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Production-weighted Estimates of Aggregate Protection in Rich Countries toward Developing Countries

By David Roodman

Abstract

A challenge in the development of aggregate indexes of trade protection is finding weights to put on various tariffs that a) reflect their importance to exporters and b) are not endogenous to the protection being measured. One common basis for weights is actual imports; but these, as is well-known, are endogenous. Various authors have worked to correct this endogeneity, but doing so is difficult in product areas where protection is both high and widespread. For this reason, I develop a new set of estimates of overall protection in rich countries with respect to developing ones that eschews import weights as much as possible in favor of weights based on the value of exporter's total production in each product area. The results are generally much higher than those from the Bouët et al. (2004) "MAcMap" data set; there, weights are based on imports of large reference groups of countries. I conclude that product areas in which protection is high and wide-spread are systematically de-emphasized when using pure MAcMap weights to aggregate across major product groups. In particular, when gauging rich-country protection with respect to developing countries, agriculture is de-emphasized. I also develop estimates of trade-distorting subsidies by country and commodity and translate these into tariff-equivalents with the methodology of Cline (2004) in order to estimate overall protection levels. Agricultural tariffs dominate subsidies in trade-distorting effect, and agricultural protection in turn dominates goods protection generally. Japan is most protective, largely because of rice tariffs near 900%, followed by Norway and Switzerland. Because of their greater reliance on agriculture, the poorest countries face higher trade barriers than wealthier developing countries, despite tariff preferences.

Production-weighted Estimates of Aggregate Protection in Rich Countries toward Developing Countries

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A central issue in the ongoing Doha "development" Round negotiations to revise the General Agreement on Tariffs and Trade has been barriers in rich countries to exports from poorer ones. For the negotiators, the substance of central interest consists of the thousand-line tariff schedules maintained by customs authorities in each country, as well as complicated subsidy programs. The negotiators will decide exactly which tariffs or subsidies will be capped for which products with respect to which exporters, and by how much. But most people interested in these issues need answers to broader-brush questions, such as which major product groups, such as rice and coffee, face the highest barriers, and which countries are most protective. Historically, the need for the big picture has led economists to developed aggregate indexes of protection, usually expressed in *ad valorem* tariff-equivalent terms (e.g., Anderson and Neary 1994, 1996, 2003; Bouët et al. 2004; Cline 2002, 2004; IMF 2005; Kee, Nicita, and Olarreaga 2005). The Commitment to Development Index (Roodman 2005a), which rates the "development friendliness" of rich countries in trade and other policy areas, naturally requires such an index. The 2003 and 2004 editions use Cline's (2002, 2004) Aggregate Measure of Protection.

The paper describes the methodology of revised measure of trade protection used in the 2005 CDI and reports results, which are of independent interest. Developing an aggregate index of trade policy is inherently difficult. As a result, debate continues on how best to do it. The raw data on tariffs and other barriers are complex and often incomplete. It is hard to estimate key parameters, such as supply elasticities, that determine welfare cost of various barriers. But without an understanding of the costs, it is hard to know, for example, whether a tariff twice as high is twice as bad. There are conceptual challenges in comparing barriers, such as tariffs and quotas, that are fundamentally different.

In addition, there is the challenge of weighting, which is the focus in this paper. Tariffs against major goods obviously matter more than those against obscure ones, and so ought to be given more weight. But what should be the basis for weights? One natural choice is the value of imports of the good in question, especially tempting since imports data are often available at the same resolution as tariff data. But this leads to a well-known endogeneity problem: categories with the most protection can get the least weight. Attempts have been made to estimate counterfactual import levels in the absence of protection.

[1] William Cline guided this work. I thank Betina Dimaranan of the Global Trade Analysis Project and David Laborde of the Centre d'Etudes Prospectives et d'Informations Internationales for assistance with data. I thank Tom Hertel, Dominique van der Mensbrugghe, Peter Timmer, Kim Elliott, Agapi Somwaru, and John Wainio for their contributions to the November 2004 meeting that gave impetus to this work.

Cline, for example, computes "adjusted import weights" for broad sectors such as agriculture based on certain assumptions about the elasticity of demand and supply for imports. Bouët et al. use observed import levels of large reference groups of countries, which are less endogenous to protection in any one country. But neither approach is reliable in product areas where protection is both high and widespread, as it is in agriculture, textiles, and apparel, the areas of most concern to developing countries. When protection is very high, extrapolated estimates of imports in the absence of protection become too heroic; when it is widespread, reference groups do not work.

This short paper presents a conceptually simple approach to aggregating protection data, one that eschews import weights as much as possible in favor of production weights. The value of Vietnam's rice production, for example, is taken as the best available indicator of its propensity to export rice to Japan—better than its actual exports to Japan, however adjusted, and better than its exports to other countries, where it also faces barriers. The underlying protection data come from Bouët et al.'s extremely detailed MAcMap data set, while the production data come from the Global Trade Analysis Project version 6 database

Section 1 of this paper details the methodology and uses it to measure protection in individual rich countries with respect to developing countries as a group, by which I mean essentially all countries that are not members of the Development Assistance Committee (DAC). Section 2 integrates estimates of the tariff equivalent of agricultural subsidies, derived with the methodology of Cline (2002, 2004), in order to calculate overall levels of protection in rich countries from the developing country point of view, in agriculture specifically and goods generally. Section 3 briefly concludes.

1. Aggregate tariff barriers

Antoine Bouët, Lionel Fontagné, and colleagues at the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII) and the International Trade Centre have made a formidable attack on the protection-measurement problem in their Market Access Map (MAcMap) data set. One sign of the value of their work is that the Global Trade Analysis Project (GTAP) switched to MAcMap data in version 6 of the GTAP modeling product. MAcMap provides *ad valorem* tariff equivalents of tariffs by importer, exporter, and 6-digit line in the Harmonized System of product classification (HS 6). The data set has some 35 million rows in all. In contrast with the GTAP 5 protection estimates, which are used in the 2003 and 2004 editions of the CDI, the MAcMap data factor in preferences for least developed countries. They also embodies considerable effort on methodologies for converting tariff-rate quotas and specific-unit tariffs into *ad valorem*–equivalent simple tariffs. And they contain a fresh approach to reducing the endogeneity of import weights that involves clustering importers into reference groups. The weight for a given barrier is based on imports not just of the country imposing the barrier but of all countries in its group. The weights, like the tariff estimates, are provided for each combination of importer, exporter, and HS 6 line.

However, some aggregate results from MAcMap differ surprisingly from previous results. In particular, trade barriers in rich countries with respect to poorer countries appear quite low. (See Table 1.) Seemingly, despite all the Doha Round controversy, rich-country tariffs are a minor problem for developing countries. And to the extent they are a problem, Australia appears to be the greatest offender, rather than Japan, Norway, or Switzerland, the rich countries usually seen as most protective. These results differ substantially from those in Cline (2004) and Kee, Nicita, and Olarreaga (2005).

Table 1. *Ad valorem* equivalent of trade barriers with respect to middle-income and least-developed country exporters, 2001 (%)

Importer	Middle-income exporters	LDC exporters
Australia	5.6	8.4
Canada	3.1	6.3
EU-15	2.7	0.8
Japan	4.1	2.0
New Zealand	2.8	4.0
Switzerland	3.5	0.6
United States	2.6	5.9

Source: Bouët et al. (2004).

Motivated by the need to update and refine the trade component of the Commitment to Development Index for 2005, I obtained the MAcMap data set and investigated the effects of alternative aggregation approaches. The goal was to take advantage of the MAcMap authors' careful work at the sub–HS 6 level while investigating and correcting potential endogeneity problems that would explain results like those in Table 1. The main concern was that MAcMap's use of reference groups for import weights does not end the endogeneity of import weights to protection. In particular, agricultural protection, which turns out to drive overall results, is high in most rich countries.

To reduce the endogeneity, I experiment with what can be thought of as four distinct changes to the MAcMap aggregation. The thrust throughout is to base weights on the value of exporter's production rather than exports. But production figures are not available at the high resolution of HS 6. The best available data appear to be from the GTAP 6.0 database; there one can find the value of world production of goods and services broken down by 87 country/regions and 57 product groups.[2] Taking advantage of this data for weighting therefore requires that the MAcMap data be aggregated in two steps: first to the GTAP level, then to the universal level. This must be done along each of two dimensions: product groups and exporters. Thus there are four aggregation steps, and in each step I experiment with one change:

1) To aggregate across HS 6 lines within GTAP product categories, I use MAcMap weights or simple averaging—whichever gives the higher number. This increases the sensitivity to the phenomenon of high barriers across an entire reference group of importers for a given product.
2) To aggregate across countries within a GTAP region, I weight by exchange-rate GDP rather than MAcMap weights. This is relevant only for GTAP regions that in fact consist of more than one country, such as "Rest of Sub-Saharan Africa." GDP is a coarse indicator of propensity to export, but has the advantage of not being very endogenous to protection faced, and does distinguish appropriately between large and small countries.
3) To aggregate across GTAP regions, to the full universe of non-DAC countries, I weight by the value of exporter's production in the product category.
4) To aggregate across GTAP product groups to the full universe of traded goods, I weight in the same manner.

[2] The 57 include services, which are not relevant here because MAcMap, like all such databases, lacks information on protection in services.

It should be emphasized that these steps reduce but do not eliminate endogeneity. Production too is endogenous to protection faced; even GDP is to some extent. Moreover, the at least partial reliance on MAcMap weighting with GTAP product categories also means that imports still enter.

To investigate the relative significance of these changes, I perform six variants of the original MAcMap aggregation—the aggregation, that is, that relies purely on MAcMap's disctinctive reference group import weights. Variant 1 makes changes 1 and 2—and performs the modified steps in that order—but uses MAcMap weights thereafter, in order to determine the importance of changes to how data are aggregated up to the GTAP level. Variant 2 makes changes 1–3 while Variant 3 makes only change 4 because, it will emerge, change 4 is the one of central importance. Variant 4 makes all the changes. Variant 5 makes all changes too, but swaps the first two steps. If all the steps simply took weighted averages, this swap would have no effect. But because change 1 involves the maximum operator, order matters.

Finally, Variant 6 drops change 1 but implements the other changes, and is my preferred variant; the maximum operator in change 1 is relatively atheoretical and inelegant and turns out to have a small effect on the absolute results and almost no effect on the relative results. Thus Variant 6 is a true weighted average of MAcMap values. It still aggregates across HS 6 lines within GTAP product groups using MAcMap weights, but aggregates across exporters within GTAP country/regions by exporter's GDP and across GTAP product groups and country/regions by the value of exporter's production. Table 2 has the results.

Table 2. Protection with respect to non-DAC countries, 2001, various aggregation systems (*ad valorem* equivalent, %)

		Variant						
Country	With MAcMap weighting	1	2	3	4	5	6	Variant 6 + export tax equivalents of textile & apparel quotas
Australia	5.44	5.71	5.62	4.36	4.73	4.49	4.36	4.36
Canada	3.04	3.33	3.21	4.23	4.51	4.39	3.93	4.77
EU-15	2.66	3.06	2.96	8.19	8.42	8.86	7.46	9.13
Japan	3.48	4.25	4.21	25.76	29.48	28.32	26.90	26.90
New Zealand	2.64	2.99	2.97	2.31	3.03	2.77	2.55	2.55
Norway	3.45	4.67	4.76	16.77	19.99	19.50	16.83	16.83
Switzerland	4.11	5.30	4.80	11.25	13.27	12.97	11.00	11.00
United States	2.35	2.68	2.81	2.61	3.24	2.96	2.83	4.08

It is apparent that change 4—weighting across GTAP product groups by production rather than MAcMap import weights—makes the biggest difference. To see this, note that the variants break into two groups going by results. Variants 1 and 2 do not make change 4 and yield results similar to the MAcMap original. Variants 3–5 include change 4 (indeed, it is the only change they all share) and produce similar and generally higher values. This suggests that product areas in which protection is high and widespread in rich countries are systematically de-emphasized when using pure MAcMap weights. It also goes a long way to explaining the difference between the MAcMap aggregates in Table 1 and those in, for example, Cline (2002, 2004) and the previous Commitment to Development Index (Roodman 2004).

The detailed appendix Table A–1 further illuminates the key difference. It has one row for each rich-country importer by GTAP product group. The "tariffs" column shows the estimated tariff level by importer and product group, as used in the preferred Variant 6—tariff levels derived, that is, by aggregating across HS 6 lines to GTAP product categories by MAcMap weight, and across countries to GTAP regions by GDP. The next column shows the MAcMap weights for each importer–product group combination. The one after shows weights based on exporters' production. Both weight sets are adjusted to sum to 100% for each importer. (The next section explains the final two columns.) In agricultural categories, most production weights are much higher than MAcMap import-based weights. For example, the EU's estimated 90% tariff on sugar from non-DAC countries gets only 0.15% weight in the MAcMap system but 0.76% going by production, a 5-fold difference. By the same token, MAcMap gives more weight to manufactures, where rich-country protection is generally low—but where Australian protection is relatively high. This explains the poor relative result for Australia in the pure MAcMap approach.

Given the high protection levels throughout the group of rich countries in certain categories, especially agriculture, it seems likely that the MAcMap reference-group system, *when used for aggregation across major product categories*, leads to substantial underestimates of protection. A similar endogeneity bias may also operate with product groups, but the similarity of results between Variants 5 and 6 offers reassurance that the bias is not too large. It might be argued that production weights are also misleading, that Thailand and Vietnam have much less propensity to export rice than produce it. But then why do rich countries maintain such high barriers against them?

Technically these estimates are for the data year of 2001, at which time Canada, the European Union, and the United States textile and apparel import quotas. Francois and Spinanger estimate the export tax equivalents of these quotas. I use the variant of their estimates that are free of some constraints imposed for consistency with GTAP 6.0. The final column of Table 2 shows what happens when these export tax equivalents are chained in with tariffs in the GTAP "textiles" and "wearing apparel" categories. Since the quotas no longer exist, they are left out of all results reported hereafter.

Table 3 and Table 4 decompose the results for the preferred Variant 6 by exporter's region and income group, using World Bank definitions of these categories. There is some evidence that rich countries erect the highest barriers against those regions with which they have the most natural propensity to trade. Japan's protection is highest against its neighbors in Asia while the Swiss and Norwegians put the highest tariffs on goods from the Americas, with Eastern Europe a close second. More importantly, in the stratification by income group, there is little sign that preferences for the poorest countries are a major factor. ("Upper income" here refers to non-DAC exporters such as Hong Kong and Slovenia.) EU tariffs against low-income countries average 6.54%, only slightly below the 7.84% for lower-middle income countries, and well above the 3.85% for high-income countries. Norwegian and Swiss tariffs are actually measured as higher for low-income countries that lower-middle income ones. And the highest number in the table is for Japan's protection with respect to low-income countries, a striking 40.12%.

Table 3. Protection with respect to non-DAC countries, 2001, by region, Variant 6 (ad valorem equivalent, %)

Country	Americas	East and South Asia	Middle East & N. Africa	Eastern Europe	Sub-Saharan Africa
Australia	4.67	4.49	4.08	4.19	3.21

Canada	4.14	3.81	3.68	4.33	2.22
EU-15	7.57	8.89	4.56	5.47	4.28
Japan	15.79	35.98	19.40	18.32	21.72
New Zealand	2.44	2.96	1.60	2.25	1.48
Norway	21.16	13.72	15.24	20.56	16.45
Switzerland	16.82	7.21	12.86	14.57	7.86
United States	2.19	3.47	1.86	2.44	1.30

Table 4. Protection with respect to non-DAC countries, 2001, by income group, Variant 6 (*ad valorem* equivalent, %)

Country	Low income	Lower middle income	Middle income	Upper middle income	Upper income
Australia	3.96	4.22	4.35	5.06	3.84
Canada	3.06	3.88	4.22	3.86	3.38
EU-15	6.54	7.84	5.95	7.13	3.85
Japan	40.12	25.02	13.85	25.47	14.79
New Zealand	4.95	2.45	2.18	2.85	1.89
Norway	18.81	16.39	18.80	5.64	8.62
Switzerland	11.89	9.88	13.74	6.43	9.38
United States	2.29	3.11	2.05	2.83	1.85

2. A closer look at agriculture

Especially now that the old quotas on textiles and apparel have been abolished, domestic agricultural subsidies loom as the most important non-tariff impediment to trade maintained by rich countries. It is often said that OECD governments spend $300 billion a year subsidizing agricultural production. Although aid to rich-country farmers is copious, the $300 billion figure is wrong, so phrased. Rather, OECD farmers and food buyers receive support by virtue of government policy that is equivalent to nearly $300 billion in subsidies, as measured by the OECD's (2004) Total Support Estimate (TSE). Much of this benefit is actually delivered in the form of tariffs, which raise prices and which the OECD converts to subsidy equivalents. Much of the rest includes "general services" such as agricultural education and R&D, transfers to consumers rather than producers, and transfers to producers in ways that create little incentive for additional production, thus little trade distortion.

The purpose at hand is to measure government payments that distort trade, which calls for a narrower definition of subsidy. This section describes such a definition, and how the subsidy totals generated by it are converted to tariff equivalents in order to allow comparison with the previous section's results.

Table 5 lays out the subsidy definition at a high level of aggregation in order to give a sense of the magnitudes involved. The OECD tracks three major kinds of support: support to producers, general services such as agricultural extension and inspection services, and support to consumers. The first major subcategory of producer support is Market Price Support (MPS, row B of the table), which is the additional income accruing to producers because their farmgate prices are higher than world prices. Governments maintain these price differentials with two kinds of border measures: barriers to imports (tariffs) and subsidies for exports. Import barriers account for the lion's share of MPS in OECD countries and, because they generate transfers from domestic consumers to domestic producers, they also show up as negative entries under support to consumers (row T). Spending on export subsidies can be inferred by taking the algebraic sum of MPS and transfers from consumers to producers (see row X).

The other subcategories of producer support do represent government expenditure. And many of these are counted here as distorting production, including "Payments based on output, "Payments based on area planted/animal numbers," "Counter cyclical payments," "Payments based on input use," and "Payments based on input constraints." "Payments based on historical entitlements" are also counted, but at 50 cents on the dollar. In theory, these subsidies are decoupled from present production and shouldn't distort it, but they are often administered in ways that do. For example, the U.S. formally decoupled many support payments in 1996—but then disbursed an extra $8.6 billion/year in "emergency assistance" during 1998–2001, and in 2002 allowed farmers to update the base figures for their "decoupled" subsidies. And some EU payments are decoupled only at the national or regional level. Allocation within regions is still based on actual production (de Gorter, Ingco, and Ignacio 2003).

To these are added export subsidies. Throughout, averages for 2001–03 are used because subsidy levels are sensitive to volatile world prices and the weather. For the countries of interest here, total trade-distorting subsidies are estimated at $77.5 billion/year for 2001–03. Of this, only $2.7 billion was for export subsidies, the type often singled out by NGOs and politicians.

Table 5. Production-distorting agricultural payments and Total Support Estimate of OECD, 2001–03 averages

	Australia	Canada	EU-15	Japan	N. Zea-land	Norway	Switzer-land	United States	Total ($)
National currency figures									
A. Producer Support Estimate (PSE)	1,552	7,002	102,708	5,359	221	20,741	7,586	44,239	
B. Market Price Support (MPS)	6	3,383	58,311	4,824	174	9,438	4,353	16,836	
C. Payments based on output	0	337	3,792	166	0	2,442	364	4,841	
D. Payments based on area planted/animal numbers	37	788	28,027	0	0	3,473	905	2,902	
E. "Counter cyclical payments"								1,426	
F. Payments based on historical entitlements	183	989	608	0	0	579	1,302	6,828	
G. Payments based on input use	1,041	484	7,908	247	47	3,911	336	7,222	
H. Payments based on input constraints	0	1	4,073	122	0	368	130	1,978	
I. Payments based on overall farming income	285	909	0	0	0	530	0	2,206	
J. Miscellaneous payments	0	111	–11	0	0	0	196		
K. General Services Support Estimate (GSSE)	909	2455	9410	1461	220	1436	532	27159	
L. Research and development	591	447	1550	54	114	688	93	2569	
M. Agricultural schools	0	248	901	52	12	0	22	0	
N. Inspection services	92	591	369	11	66	273	13	734	
O. Infrastructure	201	538	1973	1074	27	210	97	4125	
P. Marketing and promotion	8	632	3138	26	0	114	65	17434	
Q. Public stockholding	0	0	1343	46	0	14	47	123	
R. Miscellaneous	16	0	135	199	1	139	196	2174	
S. Consumer Support Estimate (CSE)	–215	–3,540	–51,904	–6,732	–162	–9,209	–5,105	4,816	
T. Transfers to producers from consumers	–3	–3,324	–55,537	–4,823	–162	-10,217	–4,415	–16,833	
Other transfers from consumers	–1	–255	–698	–1,917	0	–420	–1,031	–2,081	
U. Transfers to consumers from taxpayers	–211	28	3,762	5	0	520	230	23,729	
V. Excess feed cost	0	11	570	3	0	909	111	0	
W. *OECD Total Support Estimate (A+K+U)*	2,250	9,485	115,880	6,825	441	22,697	8,348	95,127	
X. Export subsidies (B+T)	3	59	2,774	1	12	–779	–62	3	
Y. Other direct trade-distorting subsidies (C+D+E+F/2+G+H)	1,170	2,105	44,104	535	47	10,484	2,386	21,783	
Z. Exchange rate/$	1.75	1.5	1.01	0.12	2	7.94	1.52	1	
Dollar figures									
AA. OECD Total Support Estimate (W/Z)	1,286	6,323	114,733	56,875	221	2,859	5,492	95,127	282,915
AB. Export subsidies (X/Z)	2	39	2,746	8	6	–98	–41	3	2,666
AC. Other trade-distorting subsidies (Y/Z)	667	1,405	43,663	4,427	24	1,320	1,567	21,783	74,855
Total trade-distorting subsidies (AB+AC)	**668**	**1,444**	**46,409**	**4,436**	**30**	**1,222**	**1,526**	**21,786**	**77,521**

The aggregate data in Table 5 do not in fact enter the calculations described here. Rather, more detailed data from the OECD (2004) by commodity group (beef, oats, etc.) are used, in the same way. The OECD and GTAP databases categorize agricultural products differently; some GTAP categories are subdivided in the OECD subsidy database, and vice versa in the case of rice, which GTAP splits between paddy and processed rice. In order to integrate the two agricultural data sets, I aggregate both into 9 supercategories, 8 of which are strict GTAP categories and one of which is rice. Again, I aggregate the tariff estimates using production weights.

The formula for translating production subsidies into tariff equivalents is based on Cline (2004, ch. 3). It is from a static partial equilibrium analysis that asks what uniform *ad valorem* tariff level would depress imports as much as a given production subsidy. Inputs to the formula are subsidies, s, and imports, φ_M, both as shares of the farmgate value of production; the *ad valorem* tariff equivalent of existing border measures, t; and the absolute value of the price elasticity of demand for imports, β. β is in turn estimated as $\sigma_D(1-\phi_M)$, where σ_D is the elasticity of substitution in demand between domestic goods and imports, assumed to be 3.6, and ϕ_M is imports/consumption at world prices. Cline shows that, assuming that the elasticity of domestic supply is 1, a production subsidy causes a proportionate reduction in imports equal to

$$1+\varphi_M(1+t)\left(1+\frac{1}{s}\right).$$

(This is algebraically equivalent to Equation A8 of Cline 2004, Appendix 3A–2.) Meanwhile, the proportionate reduction caused by an additional and hypothetical *ad valorem* tariff, τ, in place of the subsidy would be

$$(1+\tau)^{\beta}$$

Equating the two expressions and solving yields the tariff-equivalent of the subsidy:

$$\tau=\left(1+\frac{1}{1+\varphi_M(1+t)\left(1+\frac{1}{s}\right)}\right)^{\frac{1}{\beta}}-1.$$

This is the formula for the final column of Table A–2, which exhibits the calculations for each importer and product group.[3] Import and export data there are from the UNCTAD COMTRADE database, and are averages for 2002–03 because 2001 data are not available via the web interface for this database.

The final two columns of appendix Table A–1 chain these subsidy tariff-equivalents with tariffs derived under Variant 6 in the previous section, in order to obtain estimates of overall protection in agriculture with respect to non-DAC countries. Table 6 summarizes the results for agriculture, by major commodity group. Table 7 performs the final aggregations, across all agriculture and across all goods.

Australia and New Zealand have extremely low agricultural tariffs against developing countries, at 0.83% and 0.37% in across-the-board *ad valorem* terms. New Zealand matches the low tariffs with minimal subsidies, equivalent to just 1.09% in tariff terms; but subsidies in Australia are somewhat more substantial, equivalent to a 6.37% tariff. Along with the United States, the next-lowest on tariffs, these three countries impede agricultural imports from developing countries more through subsidies than tariffs. All, however, maintain relatively low barriers in aggregate. The other rich countries, especially Japan, Norway, and Switzerland, have higher barriers, which are imposed mainly through tariffs. This is perhaps not surprising since it is much cheaper for a government to protect farmers from foreign competition with tariffs than subsidies. Moreover, production subsidies are not as efficient at impeding imports. Paying a farmer based on outputs, inputs, etc., does not quite as directly interfere with imports.

The correlations between the top and bottom halves of Table 7 suggest that agricultural protection is in turn the dominant source of variation in levels of overall protection in goods. An examination of the details in Table A–1 bears this out. Protection tends to be much lower in textiles, apparel, and other manufactures, for example. In sum, then, agricultural *tariffs* are the major source of difference among rich countries in protection with respect to poor ones. Switzerland, Norway, and Japan impose the highest agricultural tariffs, equivalent to uniform *ad valorem* tariffs of 50.86%, 89.44%, and 158.14% respectively, and are also highest in overall goods protection, in the same order.

The final column of Table 7 compares this paper's results with those of Cline (2004). The differences are remarkably small for the EU-15 and United States, despite Cline's use of a different methodology and GTAP 5 data. The factor-two difference for Japan appears to be largely explained by different estimates for the tariff equivalent of tariff rate quotas (TRQs) on rice, which are pairs of tariffs, one high, one low, that are used to enforce pre–Uruguary Round quotas. GTAP 5 used the simple average of the two tariffs. MAcMap uses the low rate when quotas are less than 90%, the simple average for fill rates of 90–100%, and the high rate for fill rates above 100%.GTAP 5 puts Japanese paddy and process rice

[3] This is nearly equivalent to equation A10 of Cline (2004, ch. 3, appendix 3A–2), differing only in that the elasticity β enters as an exponent. Cline's formula is equivalent to

$$\tau = \frac{1}{\beta}\frac{1}{1+\varphi_M\left(1+t\right)\left(1+\frac{1}{s}\right)},$$

which is the first term in a Taylor expansion of the formula used here.

tariffs both at 409% (Dimaranan and McDougall 2002, p. 4–6). The MAcMap-based figures reported here (Table A–1) are 844% and 919%.

Table 6. *Ad valorem* tariffs with respect to non-DAC countries and tariff-equivalents of subsidies, agriculture, by importer and major product group (%)

Importer	Rice	Wheat	Corn & other grains	Sugar	Vege-tables, fruit, nuts	Beef & sheep-meat	Pork, poul-try, other meat	Dairy, eggs	Oil seeds	Wool
Tariffs, 2001										
Australia	0.0	0.0	0.0	10.0	0.8	0.0	0.7	0.9	0.8	0.2
Canada	0.0	2.6	0.3	4.5	1.8	8.4	39.5	97.7	0.0	0.0
EU-15	110.8	0.7	17.2	90.4	19.1	75.8	15.2	38.0	0.0	0.0
Japan	886.7	214.4	53.2	227.0	21.4	38.2	36.5	82.4	1.6	1.2
New Zealand	0.0	0.0	0.0	0.0	0.1	0.0	2.7	1.3	0.0	0.0
Norway	29.1	208.4	114.8	56.6	19.9	222.7	224.3	134.0	48.6	0.0
Switzerland	6.6	131.6	77.7	100.9	30.5	168.2	111.3	106.8	21.2	0.0
U.S.	5.2	3.2	0.9	24.2	5.0	2.6	3.3	16.7	8.7	1.6
Tariff equivalents of subsidies, 2001–03										
Australia	6.8	16.1	18.5	19.5	0.0	20.8	5.6	17.4	5.8	20.1
Canada	0.0	19.1	11.7	0.0	–1.3	9.3	4.8	2.7	13.2	0.0
EU-15	12.8	20.4	20.7	4.6	2.4	18.7	10.3	13.7	14.3	0.0
Japan	13.8	4.1	3.8	2.4	1.6	3.5	0.6	6.9	16.1	0.0
New Zealand	0.0	0.0	0.0	0.0	0.0	5.8	5.3	5.7	0.0	0.0
Norway	0.0	9.5	19.5	0.0	0.0	19.3	2.4	20.7	0.0	21.5
Switzerland	0.0	11.3	12.2	6.3	0.0	13.7	6.2	20.3	16.4	0.0
U.S.	20.5	21.0	20.1	4.8	13.0	7.2	9.0	11.9	20.5	4.8
Tariffs & subsidies combined										
Australia	6.8	16.1	18.5	31.5	0.8	20.8	6.4	18.5	6.6	20.3
Canada	0.0	22.1	12.0	4.5	0.5	18.5	46.1	103.1	13.2	0.0
EU-15	137.8	21.2	41.5	99.2	22.0	108.6	27.2	57.0	14.3	0.0
Japan	1023.1	227.3	58.9	234.8	23.4	43.1	37.3	95.0	18.0	1.2
New Zealand	0.0	0.0	0.0	0.0	0.1	5.9	8.2	7.1	0.0	0.0
Norway	29.1	237.8	156.7	56.6	19.9	284.9	232.2	182.3	48.6	21.5
Switzerland	6.6	157.7	99.5	113.5	30.5	204.9	124.4	148.8	41.0	0.0
U.S.	26.8	24.9	21.1	30.2	18.6	10.0	12.7	30.6	31.0	6.5

Table 7. Aggregate protection in rich countries with respect to non-DAC countries, agriculture and all goods, uniform *ad valorem* equivalents

	Tariffs (Variant 6), 2001	Subsidies, 2001–03	**Tariffs and subsidies combined**	Memo: Cline (2004) Aggregate Measure of Protection
Agriculture				
Australia	0.83	6.37	**7.32**	
Canada	10.79	2.82	**13.98**	52.26
EU-15	34.41	7.74	**45.70**	46.37
Japan	158.14	3.91	**179.10**	82.05
New Zealand	0.37	1.09	**1.48**	
Norway	89.44	3.87	**99.82**	
Switzerland	50.86	4.49	**60.07**	
United States	5.03	10.72	**16.36**	19.92
All goods				
Australia	4.36	1.03	**5.40**	
Canada	3.93	0.44	**4.43**	10.68
EU-15	7.46	1.21	**9.23**	9.53
Japan	26.90	0.61	**30.18**	15.55
New Zealand	2.55	0.17	**2.73**	
Norway	16.83	0.64	**18.49**	
Switzerland	11.00	0.70	**12.44**	
United States	2.83	1.68	**4.61**	4.01

Note: "Agriculture" includes the GTAP 6 product categories that correspond approximately to the coverage of the OECD subsidy database: Animal products; Cattle, sheep; Cattle, sheep meat; Dairy products; Oil seeds; Other grains; Other meat; Paddy rice; Plant-based fibers; Processed rice; Sugar; Sugar cane; Vegetables, fruit; Wheat.

Given the evidence that rich-country agricultural subsidies are much less important for developing countries than tariffs, why have they received so much attention from NGOs, journalists, and government officials? Table 8 borrows an idea from the Catholic Agency for Overseas Development to suggest one reason. Leaving aside the trade effect, government payments to agriculture also consume government funds. Economists call that an opportunity cost. Activists call it unjust. The table shows total government payments to agriculture for 2003, including payments excluded above as non-distortionary, per head of the relevant kind of livestock. Livestock figures are from the U.N. Food and Agriculture Organization's FAOSTAT database. Subsidies for cattle include those for milk, those for chicken include eggs, and those for sheep include wool. The final column shows net Overseas Development Assistance given per poor person in developing countries, where "the poor" are the 2.7 billion people living on less that $2 a day.[4] The rich countries as a whole give $106 in subsidies per cow, $16 per sheep, $10 per pig, and $14.50 per poor person.

[4] The net ODA figures are adjusted as described in Roodman (2005b) to subtract out interest payments received from developing countries and forgiveness of non-ODA loans.

Table 8. Subsidies per rich-country animal and aid per poor person, 2003 ($)

	Subsidies per head of livestock				Net aid transfers per poor person in developing countries
	Cattle	Chickens	Pigs	Sheep	
Australia	18.37	0.41	7.12	1.12	0.44
Canada	92.19	0.46	17.34	0.00	0.71
EU-15	200.09	0.36	10.52	35.45	11.03
Japan	160.64	0.23	5.17	0.00	2.20
New Zealand	2.55	0.47	0.44	0.05	0.06
Norway	964.98	0.85	51.50	91.07	0.75
Switzerland	985.87	2.63	140.35	15.74	0.46
United States	41.34	0.43	6.16	2.22	5.26
Total	106.54	0.40	10.48	15.76	14.50

3. Conclusion

The methodology described here is not as sophisticated as the general equilibrium approach of Anderson and Neary or the intensely econometric technique of Kee, Nicita, and Olarreaga. But within a relatively simple conceptual framework, using high-quality and detailed data from the MAcMap data set, it produces plausible results. Indeed, the results make more sense that those derived purely using MAcMap weights, which appear to introduce substantial endogeneity bias when aggregating across major product groups.

With respect to developing countries, New Zealand is least protective, followed by the United States, Canada, and Australia. EU barriers are about three times as high as those of the United States in agriculture, and twice as high overall. Non-EU members Norway and Switzerland use their policy freedom to erect even higher barriers, and Japan's well-known barriers against rice rank it as most protective. Overall, agricultural tariffs—not the subsidies so frequently cited in the media—are the largest barrier to exports from developing countries. The public attention paid to export subsidies has also been quite disproportionate. In the EU-15, for example, export subsidies are only 6.3% of all subsidies, which in turn are responsible for only about 20% of protection in agriculture with respect to developing countries. In other words, export subsidies are responsible for only 1.3% of the overall protective effect in EU agriculture. What may partly explain the attention to agricultural subsidies is the sheer amount of spending on them, which seems quite disproportionate to aid spending.

Appendix. Detailed tables

Table A–1. MAcMap protection and weights with respect to non-DAC countries, and production weights, by importer and GTAP product group (%)

Country name	Product name	Tariffs[1] (%)	MAcMap weight (%)	Production weight (%)	Tariff equivalent of subsidies (%)	Tariffs & subsidies (%)
Australia	Beverages and tobacco products	0.44	2.83	15.75	0.00	15.75
Australia	Sugar cane, sugar beet	0.00	0.19	0.00	0.00	0.00
Australia	Bovine meat products	0.09	0.89	0.00	20.76	20.76
Australia	Coal	0.55	0.56	0.00	0.00	0.00
Australia	Chemical, rubber, plastic products	6.15	9.33	3.56	0.00	3.56
Australia	Bovine cattle, sheep and goats, horses	0.06	0.88	0.00	0.00	0.00
Australia	Electronic equipment	19.88	6.20	0.96	0.00	0.96
Australia	Electricity	0.09	2.56	0.00	0.00	0.00
Australia	Metal products	1.86	2.87	5.46	0.00	5.46
Australia	Forestry	0.21	0.86	0.18	0.00	0.18
Australia	Fishing	0.22	0.97	0.20	0.00	0.20
Australia	Gas	1.89	0.97	0.00	0.00	0.00
Australia	Gas manufacture, distribution	0.00	0.15	5.00	0.00	5.00
Australia	Cereal grains nec	0.10	0.78	0.00	18.48	18.48
Australia	Ferrous metals	2.01	3.51	3.88	0.00	3.88
Australia	Leather products	2.53	1.55	8.04	0.00	8.04
Australia	Wood products	2.69	2.04	4.65	0.00	4.65
Australia	Dairy products	0.08	0.83	0.92	17.44	18.52
Australia	Motor vehicles and parts	4.87	3.63	13.86	0.00	13.86
Australia	Metals nec	3.37	2.20	0.76	0.00	0.76
Australia	Mineral products nec	1.11	4.07	3.91	0.00	3.91
Australia	Animal products nec	0.21	2.37	0.00	0.00	0.00
Australia	Crops nec	0.93	1.36	0.02	0.00	0.02
Australia	Food products nec	2.66	4.70	1.84	0.00	1.84
Australia	Oil	12.73	3.80	5.47	0.00	5.47
Australia	Machinery and equipment nec	10.40	8.00	4.04	0.00	4.04
Australia	Manufactures nec	3.78	2.85	2.74	0.00	2.74
Australia	Minerals nec	1.46	1.88	0.20	0.00	0.20
Australia	Meat products nec	0.32	1.33	0.75	5.61	6.40
Australia	Oil seeds	0.23	0.59	0.81	5.79	6.65
Australia	Transport equipment nec	1.79	1.64	1.92	0.00	1.92
Australia	Petroleum, coal products	2.84	4.11	0.00	0.00	0.00
Australia	Processed rice	0.05	1.13	0.00	6.79	6.79
Australia	Paddy rice	0.01	0.87	0.00	6.79	6.79
Australia	Plant-based fibers	0.08	0.34	0.00	0.00	0.00
Australia	Paper products, publishing	1.09	3.10	3.09	0.00	3.09
Australia	Sugar	0.15	0.76	10.05	19.52	31.53
Australia	Textiles	4.97	5.05	15.05	0.00	15.05
Australia	Vegetables, fruit, nuts	1.07	3.86	0.81	0.00	0.81
Australia	Vegetable oils and fats	0.50	0.74	1.03	0.00	1.03
Australia	Wearing apparel	6.43	2.66	22.18	0.00	22.18
Australia	Wheat	0.05	0.79	0.00	16.11	16.11
Australia	Wool, silk-worm cocoons	0.02	0.17	0.16	20.07	20.27
Canada	Beverages and tobacco products	0.44	2.83	6.93	0.00	6.93
Canada	Sugar cane, sugar beet	0.00	0.19	0.00	0.00	0.00
Canada	Bovine meat products	0.09	0.89	8.40	9.34	18.53
Canada	Coal	0.55	0.56	0.00	0.00	0.00
Canada	Chemical, rubber, plastic products	6.15	9.33	1.41	0.00	1.41
Canada	Bovine cattle, sheep and goats, horses	0.06	0.88	0.00	0.00	0.00
Canada	Electronic equipment	19.88	6.20	0.13	0.00	0.13

Country name	Product name	Tariffs[1] (%)	MAcMap weight (%)	Production weight (%)	Tariff equivalent of subsidies (%)	Tariffs & subsidies (%)
Canada	Electricity	0.09	2.56	0.00	0.00	0.00
Canada	Metal products	1.86	2.87	2.28	0.00	2.28
Canada	Forestry	0.21	0.86	0.26	0.00	0.26
Canada	Fishing	0.22	0.97	0.33	0.00	0.33
Canada	Gas	1.89	0.97	0.64	0.00	0.64
Canada	Gas manufacture, distribution	0.00	0.15	5.93	0.00	5.93
Canada	Cereal grains nec	0.10	0.78	0.32	11.67	12.04
Canada	Ferrous metals	2.01	3.51	0.37	0.00	0.37
Canada	Leather products	2.53	1.55	8.30	0.00	8.30
Canada	Wood products	2.69	2.04	2.02	0.00	2.02
Canada	Dairy products	0.08	0.83	97.69	2.75	103.12
Canada	Motor vehicles and parts	4.87	3.63	3.36	0.00	3.36
Canada	Metals nec	3.37	2.20	0.05	0.00	0.05
Canada	Mineral products nec	1.11	4.07	1.00	0.00	1.00
Canada	Animal products nec	0.21	2.37	6.45	0.00	6.45
Canada	Crops nec	0.93	1.36	0.47	0.00	0.47
Canada	Food products nec	2.66	4.70	4.38	0.00	4.38
Canada	Oil	12.73	3.80	0.00	0.00	0.00
Canada	Machinery and equipment nec	10.40	8.00	1.09	0.00	1.09
Canada	Manufactures nec	3.78	2.85	1.42	0.00	1.42
Canada	Minerals nec	1.46	1.88	0.00	0.00	0.00
Canada	Meat products nec	0.32	1.33	39.48	4.76	46.11
Canada	Oil seeds	0.23	0.59	0.00	13.20	13.20
Canada	Transport equipment nec	1.79	1.64	7.61	0.00	7.61
Canada	Petroleum, coal products	2.84	4.11	0.27	0.00	0.27
Canada	Processed rice	0.05	1.13	0.00	0.00	0.00
Canada	Paddy rice	0.01	0.87	0.00	0.00	0.00
Canada	Plant-based fibers	0.08	0.34	0.00	0.00	0.00
Canada	Paper products, publishing	1.09	3.10	0.08	0.00	0.08
Canada	Sugar	0.15	0.76	4.46	0.00	4.46
Canada	Textiles	4.97	5.05	11.41	0.00	11.41
Canada	Vegetables, fruit, nuts	1.07	3.86	1.76	-1.26	0.48
Canada	Vegetable oils and fats	0.50	0.74	2.24	0.00	2.24
Canada	Wearing apparel	6.43	2.66	15.31	0.00	15.31
Canada	Wheat	0.05	0.79	2.57	19.09	22.15
Canada	Wool, silk-worm cocoons	0.02	0.17	0.00	0.00	0.00
EU-15	Beverages and tobacco products	0.44	2.83	10.54	0.00	10.54
EU-15	Sugar cane, sugar beet	0.00	0.19	71.85	0.00	71.85
EU-15	Bovine meat products	0.09	0.89	75.79	18.66	108.58
EU-15	Coal	0.55	0.56	0.00	0.00	0.00
EU-15	Chemical, rubber, plastic products	6.15	9.33	1.32	0.00	1.32
EU-15	Bovine cattle, sheep and goats, horses	0.06	0.88	15.44	0.00	15.44
EU-15	Electronic equipment	19.88	6.20	0.85	0.00	0.85
EU-15	Electricity	0.09	2.56	0.00	0.00	0.00
EU-15	Metal products	1.86	2.87	1.26	0.00	1.26
EU-15	Forestry	0.21	0.86	0.14	0.00	0.14
EU-15	Fishing	0.22	0.97	4.63	0.00	4.63
EU-15	Gas	1.89	0.97	0.00	0.00	0.00
EU-15	Gas manufacture, distribution	0.00	0.15	0.00	0.00	0.00
EU-15	Cereal grains nec	0.10	0.78	17.25	20.72	41.55
EU-15	Ferrous metals	2.01	3.51	3.38	0.00	3.38
EU-15	Leather products	2.53	1.55	5.62	0.00	5.62
EU-15	Wood products	2.69	2.04	0.41	0.00	0.41
EU-15	Dairy products	0.08	0.83	38.02	13.73	56.97
EU-15	Motor vehicles and parts	4.87	3.63	2.73	0.00	2.73

Country name	Product name	Tariffs[1] (%)	MAcMap weight (%)	Production weight (%)	Tariff equivalent of subsidies (%)	Tariffs & subsidies (%)
EU-15	Metals nec	3.37	2.20	1.61	0.00	1.61
EU-15	Mineral products nec	1.11	4.07	2.37	0.00	2.37
EU-15	Animal products nec	0.21	2.37	4.84	0.00	4.84
EU-15	Crops nec	0.93	1.36	2.14	0.00	2.14
EU-15	Food products nec	2.66	4.70	9.16	0.00	9.16
EU-15	Oil	12.73	3.80	0.00	0.00	0.00
EU-15	Machinery and equipment nec	10.40	8.00	0.45	0.00	0.45
EU-15	Manufactures nec	3.78	2.85	1.15	0.00	1.15
EU-15	Minerals nec	1.46	1.88	0.16	0.00	0.16
EU-15	Meat products nec	0.32	1.33	15.24	10.35	27.16
EU-15	Oil seeds	0.23	0.59	0.00	14.27	14.27
EU-15	Transport equipment nec	1.79	1.64	1.16	0.00	1.16
EU-15	Petroleum, coal products	2.84	4.11	0.63	0.00	0.63
EU-15	Processed rice	0.05	1.13	137.22	12.83	167.64
EU-15	Paddy rice	0.01	0.87	76.62	12.83	99.28
EU-15	Plant-based fibers	0.08	0.34	0.00	0.00	0.00
EU-15	Paper products, publishing	1.09	3.10	0.14	0.00	0.14
EU-15	Sugar	0.15	0.76	90.37	4.63	99.19
EU-15	Textiles	4.97	5.05	5.90	0.00	5.90
EU-15	Vegetables, fruit, nuts	1.07	3.86	19.12	2.40	21.98
EU-15	Vegetable oils and fats	0.50	0.74	4.92	0.00	4.92
EU-15	Wearing apparel	6.43	2.66	6.45	0.00	6.45
EU-15	Wheat	0.05	0.79	0.67	20.36	21.17
EU-15	Wool, silk-worm cocoons	0.02	0.17	0.00	0.00	0.00
Japan	Beverages and tobacco products	0.44	2.83	16.39	0.00	16.39
Japan	Sugar cane, sugar beet	0.00	0.19	0.00	0.00	0.00
Japan	Bovine meat products	0.09	0.89	38.22	3.50	43.05
Japan	Coal	0.55	0.56	0.01	0.00	0.01
Japan	Chemical, rubber, plastic products	6.15	9.33	0.44	0.00	0.44
Japan	Bovine cattle, sheep and goats, horses	0.06	0.88	53.60	0.00	53.60
Japan	Electronic equipment	19.88	6.20	0.00	0.00	0.00
Japan	Electricity	0.09	2.56	0.00	0.00	0.00
Japan	Metal products	1.86	2.87	0.13	0.00	0.13
Japan	Forestry	0.21	0.86	0.79	0.00	0.79
Japan	Fishing	0.22	0.97	4.04	0.00	4.04
Japan	Gas	1.89	0.97	2.60	0.00	2.60
Japan	Gas manufacture, distribution	0.00	0.15	0.00	0.00	0.00
Japan	Cereal grains nec	0.10	0.78	53.18	3.75	58.93
Japan	Ferrous metals	2.01	3.51	0.39	0.00	0.39
Japan	Leather products	2.53	1.55	14.55	0.00	14.55
Japan	Wood products	2.69	2.04	0.64	0.00	0.64
Japan	Dairy products	0.08	0.83	82.44	6.90	95.03
Japan	Motor vehicles and parts	4.87	3.63	0.00	0.00	0.00
Japan	Metals nec	3.37	2.20	0.37	0.00	0.37
Japan	Mineral products nec	1.11	4.07	0.16	0.00	0.16
Japan	Animal products nec	0.21	2.37	11.02	0.00	11.02
Japan	Crops nec	0.93	1.36	1.27	0.00	1.27
Japan	Food products nec	2.66	4.70	12.11	0.00	12.11
Japan	Oil	12.73	3.80	0.00	0.00	0.00
Japan	Machinery and equipment nec	10.40	8.00	0.04	0.00	0.04
Japan	Manufactures nec	3.78	2.85	0.81	0.00	0.81
Japan	Minerals nec	1.46	1.88	0.39	0.00	0.39
Japan	Meat products nec	0.32	1.33	36.55	0.56	37.31
Japan	Oil seeds	0.23	0.59	1.62	16.09	17.97
Japan	Transport equipment nec	1.79	1.64	0.00	0.00	0.00

Country name	Product name	Tariffs[1] (%)	MAcMap weight (%)	Production weight (%)	Tariff equivalent of subsidies (%)	Tariffs & subsidies (%)
Japan	Petroleum, coal products	2.84	4.11	2.83	0.00	2.83
Japan	Processed rice	0.05	1.13	919.46	13.82	1060.37
Japan	Paddy rice	0.01	0.87	844.37	13.82	974.91
Japan	Plant-based fibers	0.08	0.34	0.00	0.00	0.00
Japan	Paper products, publishing	1.09	3.10	0.18	0.00	0.18
Japan	Sugar	0.15	0.76	227.02	2.38	234.80
Japan	Textiles	4.97	5.05	6.13	0.00	6.13
Japan	Vegetables, fruit, nuts	1.07	3.86	21.41	1.65	23.41
Japan	Vegetable oils and fats	0.50	0.74	4.83	0.00	4.83
Japan	Wearing apparel	6.43	2.66	9.73	0.00	9.73
Japan	Wheat	0.05	0.79	214.41	4.11	227.34
Japan	Wool, silk-worm cocoons	0.02	0.17	1.15	0.00	1.15
New Zealand	Beverages and tobacco products	0.44	2.90	16.30	0.00	16.30
New Zealand	Sugar cane, sugar beet	0.00	0.20	0.00	0.00	0.00
New Zealand	Bovine meat products	0.09	0.92	0.04	5.82	5.86
New Zealand	Coal	0.55	0.57	0.00	0.00	0.00
New Zealand	Chemical, rubber, plastic products	6.16	9.58	2.04	0.00	2.04
New Zealand	Bovine cattle, sheep and goats, horses	0.06	0.90	0.00	0.00	0.00
New Zealand	Electronic equipment	19.90	6.36	1.14	0.00	1.14
New Zealand	Metal products	1.87	2.95	2.94	0.00	2.94
New Zealand	Forestry	0.21	0.89	0.03	0.00	0.03
New Zealand	Fishing	0.22	0.99	0.31	0.00	0.31
New Zealand	Gas	1.89	1.00	0.00	0.00	0.00
New Zealand	Gas manufacture, distribution	0.00	0.16	0.00	0.00	0.00
New Zealand	Cereal grains nec	0.10	0.81	0.00	0.00	0.00
New Zealand	Ferrous metals	2.01	3.60	1.91	0.00	1.91
New Zealand	Leather products	2.53	1.59	6.17	0.00	6.17
New Zealand	Wood products	2.70	2.09	3.42	0.00	3.42
New Zealand	Dairy products	0.08	0.85	1.33	5.71	7.12
New Zealand	Motor vehicles and parts	4.88	3.73	6.23	0.00	6.23
New Zealand	Metals nec	3.37	2.26	0.44	0.00	0.44
New Zealand	Mineral products nec	1.11	4.18	2.27	0.00	2.27
New Zealand	Animal products nec	0.21	2.43	0.36	0.00	0.36
New Zealand	Crops nec	0.93	1.40	0.45	0.00	0.45
New Zealand	Food products nec	2.66	4.83	1.56	0.00	1.56
New Zealand	Oil	12.74	3.90	0.00	0.00	0.00
New Zealand	Machinery and equipment nec	10.40	8.21	2.53	0.00	2.53
New Zealand	Manufactures nec	3.78	2.92	2.41	0.00	2.41
New Zealand	Minerals nec	1.46	1.92	0.00	0.00	0.00
New Zealand	Meat products nec	0.32	1.36	2.71	5.31	8.16
New Zealand	Oil seeds	0.23	0.60	0.00	0.00	0.00
New Zealand	Transport equipment nec	1.80	1.68	1.35	0.00	1.35
New Zealand	Petroleum, coal products	2.85	4.21	0.68	0.00	0.68
New Zealand	Processed rice	0.05	1.16	0.00	0.00	0.00
New Zealand	Paddy rice	0.01	0.90	0.00	0.00	0.00
New Zealand	Plant-based fibers	0.08	0.35	0.00	0.00	0.00
New Zealand	Paper products, publishing	1.09	3.19	1.60	0.00	1.60
New Zealand	Sugar	0.15	0.78	0.00	0.00	0.00
New Zealand	Textiles	4.97	5.18	5.93	0.00	5.93
New Zealand	Vegetables, fruit, nuts	1.07	3.96	0.07	0.00	0.07
New Zealand	Vegetable oils and fats	0.50	0.76	0.40	0.00	0.40
New Zealand	Wearing apparel	6.43	2.73	11.58	0.00	11.58
New Zealand	Wheat	0.05	0.81	0.00	0.00	0.00
New Zealand	Wool, silk-worm cocoons	0.02	0.17	0.00	0.00	0.00
Norway	Beverages and tobacco products	0.44	2.83	22.33	0.00	22.33

Country name	Product name	Tariffs[1] (%)	MAcMap weight (%)	Production weight (%)	Tariff equivalent of subsidies (%)	Tariffs & subsidies (%)
Norway	Sugar cane, sugar beet	0.00	0.19	137.51	0.00	137.51
Norway	Bovine meat products	0.09	0.89	222.73	19.28	284.94
Norway	Coal	0.55	0.56	0.00	0.00	0.00
Norway	Chemical, rubber, plastic products	6.15	9.33	0.10	0.00	0.10
Norway	Bovine cattle, sheep and goats, horses	0.06	0.88	106.20	0.00	106.20
Norway	Electronic equipment	19.88	6.20	0.00	0.00	0.00
Norway	Electricity	0.09	2.56	0.00	0.00	0.00
Norway	Metal products	1.86	2.87	0.03	0.00	0.03
Norway	Forestry	0.21	0.86	0.46	0.00	0.46
Norway	Fishing	0.22	0.97	0.36	0.00	0.36
Norway	Gas	1.89	0.97	0.00	0.00	0.00
Norway	Gas manufacture, distribution	0.00	0.15	0.00	0.00	0.00
Norway	Cereal grains nec	0.10	0.78	114.80	19.53	156.75
Norway	Ferrous metals	2.01	3.51	0.00	0.00	0.00
Norway	Leather products	2.53	1.55	2.70	0.00	2.70
Norway	Wood products	2.69	2.04	0.01	0.00	0.01
Norway	Dairy products	0.08	0.83	134.00	20.65	182.33
Norway	Motor vehicles and parts	4.87	3.63	0.00	0.00	0.00
Norway	Metals nec	3.37	2.20	0.02	0.00	0.02
Norway	Mineral products nec	1.11	4.07	0.00	0.00	0.00
Norway	Animal products nec	0.21	2.37	88.10	0.00	88.10
Norway	Crops nec	0.93	1.36	9.49	0.00	9.49
Norway	Food products nec	2.66	4.70	29.00	0.00	29.00
Norway	Oil	12.73	3.80	0.00	0.00	0.00
Norway	Machinery and equipment nec	10.40	8.00	0.01	0.00	0.01
Norway	Manufactures nec	3.78	2.85	0.03	0.00	0.03
Norway	Minerals nec	1.46	1.88	0.00	0.00	0.00
Norway	Meat products nec	0.32	1.33	224.28	2.45	232.22
Norway	Oil seeds	0.23	0.59	48.60	0.00	48.60
Norway	Transport equipment nec	1.79	1.64	0.04	0.00	0.04
Norway	Petroleum, coal products	2.84	4.11	0.00	0.00	0.00
Norway	Processed rice	0.05	1.13	27.06	0.00	27.06
Norway	Paddy rice	0.01	0.87	31.75	0.00	31.75
Norway	Plant-based fibers	0.08	0.34	0.00	0.00	0.00
Norway	Paper products, publishing	1.09	3.10	0.00	0.00	0.00
Norway	Sugar	0.15	0.76	56.58	0.00	56.58
Norway	Textiles	4.97	5.05	4.07	0.00	4.07
Norway	Vegetables, fruit, nuts	1.07	3.86	19.95	0.00	19.95
Norway	Vegetable oils and fats	0.50	0.74	49.05	0.00	49.05
Norway	Wearing apparel	6.43	2.66	3.85	0.00	3.85
Norway	Wheat	0.05	0.79	208.40	9.54	237.82
Norway	Wool, silk-worm cocoons	0.02	0.17	0.00	21.53	21.53
Switzerland	Beverages and tobacco products	0.44	2.83	16.22	0.00	16.22
Switzerland	Sugar cane, sugar beet	0.00	0.19	7.32	0.00	7.32
Switzerland	Bovine meat products	0.09	0.89	168.16	13.72	204.95
Switzerland	Coal	0.55	0.56	0.49	0.00	0.49
Switzerland	Chemical, rubber, plastic products	6.15	9.33	1.03	0.00	1.03
Switzerland	Bovine cattle, sheep and goats, horses	0.06	0.88	4.10	0.00	4.10
Switzerland	Electronic equipment	19.88	6.20	0.43	0.00	0.43
Switzerland	Electricity	0.09	2.56	0.00	0.00	0.00
Switzerland	Metal products	1.86	2.87	1.18	0.00	1.18
Switzerland	Forestry	0.21	0.86	0.59	0.00	0.59
Switzerland	Fishing	0.22	0.97	0.11	0.00	0.11
Switzerland	Gas	1.89	0.97	0.00	0.00	0.00
Switzerland	Gas manufacture, distribution	0.00	0.15	0.01	0.00	0.01

Country name	Product name	Tariffs[1] (%)	MAcMap weight (%)	Production weight (%)	Tariff equivalent of subsidies (%)	Tariffs & subsidies (%)
Switzerland	Cereal grains nec	0.10	0.78	77.72	12.24	99.46
Switzerland	Ferrous metals	2.01	3.51	0.95	0.00	0.95
Switzerland	Leather products	2.53	1.55	1.06	0.00	1.06
Switzerland	Wood products	2.69	2.04	1.37	0.00	1.37
Switzerland	Dairy products	0.08	0.83	106.84	20.30	148.82
Switzerland	Motor vehicles and parts	4.87	3.63	1.23	0.00	1.23
Switzerland	Metals nec	3.37	2.20	0.70	0.00	0.70
Switzerland	Mineral products nec	1.11	4.07	1.94	0.00	1.94
Switzerland	Animal products nec	0.21	2.37	7.65	0.00	7.65
Switzerland	Crops nec	0.93	1.36	8.18	0.00	8.18
Switzerland	Food products nec	2.66	4.70	14.02	0.00	14.02
Switzerland	Oil	12.73	3.80	0.00	0.00	0.00
Switzerland	Machinery and equipment nec	10.40	8.00	0.74	0.00	0.74
Switzerland	Manufactures nec	3.78	2.85	22.70	0.00	22.70
Switzerland	Minerals nec	1.46	1.88	3.58	0.00	3.58
Switzerland	Meat products nec	0.32	1.33	111.32	6.19	124.40
Switzerland	Oil seeds	0.23	0.59	21.20	16.38	41.04
Switzerland	Transport equipment nec	1.79	1.64	0.72	0.00	0.72
Switzerland	Petroleum, coal products	2.84	4.11	0.02	0.00	0.02
Switzerland	Processed rice	0.05	1.13	7.11	0.00	7.11
Switzerland	Paddy rice	0.01	0.87	5.84	0.00	5.84
Switzerland	Plant-based fibers	0.08	0.34	0.00	0.00	0.00
Switzerland	Paper products, publishing	1.09	3.10	2.51	0.00	2.51
Switzerland	Sugar	0.15	0.76	100.89	6.28	113.52
Switzerland	Textiles	4.97	5.05	5.25	0.00	5.25
Switzerland	Vegetables, fruit, nuts	1.07	3.86	30.55	0.00	30.55
Switzerland	Vegetable oils and fats	0.50	0.74	26.55	0.00	26.55
Switzerland	Wearing apparel	6.43	2.66	4.55	0.00	4.55
Switzerland	Wheat	0.05	0.79	131.60	11.28	157.73
Switzerland	Wool, silk-worm cocoons	0.02	0.17	0.00	0.00	0.00
United States	Beverages and tobacco products	0.44	2.83	2.67	0.00	2.67
United States	Sugar cane, sugar beet	0.00	0.19	0.25	0.00	0.25
United States	Bovine meat products	0.09	0.89	2.59	7.20	9.98
United States	Coal	0.55	0.56	0.00	0.00	0.00
United States	Chemical, rubber, plastic products	6.15	9.33	2.15	0.00	2.15
United States	Bovine cattle, sheep and goats, horses	0.06	0.88	0.11	0.00	0.11
United States	Electronic equipment	19.88	6.20	0.43	0.00	0.43
United States	Electricity	0.09	2.56	0.00	0.00	0.00
United States	Metal products	1.86	2.87	1.75	0.00	1.75
United States	Forestry	0.21	0.86	0.16	0.00	0.16
United States	Fishing	0.22	0.97	0.28	0.00	0.28
United States	Gas	1.89	0.97	0.00	0.00	0.00
United States	Gas manufacture, distribution	0.00	0.15	0.00	0.00	0.00
United States	Cereal grains nec	0.10	0.78	0.88	20.07	21.13
United States	Ferrous metals	2.01	3.51	1.21	0.00	1.21
United States	Leather products	2.53	1.55	9.80	0.00	9.80
United States	Wood products	2.69	2.04	0.61	0.00	0.61
United States	Dairy products	0.08	0.83	16.67	11.90	30.55
United States	Motor vehicles and parts	4.87	3.63	2.28	0.00	2.28
United States	Metals nec	3.37	2.20	1.01	0.00	1.01
United States	Mineral products nec	1.11	4.07	3.59	0.00	3.59
United States	Animal products nec	0.21	2.37	0.44	0.00	0.44
United States	Crops nec	0.93	1.36	2.71	0.00	2.71
United States	Food products nec	2.66	4.70	3.13	0.00	3.13
United States	Oil	12.73	3.80	0.00	0.00	0.00

Country name	Product name	Tariffs[1] (%)	MAcMap weight (%)	Production weight (%)	Tariff equivalent of subsidies (%)	Tariffs & subsidies (%)
United States	Machinery and equipment nec	10.40	8.00	1.38	0.00	1.38
United States	Manufactures nec	3.78	2.85	1.60	0.00	1.60
United States	Minerals nec	1.46	1.88	0.09	0.00	0.09
United States	Meat products nec	0.32	1.33	3.35	9.03	12.68
United States	Oil seeds	0.23	0.59	8.71	20.48	30.97
United States	Transport equipment nec	1.79	1.64	1.05	0.00	1.05
United States	Petroleum, coal products	2.84	4.11	1.02	0.00	1.02
United States	Processed rice	0.05	1.13	5.21	20.50	26.78
United States	Paddy rice	0.01	0.87	5.19	20.50	26.76
United States	Plant-based fibers	0.08	0.34	0.99	0.00	0.99
United States	Paper products, publishing	1.09	3.10	0.18	0.00	0.18
United States	Sugar	0.15	0.76	24.22	4.78	30.16
United States	Textiles	4.97	5.05	9.81	0.00	9.81
United States	Vegetables, fruit, nuts	1.07	3.86	4.98	12.98	18.61
United States	Vegetable oils and fats	0.50	0.74	2.98	0.00	2.98
United States	Wearing apparel	6.43	2.66	11.27	0.00	11.27
United States	Wheat	0.05	0.79	3.19	21.05	24.91
United States	Wool, silk-worm cocoons	0.02	0.17	1.62	4.82	6.51

[1] MAcMap values aggregated across HS 6 lines by MAcMap weights and across exporters by exporter's GDP.

Table A–2. Computation of *ad valorem* tariff equivalents of agricultural subsidies by importer and product group

Country	Product	A. Production (farm gate prices)	B. Consumption (farm gate prices)	C. Border measures *ad valorem* equivalent	D. Imports	E. Exports	F. Trade-distorting subsidies	G. Subsidy rate (F / A)	H. Apparent consumption (A/(1+C)+ D–E)	J. Import share of consumption (D / H)	Import price elasticity ($\sigma_D \times (1–J)$)[1]	Tariff equivalent of subsidies[2]
		(million $)		(%)	(million $)			(%)	(million $)	(%)		(%)
Australia	Beef & sheepmeat	4,391	1,479	0.00	4	3,220	0	133	3.04	1,175	0.38	358.64
Australia	Corn & other grains	1,656	1,514	0.00	5	485	0	26	1.54	1,176	0.42	358.50
Australia	Dairy, eggs	1,928	988	0.92	185	1,494	0	200	10.39	602	30.76	249.27
Australia	Oil seeds	598	131	0.81	32	71	0	9	1.46	555	5.77	339.22
Australia	Pork, poultry, other meat	1,152	1,101	0.75	142	292	0	33	2.87	994	14.30	308.54
Australia	Rice	236	170	0.00	30	41	2	9	3.94	226	13.47	311.50
Australia	Sugar	551	137	10.05	5	39	0	49	8.96	467	1.13	355.95
Australia	Vegetables, fruit, nuts	8	12	0.81	201	674	0			–466	–43.15	515.35
Australia	Wheat	1,615	491	0.00	17	1,913	0	58	3.57	–281	–5.99	381.56
Australia	Wool	1,640	75	0.16	5	1,263	0	52	3.19	380	1.21	355.63
Canada	Beef & sheepmeat	4,303	2,867	8.40	610	1,424	8	298	6.92	3,156	19.34	290.36
Canada	Corn & other grains	2,392	2,444	0.32	439	398	0	311	13.02	2,426	18.11	294.80
Canada	Dairy, eggs	3,266	3,480	97.69	307	252	–1	56	1.72	1,708	18.00	295.21
Canada	Oil seeds	2,760	1,753	0.00	252	484	0	270	9.79	2,528	9.95	324.17
Canada	Pork, poultry, other meat	3,581	2,249	39.48	615	1,616	–4	106	2.95	1,566	39.25	218.70
Canada	Rice			0.00	99	1						
Canada	Sugar			4.46	249	118						
Canada	Vegetables, fruit, nuts	435	461	1.76	2,774	1,213	0	60	13.68	1,988	139.53	– 142.31
Canada	Wheat	1,836	753	2.57	12	1,990	29	292	15.93	–188	–6.45	383.22
Canada	Wool			0.00	0	2						
EU-15	Beef & sheepmeat	21,562	22,379	75.79	2,216	849	468	12,939	60.01	13,633	16.26	301.48
EU-15	Corn & other grains	27,107	25,887	17.25	920	810	59	21,634	79.81	23,229	3.96	345.73
EU-15	Dairy, eggs	43,127	41,160	38.02	1,374	5,163	642	2,478	5.75	27,458	5.00	341.99
EU-15	Oil seeds	6,349	11,818	0.00	5,658	106	0	3,540	55.75	11,902	47.54	188.85
EU-15	Pork, poultry, other meat	32,899	30,630	15.24	1,952	3,413	312	1,500	4.56	27,088	7.21	334.06
EU-15	Rice	1,474	1,546	110.81	168	139	2	276	18.74	727	23.03	277.09
EU-15	Sugar	5,258	4,565	90.37	1,406	1,067	85	290	5.52	3,100	45.34	196.78
EU-15	Vegetables, fruit, nuts	6,673	10,691	19.12	12,212	3,605	–112	183	2.74	14,208	85.95	50.59
EU-15	Wheat	13,099	11,709	0.67	1,436	1,370	12	11,808	90.15	13,078	10.98	320.47
EU-15	Wool			0.00	693	93						
Japan	Beef & sheepmeat	4,110	10,652	38.22	2,428	2	0	271	6.60	5,400	44.97	198.11
Japan	Corn & other grains	446	4,919	53.18	2,722	0	0	62	13.91	3,013	90.33	34.80
Japan	Dairy, eggs	8,407	11,208	82.44	874	11	0	486	5.78	5,472	15.98	302.48
Japan	Oil seeds	225	4,342	1.62	1,573	1	0	245	108.57	1,793	87.69	44.33
Japan	Pork, poultry, other meat	5,674	9,224	36.55	5,867	18	0	68	1.20	10,005	58.65	148.87
Japan	Rice	31,437	35,141	886.73	231	6	0	2,974	9.46	3,410	6.76	335.67
Japan	Sugar	765	2,325	227.02	310	1	0	41	5.36	543	57.17	154.20
Japan	Vegetables, fruit, nuts	8,954	13,948	21.41	2,543	62	–105	147	1.64	9,856	25.80	267.10
Japan	Wheat	931	2,217	214.41	1,108	0	0	127	13.63	1,404	78.90	75.96

Country	Product	A. Production (farm gate prices)	B. Consumption (farm gate prices)	C. Border measures *ad valorem* equivalent	D. Imports	E. Exports	F. Trade-distorting subsidies	G. Subsidy rate (F / A)	H. Apparent consumption (A/(1+C)+ D–E)	J. Import share of consumption (D / H)	Import price elasticity (σ_D × (1–J))[1]	Tariff equivalent of subsidies[2]
Japan	Wool			1.15	3	0						
N. Zealand	Beef & sheepmeat	1,889	333	0.04	26	2,141	0	9	0.46	–227	–11.24	400.47
N. Zealand	Corn & other grains	133	146	0.00	8	1	0	0	0.00	140	5.96	338.53
N. Zealand	Dairy, eggs	2,526	316	1.33	37	2,797	0	13	0.52	–266	–14.07	410.66
N. Zealand	Oil seeds			0.00	5	1						
N. Zealand	Pork, poultry, other meat	220	237	2.71	56	167	4	6	2.62	103	54.22	164.82
N. Zealand	Rice			0.00	19	0						
N. Zealand	Sugar			0.00	52	8						
N. Zealand	Vegetables, fruit, nuts			0.07	136	685						
N. Zealand	Wheat	48	78	0.00	51	0	0	0	0.00	99	51.21	175.64
N. Zealand	Wool	316	45	0.00	0	130	0	0	0.00	186	0.14	359.50
Norway	Beef & sheepmeat	401	428	222.73	33	3	–23	382	95.15	155	21.35	283.14
Norway	Corn & other grains	402	406	114.80	16	0	–1	222	55.12	203	7.82	331.86
Norway	Dairy, eggs	742	679	134.00	40	84	–8	607	81.76	274	14.74	306.92
Norway	Oil seeds			48.60	114	0						
Norway	Pork, poultry, other meat	368	376	224.28	133	56	–33	12	3.30	190	69.85	108.55
Norway	Rice			29.11	11	0						
Norway	Sugar			56.58	62	0						
Norway	Vegetables, fruit, nuts			19.95	440	3						
Norway	Wheat	76	104	208.40	44	0	–1	26	34.25	69	64.19	128.90
Norway	Wool	17	6	0.00	1	5	0	48	282.98	13	4.16	345.02
Switzerland	Beef & sheepmeat	705	784	168.16	149	4	–5	294	41.66	408	36.45	228.79
Switzerland	Corn & other grains	122	233	77.72	41	1	0	41	33.40	108	37.46	225.16
Switzerland	Dairy, eggs	1,677	1,715	106.84	240	394	25	816	48.67	656	36.53	228.50
Switzerland	Oil seeds	39	221	21.20	29	1	0	31	79.82	61	48.17	186.59
Switzerland	Pork, poultry, other meat	826	959	111.32	315	17	–47	107	12.95	689	45.71	195.45
Switzerland	Rice			6.56	22	0						
Switzerland	Sugar	96	200	100.89	64	3	0	16	16.22	109	59.23	146.77
Switzerland	Vegetables, fruit, nuts			30.55	910	4						
Switzerland	Wheat	171	335	131.60	64	0	0	59	34.60	137	46.41	192.91
Switzerland	Wool			0.00	1	1						
U.S.	Beef & sheepmeat	33,463	35,915	2.59	2,984	3,849	0	1,080	3.23	31,753	9.40	326.17
U.S.	Corn & other grains	24,958	20,275	0.88	467	5,790	0	5,197	20.83	19,417	2.41	351.34
U.S.	Dairy, eggs	27,022	26,744	16.67	1,477	761	0	1,565	5.79	23,877	6.19	337.73
U.S.	Oil seeds	15,280	9,822	8.71	228	7,149	0	3,190	20.88	7,135	3.20	348.48
U.S.	Pork, poultry, other meat	27,270	24,330	3.35	1,583	3,871	2	861	3.16	24,100	6.57	336.35
U.S.	Rice	2,146	1,261	5.20	197	534	0	1,515	70.58	1,703	11.55	318.43
U.S.	Sugar	2,115	3,581	24.22	810	98	–8	144	6.82	2,415	33.56	239.19
U.S.	Vegetables, fruit, nuts	15,214	9,852	4.98	8,179	6,713	0	3,272	21.51	15,957	51.25	175.49
U.S.	Wheat	6,391	3,885	3.19	213	3,804	0	2,161	33.81	2,603	8.19	330.50
U.S.	Wool	21	23	1.62	24	18	0	1	2.57	28	87.46	45.13

[1]Where σ_D is the elasticity of substitution in demand between domestic goods and imports, assumed to be 3.6. See Cline (2004, ch. 3).

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