

Errors in Foreign Trade Statistics

JACOB RYTEN¹

ABSTRACT

In spite of the comparative ease with which studies of error in foreign trade statistics could be conducted, there are few attempts to quantify their size, origin, distribution, and change over time. Policy makers and trade negotiators have little notion of how uncertain these statistics are in spite of their great detail. This paper takes advantage of a World Trade Database developed by Statistics Canada to examine and quantify discrepancies in existing foreign trade statistics.

KEY WORDS: Foreign trade; Bilateral trade balances; Errors.

1. INTRODUCTION

This paper discusses some of the underlying causes of errors in foreign trade statistics; difficulties in detecting errors; ways of conveying the uncertainty in the detailed figures; and a proposal to improve the quality of the data.

There has not been much written about error in foreign trade statistics since Allen and Ely (1953) co-edited a book on these statistics thirty five years ago. Some attention has been paid to accounting matters — inclusions and exclusions, demarcation of boundaries, valuation, etc. (United Nations, 1982) — and most of all to classification. In fact, one of the biggest changes in trade classification ever has just been introduced (United Nations 1986) in order to make foreign trade data more comparable among countries. But perhaps because these statistics rely on a complete accounting of all merchandise transactions that take place across borders in any period of time and this accounting is enforced by a policing agency — customs administration — there is a widespread belief that there is not much measurable error left. The lack of analysis of error in these statistics supports this contention.

Periodically, it has come to the attention, particularly of statistical offices in international agencies, that there is a serious error in the reporting of trade between pairs of countries. At its eighteenth session, the United Nations Statistical Commission (1974) was formally informed of the reconciliation of trade statistics between the United States and Canada. This followed the detection of some embarrassing differences in the bilateral trade balance between the two countries. Thereafter, and at various times, issues involving Singapore and Malaysia, Singapore and Indonesia, and any of a number of non-EEC countries and the Netherlands were brought up for discussion at international agencies that were more specifically interested in trade matters. Moreover, countries which felt that they were losing control over the quality of their foreign trade statistics — typically third world countries — have attempted to piece back their own numbers by reference to those of their principal trading partners. But there is no evidence that any of these expressions of concern has ever resulted in a systematic programme to detect, measure and reduce error in the underlying statistics.

There are few obvious alternative explanations for this lack of action other than the belief that there is no error. Foreign trade statistics are among the very few where there can be a comparison of two measurements of the same transaction derived in virtually the same detail

¹ Jacob Ryten, Assistant Chief Statistician, Statistics Canada, 13-B8 Jean Talon Building, Tunney's Pasture, Ottawa, Ontario K1A 0T6.

using the same procedures, by two independent record takers. The differences that result when these comparisons are made have been referred to in the literature going back to almost the first world war (Coats 1926). And yet, they have not resulted in proposals to incorporate the results of these comparisons in any report on the quality of the underlying statistics. One of the deterrents to pursue these comparisons systematically may have been the volume of computing they entail and the expense involved. Another may be the depth of knowledge that is required of counterpart statistical systems which, in addition to being described in some instances in a foreign language, usually involve very specific administrative and legal provisions which are not comparable from country to country.

The deterrents to systematic comparisons have changed somewhat in Statistics Canada where a world trade data base has been established. Its contents are detailed trade statistics of the countries that report data in machine-readable form to the United Nations Statistical Office (UNSO). UN member countries undertake, under the terms of membership, to report a number of key statistics to the UNSO in the manner specified by the UN Secretary General. These statistics include foreign trade statistics broken down by country and commodity, with the latter in either the full detail of the Standard International Trade Classification (SITC) or its equivalent Customs Cooperation Council Nomenclature (CCCN). Annual reports in machine-readable form go back to the early sixties.

The world trade data base was created to support Canadian negotiators involved in the current round of multilateral tariff reductions and also to help Canadian exporters and importers get a better understanding of the markets and suppliers with which they deal. Its shortcomings are that it is not complete. The centrally planned economies either fail to report or else only provide very aggregate data; many of the third world countries experience serious delays in processing their Customs records as a result of which there is still much missing in recent years; not all countries report on the same vintage of the SITC; and there is a fair amount of variation in the concepts and definitions adopted by different countries.

But these shortcomings are more than offset by the fact that the computing involved in comparing trade statistics is now manageable; that a very large proportion of world trade only involves the western countries and is reported currently; and that the latter have moved to progressively more comparable conceptual frameworks. Taking these elements into account, a world trade data base can be used to display the results of comparing counterpart trade statistics and this in turn should help statistical agencies to become more conscious of the strengths and weaknesses of their merchandise imports and exports data. This is a necessary condition to improve the reliability of trade statistics. Given the attention that is currently paid to these data, statistical agencies throughout the world are well advised to make the improvements suggested by bilateral comparisons of counterpart data even if they can only do so gradually.

In the next sections, there is a review of the principal causes of discrepancies in counterpart statistics and of what steps can be taken to estimate their relative importance in particular situations.

2. TRADE TRANSACTION RECORDS: ERRORS AND DIFFERENCES IN COUNTERPART RECORDS

Underlying two counterpart trade records, there is, in most cases, one single documented transaction. An exporter has made a sale and invoiced the purchaser accordingly. That invoice is likely to contain the essential facts about the transaction which includes a description of the product(s) sold, the corresponding value and quantity, the terms and conditions of the sale, an identification of the purchaser and of the purchaser's residence and a date on which the transaction took (or will take) place. This record generates a number of related records, some

derived by transforming the basic information in some prescribed manner and others through record linkage with related records. Examples of the latter include a description of how the products transacted were moved from the place of sale to the place of purchase and how much that cost, the cost of insuring the shipment, what amounts were charged to the two parties to the transaction because of duties, sales taxes, consular charges etc.; and of course, the form and date in which the purchase was settled.

The transformations of the basic information have to do with conventions regarding the way in which this basic information is recorded and the documentation of the different stages of the transaction over time. These transformations are not standard across countries. The conventions that rule them are either embodied in Customs law or else in the administrative regulations that govern Customs record keeping. They give rise to the documents that form the basis of foreign trade statistics. One set of documents is kept by the country of sale; and the other by the country of purchase. In practice these documents differ in spite of relating to what is in principle and in fact the same commercial transaction.

Firstly, they differ in time. Even between adjacent countries or in cases where air transport is involved, differences in time are not trivial. They arise because the chain of links that make up the transaction is long — bringing the shipment to the point from which the international carrier will depart; warehousing while waiting for international transport; arriving at the point of destination; warehousing while waiting to clear Customs formalities; and while this is going on, filing documents at different stages and having them recorded on the basis of different conventions. Also, in one country the time of transaction may be recorded as the time the invoice is received in the importing country and in another as the time amounts owing to the Customs administration are paid.

Secondly, in one country the recording of the value of the purchase may include all costs of international transportation and insurance; whereas in another these may be kept separately. Thirdly, in one country the transaction may be imputed not to the country from which the invoice was issued but rather to the country where the product was grown, extracted or manufactured; whereas in another, it is the residence of the seller that decides the country assignment. Political stances can also affect the way a country is identified on the records. Fourthly, customs regulations can bias the way imports or exports are recorded. Fifthly, there are data coding and processing errors. And finally, the units in which the quantities are reported can cause inconsistencies. The following sections provide additional detail on these factors.

i) Differences between exports and imports records: timing

Customs administrations will normally file records in a variety of ways: by country of origin; by the identification of the importing business or its agent; and by time of receipt. But there are at least four key events involved in an import transaction all of which may be recorded but only one of which will be chosen as the date for retrieval and statistics. The choice of the date is not subject to statistical standardization but rather to how customs views its prime function and to the technical capacity to store alternatives. Clearly, if one country chooses as its date to record exports the time when the forwarding agency prepares an export document; and the counterpart country chooses as time for imports the date when all duties and other dues are settled, the possible lag between the recording of exports and the corresponding imports is a maximum.

ii) Differences between exports and imports records: values

Value differences have long stood in the way of systematic comparisons so it is best to review them and assess their relative importance. The valuation of the transaction that is to say, the price at which it is recorded for purposes of customs administration — is critical. Many countries (most?) record the value of an import including the cost of international transport and

insurance relating to the shipment. Most countries record the value of the counterpart exports excluding these components. There are additional variations: some countries include portions of inland transport and insurance and some countries exclude harbour costs from costs of international transport. But these differences only present a marginal increase in the difficulty of comparing counterpart records. Transactions involving related commercial partners as in the case of multinational enterprises trading internationally pose a problem of valuation which is solved in different ways in different countries. It is possible that this source of difference will outstrip all others in the years to come.

iii) *Differences between exports and imports records: country*

There is the matter of country crediting which can introduce some of the more puzzling differences in any systematic programme of comparisons. As an exporter, a country can count as an export any sale of goods that has to cross its customs boundaries to reach its point of destination, independently of whether it was substantially changed or is being sold in the exact same form in which it was purchased from some other country. However, as an importer a country may decide to impute a purchase to the country where the last substantial transformation (normally "substantial" has a precise definition in law) took place. Accordingly in the case of three hypothetical countries, A, B, and C where A has exported some goods to B and B has exported the same goods (perhaps transformed) to C, the statistics may be recorded in any of many possible ways with different consequences, as shown in the table below.

The symbols "x" and "m" denote respectively value of exports to and imports from the partner country (second upper case letter) as recorded by the reporting country (first upper case letter).

Accordingly,

A_xB = Value of exports from A to B as recorded by A

A_mB = Value of imports from B to A as recorded by A

	Recorded as exports		Recorded as imports	Consequence
i)	$A_xB + B_xC$	—	$B_mA + C_mB$	Consistent and complete
ii)	$A_xB + B_xC$	—	$B_mA + C_mA$	Overcrediting of A by importers
iii)	$A_xC + B_xC$	—	$B_mA + C_mB$	Overcrediting of C by exporters
iv)	A_xC	—	C_mA	Consistent but incomplete
v)	A_xC	—	C_mB	No crediting of A by importers
vi)	A_xB	—	C_mA	No crediting of C by exporters

The different cases indicate that some reporting countries credit their exports to the first and others to the last known destination; that some importing countries credit imports to the country of origin and others to country of consignment; and some exporting countries count as exports whatever leaves their national territory irrespective of the degree of transformation

to which the goods may be subject. The differences involved in these approaches are not trivial matters in days of free trade agreements, Customs unions, free trade zones and other arrangements to stimulate transborder trade. For each of these arrangements, a separate statistical convention is needed to accommodate the effect of the agreement on customs record keeping. Crediting partner countries in inconsistent ways is only one source of discrepancy in bilateral or multilateral comparisons. The other is due to inconsistent geographic classification.

In fact, many countries embody their stance in international politics in their standard geographical classifications. Accordingly, there are differences that arise from inconsistent geographic definitions of partner countries. Most Latin American countries treat Puerto Rico as a separate origin or destination from the United States. Virtually each OECD member country has a different treatment of partner countries in Africa. Some lump them together by their colonial origins and others by geographic neighbourhood. Similar inconsistencies arise in the treatment of the Caribbean and South Pacific islands. The Economic Union of South Africa is treated in the statistics in ways which often reflect the reporting country's view of an embargo on commercial ties with South Africa itself. Moreover, not all countries track the changes in the political status of their trading partners with the same zeal so that not all catch up with newly created independent nations as quickly as desirable in order to conduct statistical comparisons.

iv) Differences between exports and imports records: Customs administration

There is another important difference that arises because the attention paid to exports by Customs administrations is less than what their mandate requires they pay to imports. The reporting of individual exports shipments may be consolidated in the interests of paper burden and brought into line with the manifests or other transport documents handled by the carrier. In the case of imports, the objective is to get reporting in sufficient detail to allow Customs to apply the right duties and other taxes. One consequence is that in the case of exports, low value components of a mixed shipment are more likely to be classified under the same heading as the major component whereas in the case of imports the chances are that they will be classified independently.

This difference in interest that can be ascribed to the mandate of a Customs administration has other substantial effects on the quality of exports and imports documents. On the one hand there is evidence that the extent of underreporting of exports which affected United States overland exports to Canada is not confined to North America. Almost twenty years ago the United Kingdom launched a massive programme that consisted in matching shipping manifests to export documents because of a perceived rate of underreporting of some one to two per cent of the total. On the other hand, there is a presumption that the description of exported products is unbiased (unless it covers up illegal shipments) whereas the descriptions of imported goods may be biased because they aim at minimizing the rates of duty for which the imports are liable.

In addition to these sources of difference, which are due to the different legal and administrative transformations to which the original record is subject, there are others which are more variable and more selective in terms of the records to which they apply. Examples are the treatment of low value shipments (they are defined as below different thresholds and are excluded, included, or sampled with varying rates) and the treatment of commodities that have important service elements such as recorded audio and video tapes, architects' blueprints; computing software recorded on magnetic tape; repairs and maintenance etc.

v) Differences between exports and imports records: coding and data processing

Virtually all classes of information that are included in the basic records kept by Customs reflect the application of a classification or a code to an actual situation. The way to ensure

consistency of coding is by ruling on borderline cases and ensuring that the accumulated rulings form something akin to case law — a body of decisions to be made accessible to coders and by which they should be governed. But the only central dispenser of rulings is the Secretariat of the Customs Cooperation Council in Brussels and it can neither be consulted by member countries on a day to day basis nor can its decisions go beyond a certain level of generality. For this reason, there are systematic differences in interpreting and applying standard codes sometimes within the same country, let alone among different countries.

In addition, there are inconsistencies due to errors at the data processing stage and as a consequence of the systems put in place to reduce their impact. For example, there are errors in interpreting Customs legislation and in coding source information that creep in at the stage when importers or exporters inform their authorities of an impending shipment; errors at the stage of data capture; and errors of coding within the statistical agency. The standard protection against these errors is the institution of review and editing systems that rely to differing extents on clerical inspection and review and on computerized detection and imputation. Although it is very likely that there are other sources for inconsistency, the issues reviewed above are the most frequently cited ever since these matters were first described in the literature (Coats 1926), and probably are the most important explanations of the differences in counterpart figures.

vi) *Differences between exports and imports records: quantities, a special variable*

Unlike values, reported quantities are not affected by the inclusion of transport costs nor are they biased in order to minimize tax liabilities (although if values are miscoded to lower duty categories they will drag the matching quantities along). Unfortunately, there are other problems associated with the recording and use of quantities that greatly reduce the value of these statistics for error detection. For example, quantities can apply to either an entire shipment in which case they are usually expressed as a gross weight or else to a specific commodity in which case they are expressed as either net weights or in any other appropriate unit (length, surface, volume) including, in the case of complex commodities, numbers of units.

While quantity measurements in gross or net weights are comparable across countries, their use is limited by the heterogeneity of the shipments to which they refer. Quantities expressed in other units are limited by the the variety of units used and, more importantly, by the fact that they cannot be aggregated in the commodity classification and the levels to which they apply are much too detailed for inter-country comparison, given our current state of knowledge. Nonetheless, there is a use for these units in matching trade in raw materials particularly if in conjunction with values, they are used to track changes in unit values. In fact, a proposal for an international study of errors in trade relying chiefly on the matching of unit values was made to the eighteenth session of the United Nations Statistical Commission (1974). However, member countries did not feel the possible benefit justified the expected cost. At this stage, Statistics Canada's world trade data base does not include quantity information so that the applications of quantity statistics have not yet been studied.

3. A PROGRAMME TO MEASURE ERRORS

The causes of errors have been known for many years (Coats 1926). A proper attempt at quantification was made in the first reconciliation project between the United States and Canada in the early 70's. But to this day that is a very large proportion of what is known about errors in the foreign trade statistics and obviously suffers from the fact that it concerns trade between two adjacent countries and only those two countries. Given the fact that international data

bases such as the one that Canada has will likely become more popular and that they will be provided with a variety of analytical software, it is timely to speculate on what might be done to improve trade statistics, or failing improvement, at least to inform users about the limitations of foreign trade data. It is not likely that at this stage, with the descriptive information that is currently available, users in any country realize by just how much the long term trends in trade statistics might be off, or how the monthly movements in their national trade balances are affected, and most important, how prone to error is information at detailed commodity level.

Clearly, the flow A_xB should be the same as B_mA so long as all shipments and their recording is instantaneous, the basis of valuation is the same for the two partners for the same transaction, the rules of inclusion and exclusion are the same, there are no conceptual differences (geographic, accounting, or due to Customs regime) and there are no errors (of coding or coverage). Included in "errors" are consistent interpretations of the classificatory schemes by one country which would be disputed by other countries or by the Customs Cooperation Council.

In principle, all sources of differences other than errors should be tractable although measuring the relative importance of different sources can be difficult in practice. A review of the different sources or factors is useful in order to consider how their effect can be accounted for in any comparison. Of these factors, transportation is probably the least difficult to deal with and almost certainly the least difficult to do something about. There are a number of countries such as the United States where imports are measured both ways: including and excluding transport. In principle, the information to estimate the cost of insurance and freight (c.i.f.) component across the board is available. Importers are legally bound to inform their Customs authorities of all their expenses in connection with a purchase abroad and the two broad categories of expenses are those that are dutiable (usually those connected with the product itself, including its packaging or wiring or mounting) and all others (usually those connected with the transportation, insurance and financing of the import). Accordingly, if it were necessary to conduct a study of transportation costs, there are administrative records which could be linked to the corresponding trade records. There are many technical problems related to how shipping and insurance information should be assigned to individual commodities in the case of complex shipments but there are proposals for ways to deal with these matters (Ryten 1983).

Equally, in principle, a study could be made of timing differences in the context of a particular flow of trade between any pair of countries. In the case of the reconciliation of trade statistics between the United States and Canada estimates were based on actual matches of documents which made it possible to compare dates and estimate average time lags between exports and corresponding imports. But there are less expensive methods to arrive at rough estimates that are also less constraining from the point of view of access to confidential records and are reasonably effective to calculate broad ranges of timing differences by points of exit and entry, by mode of transport, and by commodity.

Together, the estimates of timing differences and the difference between the cost of insurance and freight and free on board valuations (f.o.b.) can be expressed in the following equation:

$$A_mB(k) = B_xA(k) + A(\text{c.i.f.})B(k) + \theta + e$$

where $A_mB(k)$ is the flow of imports for commodity k from country B to country A as recorded by Country A ; $B_xA(k)$ the counterpart flow as reported by country B ; $A(\text{c.i.f.})B(k)$ the estimate of transport and insurance costs for that flow of trade as derived from country A 's records; θ a timing adjustment and e an error term that includes all the biases and random errors that affect both imports and exports statistics. It is assumed that all other sources of difference (geography, inclusions and exclusions, low value shipments etc.) have been disposed

of either by adjusting for them or preferably by excluding all transactions that may be affected by these factors from the comparison files. Over time, the average error should tend to zero and therefore the longer the period over which the comparison is made, the closer to each other the level or the average rate of change of the figures being compared. Should a comparison suddenly yield perverse results, this would constitute prima facie evidence of a deterioration in quality of at least one of the two terms of the comparison.

3.1 Analysis Using the World Trade Mini-Database

For purposes of analysis, a mini-database derived from the world trade database was created so as to start studying some of these effects. It covers the three principal trading blocs of the Western world: the EEC defined for these purposes as excluding Portugal and Spain; North America (Canada and U.S.A.); and Japan. Besides being simpler to use because of the reduced number of records, it avoids the problem of late reporting (mainly by third world countries) and of non-reporting (mainly by centrally planned economies). The mini-database includes exports and imports data for each of the constituent countries broken down by SITC (down to the four digit level of detail) and by partner country, from 1978 to 1985. In addition to the constituent countries, it includes two aggregates — the EEC and North America. Unlike the world trade database which includes a number of imputations to make analysis simpler, the mini-database only includes data as member countries reported them to UNSO after UNSO merged categories of trade deemed secret by the reporting country and converted non-standard codes reported by countries to standard SITC codes. None of these transformations is likely to affect the findings derived from the database in a significant way.

There are a few statistical problems with the grouping of countries in the mini-database. The United States has been reporting its imports to UNSO on the basis of c.i.f. but Canada reports imports f.o.b. Whereas the United States credits its partner countries on the basis of the origin of the imported goods, Canada reports on the basis of consignment (except for imports originating in Latin America). This in itself would not be too serious but for the fact that the United States is at times credited for exports routed to Canada. Accordingly, while the addition of the two countries should improve the matching of counterpart flows, the different systems of recording make it so much more difficult. Hopefully, this drawback will be overcome when United States f.o.b. imports are added to the base and when Canadian imports by origin replace imports by consignment for as many back years as possible.

In the case of the EEC countries, the key role that the Netherlands plays as port of entry to its European hinterland makes comparisons difficult. The Customs area of the port of Rotterdam acts not only as a giant distribution centre but also as a warehousing facility for the countries it serves. Accordingly, the exporter outside the EEC may not know to which specific country the sale is made but only that it will be warehoused in Rotterdam and for this reason credits the Netherlands with the sale. But the ultimate importer is bound by the rule of origin to assign the purchase to the correct country. As for the Netherlands, according to its records, no transaction involving goods has taken place across its Customs boundaries. It has simply sold harbour and warehousing services to either one of the transactors.

If the Netherlands served only the other members of the EEC as a port, the creation of an EEC total should suffice to improve the comparisons. But other countries (Switzerland and Austria in particular) also benefit from Dutch harbours and container terminals. This complicates matters somewhat because for example, the Swiss importer might apply the rule of origin to the Netherlands in cases where there has been a consolidation of imports from many origins. Or some value added operation performed outside the Customs zone in Rotterdam may not be reported as Dutch foreign trade in merchandise.

Another obstacle to interpretation is provided by the two Germanies — given that one fails to report its imports to UNSO and the other does not regard as exports the transactions it conducts with its Eastern counterpart. This means that there are extra-exports by the EEC that have no counterpart import records and, more specifically, that there are unreported trade transactions between the two Germanies. The size of this unrecorded leak varies with the relative affluence of East Germany and can only be surmised by looking at other indicators. There are also leaks that affect trade with Japan that will affect the results of comparisons involving Japan and its partner countries. These may be created by operations involving branches of Japanese firms located in S.E. Asia. However, the effect of these cases on aggregate data is not likely to be substantial and should not detract from the value of the analysis using this database.

i) Comparison of growth rates of counterpart statistics

Among the analyses conducted on the basis of the mini-database, one involved comparing growth rates in counterpart statistics, taking the period 1978-85. The assumption was that over that time period, the effect of errors and timing differences would be sufficiently attenuated so that the more permanent effects could be recognized. Moreover, by looking at growth rates, the effect of different valuations would be avoided to a considerable extent. The likelihood is small that the change in the cost of insurance and transportation is sufficiently different from the change in the average prices of the commodities transported to affect growth rates substantially over a period of three or four years. At least in the case of manufactured goods the proportion of transportation and insurance in the total cost is well below 10 per cent as borne out by United States ratios of f.o.b. to c.i.f. Moreover, transport costs would be only related to the weight and volume of the goods transported. Insurance costs, which are related to value, do not represent a significant proportion of total cost. And inter-transport mode substitution is unlikely to add to total cost in any other than exceptional circumstances. Accordingly, if the change in the corresponding cost were sufficient to affect import growth rates relative to counterpart export rates, the effects should be all in one direction and their size should vary with the average bulk of the commodities transported.

These speculations are only partly borne out by fact. Table 1 shows the differences in annual growth rates for counterpart total trade for the pairs of origins and destinations derived from trade among the EEC, North America, and Japan. While relatively small, these differences do not suggest any pattern though there may be some underlying regularities that escape superficial inspection.

Table 1
Differences in Growth Rates for Counterpart Annual Total Trade
for Japan, North America and the EEC, 1978-1985

Country A - Country B	Difference in growth rate for the period ¹			Difference in value of exports in 1982 in millions of dollars ²
	1982/78	1985/82	1985/78	
N.A. - EEC	.6	-.5	-.5	265
N.A. - Japan	-.4	.5	-	-
EEC - N.A.	-.8	-.7	-.8	365
EEC - Japan	1.1	1.9	1.5	90
Japan - N.A.	-.7	-.2	-.5	200
Japan - EEC	-1.2	-.6	-.9	155
Mean Absolute Difference	.8	.7	.7	

¹ Defined as percent growth in $A_x B$ less percent growth in $B_m A$.

² Difference between $A_x B$ and $B_m A$ rounded to the nearest five million dollars. A dash (-) denotes an insignificant value.

Table 2
Differences in Growth Rates for Counterpart Annual Total Trade by SITC Section
Japan in 1978-82 and 1982-85

SITC Section	Japan - North America			Japan - EEC		
	Difference in growth rate for the period ¹		Difference in value of exports in 1982 ²	Difference in growth rate for the period		Difference in value of exports in 1982
	1982/78	1985/82		1982/78	1985/82	
5. Chemicals	.7	-1.6	15	-1.5	.5	5
6. Semi-manufactures	-2.5	.9	60	1.9	-.5	5
7. Transportation equipment	-1.0	-1.0	275	-2.0	-.7	85
8. Miscellaneous manufactures	1.4	-.9	35	-.8	.8	20

¹ Defined as percent growth in $A_x B$ less percent growth in $B_m A$ (A is Japan).

² Difference between $A_x B$ and $B_m A$ in millions of dollars rounded to the nearest five million dollars.

Table 2 shows growth rates for selected SITC Sections between Japan and its two trading partners. The principle involved in simplifying Table 2 was to ignore flows with less than one million dollars in 1982 since such flows do not appear to be sufficiently stable to warrant interpretation.

Discussions about internationally comparable commodity classifications have invariably demanded more rather than less detail. The collection of statistics for purposes of international comparison has induced countries to publish data well beyond the 3-digit of the SITC or its equivalent. A number of third world countries publish data broken down by ten digits corresponding to nationally-annotated international classification, and country. Inspection suggests that flows coded at one digit — where there has seldom been any controversy — are subject to very considerable differences when compared with their counterparts as soon as their absolute value drops to, say, below 50 million dollars. Beyond the first digit of the classification, differences rise very rapidly.

The case of Japanese exports to North America and counterpart imports shown in both tables 1 and 2 warrants further consideration. At mid-point (1982) this trade was valued at about forty billion dollars (US). Total imports grew on average by half of one per cent per annum more than exports. This is an amount of about two hundred million dollars per annum at mid point. Detailed examination suggests that a substantial part of the explanation lies with section 7 of the SITC which includes inter alia all types of transport equipment. There the difference in growth rates is of one per cent per annum on average. It would be interesting to pursue this investigation to determine whether the discrepancy is evenly distributed or whether its incidence is chiefly felt by one particular commodity.

But whatever the causes, these comparisons suggest that over a sufficiently long number of years and for comparatively large portions of total trade flows, differences in growth rates are not large in absolute terms. Notwithstanding this observation, even small differences could play havoc with period-to-period changes in the overall trade balance, particularly when it is close to zero. Moreover, when dealing with a trading partner such as Japan, with exports heavily concentrated in one or two one-digit breakdowns of the commodity classification, the possibilities of compensation for systematic misclassification are comparatively few. This makes it all the more important to understand why bilateral trade as measured by the two counterpart reports has not been moving in step.

Table 3
Changes in X/M Ratios Between 1978 and 1985 and Comparisons with Standardized X/M Ratios Assuming Constancy of SITC Section Shares¹

	North America			EEC			Japan		
	Simple Ratio		Std Ratio	Simple Ratio		Std Ratio	Simple Ratio		Std Ratio
	1978	1985	1985	1978	1985	1985	1978	1985	1985
North America				.90	.91	.92	.85	.86	.69
EEC	.96	.92	.69				.78	.86	.89
Japan	.95	.98	.91	1.00	.94	.86			

¹ The simple ratio is $X/M = (A_x B / B_m A)$. The standardized ratio using common shares is

$$\text{Std ratio} = \frac{1}{M_{78}} \sum_{i=0}^n \frac{x_{it}}{m_{it}} \cdot m_{i78},$$

where m_{it} = current imports for section i of the SITC ($i = 0, 1, \dots, n$),
 m_{i78} = imports in 1978 for section i of the SITC,
 x_{it} = current exports for section i of the SITC, and
 M_{78} = total imports in 1978.

ii) Comparison of the ratios of annual exports to imports

A different kind of analysis was also very revealing. Any import flow should be equal to the counterpart export plus the cost of freight and insurance plus some term which reflects the sum of conceptual differences, timing, and errors. Whereas timing and errors should make their impact felt mostly in the short term, conceptual differences should emerge as the dominant influence in the longer term. For this reason, if the ratio of annual exports to annual imports changes over time this can be due to a combination of the following factors: because of a change in the shares of relatively high c.i.f. to low c.i.f. components; because of a change in the mix of commodities with small relatively to commodities with large-timing differences; because of a change in the proportion of c.i.f. to total value; and because of other factors.

Table 3 shows some aggregate results of this analysis. Against each of the flows involving Japan, the EEC and North America, there are three figures: the simple (current year weighted) ratio of aggregate exports to aggregate imports in 1978, the corresponding ratio in 1985 and the standardized base year weighted ratio assuming that the proportions of imports by section to total imports for each flow of trade remained constant since 1978. These standardized ratios are an approximation to an estimate that removes the impact of variations in the mix of c.i.f. from the variation in the ratio over time. Any difference between the 1978 and the standardized 1985 ratios should therefore be ascribed to other factors.

There are expectations about the way ratios should change over time as a result of the increased share of highly manufactured goods in certain export flows. For example, exports by the EEC to North America and Japan; exports by Japan to the EEC and to North America can be expected to include proportionately more manufactures. Accordingly, the ratio that reflects changes in mix is higher than the standardized ratio. This follows because the relative importance of c.i.f. decreases as the value of a unit of weight or volume increases.

But there are *a priori* exceptions to this prediction shown up by the table. For example, the exports of North America to Japan show a very large gap between the simple and the standardized ratios even though the share of manufactures went up relatively less.

Table 4
Variations in Simple x/m Ratios Between 1978 and 1985 Compared with Standardized
 x/m Ratios with Constant SITC Division Shares

Exports from ... to ...	N.A. EEC	EEC N.A.	EEC Japan	Japan EEC	N.A. Japan	Japan N.A.
SITC Sections						
0 Food	107	102	100	98	98	90
1 Beverages & tobacco	99	100	99	100	99	100
2 Crude materials	100	100	96	93	100	102
3 Mineral fuels	102	117	304	93	103	109
4 Animal & veg. oils	99	98	107	100	101	92
5 Chemicals	102	101	101	97	100	96
6 Manufactured goods	99	101	99	96	98	100
7 Machinery & transport	96	91	95	97	92	100
8 Misc. manufactures	100	100	100	98	97	99
9 Misc. transactions	150	176	163	157	86	92

Table 4 provides a breakdown by SITC sections for the ratios corresponding to trade flows between each of six pairs of trading blocks recorded in the mini-data base. The figures shown are ratios of the simple index at the Section (1-digit) level to the index derived using share of imports at the Division (2-digit) level. They indicate the contribution to the variation in ratios accounted for by changes in the commodity mix. They are no more than indicators partly because they only go down by one level in the commodity classification.

(Figures in the table are derived by taking the index that measures the change in each section of the simple X/M ratio from 1978 to 1985, i.e., (x/m) 1985 divided by (x/m) 1978 and dividing it by a corresponding index in which the standardized (x/m) ratio for 1985 was used and where the division ratios were aggregated using their 1978 shares in their corresponding division. Simple algebra suggests that the ratio obtained R_i is:

$$R_i = 100 \cdot M_{i78} \cdot \frac{X_{i85}}{M_{i85}} \div \sum_{j=0}^{n_i} \frac{x_{ij85}}{m_{ij85}} \cdot m_{ij78}.$$

Notation is similar to that used in table 3. Subscript i denotes the section and subscript j denotes the division within the section ($j = 0, 1, \dots, n_i$). A figure of 104 for example implies that a four percent increase in the current value of exports relative to counterpart imports took place for reasons other than the effect of changes in commodity mix on the c.i.f. component.)

No pattern is readily detectable: there are roughly as many cases which overshoot as cases which undershoot the mark. For the bigger flows, such as North America to EEC or EEC to Japan, the commodity mix is relatively stable as a result of which there is little difference between base and current weighted ratios (except for those sections of the SITC where trade is comparatively small as in the case of Mineral fuels exported by the EEC to Japan). Moreover, these do not move that much over the period. Other flows are very sensitive to the commodity mix which suggests that at lower levels of the classification f.o.b./c.i.f. differences explain a small portion of the variation in x/m ratios over time.

3.2 Analyses Using the Complete World Trade Data Base

Potential country and commodity mis-classifications:

Tables 5 and 6 derived from the complete world trade data base present counts of potential country and commodity misclassification. Table 5 presents a count of the number of cases in 1983 in which there is bilateral trade in a commodity according to one of the reporting countries of a trading pair but not according to the other. This is shown for each level of SITC detail as a proportion of all cases. Table 5A shows the impact on value, again for each level of the SITC. In addition to providing a summary measure of the size of errors, the tables also give an idea of how fast the number of anomalous situations increases as a function of the detail of the classification.

Table 5
Comparison of Foreign Trade Statistics in 1983 – Number of Records¹

SITC Level of Detail	Percentage Reporting No Exports	Percentage Reporting No Imports	Total Percentage
0 (overall)	11	4	15
1 digit	14	7	21
2 digit	16	10	26
3 digit	19	13	32

¹ Percent of number of records of trading pairs with one member reporting no exports/imports while other member reports non-zero trade.

Table 5A
Comparison of Foreign Trade Statistics in 1983 – Value of Records¹

SITC Level of Detail	Percentage Reporting No Exports	Percentage Reporting No Imports	Total Percentage
0 (overall)	.1	–	.1
1 digit	.3	.1	.4
2 digit	.6	.4	1.0
3 digit	1.1	.9	2.0

¹ Percent of value of records of trading pairs with one member reporting no exports/imports while other member reports non-zero trade.
A dash (–) denotes an insignificant value.

Table 6
Comparison of Counterpart Foreign Trade Statistics in Two Selected Years

	1979	1983
Number of records with $x > m$ as percent of all records	35	32
Value of exports where $x > m$ as percent of total exports	41	42
x/m ratio for $x > m$	1.18	1.15
x/m ratio for $x < m$.87	.85

Table 7
X/M Ratios in 1985
 From Three Selected Reporting Countries to Nine Trading Partners

To	From	Canada	U.S.A.	Japan
E.E.C.		.84	.92	.94
Netherlands		1.93	1.34	1.33
Belgium - Luxembourg		1.47	1.51*	1.26
Denmark		1.20*	.74	1.05*
France		.70	.74*	.69*
Germany, F.R.		.69	.81	.98
Ireland		.55	.78	.72*
Italy		.75	.84	.75*
U.K.		.74	.86	.89
Greece		1.00	1.23*	.89*

Table 6 shows changes between two selected years in a number of indicators — related to cases where exports are in excess of counterpart imports. While over a period of four years there has been some change in the percentage of records for which exports exceed imports as well as in the percentage value of total exports for those records, the changes in question are minor. Surprisingly, the cases of x/m account for more than 40 per cent of the total value of trade and as this figure went up fractionally, the proportion of records that accounted for it fell by 10 per cent.

In the case of Table 7 a number of *a priori* predictions are tested against fact. Three reporting exporters — Canada, United States and Japan — and nine reporting trading partners — the members of the EEC other than Spain and Portugal are studied. The tables list the 1985 simple x/m ratios for country to country trade. Other things being equal, the following predictions seem plausible:

- the higher the manufacturing content of a trade flow, the higher the x/m ratio, which is equivalent to saying that the c.i.f./total value ratio is smaller, the more value added is embodied in a commodity. For this reason, the ranking in *ascending* order of ratios should be Canada, United States, Japan;
- in the case of trade with the entrepôt countries — Netherlands, and to a lesser extent, Belgium Luxembourg — country miscoding by the exporter should apply mostly to bulk shipments. For this reason the x/m ratio in *descending* order should be Canada, United States, Japan; and
- x/m ratios greater than one should only occur for entrepôt countries.

For thirty x/m ratios (counting in the three ratios for the EEC as a whole) there are nine cases (entries with * in table) for which the predictions do not hold. Removing Greece's two because the corresponding trade flows are much too small, seven ratios do not behave according to expectations which is still in excess of twenty percent of all cases.

The critical finding in these analyses is that any increase in the level of detail in the classification hierarchy beyond the combined one makes comparisons with counterpart trade very difficult. This is not compatible with the progressive attempts, conducted both nationally and internationally, to expand the detail of the commodity classification and to increase the number of breakdowns by additional classification variables. Even when pooled over time, the transactions in these detailed cells match poorly with their counterparts. Since it cannot be argued that both reports involved in a bilateral comparison are simultaneously correct, the chances are that both contain a significant error component.

4. MAKING USERS AWARE OF ERROR

There are two separate issues. One is to make users aware, that contrary to widespread belief, the foreign trade figures, particularly the detailed figures, may be flawed. The other is to put together a programme to improve the quality of foreign trade data taking advantage of the fact that counterpart measurements of the same transaction exist. A number of proposals to get such a programme underway follow.

The analysis presented in this paper provides that beyond the two-digit level of the commodity classification by country, even annually, neither levels nor year-to-year changes can be taken with complete confidence. Users will probably not take kindly to such a finding, as they already have reason to question the coverage of aggregates in the case of exports. The results of the reconciliation programme between the United States and Canada should not be viewed as limited to the two countries. Others experience the same class of problems to a varying extent. The revelation that, in addition to these weaknesses, data by commodity beyond a certain level can only be used with great caution, could lead to a fundamental change in the perception that users have of foreign trade statistics.

But, if this measure is not taken, no matter how unpopular the news, a belief that has less than full underlying factual support is perpetuated. The detailed commodity figures are used in a variety of ways and the one that is most topical is for purposes of tariff policy. Discussions on these matters rely heavily on detailed figures, seldom on the differences between national and counterpart data, and equally seldom on domestic consumption statistics as a check on the orders of magnitude suggested by Customs data. Moreover, in another use of detailed commodity data, views about industrial and regional policy are formed and actions may be taken on the basis of evidence which this analysis suggests is not solid. Surely it is incumbent on statistical agencies to make users aware of the perceived inadequacies of the data in order to prevent the generalization of their misuse.

5. A PROGRAMME TO IMPROVE FOREIGN TRADE STATISTICS

In addition to providing users with more factual information about error in foreign trade statistics, a programme or programmes to improve the quality of these statistics over time should be formulated. The following are steps which should probably have been taken some time ago:

- i) the c.i.f. component of imports should be measured systematically. Without it, it will not be possible to compare exports with imports across the board. The information is available at the time the import is reported to Customs. Matters such as how often and to which detail will depend on resources and on the urgency to improve the knowledge of users;
- ii) an inquiry should be launched into time lags between exports and imports by commodity category and by country of origin. To make such a study effective, it is probably necessary to count on the co-operation of partner countries; although, if this is not forthcoming, reference to commercial invoices may be an acceptable surrogate;
- iii) on the basis of knowledge of these two elements, a formal method to estimate counterpart imports on the basis of exports should be used and the error of estimate tabulated for future study. If the error of estimate has no significant autocorrelation properties, coding and related errors might explain the difference between the recorded import and its statistical estimate. If, however, the error term does not satisfy these criteria, it should be marked down for future inquiry in co-operation with the partner country;

- iv) obvious surpluses or deficits should be tested against countries likely to play the role of commercial intermediary or entrepôt. For example, an export surplus with the Netherlands for the United States should be tested against corresponding deficits with such countries as the Federal Republic of Germany or France. Econometric methods can be used to disentangle an across-the-board effect of entrepôt services (although they are more likely to be used for bulky and warehousable merchandise) from short-lived effects such as coding error;
- v) for those commodities which are systematic outliers, after all adjustments have been made, either because they persist over time or because they occur across countries, advantage should be taken of the Harmonized System by enlisting the help of the Customs Cooperation Council for the interpretation of its explanatory notes.

Obviously the launching of such a programme requires preparation, approval, and resources. It cannot take place at once nor will it be sponsored by most countries straight away. But the proposals ought not to be shelved as similar proposals were some thirteen or fourteen years ago. There is too much attention paid to the trade statistics to risk delaying their improvement. Their comparison with counterpart data shows that they can only stand increased attention if they are substantially improved or if their analysts become more aware of the limitations of the material on which they test their hypotheses.

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