conditions of their accession to the World Trade Organization, and the enlargement of the European Union to 25 members. Unlike previous GTAP releases, Release 6.05 includes bilateral and unilateral trade preferences.

Liberalization scenario simulated: The phased elimination from 2005 through 2010 of all subsidies, tariffs, and other trade-distorting measures in all goods sectors. The welfare-effect estimates are for the year 2015.

a. The returns to capital and land represent the subsidy-inclusive rental costs.

Table 4-5.

Estimated Effects on Factor Returns of Full Liberalization of All Goods Sectors—2002 World Bank Study

(Percent)

	Simulations Without Productivity Effects			Simulations With Productivity Effects		
Country or Region	Unskilled Labor	Skilled Labor	Capital	Unskilled Labor	Skilled Labor	Capital
High-Income Countries	1.0	1.6	0.2	1.1	2.2	0.7
United States	0.5	0.4	0.1	0.5	0.1	0.4
Western Europe	0.7	2.6	0.1	0.7	3.1	0.7
Japan	1.5	2.7	1.2	1.9	3.4	2.2
Other high-income OECD countries	3.1	0.6	0.8	2.3	1.3	0.7
Newly industrialized economies	4.1	2.9	0.5	4.1	3.8	-0.4
Low- and Middle-Income Countries	5.7	5.6	2.7	7.4	9.6	5.1
Sub-Saharan Africa	6.9	4.5	0.8	5.4	6.8	3.4
East Asia and Pacific	6.2	7.8	4.6	11.2	15.0	9.3
South Asia	6.0	3.4	1.7	5.7	5.8	3.7
Eastern Europe and Central Asia	5.4	4.3	1.4	5.3	6.7	3.3
Middle East and North Africa	4.1	12.5	8.0	6.1	17.0	10.9
Latin America and the Caribbean	5.3	2.5	0.7	4.8	4.3	1.4
Rest of the world	3.3	2.2	0.8	2.7	4.2	3.2
World total	2.3	2.5	1.0	2.8	3.8	2.1

Source: World Bank, "Envisioning Alternative Futures: Reshaping Global Trade Architecture for Development," Chapter 6 in *Global Economic Prospects and the Developing Countries, 2002* (Washington, D.C.: World Bank, 2002), Table 6.4, p. 173.

Notes: Nominal factor prices are deflated by economywide consumer price indices.

Model: A version of the World Bank's LINKAGE model with 15 regions and 20 economic sectors. Exogenously imposed growth in populations, labor forces, and productivity cause countries' economies and trade to grow over time even with no liberalization. The simulations without productivity effects include static effects plus investment effects resulting from the influence of liberalization on household saving and on the prices of investment goods. The simulations with productivity include those effects plus effects of liberalization on productivity.

Data: Version 5 of the Global Trade Analysis Project (GTAP) data set, which has a base year of 1997. Hence, the starting point for liberalization is the policies that existed in that year.

Liberalization scenario simulated: In each year from 2005 through 2010, all tariffs, domestic production subsidies, and export subsidies in all goods sectors are reduced by one-sixth of their preliberalization levels, ending with their complete elimination. The numbers presented are the effects in 2015.

Table 4-6.

Estimated Effects on Factor Returns of Various Tariff-Reduction Scenarios—Study by Fontagne, Guerin, and Jean

(Percent)

Scenario	EU(25)	United States	Japan	Cairns Group	Developing Asia	ACP Group	Rest of World
			Unskilled Labor				
Uniform	0.3	0.2	0.4	0.4	0.8	1.2	0.5
Uniform, Except Peaks	0.1	0.1	0.2	0.2	0.3	0.5	0.3
Evening Out	0.4	0.2	0.5	0.5	1.2	1.4	0.6
			Skilled Labor				
Uniform	0.3	0.2	0.6	0.3	1.2	1.2	0.8
Uniform, Except Peaks	0.1	0.1	0.3	0.1	0.4	0.5	0.4
Evening Out	0.5	0.2	0.9	0.5	1.3	2.0	0.9
			Capital				
Uniform	0.3	0.2	0.3	0.2	0.6	0.8	0.6
Uniform, Except Peaks	0.2	0.2	0.2	0.1	0.2	0.3	0.3
Evening Out	0.5	0.2	0.4	0.2	0.7	1.0	0.8
			Natural Resources				
Uniform	-0.3	-0.2	-3.3	0.0	-1.0	1.1	2.2
Uniform, Except Peaks	0.1	0.1	-3.3	0.2	-0.5	0.8	0.7
Evening Out	-0.7	-0.5	-2.7	-0.5	-1.7	0.3	4.1
								Land
Uniform	-0.4	1.6	-5.0	2.8	-0.1	1.5	-1.7
Uniform, Except Peaks	-0.5	1.0	-1.4	1.5	-0.1	0.5	-1.0
Evening Out	-0.6	1.8	-11.6	3.7	0.4	1.4	-1.6

Continued

Table 4-6.

Continued

Source: Lionel Fontagne, Jean-Louis Guerin, and Sebastien Jean, *Market Access Liberalisation in the Doha Round: Scenarios and Assessment*, Working Paper No. 2003-12 (Paris: Centre d'Etudes Prospectives et d'Informations Internationales, September 2003), Tables 5.1-5.4, pp. 29, 30, 32, and 33.

Notes: Model: The MIRAGE (Modelling International Relationships in Applied General Equilibrium) model, which is a dynamic general-equilibrium model. It includes investment effects but no productivity effects.

Data: The model is calibrated using version 5 of the Global Trade Analysis Project (GTAP) database, which has a base year of 1997. The study uses actual tariffs—not bound and not most-favored-nation tariffs. The reference year for tariffs is 1999, and that for all other

distortions is 1997. Hence, any changes in policy since those years are not reflected in the results.

Liberalization scenarios: All scenarios are phased in in equal increments over six years for developed countries and over 10 years for developing countries. Results presented are for 14 years after the liberalization agreement.

The "Uniform" scenario consists of a 35 percent reduction in all ad valorem tariff equivalents (of ad valorem tariffs, specific duties, tariff-rate quotas, prohibitions, and antidumping duties) at the six-digit Harmonized System level. All tariffs below 2 percent are eliminated.

The "Uniform, Except Peaks" scenario consists of a 35 percent reduction in all ad valorem tariff equivalents at the six-digit Harmonized System level except for nonagricultural tariffs that are higher than 15 percent and agricultural tariffs that are higher than 85 percent. All tariffs below 2 percent are eliminated.

The "Evening Out" scenario consists of a 35 percent reduction in all ad valorem tariff equivalents at the six-digit Harmonized System level except for nonagricultural tariffs that are higher than 15 percent and agricultural tariffs that are higher than 85 percent, and reduction of those higher tariffs to a level of $a * t / (a + t)$, where t is the starting tariff rate and a is chosen so as to make the result continuous with the lower tariff rates reduced by 35 percent ($a=28$ in manufacturing, and $a=158$ in agriculture). This scenario results in a more substantial reduction of the higher tariff rates than does the uniform scenario, thereby "evening out" the higher tariffs to bring them more in line with the lower ones. All tariffs below 2 percent are eliminated.

Table 4-7.

Estimated Static Effects on Factor Returns of a 33 Percent Reduction in Agricultural Import Tariffs, Domestic Support, and Export Subsidies, by Country or Region—Study by Brown, Deardorff, and Stern

(Percent)

Country or Region	Real Wage	Return to Capital
Developed Countries		
Australia and New Zealand	-0.182	-0.224
Canada	-0.218	-0.209
EU and EFTA	-0.045	0.023
Japan	-0.039	-0.003
United States	-0.190	-0.193
Developing Countries		
Asia		
India	-0.109	-0.030
Sri Lanka	-0.307	-0.480
Rest of South Asia	-0.078	-0.119
China	-0.163	-0.320
Hong Kong	-0.186	-0.180
South Korea	0.132	0.134
Singapore	-0.038	-0.068
Indonesia	-0.113	-0.462
Malaysia	0.189	0.104
Philippines	-0.062	-0.076
Thailand	-0.703	0.054
Other		
Mexico	-0.354	-0.185
Turkey	-0.327	-0.347
Central Europe	-0.363	-0.391
Central and South America	-0.252	-0.358

Source: Drusilla K. Brown, Alan V. Deardorff, and Robert M. Stern, "Computational Analysis of Multilateral Trade Liberalization in the Uruguay Round and Doha Development Round," Discussion Paper No. 489 (Ann Arbor, Mich.: University of Michigan, School of Public Policy, Research Seminar in International Economics, December 8, 2002), Table 4.

Notes: Model: The Michigan Model of World Production and Trade, which is a static general-equilibrium model that has 21 countries/regions and 18 production sectors, of which agriculture is one sector. The model incorporates some aspects of the "New Trade Theory," including increasing returns to scale, monopolistic competition, and product heterogeneity.

Data: Version 4 of the Global Trade Analysis Project (GTAP) database, which has a base year of 1995. The study updates the base year in a very rough fashion to 2005. To estimate what the values of major economic variables would have been in 2005 in the absence of the Uruguay Round Agreement, the study makes projections based on growth rates contained in the 1999 edition of *World Development Indicators* and the 1998-1999 edition of *World Development Report*, both published by the World Bank. The study then simulates the liberalization agreed to in the Uruguay Round Agreement. The end point of that simulation is used as the starting point for the simulation that produces the estimates given in this table. As such, the policies that are liberalized to produce the estimates presented here presumably do not reflect the admission of China and Taiwan into the World Trade Organization and the expansion of the European Union to 25 countries. Moreover, they would not reflect any other changes in applied tariffs that occurred between 1995 and 2005 that were not required by the Uruguay Round Agreement.

Liberalization scenario: A 33 percent reduction in agricultural import tariffs, domestic production subsidies, and export subsidies.

Table 4-8.

Estimated Welfare Effects of Full Agricultural Liberalization, by Liberalizing and Benefiting Regions—2006 World Bank Study, LINKAGE Model Analysis

(Billions of 2001 dollars)

	Liberalizing Region		
Benefiting Region	High-Income Countries	Developing Countries	All Regions
High-Income Countries	109	19	128
Developing Countries	26	28	54
Total	135	47	182

Source: Kym Anderson, Will Martin, and Dominique van der Mensbrugghe, "Market and Welfare Implications of Doha Reform Scenarios," Chapter 12 in Kym Anderson and Will Martin, eds., *Agricultural Trade Reform and the Doha Development Agenda* (New York: Palgrave Macmillan and the World Bank, 2006), Table 12.6, p. 349.

Notes: Welfare effects are measured by equivalent variation. Small interaction effects are distributed proportionately, and numbers are rounded to sum to 100 percent.

Model: A version of the World Bank's LINKAGE model with 27 regions and 25 economic sectors. Agriculture and food comprise 13 of the 25 sectors. Exogenously imposed growth in populations, labor forces, and productivity causes countries' economies and trade to grow over time even with no liberalization. The simulations include static effects plus investment effects resulting from the influence of liberalization on household saving and on the prices of investment goods.

Data: Release 6.05 of the Global Trade Analysis Trade Project (GTAP) data set, which has a base year of 2001. However, the baseline simulation also includes major changes in trade policy through 2005, including the final stages of implementation of the Uruguay Round Agreement, tariff reductions made by China and Taiwan as conditions of their accession to the World Trade Organization, and enlargement of the European Union to 25 members. Unlike previous GTAP releases, Release 6.05 includes bilateral and unilateral trade preferences.

Liberalization scenario simulated: The phased elimination from 2005 through 2010 of all subsidies, tariffs, and other trade-distorting measures in all goods sectors. The welfare-effect estimates are for the year 2015.

Table 4-9.

Estimated Welfare Effects of Full Agricultural Liberalization, by Liberalizing and Benefiting Regions—2002 World Bank Study

(Billions of 1997 dollars)

	Liberalizing Region		
Benefiting Regions	High-Income Countries	Low- and Middle-Income Countries	All Regions
	Simulations Without Productivity Effects		
High-Income Countries	73	23	106
Low- and Middle-Income Countries	31	114	142
Total	104	136	248
	Simulations With Productivity Effects		
High-Income Countries	144	53	196
Low- and Middle-Income Countries	99	294	390
Total	243	346	587

Source: World Bank, "Envisioning Alternative Futures: Reshaping Global Trade Architecture for Development," Chapter 6 in *Global Economic Prospects and the Developing Countries 2002* (Washington, D.C.: World Bank), Table 6.1, p. 171.

Notes: Welfare effects are measured by equivalent variation.

Model: A version of the World Bank's LINKAGE model with 15 regions and 20 economic sectors. Exogenously imposed growth in populations, labor forces, and productivity causes countries' economies and trade to grow over time even with no liberalization. The simulations without productivity effects include static effects plus investment effects resulting from the influence of liberalization on household saving and on the prices of investment goods. The simulations with productivity include those effects plus effects of liberalization on productivity.

Data: Version 5 of the Global Trade Analysis Project (GTAP) data set, which has a base year of 1997. Hence, the starting point for liberalization is the policies that existed in that year.

Liberalization scenario simulated: In each year from 2005 through 2010, all tariffs, domestic production subsidies, and export subsidies in all goods sectors are reduced by one-sixth of their preliberalization levels, ending with their complete elimination. The numbers presented are the component of the resulting welfare effect in 2015 that is attributed by the study to liberalization of the agriculture and food sector.

Table 4-10.

Estimated Effects of Full Liberalization of All Goods on Agriculture and Food Trade, by Exporting and Importing Country Groups—2006 World Bank Study, LINKAGE Model Analysis

(Billions of 2001 dollars)

	Importing Country Group		
Exporting Country Group	**High-Income Countries**	**Developing Countries**	**World**
High-Income Countries	54	50	104
Developing Countries	133	77	210
World	186	128	314

Source: Kym Anderson, Will Martin, and Dominique van der Mensbrugghe, "Market and Welfare Implications of Doha Reform Scenarios," Chapter 12 in Kym Anderson and Will Martin, eds., *Agricultural Trade Reform and the Doha Development Agenda* (New York: Palgrave Macmillan and the World Bank, 2006), Table 12.16, p. 377.

Notes: Model: A version of the World Bank's LINKAGE model with 27 regions and 25 economic sectors. Agriculture and food comprise 13 of the 25 sectors. Exogenously imposed growth in populations, labor forces, and productivity causes countries' economies and trade to grow over time even with no liberalization. The simulations include static effects plus investment effects resulting from the influence of liberalization on household saving and on the prices of investment goods.

Data: Release 6.05 of the Global Trade Analysis Project (GTAP) data set, which has a base year of 2001. However, the baseline simulation also incorporates major changes in trade policy through 2005, including the final stages of implementation of the Uruguay Round Agreement, tariff reductions made by China and Taiwan as conditions of their accession to the World Trade Organization, and the enlargement of the European Union to 25 members. Unlike previous GTAP releases, Release 6.05 includes bilateral and unilateral trade preferences.

Liberalization scenario simulated: The phased elimination from 2005 through 2010 of all subsidies, tariffs, and other trade-distorting measures in all goods sectors. The trade-effect estimates are for the year 2015.

Table 4-11.

Estimated Static Effects on Developing Countries' Agricultural Trade of Full Agricultural Liberalization, by Liberalizing Country Group—Economic Research Service Study

(Percent)

	Liberalizing Country Group				
	Developed Countries			Developing Countries	All Countries
Developing-Country Trade Component	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: Mary E. Burfisher, ed., *Agricultural Policy Reform in the WTO—The Road Ahead*, Agricultural Economic Report No. 802 (U.S. Department of Agriculture, Economic Research Service, Market Trade Economics Division, May 2001), Table 16, p. 21.

Notes: Model: The Economic Research Service's own model with 12 countries/regions, nine production sectors relating to agriculture and food, and other production sectors aggregated together. The model does not have exogenously imposed growth in populations, labor forces, or productivity. The only growth in countries' economies and trade over time is that resulting from the liberalization being modeled. Consequently, the results of liberalization simulations are compared with corresponding values in the base year before liberalization instead of with a baseline.

Data: The model is calibrated using data from version 5.2 of the Global Trade Analysis Project (GTAP) data set, which has a base year of 1997. The study is based on 1998 levels of applied agricultural tariffs, domestic support and export subsidies, and tariff-rate quotas. Tariffs are from the Agriculture Market Access Database. Bound tariffs are used where applied rates are not available. Domestic support numbers are from the producer support estimates published by the Organisation for Economic Co-operation and Development. Export subsidies are from member countries' reports to the World Trade Organization (WTO).

Liberalization scenario: All tariffs and tariff equivalents of nontariff barriers are eliminated for all WTO members, as are all export subsidies. (Notably, this liberalization excludes China, which was not a WTO member when the study was published.) Domestic support in Australia, New Zealand, Japan, South Korea, the United States, Canada, the European Union, and three countries in the European Free Trade Association (EFTA) is eliminated. Those countries provided between 90 percent and 92 percent of the domestic support reported by members to the WTO for 1998, depending on which three of the four members of the EFTA are referred to.

Table 4-12.

Estimated Output Effects of Full Removal of All Agricultural Distortions in High-Income Regions, by Product and Country—Study by Beghin, Roland-Holst, and van der Mensbrugghe

(Percentage change in 2015)

Product	Low- and Middle-Income Countries	United States	Western Europe	High-Income Asia	Canada	Australia and New Zealand
Dairy Products	15.2	1.1	-16.1	-50.5	-16.6	82.0
Other Meat Products	14.3	2.4	-18.5	-20.5	-10.5	3.7
Refined Sugar	13.2	-45.6	-65.4	-59.0	32.0	-2.2
Bovine Meat Products	12.8	3.1	-36.4	-8.8	9.8	57.2
Bovine Cattle, etc.	9.5	5.3	-39.8	-27.2	12.7	30.9
Other Cereal Grains	8.5	-0.1	-51.2	-60.8	-0.9	-6.4
Wheat	7.0	4.2	-44.0	-77.1	43.3	12.0
Raw Sugar	6.1	-45.4	-43.3	-58.6	23.5	-2.2
Raw Milk	5.7	1.0	-15.7	-40.9	-12.1	73.3
Oil Seeds	5.1	-9.9	-31.2	-44.3	17.9	10.2
Agriculture	3.6	2.7	-22.3	-24.4	6.4	26.2
Agriculture and Food	3.4	0.7	-13.4	-6.7	0.2	25.4
Processed Foods	3.2	-0.2	-10.1	-0.9	-3.4	24.8
Other Livestock	2.9	1.3	-15.6	-2.4	-14.8	-7.6
Paddy Rice	1.9	473.5	-71.4	-63.7		1,285.7
Other Crops	1.7	-10.7	1.6	-12.0	-3.3	10.0
Vegetables and Fruits	1.1	4.6	-11.3	-5.0	-2.4	-5.2
Vegetable Oils and Fats	0.6	-3.2	-7.0	45.5	-1.7	-5.6
Construction	0.1	0.0	0.1	0.0	0.3	1.0
Total	0.1	0.0	0.0	0.1	-0.1	0.6

Continued

Table 4-12.

Continued

Product	Low- and Middle-Income Countries	United States	Western Europe	High-Income Asia	Canada	Australia and New Zealand
Electricity and Gas	0.0	0.2	0.4	0.3	-0.1	-0.6
Plant-Based Fibers	-0.2	1.9	19.1	104.0		-18.6
Other Services	-0.2	0.0	0.5	0.2	0.1	-0.2
Services	-0.2	0.0	0.5	0.2	0.1	-0.2
Other Natural Resources	-0.3	0.3	1.8	1.7	-0.3	-5.5
Manufacturing	-0.6	-0.1	1.2	0.5	-0.3	-3.2
Textiles, Leather, and Apparel	-0.8	0.3	2.7	1.6	-0.4	-7.2
Chemicals, Plastic, Rubber	-0.8	-0.1	1.3	0.4	-0.6	-4.1
Other Manufacturing	-0.8	-0.1	1.4	0.6	-0.6	-4.2
Fossil Fuels	-0.9	0.6	3.2	2.4	0.8	-6.1
Other Processed Food, Beverages, Tobacco	-0.9	-0.4	-0.7	3.5	-1.9	-4.0

Source: John C. Beghin, David Roland-Holst, and Dominique van der Mensbrugghe, *Global Agricultural Trade and the Doha Round: What Are the Implications for North and South?*, Working Paper 02-WP 308 (Ames, Iowa: Iowa State University, Center for Agricultural and Rural Development, June 2002), Table 3, pp. 14-15.

Notes: Loss in value is net of agricultural subsidies.

A blank space indicates that the study presents no estimate for the effect in question.

Model: A version of the World Bank's LINKAGE model with 14 countries/regions and 25 sectors. Agriculture and food comprise 17 of the 25 sectors. Exogenously imposed growth in populations, labor forces, and productivity causes countries' economies and trade to grow over time even with no liberalization.

Data: Version 5.3 of the Global Trade Analysis Project (GTAP) database, which has base years of 1997 for economic variables and 1998 for policy variables.

Liberalization scenario: The "Removal of All Protection" scenario, which involves the removal of all distortions—output subsidies, input subsidies, land and capital subsidies, export subsidies, and import tariffs—in high-income countries, which are defined to include Australia and New Zealand, Canada, the European Union, the European Free Trade Association, high-income Asia, and the United States. The liberalization is phased in between 2005 and 2010, with one-sixth of the relevant benchmark policy eliminated in each year. The numbers presented are the output effects in 2015.

Table 4-13.

Estimated Product-Specific Static Effects on U.S. Agricultural Output of Global Full Agricultural Liberalization—Study by Cooper, Johansson, and Peters

(Percent)

Product	Output Volume	Output Value
Corn	2.4	13.9
Other Coarse Grains	1.7	10.9
Poultry Meat	1.6	10.5
Beef and Veal	-0.1	8.1
Pork	0.0	5.0
Soybeans	-0.7	3.9
Wheat	-0.1	2.5
Cotton	0.0	2.1
Rice	-1.2	-0.8
Other Dairy	1.9	-1.1
Fluid Milk	1.7	-1.2
Nonfat Dry Milk	-15.0	-1.6
Cheese	-0.6	-1.9
Butter	-15.0	-12.0
Whole Dry Milk	-31.6	-13.4
Total	0.27	4.23

Source: Joseph Cooper, Robert Johansson, and Mark Peters, "Some Domestic Environmental Effects of U.S. Agricultural Adjustments Under Liberalized Trade: A Preliminary Analysis" (paper presented to an international conference titled *Agricultural Policy Reform and the WTO: Where Are We Heading?*, Capri, Italy, June 23-26, 2003), Table 1, p. 28.

Notes: Model: The Economic Research Service/Penn State trade model, which is a dynamic partial-equilibrium model of policy and trade with four countries/regions—the United States, the European Union (15), Japan, and the rest of the world—and 21 commodities, including seven crops, four oilseed products, four livestock products, and five processed dairy products.

Data: The Agricultural Market Access Database; the U.S. Department of Agriculture's Production, Supply, and Distribution database; and sources from various countries modeled. Base year for the data is 2000.

Liberalization scenario: Elimination of all policies distorting agricultural trade. The estimates presented are effectively static estimates. Although the model is dynamic, the dynamics are solely for projecting the path from one long-term equilibrium to another.

Table 4-14.

Estimated Product-Specific Effects on U.S. Agriculture of Two Agricultural Liberalization Scenarios—FAPRI Study

(Percent)

Product	Output Volume	Consumption Volume	Export Volume	Import Volume
		Full Agricultural Liberalization		
Nonfat Dry Milk	16.	-9.8	62.19	
Peanuts	5.84	8.47	-16.38	
Butter	4.7	3.1		-100.
Corn	1.99	2.32	1.16	
Soybean Oil	1.96	-0.63	18.23	
Soybean Meal	1.96	5.13	9.60	
Wheat	-0.09	0.05	0.25	
Cheese	-0.3	-1.		-58.
Soybeans	-0.85	1.72	-5.78	
Cotton	-2.3	-5.03	0.9	
Rice	-40.4	-0.95	-146.7	
Pork			215.	
Broilers			29.00	
		Removal of Border Measures Only		
Nonfat Dry Milk	14.	-4.7	84.06	
Peanuts	8.94	-2.40	90.99	
Butter	3.6	2.2		-88.
Soybean Oil	1.82	-0.83	18.81	
Soybean Meal	1.82	5.61	-12.00	
Corn	1.59	2.81	-2.46	
Wheat	0.61	-1.20	3.39	

Continued

Table 4-14.

Continued

Product	Output Volume	Consumption Volume	Export Volume	Import Volume
		Removal of Border Measures Only (Continued)		
Cheese	0.5	-2.		-73.
Soybeans	-0.68	1.61	-5.33	
Rice	-0.9	-0.42	-2.1	
Cotton	-2.9	-3.22	0.4	
Beef				-14,896.
Pork			221.	
Broilers			30.07	

Source: Food and Agricultural Policy Research Institute, *The Doha Round of the World Trade Organization: Appraising Further Liberalization of Agricultural Markets*, Iowa State University and University of Missouri-Columbia Working Paper 02-WP 317 (Ames, Iowa: Iowa State University, Center for Agricultural and Rural Development, November 2002), Tables A.3-A.46 and B.1-B.44.

Notes: FAPRI = Food and Agricultural Policy Research Institute, which has research centers at Iowa State University and the University of Missouri-Columbia.

A blank space indicates that the study presents no estimate for the effect in question.

The study presents changes in trade for each product only for selected countries. Presumably, all changes that are in some sense substantial are presented. However, the study does not explicitly say that, so the United States might have changes in exports or imports of some products that are not indicated in the table.

The change of -146.7 percent for rice under the "Full Agricultural Liberalization" scenario represents a change from net exports to net imports. The change of -14,896 for beef under the "Removal of Border Measures Only" scenario represents a change from net imports to net exports.

Model: The FAPRI multimarket world agricultural model. The model is an econometric forecasting model, not a general-equilibrium model. Macroeconomic variables such as real gross domestic product (GDP), the GDP deflator, population, and exchange rates are not determined by the model; rather, forecasts of those variables are exogenous inputs to the model. The model captures numerous linkages among different agricultural sectors but does not take into account feedback effects from liberalization in other sectors.

Data: The baseline scenario is the one established for the FAPRI 2002 World Agricultural Outlook. It incorporates the Uruguay Round Agreement on Agriculture, the Berlin Accord on Agenda 2000 reforms to the European Union's Common Agricultural Policy, the 1996 U.S. Federal Agriculture Improvement and Reform Act, and the accessions of China and Taiwan to the World Trade Organization. It does not incorporate the 2002 U.S. Food Security and Rural Investment Act, assuming instead a simple extension of 1996 farm legislation.

Liberalization scenario: The "Full Agricultural Liberalization" scenario involves the complete elimination of all trade restrictions, production subsidies, and export subsidies simultaneously and instantaneously in 2002. The "Removal of Border Measures Only" scenario involves the complete elimination of all trade restrictions and export subsidies simultaneously and instantaneously in 2002. Estimates presented are for 2011.

Table 4-15.

Estimated Product-Specific Effects on U.S. Agriculture of Full Agricultural Liberalization by High-Income Countries—Study by Beghin, Roland-Holst, and van der Mensbrugghe

(Percent)

Product	Output Volume	Export Volume	Import Volume
Paddy Rice	473.5	2,543.5	101.5
Bovine Cattle, etc.	5.3	212.4	11.4
Vegetables and Fruits	4.6	31.9	2.7
Wheat	4.2	13.4	33.1
Bovine Meat Products	3.1	47.8	16.5
Other Meat Products	2.4	27.6	6.5
Plant-Based Fibers	1.9	4.7	-3.0
Other Livestock	1.3	-1.3	-0.6
Dairy Products	1.1	150.0	92.4
Raw Milk	1.0		18.9
Other Cereal Grains	-0.1	-12.5	16.8
Other Processed Food, Beverages, Tobacco	-0.4	-7.8	0.5
Vegetable Oils and Fats	-3.2	-4.8	15.2
Oil Seeds	-9.9	-15.6	64.4
Other Crops	-10.7	15.1	27.1
Raw Sugar	-45.4	a	a
Refined Sugar	-45.6	213.7	133.0

Source: John C. Beghin, David Roland-Holst, and Dominique van der Mensbrugghe, *Global Agricultural Trade and the Doha Round: What Are the Implications for North and South?*, Working Paper 02-WP 308 (Ames, Iowa: Iowa State University, Center for Agricultural and Rural Development, June 2002), Table 5, pp. 20-21.

Notes: Model: A version of the World Bank's LINKAGE model with 14 countries/regions and 25 sectors. Agriculture and food comprise 17 of the 25 sectors. Exogenously imposed growth in populations, labor forces, and productivity causes countries' economies and trade to grow over time even with no liberalization.

Data: Version 5.3 of the Global Trade Analysis Project (GTAP) database, which has base years of 1997 for economic variables and 1998 for policy variables.

Liberalization scenario: The "Removal of All Protection" scenario, which involves the removal of all distortions—output subsidies, input subsidies, land and capital subsidies, export subsidies, and import tariffs—in high-income countries, which are defined to include Australia and New Zealand, Canada, the European Union, the European Free Trade Association, high-income Asia, and the United States. The liberalization is phased in between 2005 and 2010, with one-sixth of the relevant benchmark policy eliminated in each year. The numbers presented are the output effects in 2015.

a. The data set does not distinguish between raw sugar and refined sugar in trade.

Table 4-16.

Estimated Product-Specific Effects on U.S. Agricultural Trade of a Global 36 Percent Reduction in All Policies Distorting Agricultural Trade—Study by Roberts and Others

(Percent)

Product	Export Value	Import Value
Live Cattle, Sheep, and Wool	60	5
Rice	58	-5
Beverages and Tobacco	19	14
Other Grains	17	4
Beef and Veal	14	3
Other Meat Products	12	-2
Oilseeds	9	4
Other Animal Products	7	0
Other Crops	6	3
Wheat	5	12
Dairy Products	4	23
Other Food Products	3	2
Vegetables, Fruit, and Nuts	2	2
Vegetable Oils and Fats	-2	3
Sugar		24

Source: Ivan Roberts and others, *Reforming World Agricultural Trade Policies*, Australian Bureau of Agricultural and Resource Economics Research Report 99.12 and Rural Industries Research and Development Corporation Publication No. 99/96 (September 1999), Table 3, p. 39, and Table 4, p. 40.

Notes: A blank space indicates that the study presents no estimate for the effect in question.

Model: The Global Trade Analysis Project (GTAP) static general-equilibrium model, with 24 countries/regions and 22 commodities.

Data: Version 4 of the GTAP database (modified slightly to improve the data representation of policies where necessary), which has a base year of 1995.

Liberalization scenario: The liberalization modeled is a 36 percent reduction in all forms of agricultural support, restrictions on market access (in tariff equivalents), export subsidies, and domestic support.

Table 4-17.

Estimated Product-Specific Effects on U.S. Agriculture of Tariff-Rate Quota Liberalization—Tsigas and Ingco Study

Product	Output (Percent)	Trade Balance (Millions of Dollars)
Rice	1.6	15
Other Grains	1.4	839
Nongrains	1.2	510
Livestock	0.5	5
Meat, Milk	0.7	856
Other Food	0.9	1,284

Source: Marinos E. Tsigas and Merlinda Ingco, *Market Access Liberalization for Food and Agricultural Products: A General Equilibrium Assessment of Tariff-Rate Quotas*, Working Paper No. 2001-10-A (Washington, D.C.: U.S. International Trade Commission, Office of Economics, October 2001), Table 3, p. 15.

Notes: Model: The Global Trade Analysis Project (GTAP) static general-equilibrium model extended to allow analysis of tariff-rate quotas. The model has 17 regions and 10 trade commodities. Four of the 10 are primary agricultural commodities, and two are processed food products.

Data: The study begins with GTAP data for 1995 and 1996 and runs a simulation for the reforms agreed to in the Uruguay Round Agreement that were implemented from 1995 through 2000: (1) an increase in quota levels by about 66 percent to simulate the increase in quotas from 3 percent of domestic production to 5 percent of domestic consumption; (2) a cut in the over-quota tariffs imposed by developed regions by 36 percent and the over-quota tariffs imposed by developing regions by 24 percent; and (3) a cut in export subsidies by the same percentages that over-quota tariffs are cut in an attempt to equalize the domestic prices of imported and exported commodities (as in initial equilibrium). The end point of that simulation is then used as the starting point for the simulation that produces the results in this table. Thus, the effective base year for tariff-rate quotas for the simulation for this table is 2000.

Liberalization scenario: Trade liberalization scenario consists of the combination of a 15 percent reduction both in the within-quota tariffs and over-quota tariffs of tariff-rate quotas and in export taxes for agricultural and food commodities from their 2000 estimated levels. Estimates presented are for static effects.

Table 4-18.

Estimated Product-Specific Effects on U.S. Agricultural Trade of Two Global Domestic-Subsidy Reduction Scenarios—Economic Research Service Study

(Millions of 1997 dollars)

Product	Trade Balance	Exports	Imports
		20 Percent Reduction in Amber-Box Bounds	
Oilseeds	222.6	222.4	-0.2
Coarse Grains	149.5	136.0	-13.9
Other Livestock	145.5	145.0	-0.5
Wheat	141.6	140.5	-1.1
Beef	139.4	126.0	-13.4
Fruit and Vegetables	57.3	65.1	7.8
Dairy Products	51.1	50.5	-0.6
Rice	24.1	23.9	-0.2
Processed Foods	10.9	3.3	-7.6
Cotton and Fiber	1.8	1.8	0.0
Sugar	1.7	1.3	-0.4
Other Crops	-23.4	-12.1	11.3
Total	922.2	903.5	-18.7
		Reduction of Product-Specific Amber-Box Bounds to No More than 30 Percent of the Value of Production	
Beef	325.2	286.2	-39.0
Rice	261.4	263.0	1.6
Wheat	130.3	134.0	3.7
Coarse Grains	88.8	63.4	-25.4
Fruit and Vegetables	77.5	75.4	-2.1
Oilseeds	41.6	41.6	0.0
Other Livestock	25.1	23.5	-1.6
Dairy Products	23.2	197.0	173.8
Cotton and Fiber	16.0	15.9	-0.1
Other Crops	-24.5	-20.8	3.7
Processed Foods	-57.6	-39.5	18.1
Sugar	-106.4	4.9	111.3
Total	800.5	1,044.5	244.0

Source: C. Edwin Young and others, "Options for Reducing the Aggregate Measurement of Support in OECD Countries," Chapter 4 in Mary E. Burfisher, ed., *Agricultural Policy Reform in the WTO—The Road Ahead*, Agricultural Economic Report No. 802 (U.S. Department of Agriculture, Economic Research Service, Market Trade Economics Division, May 2001), Tables 4-6 and 4-7, p. 76.

Notes: Model: The Global Trade Analysis Project (GTAP) static general-equilibrium model.

Data: The model is calibrated to version 5.2 of the GTAP data set, which has a base year of 1997. Subsidy rates from which liberalization begins are those existing in 1998.

Liberalization scenario: All members of the World Trade Organization (WTO) reduce their amber-box subsidies as indicated in the table. (At the time the study was published, China was not a member of the WTO.) Estimates are for static effects.

Table 4-19.

Estimated Product-Specific Effects of Global Export Subsidy Elimination on the United States—OECD Study

(Percent)

Product	U.S. Export Volume	World Prices
Butter	-100	26
Skimmed Milk Powder	-46	9
Cheese	-5	
Milk	-1	
Whole Milk Powder		15
Beef (Argentina)		1
Beef (United States)		-1
Pork (United States)		0
Wheat		-1
Maize		1
Oilseed		-4

Source: Organisation for Economic Co-operation and Development, *A Forward Looking Analysis of Export Subsidies in Agriculture* (Paris: OECD, January 6, 2001), Table 2, p. 20.

Notes: A blank space indicates that the study presents no estimate for the effect in question.

Model: The Organisation for Economic Co-operation and Development's Aglink model, which is a structural econometric model representing selected OECD member, nonmember, and world markets for certain traded agricultural commodities.

Data: Subsidy notifications by member countries to the World Trade Organization as summarized in *Export Subsidies: Background Paper by the Secretariat*, World Trade Organization document number G/AG/NG/S/5, and in *Market Access, Domestic Support, and Export Subsidy Aspects of the Uruguay Round Agreement on Agriculture: Implementation in OECD Countries*, OECD document number COM/AGR/TD/WP(2000)/89/FINAL. The most recent notifications are for the 1998-1999 Global Agreement on Tariffs and Trade year or the 1998 calendar year. Subsidy numbers used are the actual export subsidies not the export subsidy bounds.

Liberalization scenario: All export subsidies are eliminated by all countries in equal steps from 2001 through 2005. Estimates are deviations from a baseline in 2005.

Table 4-20.

Estimated Effects of Global Full Liberalization of Policies That Distort Trade in Sugar—Elobeid and Beghin Study

(Percent)

Country or Region	Production Volume	Export Volume	Import Volume	Consumption Volume	Price, FOB Caribbean	Price, New York Spot
Net Exporters						
Argentina	1.82	78.83		-2.42		
Australia	9.81	12.66		-4.77		
Brazil	17.89	43.66		-8.68		
Colombia	-1.24	-2.61		-0.37		
Cuba	25.37	32.42		-7.75		
EU	-59.56	-263.04		2.87		
India	-2.54	-169.42		0.88		
Mexico	-6.90	-29.78		-7.29		
Pakistan	7.95	-123.60		-5.39		
South Africa	5.92	12.13		-0.40		
Thailand	-0.72	-1.73		1.13		
Net Importers						
Algeria	6.70		-4.18	-4.09		
Canada	2.15		-4.24	-3.78		
China	8.78		-71.02	-6.81		
Eastern Europe	-7.97		27.20	1.63		
Egypt	8.27		-44.36	-11.16		
Former Soviet Union	2.16		-0.93	0.12		
Indonesia	72.93		-63.56	-7.14		
Iran	3.97		-5.39	-2.64		
Japan	-83.71		51.11	1.39		

Continued

Table 4-20.

Continued

Country or Region	Production Volume	Export Volume	Import Volume	Consumption Volume	Price, FOB Caribbean	Price, New York Spot
Malaysia	40.19		-11.32	-6.29		
Morocco	1.70		-8.53	-3.03		
Peru	0.22		143.35	-0.72		
Philippines	-4.62		43.57	0.48		
South Korea			5.37	5.30		
Turkey	68.78		-797.6	1.79		
United States	-4.62		9.51	0.15		
Venezuela	3.44		-35.49	-1.76		
Rest of the world			-33.35			
Total	-1.76	8.19	8.19	-1.93	47.94	-4.83

Source: Amani Elobeid and John C. Beghin, *Multilateral Trade and Agricultural Policy Reforms in Sugar Markets*, Working Paper 04-WP 356 (Ames, Iowa: Iowa State University, Center for Agricultural and Rural Development, July 2004), Tables B1 and B2, pp. 40-49.

Notes: FOB = free on board.

A blank space indicates that the study presents no estimate for the effect in question.

Model: The international sugar model at the Center for Agricultural and Rural Development, which is a dynamic partial-equilibrium econometric model with 29 countries/regions.

Data: Sugar production, consumption, and ending stocks obtained from PS&D View of the U.S. Department of Agriculture. Sugarcane and sugar-beet areas, and sugar, sugarcane, and sugar-beet production for most countries are from the Foreign Agricultural Service GAIN country reports, and from the Food and Agricultural Organization of the United Nations. Gross domestic products (GDPs), GDP deflators, populations, and exchange rates are from the International Monetary Fund and Global Insight. The study does not indicate the year of the most recent numbers.

Liberalization scenario: All trade barriers, domestic production subsidies, and export subsidies are removed in 2002/2003. The estimates are for effects in 2011/2012.

Table 4-21.

Estimated Effects on the United States of Sugar Trade Liberalization in the United States and the European Union—Koo Study

	Percentage Change
Production	
Beet sugar (Volume)	-13.3
Cane sugar (Volume)	-9.1
Consumption (Volume)	4.1
Imports (Volume)	56.6
Price	
Sugar beets	-12.6
Sugarcane	-15.6
Caribbean	38.5
Import	-15.8
Wholesale	-15.2
Retail	-13.5

Source: Congressional Budget Office based on Won W. Koo, *The U.S. Cane and Beet Sugar Industry Under Alternative Trade Liberalization Policy Options*, Agricultural Economics Report No. 434 (Fargo, N.D.: North Dakota State University, Department of Agricultural Economics, January 2000), Table 5, p. 18.

Notes: Model: A dynamic global partial-equilibrium econometric model of sugar production and trade, described in M. Benirschka, Won W. Koo, and J. Lou, *World Sugar Policy Simulation Model: Description and Computer Program Documentation*, Agricultural Economics Report No. 356 (Fargo, N.D.: North Dakota State University, Department of Agricultural Economics, 1996). Macroeconomic variables such as gross domestic product growth rates, interest rates, exchange rates, and inflation rates are not modeled but rather are exogenous inputs to the model.

Data: Base year for sugar data is 1999. Other inputs to the model are forecasts from the WEFA Group, Project Link, and the Food and Agricultural Policy Institute.

Liberalization scenario: Elimination of restrictions on imports of sugar in the United States and the European Union in 2001. Estimates are deviations from a baseline in 2004.

Table 4-22.

Estimated Effects of Removing Oilseed-Related Tariffs—Study by Meilke, Wensley, and Cluff

(Percent)

	Prices				Volumes			
Country or Region	Oilseed	Oilseed Oil	Oilseed Meal	Palm Oil	Oilseed Production	Oilseed Crush	Oilseed Oil Consumption	Oilseed Meal Consumption
Argentina	6.0	6.5	1.4	9.8	1.0	-3.2	-2.0	-0.2
Australia	1.3	1.3	1.6	9.8	0.5	1.2	-0.7	-0.5
Brazil	2.3	5.0	1.4	-0.1	1.2	1.9	-1.6	0.4
Canada	3.1	6.2	1.6	3.2	1.8	7.2	-1.8	0.0
China	3.2	-10.6	1.4	0.8	0.6	-13.9	1.6	0.4
EU(15)	2.2	6.2	1.5	4.6	0.1	4.0	-1.8	-0.3
Japan	2.1	-10.3	1.5	9.8	0.0	-24.3	2.0	-0.3
United States	2.3	5.0	1.4	9.8	0.5	3.6	-1.0	-0.2
Rest of the World	-7.8	-9.6	-3.8	-4.0	-3.0	2.7	1.9	1.5
World total	2.1	6.4	1.6	9.8	0.2	0.2	-0.1	0.3

Source: Karl Meilke, Mitch Wensley, and Merritt Cluff, "The Impact of Trade Liberalization on the International Oilseed Complex," *Review of Agricultural Economics*, vol. 23, no. 1 (Spring-Summer 2001), Tables 8 and 9, p. 11.

Notes: Model: A modified version of the Organisation for Economic Co-operation and Development's (OECD's) AGLINK model, which is a structural econometric model representing selected OECD member, nonmember, and world markets for certain traded agricultural commodities.

Data: From *The Agricultural Outlook 1997–2000*, published by the OECD in 1997.

Liberalization scenario: Elimination of tariffs but not nontariff barriers to trade, in 1996. Estimates are for 2001.

Bibliography

Anderson, Kym, Will Martin, and Dominique van der Mensbrugghe (a), "Market and Welfare Implications of Doha Reform Scenarios," Chapter 12 in Kym Anderson and Will Martin, eds., *Agricultural Trade Reform and the Doha Development Agenda* (New York: Palgrave Macmillan and the World Bank, 2006).

Anderson, Kym, Will Martin, and Dominique van der Mensbrugghe (b), "Global Impacts of the Doha Scenarios on Poverty," Chapter 17 in Thomas W. Hertel and L. Allan Winters, eds., *Putting Development Back into the Doha Agenda: Poverty Impacts of a WTO Agreement* (New York: Palgrave Macmillan and the World Bank, 2006).

Beghin, John C., David Roland-Holst, and Dominique van der Mensbrugghe, *Global Agricultural Trade and the Doha Round: What Are the Implications for North and South?* Working Paper 02-WP 308 (Ames, Iowa: Iowa State University, Center for Agricultural and Rural Development, June 2002).

Brown, Drusilla K., Alan V. Deardorff, and Robert M. Stern, *Computational Analysis of Multilateral Trade Liberalization in the Uruguay Round and Doha Development Round*, Discussion Paper No. 489 (Ann Arbor, Mich.: University of Michigan, School of Public Policy, Research Seminar in International Economics, December 8, 2002).

Buetre, Benjamin, and others, "Agricultural Trade Liberalization: Effects on Developing Countries' Output, Incomes, and Trade,"Australian Bureau of Agricultural and Resource Economics Project 110039 (paper presented to the Seventh Annual Conference on Global Economic Analysis, Trade, Poverty, and the Environment, Washington, D.C., June 17–19, 2004).

Burfisher, Mary E., "Overview," in Mary E. Burfisher, ed., *Agricultural Policy Reform in the WTO—The Road Ahead*, Agricultural Economic Report No. 802 (U.S. Department of Agriculture, Economic Research Service, Market Trade Economics Division, May 2001).

Cooper, Joseph, Robert Johansson, and Mark Peters, "Some Domestic Environmental Effects of U.S. Agricultural Adjustments Under Liberalized Trade: A Preliminary Analysis" (paper presented to an international conference titled *Agricultural Policy Reform and the WTO: Where Are We Heading?*, Capri, Italy, June 23-26, 2003).

de Gorter, Harry, and Erika Kliauga, "Reducing Tariffs Versus Expanding Tariff Rate Quotas," Chapter 5 in Kym Anderson and Will Martin, eds., *Agricultural Trade Reform and the Doha Development Agenda* (New York: Palgrave Macmillan and the World Bank, 2006).

Diao, Xinshen, Agapi Somwaru, and Terry Roe, "A Global Analysis of Agricultural Reform in WTO Member Countries," Chapter 1 in Mary E. Burfisher, ed., *Agricultural Policy Reform in the WTO—The Road Ahead*, Agricultural Economic Report No. 802 (U.S. Department of Agriculture, Economic Research Service, Market Trade Economics Division, May 2001).

Elobeid, Amani, and John C. Beghin, *Multilateral Trade and Agricultural Policy Reforms in Sugar Markets*, Working Paper 04-WP 356 (Ames, Iowa: Iowa State University, Center for Agricultural and Rural Development, July 2004).

Fontagne, Lionel, Jean-Louis Guerin, and Sebastien Jean, *Market Access Liberalisation in the Doha Round: Scenarios and Assessment*, Working Paper No. 2003-12 (Paris: Centre d'Etudes Prospectives et d'Informations Internationales, September 2003).

Food and Agricultural Policy Research Institute, *The Doha Round of the World Trade Organization: Appraising Further Liberalization of Agricultural Markets*, Iowa State University and University of Missouri-Columbia Working Paper 02-WP 317 (Ames, Iowa: Iowa State University, Center for Agricultural and Rural Development, November 2002).

Hart, Chad E., and John C. Beghin, "Rethinking Agricultural Domestic Support Under the World Trade Organization," Chapters 8 in Kym Anderson and Will Martin, eds., *Agricultural Trade Reform and the Doha Development Agenda* (New York: Palgrave Macmillan and the World Bank, 2006).

Hertel, Thomas W., and Roman Keeney, "What's at Stake: The Relative Importance of Import Barriers, Export Subsidies, and Domestic Support," Chapter 2 in Kym Anderson and Will Martin, eds., *Agricultural Trade Reform and the Doha Development Agenda* (New York: Palgrave Macmillan and the World Bank, 2006).

Hoekman, Bernard, Francis Ng, and Marcelo Olarreaga, *Reducing Agricultural Tariffs Versus Domestic Support: What's More Important for Developing Countries?* Policy Research Working Paper 2918 (Washington, D.C.: World Bank, October 2002).

Jean, Sebastien, David Laborde, and Will Martin, "Consequences of Alternative Formulas for Agricultural Tariff Cuts," Chapter 4 in Kym Anderson and Will Martin, eds., *Agricultural Trade Reform and the Doha Development Agenda* (New York: Palgrave Macmillan and the World Bank, 2006).

Jensen, Hans G., and Henrik Zobbe, "Consequences of Reducing AMS Limits," Chapter 9 in Kym Anderson and Will Martin, eds., *Agricultural Trade Reform and the Doha Development Agenda*, (New York: Palgrave Macmillan and the World Bank, 2006).

Koo, Won W., *The U.S. Cane and Beet Sugar Industry Under Alternative Trade Liberalization Policy Options*, Agricultural Economics Report No. 434 (Fargo, N.D.: North Dakota State University, Department of Agricultural Economics, January 2000).

Meilke, Karl, Mitch Wensley, and Merritt Cluff, "The Impact of Trade Liberalization on the International Oilseed Complex," *Review of Agricultural Economics*, vol. 23, no. 1 (Spring-Summer 2001), pp. 2-17.

Organisation for Economic Co-operation and Development, *A Forward Looking Analysis of Export Subsidies in Agriculture* (Paris: OECD, January 6, 2001).

Roberts, Ivan, and others, *Reforming World Agricultural Trade Policies*, Australian Bureau of Agricultural and Resource Economics Research Report 99.12 and Rural Industries Research and Development Corporation Publication No. 99/96 (September 1999).

Tsigas, Marinos E., and Merlinda Ingco, *Market Access Liberalization for Food and Agricultural Products: A General Equilibrium Assessment of Tariff-Rate Quotas*, Working Paper No. 2001-10-A (U.S. International Trade Commission, Office of Economics, October 2001).

World Bank, "Envisioning Alternative Futures: Reshaping Global Trade Architecture for Development," Chapter 6 in *Global Economic Prospects and the Developing Countries, 2002* (Washington, D.C.: World Bank, 2002).

Young, C. Edwin, and others, "Options for Reducing the Aggregate Measurement of Support in OECD Countries," Chapter 4 in Mary E. Burfisher, ed., *Agricultural Policy Reform in the WTO—The Road Ahead*, Agricultural Economic Report No. 802 (U.S. Department of Agriculture, Economic Research Service, Market Trade Economics Division, May 2001).