C I N T R A F O R

Working Paper 95

Discrepancies in Forest Products Trade Statistics

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October 2004

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EXECUTIVE SUMMARY

This report describes the extent to which discrepancies in trade statistics occur within the forest products sector and identify those areas where unusually large trade statistics discrepancies appear to exist. It also identifies those factors that contribute to discrepancies in the trade statistics and makes recommendations to help trade analysts evaluate and develop a better understanding of the factors that contribute to trade statistics discrepancies.

The literature recognizes a large number of factors that can contribute to discrepancies in trade statistics between two countries, many of which have been discussed in this section. However, there is no research available that describes the relative importance of specific factors in impacting discrepancies in the trade statistics. From the review of the literature it would seem likely that this shortcoming is due to the fact that the mix of factors that influence the unique trade relationship between any two countries tends to be unique to that trading relationship and that this mix of factors differs substantially from other combinations of trading partners. In response to this weakness of the literature, we have provided a relative ranking of trade factors that impact discrepancies in the trade data by assigning each trade factor to one of three groups of factors: (a) primary normal factors, (b) secondary normal factors, and (c) abnormal factors. This ranking of factors was based on the review of the literature and was done for the sole purpose of providing the trade analysts involved in the in-depth country studies that follow this study with guidance in identifying and evaluating the relative impact of specific trade factors on discrepancies in trade statistics.

The analysis of the trade data demonstrates several fundamental characteristics of the trade statistics for forest products. First, the average discrepancy in the trade statistics is greater than zero and the discrepancy ratio becomes smaller as the degree of processing increases (the difference in discrepancy ratio was significant between logs and lumber and logs and plywood but not between lumber and plywood). Second, the majority of the discrepancy ratios observed for logs, lumber and plywood tended to be positive and concentrated above the mean discrepancy ratio, indicating that in most cases the magnitude of the reported imports exceeded that of the reported exports. Third, the statistical analysis found that, while there was a significant difference between the size of the trade statistics discrepancy ratios between developed and less-developed countries across all three products combined, further analysis determined that, on a specific product basis, this difference was only significant in the case of lumber. Finally, the trade statistics were statistically analyzed to establish a “normal” range of trade statistics discrepancies that might serve as a guide for trade analysts looking to identify unusual discrepancies that might require further investigation.

This research clearly shows that discrepancies within the trade statistics are to be expected and anticipated within limits. However, the analysis of the trade data and the bi-lateral trade statistics discrepancy ratios suggests that there are substantial discrepancies in the trade statistics for logs, lumber, and plywood. While there are a variety of reason why we would expect that reported exports would not equal reported imports, the magnitude of many of the bi-lateral trade statistics discrepancy ratios observed appear to defy conventional explanations. Clearly a more in-depth analysis of these problematic trade flows should to be conducted to determine their causes and, in the process, begin to develop recommendations to reduce these trade statistics discrepancies in the future. Finally, despite the difficulties associate with reconciling trade volumes (based on differences in the types of measurement systems used in different countries and the lack of timely data), we strongly recommend that any trade statistics discrepancy analysis consider both the value of trade and volume of trade.

Finally, this report provides a list of trade factors that could be used to guide an analysis of trade statistics discrepancies (refer to the following table). These trade factors have been broken down into: (a) primary normal factors, (b) secondary normal factors, and (c) abnormal factors based on the review of the relevant trade literature. It is recommended that an analysis of trade statistics discrepancies begin by considering the ability of the primary normal factors to explain the discrepancies in the trade statistics, and if necessary, the analysis would then consider the role of secondary normal factors followed by the role of the abnormal factors in contributing to the trade statistics discrepancy under consideration. Finally, each individual trade factor listed below is followed by a specific set of recommendations designed to assist the trade analyst in understanding how each factor might impact trade statistics discrepancies.

It should be noted that as a result of this study, the International Tropical Timber Organization has performed a series of country level studies. In each of these studies, trade analysts looked at specific problems associated with forest products trade for their countries and communicated with counterparts in trade partner countries to try and resolve some of the issues raised in this Working Paper. A synthesis report of the 11 national country studies will be presented at the ITTO Council Session to be held in Yokohama Japan in December 2004.

Summary of the factors that can contribute to discrepancies in the trade statistics and recommendations for analyzing the ability of these factors to explain trade statistics discrepancies.

Type of Activities	Recommendations for Analyzing Trade Statistics Discrepancies
Normal Activities that Result in Trade Statistics Discrepancies	
Primary Normal Factors	
Product valuation (FOB vs. CIF)	How do transportation costs affect the total value of the imported product? How are transportation costs accounted for by the exporting country and importing country? To what degree does this difference in accounting explain all or most of a trade statistics discrepancy?
Time lag between export and import	Is the shipping time between exporter and importer substantial? Was there a significant amount of product exported at the end of the year that may not have arrived at the importing country until to following calendar year? Could this shipping time lag account for a significant component of the trade statistics discrepancy?
Exchange rate fluctuations	Has there been extreme exchange rate volatility during the period in question? Are official export/import values calculated using annual or monthly exchange rates? Is there a significant difference between using annual vs. monthly exchange rates to calculate the value of trade? Could exchange rate fluctuations account for a significant component of the trade statistics discrepancy?
Declaration of destination (trans-shipments)	Do products exported by one country tend to pass through a third country before arriving at the final destination? Is there a substantial amount of this so-called triangular trade between the two countries being considered? How do the exporting and importing country account for trade through a third country? Could discrepancies in accounting for triangular trade account for a significant component of the trade statistics discrepancy?
Secondary Normal Factors	
Conversion of product weights to volumes	Are the appropriate conversion factors being used based on species, log diameters, or product sizes (e.g., nominal sizes vs. actual sizes)? Are the conversion factors being used consistent between the exporting and importing country?
Differences in log scaling methods	Are unique log scaling methods used by either the importing country or the exporting country? Are the log scaling volumetric equations appropriate for the form of log being traded (e.g., constant diameter vs. significant taper) If product volume re-estimated by the importing country, are volume differences reconciled with the exporting country? Are the volumetric equations comparable between the two countries?
Volume conversions from standard to metric	Is the appropriate conversion factor being used for the type of product being traded (e.g., lumber cut to actual sizes vs. nominal sizes vs. waney cants)? Is a comparable standard being used to report product volume (e.g., thousand square feet on a 3/8 inch basis for plywood)? How are volume differences reconciled between the importing and exporting country?

Product valuation method	What type of system is used to establish product value? If the valuation systems employed by the exporting country and importing country differ, is the difference significant? How are valuation differences reconciled between the exporting and importing countries?
Combined shipment of mixed products	Do exporters declare mixed product shipments under a single HTS code? Do customs agents check for mixed shipments? What rules are applied by customs to mixed product shipments? Do mixed product shipments represent a substantial percentage of exports?
Different product classification systems used	Do both the exporting and importing countries utilize compatible product classification codes within the Harmonized Trade System of product classification (e.g., HTS codes set at the 8 digit level vs. 9 digit level)? If not, do both systems identify products at the same level of accuracy (e.g., single species vs. a group of similar species)? At what level can the two systems be reconciled (e.g., 4 digit level vs. 6 digit level or higher)? Is a substantial amount of trade attributed to "*Other species*" or "*Other products*" categories?
Poor government policies or policy implementation	Is the exporting country using an older version of the IMF Balance of Payments manual (BPM4) to establish their trade accounts? Is there good communication of trade data between government agencies? Is trade data reconciled between government agencies?
Type of national accounting system used for trade	What type of system is used for recording merchandise trade by the exporting and importing countries (e.g., general trade vs. special trade)? Are the importing and exporting countries use different editions of the IMF Balance of Payment manual to develop their trade statistics (e.g., BPM 4 vs. BPM 5)? Does the method for collecting international trade statistics (ITS) require significant adjustments in order to comply with the IMF Balance of Payments Method (BPM5)? Are the adjustments made to reconcile the ITS with BPM5? Is there a procedure in place to reconcile trade data between countries?
Unintentional data collection, processing errors	Upon close inspection of the trade data, do there appear to be unexplained anomalies within the data? Can these anomalies be isolated and investigated further with the appropriate government agencies (e.g., customs or individual ports)? Is a substantial amount of trade attributed to "*Unidentified Countries*"?
Unreported export or import data	Does the country have a system in place to ensure that export reports are maintained by the ports and that these export reports are sent forward to the customs department for evaluation? How does the country check this system to verify the accuracy of their trade data?
Abnormal or Illegal Activities that Result in Trade Statistics Discrepancies	
Abnormal Factors	
Under-invoicing product value or volume	Do exporters have an economic incentive to under-invoice export value and/or volume? Are there credible laws and enforcement capacity in place to deter under-invoicing practices? Is there a process in place to identify forged or altered export

	documentation? Are their constraints on the ability of customs officials to verify exporters invoicing practices? Is corruption within the Port or Customs agencies a credible concern? If so, what factors contribute to corruption and how can they be addressed?
Mis-specification of product type or characteristics	Do exporters have an economic incentive to mis-specify their products (e.g., export tariffs or quotas)? Do ambiguous or complicated export rules contribute to mis-specification? Are exporters and/or customs agents familiar with product specification rules? Are there credible laws and enforcement capacity in place to deter mis-specification of product type or characteristics? Is there a process in place to identify forged or altered export documentation? Are their constraints on the ability of customs officials to verify exporters compliance with product specification rules? Is corruption within the Port or Customs agencies a credible concern? If so, what factors contribute to corruption and how can they be addressed?
Mis-specification of species or grade	Do exporters have an economic incentive to mis-specify species or product grade? If product is re-graded by the importing country, how are differences reconciled? Are any timber species exported subject to CITES trade restrictions? Are any timber species exported subject to national government trade restrictions? Are there credible laws and enforcement capacity in place to deter mis-specification of species or product grade? Is there a process in place to identify forged or altered export documentation? Are customs officials trained to identify timber species for which trade restrictions apply? Are there constraints on the ability of customs officials to verify the species and/or product grades being exported? Is corruption within the Port or Customs agencies a credible concern? If so, what factors contribute to corruption and how can they be addressed?
Transfer pricing	To what extent does intra-company trade occur? Do local tax structures provide companies with an incentive to employ illegal or exaggerated transfer pricing mechanisms to reduce their local tax burden?
Fraudulent trade data	Do rigid national policies encourage trade analysts or agencies (either overtly or subtly) to adjust trade statistics to meet national economic targets? Are there mechanisms in place to ensure the validity of trade data at every level of reporting (e.g., port to district to regional to national)? Does an analysis of the trade data identify anomalies between levels of reporting? Are there mechanisms in place to reconcile any anomalies in the national trade data?
Smuggling	Are there large unexplained trade flows that cannot be explained by any of the factors identified previously? Have there been credible reports of smuggling in the past? How easy is it to smuggle individual products out of the country (e.g.,

	logs vs. lumber vs. plywood)? Is there an economic incentive for producers to smuggle products out of the country? Are there harvest restrictions or export taxes/tariffs/quotas in place that encourage smuggling? Is there a substantial discrepancy between the reported timber harvest and the volume of products manufactured and/or exported by the country? Is there a substantial discrepancy between the reported timber harvest and the volume of timber imports reported by trading partners? Are there credible laws and enforcement capacity in place to deter smuggling? Is corruption within the Port or Customs agencies a credible concern? If so, what factors contribute to corruption and how can they be addressed?

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1.0 INTRODUCTION

The general public has little problem recognizing that the combination of small size, high intrinsic value of diamonds and other gemstones facilitate the smuggling and illegal trade of these products. This is aided by the fact that it is extremely difficult (but not impossible) to tell if a diamond was illegally exported simply by looking at it. In contrast, many people have a harder time understanding how large and bulky products like logs, lumber and plywood can be illegally traded or how there can be large discrepancies on the order of millions of cubic meters in the trade statistics between countries. These large discrepancies in the trade statistics help to fuel a public perception that illegal logging and timber smuggling are rampant within the timber industry and that the international timber trade is largely responsible for forest destruction and deforestation, particularly in tropical countries.

Discrepancies in trade statistics can be attributed to a wide variety of intentional and unintentional factors. While some of these factors can lead to trade statistics discrepancies between trading partners, others may never show up in the trade statistics at all because they are not detected. Nevertheless, this second group of factors results in trade discrepancies just as much as the first group of factors. Factors that can lead to discrepancies in the trade statistics include; illegal smuggling with forged documentation, under-reporting of export volumes or grades, and incompatible volume measurement techniques. In contrast, examples of factors that distort trade flows without appearing as trade statistics discrepancies include; illegal smuggling that avoids detection, misreporting timber species, product type, product volumes, or product values.

Despite the fact that these practices may or may not show up as discrepancies within the trade statistics, they all distort the trade statistics and contribute to unsustainable forest management practices and policies while promoting negative perceptions of the timber industry and international trade. Therefore it is of paramount importance that timber trade statistics be as accurate as possible to facilitate sustainable forest management practices, support the development of responsible government policies relating to forest management and timber trade, promote a more positive public perception of the international timber trade.

The primary objective of this report is to identify a broad range of factors that can result in discrepancies in the trade statistics for wood products. Since these factors can result in discrepancies in the reported volume and/or value of trade between two countries, we will attempt to establish a range of trade statistics discrepancies. Obviously, this implies that there is a “normal” range of trade statistics discrepancies that occurs in the normal course of international trade. Many factors influence the fact that the value and/or volume of exports reported by one country might not match the reported value and/or volume of imports reported by a trading partner and, in general these numbers will almost never be the same during the normal course of trade. Establishing a “normal” range of discrepancies can help the trade analyst to evaluate whether or not a specific discrepancy in the trade statistics is abnormally large and merits further evaluation to determine the cause of the discrepancy.

This paper will attempt to describe the extent to which discrepancies in trade statistics occur within the forest products sector and identify those areas where abnormally large trade statistics discrepancies appear to occur. It will also make recommendations to help trade analysts identify and develop a better understanding of the factors that contribute to large discrepancies in the trade statistics within the international timber trade.

1.1 STUDY OBJECTIVES

1. Review studies carried out on trade statistics discrepancies, for timber and other relevant products,

2. Review studies of different systems for reporting trade statistics and the level of reporting detail allowed (and used in practice) within the timber trade,

3. Review studies on the impact of differing measurement systems, conversion factors and reporting formats on discrepancies in trade statistics,

4. Review studies on the role of mis-classification of products in discrepancies in timber trade statistics,

5. Review studies of triangular trade and transfer pricing as a source of timber trade discrepancies,

6. Quantify discrepancies in trade statistics within a matrix of exporters and importers for logs, lumber, and plywood,

7. Establish a “normal” range of discrepancies in trade statistics for the trade of logs, lumber, and plywood, and

8. Summarize a set of recommendations to assist trade analysts in identifying and understanding the underlying causes of discrepancies within the timber trade statistics during the in-depth country studies to follow this study.

2.0 REVIEW OF THE LITERATURE

The literature on trade statistics discrepancies between trading partners is relatively sparse, despite the fact that both the IMF and the UN have commissioned studies on this topic (IMF 1987; UN 1974). While it is generally accepted that normal discrepancies in trade statistics cannot be avoided, the question remains regarding what is a "normal" trade discrepancy and how does the trade analyst distinguish between a "normal" trade discrepancy and an "abnormal" trade discrepancy. This question has important implications because of its impacts on trade balances and government policies related to trade and international balance of payments. In addition, the question is important because of its implications for sensitive areas of trade, such as the trade of CITES protected species of wood such as mahogany and ramin. It also has important implications for the forestry and wood products industries where abnormally large discrepancies in the trade statistics can be pointed to by environmental groups as evidence that illegal logging and timber smuggling are rife within the international timber industry and important factors in deforestation. Finally, this question is important simply because accurate statistics can help a country better understand what is happening in the forestry sector and therefore lead to better policy decisions in the areas of forest policy and forest management. Therefore it is in the self-interest of the timber industry to look to identify those areas where discrepancies in the timber trade statistics appear to be abnormally high and understand the factors that contribute to these trade discrepancies.

2.1 GENERAL FACTORS THAT RESULT IN DISCREPANCIES IN TRADE STATISTICS

The literature generally can be broken into two areas of interest: (1) normal activities that result in trade discrepancies between trading partners and (2) intentional acts conducted to smuggle goods or avoid/reduce export taxes. Examples of each type of activity and the relevant literature are summarized in the Relevant Literature Table below. Normal activities that contribute to discrepancies in the trade statistics tend to be related to measurement errors (such as different types of log scaling techniques and inaccurate or incompatible conversion factors being used), poor institutional capabilities (poor communications between the national customs service and the statistical office, poor policy implementation, data collection errors, data processing errors, unreported exports and/or imports, to name just a few) and factors intrinsic to international trade (time lags between when an export is recorded and the corresponding import occurs, exchange rate fluctuations, and product valuation: FOB vs. CIF).

The second area of interest relates to intentional activities that result in discrepancies in the trade statistics. Intentional acts tend to focus on illegal or quasi-illegal activities. Examples of these types of activities include timber smuggling (which is often, but not always, associated with illegal logging) and under-invoicing of product values or volumes (which are often associated with overvalued currencies, foreign exchange restrictions, export taxes, tariffs, quotas, and transfer pricing). Other examples of these activities include mis-specification of timber species or timber grades (which is often associated with under-invoicing or the trade of protected species such as mahogany or ramin) and misclassification of product type (which is often done to avoid export taxes, export quotas, import tariffs or import quotas).

2.3 FACTORS THAT IMPACT DISCREPANCIES IN TRADE STATISTICS WITHIN THE INTERNATIONAL TIMBER TRADE

Within the timber trade there are a wide range of factors which contribute to discrepancies in the trade statistics. However, the specific factors that have a disproportionately large impact on trade statistics discrepancies include: 1) incompatible volume measurement systems, 2) level of reporting detail employed within the Harmonized Trade System (HTS), 3) allocation of transportation charges (FOB vs. CIF) in product valuation, 4) time lags between reported exports and reported imports,

Table 2.1 Summary of the relevant literature on trade statistics discrepancies according to the type of activity.

Type of Activities	Relevant Literature
Abnormal or Illegal Activities that Result in Trade Discrepancies	
Smuggling	Makhoul and Otterstrom 1998; Naya and Morgan 1969; Morgenstern 1963; Bhagwati 1981; Martin and Panagariya 1984; Gullison et al. 2000; Blundell and Rodan 2002; De Wulf 1981
Under-invoicing product value or volume	Durst et al. 1986; Naya and Morgan 1969; Bhagwati 1981; Martin and Panagariya 1984; Gullison et al. 2000; Blundell and Rodan 2002; De Wulf 1981
Mis-specification of product type or characteristics	Durst et al. 1986; Morgenstern 1963; Bhagwati 1981; Martin and Panagariya 1984; Gullison et al. 2000; Blundell and Rodan 2002; De Wulf 1981
Mis-specification of species or grade	Durst et al. 1986; Morgenstern 1963; Bhagwati 1981; Martin and Panagariya 1984; Gullison et al. 2000; Blundell and Rodan 2002
Transfer pricing	Doan 1983; IMF 1987; Durst et al. 1986; Naya and Morgan 1969; Bhagwati 1981
Fraudulent trade data	Makhoul and Otterstrom 1998; Yeats 1978; Naya and Morgan 1969; Morgenstern 1963; Parniczky 1980; Bhagwati 1981; Martin and Panagariya 1984; De Wulf 1981
Normal Activities that Result in Trade Discrepancies	
Conversion of product weights to volumes	Durst et al. 1986; Luppold 1995; Darr 1984; Blundell and Rodan 2002
Combined shipment of mixed products	Luppold 1995; Darr 1984; Gullison et al. 2000
Differences in log scaling methods	Durst et al. 1986; Luppold 1995; Darr 1984
Volume conversions from standard to metric	Durst et al. 1986; Luppold 1995; Darr `1984
Exchange rate fluctuations	Makhoul and Otterstrom 1998; Durst et al. 1986; Naya and Morgan 1969; Blades and Ivanov 1985
Product valuation method	Durst et al. 1986; Luppold 1995; Naya and Morgan 1969; Gullison et al. 2000; De Wulf 1981
Product valuation (FOB vs. CIF)	Doan 1983; Sostad 1961; IMF 1987; Makhoul and Otterstrom 1998; Yeats 1978; Durst et al. 1986; Naya and Morgan 1969; Luppold 1995; Parniczky 1980; Blades and Ivanov 1985; Rozanski and Yeats 1994
Poor government policies or policy implementation	Makhoul and Otterstrom 1998; Yeats 1978; Parniczky 1980; Blades and Ivanov 1985; De Wulf 1981; Bhagwati 1981; Martin and Panagariya 1984
Type of national accounting system used for trade	Ely 1961: IMF 1987; Sostad 1961; Makhoul and Otterstrom 1998; Morgenstern 1963; Blades and Ivanov 1985; Rozanski and Yeats 1994; Yeats 1990
Different product classification systems used	Ely 1961; Rothrock 1962; Sostad 1961; Durst et al. 1986; Naya and Morgan 1969; Morgenstern 1963; Rozanski and Yeats 1994; Yeats 1990
Unintentional data collection, processing errors	Ely 1961; Rothrock 1962; Sostad 1961; Yeats 1978; Durst et al. 1986; Naya and Morgan 1969; Luppold 1995; Morgenstern 1963; Parniczky 1980; Blades and Ivanov 1985; Yeats 1990; De Wulf 1981
Merchandise vs. services	Makhoul and Otterstrom 1998; IMF 1987; Morgenstern 1963; Rozanski and Yeats 1994
Time lag between export and import	Makhoul and Otterstrom 1998; Yeats 1978; Morgenstern 1963; Parniczky 1980; Blades and Ivanov 1985
Declaration of destination (trans-shipments)	Makhoul and Otterstrom 1998; Yeats 1978; Durst et al. 1986; Morgenstern 1963; Blades and Ivanov 1985; Rozanski and Yeats 1994; De Wulf 1981
Unreported export or import data	Makhoul and Otterstrom 1998; Naya and Morgan 1969; Luppold 1995; Morgenstern 1963; Parniczky 1980; Blades and Ivanov 1985; Rozanski and Yeats 1994; Yeats 1990; De Wulf 1981

5) incorrect or unknown specification of origin or destination of shipment (including triangular trade), 6) under-invoicing of exports, and 7) smuggling. The mechanisms by which each of these factors can influence discrepancies in trade statistics will be discussed briefly in the following paragraphs.

A number of reports have discussed the problems associated with measurement errors and their impacts on trade volumes. For example, while the US generally scales logs in board feet (Scribner scale), European countries calculate volumes in cubic meters and Japan reports log volumes in both cubic meters and the traditional system of koku. For example, research on log scaling techniques in the Pacific Northwest indicates that while the Japanese frequently use a conversion factor of 4 cubic meters per thousand board feet (Scribner scale), more accurate conversion factors vary by specific geographic location within the region, with a conversion factor of 5 to 5.5 being more appropriate for western Washington, 5.5-6.0 for coastal British Columbia, and 6.0 to 6.5 for interior British Columbia. Similarly, the literature notes that the generally accepted conversion factor for lumber is 2.36 cubic meters per thousand board feet (mill tally). However, this conversion factor is only accurate for lumber that is sawn to full dimensions and is squared on all four sides. In the case of lumber sawn to nominal dimensions or lumber with substantial wane (e.g., waney cants; which are cants sawn on two sides with wane running the length of the two unsawn sides), this conversion factor significantly over estimates lumber volume. To the extent that non-standard volumetric systems or conversion systems are used, it is likely that they make a substantial contribution to trade discrepancies on a volumetric basis. Durst et al. (1986) note that discrepancies in the trade statistics for hardwood logs exported from the US (on a volumetric basis) ranged from a 25% overestimation (in the case of Switzerland) to a high of 620% (in the case of Austria). More importantly, the trade statistics discrepancy for the two largest trading partners, Canada and Germany, were 169% and 140%, respectively.

Although the Harmonized Trade Schedule (HTS) provides for the common classification of products at the four digit level across all countries (for example, the HTS code for logs is 4403, for lumber is 4407 and for plywood is 4412), the system allows each country to assign individual products up to a 10 digit HTS code which can be unique to that country. So, while this system allows for the common classification, and comparison, of products at the general four digit level, the trade analyst encounters substantial problems when trying to analyze the trade of very specific products, since each country may use a different HTS code for those products. For example, the US classifies western red cedar using the 10 digit HTS code 4403.20.0055 [Western Red Cedar (Thuja Plicata) Logs and Timber] whereas Japan classifies western red cedar using the 9 digit HTS code 4403.20-097 [Wood in the Rough, of red cedar and other genus thuja). Similarly, whereas the US uses the HTS code 4403.32.000 [White luaun, white meranti, white seraya, yellow meranti], Japan uses the 9 digit HTS code 4403.49-110. This use of different HTS codes and different number of digits within codes provides the opportunity for classification error between countries, particularly when shippers or customs personnel are unable to differentiate between individual timber species.

A widely recognized cause of discrepancies in the trade statistics is the problem associated with the allocation of transportation charges in the product valuation process. Most of the literature on trade discrepancies refers to a discontinuity between the valuation of products by the exporting country and the importing country. This discontinuity occurs because exports are generally valued on an FOB basis (free on board) in contrast to imports which are generally valued on a CIF basis (cost, insurance, and freight). Yeats (1978) reports that including transportation costs in the value of imports generally results in a trade discrepancy of approximately 10% between reported exports and reported imports for a broad range of manufactured goods. Doan (1983) further suggests that transportation costs in the forest products sector can increase the value of imports by up to 20% or more relative to the FOB value of exports while Finger and Yeats (1976) note that costs can comprise up to 40% of the value of imported products. However, it is important to note that the impact of transportation costs on trade discrepancies is highly variable and influenced by such factors as distance to market, type of transportation system used (e.g., break bulk vs. container vessels), product form (e.g., logs vs. lumber or plywood), and the availability of cheap back haul transportation rates (e.g., shipping Scandinavian lumber to Japan on relatively empty container vessels returning to Japan).

Shipping times and time-in-transit can also contribute to trade statistics discrepancies, particularly when products are shipped at the end of the year or have long distances to transit. For example, goods shipped in December 2001 but received in January 2002 would likely be included in the 2001 export statistics by the exporting country but the 2002 import statistics by the importing country. To the extent that significant amounts of trade occur at the end of the year, these time lags could have a substantial impact on discrepancies in trade statistics. Similarly, transit times vary substantially and while lumber shipped from Seattle to Japan may take 10-14 days to arrive in Tokyo, a similar shipment from Sweden or Finland may take more than a month to arrive in Tokyo. Methods of accounting for ownership and transfer of ownership can also impact trade discrepancies. For example, transfer of ownership can occur either when the proper documentation is exchanged or when the buyer takes physical possession of the product.

Incorrect or unknown specification of origin or destination of shipment can affect trade statistics discrepancies in two ways. First, paperwork for products shipped on Liberian or Panamanian registry vessels can mistakenly reflect the country of origin as Liberia or Panama, either through inadvertent mistakes made by the shipper or the receiving customs officials. In addition, countries that are actively engaged in triangular, or entrepot, trade (e.g., Singapore and the Netherlands) are often mistakenly identified as the exporter despite the fact that the products are simply transshipped through the country. For example, a recent study of the US-Canada-Europe trade in hardwood lumber noted that between 10-20% of the hardwood lumber exported from the US to Canada was re-exported to Europe with little or no additional processing being performed in Canada. This study found that these shipments were reported by the Canadian government as exports but that many European countries reported these Canadian re-exports as originating from the US. Clearly these triangular trade patterns can have a substantial impact on trade discrepancies to the extent that they involve substantial volumes or values of products. Finally, incomplete paperwork or inadvertent errors can result in the loss of shipment information and the classification of trade under the heading “Unidentified Country”. For example, the Russian trade statistics reported $US14.7 million worth of plywood exports (or 6.1% of Russia’s total plywood exports) as going to an unidentified country. This classification ranked as the 6th largest trade flow for Russian plywood in 2001.

Under-invoicing or mis-labeling of wood products can be a particular problem in those countries that have over valued currencies, non-convertible currencies, foreign exchange controls, or restrictions on access to foreign exchange. In these countries exporters have an incentive to collude with importers to under value export shipments, either directly or by mis-labeling the species or grade of product being exported, with the difference in value usually being deposited into an off-shore account controlled by the exporter. Similarly, exporters have an incentive to mis-specify a higher value product (e.g., mouldings) as a lower value product (e.g., lumber). High export taxes, high import tariffs, or import quotas can also contribute to this practice.

Finally, smuggling of wood products has the ability to skew trade discrepancies. Two factors that contribute significantly to smuggling are illegal logging and CITES protection of specific timber species (e.g., mahogany and ramin). It is important to note that wood products that are illegally exported and illegally received in the importing country are not likely to show up in either country's trade statistics and are therefore unlikely to contribute to a discrepancy in the trade statistics. More likely, any trade statistics discrepancies attributed to smuggling will occur as a result of illegal exports that receive forged or illegally obtained export documentation prior to arriving at their final destination. In this way these illegal trade flows do not show up in the export statistics of the exporting country but are duly reported as legitimate imports by the receiving country. Clearly this type of smuggling activity requires either the complicit participation of a government official to provide official export documentation or it requires the theft, forging and/or altering of export documentation by a third party. Finally, in cases where smuggling occurs between two countries with contiguous borders, the smuggling operation is much more difficult to monitor since it is possible for the smugglers to by-pass port and customs authorities altogether. However, as mentioned earlier, since this type of smuggling represents an unreported flow of goods between two countries, it is unlikely to show up in the trade statistics and therefore will not contribute to a trade discrepancy, despite the fact that it may involve a substantial flow of products.

2.4 SUMMARY

The literature recognizes a large number of factors that can contribute to discrepancies in trade statistics between two countries, many of which have been discussed in this section. However, there is no research available that describes the relative importance of specific factors in impacting discrepancies in the trade statistics. From the review of the literature it would seem likely that this shortcoming is due to the fact that the mix of factors that influence the unique trade relationship between any two countries tends to be unique to that trading relationship and that this mix of factors differs substantially from other combinations of trading partners. In response to this weakness of the literature, we have provided a relative ranking of trade factors that impact discrepancies in the trade data by assigning each trade factor to one of three groups of factors: (a) primary normal factors, (b) secondary normal factors, and (c) abnormal factors. This ranking of factors was based on the review of the literature and was done for the sole purpose of providing the trade analysts involved in the in-depth country studies that follow this study with guidance in identifying and evaluating the relative impact of specific trade factors on discrepancies in trade statistics.

3.0 DISCREPANCIES IN TRADE STATISTICS ACROSS ALL PRODUCT CATEGORIES

The following excerpts are taken from the WTO International Trade Statistics appendix (WTO 2000). The definitions are useful as a first step in understanding trade statistic definitions and derivations commonly practiced by WTO member countries. Following the elaboration of these definitions, we examine the general trade statistics for imports and exports across all product categories between the US-Canada and the US-Mexico. We do this to establish a range of trade statistics discrepancies that might be considered as normal.

3.1 EXPORTS AND IMPORTS

Two systems of recording merchandise exports and imports are in common use. They are referred to as general trade and special trade and differ mainly in the way warehoused and re-exported goods are treated. General trade statistics are larger than the corresponding special trade statistics because the latter exclude certain trade flows, such as goods shipped through bonded warehouses. The WTO International Trade Statistics, for instance, define trade according to the general trade definition which covers all inward and outward movements of goods through a country or territory including those through customs warehouses and free zones. Further explanations are provided in United Nations International Trade Statistics, Concepts and Definitions, Series M, No 52, Revision 2. Export statistics are valued at transaction value, including the cost of transportation and insurance to bring the merchandise to the frontier of the exporting country or territory (f.o.b. valuation). Imports are valued at transaction value plus the cost of transportation and insurance to the frontier of the importing country or territory (c.i.f. valuation).

3.2 WORLD TRADE NETWORK

The world merchandise trade network by region and product, from which trade data for the following analysis of trade statistics discrepancies were derived, is based on export data. The WTO trade statistics are constructed in the following way. First, total merchandise exports from each of the seven regions are aggregated from country figures published by the International Monetary Fund in International Financial Statistics, other international organizations, and national statistical authorities. They are supplemented by Secretariat estimates. Next, the total merchandise exports of each region are distributed by destination and then by product. The regional and commodity breakdown is based on OECD, Monthly Statistics of Foreign Trade; UNSD, Comtrade database, International Trade Statistics Yearbook, and Monthly Bulletin of Statistics; national statistics and Secretariat estimates. During this process, the principal adjustments to the figures are as follows:

i. Exports of ships to the open registry countries Panama and Liberia are re-allocated from each region's exports to Latin America and Africa to « unspecified destinations » (a category not shown separately).

ii. Re-exports of Hong Kong, China are excluded. This is because the magnitude of Hong Kong, China's re-exports (9.8 per cent of Asian total merchandise exports in 1999) would introduce a significant element of double counting into the trade of the Asian region since a large proportion of Hong Kong, China's re-exports are goods of Chinese origin or have China as their final destination.

iii. China's exports are adjusted to approximate their final destination.

iv. Exports of military goods and non-monetary gold, where known, are included. When they cannot be broken down by destination, they are allocated to « unspecified destinations ».

3.3 MERCHANDISE TRADE IN BALANCE OF PAYMENTS STATISTICS

Merchandise trade statistics together with other basic statistical systems (such as industrial and transport statistics) provide the foundation for the system of national accounts (SNA) and the balance of payments (BOP). Merchandise trade statistics are basic to the compilation of the goods account in the balance of payments as structured and defined in the fifth edition of the International Monetary Fund's Balance of Payments Manual (BPM5).

Goods (merchandise) are defined in the SNA as physical objects for which a demand exists, over which ownership rights can be established and whose ownership can be transferred from one institutional unit to another by engaging in transactions on markets. Thus, for the SNA and BOP statistics the recording of transactions should be based on the change of ownership principle.

However, the compilation of international merchandise trade statistics (ITS) is usually based on customs records that essentially reflect the physical movement of goods across borders, and follow international guidelines on concepts and definitions, which do not fully conform to the principles of the SNA and the BPM5, i.e. change of ownership principle.

There are a number of adjustments made to international merchandise trade statistics before they match the specific requirements of national accounts and balance of payments statistics. For aggregate exports and imports these adjustments are mainly related to coverage, the system of trade, and valuation.

With respect to coverage, the ITS in most instances conforms with the BPM5. Differences remain for the following cases:

i. transactions that represent services transactions (e.g. blueprints, videos, and tapes) should be valued in ITS at the value of the material in which they are incorporated, while under BPM5 these transactions should be excluded from goods and included, at market value, in services ;

ii. transactions in which one or both national boundaries are not crossed (e.g. trade in vessels and aircraft, exports of bunkers, etc.) are not always included in ITS for practical reasons, whereas they are usually included in BOP statistics ;

iii. goods under the improvement and repair trade regime should be excluded from ITS, but they are to be included at the value of the repair under the BPM5.

Concerning the system of trade, the ITS guidelines outline the measurement of trade flows on the basis of (1) the special trade system and (2) the general trade system. Under the special trade system, the customs frontier is regarded as the statistical boundary whereas, under the general system of trade, the national frontier is regarded as the statistical boundary. The BPM5 stresses that measurement for BOP compilation should be based on change of ownership rather than on the general trade system or the special trade system. The general trade system appears to be a better proxy for measuring change of ownership because it provides broader coverage and the date of change of ownership may be closer to the date goods cross the national frontier than to the date goods clear through customs.

As far as valuation is concerned, the issue that affects most data comparability concerns the point of valuation, namely, whether goods are valued at the importer's border – that is at the c.i.f. value – or at the f.o.b. value at the exporter's border. ITS guidelines recommend the adoption of the c.i.f. valuation for imports whereas BPM5 requires the f.o.b. valuation. Additional adjustments may be made by BOP compilers to conform to the BPM5 requirement for a market price for valuing trade, processing trade, and with respect to currency conversion.

Once adjusted, merchandise trade is recorded in the goods category of the current account, along with services, income, and current transfers. Therefore, within the balance of payments framework transactions in both goods and services are harmonized and provide for comparable statistical series. It is not strictly speaking correct to aggregate the figures for commercial services and merchandise shown elsewhere in the WTO trade statistic report.

It should be noted that some countries still apply the concepts of the fourth edition of the Balance of Payments Manual, and thus do not include goods for processing and goods procured in port carriers in the goods account.

3.4 TRADE MATRICES AND DISCREPANCIES BETWEEN IMPORT AND EXPORT STATISTICS

A. Canada-US Trade Flows.

In order to develop a baseline of the range of trade statistics discrepancies that can occur between trading partners, we have taken bilateral trade data for 1997, 1998 and 1999 and compared exports and imports for 22 categories of merchandise using the most recent trade data for the US and Canada as well as the US and Mexico. The trade data was derived from the WTO statistical database (WTO 2000). For each bilateral trade flow, we calculated the discrepancy in the trade statistics for each product category and year using the methodology described in the following section. (Essentially we subtract reported exports from reported imports and divide this number by reported imports as described in Equation 1). We report the trade discrepancy ratios for trade between the US and Canada as well as the US and Mexico.

Figure 3.1 presents the frequency distribution of the bi-lateral trade statistics discrepancy ratios between (1) Canada's reported imports from the US relative to the US reported exports to Canada and (2) the US reported imports from Canada relative to the Canadian reported exports to the US. The analysis was carried out using 22 product categories traded in 1997, 1998, and 1999 resulting in a total of 66 observations. An analysis of the US-Canada trade data shows that the mean bi-lateral trade statistics discrepancy ratio for US imports of Canadian products was -0.032 while the mean bi-lateral trade statistics discrepancy ratio for Canadian imports of US products was -0.132. A statistical analysis of the two distributions of trade statistics discrepancy ratios found that they were significantly different.

The frequency distribution in Figure 3.1 shows that few of the product categories displayed a bi-lateral trade statistics discrepancy ratio greater than 0.15. Figure 3.1 further indicates that reported Canadian exports to the US, when compared to US reported imports from Canada, tended to represent trade statistics discrepancy ratios within the 0 to -0.10 range. In contrast, when considering the reverse trade flow (i.e., Canadian imports from the US), the trade statistics discrepancy ratios were somewhat larger and tended to be grouped in the -0.6 to -0.15 range. A negative trade statistics discrepancy ratio indicates that reported exports exceeded the corresponding reported imports. Thus, it appears that the import statistics in Canada appear to be more in line with US export statistics than the Canadian export statistics are with the US import statistics.

Figure 3.2 shows that the bi-lateral trade statistics discrepancies can differ significantly across product categories. The trade statistics discrepancies for the US-Canada ranged from -0.586 to 0.056., although the trade statistics discrepancies in most categories have been declining. In addition, the total trade statistics discrepancy between the US and Canada was 3.24% in 1997 and this declined to 1.78% in 1999.

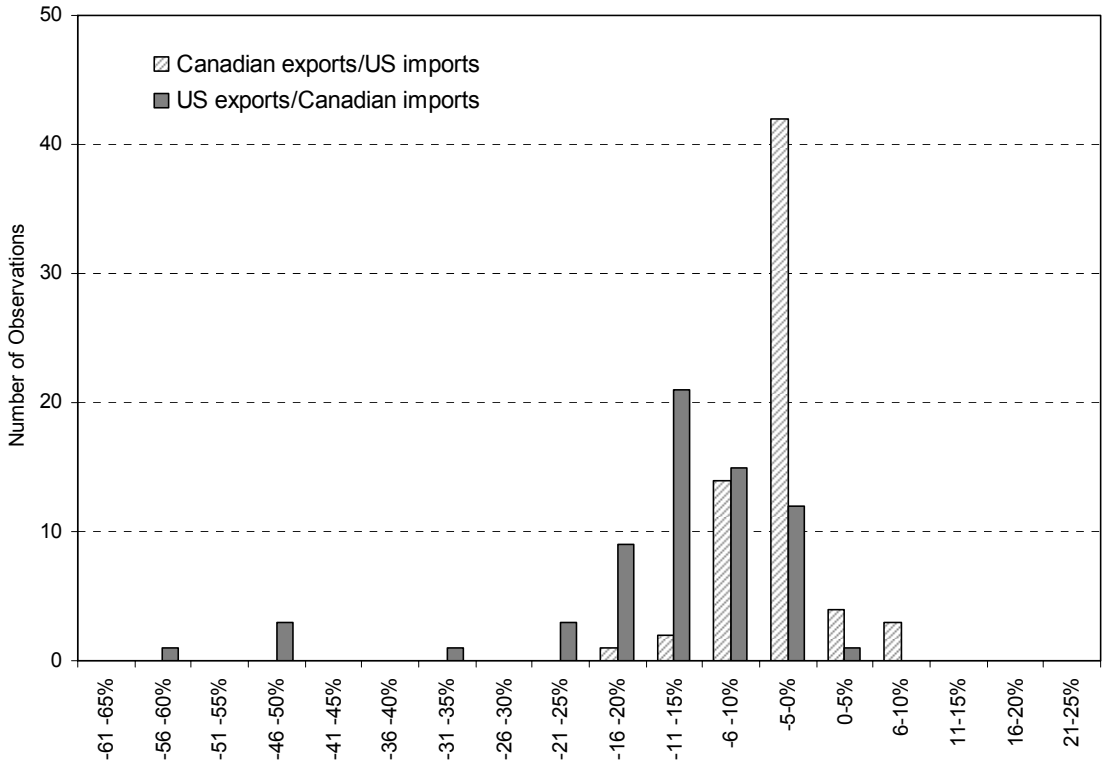


Figure 3.1 Frequency of trade statistics discrepancy ratios for Canadian exports to the US and US imports from Canada.

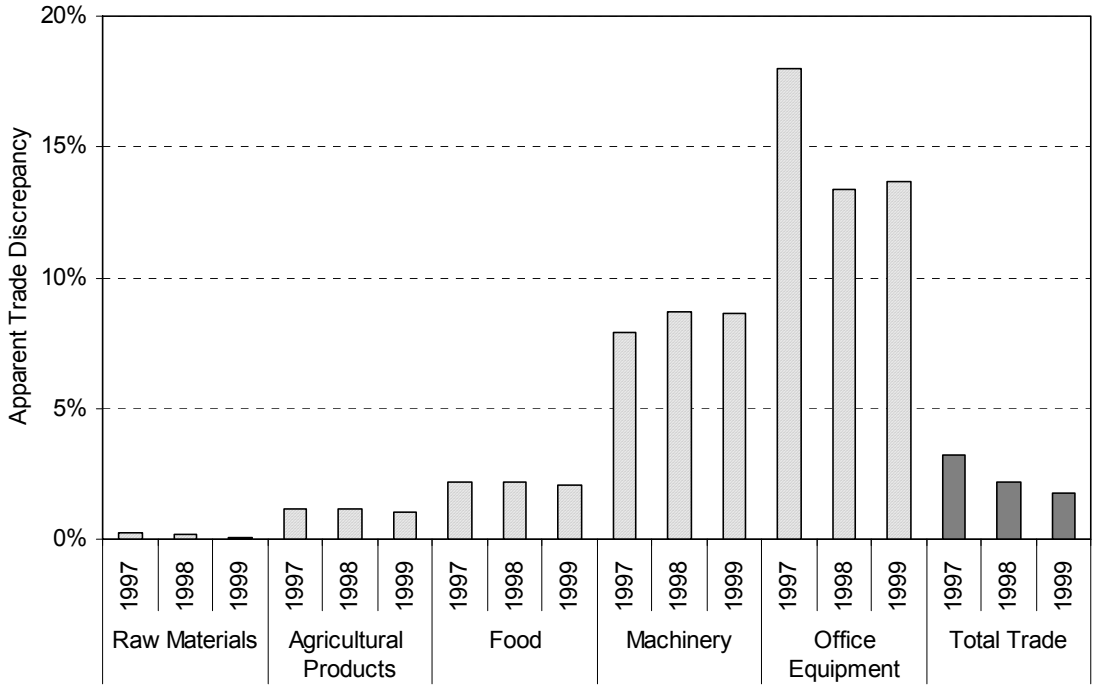


Figure 3.2 Range of trade statistics discrepancy ratios between the US and Canada across different product categories.

B. Mexico US Trade Flows

In a similar vein we constructed frequency charts for the Mexican-US trade flows. Figure 3.3 presents the frequency distribution of the bi-lateral trade statistics discrepancy ratios for (1) reported Mexican imports from the US relative to the reported US exports to Mexico and (2) reported US imports from Mexico relative to the reported Mexican exports to the US for the 22 product categories in 1997, 1998, and 1999. A statistical analysis of the US-Mexico trade data shows that the mean bi-lateral trade statistics discrepancy ratio for US imports of Mexican products was -0.163 while the mean bi-lateral trade statistics discrepancy ratio for Mexican imports of US products was 0.170. A statistical analysis of the two distributions of trade statistics discrepancy ratios found that they were significantly different.

Figure 3.3 shows the frequency distribution of the trade statistics discrepancy ratios for Mexican imports from the US and US imports from Mexico. Figure 3.3 shows that over 90% of the bi-lateral trade statistics discrepancy ratios for the reported US exports to Mexico were substantially higher than the Mexican reported imports from the US. The majority of the trade statistics discrepancy ratios for the US exports to Mexico fell within the 0.11 to 0.25 range. In contrast, the trade statistics discrepancy ratios for the reported US imports from Mexico relative to reported Mexican exports to the US were substantially smaller, with the majority of the trade statistics discrepancy ratios falling within the 0 to -0.15 range. Figure 3.4 illustrates that the total trade statistics discrepancy ratios between Mexico and the US is substantially larger than the corresponding total trade statistics discrepancy ratios between the US and Canada.

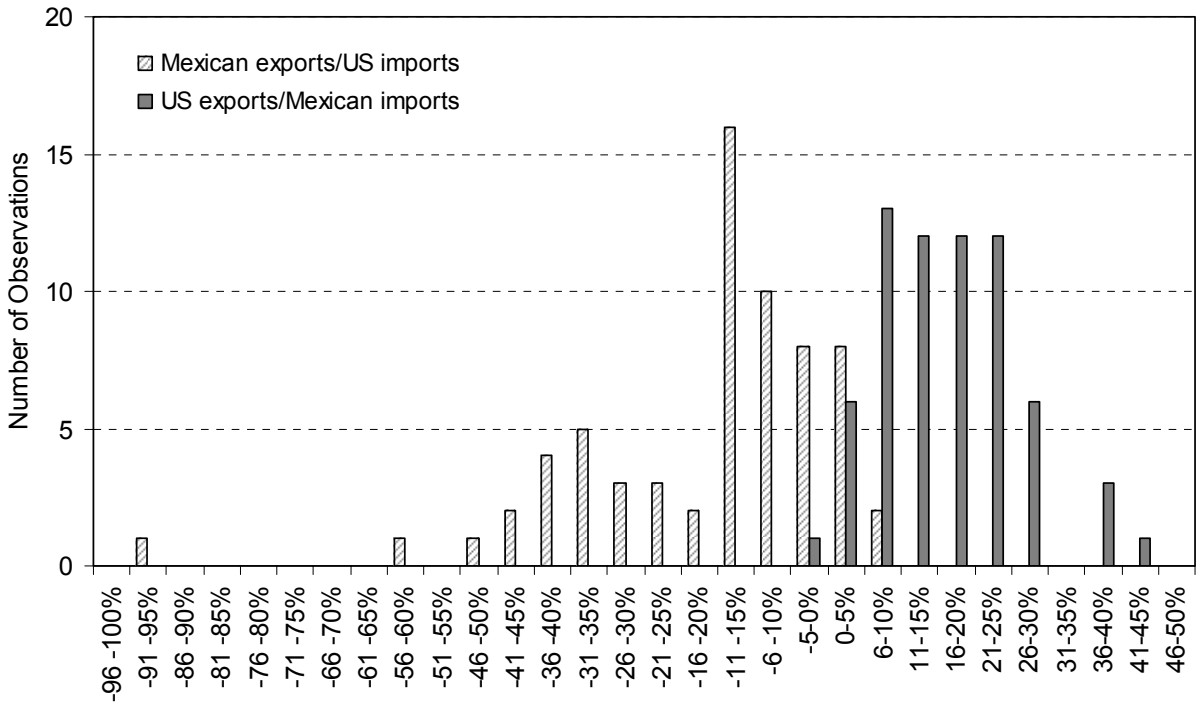


Figure 3.3 Frequency of trade statistics discrepancy ratios for Mexican exports to the US and US imports from Mexico.

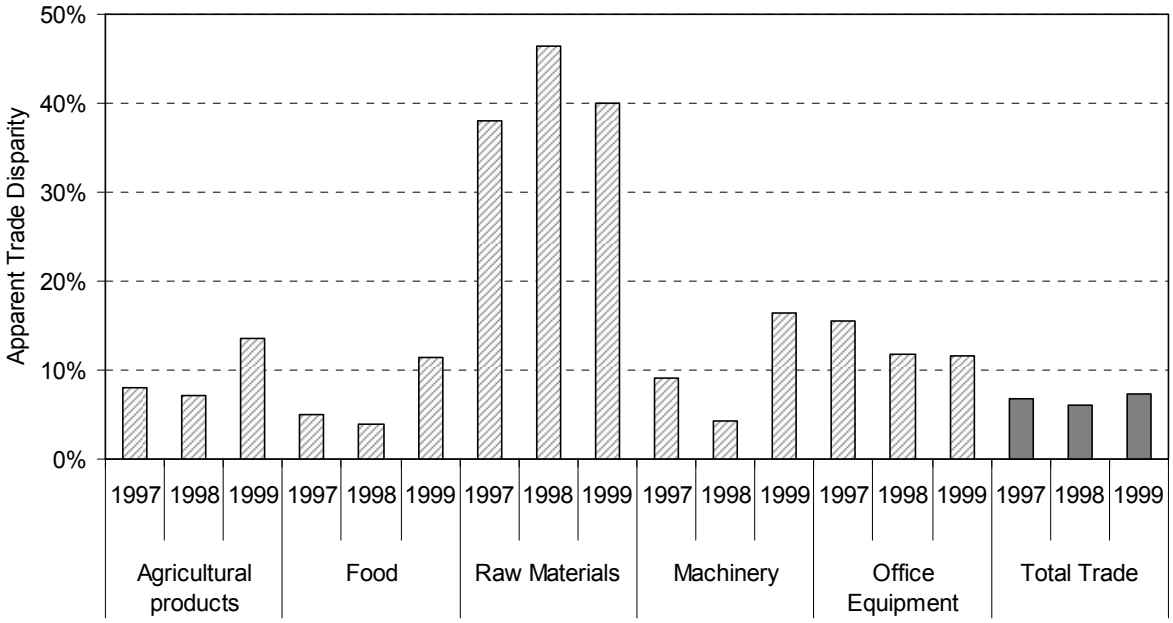


Figure 3.4 Range of trade statistics discrepancy ratios between the US and Mexico across different product categories.

C. Freight

Freight costs are an important component in the transfer of merchandise and their subsequent valuation. Freight cost as a component of import value varies by commodity and country. During the early 1980's, freight costs as a percentage of import value ranged from 5.7% to 6.7% globally (UNCTD Review of Maritime Transport 1986). The difference between developed market economies and developing economies ranged from 4.7% to 10.7%, respectively. Within the forest products sector, freight charges have been estimated to range from 7% to 20% or higher (Doan 1983; Durst et al. 1986).

Many other factors can be attributed to the differences in the trade statistics as well. Consider the diagram below where we describe the elements in a dry bulk transport system, Table 3.1. FOB (and CIF) may mean different points in the transport system described below, but usually imply exporters accept charges up to the point of ocean transport or just prior to loading. There are many charges, duties and other costs that also need consideration and can range up to 10% of total freight charges during the transport stage. In addition, these costs vary substantially between countries. FOB and CIF are not symmetric as well and the rates for exports from one country are often not the same as rates for imports for that country.

Table 3.1 An example of a dry bulk transport system outlining the stages from exporter to importer.

Ownership	Transport Stage	Location
Exporter	Producer	Forest
	Into Storage	
	Storage	Landing/Log Yard
	Out of Storage	
	Land Transport	Log Truck
	Into Storage	
	Storage	Log Yard at Port
	Out of Storage	
	Cargo Handling	Crane Loader
Ocean Transport		
	Discharge	Crane loader
	Into Storage	
	Storage	Log Yard at Port
	Out of Storage	
	Land Transport	Log Truck
	Into Storage	
	Storage	Log Yard at Mill
	Out of Storage	
Importer	Processing	Mill

4.0 DISCREPANCIES IN TRADE STATISTICS WITHIN THE FOREST PRODUCTS SECTOR

In order to evaluate the extent to which trade statistics discrepancies occur within the forest products sector, trade matrices based on the value of trade for the major exporters and importers of logs, lumber, and plywood were prepared, Tables 4.1-4.3. The design of the trade matrices was carefully developed to ensure that the countries included in the matrices would capture at least two-thirds of the global trade in each product category. The product categories included in the analysis were logs (HTS code 4403), lumber (HTS code 4407), and plywood (HTS code 4412). We opted to utilize HTS codes at the four digit level because of the incompatibility of HTS codes between some countries at the more specific level. In addition, utilizing four digit HTS codes allowed us to evaluate trade discrepancies across a range of countries irrespective of whether their trade was based predominantly on hardwood or softwood products. The product descriptions for each of the HTS product codes are summarized below:

HTS Code	HTS Product Description
4403	WOOD IN THE ROUGH, WHETHER OR NOT STRIPPED OF BARK OR SAPWOOD, OR ROUGHLY SQUARED:
4407	WOOD SAWN OR CHIPPED LENGTHWISE, SLICED OR PEELED, WHETHER OR NOT PLANED, SANDED OR END-JOINTED, OF A THICKNESS EXCEEDING 6 MM (.236 IN.) (LUMBER):
4412	PLYWOOD, VENEERED PANELS AND SIMILAR LAMINATED WOOD: PLYWOOD CONSISTING SOLELY OF SHEETS OF WOOD, EACH PLY NOT EXCEEDING 6 MM IN THICKNESS:

The trade data for each country was obtained from the World Trade Atlas, an on-line searchable trade database. The statistics included in the World Trade Atlas are derived from the official statistics compiled and published by each country. A list of the original data source for each country is provided in Appendix A.

Tables 4.1-4.3 provide the value of trade between the specified countries during 2001. Each table has been designed to show both the value of imports from country A, as reported by the importing country B, as well as the corresponding value of products that were exported to country B as reported by the exporting country A. For example, consider the US-Japan cell of the log trade matrix presented in Table 4.1. The top number in the cell (all of the exporter numbers in Tables 4.1-4.3 are highlighted by italics) shows that the US reported exporting $US 535,460,652 worth of logs to Japan in 2001. In contrast, the lower number in this cell indicates that Japan reported importing $US 734,829,724 worth of logs from the US in 2001. Similarly, the trade values for lumber and plywood are presented in Tables 4.2 and 4.3, respectively.

The trade values provided in Tables 4.1-4.3 were then used to calculate the trade statistics discrepancy ratios between the value of product that a country reported importing from the exporting country and what the partner country reported exporting to the importing country. Trade statistics discrepancies were calculated using the following formula:

$$\frac{\text{Reported Imports}_{AB} - \text{Reported Exports}_{BA}}{\text{Reported Imports}_{AB}} \qquad \textbf{(Equation 1)}$$

where:

Imports_{AB} refers to the reported imports by country A from country B

Exports_{BA} refers to the reported exports from country B to country A

Again using the US-Japan log trade values as an example, the trade statistics discrepancy in the value of logs traded between the US and Japan would be calculated as:

$$\frac{\$US\ 734,829,724 - \$US\ 535,460,652}{\$US\ 734,829,724} = 0.271$$

In other words, the trade statistics discrepancy between the value of logs that Japan reported importing from the US and the value of logs that the US reported exporting to Japan was 27.1% of Japan's reported imports. It is important to keep in mind that the trade statistics discrepancy ratios were calculated based on the value of reported imports rather than the value of reported exports. The trade statistics discrepancy ratios for logs, lumber, and plywood are presented in Tables 4.4-4.6.

A review of Tables 4.4-4.6 reveals that many of the cells in the three trade statistics discrepancy ratio matrices contain zeroes. While in some cases these zeroes indicate that there was no trade between the two countries, they also represent those situations where one trade partner reported a minor amount of trade (generally less than $US 1million) while the other partner reported no trade. Bi-lateral trade flows of less than $US 1million in 2001 are reported in the grey shaded cells in Tables 4.4-4.6 because the differences in the reported trade values, while small in an absolute sense, often resulted in disproportionately large trade statistics discrepancy ratios which skewed the analysis to a considerable degree. For example, the difference in the reported trade of logs between the US (reported export of $488,896) and the Philippines (reported imports of $22,540) resulted in a trade statistics discrepancy ratio of -20.69 while the difference in the reported trade of plywood between the US (reported exports of $320,197) and Indonesia (reported imports of $51) resulted in a trade statistics discrepancy ratio of -6277.37. The bi-lateral trade statistics discrepancy ratios located in the grey shaded cells were removed from the subsequent statistical analyses of the trade statistics discrepancy ratios. For each of the three product categories considered, the value of removed trade represented by the grey shaded cells totaled less than one-tenth of one percent of the global trade for that product category in 2001.

Finally, as mentioned earlier the bi-lateral trade statistics discrepancy ratios were based on the reported value of imports (Equation 1). The decision to use this methodology was influenced by the review of the relevant literature where numerous studies made reference to the fact that import statistics are generally more reliable than are the corresponding export statistics (Bhagwati 1981; Federico and Tena 1991, Makhoul and Otterstrom 1998; Yeats 1978; Yeats 1992). One consequence of adopting this convention is that it is possible to obtain negative bi-lateral trade statistics discrepancy ratios in those cases where the reported value of exports exceeds the reported value of imports. These negative bi-lateral trade statistics discrepancy ratios, which are reported in Tables 4.4-4.9, were used in all of the statistical analyses of the trade statistics discrepancy ratios. However, to simplify the visual presentation of the trade statistics discrepancy ratios, we used the absolute values of the bi-lateral trade statistics discrepancy ratios in the scatter diagrams presented in Figures 4.4-4.5.

4.1 BI-LATERAL TRADE FLOWS FOR LOGS, LUMBER AND PLYWOOD

The value of the bi-lateral trade flows are reported in Tables 4.1-4.3. As mentioned earlier, these trade values were obtained from the World Trade Atlas and are based on import and export statistics as reported by the relevant government agency in each country (Appendix A). When viewing the data in the tables, note that the value of trade as reported by the exporting country is presented in italics while the value of trade as reported by the importing country is typed in a normal font. For example, Canadian reported exports to the US ($215,183,143) are presented in italics while US reported imports from Canada ($209,581,713) are not italicized. In addition, all of the trade values presented in Tables 4.1-4.3 have been expressed in US dollars.

While the trade data provides few surprises in the sense that the major trade patterns are clearly defined by the data, we can begin to see the magnitude of some of the discrepancies in the bi-lateral trade flow data. We can also begin to notice patterns to some of the trade discrepancies. Note that it will be useful to refer back to these trade value tables as we begin to discuss the trade statistics discrepancy ratios in the following section.

Table 4.1 A comparison of the value of logs traded, as reported by the exporting nation and the importing nation, 2001 (in $US).

Importing Nation		*Exporting Nation*										
Importing Nation	Reporting Nation	*US*	*Canada*	*Finland*	*Sweden*	*Germany*	*Austria*	*Chile*	*Ghana*	*Malaysia*	*Indonesia*	*Russia*
US	Exporter	--	$215,183,143	$3,633	$893	$110,947	$0	$463,551	$0	$0	$37,844	$19,799
	Importer	--	$209,581,713	$1,218,251	$202,705	$988,930	$435,913	$889,114	$38,290	$442,492	$208,893	$448,598
Japan	Exporter	$535,460,652	$109,846,125	$21,488	$5,459	$5,086,278	$0	$10,483,732	$0	$126,190,326	$11,346,686	$557,770,750
	Importer	$734,829,724	$186,533,472	$1,979	$0	$9,602,777	$9,171	$10,044,791	$0	$191,745,650	$26,296,902	$467,439,076
S. Korea	Exporter	$63,253,152	$3,382,136	$33,722	$0	$969,272	$0	$1,439,423	$0	$17,099,175	$6,130,198	$94,306,331
	Importer	$75,692,489	$7,174,414	$0	$0	$561,483	$0	$1,021,239	$0	$25,713,304	$8,385,271	$98,096,221
United Kingdom	Exporter	$8,474,280	$238,461	$3,009,087	$2,545,203	$686,670	$0	$0	$0	$0	$47,921	$136,961
	Importer	$12,365,334	$1,429,047	$7,735,954	$16,457,967	$1,525,637	$0	$24,338	$405,943	$455,507	$64,905	$7,879,682
Germany	Exporter	$42,021,933	$783,628	$3,762,268	$1,323,246	--	$6,366,447	$391,134	$0	$0	$10,619	$31,640,929
	Importer	$43,755,592	$3,351,299	$2,659,934	$10,563,068	--	$11,410,041	$295,340	$908	$89,111	$4,426	$46,758,193
France	Exporter	$6,819,529	$1,252,937	$720,708	$95,295	$8,673,382	$2,704,447	$17,850	$0	$0	$0	$205,621
	Importer	$9,342,799	$1,856,885	$2,156,510	$1,095,616	$26,599,467	$1,977,501	$862	$122,748	$0	$0	$424,888
Italy	Exporter	$28,868,914	$1,027,825	$1,823	$1,314,366	$29,715,885	$55,848,792	$36,213	$0	$0	$2,760	$1,411,665
	Importer	$33,457,010	$1,153,547	$2,159,768	$429,539	$42,217,730	$55,405,089	$54,457	$228,986	$482,677	$237,633	$2,519,909
Spain	Exporter	$14,505,202	$475,050	$112,908	$207,485	$2,518,336	$938	$10,017,784	$0	$0	$6,987	$670,386
	Importer	$12,524,025	$642,086	$992,383	$4,924,730	$7,362,194	$189,693	$15,655,979	$445,360	$0	$0	$1,320,444
Malaysia	Exporter	$5,719,688	$348,598	$0	$0	$289,650	$0	$0	$0	--	$3,143,997	$4,873
	Importer	$4,509,079	$701,037	$0	$0	$0	$0	$0	$123,493	--	$41,641,676	$0
Indonesia	Exporter	$17,668,072	$132,277	$0	$0	$1,114,972	$0	$0	$0	$5,237,788	--	$0
	Importer	$27,322,482	$7,050	$5,282	$0	$0	$0	$0	$0	$648,676	--	$0
Philippines	Exporter	$488,896	$0	$0	$0	$0	$0	$0	$0	$2,055,033	$390,711	$0
	Importer	$22,540	$0	$0	$0	$0	$0	$0	$0	$5,973,298	$4,964,828	$0
Thailand	Exporter	$3,286,200	$0	$0	$97,326	$75,993	$0	$0	$0	$2,639,413	$2,448,841	$0
	Importer	$822,962	$0	$0	$0	$124,341	$0	$0	$0	$10,634,890	$13,091,001	$0
Taiwan	Exporter	$17,342,612	$3,962,913	$13,808	$0	$861,652	$31,016	$70,942	$0	$50,345,091	$158,622	$0
	Importer	$20,052,854	$6,444,482	$15,204	$30,961	$1,639,195	$20,249	$111,257	$9,443	$66,577,793	$524,081	$12,286
China	Exporter	$43,180,929	$1,188,055	$92,560	$0	$95,198,252	$4,528,025	$43,192	$0	$81,059,065	$21,514,398	$541,642,703
	Importer	$24,309,297	$3,356,494	$56,400	$25,724	$113,557,228	$1,286,552	$4,694	$0	$152,653,245	$170,981,909	$551,826,115

Table 4.2 A comparison of the value of lumber traded, as reported by the exporting nation and the importing nation, 2001 (in $US).

Importing Nation		*Exporting Nation*										
Importing Nation	Reporting Nation	*US*	*Canada*	*Finland*	*Sweden*	*Germany*	*Austria*	*Chile*	*Ghana*	*Malaysia*	*Indonesia*	*Russia*
US	Exporter	--	$6,158,580,947	$17,978,954	$64,745,546	$82,023,322	$47,118,523	$131,641,170	$7,507,785	$7,984,994	$3,781,938	$5,078,444
	Importer	--	$5,891,984,946	$12,238,106	$80,221,210	$72,203,953	$51,408,236	$133,059,917	$8,506,168	$22,636,324	$9,486,272	$8,084,503
Japan	Exporter	$189,279,608	$912,893,968	$164,403,950	$156,696,381	$12,533,418	$119,637,009	$55,698,141	$563,333	$82,621,058	$22,076,846	$132,758,522
	Importer	$207,330,825	$1,087,164,572	$199,484,279	$159,553,947	$16,959,394	$133,049,847	$80,636,352	$649,552	$149,720,777	$156,934,098	$121,094,889
S. Korea	Exporter	$23,398,181	$8,855,212	$1,031,616	$951,021	$760,280	$133,430	$5,232,627	$0	$24,699,554	$5,858,188	$4,006,238
	Importer	$34,402,887	$17,751,794	$1,546,956	$424,579	$769,428	$267,858	$9,094,969	$0	$38,177,143	$66,248,598	$4,674,569
UK	Exporter	$94,232,012	$63,617,166	$241,810,970	$441,390,159	$27,593,937	$1,960,250	$2,906,829	$5,581,339	$24,047,521	$1,248,766	$62,478,236
	Importer	$102,626,512	$78,853,969	$210,511,684	$370,014,326	$32,095,673	$2,812,687	$3,800,706	$8,975,625	$28,119,234	$5,083,867	$74,752,483
Germany	Exporter	$38,434,224	$44,630,507	$122,663,799	$167,690,435	--	$100,205,555	$809,672	$12,367,956	$11,247,343	$563,191	$46,950,956
	Importer	$37,014,597	$47,295,832	$107,254,035	$103,416,817	--	$55,130,562	$205,965	$19,821,892	$12,570,134	$3,583,791	$65,820,146
France	Exporter	$22,201,587	$20,417,196	$125,489,997	$71,748,356	$93,808,998	$3,740,504	$94,720	$7,780,876	$5,150,859	$169,509	$39,008,157
	Importer	$27,039,622	$24,983,554	$124,910,608	$61,512,790	$87,179,612	$1,328,922	$61,790	$13,171,910	$16,813,012	$3,984,975	$49,411,899
Italy	Exporter	$98,023,474	$39,101,607	$45,236,183	$51,999,894	$75,002,602	$555,606,706	$3,097,279	$7,493,615	$15,492,306	$2,077,853	$40,062,700
	Importer	$115,687,854	$39,204,094	$49,165,636	$53,342,248	$106,064,811	$466,738,182	$3,114,549	$13,074,300	$18,493,866	$14,110,394	$50,806,192
Spain	Exporter	$130,386,406	$13,255,477	$32,151,137	$85,078,769	$29,524,635	$1,859,964	$9,686,464	$1,764,629	$134,757	$22,554	$15,315,709
	Importer	$171,041,396	$15,569,163	$31,612,046	$68,231,727	$25,235,190	$2,043,531	$12,057,908	$2,399,044	$261,486	$723,564	$23,612,544
Malaysia	Exporter	$13,225,337	$1,545,297	$1,335,191	$1,808,015	$602,672	$147,758	$18,779	$203,437	--	$1,503,290	$0
	Importer	$13,910,418	$4,688,239	$1,412,415	$706,233	$3,108,975	$3,340,489	$24,514	$9,689	--	$46,637,015	$0
Indonesia	Exporter	$16,349,307	$380,761	$15,224	$601,776	$2,221,736	$50,148	$0	$173,352	$263,562	--	$0
	Importer	$16,783,650	$247,099	$0	$0	$2,983,935	$29,996	$0	$214,522	$394,042	--	$53,575
Philippines	Exporter	$17,255,707	$8,724,416	$0	$0	$119,997	$6,268	$0	$0	$25,324,264	$3,362	$0
	Importer	$28,653,679	$10,727,143	$0	$0	$102,324	$0	$0	$0	$23,383,195	$446,261	$0
Thailand	Exporter	$18,474,963	$2,760,056	$454,019	$454,019	$459,392	$471,033	$625,509	$0	$85,358,065	$628,245	$14,950
	Importer	$25,701,328	$2,969,579	$639,303	$664,603	$740,322	$361,544	$945,821	$61,137	$119,441,517	$2,004,907	$55,970
Taiwan	Exporter	$33,162,962	$24,278,448	$3,307,977	$1,662,048	$1,491,903	$1,608,318	$4,995,378	$1,742,515	$28,675,072	$3,621,835	$2,880
	Importer	$33,494,538	$30,527,872	$1,419,888	$1,039,513	$1,555,618	$2,889,444	$6,096,794	$1,812,207	$37,259,353	$25,329,776	$53,127
China	Exporter	$73,652,820	$16,238,485	$4,329,743	$2,745,603	$42,144,021	$7,406,680	$5,674,846	$665,878	$39,429,032	$28,375,565	$29,443,195
	Importer	$107,550,172	$39,028,837	$7,770,946	$4,380,017	$52,325,759	$9,513,619	$6,062,017	$879,458	$97,206,409	$317,323,073	$42,858,476

Table 4.3 A comparison of the value of plywood traded, as reported by the exporting nation and the importing nation, 2001 (in $US).

Importing Nation		*Exporting Nation*										
Importing Nation	Reporting Nation	*US*	*Canada*	*Finland*	*Sweden*	*Germany*	*Austria*	*Chile*	*Ghana*	*Malaysia*	*Indonesia*	*Russia*
US	Exporter	--	$326,793,138	$22,238,057	$2,921,943	$2,989,309	$223,804	$23,967,166	$4,995,818	$98,456,900	$191,980,007	$70,995,150
	Importer	--	$315,466,309	$22,852,224	$3,432,192	$4,312,781	$1,343,941	$22,432,486	$4,160,626	$95,193,597	$194,234,376	$101,093,437
Japan	Exporter	$5,459,941	$39,704,449	$3,172,929	$649,406	$111,234	$355,856	$1,622,480	$0	$501,840,594	$753,009,765	$0
	Importer	$8,063,133	$45,461,292	$4,581,369	$1,308,098	$757,733	$1,162,254	$2,386,408	$0	$583,877,528	$906,593,096	$4,914,394
S. Korea	Exporter	$829,555	$46,190	$7,820,454	$0	$530,133	$0	$2,417	$0	$90,309,825	$114,999,837	$10
	Importer	$1,669,670	$816,973	$6,750,905	$246,028	$2,885,024	$28,360	$65	$0	$97,405,399	$136,717,493	$160,767
United Kingdom	Exporter	$2,735,352	$6,641,706	$44,486,401	$4,025,908	$8,047,739	$135,967	$6,270,343	$229,656	$25,054,869	$83,948,982	$17,101,156
	Importer	$7,017,058	$13,811,837	$52,223,014	$4,918,966	$32,430,842	$115,846	$6,112,119	$772,477	$34,602,207	$98,862,182	$16,066,064
Germany	Exporter	$949,913	$916,925	$109,537,710	$2,167,464	--	$48,089,382	$570,188	$184,079	$3,869,540	$32,764,234	$9,630,707
	Importer	$397,928	$646,510	$113,483,535	$1,342,725	--	$19,066,845	$581,638	$211,707	$3,308,431	$43,286,963	$21,190,397
France	Exporter	$321,093	$92,573	$38,655,863	$100,549	$8,133,382	$8,267,204	$0	$625,894	$743,433	$10,887,979	$1,844,064
	Importer	$3,674,003	$176,162	$30,266,382	$108,874	$18,534,917	$5,670,084	$0	$1,756,717	$3,293,943	$21,777,364	$2,665,463
Italy	Exporter	$214,135	$536,280	$29,503,359	$63,413	$8,218,870	$27,549,546	$2,025,688	$1,265,377	$2,036,112	$7,010,832	$12,433,384
	Importer	$238,056	$898,238	$28,671,995	$36,639	$6,556,756	$16,688,780	$1,881,380	$1,437,451	$682,078	$8,300,942	$28,783,230
Spain	Exporter	$955,347	$0	$23,586,285	$48,968	$2,346,431	$1,607,049	$69,366	$133,300	$8,418	$49,600	$1,799,296
	Importer	$270,263	$0	$37,547,995	$128,043	$3,887,443	$3,429,107	$166,911	$141,904	$0	$0	$3,085,091
Malaysia	Exporter	$9,408	$0	$2,214,006	$10,338	$6,031	$0	$0	$0	--	$5,820,359	$1
	Importer	$44,864	$4,339	$2,208,004	$0	$322,116	$0	$0	$0	--	$5,104,721	$0
Indonesia	Exporter	$320,197	$0	$0	$0	$0	$0	$0	$0	$42,920	--	$0
	Importer	$51	$0	$0	$5	$51,392	$0	$0	$0	$166,618	--	$0
Philippines	Exporter	$57,957	$7,147	$0	$9,083	$43,092	$0	$0	$0	$4,136,316	$1,029,408	$0
	Importer	$79,359	$0	$0	$0	$29,532	$0	$0	$0	$1,116,172	$596,714	$0
Thailand	Exporter	$29,819	$0	$28,469	$0	$0	$0	$0	$0	$6,219,275	$2,363,766	$0
	Importer	$74,241	$17,012	$21,892	$592	$53,779	$90	$0	$0	$6,448,167	$2,690,239	$100,651
Taiwan	Exporter	$366,315	$38,067	$231,531	$0	$13,077	$51,068	$340,147	$0	$41,635,744	$71,700,117	$0
	Importer	$208,923	$22,350	$245,301	$0	$9,620	$25,995	$304,297	$0	$35,977,884	$70,907,380	$281,392
China	Exporter	$878,573	$0	$2,240,830	$0	$84,534	$63,680	$2,975	$0	$24,474,483	$88,120,723	$0
	Importer	$145,829	$414,629	$1,884,595	$215,471	$1,882,613	$24,746	$0	$0	$29,989,944	$170,958,523	$789,193

Table 4.4 Bi-lateral trade statistics discrepancy ratios for reported log exports versus reported log imports, 2001.

Importing Nation	*Exporting Nation*										
	US	*Canada*	*Finland*	*Sweden*	*Germany*	*Austria*	*Chile*	*Ghana*	*Malaysia*	*Indonesia*	*Russia*
US	--	-0.027	0.997	0.996	0.888	0.000	0.479	0.000	0.000	0.819	0.956
Japan	0.271	0.411	-9.858	0.000	0.470	0.000	-0.044	0.000	0.342	0.569	-0.193
S. Korea	0.164	0.529	0.000	0.000	-0.726	0.000	-0.409	0.000	0.335	0.269	0.039
United Kingdom	0.315	0.833	0.611	0.845	0.550	0.000	0.000	0.000	0.000	0.262	0.983
Germany	0.040	0.766	-0.414	0.875	--	0.442	-0.324	0.000	0.000	-1.399	0.323
France	0.270	0.325	0.666	0.913	0.674	-0.368	-19.708	0.000	0.000	0.000	0.516
Italy	0.137	0.109	0.999	-2.060	0.296	-0.008	0.335	0.000	0.000	0.988	0.440
Spain	-0.158	0.260	0.886	0.958	0.658	0.995	0.360	0.000	0.000	0.000	0.492
Malaysia	-0.268	0.503	0.000	0.000	0.000	0.000	0.000	0.000	--	0.924	0.000
Indonesia	0.353	-17.763	1.000	0.000	1.000	0.000	0.000	0.000	-7.075	--	0.000
Philippines	-20.690	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.656	0.921	0.000
Thailand	-2.993	0.000	0.000	0.000	0.389	0.000	0.000	0.000	0.752	0.813	0.000
Taiwan	0.135	0.385	0.092	0.000	0.474	-0.532	0.362	0.000	0.244	0.697	0.000
China	-0.776	0.646	-0.641	0.000	0.162	-2.520	-8.202	0.000	0.469	0.874	0.018

Table 4.5 Bi-lateral trade statistics discrepancy ratios for reported lumber exports versus reported lumber imports, 2001.

	Exporting Nation										
Importing Nation	*US*	*Canada*	*Finland*	*Sweden*	*Germany*	*Austria*	*Chile*	*Ghana*	*Malaysia*	*Indonesia*	*Russia*
US	--	-0.045	-0.469	0.193	-0.136	0.083	0.011	0.117	0.647	0.601	0.372
Japan	0.087	0.160	0.176	0.018	0.261	0.101	0.309	0.133	0.448	0.859	-0.096
S. Korea	0.320	0.501	0.333	-1.240	0.012	0.502	0.425	0.000	0.353	0.912	0.143
United Kingdom	0.082	0.193	-0.149	-0.193	0.140	0.303	0.235	0.378	0.145	0.754	0.164
Germany	-0.038	0.056	-0.144	-0.622	--	-0.818	-2.931	0.376	0.105	0.843	0.287
France	0.179	0.183	-0.005	-0.166	-0.076	-1.815	-0.533	0.409	0.694	0.957	0.211
Italy	0.153	0.003	0.080	0.025	0.293	-0.190	0.006	0.427	0.162	0.853	0.211
Spain	0.238	0.149	-0.017	-0.247	-0.170	0.090	0.197	0.264	0.485	0.969	0.351
Malaysia	0.049	0.670	0.055	-1.560	0.806	0.956	0.234	0.000	--	0.968	0.000
Indonesia	0.026	-0.541	0.000	0.000	0.255	-0.672	0.000	0.192	0.331	--	0.000
Philippines	0.398	0.187	0.000	0.000	-0.173	0.000	0.000	0.000	-0.083	0.992	0.000
Thailand	0.281	0.071	0.290	0.317	0.379	-0.303	0.339	0.000	0.285	0.687	0.733
Taiwan	0.010	0.205	-1.330	-0.599	0.041	0.443	0.181	0.038	0.230	0.857	0.946
China	0.315	0.584	0.443	0.373	0.195	0.221	0.064	0.243	0.594	0.911	0.313

Table 4.6 Bi-lateral trade statistics discrepancy ratios for reported plywood exports versus reported plywood imports, 2001.

Importing Nation	*Exporting Nation*										
	US	*Canada*	*Finland*	*Sweden*	*Germany*	*Austria*	*Chile*	*Ghana*	*Malaysia*	*Indonesia*	*Russia*
US	--	-0.036	0.027	0.149	0.307	0.833	-0.068	-0.201	-0.034	0.012	0.298
Japan	0.323	0.127	0.307	0.504	0.853	0.694	0.320	0.000	0.141	0.169	1.000
S. Korea	0.503	0.943	-0.158	0.000	0.816	0.000	-36.185	0.000	0.073	0.159	0.000
United Kingdom	0.610	0.519	0.148	0.182	0.752	-0.174	-0.026	0.703	0.276	0.151	-0.064
Germany	-1.387	-0.418	0.035	-0.614	--	-1.522	0.020	0.131	-0.170	0.243	0.546
France	0.913	0.475	-0.277	0.076	0.561	-0.458	0.000	0.644	0.774	0.500	0.308
Italy	0.100	0.403	-0.029	-0.731	-0.253	-0.651	-0.077	0.120	-1.985	0.155	0.568
Spain	-2.535	0.000	0.372	0.618	0.396	0.531	0.584	0.061	0.000	0.000	0.417
Malaysia	0.790	0.000	-0.003	0.000	0.981	0.000	0.000	0.000	--	-0.140	0.000
Indonesia	-6277.373	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.742	--	0.000
Philippines	0.270	0.000	0.000	0.000	-0.459	0.000	0.000	0.000	-2.706	-0.725	0.000
Thailand	0.598	0.000	-0.300	0.000	0.000	0.000	0.000	0.000	0.035	0.121	0.000
Taiwan	-0.753	-0.703	0.056	0.000	-0.359	-0.965	-0.118	0.000	-0.157	-0.011	0.000
China	-5.025	0.000	-0.189	0.000	0.955	-1.573	0.000	0.000	0.184	0.485	0.000

4.2 DISCREPANCIES IN THE TRADE STATISTICS FOR LOGS, LUMBER AND PLYWOOD

Discrepancies in the Trade Statistics for Logs

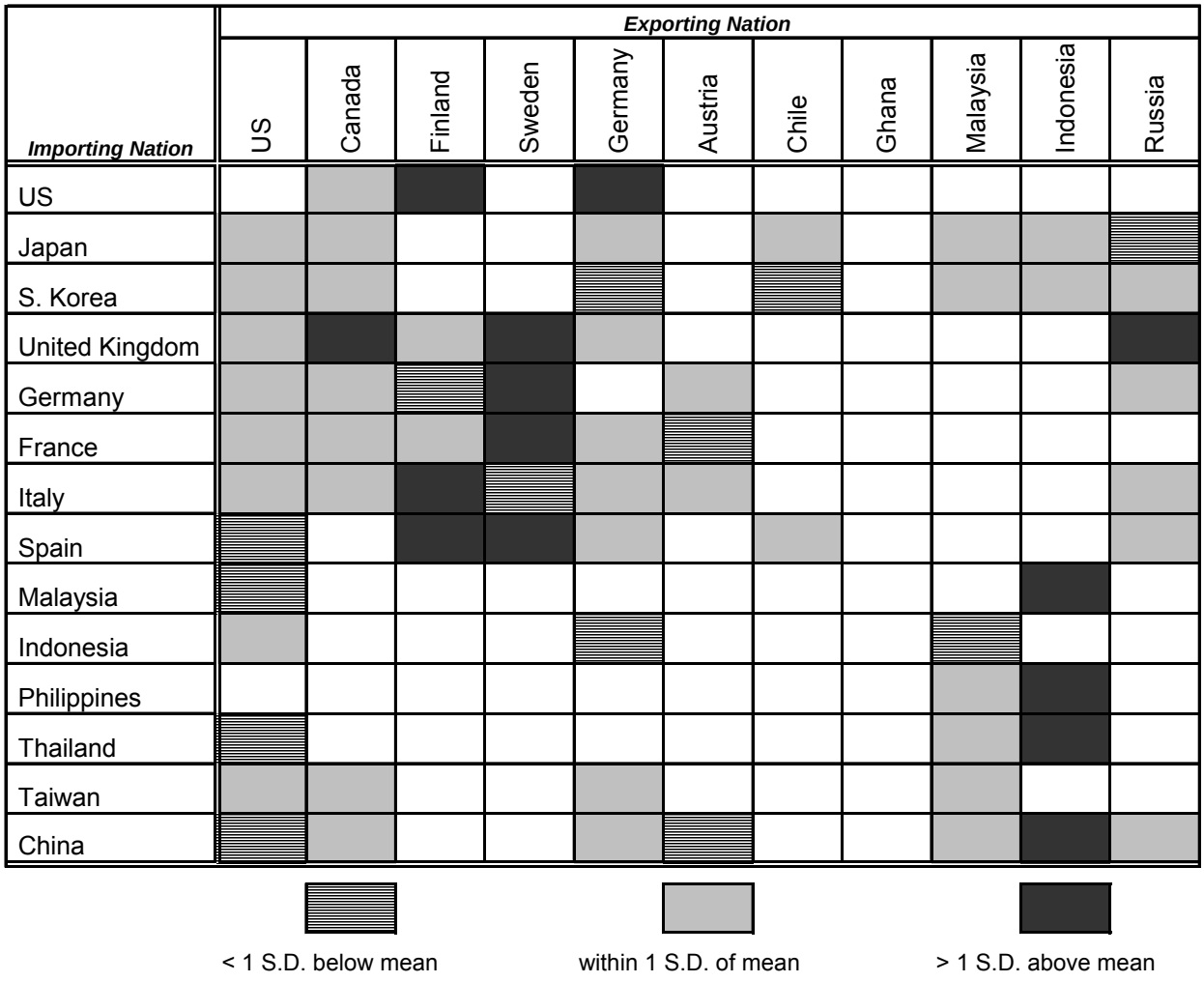
Global imports of logs in 2001 totaled $US 10,421,770,000 while global exports totaled $US 8,121,646,000, representing an apparent global trade statistics discrepancy ratio of 0.221 (FAO 2002). The 2001 trade data shows that the export of logs is dominated by a relatively small number of countries who account for over 60% of global log exports. The largest log exporters are Russia (20.9% of global log exports) and the US (15.5%). Other important log exporting countries include Malaysia (8.5%), Indonesia (4.6%), New Zealand (3.9%), Germany (3.8%), and Canada (3.7%). All of these countries, with the exception of New Zealand, were included in the log trade statistics discrepancy analysis.

The bi-lateral trade statistics discrepancy matrices for logs are presented in Tables 4.4 and 4.7 while the discrepancy ratio distributions for each product are presented in Figures 4.1, 4.4 and 4.5. Although the entire range of bi-lateral trade statistics discrepancy ratios are presented in Table 4.4, the grey shaded cells that represent trade flows below $US 1million were subsequently excluded from the statistical data analysis. Color coded trade statistics discrepancies are presented in Table 4.7 to provide a more visual representation of the intensity of the bi-lateral trade statistics discrepancies between specific trading partners.

The trade statistics discrepancy data for logs ranged from -20.69 to 0.999, Tables 4.4 and 4.7. However, 61.2% of the viable observations represent trade statistics discrepancies that exceed ± 0.40, while 43.3% of the trade discrepancies exceed ± 0.60, Figures 4.1 and 4.4-4.5. A statistical analysis of the distribution of bi-lateral trade statistics discrepancy ratios showed that the kurtosis value for the distribution of log trade statistics discrepancy ratios was 0.1108, indicating that this distribution clusters slightly more than a normal distribution and has a slightly longer tail. The skewness statistic for the log trade statistics discrepancy distribution was -0.6132 suggesting that the distribution has a slightly longer left tail and, since the skewness statistic was more than twice as large as the standard error (SE=0.3875), the distribution of log trade statistics discrepancy ratios is not a normal distribution. Finally, the mean of the log trade statistics discrepancy distribution was 0.387 with a standard deviation of 0.425, indicating that 68% of the log statistics discrepancy ratios fall within the range of -0.037 and 0.812. This analysis clearly shows that not all of the countries considered have the same magnitude or range of trade statistics discrepancies with respect to their trade of logs.

The color coded discrepancy data displayed in Table 4.7 demonstrates that the bi-lateral trade statistics discrepancies occur both within trade between developed countries (i.e., Finland, Sweden, and Germany) as well as within trade between less-developed countries (i.e., Indonesia and Malaysia). In particular, Canada, Finland, Sweden, and Germany have large trade statistics discrepancies with several of their trading partners as do Malaysia and Indonesia. It is useful to note that the unusually large individual bi-lateral trade statistics discrepancy ratios observed for the US/Thailand (-2.993), Sweden/Italy (-2.060), and Austria/China (-2.520) are unique cases that represent relatively small trade values. The bi-lateral trade statistics discrepancy ratios are graphically displayed in Figure 4.1 and further supports the earlier observation that there appears to large and consistent trade statistics discrepancies within the global log trade. This observation is further supported by the frequency diagram of bi-lateral trade statistics discrepancies, Figure 4.4. The frequency diagram for logs shows that 79% of the trade discrepancy ratios are positive and greater than zero indicating that discrepancies in the log trade statistics are not unusual. The frequency diagram is heavily skewed by the large number of bi-lateral trade statistics discrepancy ratios (almost 35%) that exceed 0.6. In addition, an additional 10% of the observations exceed -0.6.

Table 4.7 Range of trade statistics discrepancy ratios for logs.



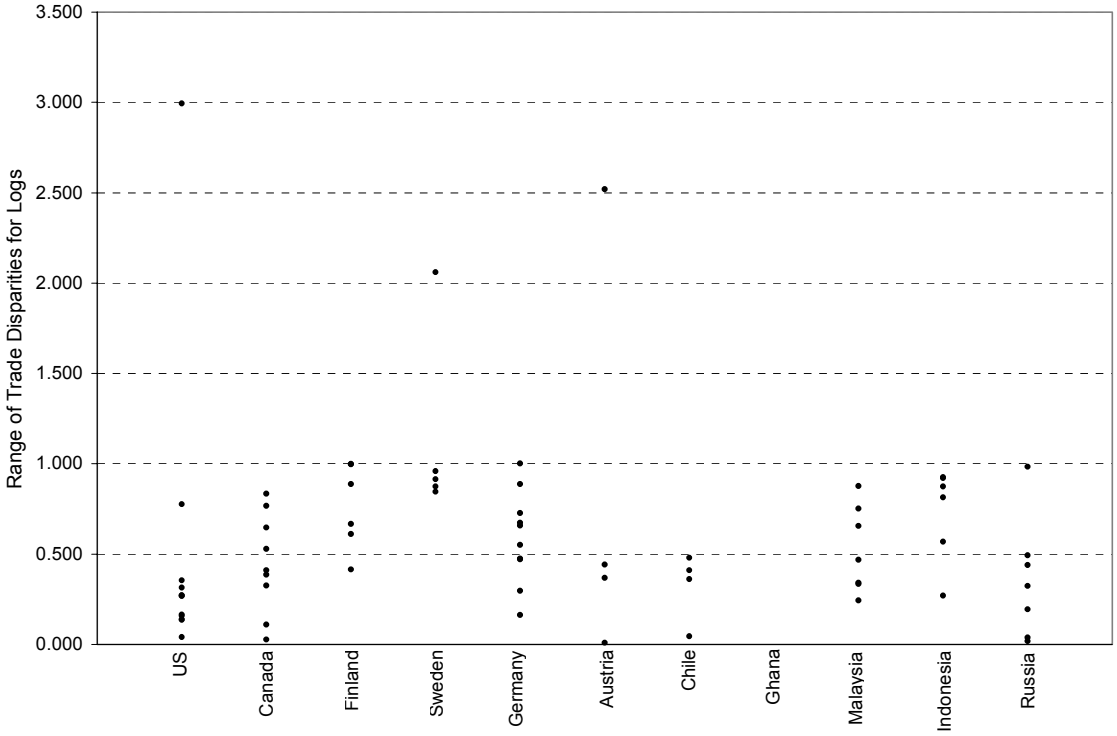


Figure 4.1 Scatter diagram of bi-lateral trade statistics discrepancy ratios for logs (absolute values).

Discrepancies in the Trade Statistics for Lumber

Global imports of lumber totaled $US 23,988,254,000 while global exports totaled $US 21,496,708,000, representing an apparent global trade statistics discrepancy ratio of 0.104 (FAO 2002). While over two-thirds of lumber exports are provided by just seven countries, the global trade of lumber is dominated by Canada which generated 34.9% of global exports in 2001. Other important lumber exporting countries include Sweden (8.6%), the US (8.2%), Finland (5.9%), Russia (3.4%), Germany (3.4%), and Indonesia (2.8%). All of these countries are included in the lumber trade statistics discrepancy analysis.

The trade statistics discrepancy ratios for lumber are presented in Tables 4.5 and 4.8 as well as in Figures 4.2 and 4.4-4.5. In contrast to logs, where just 9% of the trade statistics discrepancy ratios between trading partners were within ±0.2, 49.1% of the lumber trade statistics discrepancy ratios were within this range, Figures 4.4 and 4.5. The trade statistics discrepancy ratios for lumber ranged from -1.815 to 0.968, Tables 4.5 and 4.8. A statistical analysis of the distribution of bi-lateral trade statistics discrepancy ratios found that the kurtosis value for the distribution of lumber trade statistics discrepancies was 0.9268, indicating that this distribution clustered more than a normal distribution and has a longer tail. The skewness statistic for the lumber trade statistics discrepancy distribution was 0.082 suggesting that the distribution has a slightly longer right tail and, since the skewness statistic was more than twice as large as the standard error (SE=0.0315), the distribution of lumber trade statistics discrepancy ratios is not a normal distribution. Finally, the mean of the lumber discrepancy distribution was 0.226 with a standard deviation of 0.332, indicating that 68% of the lumber discrepancy values fall within the range of -0.106 and 0.558. This analysis clearly shows that not all of the countries considered have the same magnitude or range of trade statistics discrepancy ratios with respect to their trade of lumber.

Whereas the log discrepancies occurred across all countries, the largest bi-lateral lumber trade statistics discrepancy ratios were consistently observed with Indonesia, and to a much lesser extent, Malaysia, Austria, and Sweden, Table 4.8 and Figure 4.2. However, in contrast to the case of Indonesia where exports appear to be consistently under-reported by an extremely large amount, the bi-lateral trade statistics discrepancies for Malaysia, Austria, and Sweden are due to an over-reporting of exports by the exporting country relative to the value of lumber imports reported by the importing country. The average bi-lateral trade statistics discrepancy ratio for Indonesia was 0.84 and their bi-lateral trade discrepancies range from 0.601 to 0.968. The trade data clearly demonstrates that Indonesian lumber export statistics consistently and substantially under-report the value of lumber exported to all of their trading partners included in this report.

The frequency diagram of bi-lateral trade statistics discrepancy ratios in Figure 4.5 is centered on the 0-0.199 range of values and the mean value for this distribution was 0.226. Similar to the pattern observed with logs, over 80% of the trade statistics discrepancy ratios were greater than zero. However, in contrast to the situation with logs, almost half of the trade discrepancy ratios (49.1%) were within 20% of zero compared to just 19.4% for logs. While approximately 18% of the bi-lateral trade statistics discrepancy ratios exceed ±0.6, the lumber trade statistics discrepancy distribution is nowhere near as skewed as that seen with the log trade statistics discrepancy distribution.

We also looked at the impact of currency fluctuations on lumber trade statistics discrepancy ratios. In particular, the literature suggests that foreign denominated trade values can be converted to US dollars by using either the average annual exchange rate or the average monthly exchange rates. Using the US-Japan lumber trade value as an example, Japan imported ¥25,194,676,000 worth of lumber from the US in 2001. Since the average exchange rate for the Japanese yen in 2001 was ¥121.52 per $US, a simple conversion shows that Japan imported $US 207,330,825 worth of lumber from the US. We then converted the monthly Japanese lumber import values using the average monthly exchange rate and found that Japanese lumber imports from the US were $US 207,836,706 using this methodology. Despite the fact that there was a 9.8% variation between the monthly exchange rate values in 2001, the impact on the Japan-US trade statistics discrepancy was just 0.2%. While this is a single example using a single currency, it suggests that exchange rate fluctuations, in and of themselves, do not necessarily result in substantial discrepancies in the trade statistics. However, for trade analysts looking at other combinations of trading partners where one of the currencies was subject to unusual exchange rate volatility, it may be useful to compare the impact of using annual versus monthly exchange rates in converting trade values to help explain discrepancies in the trade statistics between the two countries.

Table 4.8 Range of trade statistics discrepancy ratios for lumber.

	Exporting Nation										
Importing Nation	US	Canada	Finland	Sweden	Germany	Austria	Chile	Ghana	Malaysia	Indonesia	Russia
US											
Japan											
S. Korea											
United Kingdom											
Germany											
France											
Italy											
Spain											
Malaysia											
Indonesia											
Philippines											
Thailand											
Taiwan											
China											

< 1 S.D. below mean within 1 S.D. of mean > 1 S.D. above mean

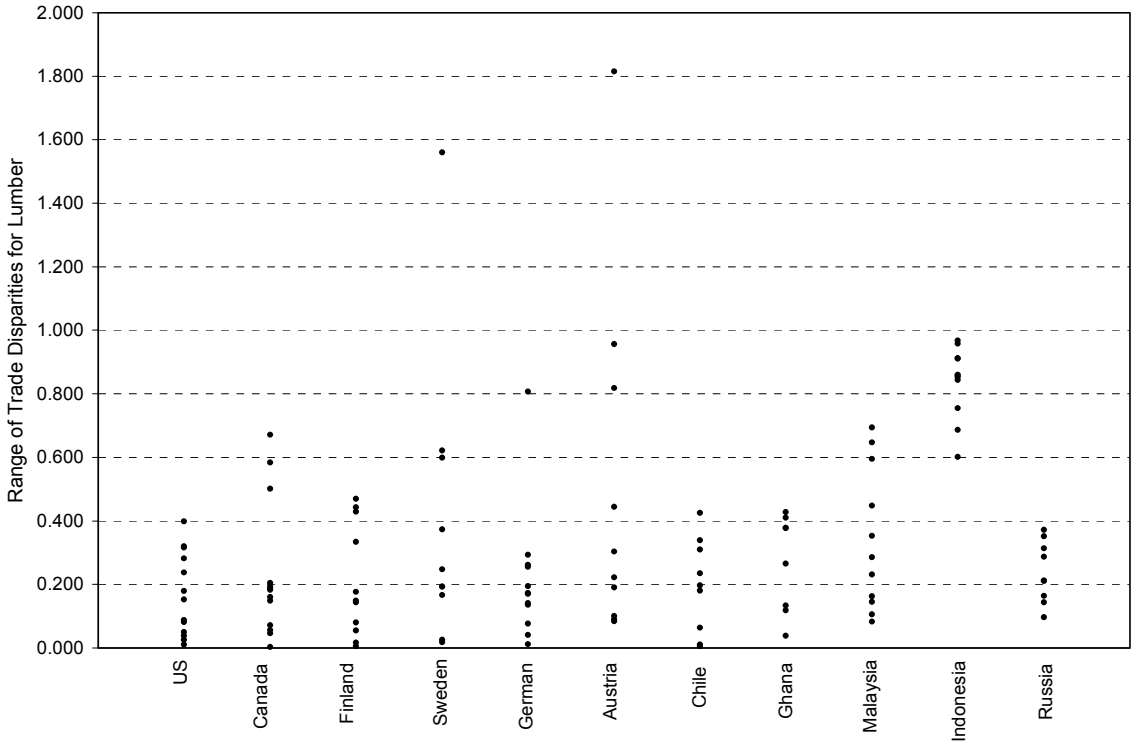


Figure 4.2 Scatter diagram of bi-lateral trade statistics discrepancy ratios for lumber (absolute values).

Discrepancies in the Trade Statistics for Plywood

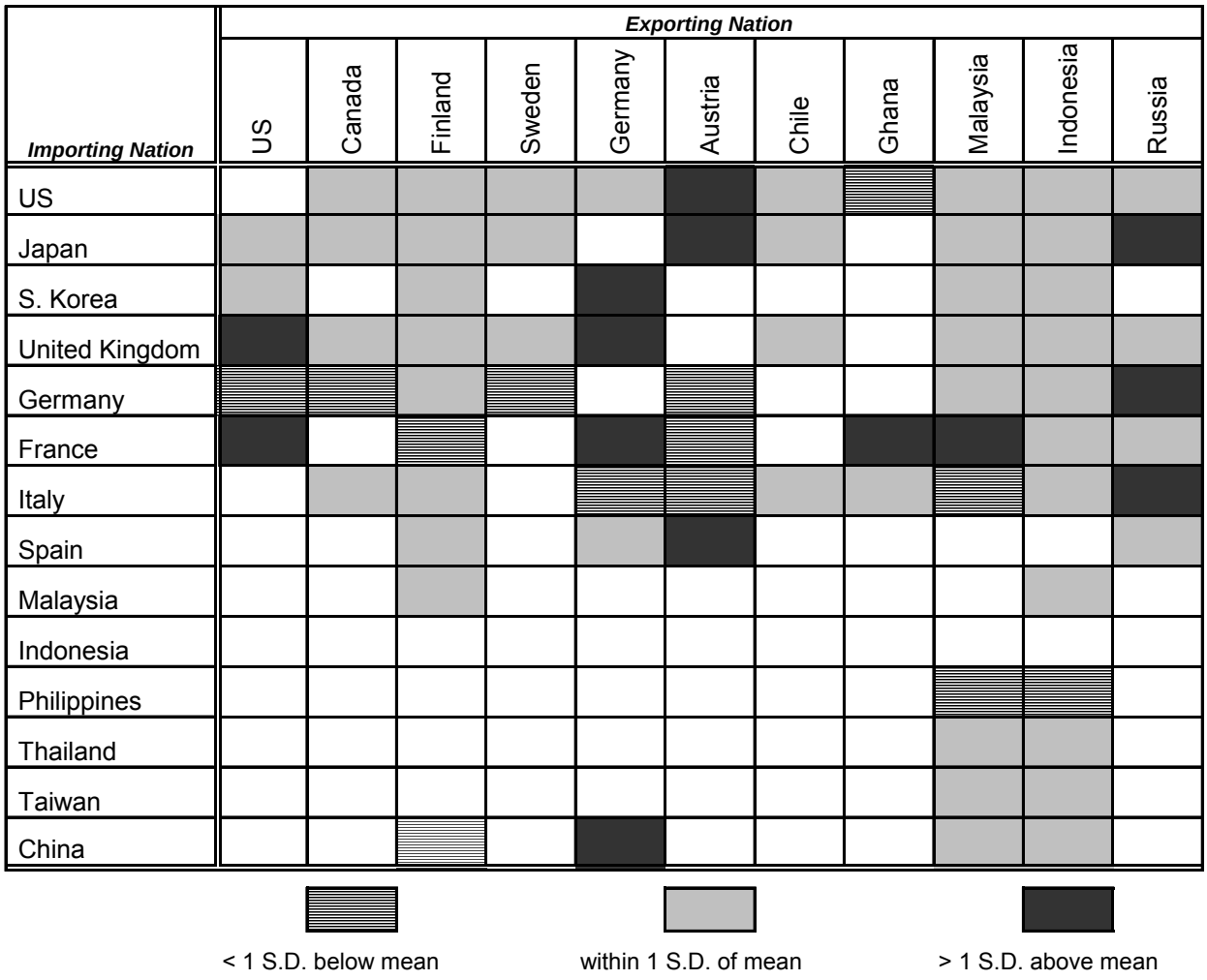
Global imports of plywood totaled $US 7,313,357,000 while global exports totaled $US 6,603,892,000, representing an apparent global trade discrepancy of 0.097 (FAO 2002). The 2001 trade data indicates that the export of plywood is dominated by just a few countries. Indonesia (30.2%) and Malaysia (15.3%) represent 45% of total global plywood exports while Finland (7.3%), China (6.1%), and Canada (5.7%) are the other major plywood exporting nations. Together these six countries provided almost two-thirds (64.6%) of global plywood exports. All of these countries are included in the plywood trade statistics discrepancy ratio analysis.

The bi-lateral trade statistics discrepancy ratios for plywood are presented in Tables 4.5 and 4.9 as well as in Figures 4.3 and 4.4-4.5. In contrast to logs and lumber, where 9% and 49.1% of the bi-lateral trade statistics discrepancy ratios between trading partners were within ±0.2, 26.3% of the plywood trade statistics discrepancy ratios were within this range, Figures 4.4 and 4.5. The trade statistics discrepancy ratios for plywood ranged from -2.076 to 0.955, Tables 4.5 and 4.8. A statistical analysis of the distribution of bi-lateral trade statistics discrepancy ratios showed that the kurtosis value for the distribution of plywood trade discrepancies was 0.073, indicating that this distribution clusters slightly more than a normal distribution and has a slightly longer tail. The skewness statistic for the plywood discrepancy distribution was -0.186 suggesting that the distribution has a slightly longer left tail and, since the skewness statistic was more than twice as large as the standard error (SE=0.0441), the distribution of plywood trade statistics discrepancy ratios is not a normal distribution. Finally, the mean of the plywood trade statistics discrepancy distribution was 0.182 with a standard deviation of 0.358, indicating that 68% of the plywood discrepancy ratios fell within the range of -0.176 and 0.540. This analysis clearly shows that not all of the countries considered have the same magnitude or range of trade statistics discrepancy ratios with respect to their trade of plywood.

In reviewing the plywood bi-lateral trade statistics discrepancy ratios, many of the larger bi-lateral trade statistics discrepancy ratios occur within rather small trade flows, Tables 4.6 and 4.9. For example, while Table 4.9 indicates that Malaysia had three large trade statistics discrepancy ratios (with France, Italy, and the Philippines), each of these trade flows is less than $5 million and would be considered relatively minor flows within the overall context of the global plywood trade. In contrast, when the larger bi-lateral trade flows (above $US80,000,000) are considered, only a few show trade statistics discrepancy ratios over 0.2. Given their magnitude, three bi-lateral trade flows are worth noting. The first is between Indonesia and Japan, where Japan reported receiving $US153,000,000 less plywood than Indonesia reported exporting. Similarly, Japan reported receiving $US82,000,000 less plywood from Malaysia than the Malaysian export statistics indicated was shipped. In addition, China reported receiving $US82,000,000 less plywood than Indonesia reported shipping. However, in general, the plywood bi-lateral trade statistics discrepancy ratios are much less pronounced than those of logs but are slightly more pronounced than lumber.

The frequency diagram of bi-lateral trade statistics discrepancy ratios in Figure 4.5 is centered on the 0-0.199 range of values and the mean value for this distribution was 0.182. Similar to the pattern observed with logs and lumber, almost two-thirds of the trade statistics discrepancy ratios were greater than zero. However, in contrast to the situation with logs, almost half of the trade discrepancy ratios (44.3%) were within 20% of zero compared to just 19.4% for logs. While approximately 21% of the bi-lateral trade statistics discrepancy ratios exceed ±0.6, the lumber trade statistics discrepancy distribution is nowhere near as skewed as that seen with the log trade statistics discrepancy distribution.

Table 4.9 Range of trade statistics discrepancy ratios for plywood.



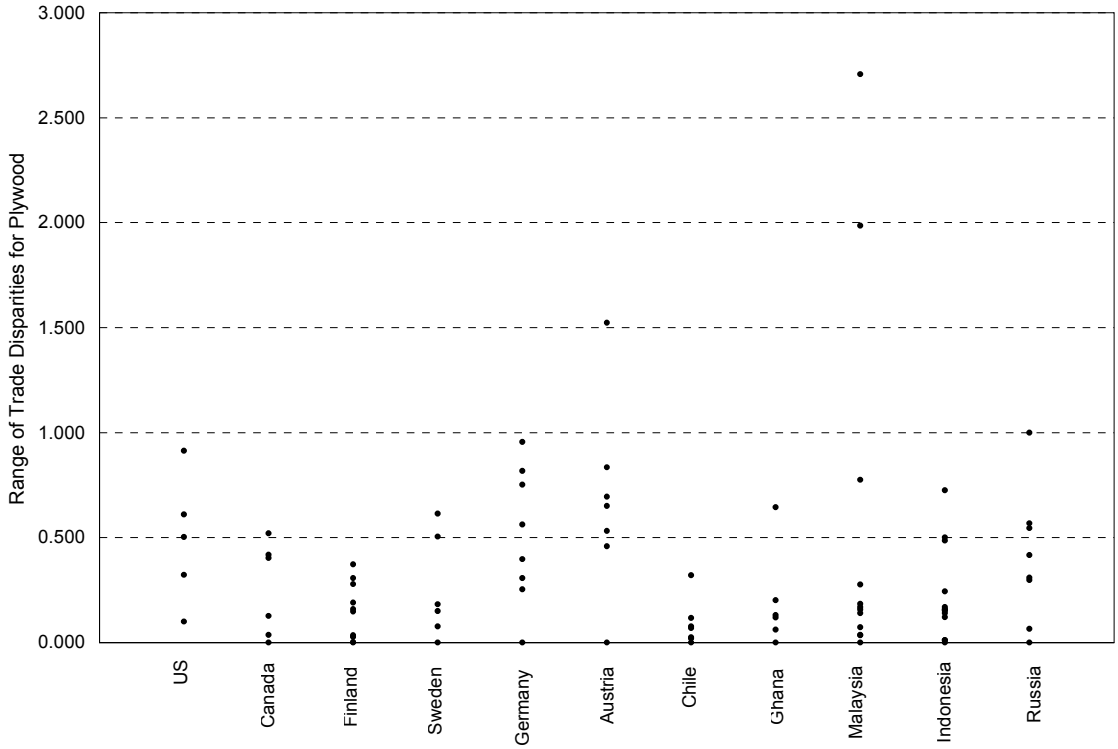


Figure 4.3. Scatter diagram of bi-lateral trade statistics discrepancy ratios for plywood (absolute values).

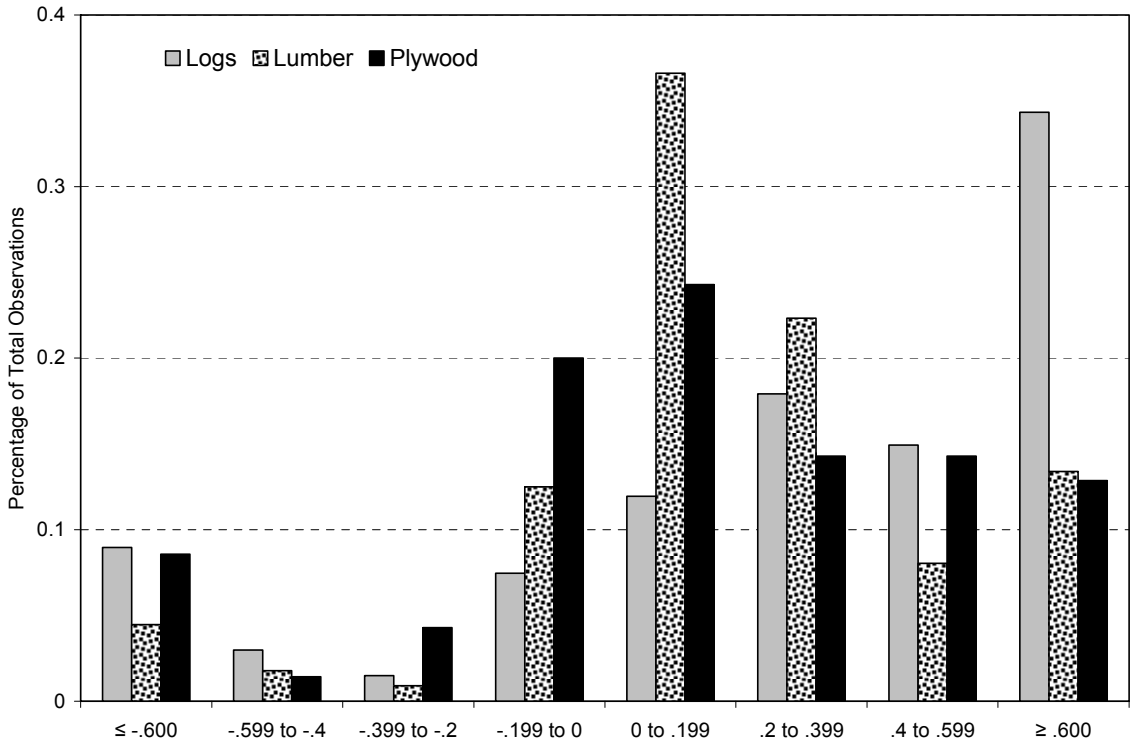


Figure 4.4. Frequency histogram of bi-lateral trade discrepancy ratios for logs, lumber, and plywood.

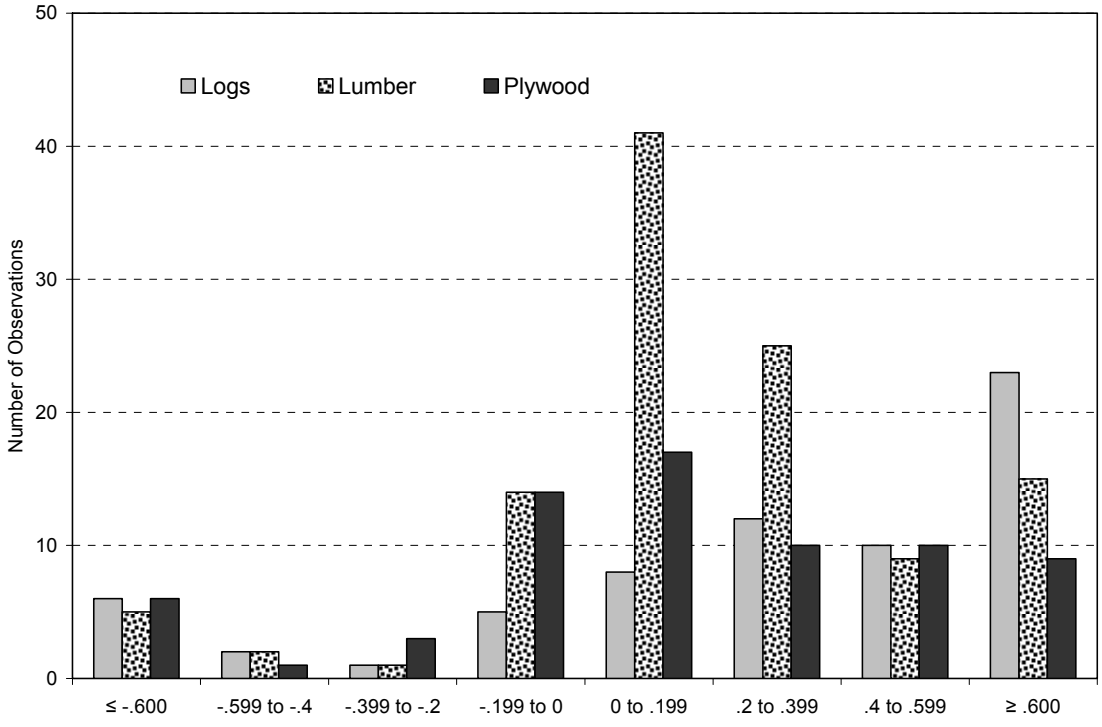


Figure 4.5. Histogram of bi-lateral trade discrepancy ratios for logs, lumber, and plywood.

5.0 CONCLUSIONS

Two additional statistical tests were run to determine if there was a significant difference in the distribution of trade statistics discrepancy ratios between (1) developed economies and less developed economies, and (2) the three product categories. The expectation prior to running these tests was that the developed economies would have lower bi-lateral trade statistics discrepancy ratios. Similarly, we would expect to see smaller bi-lateral trade discrepancy ratios as the degree of product process increased (i.e., plywood should be lower than lumber which should be lower than logs). These hypotheses are supported by the fact that the aggregate FAO trade statistics for logs, lumber and plywood show declining trade statistics discrepancy ratios as the degree of processing increases. Using the FAO trade statistics, the trade statistics discrepancy ratios between global imports and exports of logs in 2001 was 0.221, while the global trade statistics discrepancy ratio for lumber was 0.104 and the global trade statistics discrepancy ratio for plywood was 0.097.

The statistical tests of the distributions of trade statistics discrepancy ratios were conducted using the SPSS statistical package. ANOVA tests were used to determine if there was a statistical difference between the product distributions while a t-test was used to identify where the difference existed. The results of the first t-test test (developed economies vs. less developed economies) indicated that there was a statistical difference between developed and less developed economies for all products (p=.03), with the mean discrepancy ratio for less-developed economies being significantly higher than that of the developed economies. For this analysis the exporting countries were segmented into the following groups: developed economies (US, Canada, Finland, Sweden, Germany, and Austria) and less developed economies (Chile, Ghana, Malaysia, Indonesia, and Russia). Further analysis indicated that at the individual product level there was a significant difference between developed and less developed economies for lumber (p=.000) but not for logs (p=.409) or plywood (p=.884).

The results of the second statistical test (logs vs. lumber vs. plywood) indicated that while there was a significant difference in the distribution of trade statistics discrepancy ratios for logs and lumber (p=.036) and logs and plywood (p=.052), there was not a significant difference in the trade statistics discrepancy ratios for lumber and plywood (p=.984). In addition, as discussed in the previous section, the average trade statistics discrepancy ratio for logs, lumber and plywood were found to be 0.387, 0.226, and 0.182. Thus we see that the trade statistics discrepancy ratio does indeed decline as the degree of processing increases and that the trade statistics discrepancy ratios for lumber and plywood are significantly lower than for logs. It is interesting to note that the mean trade statistics discrepancy ratios derived from this study were substantially higher than the global trade discrepancies derived from the FAO data (logs = 0.221, lumber = 0.104, and plywood = 0.097), suggesting that at least some of the countries included in this study have trade statistics discrepancies that are substantially higher than the global average.

The results of these statistical tests suggest that developed economies have statistically smaller trade statistics discrepancy ratios for forest products than do less developed economies. However, with respect to specific wood products, a statistical difference was detected between developed and less developed economies only for lumber. This suggests that there should be further investigation into the causes of the larger trade statistics discrepancy ratios found in developing economy lumber exports. In addition, further analysis demonstrated that there was a significant difference in the trade statistics discrepancy ratios for logs and lumber and logs and plywood, but not lumber and plywood. This would tend to indicate that the causes of the discrepancies in the trade statistics in the log trade need further investigation. This investigation of the log trade statistics should be conducted across a range of countries since there was not a significant difference between the trade statistics discrepancy ratios of developed and less developed countries.

5.1 SUMMARY CONCLUSIONS AND PRELIMINARY RECOMMENDATIONS

The analysis of the trade data demonstrates several fundamental characteristics of the trade statistics for forest products. First, the average discrepancy in the trade statistics is greater than zero and the discrepancy ratio becomes smaller as the degree of processing increases (the difference in discrepancy ratio was significant between logs and lumber and logs and plywood but not between lumber and plywood). Second, the majority of the discrepancy ratios observed for logs, lumber and plywood tended to be positive and concentrated above the average discrepancy ratio, indicating that in most cases the magnitude of the reported imports exceeded that of the reported exports. Third, a statistical analysis found that, while there was a significant difference between the size of the trade statistics discrepancy ratios between developed and less-developed economies across all three products combined, further analysis determined that, on a specific product basis, this difference was only significant in the case of lumber. Finally, the trade statistics were statistically analyzed to establish a "normal" range of trade statistics discrepancies that might serve as a guide for trade analysts looking to identify unusual discrepancies in the trade statistics that might require further investigation.

This research clearly shows that discrepancies within the trade statistics are to be expected and anticipated within limits. However, the analysis of the trade data and the bi-lateral trade statistics discrepancy ratios suggests that there are substantial discrepancies in the trade statistics for logs, lumber, and plywood. While there are a variety of reason why we would expect that reported exports would not equal reported imports, the magnitude of many of the bi-lateral trade statistics discrepancy ratios observed appear to defy conventional explanations. Clearly a more in-depth analysis of these problematic trade flows should to be conducted to determine their causes and, in the process, begin to develop recommendations to reduce these trade statistics discrepancies in the future. Finally, despite the difficulties associate with reconciling trade volumes (based on differences in the types of measurement systems used in different countries and the lack of timely data), we strongly recommend that any trade statistics discrepancy analysis consider both the value of trade and volume of trade.

One of the objectives of this study was to key areas for research in the in-depth country studies to follow this study (as referenced within Decision 6(XXX) "Forest Law Enforcement in the Context of Sustainable Timber Production and Trade" from the Thirty-First ITTC Session in Yokohama, Japan in 2001). However, since the location of the specific in-depth country studies remains uncertain, we will provide our recommendations based on the trade statistics discrepancies observed within the matrix of countries analyzed in this report.

5.2 RECOMMENDATIONS FOR ANALYZING TRADE STATISTICS DISCREPANCIES IN THE FOREST SECTOR

Clearly, identifying unusual discrepancies within the trade statistics is only the first step of the challenge confronting the trade analyst. In most cases, this first step should be followed by an investigation of the factors that contribute to the observed trade statistics discrepancies. As discussed earlier in this report, we would expect to observe some "normal" level of discrepancy between reported exports and reported imports between trading partners. This is illustrated by the fact that the sample of trade statistics discrepancy ratios for logs, lumber and plywood were not normally distributed (i.e., each distribution was skewed) and the average trade statistics discrepancy ratio for each distribution was significantly higher than 0, a clear indication that trade statistics discrepancies between trading partners are to be expected in the normal course of trade, Table 5.1. This report indicates the ranges of these "normal" trade statistics discrepancies for logs, lumber and plywood based on a statistical analysis of the distribution of the trade statistics discrepancy ratios derived for eleven major exporters of wood products and 14 major importers of wood products, Table 5.1. Together these eleven major exporters and fourteen major importers represent at least two-thirds of global trade in the three wood products considered in this report and therefore provide a representative sampling of the range of trade statistics discrepancies that a trade analyst might expect to encounter when analyzing the trade data.

Often it is the task of the trade analyst to identify the underlying causes of those trade statistics discrepancies that lie outside of the established "normal" range. In addition, the trade analyst may also be interested in identifying the underlying factors behind the trade statistics discrepancies for those countries where the observed trade statistics discrepancy ratios are consistently outside the "normal" range. In other words, the "normal" trade statistics discrepancy ranges summarized in Table 5.1 simply provide a guide for the trade analyst confronted with the task of evaluating the trade statistics discrepancies for a specific set of countries. Since every trade flow is subject to a unique set of factors that influence the magnitude of any discrepancy in the trade statistics, the statistical analysis of the trade statistics for forest products provided in this report can help a trade analyst determine if a specific trade statistics discrepancy (or set of trade statistics discrepancies) requires further analysis. However, ultimately the trade analyst must decide what the "normal" range of discrepancies in the trade statistics are based on the specific set of trade data being considered.

The first task of the trade analyst is to determine to what extent the observed discrepancies in the trade statistics can be explained by the various factors listed in Table 5.2. (Note that Table 5.2 is based on the trade related activities summarized in the table within the literature review). Based on our review of the literature, we have provided a relative ranking of the trade factors that impact discrepancies in the trade statistics by assigning each trade factor to one of three groups of factors: (a) primary normal factors, (b) secondary normal factors, and (c) abnormal factors. This ranking of factors was based on the review of the literature and was done for the sole purpose of providing the trade analysts involved in the in-depth country studies that follow this study with guidance in identifying and evaluating the relative impact of specific trade factors on discrepancies in trade statistics.

To begin, we would suggest that the trade analyst consider the ability of the primary normal factors to explain an observed trade statistics discrepancy. Based on the extent to which this set of factors is efficient in explaining the observed discrepancy in the trade statistics, the trade analyst may decide to conclude the analysis at this point. (The efficiency of a factor, or set of factors, refers to their ability to explain the observed discrepancy in the trade statistics. It is the job of the trade analyst to establish prior to beginning their analysis the specific level of efficiency they wish to achieve with respect to an observed trade statistics discrepancy). It is during this initial stage of the analysis that the trade analyst should consider how any differences in volume estimation or product valuation methods between trading partners are reconciled within their respective trade statistics.

If, following this first stage of the analysis, a large component of the observed discrepancy in the trade statistics remains unexplained, the analyst may wish to consider the ability of the secondary normal factors to explain the unexplained component of the observed discrepancy in the trade statistics. Finally, in cases where the primary and secondary normal factors are unable to explain a substantial component of the observed discrepancy in the trade statistics, the analyst may wish to consider the ability of the abnormal factors to help explain the observed discrepancy in the trade statistics.

Once the trade analyst has completed the analysis of the trade statistics discrepancy data and has identified the factors that are at least partially responsible for the trade statistics discrepancy, it remains for the trade analyst to suggest a set of policy recommendations to reduce the size and occurrence of discrepancies in the trade statistics in the future. This task of providing policy recommendations may be quite challenging since it is entirely possible that even within a single country's set of trade relationships for a single product, there may be a wide variety of different factors that influence the size and occurrence of discrepancies within the trade statistics. More importantly, the set of relevant factors responsible for discrepancies in the trade statistics may vary based on the specific trading partner being considered. Thus, the policy analyst should develop a methodology for prioritizing the factors that contribute to trade statistics discrepancies and develop policy recommendations for those factors that prove to have the greatest influence on trade statistics discrepancies for the specific country being considered.

Table 5.1 "Normal" range of trade statistics discrepancy ratios observed for logs, lumber and plywood.

Product Type	Mean Trade Discrepancy	"Normal" Range of Trade Discrepancies
Logs	0.387	-0.037 to 0.812
Lumber	0.226	-0.106 to 0.558
Plywood	0.182	-0.176 to 0.540

Note: The "normal" range of trade statistics discrepancies are based on trade discrepancy values that are within approximately one standard deviation of the mean trade discrepancy.

Table 5.2 Summary of the factors that can contribute to discrepancies in the trade statistics and recommendations for analyzing the ability of these factors to explain trade statistics discrepancies.

Type of Activities	Recommendations for Analyzing Trade Statistics Discrepancies
Normal Activities that Result in Trade Statistics Discrepancies	
Primary Normal Factors	
❖ Product valuation (FOB vs. CIF)	❖ How do transportation costs affect the total value of the imported product? ❖ How are transportation costs accounted for by the exporting country and importing country? ❖ To what degree does this difference in accounting explain all or most of a trade statistics discrepancy?
❖ Time lag between export and import	❖ Is the shipping time between exporter and importer substantial? ❖ Was there a significant amount of product exported at the end of the year that may not have arrived at the importing country until to following calendar year? ❖ Could this shipping time lag account for a significant component of the trade statistics discrepancy?
❖ Exchange rate fluctuations	❖ Has there been extreme exchange rate volatility during the period in question? ❖ Are official export/import values calculated using annual or monthly exchange rates? ❖ Is there a significant difference between using annual vs. monthly exchange rates to calculate the value of trade? ❖ Could exchange rate fluctuations account for a significant component of the trade statistics discrepancy?
❖ Declaration of destination (trans-shipments)	❖ Do products exported by one country tend to pass through a third country before arriving at the final destination? ❖ Is there a substantial amount of this so-called triangular trade between the two countries being considered? ❖ How do the exporting and importing country account for trade through a third country? ❖ Could discrepancies in accounting for triangular trade account for a significant component of the trade statistics discrepancy?
Secondary Normal Factors	
❖ Conversion of product weights to	❖ Are the appropriate conversion factors being used based on species, log

volumes	diameters, or product sizes (e.g., nominal sizes vs. actual sizes)? ❖ Are the conversion factors being used consistent between the exporting and importing country?
❖ Differences in log scaling methods	❖ Are unique log scaling methods used by either the importing country or the exporting country? ❖ Are the log scaling volumetric equations appropriate for the form of log being traded (e.g., constant diameter vs. significant taper) ❖ If product volume re-estimated by the importing country, are volume differences reconciled with the exporting country? ❖ Are the volumetric equations comparable between the two countries?
❖ Volume conversions from standard to metric	❖ Is the appropriate conversion factor being used for the type of product being traded (e.g., lumber cut to actual sizes vs. nominal sizes vs. waney cants)? ❖ Is a comparable standard being used to report product volume (e.g., thousand square feet on a 3/8 inch basis for plywood)? ❖ How are volume differences reconciled between the importing and exporting country?
❖ Product valuation method	❖ What type of system is used to establish product value? ❖ If the valuation systems employed by the exporting country and importing country differ, is the difference significant? ❖ How are valuation differences reconciled between the exporting and importing countries?
❖ Combined shipment of mixed products	❖ Do exporters declare mixed product shipments under a single HTS code? ❖ Do customs agents check for mixed shipments? ❖ What rules are applied by customs to mixed product shipments? ❖ Do mixed product shipments represent a substantial percentage of exports?
❖ Different product classification systems used	❖ Do both the exporting and importing countries utilize compatible product classification codes within the Harmonized Trade System of product classification (e.g., HTS codes set at the 8 digit level vs. 9 digit level)? ❖ If not, do both systems identify products at the same level of accuracy (e.g., single species vs. a group of similar species)? ❖ At what level can the two systems be reconciled (e.g., 4 digit level vs. 6 digit level or higher)? ❖ Is a substantial amount of trade attributed to "*Other species*" or "*Other products*" categories?

❖ Poor government policies or policy implementation	❖ Is the exporting country using an older version of the IMF Balance of Payments manual (BPM4) to establish their trade accounts? ❖ Is there good communication of trade data between government agencies? ❖ Is trade data reconciled between government agencies?
❖ Type of national accounting system used for trade	❖ What type of system is used for recording merchandise trade by the exporting and importing countries (e.g., general trade vs. special trade)? ❖ Are the importing and exporting countries use different editions of the IMF Balance of Payment manual to develop their trade statistics (e.g., BPM 4 vs. BPM 5)? ❖ Does the method for collecting international trade statistics (ITS) require significant adjustments in order to comply with the IMF Balance of Payments Method (BPM5)? ❖ Are the adjustments made to reconcile the ITS with BPM5? ❖ Is there a procedure in place to reconcile trade data between countries?
❖ Unintentional data collection, processing errors	❖ Upon close inspection of the trade data, do there appear to be unexplained anomalies within the data? ❖ Can these anomalies be isolated and investigated further with the appropriate government agencies (e.g., customs or individual ports)? ❖ Is a substantial amount of trade attributed to "*Unidentified Countries*"?
❖ Unreported export or import data	❖ Does the country have a system in place to ensure that export reports are maintained by the ports and that these export reports are sent forward to the customs department for evaluation? ❖ How does the country check this system to verify the accuracy of their trade data?
Abnormal or Illegal Activities that Result in Trade Statistics Discrepancies	
Abnormal Factors	
❖ Under-invoicing product value or volume	❖ Do exporters have an economic incentive to under-invoice export value and/or volume? ❖ Are there credible laws and enforcement capacity in place to deter under-invoicing practices? ❖ Is there a process in place to identify forged or altered export documentation? ❖ Are their constraints on the ability of customs officials to verify exporters invoicing practices?

	❖ Is corruption within the Port or Customs agencies a credible concern? ❖ If so, what factors contribute to corruption and how can they be addressed?
❖ Mis-specification of product type or characteristics	❖ Do exporters have an economic incentive to mis-specify their products (e.g., export tariffs or quotas)? ❖ Do ambiguous or complicated export rules contribute to mis-specification? ❖ Are exporters and/or customs agents familiar with product specification rules? ❖ Are there credible laws and enforcement capacity in place to deter mis-specification of product type or characteristics? ❖ Is there a process in place to identify forged or altered export documentation? ❖ Are their constraints on the ability of customs officials to verify exporters compliance with product specification rules? ❖ Is corruption within the Port or Customs agencies a credible concern? ❖ If so, what factors contribute to corruption and how can they be addressed?
❖ Mis-specification of species or grade	❖ Do exporters have an economic incentive to mis-specify species or product grade? ❖ If product is re-graded by the importing country, how are differences reconciled? ❖ Are any timber species exported subject to CITES trade restrictions? ❖ Are any timber species exported subject to national government trade restrictions? ❖ Are there credible laws and enforcement capacity in place to deter mis-specification of species or product grade? ❖ Is there a process in place to identify forged or altered export documentation? ❖ Are customs officials trained to identify timber species for which trade restrictions apply? ❖ Are there constraints on the ability of customs officials to verify the species and/or product grades being exported? ❖ Is corruption within the Port or Customs agencies a credible concern? ❖ If so, what factors contribute to corruption and how can they be addressed?
❖ Transfer pricing	❖ To what extent does intra-company trade occur? ❖ Do local tax structures provide companies with an incentive to employ illegal or exaggerated transfer pricing mechanisms to reduce their local tax burden?

❖ Fraudulent trade data	❖ Do rigid national policies encourage trade analysts or agencies (either overtly or subtly) to adjust trade statistics to meet national economic targets? ❖ Are there mechanisms in place to ensure the validity of trade data at every level of reporting (e.g., port to district to regional to national)? ❖ Does an analysis of the trade data identify anomalies between levels of reporting? ❖ Are there mechanisms in place to reconcile any anomalies in the national trade data?
❖ Smuggling	❖ Are there large unexplained trade flows that cannot be explained by any of the factors identified previously? ❖ Have there been credible reports of smuggling in the past? ❖ How easy is it to smuggle individual products out of the country (e.g., logs vs. lumber vs. plywood)? ❖ Is there an economic incentive for producers to smuggle products out of the country? ❖ Are there harvest restrictions or export taxes/tariffs/quotas in place that encourage smuggling? ❖ Is there a substantial discrepancy between the reported timber harvest and the volume of products manufactured and/or exported by the country? ❖ Is there a substantial discrepancy between the reported timber harvest and the volume of timber imports reported by trading partners? ❖ Are there credible laws and enforcement capacity in place to deter smuggling? ❖ Is corruption within the Port or Customs agencies a credible concern? ❖ If so, what factors contribute to corruption and how can they be addressed?

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APPENDIX A

SOURCES OF COUNTRY DATA CONTAINED WITHIN THE WORLD TRADE ATLAS

Country	***Source of Trade Data***
US	U.S. Dept. of Commerce, Bureau of Census
Japan	Japan Customs
S. Korea	Korean Customs Service
United Kingdom	H.M. Customs and Excise
Germany	Eurostat
France	Eurostat
Italy	Eurostat
Spain	Eurostat
Malaysia	Department of Statistics Malaysia
Indonesia	Statistics Indonesia
Philippines	Philippines National Statistics Office
Thailand	Thai Customs Department
Taiwan	Taiwan Directorate General of Customs
China	China Customs
Canada	Statistics Canada
Finland	Eurostat
Sweden	Eurostat
Austria	Eurostat
Chile	Servicio Nacional de Aduana
Ghana	Ghana Timber industry Development Division
Russia	Customs Committee of Russia