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Anita Regmi, Mark Gehlhar, John Wainio, Thomas Vollrath, Paul Johnston, and Nitin Kathuria

Abstract

Market access remains a major impediment for expansion of global trade in high-value foods, particularly processed foods. Countries use tariffs and other measures that effectively stimulate imports of relatively unprocessed agricultural commodities at the expense of processed products. Tariff escalation, in which tariffs rise with the level of processing, discourages trade in high-value foods, and trade remedy measures, such as antidumping duties, are concentrated among high-value products. Globalization has provided countries with easier access to capital and technology needed to produce processed food, further affecting trade patterns and markets for high-value foods. A uniform cut in tariffs increases trade in high-value foods more than trade in raw agricultural commodities and improves real wages in developing and developed countries.

Keywords: Food trade, processed food, high-value foods, tariff, tariff escalation, trade remedy measures, sanitary and phytosanitary measures, safeguard measures, revealed comparative advantage, trade complementarities.

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Contents

Summary

Global production of high-value foods, particularly processed foods, grew rapidly for much of the last two decades; however, exports of processed foods remain at the same level as they were in the mid-1990s. The lack of growth in processed food trade is partly due to the preference of many manufacturers to locate production units close to their consumer bases rather than export the finished products. Market access barriers, such as tariffs, are also a significant obstacle to trade. For processed products, in particular, the protective effect of tariffs can be magnified through "tariff escalation," in which importing countries base tariff rates on the level of processing within a product, with primary products being levied the lowest rates.

In addition to, or in place of, tariffs, countries have at their disposal other measures that may encourage imports of relatively unprocessed agricultural commodities at the expense of more processed products, including sanitary and phytosanitary (SPS) measures as well as various forms of contingent protection measures (antidumping duties (AD), countervailing duties (CVD), and safeguards).

SPS notifications to the World Trade Organization (WTO) by member countries have steadily increased from 196 in 1995 to 855 in 2003. The animal and meat sector accounts for almost two-thirds of the total number of notifications on agriculture. These notifications may signal the imposition of a new procedure, rule, or requirement that may act as a barrier to trade, or the removal of such. Therefore, the increase in the number of notifications in itself does not indicate that SPS measures have been used to restrict trade in high-value products. However, WTO members have formally raised concerns that some of the SPS measures may have been designed to restrict trade. These concerns totaled 183 between 1995 and 2003, with the number increasing each year. Additionally, most of these complaints concerned high-value and processed food products, and only 2 percent of the complaints were for primary agricultural commodities.

The use of contingent protection is concentrated on high-value products. Fully processed products accounted for 55 percent of total AD measures and 73 percent of CVD measures in 2003. Of the total 43 agricultural safeguard measures implemented through October 2003, processed agricultural products accounted for 33, fresh fruits and vegetables accounted for 7, and primary agricultural commodities accounted for only 3. Likewise, of the 1,285 special agricultural safeguards (SSG) implemented through October 2004, processed foods and beverages accounted for two-thirds.

The use of contingent protection measures is no longer limited to developed countries. Developing countries increasingly use these measures and now account for a significant share of total AD, CVD, and safeguard measures in place. However, many developing countries did not reserve the right to use SSG, in conformity with WTO rules established at the Uruguay Round, and, therefore, lost their authority to use these instruments on products that underwent "tariffication," the conversion of nontariff barriers into equivalent bound tariffs.

Global trade patterns for land-based high-value foods, whose production is dependent upon particular resources, are relatively stable despite changes in the overall composition of food trade, shifts in the direction of this trade, and trade-balance reversals. By contrast, the pattern of trade for manufactured high-value foods, which can be produced anywhere capital and technology are available, is less predictable. Data also show that it can be difficult, and sometimes impossible, to gauge empirically the nature of bilateral complementarity of trade in processed products, given the absence of sufficiently detailed data required to capture the fine degree of specialization taking place within the food industry.

Cutting tariffs uniformly would boost trade in processed products more than trade in raw commodities. While the growth in global processing activity would enhance wages worldwide, the benefits would accrue disproportionately to developing countries, where a high share of labor is employed in the high-value food sector.

Market Access for High-Value Foods

Introduction

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[1] The authors are ERS economists, with the exception of Paul Johnston, who recently retired from the agency, and Nitin Kathuria, who is a management trainee at Marico Industries Ltd., Mumbai, India.

Global trade in high-value foods has grown significantly in the past three decades and now dwarfs raw agricultural commodity trade. High-value food, which in 1976 accounted for 30 percent of total U.S. agricultural trade and 48 percent of world agricultural trade, doubled in share of U.S. agricultural trade to 60 percent in 1994 and increased in share of world trade by 27 percentage points to 75 percent during the same period. From 1994 to 2002, however, U.S. trade in high-value food grew at a slower pace, registering growth of only 3 percentage points during the 9-year period and accounting for 63 percent of U.S. agricultural trade. Similarly, world trade in high-value food grew only 4 percentage points during the same period, reaching 79 percent of world agricultural trade in 2002. Although the potential for trade expansion remains great, market access is a major problem for countries exporting high-value foods, particularly processed foods, for which trade is still highly concentrated among few partners. Without improved access to global markets, the growth prospects for high-value food trade remain uncertain.

Food trade comprises traditional bulk commodities, such as wheat, rice, and corn; semi-processed products, such as flour and oils; horticultural products such as fresh fruits and vegetables and nursery products; and processed food products such as breakfast cereals and canned soups (see box on product groupings). Horticultural, processed, and semi-processed products are considered to be high-value products.

While the Uruguay Round of WTO negotiations laid the framework for subjecting food and agricultural trade to multilaterally agreed upon rules similar to those governing trade in industrial products, actual accomplishments in removing trade barriers have been more modest. In the market access area, countries agreed to upper limits on agricultural tariffs and timetables for reductions in these limits but were given much latitude to protect sensitive products from tariff reductions. Additionally, pre-Uruguay Round agricultural tariffs were much higher than tariffs on nonagricultural products and remain so even after the Uruguay Round reductions. More important, tariff protection remains highly uneven across both countries and products. Concerns have also been raised by some members that tariffs on processed and semi-processed products are generally higher than tariffs on primary commodities, reflecting efforts to protect domestic processing sectors.

In addition to tariffs, WTO members employ numerous other instruments to regulate the flow of imports, including sanitary and phytosanitary (SPS) measures as well as a number of trade remedy measures. High-value prod-

Description of Product Groupings

Primary bulk commodities

Description	HS code
Coffee	09011
Tea	0902
Coffee mate	0903
Wheat	1001
Rye	1002
Barley	1003
Oats	1004
Corn	1005
Rice	1006
Sorghum	1007
Other grains	1008
Soybeans	1201
Peanuts	1202
Oilseeds	1204-1207
Cotton linters	14042
Cocoa beans	1801
Tobacco	24011-24013
Cotton	5201-5203
Hemp	5302

Semi-processed

Live animals	0101-0106
Pig fat	0209
Hairs	0501-0503
Animal products	0504-0511
Dried, shelled beans	0713
Coffee husks	09019
Grain flours, groats	1101-1103
Starch	11081
Inulin	11082
Wheat gluten	1109
Copra	1203
Soy flour & meal	1208
Sowing seeds	1209
Roots, seeds cut/crushed	1211
Straw, husks, fodder	1213, 1214
Gum, lac, plant extracts	1301, 1302
Furnishing material	1401-1404
Animal fat	1501-1503, 1505, 1506
Vegetable oils	1507-1516
Inedible fats, oils	1518
Crude glycerol	1520
Wax	1521
Degras	1522
Sugar	17011
Cocoa products	1802-1806
Grain products	2301-2303
Oilseed cake	2304-2306
Plant waste material	2308
Pet food material	2309
Glycerol/sorbitol/mannitol	2905
Special plant oils	33011-33013, 33019
Proteins/gelatins/starches	3501-3505
Amylaceous substance	38091
Fatty acids, alcohols	3823-3824
Hides, skins	4101-4103
Fur	4301
Silk	5001-5003
Wool	5101-5103
Flax	530

Produce/horticulture

Description	HS code
Planting material	0601-0602
Cut flowers/plants	0603-0604
Vegetables	0701-0709
Roots, tubers	0714
Coconut	08011
Brazilnut	08012
Cashew nuts	08013
Other nuts	08021-08025, 08029
Fruit	0803-08010
Frozen fruit	08119
Dried fruit	08131-08135
Pepper	09041-09042
Vanilla	905
Cinnamon	09061-09062
Cloves	0907
Nutmeg	09081
Mace	09082
Cardamom	09083
Other seeds	09091-09095
Other spices	09101-09105
Spice mix	091091, 091099
Hops	12101, 12102
Stone fruit	12123
Sugarbeet	121291
Sugarcane	121292

Processed

Fresh, chilled meats	0201-0208
Processed meat	-210
Dairy products	0401-0406
Eggs and products	0407-0408
Honey	0409
Other animal products	0410
Processed vegetables	0710-0712
Processed fruit	0811-0812, 0814
Coffee	09012, 09014
Processed grains	1104-1107
Other vegetables	1212
Fish & animal oils	1504, 1517
Prepared meats	1601-1603
Sugar, sweeteners	1701-1704
Chocolates	1806
Flour preparations	1901
Pasta	1902
Tapioca	1903
Other preparations	1904-1905
Prepared vegetables	2001-2005
Prepared fruit	2006-2009
Extracts, essences, broths	2101-2106
Beverages	2201-2208
Vinegar	2209
Tobacco products	2402-2403
Other products	3502

Note: The Harmonized System (HS) provides a nomenclature for classifying internationally trade goods. The definitions of HS commodity groupings up to the 6-digit level are established by the World Customs Organization (*http://www.wcoomd.org/ie/En/en.html*).

ucts, unlike bulk commodities, are often ready-to-eat products and are generally more perishable in nature. They also require specialized shipping, packaging, and handling. These characteristics make high-value products subject to a higher degree of scrutiny regarding quality and food safety than bulk commodities. Partly because of such stringent requirements and partly because of the ease in catering to local consumer preferences, suppliers sometimes choose to invest and manufacture high-value food locally rather than export to a market, thereby affecting trade.

Although trade policy has the greatest effect on high-value food trade, other factors influence trade flows. Food trade patterns are shaped by underlying forces that affect consumer preferences and factors of food production. Countries specialize in and export those products that make use of their abundant inputs. Globalization of the food industry has enabled firms to have easier access to capital and technology, the two most important inputs used in the production of many high-value foods. Accordingly, food trade patterns are shifting in composition, partners, and net trade positions for many high-value foods.

A major goal of the ongoing Doha Round of the WTO negotiations is to improve market access for agricultural products, particularly high-value foods that suffer from tariffs that are generally much higher than the tariffs levied on primary agricultural commodities. The actual rates of cuts and the formula for cuts are yet undecided. However, for illustrative purposes, it is meaningful to examine how a uniform tariff cut across both primary and processed products can have varying trade impacts across countries and products, particularly high-value foods.

To better understand the forces affecting trade in high-value foods, this report examines current multilateral rules governing global trade in high-value foods, analyzes trade patterns by the content of trade, and evaluates the impact of improved market access by uniform reductions in global tariffs.

WTO Measures Affecting Market Access

The last round of multilateral trade negotiations, the Uruguay Round of 1986-94, resulted in the formation of the World Trade Organization (WTO) and the adoption of the Agreement on Agriculture (AoA), which subjects agricultural trade to stronger international disciplines. Though agricultural tariffs were bound to maximum applicable levels and reductions negotiated, agricultural tariffs remain a major distorting feature of international trade, and their global average is ten times the level of industrial tariffs (Gibson et al., 2001). Tariff rates are highly uneven across both countries and products, with many countries having bound a large proportion of their agricultural tariffs at low or duty-free levels while maintaining tariff peaks (megatariffs), often in excess of 100 percent, on import-sensitive products.

In addition to tariffs, WTO members have numerous other instruments at their disposal to regulate the flow of imports. Most notable are technical measures, including sanitary and phytosanitary (SPS) restrictions. Many of these measures restrict agricultural trade to protect a country from the introduction of diseases and pests that can threaten the health of plants, animals, and humans. Member countries can also limit imports for limited periods through a number of trade remedy measures, such as antidumping duties and countervailing duties, which allow WTO members to protect domestic industries from "unfair" foreign competition. Another trade remedy measure allowed under the WTO Agreement on Safeguards enables members to impose safeguards (by increasing a tariff or imposing a quantitative restriction) if they determine that a surge in imports causes or threatens to cause serious injury to a domestic industry. A related instrument created for agricultural trade under the Special Safeguards provision of the AoA permits members to impose additional duties on certain imports in times of sudden import surges or price drops. Tariffs, SPS restrictions, and contingency protective measures have varying impacts on market access for high-value foods.

Tariff Protection on High-Value Food Trade

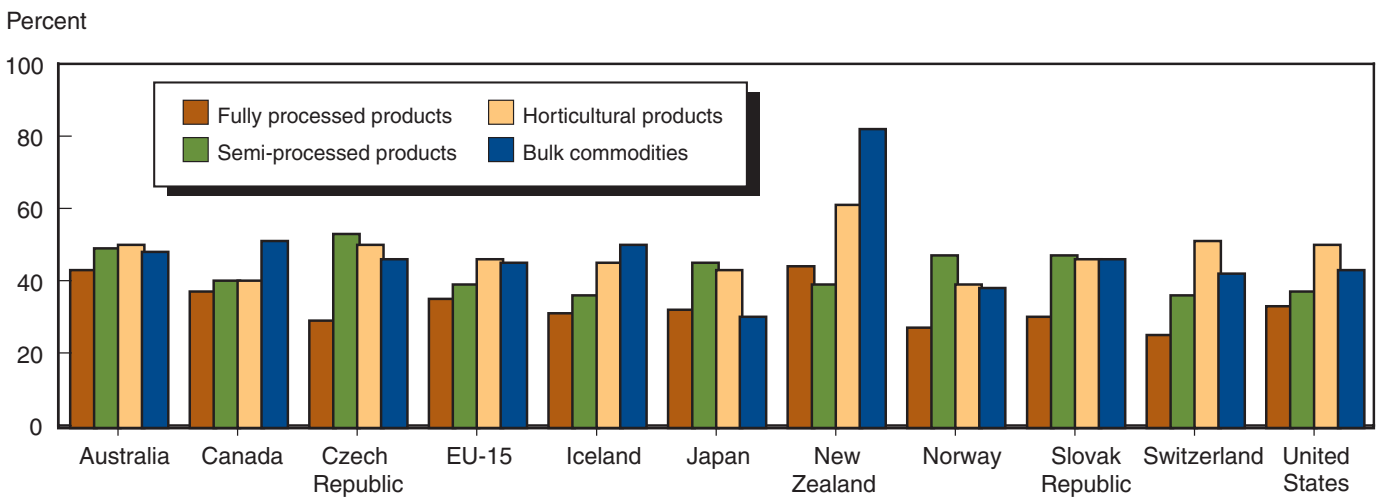
In the Uruguay Round AoA, countries agreed to convert their agricultural nontariff barriers to tariffs, a process known as tariffication. Developed countries agreed to reduce agricultural tariffs, including those resulting from tariffication, from their base-period rates by a total of 36 percent, on a simple-average basis, with a minimum cut of 15 percent for each tariff.[2] This tariff-cutting formula allowed countries considerable latitude in determining the depth of cuts applied to individual products. Since the subset of tariffs most critical to a country's agricultural sector is generally small, it was possible for countries to meet their overall tariff-cutting commitment while limiting the impact on tariffs on imports of politically sensitive commodities.

Without exception, member countries of the Organisation for Economic Cooperation and Development tended to cut tariffs on fully processed products by smaller amounts than on semi-processed or bulk commodities (fig. 1). For example, in Switzerland, the average tariff cut on imports of fully processed products was 25 percentage points less than the average cut on semi-processed products, while in New Zealand, the average cut on fully

[2] For tariffs that were already bound, the base was the current bound rate; for existing but unbound tariffs, the base was the 1986 tariff rate; and for over-quota duties that resulted from tariffication, the base was the level of protection provided by the nontariff barriers during 1986-88. In-quota duties were not subject to reduction.

Figure 1

Uruguay Round resulted generally in lower tariff cuts on processed products



Source: AMAD, 2003.

processed items was 38 percentage points below that on bulk commodities (see box on average weighted tariffs). Only 3 of the 11 countries reduced the simple average tariff on fully processed products by the required 36-percent average cut.

Tariff escalation, where duties imposed by an importing country increase with the level of processing, greatly affects countries producing and exporting raw materials since it impedes their efforts to develop processing industries for export, thereby affecting global trade in high-value foods. By encouraging imports of relatively unprocessed agricultural commodities at the expense of more processed products, importers can protect domestic processing industries and capture value added locally. Developing countries seeking to export processed foods have been vocal in supporting efforts to decrease tariff escalation in the current round of multilateral negotiations, the Doha Development Agenda.

In the current negotiations, a WTO proposal to discipline opportunities for discretionary decisions on tariff reductions by governments recommended that "where the tariff on a processed product is higher than the tariff for the products in its primary form, the rate of tariff reduction for the processed product shall be equivalent to that for the product in its primary form multiplied, at minimum, by a factor of [1.3] percent" (WTO, 2003a).[3] But, the eventual framework adopted by the WTO General Council on August 1, 2004, was much less specific, proposing only that tariff escalation "be addressed through a formula to be agreed" (WTO, 2004a).

Three post-Uruguay Round studies by Cernat et al. (2002); the U.S. International Trade Commission (2001); and Lindland (1997) attempted to measure the extent of tariff escalation by identifying various processing chains and examining whether tariffs increase as products undergo increased processing. All three studies concluded that tariff escalation was a significant problem in agricultural trade, particularly for vegetable oils, beef, eggs, cereal products, and tobacco products. In some sectors, such as dairy products and sugar products, while tariff escalation itself was not widespread,

[3] Bracket indicates that the figure was a proposal by the Chairman of the WTO Committee on Agriculture that would be subject to negotiation by WTO members.

Average Weighted Tariffs Vary Based on their Calculation Methods

The tariffs used in most economic analyses are typically averages of most-favored-nation (MFN) tariff lines. Different calculation methods used can yield different averages and, in turn, can have significant effects on the research results. The most popular approach is to calculate simple, unweighted averages of the tariffs levied within each commodity category for each country. This places equal weights on products regardless of their role in international trade. In addition, a simple average tariff applied to each trading partner means that all exporters face the same level of protection regardless of what they actually export.

To account for the relative importance of trade, a tariff and trade-weighted method is preferable. When comparing tariffs between trading partners, this puts the greatest emphasis on those tariffs in the importing country that are of the greatest importance to the exporting partner. For example, the United States exports over $18 billion of oilseeds (with 16 tariff lines), over 90 percent of which consists of soybeans. Unlike a simple average, which would assign equal weights to all 16 tariff lines, a trade-weighted measure assigns soybean tariffs a weight of over 90 percent in estimating the average tariff faced by U.S. oilseeds exporters.

Table B-1 demonstrates how the weighted and unweighted tariff means faced by U.S. exports can differ within an aggregate commodity category—in this case, pork and poultry meat. Poland's simple average tariff across the 30 products in this category is 54 percent, while the trade-weighted tariff is 67 percent. The difference between the two averages is even greater for India, with a simple average for pork and poultry at 43 percent and a weighted average of 72 percent.

Table B-1—U.S. poultry and pork exports (2000) and tariffs faced in selected countries

	HS 6-digit	U.S. exports	Tariffs faced by exports		
			Poland	India	World[1]
		$ million	*Percent*		
Chicken cuts & offal, except livers, frozen	020714	1,283.2	86	110	44
Swine cuts, fresh/chilled, nes	020319	461.1	54	39	31
Swine cuts, frozen, nes	020329	270.4	41	39	32
Chicken cuts & offal, except livers, fresh/chilled	020713	198.2	78	110	44
Turkey cuts & offal, except livers, frozen	020727	128.8	72	39	50
Swine hams, shoulders & cuts bone in, fresh/chilled	020312	127.7	43	39	37
Swine carcasses and half carcasses, fresh/chilled	020311	111.4	36	39	33
Hams, shoulders and cuts, of swine, bone in, frozen	020322	108.2	38	39	36
Swine edible offal, frozen except liver	020649	80.5	126	39	36
Poultry, domestic, whole, fresh/chilled	020711	58.3	76	39	65
Turkey cuts & offal, except livers, fresh/chilled	020726	58.0	73	39	65
Bellies (streaky) of swine, salted/dried/smoked	021012	32.8	42	39	55
Chicken (Gallus Domesticus), whole, frozen	020712	31.4	76	35	39
Other meat, edible offal and flours/meals thereof, salted/dried/smoked	021090	21.9	22	39	62
Swine meat, salted/dried/smoked, not ham	021019	18.7	28	39	44
Meat and edible offal nes, fresh/chilled	020890	16.7	20	39	29
Hams and shoulders, swine, salted/dried/smoked	021011	14.5	22	39	44
Turkeys, domestic, whole, frozen	020725	14.3	76	39	37
Swine carcasses and half carcasses, frozen	020321	8.8	37	39	31
Pig and poultry fat, unrendered	020900	8.7	64	39	26
Swine edible offal, fresh/chilled	020630	5.8	11	39	37
Duck, goose, guinea fowl cuts, offal, frozen	020736	4.4	69	39	39
Swine livers, frozen	020641	4.3	154	39	29
Sheep, goat, ass, mule, hinnie edible offal, frozen	020690	4.1	17	39	32
Ducks, geese, and guinea fowls, frozen	020733	3.7	67	39	34
Turkeys, domestic, whole, fresh/chilled	020724	3.0	76	39	66
Sheep, goat, ass, mule, hinnie offal, fresh/chilled	020680	2.4	17	39	31
Fatty livers (geese,ducks), fresh/chilled	020734	0.1	76	37	25
Frog legs, fresh, chilled or frozen	020820	0.1	20	39	28
Rabbit or hare meat, offal, fresh/chilled	020810	0.1	49	39	28
Simple average			54	43	38
Weighted average			67	72	40

[1]Simple world average. The Harmonized System (HS) provides a nomenclature for classifying internationally trade goods. The definitions of HS commodity groupings up to the 6-digit level are established by the World Customs Organization.

Source: AMAD, 2003.

tariffs on processed goods were bound at very high levels as additional protection on protected primary products.

Among major importers, average tariffs on fully processed products exceed tariffs on bulk commodities and semi-processed products for most countries, with wedges ranging from 1 percentage point for the United States to over 40 percentage points for Turkey (fig. 2).[4, 5] For all countries, the average tariff was 34 percent on fully processed goods and 23 percent on bulk commodities, suggesting that a general bias may exist toward the import of bulk commodities in relatively unprocessed form.

As shown in the figure, tariff escalation is not confined to developed countries. The average tariffs in figure 2, however, are based on bound tariffs, the maximum rates set by many developing countries, instead of on applied tariffs, which are considerably lower than the bound tariff ceilings. However, the gaps between tariffs on imports of bulk commodities and imports of processed products can be even larger for applied rates than for bound rates (table 1). The perception that developing countries are protecting their processing industries via tariff escalation tends to be supported by both bound or applied tariffs across processing stages.

While the information in figure 2 implies the existence of broad differences in tariff patterns across categories, a more disaggregated analysis is needed to conclude that tariff escalation exists within product sectors. Table 2 presents tariff averages and import values for some raw commodities and their processed and semi-processed products in five developed countries. While the table shows no general pattern applicable to all countries and commodities, evidence of tariff escalation (a positive tariff wedge between stages) is noted in over 60 percent of the cases presented. Cocoa and coffee tend to face lower tariffs than their semi-processed or processed products.

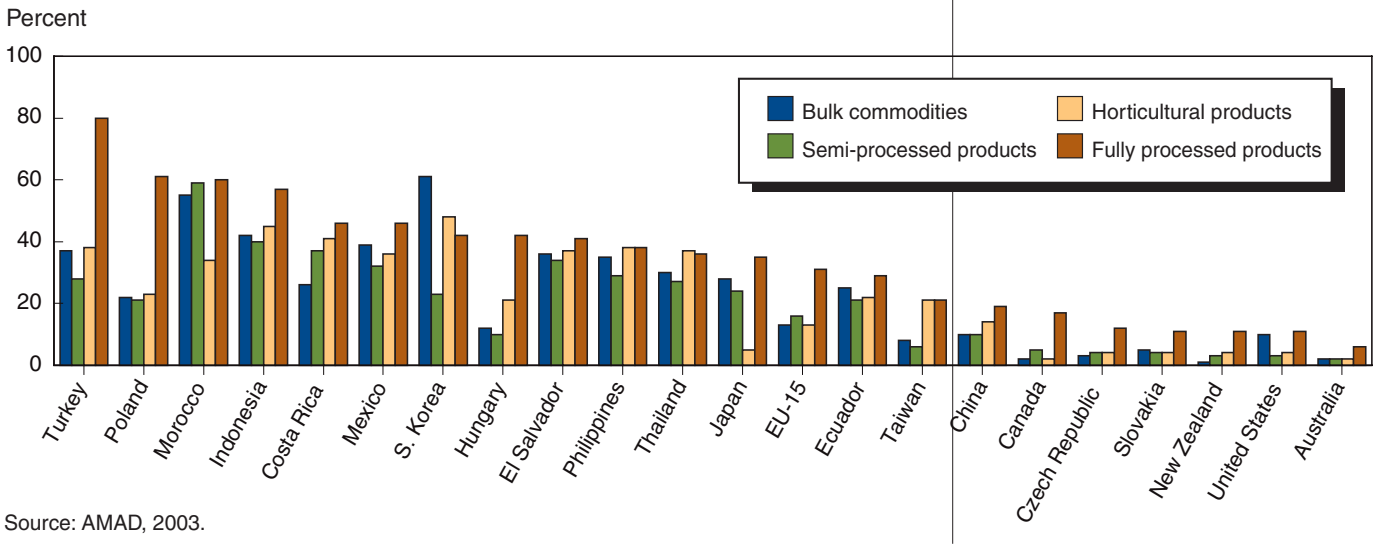
The tariffs on cocoa beans and cocoa products illustrate the impact of tariff escalation on global trade. With the exception of Australia, which has an ad valorem tariff equivalent of 1 percent, the other four countries have no tariff

[4] Under a tariff-rate quota, imports allowed under the quota are assessed a "low or minimal" in-quota tariff, and imports in excess of the quota are assessed a higher over-quota tariff. For these products, the mean of the in-quota and over-quota rates is used in this analysis. Note that extremely high over-quota rates, well in excess of 100 percent, exist in certain cases. The tariff averages in these cases are biased upward and the level of tariff escalation between these commodities and processed goods is reduced.

[5] These countries were chosen because they are major importers of agricultural products and they tended to show a difference in mean tariffs across the four categories. Many developing countries bound their entire tariff schedule at a uniform tariff level, therefore there would be no difference in the means across categories.

Figure 2

Fully processed items have the highest tariff levels



Source: AMAD, 2003.

Table 1—Comparison of tariff escalation for bound versus applied tariffs[1]

Processing level	Bound mean	Applied mean	Difference
		Percent	
Fully processed products	53	21	32
Horticultural products	47	17	30
Semi-processed products	45	11	34
Primary products	45	11	34

[1] Based on a subset of developing countries where a meaningful comparison of bound and applied rates was possible, including Argentina, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Egypt, El Salvador, Guatemala, Honduras, India, Indonesia, Jamaica, Mexico, Morocco, Nicaragua, Pakistan, Panama, Paraguay, Peru, Philippines, South Africa, Thailand, Trinidad and Tobago, Turkey, Uruguay, and Venezuela.

Source: AMAD, 2003.

Table 2—Tariff escalation and trade (2000-02 total export value) - selected countries and agricultural processing chains

	Average tariffs					Global exports	Developing country exports	
Processing chain	Australia	Canada	EU	Japan	U.S.		Value	Market share
			Percent			*Million $*	*Million $*	*Percent*
Cocoa:								
Cocoa beans	1	0	0	0	0	8,380	8,084	96
Cocoa paste	0	0	10	8	0	838	440	52
Cocoa butter	0	0	8	0	0	4,397	1,887	43
Cocoa powder	9	6	27	19	16	620	156	25
Chocolate & products	17	57	18	21	15	4,355	361	8
Coffee:								
Not roasted	1	0	4	0	0	14,213	13,592	96
Roasted	0	0	8	12	0	1,843	164	9
Mixtures & extracts	1	1	12	39	10	2,638	1,084	41
Grains:								
Grains	1	11	42	133	2	9,356	2,360	25
Grain products	4	11	41	93	8	2,857	399	14
Vegetable oils:								
Oilseeds	1	0	0	66	16	2,527	883	35
Vegetable oil[1]	4	6	10	7	4	31,018	12,649	41
Beef, pork, and poultry:								
Meat: fresh or frozen	0	54	40	41	7	12,240	1,817	15
Meat preparations	7	50	37	91	3	1,712	532	31
Sugar:								
Sugar	12	5	61	198	24	13,840	9,292	67
Sugar confectionery	11	9	20	16	11	4,625	1,255	27
Tobacco:								
Unmanufactured tobacco	10	10	38	9	60	7,461	3,963	53
Tobacco products	16	4	14	0	46	6,467	898	14

[1] Excludes tropical oils (palm, palm kernel, and coconut).

Source: AMAD (2003) and United Nations COMTRADE.

on cocoa beans. However, ad valorem tariff equivalents tend to increase along the processing chain, with tariffs on chocolates and other cocoa products ranging between 15 and 57 percent. The effect is to decrease the cocoa bean producer's share of world exports as the stage of processing increases. In 1998-2000, the trade shares of cocoa-producing countries ranged from a high of 96 percent for cocoa beans to a low of only 8 percent for chocolate.

Tariffs in some processing chains, however, do not increase and may even decrease from primary to processed product. In many of these cases (EU and Japanese grains, EU and Canadian meats, and U.S. tobacco), the domestic processing industry is protected by relatively high nominal tariffs, so there is little need to increase effective protection via tariff escalation. In other cases (Japanese vegetables and vegetable oils, EU sugar and meats, and U.S. vegetable oils), the higher tariffs on primary products are misleading, as the average tariff on the primary product is inflated by the existence of tariff-rate quotas (TRQ) with extremely high over-quota tariff rates and low or zero tariffs within the quota (see footnote 4).

WTO Sanitary and Phytosanitary Measures

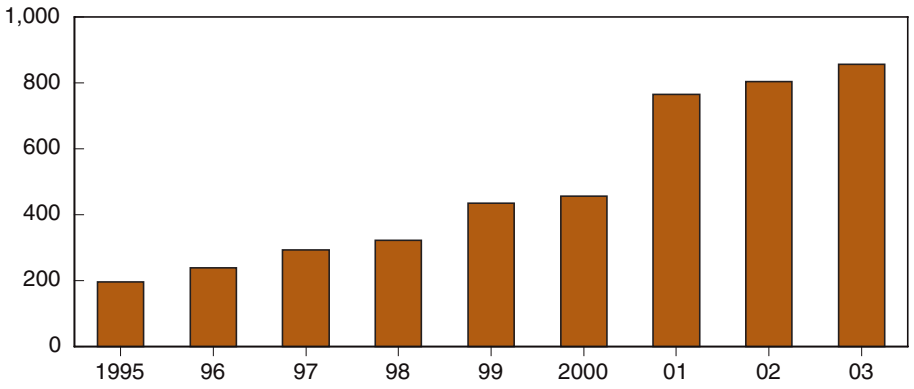
The Uruguay Round's Agreement on the Application of Sanitary and Phytosanitary measures (SPS Agreement) built on the existing disciplines contained in the General Agreement on Trade and Tariffs (GATT) and the Standards Code of 1979 to prohibit the illegitimate use of sanitary measures to restrict trade. The GATT and the Standards Code allowed imports to be subject to stringent standards providing that domestic products were subject to the same rules. The SPS Agreement recognizes the right of member countries to adopt the necessary SPS measures to protect human, animal, or plant life or health, subject to conducting a risk assessment and providing that these are not disguised measures to restrict trade (WTO, 1996).

Measures implemented by WTO member countries are to be based on scientific principles and not maintained without sufficient scientific evidence (*science requirement*). WTO members are also to base their SPS measures on international standards, where they exist (*harmonization requirement*). Members can adopt more stringent regulations if there is a scientific justification or as a consequence of risk assessment carried out in accordance with Article 5 of the SPS Agreement. Importing countries are required to accept SPS measures of the exporting countries as equivalent to their own, if the exporting country can demonstrate that its health measures achieve the same level of protection as for the importing country (*equivalency requirement*).

The SPS Agreement also requires that WTO members notify the WTO and trading partners of changes in their SPS measures according to the procedure outlined under Annex B (*transparency requirement*). These notifications may contain information on the imposition or removal of a procedure or requirement that may act as barriers to trade. The imposition of SPS measures by WTO member countries has trended upwards from 196 in 1995 to 765 in 2001 (fig. 3). The growth in notifications partly reflects an increase in the number of members submitting notifications, from 19 in 1995 to a high of 54 in 2001. In all, 84 members have submitted a total of 4,362 notifications during the period.

Figure 3

SPS notifications to the WTO have increased



Source: USDA, FAS, SPS Notification Database. Members Notifications to WTO, and Member notifications accessed at *www.wto.org/english/tratop_e/sps_e/sps_e.htm*

It is difficult to evaluate the extent to which these measures restrict the trade of agricultural high-value products because a large proportion of the notifications target broad categories of goods, such as "animals, plants, and their products," "agricultural commodities," or "all foodstuffs." Many measures targeting broad categories of goods may establish maximum tolerances or residue limits for chemical inputs used in plant and animal production. Other examples of SPS measures targeting broad product groupings are those stipulating rules and regulations for the transport and handling of all genetically modified organisms (GMO) and of food and feed products produced from GMOs. While economists have found it difficult to evaluate the impact these measures have on trade, the common belief is that it can be significant (Josling et al., 2004).

Table 3 separates those measures that target specific products from those that target an aggregate product grouping. The overwhelming proportion of the measures targeting specific imports is aimed at live animals and their products. Some of these restrict the use of certain veterinary drugs, while others define requirements on slaughterhouses or on transport and storage methods. The bulk, however, are notified as emergency measures targeted against imports from countries that have experienced outbreaks of diseases like bovine spongiform encephalopathy (BSE), foot-and-mouth disease, or avian influenza. These emergency notifications can target either a specific item, such as "fresh or chilled meat," or a range of products, such as "bovine animals, their products, and by-products," which could include semi-processed items, such as live animals, hides and skins, and tallow as well as fully processed items, such as cuts of meat and processed meat products. From 1995 to 2003, live animals, meat and products, and other animal products accounted for 63 percent of all product-specific notifications. With the addition of fish and seafood, dairy products, and eggs, the animal sector accounted for 74 percent of all notifications during this period.

The next most frequently targeted products were fruits and vegetables, which accounted for 12 percent of product-specific SPS notifications. A large number of these notifications announce tolerances or maximum

Table 3—Classification of SPS notifications by product, January 1995 - December 2003[1]

Product category	Number of notifications	Share of total notifications
		Percent
Live animals	716	22
Meat and products	787	24
Other animal products	556	17
Dairy products	113	3
Eggs	121	4
Fish and seafood	122	4
Animal feeds/additives	137	4
Cereals	127	4
Oilseeds	18	1
Other bulk commodities	53	2
Cereal products	15	0
Oilseed products	32	1
Fruits and vegetables	403	12
Horticultural products	33	1
Sugar and sweeteners	13	0
Beverages	50	2
Total product-specific SPS notifications to the WTO	3,296	100
Other processed food products	251	12
Functional foods	25	1
Measures targeting various products	435	21
Food additives	162	8
Inputs	771	37
Forestry products	68	3
Reproduction/propagation materials	362	17
Total nonproduct-specific SPS notifications to the WTO	2,074	100

[1]The classification excludes notifications that do not target products. The same notification may address more than one product.

Source: USDA, FAS, SPS Notification Database. Member notifications accessed at *www.wto.org/english/tratop_e/sps_e/sps_e.htm*

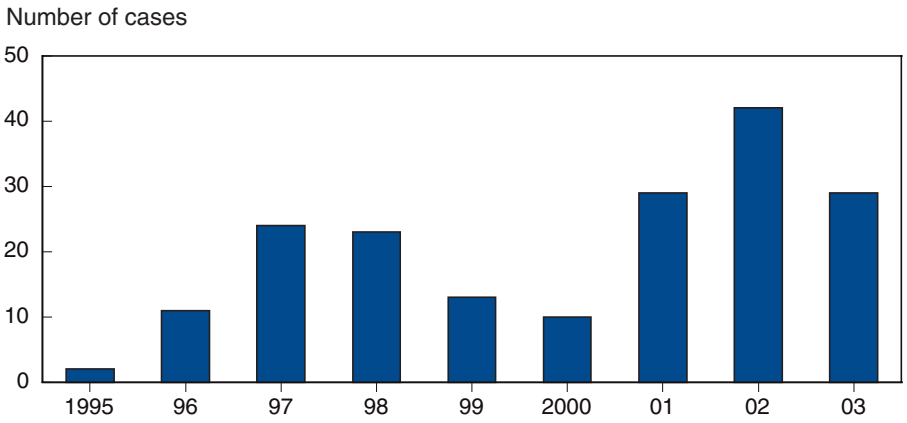
residue limits on pesticides, insecticides, and herbicides. Bulk agricultural commodities, such as cereals and oilseeds, account for only a small share of the total number of notifications filed with the WTO (7 percent), largely restrictions on imports produced with gene technology.

Although notification statistics provide some indications of SPS actions on high-value foods, they do not distinguish between legitimate measures designed to protect human, animal, or plant health and those that may be disguised efforts to restrict trade. While the harmonization component of the SPS Agreement urges countries to conform to standards, guidelines, and recommendations set by international agencies, it also allows them to apply more stringent measures provided that these standards are based on risk assessments.[6] Article 5.7 of the SPS Agreement provides additional leeway to WTO members by stating that "where relevant scientific evidence is insufficient," a member may provisionally adopt an SPS measure based on "available pertinent information." This potential loophole has raised concerns that as traditional trade barriers are removed through trade agreements, countries may resort to using SPS measures to protect domestic markets. In fact, from 1995 to 2003,

[6] These agencies are the Codex Alimentarius Commission (Codex), the International Office of Epizootics (IOE), and the International Plant Protection Convention (IPPC).

Figure 4

SPS trade concerns raised by WTO members



Source: WTO, 2003a.

WTO members raised 183 specific concerns related to SPS measures (fig. 4). The number of new concerns raised in the last 3 years of the period far exceeds those raised in the 6 years following the conclusion of the Uruguay Round, which parallels the upward trend in SPS notifications.

Many of the complaints center on the measures in question being unnecessarily trade restrictive. Requirements are often cited as being stricter than international recommendations, while lacking sufficient scientific grounds and risk analysis to justify a higher level of protection. In some cases, WTO members complain that imports are being restricted based on health concerns, even though international health organizations have concluded that these imports pose negligible health risks. Other concerns include the lack of transparency about measures and claims that imports are being held to higher standards than domestic products.

In terms of product coverage, specific trade concerns address measures that affect imports of fully processed products (50 percent), semi-processed products (37 percent), horticultural products (11 percent), and primary products (2 percent). Forty countries expressed concerns to the WTO and 48 countries were cited in the complaints. The most frequently targeted country was the EU, which received 18 percent of all complaints, followed by the United States and Australia, with 9 percent each. The most frequent complainant was the United States, which accounted for 18 percent of the total, followed by the EU with 14 percent. Developing countries raised about 30 percent of all trade-related concerns about SPS measures.

WTO Trade Remedy Measures

Over the last century, governments of industrialized nations devised three basic trade remedies as defense measures to protect domestic industries: antidumping duties (AD), countervailing duties (CVD), and safeguards (see box on trade remedy laws). The first two measures are meant to offset "unfair trade" created by foreign firms dumping goods in the international market (AD measures) or by foreign governments subsidizing exports (CVD measures). Before a country can impose either AD or CVD measures, it must

also show that the dumped or subsidized imports cause or threaten to cause material injury to the domestic industry. The third trade remedy measure, safeguards, is specifically designed to protect industries that are injured because of trade liberalization. Countries imposing safeguards are not required to show proof of unfair trade practices (dumping or subsidization), although the need to show "serious injury" in a safeguard investigation is more demanding than the material injury standard under AD/CVD law.

Antidumping and Countervailing Duties

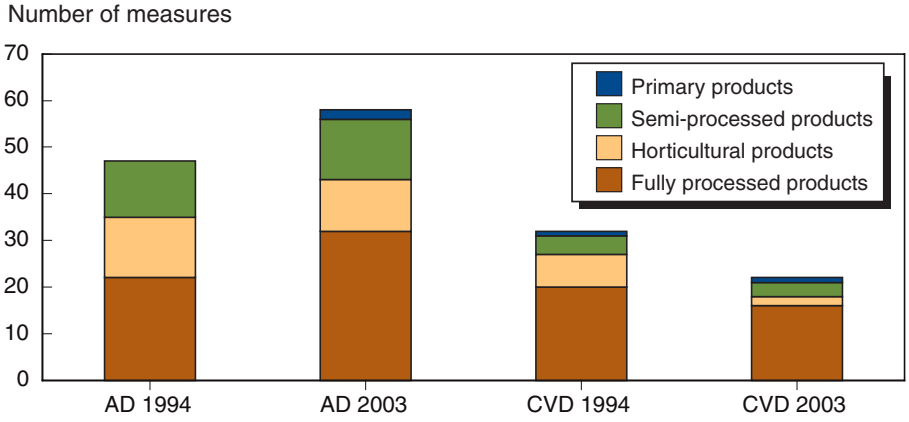
At the end of 1994, the global stock of AD/CVD measures on agricultural products amounted to 79 duties and price undertakings (where, in lieu of facing additional duties, exporting countries reach agreements with importing countries to raise the price for their exports). Eight years later, the number of active AD/CVD measures imposed on agricultural trade was essentially the same at 80, but the mix changed (fig. 5). From 1994 to 2003, the number of active CVD measures dropped sharply from 32 to 22, and the number of AD measures increased from 47 to 58. Forty-seven of the 58 AD measures were new, having been put in place since 1994, while only 11 of the 22 CVD measures were new, the others dating back to at least 1994. Antidumping investigations have always been much more widespread than subsidy investigations, but this disparity between numbers of AD and CVD measures has grown since the Uruguay Round. This is largely a function of the Due Restraint provision (commonly referred to as the "Peace Clause") of the AoA, which exempts domestic support measures conforming to the provisions of the Agreement from CVD actions.[7] Despite the Peace Clause, CVD investigations are still more prevalent in agricultural than in non-agricultural trade, a reflection of the level of subsidies granted to the agricultural sector. For example, in 2003, CVDs represented 28 percent of all measures in place on agricultural trade compared with 5 percent of all measures in place on nonagricultural trade.

Fully processed items accounted for the majority of measures—55 percent of the AD total in 2003, up from 47 percent in 1994; and 73 percent of the CVD total in 2003, up from 63 percent in 1994 (fig. 5). Most of these meas-

[7] The Peace Clause expires at the end of the implementation period of the Uruguay Round Agreement, and unless extended under the Doha Round of Agreement, agricultural subsidies will not be exempt from CVD actions.

Figure 5

Unfair trade measures in place on Dec. 31, 1994 and 2003



Source: WTO, 2004b.

International Trade Remedy Laws

GATT 1947, Article VI (WTO, 1996), allows the use of antidumping duties (AD) to restrict entry of products of one country introduced into the commerce of another country at less than the fair or *normal value*. Normal value is defined by the WTO as the comparable price for the product, in the ordinary course of trade, when destined for domestic consumption in the exporting country. If such a price is not available, or if the price does not allow for a representative comparison, normal value may be established by using a comparable price for the product exported to a third country or computed based on the cost of production for the product, taking into account additional selling expenses and profits—the "constructed value" method. GATT Article VI also allows the imposition of countervailing duties (CVD) to offset public subsidies for the manufacture, production, or export of any merchandise. The Uruguay Round establishes disciplines for calculating subsidies and defines which subsidies are countervailable.

AD and CVD investigations involve a two-part test. The importing country must first demonstrate that dumping or subsidization exists. Before definitive duties can be imposed, however, both ADs and CVDs also require evidence that the dumped or subsidized imports cause or threaten to cause material injury to the domestic industry or retard the establishment of a domestic industry. If both requirements are satisfied, a duty can be imposed, but this may not exceed the margin of dumping (the difference between the export price and normal value) or the value of the subsidy.

Article XIX of GATT 1947 allows members to impose temporary border control measures called safeguards if a surge of imports causes or threatens to cause serious injury to a domestic industry. The WTO Agreement on Safeguards grants members imposing a safeguard a 3-year retaliation-free period if the measures taken conform to the Agreement's provisions and if they are the result of an absolute increase in the quantity of imports from the exporting country. After 3 years, adversely affected trading partners can seek compensation through consultations or, if no agreement is reached, can retaliate by raising tariffs on imports from the country applying the safeguard. While CVD and AD actions apply only to particular exporters, safeguards are meant to apply to all suppliers, although the special and differential treatment provisions of the Safeguards Agreement exempt actions against developing countries with market shares of less than 3 percent, unless the cumulative shares of developing countries is greater than 9 percent. The Agreement also strengthened the "material injury" standards for safeguard actions, requiring a causal link to be made between "increased imports of the product concerned and serious injury or threat thereof."

A number of common WTO criteria apply to all three measures. Domestic industries or companies may request their governments to initiate investigations into dumping, subsidization, and injury. In each case, if measures are imposed, they can be challenged by the exporter through the WTO's dispute settlement process. All measures are subject to set time limits (a "sunset clause"). AD/CVD measures must be terminated after 5 years unless it has been determined that the dumping or subsidy still exists and removing the duty would likely lead to material injury to the domestic industry. Safeguard actions lapse after 4 years, unless the sunset review reveals that the measure is still needed and the domestic industry is adjusting, in which case the safeguard can be re-imposed for an additional 4 years.

ures were assessed on cheeses, meats (including canned ham and luncheon meats), refined sugar, and canned fruits. Some of the new measures placed on imports of processed foods and beverages since 1994 include duties on bottled olive oil, brandy, pasta, canned peaches and pineapples, concentrated apple and pineapple juice, and prepared baby foods. Measures were rarely assessed on primary products. The United States imposed CVD duties on Thai rice in 1994 and Canadian hard red spring wheat in 2003, and Mexico imposed an AD duty on U.S. rice in 2003.

Safeguards

The numbers of countries applying safeguards has increased in recent years (WTO 2000b, 2001, 2002b, and 2003b). Between 1995 and 2000, 87 countries notified the WTO that they had initiated safeguard investigations. By October 2003, this number had risen to 100, with developing countries accounting for the majority of new users.

Safeguard investigations tend to be disproportionately concentrated in a few industries, with agricultural imports accounting for about 35 percent of the 124 investigations initiated since 1995. During the same period, about 5 percent of all AD investigations and about 25 percent of all CVD investigations targeted agricultural imports. Among safeguard investigations that actually resulted in a measure being imposed, the agricultural share increases slightly to 38 percent. Of the 96 investigations that had been concluded by October 2003, 61 resulted in the imposition of a safeguard measure (higher tariff or a quantitative restriction), including 23 that targeted agricultural products.

From January 1, 1995, to October 20, 2003, bulk commodities accounted for three safeguard actions on agricultural imports—investigations by Costa Rica and El Salvador on rice imports and Chile on wheat imports (app. A). High-value foods accounted for all other actions: 7 investigations targeted fresh fruits and vegetables, and 33 actions targeted imports of processed agricultural products. Chile has led the way in actions against high-value food imports with investigations initiated against wheat flour, sugar, edible vegetable oils, liquid/powdered milk, and fructose/glucose. The United States is among the next most active users.

Special Agricultural Safeguards

In addition to the temporary protection available under the WTO Safeguards Agreement, the AoA created a Special Safeguard (SSG) for those agricultural products subject to tariffication. Tariffication also resulted in the creation of TRQs, which generally impose a relatively low in-quota tariff on imports up to a specified level (the quota), with imports above that level subject to a higher over-quota tariff. The SSG was created to alleviate the fears of some members that the removal of nontariff measures might result in a surge in imports or in a decline in domestic prices if over-quota tariffs did not provide sufficient protection. An SSG can only be invoked after the TRQ has been filled and only on those products for which application of the SSG was indicated in the WTO member's tariff schedule.

Under the SSG provision, members can temporarily roll back trade liberalization to provide a domestic industry with time to adjust to increased competition from imports. The SSG provision allowed countries to levy an additional, time-limited duty on an imported product if the import volume exceeded a pre-set (according to WTO guidelines) volume trigger, or the price of the imported product was below the set trigger level. The AoA provides general guidelines for setting trigger levels and for calculating additional duties when an SSG action is to be taken. For example, the maximum additional duty may not exceed one-third of the ordinary customs duty in effect for the commodity in question and may only be maintained until the end of the year in which it has been imposed.

The SSG provisions differed from normal safeguards in several ways. First, they were much easier to invoke since they did not require an injury test, and were triggered automatically if the volume or price limits were exceeded. However, unlike normal safeguards, they were only available for products that underwent tariffication during the Uruguay Round. This amounted to less than 20 percent of all agricultural products (as defined by the proportion of tariff-lines). A government could only apply an SSG if it reserved the right to do so in its country schedule. According to the WTO, 39 WTO members had reserved the right to invoke SSGs on a combined 6,156 agricultural products (WTO, 2002a). High-value agricultural products account for the greatest number of products for which countries had reserved the right to apply the SSG in their tariff schedules, particularly animals and animal products category, fruits and vegetables, and dairy products. Together these three categories accounted for almost one-half of potential SSGs. In practice, however, they have accounted for almost 70 percent of all notified SSGs between 1995 and 2003 (app. B).

In total, there were 1,285 SSG actions initiated by 12 countries as of October 2004. Almost two-thirds were on imports of processed foods and beverages. The United States and the EU have accounted for most of the SSG cases mostly for sugar, dairy, cocoa preparations, chocolate, and animal and horticultural products even though the United States has not yet notified its SSGs for 2003 nor has the EU for 2002 or 2003. Poland and Japan are other leading users of SSG actions. Unlike AD/CVD actions and general safeguards, few developing countries used SSGs.

Some developing countries failed to reserve the right to use SSGs on all eligible products at the conclusion of the Uruguay Round and were thus prohibited from using them to their fullest extent. At the moment, the right to use the special agricultural safeguard will lapse if there is no agreement in the current negotiations to continue the reform process initiated in the Uruguay Round. Proposals to the WTO range from continuing with the provision in its current form, to abolishing or revising it to prevent its use on more products imported from developing countries. Some developing countries have proposed that only they should be allowed to use SSGs.

Impacts on Market Access

High tariffs on some agricultural products continue to be a significant barrier to market access. For high-value foods, in particular, the protective

effect of tariffs can be magnified with tariff escalation, the practice of levying low or zero tariffs on imports of primary products and higher tariffs on imports of more processed forms of the same products. There is insufficient information to ascertain whether the increasing number of SPS notifications noted for high-value agricultural products are the result of protectionist trade policies. However, available evidence suggests that the use of contingency protection measures has been concentrated on high-value product trade.

Economics Underlying Food Trade Patterns

Countries vary in their trade orientation because of underlying forces affecting supply and demand, some of which are not very well understood. Changing consumer preferences, geography, technology, and policies affecting market access all contribute toward shaping patterns of food trade. While recognizing that fundamental economic forces often change over time, trade patterns can be examined by focusing on such characteristics as product composition, trade balances, and product makeup of trading partners.

Patterns in food trade form when countries specialize in producing specific foods. Countries may export those products that make use of their abundant inputs. Specialization in food is also determined by the ability of the exporter to differentiate products. However, inputs required for producing and differentiating food vary widely by product. As globalization of the food industry enables firms to have easier access to capital and technology, the two most important inputs used in the production of many high-value products, the tendency of countries to specialize may become less predictable.

Food trade patterns have substantially changed for some countries in recent decades, making it difficult to discern future trends. For example, the composition of U.S. agricultural exports began to shift toward high-value food in the 1980s, with the rapid growth of markets in East Asia (Gehlhar and Coyle, 2001). Changes in the product makeup of U.S. exports led some to believe that the United States was becoming increasingly competitive in processed products and that the future of U.S. trade growth lie with high-value foods. These expectations were, however, tempered after U.S. exports of processed food slowed markedly (Carter, 2000). Fueling speculation and confusion are the frequent shifts between surpluses and deficits in U.S. high-value food trade.

Not all countries are characterized by unstable trade patterns. New Zealand, for example, is a consistent net exporter of specific high-value-foods. Its food exports, such as horticultural and livestock products, are dependent upon land and climate conditions ideal for growing crops and grazing animals. South Korea, by contrast, is a consistent net exporter of bakery products, even though it has scarce agricultural resources. Clearly, the production of some but not all high-value-food products is dependent on a country's natural resource endowment. This raises the question whether specialization patterns are stronger for products more closely tied to natural resources than for food products less dependent on land and climate.

A fundamental economic factor often motivating trade between partners is the resource endowment of each country. Differences in availability of natural resources generate incentives for specialization and product exchange. Such differences do not, however, explain why Canada, a food-surplus country having a resource endowment similar to that of the United States, recently became the largest importer of U.S. high-value foods. This bilateral trade pattern raises important questions about the nature of specialization taking place between countries endowed with similar production resources.

This study makes distinctions among various types of food products in order to provide clarity as to how and why patterns in food trade emerge. For example, viewing processed and unprocessed food trade in U.S. trade illustrates the importance of drawing economic distinctions among various types of products. The U.S. trade balances in these components are moving in opposite directions, suggesting that processed and unprocessed foods are affected by a unique set of economic factors (fig. 6). Using economic criteria, processed products can be further broken down into categories that enable us to better understand the nature and emerging patterns of food trade.

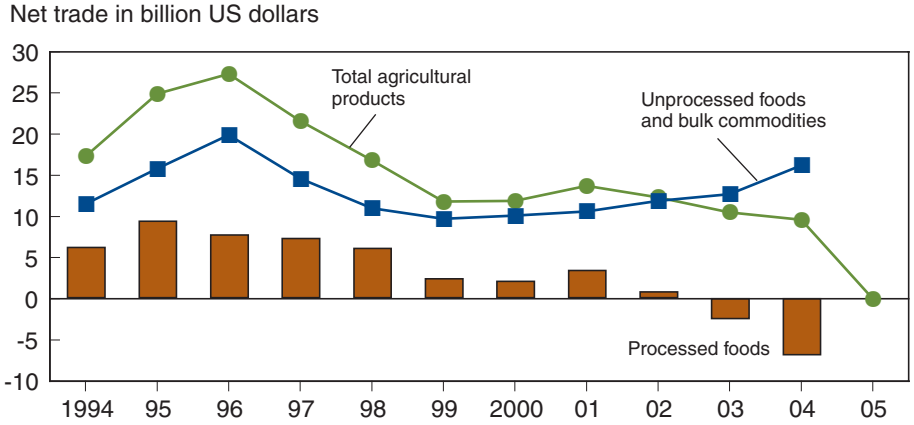
Classification of Food Products by Economic Criteria

Any country can, in theory, engage in food processing given the availability of needed raw material inputs, labor, capital, and technology. Food manufacturers have the option of exporting to markets abroad or locating production close to sites of final consumption. Some manufacturing operations are strategically located to minimize distribution costs and enhance the ability to frequently replenish retail inventories. Timeliness of delivery is critical for inventory management, often subject to changing consumer demands. The economics of marketing finished food products tend to favor multiple manufacturing locations and relatively short distribution distances. Therefore, bakery, snack food, confectionery, and beverage industries often choose to manufacture close to consumer markets and are generally not export oriented.

Foreign direct investment (FDI) can play an important role in the location of food processing facilities. Increases in FDI in food manufacturing make production less location specific. International cross-ownership of assets becomes more common as global markets become increasingly integrated. In open economies, domestic firms can easily source their inputs from a

Figure 6

U.S. agricultural trade surplus has been offset by a declining balance in processed food trade



Note: Agricultural trade surplus for 2005 is projected.

Source: USDA, ERS.

foreign country and manufacture finished products locally to meet the needs of domestic retail markets.

The mobility of inputs employed in production also plays a role in the location of food production (see box on characteristics of high-value foods). Food processing and food manufacturing are distinct activities because of the mobility criterion that affects procurement costs (Atkins and Bowler, 2001). Food processing involves the "manipulation of raw materials into food products that retain characteristics of the original materials." Food manufacturing, by contrast, "is the transformation of agricultural raw materials into food products that have lost many of the characteristics of the original materials."

Land-based foods include not only all raw commodities, such as grains, fruits, and vegetables, but also some processed products, such as preserved fruits and vegetables, meat, and dairy products. The production location of land-based processed-food is influenced by product perishability, transportation costs, and geography. Frozen vegetables, for example, are classified as land-based processed foods since freezing facilities are typically located near vegetable-growing areas to minimize spoilage. High transportation costs and perishability can be used to classify raw vegetables, such as potatoes, as land based. The importance of geography in providing low-cost feed makes livestock products land based.

Manufactured foods can be produced almost anywhere investments are made in processing facilities. These goods are final consumer products and have relatively long shelf lives. Examples include breakfast cereal, infant formula, candy, beer, soft drinks, and other processed preparations. The location of manufactured-food production is not tied closely to the presence of natural resources. The raw ingredients of manufactured foods, such as refined sugar, starches, and grains, are relatively nonperishable and inexpensive to transport. These characteristics enable manufactured foods to be widely produced throughout the world.

Conceivably, some foods, such as poultry and beer, can be classified as either manufactured or land-based food. The location of poultry production may depend on natural resources, such as available area for bird waste disposal, and hence be considered a land-based food. However, poultry may also be considered a manufactured food because poultry feed is a widely traded input. In this study, a simple rule is used: as land is considered central to production, all meat and livestock are classified as land-based foods.

In comparison with poultry, beer can be brewed anywhere. The inputs used in beer production (malt, hops, and grains) are widely traded. Moreover, there are globally recognized licensing agreements for brand usage and brewing technologies. To minimize transportation costs, for example, a beer of Australian origin is brewed in Canada, where it is sold and exported to the United States under its Australian name. The mobility of brewing provides a rationale for beer to be classified as a manufactured food. Transportation cost considerations are, however, not always the most important factor driving production location decisions for beer. Several European breweries use the locality of beer production as a marketing strategy to

Characteristics of land-based and manufactured high-value foods

	Land-based products	Manufactured products
Input characteristics	Sourced locally perishable, high transport cost	Sourced globally nonperishable
Input examples	Milk, live animals, fresh horticulture	Sugar, wheat, rice
Processing function	Preserving basic commodities	Transforming commodities
Processing examples	Freezing, canning, animal slaughter,	Blending, fermentation, cooking
Production location	Close to agricultural production Supply oriented to minimize input cost	Close to consumer markets Location is demand oriented to minimize distribution cost of final products
Product examples	Frozen strawberries, meat, canned fruit	Confectionery, beer, bakery products
Extent of trade	Highly traded in global markets	Locally traded in regional markets

differentiate their countries' beers. In this study, beer is, nevertheless, classified as a manufactured food since all of its raw material ingredients are economically traded goods.

Trade Indicators

Information that reveals the importance of commodity and partner markets for exports may improve economic decisionmaking related to trade. Simple statistics, such as the net trade balance and trade shares, can be easily calculated and are readily transparent. However, these statistics provide little information about important economic dimensions of trade. For instance, they do not reveal a country's tendency to specialize in relation to other exporting countries. More sophisticated indicators are needed to reflect complexities not discernible in the commonly used trade statistics.

Three indicators, export share of production, revealed comparative advantage, and bilateral trade complementarity provide insights about the benefits of trade. Commodity export shares of production for the United States are routinely published by USDA. They depict the dependency of domestic producers on export markets. A country with a high export share of production stands to gain from improved market access, but it may also be vulnerable to global economic shocks. The revealed comparative advantage puts a country's agricultural exports in the context of the global market and total merchandise trade, placing in perspective the sector's economic perform-

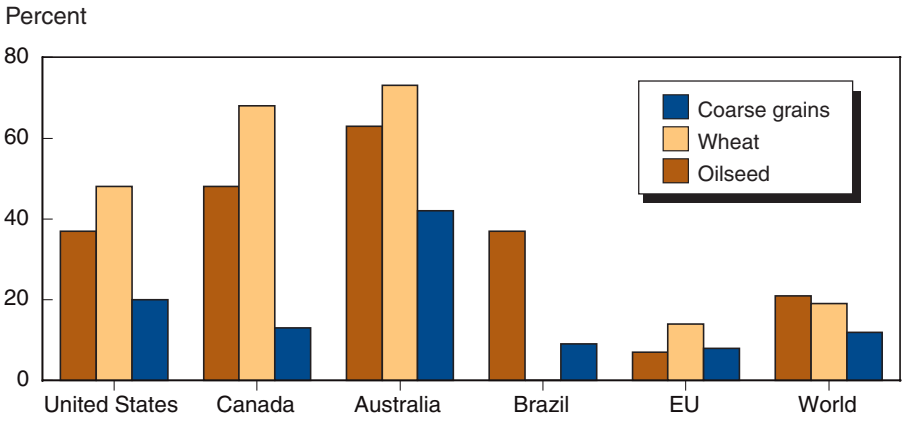
ance in comparison with economic activity in the rest of the world. A change in this measure may or may not present a problem. But information about revealed comparative advantage can aid policymaker decisions regarding public investments in education, research, improving port capacity, and transportation networks. The bilateral trade complementarity index gauges how well a country's commodity export profile complements its partner's commodity import profile. This measure embodies national differences in factor endowments and variations in product demand. The complementarity index enables decisionmakers in an exporting country to identify national markets with whom it is likely to be highly advantageous to trade, based upon its profile of relative export advantages and the composition of partner imports across various commodities.

Export Share of Production

The reliance of a country's agricultural sector on international markets is determined by the relative abundance of agricultural resources and the domestic demand for its agricultural outputs. This dependency can be measured for a given commodity or a product by the ratio of its total exports to its total domestic production. Canada has relatively high export-dependency ratios across a diverse set of land-based agricultural commodities, including both bulk and semi-processed products (figs. 7, 8). Canada exports about half of its total production of oilseeds and three-quarters of the total wheat production, much higher export shares than the global average rates of 15-20 percent for major bulk agricultural commodities. Canada also greatly exceeds the global average export-dependency ratios for oils and meals. Similarly, Australia is highly dependent on exports, and has dependency ratios that exceed the world average levels in three bulk commodities (wheat, coarse grains, and oilseeds) and two semi-processed products (dairy and meats). The export dependency of the United States and Brazil, two other major exporters of agricultural goods, exceeds the global average in four of these commodity groups. The EU, while a major exporter of agricultural goods, is less dependent on the export market for its land-based products than Australia, Brazil, Canada, United States, or New Zealand.

Figure 7

Export dependency in bulk commodities, 1999-2003[1]

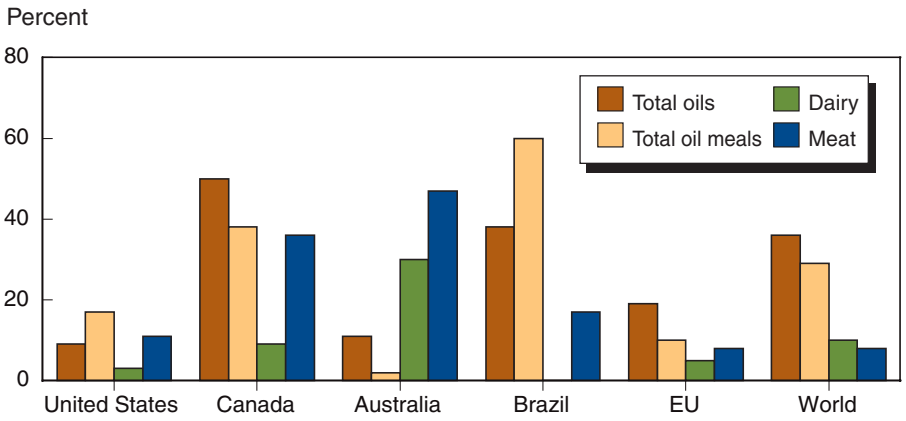


[1]Exports as share of total production averaged over the years.

Source: USDA, FAS, PS&D Database.

Figure 8

Export dependency in semi-processed food products, 1999-2003[1]



[1]Exports as share of total production averaged over the years.
Source: USDA, FAS, PS&D Database.

Oilseed products are the most internationally traded products when total exports are compared with global production. The dependency of oilseed producers on foreign markets would be even higher if trade statistics accounted for the oilseed content in all manufactured foods. Likewise, the export dependency ratios for producers of coarse grains and oil meals would be higher if one took into account the proportion of these products used to produce meat and dairy products.

The export orientation in processed foods also differs across countries. Although the EU and the United States have the world's largest food processing sectors, their export share (5 percent) of output is relatively small in comparison to that of developing countries (GTAP, 2001). Lower processing costs are often a source of comparative advantage for developing countries relative to industrialized countries, while modern technology, access to capital, and proximity to large markets are sources of scale economies for many developed countries. U.S. and EU consumers purchase a large share of their countries' domestically processed foods. Export earnings from processed foods are a larger share of food sector incomes in developing countries.

Export dependency does not necessarily reflect comparative advantage because it does not take into consideration the size of world trade. To gain a better understanding of U.S. relative trade advantage in agriculture, two specialized trade indices are used: the revealed comparative advantage (RCA) index and the bilateral complementarity index (see box on trade indices descriptions, app. C, and box on advantages and disadvantages of RCA indices).

Revealed Comparative Advantage

The United States possesses a persistent RCA in agriculture despite changes in the composition of U.S. and world trade. This fact is evident from RCA calculations for U.S. agriculture, which are consistently greater than the comparative-advantage/comparative-disadvantage threshold of one (fig. 9). While there have been major shifts in the importance of bulk commodities

Description of the Specialized Trade Indices

This report examines U.S. food in the context of global and bilateral trade using indicators that measure revealed comparative advantage (RCA), export specialization (XSP), import share (MS), and complementarity in the commodity composition of partner trade (CCD). Correlations are computed between XSPs for U.S. food exports and corresponding MS for its partner imports (app. C).

RCAs identify the extent to which an exporting country captures world market share in a particular area relative to the degree to which it captures export market share for all traded goods. An RCA greater (less) than one signifies a comparative advantage (disadvantage) for the particular item, while an RCA equal to one identifies neither. If, for example, U.S. agricultural exports are 25 percent of world agricultural trade and the United States capture a 20-percent share of all merchandise trade, then the U.S. RCA for agriculture is 1.25, revealing that the United States has a comparative advantage in this sector. This "revelation" assumes that there are no artificial impediments to trade, such as imperfect knowledge about market opportunities or policy distortions.

XSP is structured similarly to the RCA index. One difference is that the XSP focuses on an individual commodity, such as wheat, or a specific product, such as bread, within the food sector, whereas the RCA has an economywide focus that centers on foods in relation to total merchandise trade. An XSP greater (less) than one signifies a relative export advantage (disadvantage) for a specific product within the food sector; an XSP equal to one identifies neither.

The CCD index is a summary measure that links one country's XSPs with its trading partner's MSs across the spectrum of all traded foods within a designated food subsector (i.e., land-based or manufactured foods). A simple correlation of the two components of CCD generates a view of complementarity that matches U.S. relative export advantages for the various products within the specified food subsector with the importance of each food product in its trading partner's import basket. A positive correlation denotes bilateral complementarity in the product makeup of U.S. exports and partner imports in the particular food subsector. A negative coefficient denotes the absence of complementarity. In this case, U.S. export specializations and corresponding product import shares of the U.S. partner move in the opposite direction. A correlation of zero indicates no meaningful relationship.

in the composition of U.S. and world trade within the past two decades, the United States also reveals consistently stable comparative advantages in land-based foods.

In contrast to land-based foods, U.S. manufactured foods are not depicted as having a comparative advantage during 1989-2001. The RCA statistics for U.S. manufactured foods have, however, moved upward toward a value of one, showing a strengthened ability by the United States to export manufactured foods in recent years. This finding is not altogether surprising because

Advantages and Disadvantages of Using RCA Indices

Comparative advantage is a central concept in economics. This concept focuses on the relative efficiency of producing different goods in the home country vis-à-vis the rest of the world. Theoretical expositions of comparative advantage show that unfettered trade across national borders results in countries making the best possible use of their domestic and foreign resources and available technologies. As articulated in a recent *Amber Waves* article, "a country should produce and export goods that reflect the relative abundance, and quality, of its land, labor, and capital resources" if it is to fully exploit economic comparative advantage (Dohlman et al., 2003).

The notion that countries can mutually benefit from trade if the relative prices of commodities differ between them in the absence of trade was first articulated by David Ricardo early in the 19th century. Ricardo provided a numerical example to illustrate his theory of comparative advantage (Ricardo, 1817). He demonstrated that even though England had higher per unit cost of production than Portugal in both wine and cloth, both countries could benefit from specialization and trade because England's cost disadvantage was relatively less for cloth.

Alternative theories of comparative advantage are based on (1) relative factor endowment (the Heckscher-Ohlin model), and (2) the differences in relative export supply and import demand (the neoclassical model) (Caves and Jones, 1981). Comparative advantage is dependent on numerous factors, some more easily measured and/or identified than others. For this reason, Balassa (1979) believed that more could be gained "if, instead of enunciating general principles and trying to apply these to explain actual trade flows, one took the observed pattern of trade as a point of departure." His reasoning was that comparative advantage could be "revealed" through the examination of real-world country/commodity trade patterns because cross-border trade "reflects relative costs as well as differences in nonprice factors." He, therefore, developed the revealed comparative advantage index (RCA). This index is a widely used indicator of comparative advantage (*http://unstats.un.org/unsd/comtrade/mr/rfReportersList.aspx*). RCA denotes relative efficiency indirectly, based on trading patterns that emerge from actual market transactions.

RCA indices have been used by applied economists as cardinal, ordinal, and/or dichotomous indicators of comparative advantage. As cardinal measures, they identify the extent to which a country has a comparative (dis)advantage in a particular product. As ordinal measures, RCAs rank products by degree of comparative advantage. They provide a binary-type demarcation between comparative advantage and comparative disadvantage as dichotomous indicators. Consistency tests have been developed to determine whether researchers can have confidence in the alternative interpretations of the index (Ballance et al., 1987). Recent test results suggest that RCAs are best viewed as ordinal and/or dichotomous indicators rather than as cardinal measures of comparative advantage (Ferto and Hubbard, 2003).

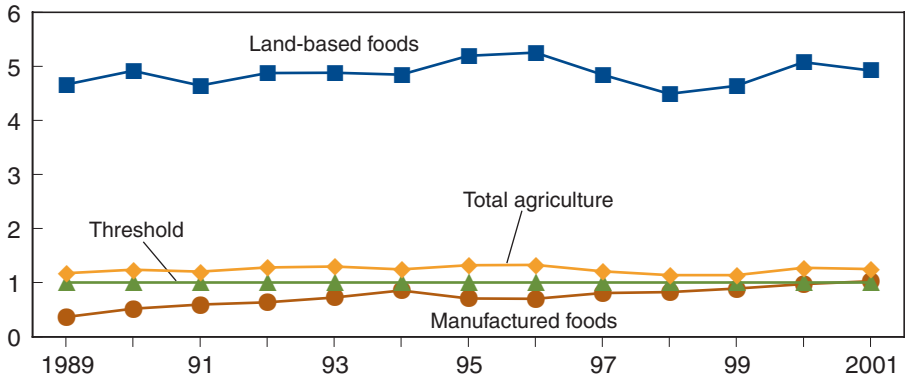
The advisability of using RCA as a proxy for actual comparative advantage depends on the problem being investigated and tradeoffs between the strengths and weaknesses of alternative empirical measures. The RCA is an imperfect measure of comparative advantage because it embodies not only the fundamental economic factors affecting relative efficiency, but also government policies and institutions that may distort markets. Alternative measures of comparative advantage are "domestic resource costs" (DRC) and "social cost-benefit ratios" (SCB), both of which compare the cost of domestic production with world prices (Masters and Winter-Nelson, 1995). Unfortunately, the data required to calculate these indicators are not readily available for many commodities. Calculation of DRCs and SCBs necessitate data on domestic prices, international prices, government subsidies, and taxes for the specific commodities being evaluated as well as the shadow price of foreign exchange. In addition, these indicators require information about the proportion of tradable and nontradable inputs used to produce one unit of each particular good. It is difficult, given these requirements, to assemble such detailed data for all but a few commodities in a limited number of countries.

DRCs or SCBs are often preferred indicators of comparative advantage when the focus of attention is restricted to a few commodities and/or trading areas. There are, however, circumstances when a case can be made for exploiting information readily available in the trade record to gauge comparative advantage, provided that it is also recognized that the "revealed" measures generated are likely to be imperfect measures of comparative advantage. Here, we use RCAs because of interest in providing a synoptic view of comparative advantage among many countries/regions and across various goods. We also use them because of the ease of calculation and the focus in this study on processed products and various foods subsectors where data needed to calculate DRCs and/or SCBs simply do not exist.

Figure 9

The United States reveals a stronger comparative advantage in land-based foods than for total agriculture and a comparative disadvantage in manufactured foods

RCA indices



Source: Derived from United Nations COMTRADE.

of the international mobility of inputs used in food production, which can lead to specialization within manufactured foods.

Bilateral Trade Complementarity

Bilateral trade complementarity is measured using statistical correlations between the two components of Drysdale's commodity complementarity index, namely U.S. export specializations of traded commodities with corresponding partner import shares.[8] Export specializations measure the ability of one country to export a particular product compared with the rest of the world. Partner import shares measure the importance of a product import relative to all other imports. The correlation between these two measures indicates the extent to which the importing trade partner has a propensity to import products that the exporting partner has an advantage in supplying to the rest of the world. In this study, these indicators effectively link U.S. export advantages within the agricultural sector with relative importance of product imports by the partner country across the spectrum of land-based (fig. 10) and manufactured foods (fig. 11). The correlations help identify with whom it is advantageous for the United States to trade based on economic forces affecting U.S. supply and partner demand.

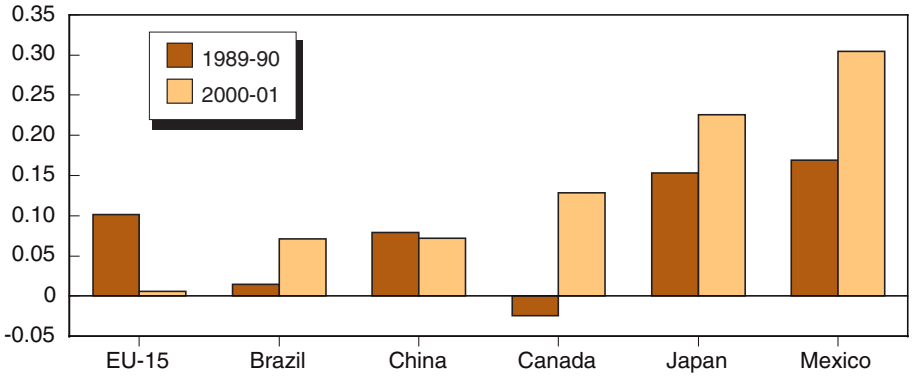
In land-based foods, the largest 2000-01 complementarities are for neighboring Mexico and Canada and resource-poor Japan. Interestingly, the coefficient for Canada turned positive after the first year of the Canada-U.S. Free Trade Agreement (CUSTA) in 1989. This switch, together with the post-1994 rise in the positive correlation coefficients for Mexico, suggests that the North American Free Trade Agreement(s), which enabled market forces to operate more freely, deepened U.S.-Canadian and U.S.-Mexican complementarity in land-based products. The relatively large and positive U.S.-Japanese correlations can be explained by the fact that Japan is land-resource poor and has to rely on other land-resource rich countries, such as the United States, to meet its demand for land-based food products.

[8] The Drysdale index is unweighted. Attaching weights that account for the relative importance of the various products in domestic production would strengthen the index.

Figure 10

U.S. complementarities in land-based foods are greater for NAFTA countries and Japan

Correlations, XSPus and MSj

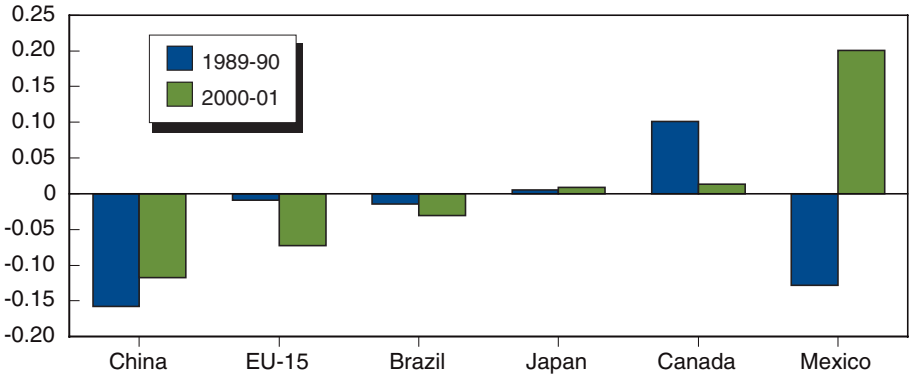


Source: Derived from United Nations COMTRADE.

Figure 11

U.S. complementarities of manufactured food products are positive for neighboring NAFTA countries

Correlations, XSPus and MSj



Source: Derived from United Nations COMTRADE.

Elsewhere, U.S.-partner complementarities in the land-based food subsector are mixed. U.S. complementarities with China have not materially changed during the last decade. However, U.S.-Brazilian complementarity deepened in the land-based subsector over time, due, in part, to increased Brazilian imports of wheat, a bulk commodity of which the United States possesses a strong comparative advantage.[9]

Policy interventions have affected the nature of bilateral trade and partner complementarity. The decline in U.S.-EU complementarities between 1989-90 and 2000-01 reflects the fact that the EU is becoming less important as a market for land-based foods. This decline is due, in part, to increases in the use of domestically produced grains as feed in the EU, the direct result of EU-92 reforms. These reforms redressed EU internal price differentials between soybeans and grains by lowering domestic prices for feed wheat and barley. In addition, concerns about genetically modified organisms

[9] Argentina supplies Brazil with most of its wheat and wheat-based products because of logistical advantages and phytosanitary restrictions imposed by Brazil on U.S. commodities. However, this does not detract from the economic relationship characterizing U.S. and Brazilian trade in the land-based sector (as defined in the methodology used in this analysis) given fungibility of commodity trade in the world market.

curtailed EU imports of soybean products, commodities in which the United States possesses comparative advantages.

The profile of U.S.-partner complementarities for manufactured foods is different than that for land-based foods. The correlations are generally negative—an inverse relationship exists between U.S. export specializations for the various food products in the manufactured food subsector and corresponding partner import compositional shares for these products. This relationship reflects the relative export disadvantage for many U.S. manufactured foods for which partners have comparatively large import shares. Negative correlations do not mean that societal payoffs from increased U.S. exports of manufactured foods are not realized, for there are likely to be profitable niches within each foreign market for differentiated products.

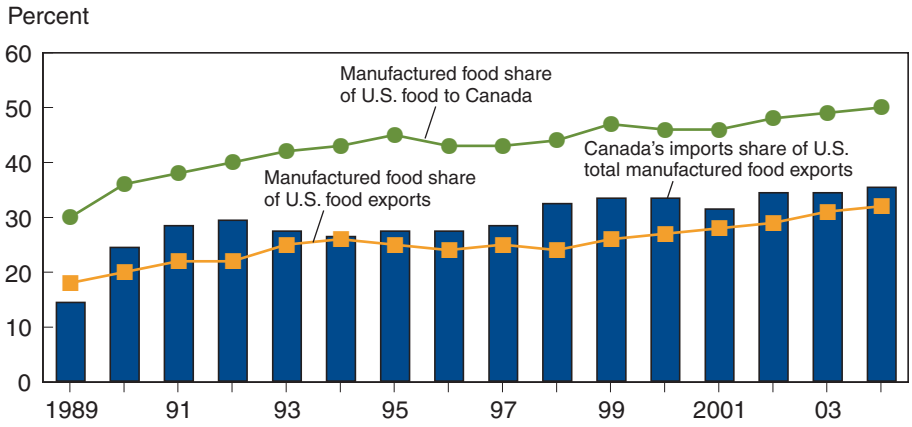
U.S.-Mexican complementarities in manufactured foods shifted from being negative in 1989-90 to being strongly positive in 2000-01, suggesting that NAFTA freed up cross-border trade in processed products by removing tariffs and other trade barriers and allowing market forces to operate more efficiently. In contrast, U.S.-Canadian complementarities fell between 1989-90 and 2000-01. In addition to the 1989 CUSTA, the expansion of two-way, or intra-industry, trade in manufactured foods between the United States and Canada, whereby similar products are simultaneously imported and exported by both partners, contributed to changes in U.S.-Canadian complementarities. The expansion of two-way trade in manufactured foods reduces complementarity whenever trade in virtually identical products occurs (app. D). Moreover, much of the measured Canadian-U.S. intra-industry food trade is more apparent than real, given the aggregation of international trade data. Not having sufficiently detailed trade data at the individual, product level for semi-processed products (like prepared flour mixes and dough) as well as for differentiated consumer foods (such as branded beverages, breakfast cereals, and confectionary products) limits our ability to accurately measure complementarity in manufactured foods using the Drysdale framework.

NAFTA partners have accounted for an increasingly larger share of U.S. agricultural exports, in part, because of efficient transportation linkages. Due to differences in national endowments, Mexico is consuming a larger share of U.S. exports of land-based processed food, such as livestock and oilseed products. By contrast, Canada is the largest market for U.S. manufactured foods. Moreover, Canada's import share of U.S. manufactured food exports is increasing (fig. 12). U.S. food exports are increasingly shifting toward manufactured foods, as reflected in the RCA, with Canada's share having reached 50 percent in 2004. Countries with relatively high incomes and similar resources, like the United States and Canada, typically engage in intra-industry food trade (Henderson et al., 1998).

Empirical evidence in this report shows that specialization patterns in food trade are relatively stable for land-based products. This finding is consistent with the resource-endowment explanation of specialization and trade. Less well understood are changes taking place for food products that can be produced most anywhere capital and technology are available. The growth of intra-industry trade makes trade patterns for manufactured food products less stable and less predictable than for land-based products. Exporters with a highly diversified product portfolio, such as the United States, are bound to

Figure 12

Canada is becoming a more important market for U.S. manufactured food products



Source: Derived from United Nations COMTRADE.

see changes in the composition of their food exports over time. It would be misleading to state that the United States is losing its comparative advantage in high-value foods based on trends or shifts in the overall U.S. trade balance or the composition of its food trade. The United States has a comparative advantage for high-value food products that are dependent on the U.S. natural resource base. The United States also has the potential, as do other countries, to develop comparative advantages in products less dependent on this natural resource base. The United States has opportunities to cultivate comparative advantages in manufactured food, given improved access to the enlarged North American market due to NAFTA.

Implications of Global Tariff Reductions

Agricultural trade policy influences global patterns in high-value food trade. Market access affects not only trade flows, but also underlying economic activities, such as food processing, wholesaling, transportation, and agricultural production in individual countries. An often overlooked benefit of improved global market access in agricultural trade is the potential for boosting overall economic activity and employment related to high-value food trade.

Trade in high-value foods is not independent of trade in raw commodities. The production and trade of processed products rely on commodity inputs that are both imported and produced domestically. Thus, market access for primary agricultural commodities can affect high-value food trade. For example, South Korea improved market access for wheat imports and became a more competitive exporter of wheat-based food products through use of cheaper foreign supplies of raw inputs. Improved market access of raw inputs enables some countries to export processed products despite not having a comparative advantage in agricultural commodities. Improved market access of processed products can benefit not only processed food trade but also production and trade of raw commodities elsewhere.

Given the interaction between trade in primary agricultural commodities and processed foods, the prospects for individual countries exporting high-value foods are not always clear. Each exporter faces a diverse array of import markets, widely ranging in tariffs and overall market access. Exporters also differ in product specialization and competitiveness. For example, the United States exports both raw commodities and high-value foods. As mentioned earlier, the United States has a revealed comparative advantage in natural resource-based products, which suggests that the U.S. farm sector may benefit from improved global market access. The effect of more open markets on U.S. exports of high-value products, however, is uncertain.

Future tariff reductions in agriculture will require cuts in both raw and processed product tariffs. As previously indicated, trade in food and agricultural products is subject to tariff escalation, whereby countries maintain higher tariffs on value-added products, compared with tariffs on raw commodities. Tariff escalation enables food processing sectors in many countries to benefit from relatively free access to international sources of inputs while sheltering domestic processed products from foreign competition. Although tariff reductions are not the only measure needed to improve market access, the economic effects of other types of trade barriers are difficult to measure. Furthermore, tariff reductions are more significant for trade in high-value foods than for trade in raw commodities.

Methodology

An assessment of the economic consequences of global tariff reductions requires a trade model that captures the interaction between high-value foods and raw commodities.[10] The model employed here includes demand

for consumer and intermediate goods, such as finished and semi-processed food, and supplies of primary factors (land, labor, and capital), which are allocated across competing industries. The Global Trade Analysis Project (GTAP) modeling framework links factors of production—land, labor, and capital—to all production activities, such as farm production, food processing, and other industrial manufacturing, as well as production of services, such as transportation. Thus, the model estimates the effects of tariff reductions on employment and wages.

In this framework, each country can simultaneously be an exporter and an importer of processed foods. For example, the United States is both an exporter and importer of meat. As an exporter, it faces tariffs on meat in other countries, and as an importer, it imposes tariffs on meat from other countries. The livestock sector in each country uses raw commodities that can be purchased domestically or imported. Thus, improved market access for all commodities can stimulate global trade in meat and livestock products. However, if tariffs on livestock products remain unchanged, it would lessen global meat trade while bringing about greater trade in feed grains.

To represent tariffs at a sector level for modeling purposes, tariffs must be aggregated. As previously discussed, the choice of weighting scheme can alter average tariff rates (see box on average weighted tariffs, pg. 6). Also, while many countries maintain high maximum levels to which they can legally raise the tariffs on imports (WTO bound rates), actual applied tariffs can be substantially below these bound rates. This is especially true for developing countries. The ongoing WTO negotiations generally consider reducing tariffs based on the bound rates. As these rates are often higher than the applied rates, tariff reductions based on bound rates can result in tariffs that in certain cases may be similar or higher than the current applied rates and can potentially have little impact on actual market access for some products. Tariff reductions here are considered based on the applied rates.

Proper evaluation of different tariff-cutting formulas and the impacts of reductions in tariff escalation require detailed analysis, beginning at the tariff line where differential rates are observed. However, most trade models, including the GTAP, are ill-suited for this type of analysis given their highly aggregate sector classifications. For example, in the GTAP model, intermediate products, such as wheat flour and starch, are included in a sector containing other finished processed products such as pasta and breakfast cereals. This limits the ability to perform a more refined analysis and examine the benefits from reductions in tariff escalation.

The potential benefits from broad reductions in tariff escalation may be deduced by considering a global reduction in tariffs, since such a reduction would imply larger absolute cuts in the largest tariffs. For example, the calculated results of a 36-percent tariff cut made uniformly across all commodities for selected products globally, and for Taiwan, show features common to many food-importing countries (table 4). The uniform cut reduces the disparity between the highest and lowest tariffs at both the national and the global level. High-value and processed products undergo larger cuts, with tariff reductions in processed products averaging 8 percentage points worldwide, while bulk commodities record only a 4-percentage point cut. The difference between the global averages of

[10] This model, the Global Trade Analysis Project, is a multiregion model that includes explicit treatment of bilateral trade in all goods and services between regions (Hertel, 1997).

unprocessed bulk agricultural products and processed products is 10 percentage points before implementing the global tariff cut; it is reduced to 6.4 percentage points after the cut. The reduction varies across countries depending on the existing rates of escalation. For example, a 36-percent global tariff cut in Taiwan reduces escalation from an average 17-percentage point difference to an 11-percentage-point difference. Therefore, uniform global tariff cuts effectively reduce tariff escalation, by narrowing the tariff wedge between bulk agriculture commodities and processed food products.

In general, the tariffs faced by U.S. exporters tend to escalate with the degree of processing. For example, U.S. bulk raw commodity exports face an average tariff rate of 11 percent, much lower than the 24-percent average faced by U.S. exports of processed products (table 5). U.S. oilseeds face an average 5-percent tariff while processed oilseed products face a tariff of 19

Table 4—Effect of uniform global tariff cuts on tariff escalation

Product	Initial tariff rate	Tariff rate with 36-percent cut	Percentage pt. tariff reduction
		Percent	
Taiwan			
Bulk agricultural commodities	3.5	2.2	1.3
Wheat	6.0	3.8	2.2
Oilseeds	1.0	0.6	0.4
Horticultural products	25.5	16.3	9.2
Fresh fruit and vegetables	38.0	24.3	13.7
Other horticultural crops	13.0	8.3	4.7
Processed products	20.5	13.1	7.4
Other food products	18.0	11.5	6.5
Beverages and tobacco	47.0	30.1	16.9
World			
Bulk	12.1	7.7	4.4
Horticultural	15.2	9.7	5.5
Processed products	22.1	14.1	8.0
Bulk and processed average tariff difference			
Taiwan	17.0	10.9	
World	10.0	6.4	

Source: GTAP, 2001.

Table 5—Aggregate tariffs facing U.S. agricultural exports

	Ad valorem rates	Share of U.S. agriculture exports
	Percent	
Grains	12	25
Oilseeds	5	15
Other crops	16	15
Livestock	12	4
Total bulk commodities	11	58
Meat	26	11
Oilseed products	19	5
Dairy products	80	1
Other processed products	21	25
All processed products	24	42
All agricultural products	17	100

Source: GTAP, 2001.

percent. U.S. meat exports face particularly high tariffs. However, major U.S. agricultural exports do not face the highest levels of tariffs in global trade. Dairy products, which account for only 1 percent of total U.S. exports, face the highest aggregate tariffs.

Impacts From Global Tariff Cuts

A uniform reduction in tariffs has differing impacts on the returns to factors of production across individual countries and regions. Much of these differences can be traced to the structure of the countries' economies and trade policies. As would be expected, some countries experience a decline in returns to land, while others experience an increase (table 6). Countries whose agricultural sectors are more export-oriented and provide less tariff protection realize higher returns when tariffs are globally reduced. Countries/regions most likely to benefit are Canada, Oceania, the United States, Argentina, and Brazil.

There are positive benefits to labor for all countries as a result of improved market access. When tariffs are uniformly cut by 36 percent, increases in returns to labor are generally greater for developing countries. The effects on returns to labor across countries will depend on how much of an economy's labor force is employed in tradable or trade-dependent sectors. The United States, for example, has a highly diversified economy with a relatively large amount of labor employed in less trade-dependent or nontraded service sectors. Consequently, wages are marginally (0.1 percent) increased by trade liberalization. In developing countries, household income increases resulting from trade reforms occur mainly through changes in

Table 6—Impact of a 36-percent global tariff cut

	Primary factors of production			
	Land	Unskilled labor	Skilled labor	Capital
		Percent change		
United States	5.7	0.1	0.1	0.1
Canada	14.9	0.1	0.2	0.1
Mexico	0.8	0.2	0.2	0.1
Oceania	6.9	0.4	0.3	0.2
Brazil	3.6	0.4	0.5	0.4
Argentina	4.8	0.4	0.3	0.3
Other Latin America	6.1	1.4	1.3	1.2
EU	-6.0	0.2	0.3	0.3
Central and Eastern Europe	-1.7	2.9	3.2	3.1
Turkey	1.5	1.0	0.9	1.0
Former Soviet Union	1.5	0.9	0.9	0.7
Japan	-12.5	0.5	0.6	0.5
Korea	-3.9	2.3	2.3	2.3
Taiwan	-3.4	1.1	1.0	1.1
ASEAN	1.3	1.5	1.5	1.5
India	1.7	0.7	0.7	0.6
Other S. Asia	0.4	2.3	2.6	2.4
China	0.2	1.4	1.5	1.4
Sub-Saharan Africa	4.0	1.3	1.3	1.0
Middle East and North Africa	-12.9	2.1	2.9	2.4

Note: ASEAN=Association of South East Asia Nations.
Source: Estimated using the GTAP model.

wages from agriculture, food processing, and nonagricultural activities. While returns to agricultural land (rents) represent only 1 percent of income paid to all factors of production globally, nearly 60 percent of income is accrued by skilled and unskilled labor. Therefore, while only a small increase in wage rates, a primary benefit of improved global trade is enhanced wage earnings for workers.

A 36-percent cut in global tariffs is estimated to generate a 12-percent increase in U.S. exports of processed products, compared with a 4-percent increase in U.S. exports of raw agricultural commodities (table 7). The larger growth in exports of processed products reflects the fact that processed products currently face higher tariffs than raw agricultural commodities. In addition, expansion of processed product exports increases domestic demand for U.S. agricultural raw commodities used in the production of these exports, thereby boosting domestic prices and production.

While exports of bulk commodities increase 4-percent, exports of some commodities do not increase. For example, U.S. oilseed production expands even though oilseed exports fall slightly and imports increase. Given the current high tariffs on oilseed products compared with oilseeds, improved global market access tends to result in larger trade changes for oilseed products. Accordingly, exports of U.S. vegetable oil and oilseed meal grow by 6 percent, supported by the expansion in U.S. oilseed production.

Impact on Market Access

A uniform cut in global tariffs results in increased trade in high-value foods over raw agricultural commodities. Expanded global processing activity enhances returns to labor. Thus, improved market access has broad benefits beyond improving returns to agriculture for agricultural export-oriented countries. For developing countries, improvements in real wages for labor demonstrate the importance of more open markets in the global economy.

Table 7—Impacts of a 36-percent global tariff cut on U.S. processed food and agricultural commodities

	Production	Exports
	Percent change	
Grains	1.0	2.7
Oilseeds	0.4	-0.1
Fruit, vegetables, nuts	1.5	12.1
Other crops	-1.6	4.8
Livestock	0.7	6.6
Total agriculture	0.5	3.8
Meat	0.8	10.4
Vegetable oils	1.5	6.2
Other livestock products	-0.6	5.0
Other processed products	0.5	13.5
Total processed products	0.4	11.7

Source: Estimated using the GTAP model.

Conclusion

An examination of agricultural trade rules, evolving patterns of food trade, and the economic effects of reducing global tariffs reveal a number of issues specific to market access for high-value foods. For processed products, in particular, the protective effect of tariffs can be magnified when lower tariffs are levied on primary products ("tariff escalation"). The practice of levying low or zero tariffs on imports of primary products, with tariffs increasing as the level of processing increases, continues to be an enduring feature of many countries' tariff regimes.

In addition to, or in place of, tariffs, countries have at their disposal other measures that may encourage imports of relatively unprocessed agricultural commodities at the expense of more processed products. These include sanitary and phytosanitary measures as well as various forms of contingent protection (antidumping duties, countervailing duties, and safeguards). While it can not be ascertained whether increases in SPS notifications observed for high-value agricultural products are the result of protectionist trade policies, available evidence suggests that the use of contingent protection has concentrated on high-value products.

Global trade patterns for land-based high-value foods, whose production is dependent upon particular resources, are relatively stable despite changes in the overall composition of food trade, shifts in the direction of this trade, and trade-balance reversals. By contrast, the pattern of trade for manufactured high-value foods, which can be produced anywhere capital and technology are available, is less predictable. Data also show that it can be difficult, and sometimes impossible, to gauge empirically the nature of bilateral complementarity of trade in processed products, given the absence of sufficiently detailed data required to capture the fine degree of specialization taking place within the food industry.

Benefits of global cuts in tariffs are not limited to the largest agricultural exporters, but also accrue to smaller exporters, including many developing countries. The effects of tariff cuts on returns to labor vary across countries based on a country's share of total labor force employed in trade-dependent sectors. Consequently, increases in returns to labor are generally lower for more developed countries, where a greater share of processing is destined for domestic markets, and are higher for developing countries, where more of the value added is oriented toward foreign markets.

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Appendix A—Summary of WTO general safeguard investigations on agricultural imports, January 1, 1995 - October 20, 2003

Country	Product	Initiation date	Outcome of injury investigation	Decision on applying definitive measure
Argentina	Peaches	12.01.01	Affirmative	Affirmative
Australia	Swine meat	26.06.98	Affirmative	Negative
Brazil	Coconuts	10.08.01	Affirmative	Affirmative
Chile	Fructose	08.06.02	Affirmative	Affirmative
	Glucose	08.06.02	Investigation terminated	NA
	Mixed oils	19.12.00	Negative	Negative
	Liquid & powdered milk	21.06.00	Affirmative	Affirmative
	Wheat, wheat flour, cane & beet sugar, edible vegetable oils	30.09.99	Affirmative	Affirmative
Costa Rica	Rice	11.03.02	Ongoing	NA
Czech Republic	Cane and beet sugar	03.03.99	Affirmative	Affirmative
	Cocoa powder	15.11.01	Affirmative	Affirmative
	Isoglucose	20.12.00	Affirmative	Affirmative
	Citric acid	30.01.02	NA	Negative
Egypt	Powdered milk	25.09.00	Affirmative	Affirmative
El Salvador	Pork	19.01.00	Affirmative	Affirmative
	Rice	26.06.00	Affirmative	Affirmative
Estonia	Swine meat	15.04.03	Ongoing	NA
European Communities	Mandarins	28.07.03	Ongoing	NA
Hungary	Sugar	28.07.03	Ongoing	NA
India	Vegetable oil	27.05.02	Ongoing	NA
Japan	Shiitake mushrooms	22.12.00	Investigation terminated	NA
	Tatami-Omote	22.12.00	Investigation terminated	NA
	Welsh onions	22.12.00	Investigation terminated	NA
Jordan	Biscuits	10.12.00	Affirmative	Affirmative
	Chocolate	10.12.00	Investigation terminated	NA
	Pasta	18.05.02	Affirmative	Affirmative
	Aerated water	20.09.02	Investigation terminated	NA
Korea	Garlic	16.10.99	Affirmative	Affirmative
	Dairy products	28.05.96	Affirmative	Affirmative
	Soybean oil	30.08.95	Affirmative	Negative
Latvia	Live pig and pork	01.07.02	Affirmative	Affirmative
	Pork	20.05.99	Affirmative	Affirmative
Lithuania	Pastry yeast	N.A	Affirmative	Affirmative
Moldova	Sugar	30.09.03	Affirmative	Affirmative
Morocco	Bananas	26.06.00	Affirmative	Affirmative
Philippines	Tomato paste	N.A	Investigation terminated	NA
Slovak Republic	Pork	05.05.99	NA	Negative
	Sugar	20.10.00	Affirmative	Affirmative
Slovenia	Swine meat	15.10.98	Negative	Negative
United States	Wheat gluten	01.10.97	Affirmative	Affirmative
	Lamb meat	07.10.98	Affirmative	Affirmative
	Tomatoes & peppers	11.03.96	Negative	Negative
	Tomatoes	29.03.95	Negative	Negative

Notes: NA = information is unavailable or not applicable.
Total investigations on agricultural products = 43; 66 percent of concluded cases resulting in safeguards.
Total investigations on nonagricultural products = 81; 62 percent of concluded cases resulting in safeguards.

Sources: WTO, 2000b; WTO, 2001; WTO, 2002b; WTO, 2003b.

Appendix B—Use of special agricultural safeguards by country and product (number of tariff lines),1995-2003

Agricultural product	United States	EC-15	Poland	Japan	Korea	Hungary
Animals and products	12	28	197	41		
Fruits and vegetables	16	201	31	8	10	
Dairy products	218		1	52		
Sugar and confectionery	40	66	3			35
Cereals	25		12	32	22	
Coffee, tea, mate, cocoa, spices, andpreparations	74		2	4	2	
Other agricultural products			27	1	3	
Oilseeds and products	5				12	
Agricultural fibers	1			10		
Beverage and spirits	6					
Eggs		1	3			
Total	397	296	276	148	49	35

Agricultural product	Taiwan	Czech Rep.	Costa Rica	Philippines	Switzerland	Slovak Rep	Total
Animals and products	8	14		6	7	4	317
Fruit and vegetables	17	1	1	1			286
Dairy products	2	6					279
Sugar and confectionery	1						145
Cereals	1	1	6				99
Coffee, tea, mate, cocoa, spices and preparations	2					1	85
Other agricultural products		1					32
Oilseeds and products	2	2					21
Agricultural fibers							11
Beverage and spirits							6
Eggs							4
Total	33	25	7	7	7	5	1,285

Source: WTO, 1998; WTO, 2000a; WTO, 2002a; member notifications to the WTO Committee on Agriculture as of October 31, 2004.

Appendix C—Algebraic formulations of trade-based indicators

Revealed comparative advantage (RCA)[1]:

$$RCA_i^k = \frac{X_{iw}^k}{X_{ww}^k} \Bigg/ \frac{\sum_{k=1}^{K_M} X_{iw}^k}{\sum_{k=1}^{K_M} X_{ww}^k} \tag{1}$$

$$= \frac{\text{country i's export share of world trade in sector k}}{\text{country i's export share of world merchandise trade}}$$

Export specialization (XSP)[2]:

$$XSP_i^k = \frac{X_{iw}^k}{X_{ww}^k - X_{wi}^k} \Bigg/ \frac{\sum_{k=1}^{K_N} X_{iw}^k}{\sum_{k=1}^{K_N} \left(X_{ww}^k - X_{wi}^k\right)} \tag{2}$$

$$= \frac{\text{country i's export share of rest-of-world trade in product k}}{\text{country i's export share of rest-of-world agriculturtal trade}}$$

Import compositional share (MS):

$$\text{MS}_\text{j}^\text{k} = \left(\frac{M_{jw}^k}{\sum_{k=1}^{K_N} M_{jw}^k} \right) \tag{3}$$

$$= \text{product k's share in country j's imports in sector N}$$

[1] Balassa's index, (Balassa, 1965).

[2] XSP is structured similarly to the RCA index. Notice, however, that XSP focuses on a *supplier's foreign market* rather than the world market by netting out own-country exports from global totals. Moreover, XSP compares the supplier's exports of a specific commodity with its exports of all goods within a particular sector rather than for all merchandise.

Correlation of commodity complementarity (CCD[3]) components, XSP and MS:

$$\rho_{ij}^{s} = \frac{\mathrm{cov}(XSP_i^k, MS_j^k)}{\sigma_{XSP_i}\sigma_{MS_j}} = \frac{(CCD_{ij}^{S} - N_S\,\overline{XSP} * \overline{MS})}{\sigma_{XSP_i}\sigma_{MS_j}}$$

where (4)

$$CCD_{ij}^{S} = \sum_{k}^{K_S}\left[XSP_i^k * MS_j^k\right]$$

and where

ρ_{ij}^{S} = correlation of country i's exports specialization for product k with country j's import share for product k, summed over all trade products in subsector S.

Key to notation:

- i = exporter
- j = importer
- w = world, where world excludes intra-EU trade
- M = total merchandise
- N = sector
- S = subsector
- k = individual item with k = 1,…..K_S,…….K_N,…….K_M where
  - K_S = elements in subsector S
  - K_N = elements in sector N
  - K_M = elements in total merchandise M
- X_{iw} = exports from *i* to *w*
- X_{wi} = exports from *w* to *i*
- M_{jw} = imports by *j* from *w*

[3] CCD is Drysdale's index, (Drysdale, 1967). A "competitive index," similar in structure to Drysdale's measure of complementarity, was used in an OECD study examining the impact of economywide trade liberalization on global food security (OECD, 2002). This competitive index is the product of a non-OECD member's export share and the developed country share of world production summed over all commodities. It was used to classify developing countries according to the degree to which an OECD policy change in commodity markets is likely to affect non-OECD-member economies.

Appendix D—Grubel-Lloyd index for U.S. trade with Canada and other U.S. partners

The Grubel-Lloyd index is the most frequently used measure of intra-industry trade. The index ranges from 0 to 1 where a higher value means there is a greater overlap between exports and imports within each 4-digit industry code. The indices presented in the table provide evidence that there is greater intra-industry trade among products with higher degree of processing or differentiation. However, seasonal trade, where there is exporting during one season and importing during another, can overstate intra-industry trade. The Grubel-Lloyd index can be used to measure intra-industry trade between a country and individual partners, a region, or the world.

		Grubel-Lloyd index for U.S. trade with:	
SIC code	Products	Canada	All other partners
2051	Bread and other bakery products	0.978	0.321
2099	Food preparations	0.973	0.946
2096	Potato chips, corn chips, and similar snacks	0.963	0.695
2022	Natural, processed, and imitation cheese	0.958	0.261
2048	Prepared feeds	0.947	0.378
2079	Shortening, table oils, margarine	0.946	0.315
2062	Cane sugar refining	0.925	0.187
2098	Macaroni, spaghetti, vermicelli, and noodles	0.914	0.211
2045	Prepared flour mixes and doughs	0.914	0.104
2052	Cookies and crackers	0.864	0.459
2043	Cereal breakfast foods	0.855	0.217
2032	Canned specialities	0.847	0.692
2035	Salad dressings	0.831	0.974
2077	Animal and marine fats and oils	0.789	0.220
2086	Bottled and canned soft drinks and carbonated waters	0.736	0.381
2041	Flour and other grain mill products	0.728	0.289
2046	Wet corn milling	0.695	0.336
2095	Roasted coffee	0.668	0.465
2033	Canned fruits, vegetables, preserves	0.657	0.607
2023	Dry, condensed, and evaporated dairy products	0.655	0.989
2064	Candy and other confectionery products	0.627	0.260
2066	Chocolate and cocoa products	0.623	0.300
2097	Manufactured ice	0.615	0.396
2085	Distilled and blended liquors	0.569	0.341
2091	Canned and cured fish and seafoods	0.562	0.352
2047	Dog and cat food	0.522	0.199
2084	Wines, brandy and brandy spirits	0.521	0.272
2015	Poultry slaughtering and processing	0.518	0.033
2024	Ice cream and frozen desserts	0.498	0.276
2011	Meat packing	0.462	0.728
2076	Vegetable oil, except corn, cottonseed and soybean	0.422	0.307
2092	Prepared fresh or frozen fish and seafoods	0.401	0.430
2038	Frozen specialties	0.368	0.215
2082	Malt beverages	0.347	0.162
2067	Chewing gum	0.346	0.998
2037	Frozen fruits, fruit juices, and vegetables	0.334	0.939
2074	Cottonseed oil	0.327	0.417
2034	Dried and dehydrated fruits, vegetables and soup mixes	0.307	0.861
2053	Frozen bakery products, except bread	0.306	0.763
2026	Fluid milk	0.266	0.612
2021	Creamery butter	0.255	0.761
2087	Flavoring extracts and flavoring syrups	0.250	0.945
2013	Sausage and other prepared meats	0.200	0.441
2075	Soybean oil	0.177	0.057
2044	Rice milling	0.121	0.489
2083	Malt	0.101	0.754
2068	Salted and roasted nuts and seeds	0.070	0.746
2063	Beet sugar	0.045	0.020
	Trade-weighted average	0.566	0.482

Source: U.S. Census Bureau, Foreign Trade Statistics, based on U.S Standard Industry Classification (SIC).