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Methods of Reconciling World Trade Statistics

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Abstract

Import volumes reported to the United Nations (U.N.) for both food and feed grains from 1962 to 1983 differed 32-52 percent from reported export volumes. Because, in theory, reported import levels should equal those of reported exports, the U.S. Department of Agriculture (USDA) must reconcile trade data inconsistencies to present the most reliable trade numbers to the public. USDA studied the inconsistencies in U.N. import and export data to improve reconciliation methods and thus improve the USDA data base. This report reviews USDA methods of editing trade data, cites examples of possible problems in reconciling food and feed grain data, and examines the causes of data inconsistencies.

Keywords: Trade statistics, agricultural trade, imports, exports, computer software, reconciliation, trade data

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Import volumes reported to the United Nations (U.N.) for food and feed grains from 1962 to 1983 differed 32-52 percent from reported export volumes. Because, in theory, reported import levels should equal reported export levels, the U.S. Department of Agriculture (USDA) must reconcile trade data inconsistencies to provide the most reliable trade data to the public. USDA studied inconsistencies in U.N. import and export data to improve reconciliation methods and thus improve the data base. This report reviews USDA methods of editing trade data, cites examples of possible problems in reconciling food and feed grain data, and examines the causes of data inconsistencies.

This report studies trade statistics on the volume of imports reported to the U.N. by about 110 countries and their trading partners for the period 1962-83. USDA corrects U.N. trade data for several reasons:

- Many centrally planned and developing countries do not report trade for all years.
- Transshipments can obscure the link between exports sent and imports received. A similar problem arises when exports are sent in one reporting period and received in another.
- Changes in political boundaries often render previously collected trade statistics obsolete.
- Some developing countries report only commercial imports.
- The sheer size of the data sets leads to errors in reporting, handling, and updating.

Import and export data for food and feed grains recorded for common transactions differed 32-52 percent over the period 1962-83. The inconsistency varied more by commodity than by year for individual commodities. When only one partner involved in a transaction reported data, the level of inconsistency could not be measured.

USDA used a mix of computer and manual operations to edit the inconsistencies in the U.N. trade data. During this study, the mix of operations was altered, thereby increasing operational efficiency and analytic capacity. These changes focused on increasing the computer tabulation of routine activities; using magnetic tapes for data storage; and using computer methods for recording data sources, correcting errors, and creating tables suitable for publication.

Methods of Reconciling World Trade Statistics

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Problems With Trade Statistics

International trade is often assumed to take place in a single world market where commodities are bought and sold based on quoted prices that reflect supply and demand. Such an assumption implies that trade statistics measure the quantity of market exchanges. The nature of exchanges and commodity use are assumed to be constant over countries and through time.

This assumption is tenuous. Trade among countries can be a gift, an obligation, a transfer between divisions of a multinational corporation, or a commercial transaction (the usual assumption). The commodity traded can be used for domestic consumption, for further processing or storage, for exporting more than once (re-exports), or for speculation. Because the nature of an exchange and commodity use affect the manner with which national ministries record trade, importer and exporter data for the same exchange seldom correspond perfectly.

New forms of exchange, new uses of commodities, production shortfalls, changes in domestic and trade policy, and entry of new market participants change the nature of trade and alter the agreement between import and export data.

This report examines problems with agricultural trade statistics reported by the United Nations (U.N.) and the methods used by the Economic Research Service (ERS), U.S. Department of Agriculture (USDA), to correct these problems.[1] These trade statistics consist of data on import quantities reported to the U.N. by some 110 countries and their trading partners for the period 1962-83.

Consistency of Export and Import Data

Data for import (M) and export (X) quantities reported for the same exchange are consistent when they are exactly equal and are inconsistent when they are not exactly equal. Inconsistency among import and export data can be measured as an absolute difference, a percentage difference, or a ratio (*3*).

Several studies have examined the consistency of international trade statistics. The U.S. Bureau of the Census and Statistics Canada undertook a joint study in 1970 (*18*). They matched import and export reporting documents for the same transaction to determine sources of statistical discrepancy. They considered any physical transfer of merchandise between the United States and Canada a transaction unless (1) the goods were exported with the intention of being returned to the exporter in substantially the same condition as they left the exporter, or (2) the goods were leased from the exporting to the importing company for a period of a year or less (*18*). Inconsistencies in quantity data were attributed to the following:

- The trading countries, usually the exporting country, did not receive reporting documents;
- The two countries classified commodities differently;
- The countries defined merchandise trade transactions differently, leading one country to exclude transactions or categories of transactions included in the other's figures; and
- Processing lags caused one of the two countries to include the same transaction in statistics for a later time period.

The most important of these problems was nonreceipt of export documents. Temporary transactions were also often included in import statistics. Neither problem, however, was attributed specifically to agricultural commodities (*18*).

The Food and Agriculture Organization of the U.N. (FAO) also studied consistency in trade statistics (*3*). FAO reported the following sources of inconsistency:

- Receipt of imports lagged declaration of exports;
- Customs officials paid closer attention to import data than to export data because of tariff and tax administration requirements;
- Importers and exporters classified commodities at different levels of aggregation or for different uses;
- The origin or destination of the commodity was unknown because of storage, further processing, or transshipment; and

[1] This project expands on the work of two earlier USDA studies: (*1, 6*). Underscored numbers in parentheses refer to items listed in the references.

- The importer and exporter defined imports and exports differently.[2]

FAO concluded that import data are probably as good as or better than export data because customs officials inspect imports more closely than exports, exports are underreported (*3*), entrepôt trade is less of a problem for imports than for exports, and the definition of imports used by most countries is closer than that of exports to the theoretical concept.

FAO attempted to reconcile 1979 import and export statistics for beef, wheat, coffee, tobacco, soybeans, and cotton in followup research (*3*). The reconciliation process was divided into two steps: computer and manual operations. In the computer operations, FAO used the following principles to create an import and export matrix table:

- If statistics from only one side of the exchange were available, they were added to the matrix;
- If both import and export statistics were available and the range of their ratio (R = X/M) was between 0.8 and 1.2, the import statistics were added to the matrix; and
- If the ratio of exports to imports fell outside of the 0.8-1.2 range, a question mark was added to the matrix.

In the manual operations, FAO applied the following principles to create the matrix table.

- The official totals of the importing and exporting countries were used in the matrix as much as possible;
- Large discrepancies were analyzed using all available trade information;
- Transshipments were isolated and a direct link between the supplier and the consumer was established as much as possible;
- Columns were made consistent with row totals; and
- Residuals were made consistent with other information.

In this manner, FAO generated a trade matrix designed to cover 90 percent of world trade within a 20-exporter by 30-exporter matrix. FAO concluded that additional information about monthly trade, shipping distances, and valuation problems would be needed to complete its procedures and to produce FAO-reconciled trade tables for regular publication (*3*).

The International Food Policy Research Institute (IFPRI) studied trade statistics reported by FAO and by USDA's Foreign Agricultural Service (FAS). FAO and FAS trade data consist of statistics on world imports and exports rather than data on country of origin and destination as reported by the U.N. For the commodities common to FAO and FAS data bases, IFPRI reported that 60 percent of the 1,200 pairs of FAO/FAS country data on cereal imports in 1965, 1970, and 1975 differed by more than 20 percent (*10*). IFPRI cited the following reasons for discrepancies in FAO and FAS data:

- FAO reported calendar year data, while FAS reported marketing year data;
- FAO reported data for many small developing countries that FAS did not include; and
- FAO and FAS used different sources of unofficial information and undertook different degrees of historical revision.

The most important reason for the discrepancy between FAO and FAS data was the difference in the reporting period. Averaging data over a 6-year period failed to remove the discrepancy.[3]

Classification Issues

Conflicting definitions of commodity and transaction classifications pose an important source of inconsistent trade statistics. Harmonizing administrative and statistical methods between countries has been a goal of international negotiations since the founding of the League of Nations. General Agreement on Trade and Tariffs (GATT) has sponsored the most recent effort to harmonize administration standards and customs procedures of countries. These new procedures will be integrated into U.S. practice, if they are approved by Congress, on January 1, 1987 (*13*). This section uses statistics on rice trade to illustrate the nature of classification problems.

Commodity Definitions. Import and export data for U.S. and Thailand rice illustrate problems in reconciling country statistics. During the period 1978-80, the United States was the world's largest rice exporter, with 24

[2]Also see (*8, 13*).

[3]The IFPRI study also compared totals by region and world, by special and general trading systems, and by economic classification (*10*).

percent of the world market, and Thailand was the second largest exporter, with 22.3 percent of the market (*11*). The Thai and U.S. systems for classifying rice exports depend on the rice types produced in each country and on the preferences of Thai and U.S. customers (table 1). Several differences in these classifications are apparent:

- The U.S. classification system emphasizes whole kernel or "head" rice, while the Thai system focuses on percentages of broken kernels;
- The U.S. system classifies rice kernels by size (that is, long, medium, or short), while the Thai system classifies them by glutinous content; [4]
- The U.S. system breaks out rice going into food aid shipments but not rice used for ship stores, as reported in Thai statistics (and vice versa); and
- Only Thailand exports rice flours.

Getting U.S. and Thai export categories to correspond is difficult. Similar problems arise in reconciling the U.S. rice import classification system with either the U.S. or Thai export classification (table 2). For example, neither the U.S. nor Thai export classifications break out Basmati or broken brewer's rice.[5]

Several other problems arise when the rice export categories listed in table 1 are reconciled with import categories for reporting aggregate statistics on rice trade. First, the rice reported by the United States as a

[4]Although the glutinous content of rice is inversely related to the length of the kernel, only Thailand produces a glutinous rice variety. Thai consumers prefer glutinous (sticky) rice.

[5]Basmati rice is an aromatic rice exported primarily by Pakistan.

Table 1–Customs classifications of U.S. and Thai rice exports

United States		Thailand	
Code	Name	Code	Name
130.5000	Rough rice	100689	In the husk or paddy
NA	NA	100690	In the husk, glutinous
130.5520	Brown, long	100601	Cargo rice, 100 percent
130.5540	Brown, medium	NA	NA
130.5560	Brown, short	NA	NA
130.5580	Brown, mixed	NA	NA
131.3010	Relief, milled	NA	NA
131.3015	Parboiled, long	100650	Broken, parboiled
131.3025	Parboiled, other	NA	NA
131.3030	Milled, long	NA	NA
131.3040	Milled, medium	NA	NA
131.3050	Milled, short	NA	NA
131.3060	Milled, mixed	NA	NA
131.3070	Broken	100642	Broken, A1–super
NA	NA	100643	Broken, A1–special
NA	NA	100644	Broken, A1–ordinary
NA	NA	100659	Broken, A1–other
NA	NA	100669	Broken, glutinous
131.3080	Rice, n.e.c.	100662	Glutinous, 5 percent
NA	NA	100663	Glutinous, 10 percent
NA	NA	100660	Glutinous, 25 percent
NA	NA	100665	Glutinous, 35 percent
NA	NA	100661	Glutinous, 100 percent
NA	NA	100679	Glutinous, other
NA	NA	100680	Rice for ship stores
NA	NA	110103	White rice flour
NA	NA	110104	Glutinous rice flour

NA = Not available.
n.e.c. = Not elsewhere classified.
Sources: (*12, 17*).

food aid export will frequently not be reported by the recipient nation as an import. Developing countries, particularly those that receive food aid shipments, often record only commercial transactions in import statistics because only commercial transactions require use of foreign exchange, a scarce commodity. Second, the rice recorded for use as ship's stores by Thai statistics will likely never be imported by a second country because the rice is destined for consumption in transit. Third, determining whether milled or parboiled rice is a transshipment may be difficult. This rice may have been imported as rough (or paddy) rice for processing and re-exporting. This could happen regardless of the manner in which the country in question normally handles transshipments for statistical purposes because the decision to re-export may be made subsequent to importation. Transshipments often result in double counting of international transactions. Fourth, neither the U.S. nor Thai statistics use Standard International Trade Classification (SITC) codes for customs administration. Consequently, reconciling country statistics into an internationally comparable series is not likely to be a straightforward task.

Classification of Transactions. The terms "import" and "export" are defined differently in different countries. Two widely recognized trading systems exist: the special trade system and the general trade system. The special trade system is based on the concept of "clearance through customs for home use." Imports and exports are recorded, therefore, only when they have been earmarked for domestic use. Under the general trade system, all goods crossing the national boundaries are recorded (*13*).

Special trade imports include imports declared directly for home use from abroad and from national free zones or free ports, imports declared for processing in warehouses, or imports stored in bonded warehouses. Special trade exports include exports of goods of national origin, exports from warehouses for processing, and re-exports of imported goods in free circulation. In contrast, under the general trade system, all commodities that enter the country (imports) and all commodities that leave the country (exports) are recorded. A distinction, however, is often made between national exports and re-exports. Commodities of national origin also include imported items that have undergone substantial processing (*13*).

An agreement on the "Simplification and Harmonization of Customs Procedures," signed at Kyoto, Japan, in May 1973, will standardize reporting procedures among the participating countries. To date, the United States, Japan, and the European Community have accepted the Kyoto Convention.[6] The U.N. has published a list of the conventions followed by the different nations (*14*).

Aggregation and Valuation Problems

Import and export statistics tend to become more consistent at higher levels of aggregation; however, aggregation has its own problems. These problems stem from two sources: (1) the greater the level of aggregation, the more likely that dissimilar commodities (such as apples and oranges) are being grouped together; and (2) the value of the commodities grouped together provides the only meaningful unit of measurement at higher levels of aggregation.

Aggregation Problems. The rice example best describes possible aggregation problems. For rice imports, the primary figure quoted is for rice imports, SITC 042. This number would be derived for U.S. monthly imports by multiplying each category of rice cited in table 2 by an appropriate conversion factor (table 3) to yield an equivalent figure for rough rice units. This same procedure is used with milled rice data to calculate a milled rice equivalent. These two tables–rough and milled rice equivalents–are then compared for consistency. The equivalent import figures for milled rice are then summed and made into an annual import figure and reported to the international community as the official U.S. import figure for the year.[7]

Several errors can result from this or a similar procedure. First, variation in the procedure can lead to a situation in which the exporter reports in rough rice equivalents and the importer reports in milled equivalents. Alternatively, milled and rough rice can be added together without conversion to any common unit. In the rice trade,

[6]By 1982, 31 countries had agreed to the convention (*13*).

[7]IFPRI reported two problems specific to rice trade statistics: "First, world export and import totals are not fully reconciled; second, due to political boundary changes, treatment of data for specific countries may be inconsistent over time." Although the IFPRI study used USDA and FAO trade data, these problems also exist in U.N. trade data (*11*).

Table 2–Customs classifications of U.S. and Thai rice imports

United States		Thailand	
Code	Name	Code	Name
130.5000	Rough rice	NA	NA
130.5600	Basmati	NA	NA
130.5800	Other	NA	NA
131.3000	Milled rice	NA	NA
131.3300	Brewer's, broken	NA	NA
131.3500	Edible meal, flour	NA	NA
NA	NA	110809	Rice starch

NA = Not available.
Sources: (*12, 17*).

Table 3–Rice conversion factors, 1979[1]

Product[2]	Factor for converting:			
	CWT rough rice to lbs. product	Lbs. of product to CWT of rough rice	Lbs. of milled rice to lbs. of product	Lbs. of product to lbs. of milled rice
Rough rice	100.0	0.01000	1.5038	0.6650
Brown rice	82.0	.01220	1.2330	.8110
Milled rice[3]	66.5	.01504	1.0000	1.0000
Brewer's rice	3.0	.33333	.0451	22.1667
Rice bran	10.9	.09174	.1639	6.1009
Polished rice	1.6	.62500	.0241	41.5625
Rice grits	69.5	.01439	1.0451	.9568
Rice flour	64.2	.01558	.9654	1.0358
Rice starch	49.1	.02037	.7383	1.3544
Precooked rice	63.9	.01565	.9609	1.0407
Precooked,dehydrated rice	60.5	.01653	.9098	1.0992
Rice cereals:				
Puffed rice	66.5	.01504	1.000	1.0000
Rice flakes	61.2	.01634	.9203	1.0866

CWT = Hundredweight.

[1]Rice conversion factors vary substantially, depending on the type and variety of rice milled. These data are based on national averages over a period of time and are not a perfect measure of any crop's milling yield.

[2]Miscellaneous factors relating to rice: 1 bushel of rough rice equals 45 pounds; 1CWT of rough rice equals 2.22 bushels; and 1 barrel of rough rice equals 162 pounds or 3.6 bushels.

[3]Excluding brewer's rice.

Source: (*16*).

however, trade figures are generally understood to be reported in milled equivalents.[8]

Second, conversion factors vary by crop, milling technology, rice variety, and country. Average rice milling rates, for example, vary from 60 percent for Colombia to 72.8 percent for Japan. While exporters probably use the appropriate conversion factors for their own rice, importers who must receive rice from multiple sources probably do not. Third, by far the largest source of statistical inconsistency for the rice trade comes from discrepancies in the time period in which imports and exports are recorded. Rice is produced worldwide. Accordingly, shipping distances can be long, and the number of crops per year and the harvest season can vary widely (*18*). Consequently, exports could be shipped in one period and imports could be received in another. Fourth, not all countries report statistics on a Gregorian calendar year (*13*).

Valuation Problems. Value data consist of quantity data multiplied by a price. This relationship implies that value data suffer from all the problems of quantity data plus the special problems associated with settling on a price. This section focuses on pricing problems.

[8]USDA uses rough rice equivalents in recording domestic trade and milled rice equivalents in recording international trade.

Arriving at a price can be difficult for several reasons:

- Trade and barter agreements can be based on quantities without stated prices;
- Goods may be sold on consignment;
- Re-imports or re-exports can go unsold;
- Private agencies or persons can make gifts;
- Articles can be sold to cover customs duties; and
- Customs authorities can confiscate contraband (*13*).

In other words, not all trade involves a commercial transaction.

Prices vary among markets, which may motivate exporters and importers to report the prices quoted in different markets. For example, if grading classifications vary within import and export markets, as in rice trade between the United States and Thailand, then the importers and exporters may have some latitude in selecting the classification under which their rice is recorded. Because differences in market prices are an important incentive for trading, this problem is an important source of discrepancies in import and export values.

Prices are often quoted in terms of national currencies, and exchange rates vary considerably over time. For example, if exchange rates vary by 20 percent during a reporting period, 90 percent of the commodity traded during this period may be traded at the most advantageous exchange rate. The value of the trade, however, may be recorded at the average exchange rate for the period. Further problems arise when multiple official exchange rates exist or when a substantial volume of illicit trade takes place. For these reasons, the prices recorded for customs purposes might better be considered a legal, rather than an economic, entity; and as such, pricing conventions have an important impact on the prices reported. The most widely recognized conventions are to report export values f.o.b. (free on board) and import values c.i.f. (cost plus insurance and freight). Nevertheless, 18 countries still report import values f.o.b. (*13*).

Research Methods

ERS' objective in this study was to improve the data base for trade in food and feed grain products in view of the problems inherent in trade statistics. To minimize the number of problems requiring attention and to ensure the most reliable trade numbers, the project focused on editing data on import quantities. U.N. trade statistics were the primary source of data.[9]

The mix of computer and manual methods used to edit U.N. trade data was altered and improved as the project progressed. These changes focused on increasing the computer tabulation of routine activities; using magnetic tapes for data storage; and using computer methods for recording data sources, correcting errors, and creating tables suitable for publication. These improvements increased productivity and analytical capacity.

This section divides the editing process into these components: computer operations, editing (that is, manual operations), data entry, and project coordination. Problems, alternative methods, and other aspects of the approach are discussed.

Computer Operations

The computer operations involve the following steps:[10]

- *Assembling the data.* FAO and U.N. trade data for each commodity are transferred from tape to disk files on the mainframe computer (a large computer maintained by USDA's Washington Computer Center). These files are created: FAO import data, U.N. import data, and U.N. export data. These files and a concordance file containing country or region codes are required to print the tables for editing.

- *Printing the tables for editing.* The tables are printed for editing. They list each importing country and its trading partners, and display data reported by the importer, when available, and data reported by the exporter when import data are unavailable. Table and FAO trade totals given at the bottom of the tables are compared for agreement.

- *Entering the data.* U.N. trade data are transferred (downloaded) from the mainframe computer to the microcomputer. Changes are manually entered into the data set, after which the data are stored on floppy disks.

- *Storing the tapes.* The data are returned (uploaded) to the mainframe computer where they are reformatted, stored on tape, and printed out to check for errors. An updating routine permits corrections to be made in the file as needed.

- *Printing the publication tables.* Market shares, growth rates, and regional tables are printed (*5*).

The Tables Used in Editing. Table 4 is an example of the computer tables used in manual operations. A set of such tables must be run for each commodity. This printout lists each importing country and its trading partners by 12-year periods, and contains data reported by the importer (M) when they are available. When import data are unavailable, data reported by the exporter (X) are entered. When both import and export data are available, the program prints the import data and records the percentage difference between the two with a single letter.[11] These numbers are summed and displayed opposite the import total reported by FAO in its trade yearbook. The table total can be checked against the FAO total for consistency. Beneath the FAO total are printed the sum of the import observations for quantity and value data, the sum of the export observations for quantity and value data, and average unit prices for import and export data.

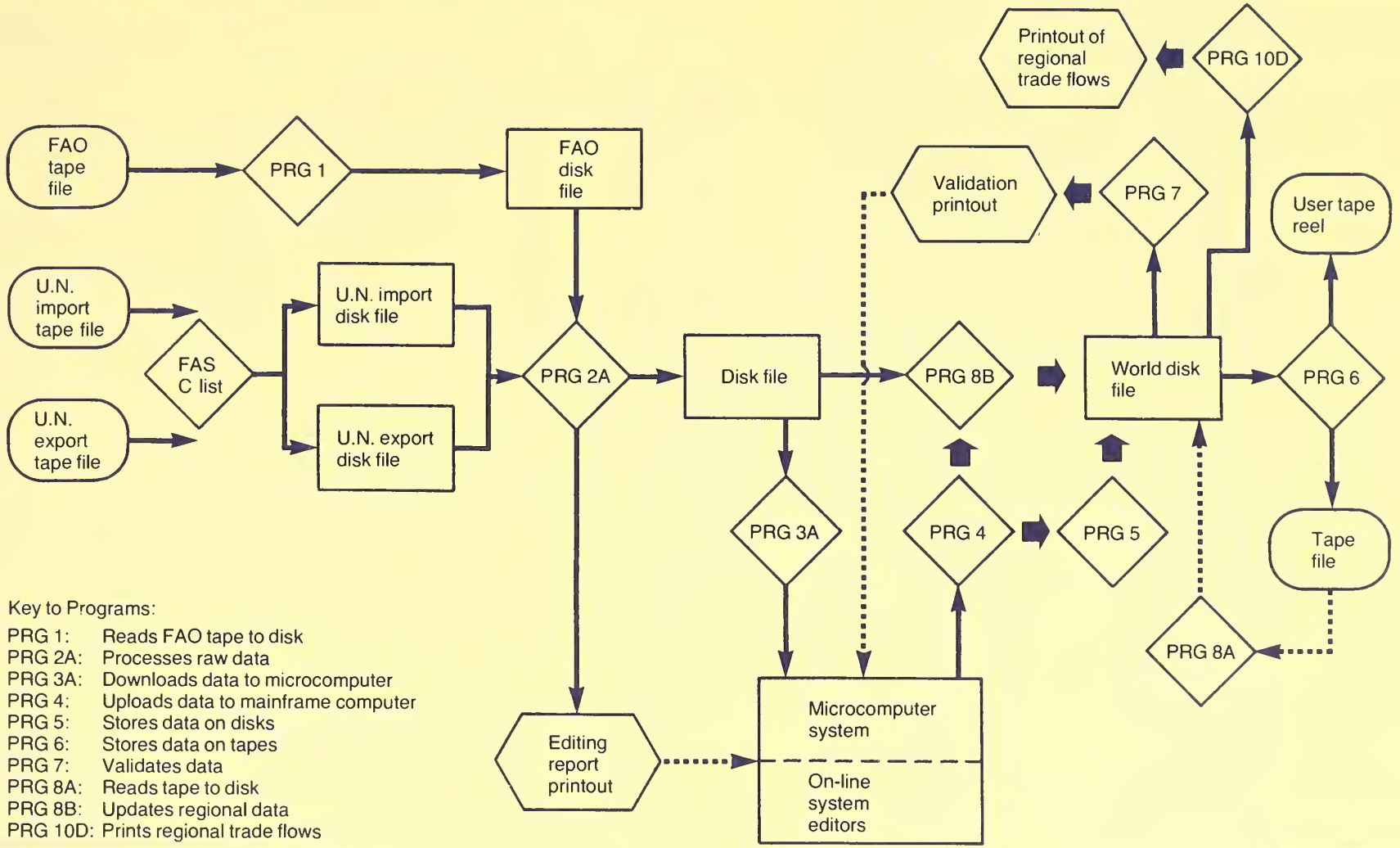
A second printout summarizes the source and consistency of import and export trade observations (table 5). This printout summarizes how many times import and

[9]Computer procedures used in the editing process are documented in (*5*).

[10]The first four steps are discussed in (*5*).

[11]An "A," for example, indicates that import and export observations differ by 10 percent. A "B" indicates a 20-percent difference, etc.

Outline of the World Trade Project Computer System



Key to Programs:

PRG 1: Reads FAO tape to disk
PRG 2A: Processes raw data
PRG 3A: Downloads data to microcomputer
PRG 4: Uploads data to mainframe computer
PRG 5: Stores data on disks
PRG 6: Stores data on tapes
PRG 7: Validates data
PRG 8A: Reads tape to disk
PRG 8B: Updates regional data
PRG 10D: Prints regional trade flows

export data enter the initial processed file and the final edited file, the average percentage difference between import and export data, the number of changes made, and the total number and volume of import observations. Changes in the composition of the data set can be determined by running this program before and after editing a file, as illustrated for wheat in table 9.

Manual Operations

The computations used in this project were initially tabulated by hand, as in earlier ERS publications (*1, 6*). Import numbers reported to the U.N. were copied from reference materials for study and permanent storage from country trade yearbooks. Export figures for a limited number of major exporters were also added.

Initially no attempt was made to substitute computer tabulations for manual tabulations, although the ERS trade yearbooks were constructed from computer tabulations of U.N. import and export statistics. Through implementation of procedures outlined in the previous section, computer tables were used for the first time as the basic worksheet. The use of computer tables increased the number of observations in the data base in two ways. First, all figures on exports were made available to the analyst for the centrally planned and developing countries that did not report import statistics to the U.N. Although about half of these observations were discarded in manual operations in favor of import data from country trade yearbooks, the procedure made possible the addition of 20-30 percent more observations to the file. Second, because the computer printout became the worksheet, the incentive to delete trades of small quantity by rounding numbers was eliminated. These small trades made up a significant portion of world trade for many commodities. For example, the number of observations in the wheat file increased from roughly 12,000 under the manual procedure to over 33,000 using the new procedure.

Table 4–Example of a computer table used to update Greece's import file

IMPORT (M) AND EXPORT (X) UNITED NATIONS TRADE DATA
IMPORT DATA IS PREFERRED WHEN AVAILABLE
WHEN M AND X EXIST, THE DIFFERENCE IS RECORDED
DIFFERENCES: A LT 10 %, 10 % LE B LT 20 %, ..., * GE 90 %
DIFFERENCES: N GT −10 %, −20 % GT O LE −10 %, ..., + LE −90 %

RICE IMPORTS, SITC 042

REGION: EC-10

TRADING PARTNERS GREECE	300	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
ARGENTINA	32	.	.	.	.	.	.	.	0.5M	0.0M	.	.	.
BELGIUM-LUX	56	.	.	.	.	.	.	0.0X	0.8P	1.4P	1.9B	.	.
CYPRUS	196	.	.	.	.	.	.	.	.	0.0M	.	.	.
FRANCE	250	.	.	.	.	0.0A	0.0A	0.0O	0.0P	0.0R	.	.	.
GERMANY FR	280	.	.	.	.	.	.	.	0.0A	0.1A	0.1A	.	.
ISRAEL	376	.	.	.	.	.	.	0.0X	.	.	.	.	.
ITALY	380	.	.	.	.	.	0.1R	0.0P	1.2A	1.2F	0.1B	.	.
NETHERLANDS	528	.	.	.	.	.	0.0X	0.0X	0.0X	0.1*	0.0O	.	.
SPAIN	724	.	.	.	.	.	.	0.0X	.	.	.	.	.
SURINAM	740	.	.	.	.	.	.	.	.	.	6.5M	.	.
THAILAND	764	.	.	.	.	.	.	0.0X	.	0.0X	.	.	.
UK	826	.	.	.	.	.	0.0X	0.0X	0.0X	0.0X	0.0X	.	.
U.S.	840	.	.	.	.	.	0.0+	0.0+	0.0+	7.1*	0.0M	.	.
TOTAL IMPORTS		0.0	0.0	0.0	0.0	0.0	0.2	0.1	2.5	10.0	8.6	.	.
FAO IMPORTS		.	.	.	.	.	0.1	0.0	2.5	8.4	.	.	.
SUM OF QTY IMPORTS		.	.	.	.	.	0.1	0.0	2.5	10.0	8.6	.	.
SUM OF QTY DIMPORTS		.	.	.	.	.	0.2	0.2	6.6	3.9	1.9	.	.
SUM OF IMPORT VALUES		.	.	.	.	.	104.0	25.0	1960.0	5229.0	5258.0	.	.
SUM OF DIMPORT VALUES		.	.	.	.	.	144.0	101.0	2974.0	3488.0	2675.0	.	.
MEAN IMPORT PRICE		.	.	.	.	.	748.2	925.9	774.1	523.7	609.0	.	.
MEAN DIMPORT PRICE		.	.	.	.	.	682.5	619.6	450.7	888.4	1404.2	.	.

The editing procedure involves data assembly, a consistency test, and analysis of import and export inconsistencies. In data assembly, trade data are brought together in the worksheet from the U.N., FAO, country trade yearbooks, and miscellaneous publications from international trade organizations. Once these data are entered into the worksheet, table totals are completed and compared with the FAO totals for importing countries. Origin and destination data judged to be unrealistic or inconsistent with the FAO import totals are deleted from the table. Rejected data are then analyzed to see if transshipment relationships can be identified.

The computer procedures outlined above permit identification of several classes of transshipments that are difficult to track in data obtained exclusively through manual operations. First, the destination of exports is often unknown at the time of export. These exports are classified as exports to "ships," "areas not elsewhere specified (n.e.s.)," or similar designations. The destination of these shipments can sometimes be identified by isolating imports of the same quantity that have no corresponding export reported. Second, countries will occasionally report exports to a coastal nation, particularly in Africa or west Asia, but the nation designated will not acknowledge the import. In this case, a neighboring country may sometimes report an import of the same quantity with no corresponding export reported. A second explanation is that many food aid recipients report only commercial transactions in their import statistics. Third, countries will sometimes report the export of a commodity that they have never produced (such as soybeans in West Germany) or cannot physically have shipped (such as Swiss maritime exports). In some cases, the country

Table 5–Example of the computer summary table used to analyze rice trade statistics

UNITED NATIONS TRADE DATA
RICE TRADE, SITC 042

YEAR	WORLD IMPORTS IN 1000 MT	ONLY IMPORT DATA REPORTED (NUMBER OBS)	ONLY EXPORT DATA REPORTED (NUMBER OBS)	DIFFERENCE BETWEEN M AND X DATA WHEN BOTH ARE AVAILABLE (%)	USDA CHANGES NUMBER	USDA CHANGES % WORLD IMPORTS	TOTAL NUMBER OF IMPORT AND EXPORT TRADES
62	4161.1	260	288	0.50	0	0.00	761
63	5750.4	223	318	0.48	0	0.00	813
64	5398.3	197	296	0.48	0	0.00	749
65	5930.7	203	313	0.45	0	0.00	813
66	5823.5	266	295	0.45	0	0.00	896
67	5035.6	261	283	0.44	0	0.00	887
68	5227.4	123	236	0.36	0	0.00	520
69	5677.5	277	313	0.39	0	0.00	931
70	6976.4	293	363	0.44	0	0.00	1062
71	6555.7	300	376	0.48	0	0.00	1069
72	6025.2	308	305	0.51	0	0.00	1012
73	5846.2	318	329	0.52	0	0.00	1045
74	7131.5	377	330	0.47	0	0.00	1091
75	7158.3	319	313	0.50	0	0.00	998
76	7602	281	371	0.49	0	0.00	1021
77	9582.8	249	417	0.51	0	0.00	1033
78	8507.8	259	439	0.52	0	0.00	957
79	10429.6	377	364	0.55	0	0.00	1182
80	10561.3	370	393	0.51	0	0.00	1138
81	11359.1	365	416	0.55	0	0.00	1159
82	10459.4	304	441	0.53	0	0.00	1092
83	5638.5	250	393	0.53	0	0.00	804
TOTAL	156839.0	6180	7590	0.49	0	0.00	21030
Percent of total number of transactions[1]		0.29	0.36	0.35	0	0.00	100

OBS = Observations.

[1]For example, (7590)/(21030) = 0.36. In the case in which the mean level of inconsistency is given instead of the total number of transactions (that is, 0.49), the total number of transactions is calculated by subtracting the totals for the other two columns from the grand total. That is: 21030 − (6180 + 7590) = 7260, (7260)/(21030) = 0.35.

of origin is apparent from the country's import statistics. Fourth, sometimes entrepôt trade is apparent because of large shifts in historically consistent trade relationships. War, the formation of free trade areas, and changes in policy are often responsible for these shifts, and provide information on the origin and destination of such trade.

Data Entry

Changes in the data base requested by the analyst are entered into a spreadsheet maintained on a microcomputer for each region of the world. Regional files are maintained because world files are frequently too large for microcomputer processing. The spreadsheet is formed by downloading processed regional data from world files stored on mainframe tapes. Once these changes have been made, the files are uploaded onto the mainframe for further processing and tape storage. Regional files sometimes can be merged into a world file on the microcomputer before they are uploaded onto the mainframe.

The chief motivation for entering data on the microcomputer is cost. Updating large commodity files can take a week or more. The downloading and uploading procedures for each file can take as long as a day; but once undertaken, the data can be examined repeatedly without additional expense or effort. Printing is also possible without undue effort. Once the data have been entered and the files have been uploaded, additional corrections can be entered interactively on the mainframe, thereby keeping telecommunication expenses to a minimum.

Several errors may result from this procedure primarily because data are stored by year (that is, by individual observations) on the mainframe and for 12-periods (or rows of observations) on the microcomputer. First, data can be lost in uploading through errors in spacing in the microcomputer records because the mainframe program searches for numbers in particular columns of each record. Second, entire lines of data from the microcomputer can be lost when country names are misspelled because these names link observations to the correspondence file containing country and region codes. Third, a region from the world file can be lost or duplicated through errors made in merging the regional files into a world file because regional files are uploaded one at a time. These errors occur in addition to the typical problem of wrong entries entered correctly. The upload program can identify the first two categories of errors in the printed tables because the program rejects these observations and flags them at the beginning of computations. In the process of printing the data and reviewing the corrected observations, other errors can be identified.

Empirical Issues

This section reviews results of the study to highlight the problems inherent in using unedited trade statistics reported by country of origin and destination.

Trade Data Coverage

The concept of consistency is found in the literature on the quality of trade statistics, but recent literature says little about data coverage (7). Coverage refers to the degree to which import or export observations exist for all transactions. Coverage is complete when a one-to-one correspondence exists between import (export) observations and actual exchanges.

Import and export data provide unequal coverage of international exchanges. Table 6 summarizes the import and export composition of the U.N. trade data used for the food and feed grains edited in this project. Coverage is measured by the number of observations that can be derived from only export (import) data. For example, rice data were available only from the importer 29 percent of the time, only from the exporter 36 percent of the time, and from both importer and exporter 35 percent of the time.

The use of export statistics substantially increases trade data coverage. Coverage increased from 22 percent for rye to 46 percent for wheat flour through the use of export data (table 6). Because rye is traded primarily among developed countries and flour is most often traded between developed and developing countries, export statistics appear to increase coverage because many centrally planned and developing countries do not report trade statistics to the U.N.

The increase in coverage cited above applies to coverage of transactions, not countries. For wheat, export coverage extended the number of transactions in the data base by 35 percent. In contrast, the number of countries increased by only 26 percent because trading partners are listed only for the year in which they have trade (table 7). Accordingly, trading partners are duplicated as observations are aggregated.

Table 7 verifies this observation. Countries were grouped according to six criteria: (1) those reporting only imports, (2) those reporting only exports, (3) those reporting a difference between imports and exports of less than 20 percent, (4) those reporting a difference between imports and exports of 20-50 percent, (5) those reporting a difference between imports and exports of 50-75 percent, and (6) those reporting a difference in the two greater than 75 percent. The composition of these categories has been further examined for corn and wheat.

The two smallest groups (countries reporting only imports and countries reporting a difference between imports and exports of less than 20 percent) included countries with no significant corn trade. Rather, these groups included mostly small island nations. The group reporting only exports consisted of centrally planned countries, developing countries, and island nations. Developed countries and most of the important corn traders had trade statistics in which the import and export figures differed by at least 20 percent.

The groupings for countries trading wheat differed slightly from those for countries trading corn. The group reporting a difference between imports and exports of less than 20 percent was larger and contained a larger number of important trading nations. In addition, a larger number of important traders fell into the group reporting a difference of 20-50 percent. Together, these observations for corn and wheat show more clearly that export statistics extended coverage in the trade file to countries which do not report.

Table 6–The average coverage of international transactions and inconsistency of trade data for food and feed grains, 1962-83[1]

Commodity	Coverage			Inconsistency when both M and X are recorded	Total	
	Imports only (M)	Exports only (X)	Both		Observations	Import volume
	Percent				*Thousands*	*Million metric tons*
Wheat	23	35	42	40	11	1,210
Rice	29	36	35	49	21	157
Wheat flour	19	46	35	50	18	92
Corn	34	30	36	50	13	931
Barley	30	27	44	38	7	222
Rye	28	22	50	32	2	15
Oats	29	25	46	42	5	30
Grain, n.e.s.	36	27	38	52	12	173

[1]"Coverage" refers here to observations added to the data set by the source indicated. "Inconsistency" is the absolute value of the percentage difference between the import and export observations of the same transaction. Mathematically: ABS((M – X)/X).

Source: A computer tabulation of U.N. and country trade yearbook statistics.

Table 7–Distribution of countries with respect to trade data coverage and inconsistency for food and feed grains, 1962-83

Commodity	Counties and destinations observed		Coverage		Mean level of inconsistency when both M and X are recorded			
			Imports only (M)	Exports only (X)	LT 20%	20-50%	50-75%	75% +
	Number		*Percent*[2]					
Wheat	188	100	1	32	5	30	23	8
Rice[1]	197	100	1	28	51	13	5	3
Flour[1]	199	100	0	28	42	24	5	2
Corn	197	100	1	26	12	41	13	7
Barley	157	100	5	28	19	36	8	4
Rye	103	100	16	39	19	19	4	3
Oats	151	100	8	31	17	25	12	7
Grains, n.e.s.	181	100	3	29	9	24	27	8

LT = Less than.
[1]"Inconsistency" is (M – X)/X. For other commodities, it is ABS((M – X)/X.
[2]Percentages may not sum to 100 due to rounding.
Source: A computer tabulation of U.N. and country trade yearbook statistics.

Export data sometimes provide improved coverage in another sense. For many developing countries, import data are incomplete because aid and barter transactions are omitted. When only commercial imports are reported, export statistics may provide a more reliable estimate of the total trade volume.

Import and Export Consistency

When import and export observations for a transaction exactly match, they are consistent. The inconsistency of import and export statistics varies from 32 percent for rye to 52 percent for miscellaneous grains.[12]

The inconsistency of import and export statistics on food and feed grains shows a degree of variance comparable to the variation in country import coverage because when import (or export) data are not reported, the level of inconsistency cannot be calculated. Because developing countries often do not report imports and most trade is done by developed countries, statistics on trade by developing countries appear no more or less inconsistent than that of developed countries, contrary to expectations. This relationship could change if a larger percentage of developing countries traded with other developing countries.

Information developed from data on food and feed grains can illustrate several observations regarding import and export inconsistency. Table 6 shows that a significant degree of correlation ($r = 0.80$) exists between the percentage of inconsistency and the total number of observations. This relationship implies that the more frequently a commodity is traded, the higher the likelihood of inconsistency in its trade data.[13] This relationship would exist if, as the frequency of trade increased, the likelihood of transshipment also increased.

Although the likelihood of transshipment appears to vary by commodity, the probability of transshipment for a given commodity does not appear to vary much from year to year, except perhaps for rice. This observation can be derived from the correlations in table 8. Correlations between the total number of trade observations and the mean percentage of inconsistency varied from −38.7 percent for rye to 60.4 percent for rice over the period 1962-83.

Table 8 suggests another relationship with respect to the inconsistency of trade statistics. Table 8 lists growth rates and simple correlations between the mean percentage of inconsistency and other observations summarized for food and feed grains, as in table 5. The total volume of trade does not appear to affect the level of inconsistency,[14] but variation in the volume of trade does affect inconsistency in trade data for some commodities,

[12]For the United States, miscellaneous grains consist primarily of grain sorghum. More generally, they also include trade in millet, canary seed, and buckwheat (*15*).

[13]This relationship appears to run counter to what we would normally expect, which is that the more frequently a commodity is traded, the more experienced the customs authorities would become in recording its transactions.

[14]Grains, n.e.s., are one exception.

Table 8–Selected relationships pertinent to import trade and the consistency of import/export statistics for food and feed grains, 1962-83[1]

Commodity	Rate of growth in import volume	Simple correlations between:		
		Total import volume and mean percentage inconsistency	Deviations from a linear trend in total imports and mean percentage inconsistency	Total number observed and mean percentage inconsistency
	Percent			
Wheat	3.9	−6.9	−68.4	22.6
Rice	3.4	−12.5	19.6	60.4
Wheat flour	1.6	−7.1	−7.8	2.2
Corn	7.3	16.8	57.9	41.2
Barley	4.6	18.7	−7.5	2.0
Rye	1.1	−19.7	−21.9	−38.3
Oats	−1.3	32.5	−11.3	10.9
Grain, n.e.s.	5.4	56.8	−7.6	5.8

[1]"Inconsistency" is the absolute value of the percentage difference between import and export observations of the same transaction. Mathematically: ABS((M − X)/X).

Source: A computer tabulation of U.N. and country trade yearbook statistics.

particularly wheat and corn. This relationship is reasonable if the variation were to affect the probability of transshipment. Table 8 suggests that unexpected contingencies (that is, deviations from trend in trade volumes) motivate wheat traders to accelerate shipments and corn traders to stockpile grain. Direct shipment and stockpiling both affect the likelihood of transshipment. Other food and feed grains do not appear to be strongly affected by unexpected contingencies.

Two further observations can be made on the inconsistency of import and export statistics. As noted in table 7, two methods were used to compute the country data summarized in the table. In the first computational method, an absolute value was taken of the percentage differences between import and export statistics so that positive and negative differences would not be combined in computing the average percentage level of inconsistency. Later in the project, interest developed in learning the sign of these differences so that it could be determined whether imports or exports had the greater magnitude. Country-by-country tabulations of these figures show two characteristics. First, the percentage inconsistency for some countries remains positive or negative for a number of years even if it periodically changes. This observation suggests that these countries maintain reasonably stable trade relationships; they do little or no shopping around in international markets for trading partners. Second, the sum of positive and negative numbers is less than the sum of the absolute value of those same numbers because the negative numbers are added instead of subtracted from the total. Consequently, the mean of the distribution of rice and wheat flour appears predictably to have shifted to the left in table 7.

Along these lines, the sum of the percentage inconsistencies in import and export trade data for many countries is exactly zero, implying that correspondence between import and export statistics over time is exact. This exact correspondence suggests that discrepancies in trade statistics in these cases originate solely from the fact that exports and imports are recorded in different time periods.

Effects of the USDA Editing Process

The primary reasons for editing U.N. trade statistics in this study were (1) to create tables which contained export data whenever import data were unavailable; (2) to provide yearbook statistics on trade of countries whenever discrepancies existed in U.N. trade data; and (3) to reconcile U.N. statistics on origin and destination of commodities with FAO import totals. These procedures were used to reconcile trade statistics on food and feed grains among all countries reporting import or export data to the U.N. This section reviews the effect of these changes on world wheat import statistics.

Table 9 summarizes the effects of USDA revisions of data on world wheat imports by year from 1962 to 1983. The table compares the composition of U.N. data available to the analyst before and after the editing process. The two primary effects of editing were to reduce the number of export observations in the file and to increase the total number of observations in the file. In 1962, for example, the number of exports in the file declined from 106 to 56, while the total number of observations in the file increased from 355 to 402. These effects were the result of the deletion of selected export data and the addition of country yearbook data. Some import observations, primarily small trades rounding to zero were also deleted. In 1962, a total of 107 changes were made, adding 25 percent to the volume of world wheat imports. This increase in the volume of world imports resulted mainly from the addition of observations for centrally planned and developing countries that do not normally report statistics to the U.N. On average, the volume of world imports in the file increased 32 percent over the period 1962-83 because of ERS editing.

The methods used in a trade reconciliation study that FAO recently completed differed from those used in this study in three respects. First, the FAO study concentrated on trade statistics for the top 30 importers and the top 20 exporters. This study edited statistics for all the countries covered by U.N. trade data (roughly 230). Second, the FAO computer procedure printed out both import and export statistics in a matrix format and gave preference to the import figure only when the import and export observations differed by less than 20 percent. The procedure used in this study printed out the import figures whenever available and printed out data on exports only when no import figure was given. Third, FAO attempted to reconcile trade figures for both reported imports and exports. This study reconciled trade figures only with respect to the import total reported in FAO's trade yearbook. These two procedures yielded data on world wheat imports that differed by less than 1 percent (table 10). Neither procedure yielded import totals as reported in FAO's trade yearbook.

Looking to the Future

The results of this study suggest two areas that need further research. First, although the methods used to edit U.N. trade statistics increased the coverage of transactions and countries in the data set, the inconsistency of import and export observations changed little.

Table 9–A comparison of trade data derived from U.N. data, before and after USDA editing, 1962-83

Year	Trade exchanges observed[1]						USDA changes[2]		Inconsistency when both M and X are recorded	
	Imports only (M)		Exports only (X)		Total		Total	Portion of trade volume		
	Before	After	Before	After	Before	After			Before	After
	Number							*Percent*		
1962	124	121	106	56	355	402	107	25	39	36
1963	81	78	142	80	417	427	84	43	40	38
1964	83	81	159	89	413	421	89	44	41	39
1965	90	84	155	80	437	429	84	39	40	38
1966	96	94	129	74	422	436	76	22	37	36
1967	118	113	142	74	471	467	75	21	39	39
1968	76	75	153	47	374	387	120	34	37	37
1969	134	131	143	76	498	489	62	15	35	35
1970	155	152	158	92	537	515	52	18	40	40
1971	106	105	154	90	472	478	75	22	42	42
1972	122	113	152	91	501	488	62	27	42	41
1973	148	143	181	91	561	536	75	36	40	39
1974	174	164	173	103	578	556	67	17	38	36
1975	139	125	168	98	556	527	61	21	40	38
1976	100	89	184	105	514	499	80	24	42	41
1977	112	103	210	126	541	525	83	26	40	39
1978	99	81	228	109	522	527	152	36	38	35
1979	141	119	193	112	594	566	97	33	43	39
1980	119	108	204	130	573	555	82	37	41	38
1981	128	111	228	126	598	588	124	41	43	40
1982	98	82	291	175	601	592	119	40	37	35
1983	42	77	138	100	190	506	231	49	66	38
Total	2,485	2,349	3,791	2,124	10,725	10,916	2,057	32	40	38

[1]This total is the sum of imports only data, exports only data, country data (that is, USDA changes), and import data for which export data are also available (that is, for which the percentage inconsistency was calculated). Example: The total number of observations in the file in 1962 before editing was 124 + 106 + 107 + (18) = 355. The percentage inconsistency before editing (39 percent) is accordingly a weighted average based on 18 observations. (355 − (124 − 106 − 107) = 18).

Source: A computer tabulation of U.N. and country yearbook trade statistics.

Furthermore, the study did not focus on explaining these inconsistencies, even though general reasons for inconsistencies were discussed. Therefore, reconciling import and export statistics remains an area in need of further research.

Second, the evidence presented supports the contention of previous studies that inconsistencies in import and export observations are caused primarily by discrepancies in reporting practices. Some data are reported in different time periods and for different commodity categories; other data go unreported. These results lend support to the need for improved coordination of national trade reporting practices. In the meantime, a better understanding of existing statistics is needed.

Several aspects of existing trade statistics are not well understood or extensively studied. First, analysis of quantity data should be extended to analysis of value data. Because unit trade values are derived by dividing the total value of trade flows by the quantity of trade, discrepancies in quantity data are compounded in value data. Value data also has its own problems. Existing value data, therefore, has greater need of reconciliation than quantity data. Second, seasonal trade patterns are not well studied. Greater availability of these data would improve forecasting of seasonal trade and would simplify

Table 10–World wheat imports, 1979

Source	World wheat imports	
	1,000 metric tons	*Percent*
FAO trade yearbook	77,201	100
FAO reconciliation study	75,788	98
U.N. data	68,132	88
USDA edited data	75,366	98

Sources: (*3, 4*).

trade reconciliation. Third, commodity trade studies that go beyond the three-digit SITC level are needed to analyze patterns of trade in the different commodity grades. For example, the analysis would not be confined to rice in general but would be extended to trade in polished, rough, and milled rice. At this level of detail, both statisticians and commodity analysts would benefit from increased insight into the functioning of commodity markets. This does not imply that more disaggregated data have fewer statistical discrepancies. Instead, it implies that the discrepancies in the annual figures will be easier to explain given more information about their composition. Furthermore, only with this level of insight into statistical discrepancies would reconciliation of import and export observations be credible and harmonization of country practices yield a classification system acceptable to the many countries involved.

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