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By

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Inaccuracies in forest products trade statistics

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Abstract

Between two trading partners, the export flow reported by one country often disagrees with the import flow reported by the other. For international trade in hardwood logs and lumber, double accounts to directly compare exporters' statistics with importers' statistics indicate that discrepancies in trade volumes and values are numerous and sometimes large. Export flows appear to be underreported from the developing countries, but overreported from many of the industrialized ones. Countries such as the United States publish export statistics not at all consistent with statistics reported by trading partners. Identification of these data inconsistencies helps analysts define information needs for improved decisionmaking.

Trade statistics, including those which describe the international trade of forest products, are frequently inaccurate and misleading. Yet many decisionmakers fail to recognize erroneous trade data when formulating business strategies or government policies. Business losses, suboptimal production targets, ineffective tariffs, and unnecessary subsidies are among the possible consequences of accepting faulty trade data at face value.

This paper presents empirical evidence of the inaccuracies which exist in the statistics for international trade of hardwood sawlogs and hardwood lumber. These two commodities illustrate statistics on forest products traded both within and between blocks of industrialized and developing countries. The magnitude of data discrepancies is estimated by comparing exporters' reports with the corresponding import reports of trading partners.

Causes of discrepancies in trade data

When a commodity is traded internationally, independent reports of the transaction are usually available from both the importing country and the exporting country. If the transactions are legally conducted, classified by the same product definition, and accurately recorded, then the statistics of the trading partners should closely agree. But in practice, discrepancies are common.

The volume statistics can differ for several reasons:

1. Exports occurring at the end of one reporting period (i.e., calendar year) may not reach their destination until the following period;

2. The origins and destinations of shipments are not always correctly identified in the trade documents, especially when trade is routed through market centers like Singapore and the Netherlands (6). Sometimes shipments are erroneously identified with shipping registration (e.g., Liberia and Panama);

3. Commodities are not always consistently classified, measured, and reported according to the Standard International Trade Classification system (13). Moreover, data differences sometimes result when different conversion factors are used, e.g., different methods and formulas to convert cubic meters to an equivalent in board feet (3);

4. Simple counting and recording errors may result from carelessness and incompetence by customs officers and reporting officials;

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5. Smuggled goods may go unreported by one or both partners conducting trade. Serious data inconsistencies follow when traded goods go unreported by only one country. If trade escapes detection by both countries, the smuggling does not create discrepancies in the data, but export and import totals are clearly understated (8).

Even if volume reports of trading partners are in agreement, value reports may differ for the following reasons:

1. Imports are usually reported in terms of c.i.f. (cost, insurance, and freight) and exports in terms of f.o.b. (free on board). For most products, c.i.f. and f.o.b. values normally vary by about 10 percent (15) although differences of 20 to 40 percent are not uncommon for trade of forest products (5, 9);

2. Trade data are usually converted to U.S. dollars for purposes of consistent reporting even if the actual transactions were concluded in another currency. Reported values of exports and imports are likely to be distorted somewhat by the conversion, especially where the exchange rate with the dollar fluctuates frequently;

3. Valuation practices sometimes differ among countries. Actual transaction values may not appear on invoices if customs agencies perform valuation according to administered prices, or if the government allows traders to value their shipments at reduced "check prices" to stimulate exports (12);

4. Opportunities to increase profits motivate importers and exporters to falsify invoices, especially in countries where the risk of being detected is minimal or the penalties are not severe (1, 2, 4). Traders often attempt to circumvent tariffs, quotas, and other trade barriers by underinvoicing exports and imports. Subsidies provide incentives for overinvoicing. Overvalued exchange rates encourage overinvoicing of imports and underinvoicing of exports, allowing traders to benefit from currency premiums in the black market. Moreover, multinational businesses often seek to reduce overall tax liability by invoicing trade to shift accounting profits to countries with liberal taxation policies.

Assessing data discrepancies

To determine the extent of unreliable statistics on forest products trade, importers' reports were compared with exporters' reports for worldwide trade of hardwood sawlogs and lumber. Such a comparison permits the detection of possible reporting inaccuracies attributable to one or both trading partners.

Following a procedure described by Naya and Morgan (11), reported imports by country "i" (Mij) were compared with reported exports by country "j" (Xji). The comparison allowed the computation of volume and value ratios (i.e., Mij/Xji) for each trade flow considered. If there are no inaccuracies in the reports of either country, then Mij/Xji volume ratios should be about 1.00.

The Mij/Xji value ratios should be near 1.20, assuming an average 20 percent margin for differences between c.i.f. and f.o.b. values. Transportation, handling, and insurance costs will vary with shipping distance and with the value, volume, and type of goods traded. However, the 20 percent rule of thumb provides a useful approximation by which c.i.f. and f.o.b. differences can be compared. Analysts with evidence supporting margins other than 20 percent can adjust the analysis to fit their conditions.

Computed volume ratios below 1.00 and value ratios below 1.20 indicate overreporting of shipments by exporters in relation to the reports filed by importing partners. Conversely, computed ratios exceeding 1.00 and 1.20 (for volume and value, respectively) imply underreporting.

Both unweighted and weighted means of Mij/Xji are calculated for: 1) each exporting country, 2) the aggregate of exporting industrialized countries, and 3) the aggregate of exporting developing countries. When calculating the unweighted means, each trade flow is considered equally important, thereby providing insight into the extent and usual direction (overreporting or underreporting) of discrepancies for each exporting country and group of countries.

To compute weighted means, individual ratios of Mij/Xji are weighted according to the magnitude of trade each ratio represents. For example, an Mij/Xji which represents 40 percent of a country's total log exports receives four times the weight of an Mij/Xji representing only 10 percent of the country's log exports. Weighting individual Mij/Xji ratios prior to calculating the means focuses attention on the major trade flows, discounting the importance of smaller transactions.

The means of the Mij/Xji for each exporting country and group of countries are tested using a two-tailed t-test (following a logarithmic transformation to make the data more closely approximate a normal distribution). This identifies those ratios which statistically differ from the expected ratios of 1.00 and 1.20.

The two most comprehensive sources of statistics on forest products trade are the Food and Agriculture Organization (FAO) and the United Nations (U.N.) Statistical Office. Both rely on reports submitted by forestry and customs authorities in member countries. In its *Yearbook of Forest Products* (7) the FAO frequently adjusts trade data it believes to be erroneous, and even estimates data which are missing from its questionnaires (10). Although these adjusted FAO data may be somewhat more accurate, the statistics published through the U.S. Statistical Office reflect the quality of data more typically available to most decisionmakers at local levels. Furthermore, many decisionmakers require more detail than can be obtained from the highly aggregated FAO *Yearbook of Forest Products*. Therefore, ratios of Mij/Xji for this study were computed from the United Nations' *Commodity Trade Statistics* (14), which shows annual exports and imports in excess of $100,000 by commodity, country, and year.

To mitigate the potential problem created by transport time lags, data on flows between trading partners were summed for a 3-year period. By considering a time period longer than a single year, it is more likely that the effects of recording lags cancel out. The period se-

lected for study was 1976 to 1978, providing relatively complete data coverage for a broad cross section of trading countries, including developing countries. Because this study computed an average Mij Xji over the 3-year period, measures of trade value were converted to constant dollars.

Previous studies (8,11,15) have concluded that trade statistics reported by industrialized countries are more reliable than those reported by developing countries. This is due in part to the training, equipment, and organization available to customs officers in industrialized countries. To provide consistency and minimize problems of data interpretation, this study is limited on the importing side to a group of 19 industrialized countries. This group of countries imports hardwood logs and lumber from both developing countries and other industrialized countries. Consequently, discrepancies between Mij and Xji are more likely attributable to, but certainly not restricted to, reports of the exporting countries.

Empirical results

Table 1 presents the means of Mij Xji for the consolidated groups of industrialized and developing ex-

TABLE 1. — *Volume and value ratios for hardwood exports from industrialized and developing countries.*

		Volume ratio[a]	Value ratio[a]
Hardwood sawlogs exporters			
Industrialized countries	U	1.27	1.33
	W	1.22	1.20
Developing countries	U	1.27	1.93
	W	1.21	1.68
Hardwood lumber exporters			
Industrialized countries	U	1.07	1.25
	W	0.99	1.15
Developing countries	U	1.27	1.62
	W	1.17	1.67

[a]Ratios are means of Mij Xji (unweighted (U) and weighted (W)) for shipments from the exporting countries to a block of 19 industrialized countries.

TABLE 2. — *Volume and value ratios for countries which export hardwood logs and lumber.*

		Hardwood sawlogs		Hardwood lumber	
		Volume	Value	Volume	Value
		mean ratios[a]			
Industrialized exporters					
Australia	U	—	—	1.73	1.49
	W	—	—	0.54***	2.26***
Austria	U	0.91	1.12	1.20	1.15
	W	1.14	1.19	1.09***	1.09**
Belgium-Luxembourg	U	0.93**	0.93*	0.65	0.69
	W	0.94***	0.97**	0.60**	0.59**
Canada	U	1.89	2.45*	1.27	1.54**
	W	2.11**	2.37**	1.12**	1.41***
Denmark	U	1.91	1.56	1.00	1.14
	W	2.35*	1.43	0.95	1.07***
Finland	U	1.35	1.20		—
	W	1.35	1.20	—	—
France	U	0.86**	0.96***	1.01	1.02***
	W	0.91***	1.01***	0.95***	0.95***

TABLE 2 (*Continued*). — *Volume and value ratios for countries which export hardwood logs and lumber.*

		Hardwood sawlogs		Hardwood lumber	
		Volume	Value	Volume	Value
		mean ratios[a]			
Germany (F.R.)	U	1.01	0.80**	1.21	1.06*
	W	1.15**	0.92***	1.00	1.06***
Ireland	U	—	—	1.42	1.70
	W	—	—	1.42	1.70
Italy	U	0.78	0.94	0.88	0.87***
	W	0.78	0.94	0.86**	0.84***
Japan	U	—	—	—	1.21
	W	—	—	—	1.17
Netherlands	U	0.77	0.91	0.98	0.83
	W	0.97	1.18	0.62**	0.58***
New Zealand	U	—	—	—	3.10
	W	—	—	—	3.10
Sweden	U	—	—	1.91	1.97
	W	—	—	1.43	1.65
Switzerland	U	1.03	1.08	0.87	0.88*
	W	0.99	1.02*	0.95	0.94***
United Kingdom	U	—	—	1.00	0.88
	W	—	—	0.84	0.72*
United States	U	1.66	1.96	1.26**	1.66***
	W	1.56***	1.48**	1.02	1.45***
Yugoslavia	U	1.80	1.59	0.94**	1.11
	W	1.48**	1.05*	0.98***	0.90***
Developing exporters					
Brazil	U	0.84	1.20	1.14**	1.46***
	W	0.84	1.20	.08***	1.30***
Cameroon	U	1.11	1.54**	1.26**	1.61**
	W	1.04	1.50***	1.22***	1.62***
Central African Republic	U	0.68	1.35	1.03	1.52
	W	0.73	1.27	1.71	2.51
Colombia	U	—	—	1.08	0.77
	W	—	—	1.08	0.77
Congo	U	2.71**	3.86***	—	—
	W	3.92***	5.22***	—	—
Ecuador	U	—	—	2.33*	1.48
	W	—	—	3.35***	1.25
Gabon	U	0.98	1.97	—	—
	W	0.66***	1.69***	—	—
Ghana	U	0.99	1.35	1.03	1.15
	W	1.21	1.75***	1.08*	1.26
Guyana	U	0.73	0.96	0.30**	1.54
	W	0.73	0.96	0.31**	1.64
India	U	—	0.94*	—	—
	W	—	1.02**	—	—
Indonesia	U	1.10	2.15**	1.41	2.65***
	W	1.28***	1.76***	1.04	2.13***
Ivory Coast	U	0.99	1.47	1.28	1.99
	W	1.03	1.58***	1.12	1.65***
Korea (Rep.)	U	—	—	0.83	0.91
	W	—	—	0.77*	1.04
Liberia	U	—	1.35	—	3.05*
	W	—	1.58***	—	3.25***
Malaysia	U	1.19	1.38	—	2.07*
	W	1.26**	1.49**	—	1.92***
Peru	U	—	—	0.80	0.84
	W	—	—	0.80	0.84
Philippines	U	1.17	2.88*	0.99	1.13
	W	0.83***	1.54**	1.18***	1.31***
Singapore	U	—	—	—	0.75***
	W	—	—	—	0.83***
Tanzania	U	—	—	1.59	1.22
	W	—	—	1.59	1.22
Thailand	U	1.94	2.34	1.81	1.25
	W	1.94	2.34	1.24*	1.09**

[a]Ratios are unweighted (U) and weighted (W) means of Mij Xji for the specified exporting country shipping to 19 industrialized importing countries.

Asterisks: Rejection of the null hypothesis, Ho: Mij Xji equals 1.00 (or 1.20 for value) at 90 (*), 95 (**), or 99 (***) percent confidence level.

porters. At this level of analysis, computed ratios are close to hypothesized (i.e., expected) ratios for the value of logs, the volume of lumber, and the value of lumber exported from the industrialized countries. For all other categories, computed ratios exceed expected ratios, suggesting export underreporting. The largest deviations occur for value ratios associated with the developing countries. The value of exports reported by the developing countries is less than two-thirds the value reported by importers.

Weighted means of Mij/Xji are closer to the expected ratios of 1.00 and 1.20 than are the unweighted means in all but one of the cases analyzed (i.e., value reports of lumber from developing countries). This indicates that statistics describing the world's largest trade flows show slightly less disagreement than those describing smaller transactions.

Table 2 focuses on the reporting records of individual countries and identifies those means which differ statistically from the hypothesized ratios. Ratios in Table 2 are noticeably less uniform than the grouped ratios in Table 1. The weighted volume ratios range from a low of 0.31 for Guyana's exports of lumber (i.e., Guyana's reported export volume is more than three times what importers claim to have received from Guyana) to a high of 3.92 for the Congo's exports of sawlogs (i.e., the Congo reports only one-fourth the volume importers claim to receive from there). The weighted value ratios range from 0.58 (for lumber exported from the Netherlands) to 5.52 (for sawlogs exported from the Congo).

At the country level, a surprising number of weighted means of Mij/Xji deviate from the expected ratios by a greater margin than the corresponding unweighted means. When this occurs, it must be assumed that the largest transactions are reported even less accurately than the smallest ones.

The country level data indicate that developing countries underreport exports more frequently than do industrialized countries. Considering both unweighted and weighted ratios for which statistical differences can be established, the industrialized exporters have 16 means above and 33 means below expected levels. But for the developing exporters, this proportion changes to 38 means above and 10 means below.

In drawing conclusions from these analyses, it is important to distinguish practical significance from statistical significance. Several means of Mij/Xji are determined to be statistically different from the expected means of 1.00 and 1.20 although they are relatively near these expected values (e.g., sawlog volume ratios for Belgium-Luxembourg and France; lumber volume ratios for Austria, France, and Yugoslavia). This signifies consistency of reporting by these countries over a large number of observations. The small variance among trade ratios permits rejection of the null hypothesis, even though a slight difference between importers' and exporters' reports is probably not significant in a practical sense.

TABLE 1. — *Dispersion in volume ratios for U.S. exports of hardwood sawlogs to major trading partners*

Importer	Volume ratio*	Total exports
		%
Austria	0.20	0.8
Belgium-Luxembourg	2.38	2.6
Canada	1.69	52.9
France	1.27	1.3
Germany, F.R.	1.40	29.9
Italy	0.99	5.1
Japan	0.98	4.5
Netherlands	0.41	0.7
Spain	0.52	0.9
Sweden	3.42	0.2
Switzerland	0.25	1.0
United Kingdom	0.45	0.1
		100.0
Unweighted mean	1.66	
Weighted mean	1.56***	

*Ratios are Mij/Xji for the U.S. export shipments (Xji is the United States) to the specified importing countries.

*** Rejection of the null hypothesis at the 99 percent confidence level. See second footnote in Table 2.

Conversely, the null hypothesis cannot be rejected in several instances even when the means of Mij/Xji differ noticeably from the expected ratios (e.g., sawlog volume ratios for the Central African Republic; lumber ratios for Sweden). In these cases, the broad dispersion of observations makes it impossible to find statistical differences.

In Table 3, data on the exports of hardwood logs from the United States are used to illustrate a wide dispersion of trade ratios masked by overall means. Widely ranging ratios imply serious reporting discrepancies, even if not in a consistent direction.

Conclusions

The empirical data for the trade of hardwood sawlogs and lumber verify the existence of frequent and serious disagreements among trade reports, especially reports of commodity value. Export underreporting characterizes most of those developing countries for which statistical tests are significant, while overreporting is observed for many of the industrialized exporters. The magnitude of discrepancies appears to be more pronounced for developing than for industrialized exporters. But even some industrialized countries (e.g., the United States) publish export statistics which greatly differ from those reported by importing partners.

Discrepancies in reports describing the same transactions imply inaccuracies on the part of the exporter, the importer, or both simultaneously. Whether inaccuracies are innocent or deliberate, analysts and policymakers need to be cognizant of their existence. By establishing double accounts, as demonstrated here, data disagreements are quickly revealed. Analysts will then be prompted to seek explanations for differences, ultimately leading to more effective decisionmaking.

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