



TECHNICAL

NOTES & MANUALS

The Use of Mirror Data by Customs Administrations

From Principles to Practice

Anne-Marie Geourjon, Bertrand Laporte, and Gilles Montagnat-Rentier

TECHNICAL NOTES AND MANUALS

The Use of Mirror Data by Customs Administrations From Principles to Practice

Anne-Marie Geourjon, Bertrand Laporte, and Gilles Montagnat-Rentier

Authorized for distribution by Paolo Mauro

This technical note addresses the following questions:

- What is mirror data analysis, and why is it important for customs administrations?
- Which specific method should be used by customs administrations to complete a mirror data analysis?
- What are the possible applications of mirror data analysis results by customs administrations?

© 2023 International Monetary Fund
Cover Design: IMF Creative Solutions

Cataloging-in-Publication Data
IMF Library

Names: Geourjon, Anne-Marie, author. | Laporte, Bertrand, author. | Montagnat-Rentier, Gilles, author. | International Monetary Fund, publisher.

Title: The use of mirror data by customs administrations : From principles to practice. / Anne-Marie Geourjon, Bertrand Laporte, and Gilles Montagnat-Rentier

Other titles: From principles to practice. | Technical notes and manuals.

Description: Washington, DC : International Monetary Fund, 2023. | TNM/2023/05. | Includes bibliographical references.

Identifiers: ISBN:

9798400251283 (paper)

9798400251351 (ePub)

9798400251320 (web PDF)

Subjects: LCSH: Customs administration—Data processing. | Customs administration—Technological innovations.

Classification: HJ6613.G4 2023

DISCLAIMER:

This Technical Guidance Note should not be reported as representing the views of the IMF. The views expressed in this paper are those of the authors and do not necessarily represent the views of the IMF, its Executive Board, or IMF management.

Recommended citation:

Geourjon, Anne-Marie, Bertrand Laporte, and Gilles Montagnat-Rentier. 2023. "The Use of Mirror Data by Customs Administrations: From Principles to Practice." IMF Technical Notes and Manuals 2023/05. International Monetary Fund, Washington, DC.

Please send orders to:

International Monetary Fund, Publication Services

PO Box 92780, Washington, DC 20090, USA

Tel: (202) 623-7430 | Fax: (202) 623-7201

publications@IMF.org

elibrary.IMF.org

bookstore.IMF.org

Contents

Abbreviations	iv
Introduction	1
I. Background and Merits of Mirror Data Analysis	2
Capacity Development Work on Mirror Data Analysis	2
Data Analysis: An Essential Focus for Modern Customs	2
The Specific Value of Mirror Analysis	4
Challenges and Precautions to Be Taken	5
II. Methodology	8
Databases Used	8
Extracting Mirror Data in WITS	9
Reconcile the Export Data Extracted from WITS with the Customs Import Data:	
Create the Working File (Excel)	10
Mirror Analysis: Types of Situations and Data Analysis	11
Importance of Disaggregated Data (HS6)	11
Recommended Method for Identifying Tariff Headings and Subheadings Whose	
Situation Should Be Analyzed	14
III. Mirror Analysis Sustainability and Operational Utilization of Its Results	18
An Intermediate Step: Sorting the Gaps	18
Examination of Past Suspect Operations	18
Preventative Action for Current or Future Imports	19
Other Potential Uses of Results of Mirror Analysis	20
Ownership by Customs and Suggested Institutional Framework	21
Annex 1. Seven Steps for Extracting Mirror Data in WITS	23
References	30

Abbreviations

ASYCUDA	Automated System for Customs Data
CIF	cost, insurance, and freight
Comtrade	United Nations Trade Database
Eurostat	Directorate-General of the European Commission
FOB	free on board
GAINDE	System of Automated Management of Customs Information and Exchanges
HS	Harmonized System
HS2	Chapter of the Harmonized System
HS4	Heading of the Harmonized System
HS6	Subheading of the Harmonized System
IMF	International Monetary Fund
FAD	Fiscal Affairs Department
M	imports
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
WCO	World Customs Organization
WITS	World Integrated Trade Solution
X	exports

Introduction

Mirror data analysis consists of comparing, for the same product and period, the flows reported by the exporting country with those reported by the country receiving the goods and identifying discrepancies. This note aims to show how this data analysis technique can be used in practice to improve customs administrations, particularly in developing countries faced by the challenge of raising revenue more effectively.

For customs administrations, the main application and benefit of mirror data analysis is risk management for control. Customs is the administration responsible for processing international trade in goods and verifying that the rules applicable for importation and exportation are complied with and that the duties and taxes due are collected. Given the enormous volume of international trade, customs control must be selective, targeted at transactions presenting the highest risks. Otherwise, resources are spread thin, checks are insufficiently thorough and effective, cost for trade is increased, more opportunities for collusion and discretionary decisions are provided, and overall results are unsatisfactory. For customs in developing countries, however, risk analysis and control selection still lag far behind best practices.¹

Mirror analysis is indeed very useful in detecting a variety of suspected false or missing customs declarations with the potential to significantly affect the amount of duties and taxes due. The most common of these include underdeclaration of the value of the imported goods, which represents the taxable base; incorrect tariff classification (using a subheading of the tariff nomenclature with a low rate of duty or tax that is not applicable to the goods); and declaring an incorrect country of origin under preferential rules of origin entitling the goods to a reduced or zero duty. The technique can also help identify the misuse of special procedures that suspend duties and taxes in certain circumstances, to divert the product later illegally to the domestic market. An export from the country of departure that is not found in the customs data of the country of arrival may be a result of import smuggling.

The note consists of three sections. Section I presents mirror analysis and its principles, its relevance for the purposes of customs control, and the precautions to be taken for its relevant usage. Section II presents the methodology in detail. Section III provides guidance for exploiting the results of the analysis in an operational manner and for sustaining the approach in customs administrations.

¹ On average, in low-income countries, 83 percent of imports are currently selected for documentary or physical customs verification of goods, compared with 42 percent in emerging markets and 12 percent in advanced economies.

I. Background and Merits of Mirror Data Analysis

Capacity Development Work on Mirror Data Analysis

The recommendations of this note build on the recent work of the Fiscal Affairs Department of the IMF in developing customs capacity in sub-Saharan Africa. Support for the use of mirror data by customs administrations has been provided in Benin, Comoros, Côte d'Ivoire, Guinea, Kenya, Liberia, Senegal, Togo, and Zimbabwe. The early implementation of the method by these countries' customs is showing encouraging and interesting positive results. One customs administration reports that mirror analysis significantly contributed to a doubling of the compromised duties and taxes detected by the postclearance audit function between 2020 and 2022. Another one reports that already 15 percent of the compromised duties and taxes recovered after clearance of goods came from audits initiated because of a discrepancy identified by the mirror analysis. A third customs reports having detected significant misrepresentations or missing import declarations for consumer goods such as meat, wheat, and cement.

While drawing on the literature, this note therefore provides practical lessons from experience in the field. Box 1 summarizes the main orientations and recommendations.

Data Analysis: An Essential Focus for Modern Customs

Customs administrations can benefit from enhanced data analysis, a recommendation that has been reinforced by several international organizations. For example, the World Customs Organization chose the theme "Data Analysis: Seizing Opportunities for Effective Border Management,"² which continued the 2016 theme "Digital Customs: Progressive Engagement." The priority focuses proposed for customs administrations were clear: digitalization and exploitation of data, as for all modern organizations. These are also major themes of the IMF's new book on the importance of customs and necessity of strengthening this administration in a changing world (Pérez and others 2022).

Data analysis improves fraud control by further curtailing the importer's information advantage and thus reducing the asymmetry in information knowledge inherent in international trade transactions. All economic activity is a source of data, in particular movements of goods. Volumes of data produced and storage capacities continue to grow, and data utilization techniques improve. Thus, many opportunities are offered to identify potential fraud in customs. For example, the positive effect of information provided to customs inspectors on detection of noncompliance cases and recovery of revenue was recently brought to light for Malagasy Customs, although it was underscored that it could be neutralized by the presence of corruption, a poor system of staff incentives, or both (Chalendard and others 2020).

Customs administrations, which have long been computerized, already have a large amount of data in-house, which they are beginning to exploit. Detailed data, submitted as part of the customs clearance procedure and stored in the information technology (IT) system, are increasingly being cross-checked and analyzed in greater depth. For example, several African countries have developed sophisticated internal risk-analysis systems to select the declarations to examine.³ However, the technique used is limited in that it aims to reduce the intensity of controls only to maintain previous results; it is not designed to increase results. Moreover, performance in terms of customs verifications is often very poor. In Gabon, for example, over a

² See the World Customs Organization's WCO News, No. 82 (<https://mag.wcoomd.org/magazine/wco-news-82/>).

³ With technical assistance from the IMF, Benin, Burkina Faso, Côte d'Ivoire, Senegal, and Togo have developed these systems that are either operational or are becoming operational.

BOX 1. Main Findings and Recommendations for the Use of Mirror Analysis by Customs Administrations

1. Mirror analysis has the major advantage of enabling the cross-checking of all the import data of a country with that of an external source presented in a similar format and directly usable. Customs administrations are strongly encouraged to implement this technique.
2. Because mirror analysis by customs administrations is primarily operational in purpose, it must be carried out at the finest possible level of detail. A discrepancy observed at the level of the chapter of the nomenclature of the Customs Tariff (the Harmonized System, or HS) may cover different situations. Moreover, no discrepancy observed at the HS chapter level does not guarantee an absence of a discrepancy at the level of the tariff heading (HS4) or subheading (HS6).
3. Cross-checking with external data may reveal customs fraud and irregularities that are difficult to detect by exploiting internal data alone. The effect is thus generally high for a limited investment on the part of the customs administration.
4. To ensure the accuracy of the analysis, steps are necessary prior to the creation of a single file containing internal customs data and external data (express the internal data in free-on-board value and convert the external data into current local currency).
5. A rigorous analysis cannot be limited to the study of the corresponding flows. It must also include the study of "lost exports" and "orphan imports."
6. A discrepancy does not necessarily indicate fraud or irregularity in the country of importation, because there are many potential causes for a discrepancy.
7. It is after a careful examination of each difference and the identification of its probable cause that a suspicion of fraud can be concluded (risk analysis phase). It is at the end of a formal and positive customs check that the occurrence of fraud is certain.
8. Although accurate estimates of missing revenue because of fraud or customs malfunctions cannot be derived directly from the mirror analysis, the results once sorted and verified can help to reconstruct the gaps between revenue collected and potential revenue.
9. The application of mirror analysis can be a catalyst for the development of the data analysis function in less advanced customs administrations.

three-year period (2013, 2014, and 2015), only 1.13 percent of the declarations that were checked during the customs clearance process, which accounted for 90 percent of all declarations received, were deemed incorrect (Cariolle and others 2019). Undetected or unreported fraud is therefore likely to be widespread.

The utilization of external data opens broad additional opportunities for identifying potential fraud and mitigation measures. Customs should identify and examine the patterns in their databases, which may reveal anomalies because of possible fraud. For the same purpose, they should also cross-check their own data with that of third parties. External sources, which include, for example, data from the domestic tax administration, the port authority, banks, and others, can be cross-checked with in-house data. This is an essential approach where information is asymmetrical and unfavorable to the administration. It may indeed reveal fraudulent practices or movements that customs had not otherwise detected, and thus supplement the results of risk analyses based on internal data.⁴ The mirror data analysis is thus one technique that is part of a richer risk-management system that customs should have, which should rely on third-party data, cross-checking, and exchange of information more broadly.

⁴ Customs administrations generally have a "fraud intelligence" function, which is also of major interest to target its interventions.

The Specific Value of Mirror Analysis

Among external data sources, international trade statistics are of great interest for the analysis of customs fraud risks. The advantage is that it is possible to cross-reference all the import data of a country with external sources presented in a similar format and directly exploitable (without the data preparation stage generally needed to make it suitable for further processing and analysis). This “mirror analysis” is recognized as particularly welcome and effective (World Customs Organization 2015). The Fiscal Affairs Department’s work in support of customs capacity building confirms this. Many inconsistencies deserving in-depth analysis have been uncovered during the Fiscal Affairs Department’s missions that helped customs of several sub-Saharan African countries in recent years, as well as following these missions. These data-based strong suspicions have thus contributed significantly to improving the targeting of the postclearance audit plan, and the initial results are encouraging, as mentioned previously.

Data were first used in empirical mirror analysis studies before being employed in practice by customs administrations. The method was used in 1964 for the first time by Bhagwati to estimate customs fraud in Turkey. Other studies were later conducted to assess the effects and causes of fraud. The relation between fraud, estimated using mirror discrepancies, and the level of taxation was estimated for trade between China and Hong Kong SAR (Fisman and Wei 2004), in India (Mishra, Subramanian, and Topalova 2008), in Africa (Worku, Mendoza, and Wielhouwer 2016), and in particular in Mozambique (Van Dunem and Arndt 2009), Kenya and Tanzania (Levin and Widell 2014), and Tunisia (Rijkers, Baghdadi, and Raballand 2015). These papers show that customs fraud is correlated with tax and tariff, especially in countries with poor governance. The practical use of mirror analysis in customs is more recent. It entails cross-checking data held by customs of the destination country against those on exports from partner countries (a source external to the importing country’s customs administration). This analysis was conducted to estimate customs fraud in Cameroon (World Customs Organization 2015) and in Malawi (Kalizinje 2018). Malagasy customs also used this technique to develop its risk analysis with World Bank support (Chalendard, Raballand, and Rakotoarisoa 2016). Several African administrations are currently carrying out such exercises (Benin, Comoros, and Côte d’Ivoire, for example).

Mirror analysis consists primarily of assessing the difference in value in international trade statistics for the same flow of goods. The value declared for export in the partner countries (exporting countries) and the value declared for import in the importing country (see Table 1) are reconciled. In a perfect framework and without transport and insurance cost, the value declared on export is equal to the value declared on import. Any difference is then attributable to misdeclaration behavior on the part of the exporter, importer, or both. Because the exporter generally has little incentive to misdeclare the export of its goods, the assumption that the discrepancy is a result of a noncompliant declaration by the importer is generally accepted.

For the specific needs of customs administrations, mirror analysis goes beyond the difference in value in the cross-checking of data. Unlike the approach of most empirical studies, the detailed import data that is the most disaggregated are used by the customs administration that performs a mirror analysis. Customs has both the legal and practical means to access the data on its computer system, which contains all the elements of customs declarations (see Section II).⁵ This mirror analysis thus focuses not only on differences in customs value but also on differences in quantity; classification in the nomenclature of the tariff; country of origin; and, if applicable, other declared elements likely to produce indications of fraud or customs malfunction, for example, a potentially misused or even fraudulent use of customs procedures to suspend duties and taxes. The approach and expected results are therefore operational in nature.

Reference is traditionally made to Cost, Insurance, and Freight-Free on Board (CIF-FOB) ratios in the international trade literature using mirror data. This is because the data from the database commonly

⁵ Almost all customs administrations now have a computer system available to declarants and officers for processing imports and exports.

Table 1. Comparison of Declared Values–Identifications of Discrepancies

Harmonized System Position	Declared Import Value (FOB) in Country A, Provenance in Country B (M in US Dollars)	Harmonized System Position	Declared Export Value (FOB) in Country B, with the Destination Being Country A (M in US Dollars)
170114	261	170114	261
220210	98	220210	121
220300	234	220300	234
220890	5	220890	5
440890	0		3
851712	544	851712	544
890190	16	890190	16
890392	2	890392	0
870323	4 585	870323	4 585
190190	1 229	190190	1 098

Source: Based on hypothetical data.

Note: FOB = free on board; M = imports.

used (Comtrade, see following text) are CIF for imports and FOB for exports, respectively. The use of data from customs systems normally makes it possible to make FOB-FOB comparisons, which are essential for gap analysis.

The "M-X"⁶ discrepancies make it possible to reveal typical customs fraud. The undervaluation of the good in order to reduce the amount of duties and taxes payable is a common explanation for a negative gap (M<X). Several econometric studies have empirically shown a positive correlation between mirror differences and tariff level, for example, Fisman and Wei (2004) and Carrère and Grigoriou (2015). There is also tariff slippage (false declaration of tariff classification) leading to declaring goods subject to a high duty rate under a different tariff heading with a lower duty rate. Such a situation results in a negative gap for highly taxed goods. Last, smuggling and imports without declarations imply that tariff headings are not registered by customs on the import side, although they are present on the export side. In contrast, overvaluation of imports may be observed in connection to transfer pricing mechanisms or when an economic operator seeks to remove capital from the country. The tariff slippage mechanism mentioned previously may also lead to positive gaps for goods with low duty rates, which will serve as a "safe haven." This list is not exhaustive. For example, the origin of a good may be incorrectly declared to benefit unduly from a preferential customs duty rate.

Challenges and Precautions to Be Taken

A potentially substantial part of the discrepancies calculated in the mirror data analysis is not attributable to customs fraud. This is a result of the many structural and logistical factors that can explain (in part) the discrepancies observed in the mirror data. These factors have been discussed in the literature and are confirmed in practice. The most common are the following:

- Differences in the way goods are classified in the tariff nomenclature between exporting and importing countries (Nitsch 2012) and misclassifications (Jean and Mitaritonna 2010).
- Imperfect conversion of local currency imports into US dollars (Carrère and Grigoriou 2015).

⁶ The letter "M" represents imports; the letter "X" represents exports.

- Transit time of goods (Yeats 1995).⁷
- Constraints coming from the distinct notions of country of origin and country of provenance and from different reporting standards applicable to export and import, particularly present in the case of transshipment, re-export (Hummels and Lugovskiy 2006, Ferrantino, Liu, Wang 2012) and transit.^{8,9}
- Weakness of the control of export declarations by the exporting country (Stoyanov 2012) is a situation commonly observed in many countries. Import data are typically checked and recorded with greater care than exports, because tariffs are generally applied to imports and not to exports.
- Minimum thresholds at which economic operators are required to report their trade flows may differ from one country to another, resulting in sources of discrepancy that are not associated with fraud.
- Other reasons, related to the country's legislation and regulations and the practices and procedures of each customs administration, may explain the discrepancies. Free zones, for example, may be outside the scope of customs control.

The European Commission (Eurostat 2009) thus distinguishes three categories of causes that can explain the asymmetries in the mirror data of external trade statistics: (1) those that exist despite a harmonized methodology in the partner countries (different exchange rates used and triangular trade, for example); (2) asymmetries as a result of differences in methodology (special trade versus general trade); and (3) those created by malfunctions in collection systems (unilateral exclusion of certain goods on grounds of confidentiality, differences in interpretation of tariff classification rules, and fraudulent transactions).

The identification of the probable cause of an observed gap is necessary before the gap may be viewed as being a result of fraud. The inconsistencies identified must be analyzed and assessed in the light of their nature and context to isolate those that may be linked to customs fraud (see following text). It should be noted that, at this stage, it will be possible for the customs authorities to draw initial conclusions on the occurrence and nature of the fraud, but only customs control carried out in accordance with the procedures laid down by law will make it possible to conclude with certainty (Section III). The purpose of the use of mirror data by customs administrations is to identify inconsistencies that should lead customs to act on them (not to demonstrate the existence of fraud).

Mirror data analysis, therefore, naturally integrates with the customs function of risk analysis and management. In the context of information asymmetry unfavorable to customs mentioned previously, any information, especially any information specific to a good or an operator, or better, to a transaction, is valuable. The customs services will be able to analyze this additional new information (data discrepancy) and, depending on the conclusions they will be able to draw, they will estimate a greater or lesser probability of existence of fraud. This will contribute to the process of selecting controls and addressing risks.

The value of external information is more relevant for developing countries' customs administrations, particularly in fragile states, which are confronted daily with submissions by declarants of unreliable documentation. For example, in the determination of the customs value and specifically the application of the transaction value (the first method of valuation of imports to be used under the World Trade Organization rules), customs often cannot refer to the invoices submitted, because they are insufficiently precise; incomplete; and, in a number of cases, the price indicated does not correspond to the actual transaction, as a result of collusion between the seller and the buyer, or sometimes, of filling in the invoice by the buyer. Having an independent source of information becomes essential for selecting and guiding examinations.

⁷ Because of transit times, export and import may be recorded in different periods. This can lead to significant discrepancies, especially where the country's international trade volume is changing rapidly.

⁸ Peripheral countries (mainly low-income countries) are the most affected because they do not have direct trade routes with the main exporting countries.

⁹ The ordinary import trade statistics compiles imports by country of origin whereas the ordinary export statistics compiles exports by last known destination. They often do not match, particularly for the re-exported goods. For comparison, the United Nations encourages trade statistics to be compiled by country of consignments for both imports and exports.

The value of mirror analysis for customs in developing countries was highlighted by Grigoriou and others (2019), who showed its positive effect on fraud detection while stressing that the method is inexpensive and easy to implement, and therefore well adapted to the capacities of these administrations.

Care should be taken not to extrapolate a loss of revenue from aggregated mirror data or discrepancies whose origin has not been precisely examined. Some studies have assessed the shortfalls in customs revenue because of undetected fraud, based on the mirror data gaps by applying an average effective tax rate to them. This approach is unlikely to result in a correct estimate of revenue losses, both at the operational level (by product category or economic sector) and at the macro-economic level. Explanations covered earlier show that to obtain reliable results, the analysis is complex and meticulous. General data necessarily include inconsistencies unrelated to fraud and positive and negative gaps that offset each other. It is at the end of the risk analysis conducted on disaggregated data, or even better, in view of the results of the first customs verifications of suspicious discrepancies, that gaps between revenue collected and potential revenue can be reconstructed.

II. Methodology

Databases Used

Mirror analysis combines data “internal” to the customs of the importing country that is conducting the analysis with “external” data that comes mainly from international databases. Published empirical studies on the results of mirror analysis to evaluate the scope of total fraud use data from international trade databases only. To identify operational actions and strategy, the data used for mirror analysis—at least the import data—must be much more detailed than those. The customs import data used under the approach proposed in this note meet this critical requirement.

Import Data (Internal to Customs)

Import data are extracted from the importing country’s customs information system, which implements a mirror analysis of its import flows. The information is obtained from declarations entered in the computerized customs clearance system. The majority of customs administrations today have such a system (for example, ASYCUDA, which is being used in many developing countries, and GAINDE in Senegal). Its use is required for importers, exporters, and their agents. For comparable flows between what is declared entering the country and what the supplier countries declare as going to the destination, attention should be paid to the customs procedures that are to be considered. All merchandise that entered the country during a benchmark year should be included, and not just imports for direct or indirect consumption (Cantens 2015; World Customs Organization 2015). The idea is to closely capture the same flows of goods as those declared by the partner countries and reported in the external database. Customs procedures should therefore be carefully selected to capture all these flows and at the same time to avoid double counting of some of these merchandises.¹⁰ The created file should include (1) country of provenance; (2) import date; (3) national HS and subdivision code up to the most detailed level used by the country (for example, HS10); (4) the customs procedure with an additional code; (5) the FOB invoice amount in local currency; (6) net weight, quantity, and additional units; (7) total duties and taxes paid for goods that are consumed directly and indirectly; and (8) the cumulative taxation rate. This detailed extraction aims to subsequently give analysis units the most detailed information to analyze the discrepancies and determine the tariff headings that are to be thoroughly investigated.

These import data should be aggregated at the HS6 level so that they can be compared with the export data. Once the most significant discrepancies have been identified, the most disaggregated data will again be used to fine-tune the analysis of the discrepancies and establish the verification strategy.

The import data that are used are the customs clearance import data recorded after any potential adjustments are made by customs inspectors. Thus, the discrepancy that is potentially found with the mirror data is an indicator of “fraud that remains to be addressed.” It consists of fraud not yet detected by the customs administration and fraud that is detected but intentionally not recorded by the examining officers/inspectors and hence not reported because of potential collusion. For both cases of fraud, the customs postclearance audit unit and the investigation unit may still intervene, given that the law authorizes the administrations to conduct ex post verification several years after customs clearance or introduction of goods.

¹⁰ For example, goods brought into a country are placed under the suspensive customs warehousing procedure. Later on, they are removed from this procedure with a customs declaration made for import for consumption. It is therefore necessary in such case to compare the entry flow with that recorded in the country of export and not to double-count the goods on import.

Export Data (External to Customs)

“Mirror data,” in other words the exports that should match the imports declared in the importing country and reported by the partner countries (exporters) should ideally come directly from the customs information system of the partner countries, in particular to prevent reprocessing errors. This is because customs data have relatively standardized formats from one country to another. However, mechanisms and procedures for exchanging information between the customs of the various countries in the world are not yet able to provide this type of data. If this exchange of data were universal, it would bring significant progress in enhancing the reliability of mirror analysis and the ease of using the data, primarily by eliminating delays in obtaining databases compiled by international institutions (Grigoriou, Kalizinje, and Raballand 2019).

Export “mirror” data that are usable today are from the Comtrade database. This base comes from the United Nations Conference on Trade and Development’s (UNCTAD) units that consolidate, harmonize, and make available to the public trade flows data from customs throughout the world.¹¹ Countries are required to submit their international trade statistics every year to the Statistics Division of the United Nations. Only a few oil-producing and developing countries do not comply with this obligation. This database is accessible through the statistics office of the United Nations (<http://comtrade.un.org/>), but also through the World Bank’s World Integrated Trade Solution (WITS) (<http://wits.worldbank.org/>). It is easier to extract a large amount of data from WITS. The data are FOB values expressed in thousands of US dollars and weights and quantities. The data are for the HS six-digit subheadings, in other words the groups of products in HS6, which is the maximum level of disaggregation for which the nomenclature is harmonized worldwide.

Extracting Mirror Data in WITS

A step-by-step approach is required for extracting mirror data in WITS. Annex 1 describes the seven steps.

The use of Comtrade has two drawbacks: data compilation is time-consuming, and some data are not transmitted.

The collection and harmonization of international trade data from all the countries in the world takes time. Therefore, it is necessary to wait at least one full year before comprehensive data for the past year are obtained; this is essential to be able to interpret the discrepancies observed as potential sources of irregularities. This means that the information obtained from mirror analysis will be much more directly usable by the postclearance audit units (which, by definition, are in charge of reviewing the customs transactions of previous years) than by other customs services (Section III). Given this fact, although the comprehensive compilation of the entire previous year is a lengthy process, it is nonetheless possible to have piecemeal data more quickly. UNCTAD’s statistics units process the data and post them online as they receive them from the various administrations throughout the world (often the statistics offices of the ministry of the economy or planning). This may make it possible to use the data for comparison purposes, for example, on the value, weight, or quantity of certain specific descriptions.

A certain number of countries do not submit their data to the UNCTAD statistics units. Therefore, they do not appear in the mirror flows. Import declarations from countries that do not submit export data to UNCTAD should not be included, nor should those that are not up to date in their submission because doing so would create an artificial discrepancy solely because of a lack of information. These countries should be identified and excluded from the analysis. It is essential to identify them and to drop them in the internal import database before calculating discrepancies.

¹¹ Bilateral data may on a case-by-case basis come from partner countries whose statistics departments make their foreign trade data available to the public. This is true, for example, for the United States and the countries of the European Union. These databases provide information that is less comprehensive by definition than the Comtrade data, but they are updated more regularly, and they provide more recent information.

The information on the countries that have submitted their exports is found here: <http://wits.worldbank.org/WITS/WITS/Support%20Materials/ComtradeCatalog.aspx?Page=DataCatalog>. Having downloaded the file, users should identify—for the benchmark year and the nomenclature concerned—the countries that do not submit export data to UNCTAD.

The file specifies if the country has declared its imports (I), exports (E), re-exports (R), and re-imports (M). For calculating discrepancies, one needs to use “gross export” that equals to “export” plus “re-export.” Some countries declare their exports but do not declare their re-exports. It is common to assume that these countries report all re-exports and exports—indiscriminately—in their export declarations, so that in the end, gross exports are equal to exports and re-exports for all countries.

Reconcile the Export Data Extracted from WITS with the Customs Import Data: Create the Working File (Excel)

Merging several files is always a complex task; there is a chance that information will be lost. The following 20 steps help prevent the major stumbling blocks that may distort the calculation of discrepancies.

Preparation of the Export Database

1. Open the relevant data extracted from WITS.
2. Keep only the columns that are necessary for the calculation of mirror gaps: the HS6 with its description, the exporter name, and its associated code (three-digit ISO code), the value of gross export, and weight.
3. Rename the key variables that will be used to merge to harmonize with the import database. For example, one can rename the “Product Code” as “HS6,” the “ProductDescription” as “HS6ProductDescription,” the “ReporterName” as “ExporterName,” and the “ReporterISO3” as “ExporterCode.” One can also rename the “Netweight” as “NetWeightExport” to avoid confusing it with the weight declared for import once the bases will be merged.
4. Convert the value of gross export into local currency using the average exchange rate for the year. This exchange rate could be obtained from the central bank.
5. If the custom’s system uses a two-digit code to identify the exporter, convert the three-digit code used to a two-digit code to harmonize with the customs database.
6. Before merging, it is generally necessary to sort data by couple ExporterCode/HS6.
7. Save the export database, ready to be merged.

Preparation of the Import Database

8. Open the import data extracted from the customs database. It includes information on imports using the most detailed level of the HS nomenclature, additional procedures and codes, origin/provenance, declarant, importer, FOB value of imports, net weight... total duties and taxes paid, and total taxation rate. Keep a copy of the original database for potential investigation after the mirror data results.
9. If information is missing for the last country of consignment, one can replace the missing information by the country of origin.
10. Delete all partner countries (last country of consignment) that do not indicate their exports in UN Comtrade.
11. Select only the regime codes validated by the team for inclusion in the analysis.
12. Keep only the columns that are necessary for the calculation of mirror gaps: the last country of consignment code, the HS code (HS8 or HS10 or HS12, depending on the country at this stage of the analysis), the net weight, and the FOB and CIF values of the imports.
13. Create the HS6 corresponding to the HS code and then aggregate information by HS6 and the last country of consignment.

14. Rename the key variables to be used for merging the databases to harmonize with the export database. In particular, the last country of consignment's code should be named "ExporterCode" as in the export database. For example, you can also rename "FOBValue" as "ImportFOB," "CIFValue" as "ImportCIF," and "NetWT" as "NetWeightImport."
15. Before merging, it is generally necessary to sort data by couple ExporterCode/HS6.

Merge Databases

16. Combine the information from the WITS file and the customs file into the same file, using the HS6 and the last country of consignment (named ExporterCode).
17. It is necessary to fill the missing data on the "HS6 product description" and "Exporter Name" columns. These two columns have been merged from the export database and are missing in the lines coming from the import database when there is no correspondence with the export database.
18. Create the HS4 and HS2 corresponding to the HS6 code and add HS4 et HS2 product description.
19. Save the final database.

Calculate Gaps

20. Calculate absolute (M-X) and relative gaps (M/X) for values and weights.
The expected file must be in the format presented in Table 2.

Mirror Analysis: Types of Situations and Data Analysis

Confronting import data with the matching mirror flows that exporting countries report to UNCTAD reveals three possible situations: (1) *matching flows*, when a partner country's export is reported for the declared import description; (2) *orphan imports*, when the trade flow is declared by the importing country's customs but is missing in the partner country, which supports either tariff slippage or fraud on the country of origin; and (3) *lost exports*, if the trade flows reported as exports by the partner countries have no corresponding declaration and are not recorded in the importing country's customs data (Carrère and Grigoriou 2015). Table 3 illustrates these three types of situations. The discrepancies are calculated in absolute value (M-X) to classify the HS positions according to three possible situations. The calculation of discrepancies in relative value (M/X) is worthwhile for the matching flows too because it provides additional information on the extent of the discrepancy.

The analysis should not be limited to the "matching" trade flows only. Mirror analyses have often been limited to them, as only the situations in which the flows match can be used to calculate the ratios or M-X or M/X discrepancies. However, analyzing the discrepancies of the matching flows only provides truncated results. This is tantamount to excluding all the "orphan imports" or "lost exports" that represent suspected cases of tariff slippage. The larger number of orphan import or lost export cases as the disaggregation level increases implies that the amount of relevant information is substantial and must not be forgone.

Importance of Disaggregated Data (HS6)

The most detailed level of disaggregation available should be used for the analysis. The study can be started at the level of a chapter (HS2) that appears to contain irregularities (significant M-X discrepancies), that is a large contributor to revenue, or that represents a considerable volume of declarations. However, it is essential to then drop down to the most detailed disaggregation level of the Harmonized System (subheading or HS6) to better reveal potential cases of customs fraud.

The discrepancy calculated for the chapter (M-X) may in fact conceal different situations at the heading and subheading levels. A neutral discrepancy (X = M) in the chapter (HS2) may reveal diametrically opposed situations (see Table 4). This neutral discrepancy may be (1) a clean chapter, in which the exports reported

Table 2. Format of the Standard File for Analyzing Discrepancies

HS Position	Import Value Declared in Importing Country (local currency unit)	Export Value Declared by the Partner Countries (local currency unit)	M-X Discrepancy on Values (local currency unit)	M/X in Value (1)	Import Declared Weight in Importing Country (kg)	Export Weight Declared by the Partner Countries (kg)	M-X Discrepancy on Weight (kg)	M/X in Weight (2)	(1)/(2)
170114	4,643	43,213	-38,571	0.11	16,718,160	226,941,277	-210,223,117	0.07	1.46
170199	0	25,108	-25,108	0.00	0	135,869,047	-135,869,047	0.00	
220210	1,850	15,757	-13,907	0.12	4,360,184	43,830,123	-39,469,940	0.10	1.18
220300	4,171	9,978	-5,807	0.42	12,138,819	37,167,891	-25,029,072	0.33	1.28
220421	5,979	20,269	-14,290	0.29	13,526,066	27,497,000	-13,970,934	0.49	0.60
220890	96	4,201	-4,105	0.02	122,697	8,593,731	-8,471,034	0.01	1.60
440890	66,198	66,198	0	1.00	4,231	4,231	0	1.00	1.00
851712	9,691	25,256	-15,565	0.38	1,013,517	689,512	324,004	1.47	0.26
851762	31,991	50,605	-18,614	0.63	399,548	1,029,851	-630,302	0.39	1.63
851770	2,547	0	2,547		164,141	0	164,141		
852872	4,593	32,926	-28,332	0.14	2,256,104	3,225,484	-969,380	0.70	0.20
890190	291	66,732	-66,440	0.00	360,800	12,374,691	-12,013,891	0.03	0.15

Source: Based on hypothetical data.

Note: Some values are blank because the ratio M/X cannot be computed when X = 0. HS = Harmonized System; M = imports; X = exports.

Table 3. Identification of the Three Different Situations Brought to Light by Mirror Analysis

HS Position	Import Value Declared in Importing Country (local currency unit)	Export Value Declared by the Partner Countries (local currency unit)	M-X Discrepancy on Values (local currency unit)	M/X in Value (1)	Import Declared Weight in Importing Country (kg)	Export Weight Declared by the Partner Countries (kg)	M-X Discrepancy on Weight (kg)	M/X in Weight (2)
170114	4,643	43,213	-38,571	0.11	16,718,160	226,941,277	-210,223,117	0.07
170199	0	25,108	-25,108	0.00	0	135,869,047	-135,869,047	0.00
220210	1,850	15,757	-13,907	0.12	4,360,184	43,830,123	-39,469,940	0.10
220300	4,171	9,978	-5,807	0.42	12,138,819	37,167,891	-25,029,072	0.33
220421	5,979	20,269	-14,290	0.29	13,526,066	27,497,000	-13,970,934	0.49
220890	96	4,201	-4,105	0.02	122,697	8,593,731	-8,471,034	0.01
440890	66,198	66,198	0	1.00	4,231	4,231	0	1.00
851712	9,691	25,256	-15,565	0.38	1,013,517	689,512	324,004	1.47
851762	31,991	50,605	-18,614	0.63	399,548	1,029,851	-630,302	0.39
851770	2,547	0	2,547	0.00	164,141	0	164,141	0.00
852872	4,593	32,926	-28,332	0.14	2,256,104	3,225,484	-969,380	0.70
890190	291	66,732	-66,440	0.00	360,800	12,374,691	-12,013,891	0.03

Lost export

Flow with correspondance

Orphan import

Source: Based on hypothetical data.

Note: Some values are blank because the ratio M/X cannot be computed when X = 0. HS = Harmonized System; M = imports; X = exports.

by the partner countries match the imports declared by the importers exactly. This neutral discrepancy may also (2) conceal cases of under-/overdeclarations of value or quantity (weight), or even substantial tariff slippages in the opposite direction of a heading (HS4) or subheading to the other, which offset each other when the various sections/subsections are aggregated.

A neutral discrepancy at the chapter level may thus be a situation in which revenue is heavily affected by fraud if the discrepancy conceals tariff slippages among tariff headings and subheadings with the highest duty/tax rate to those of the chapter for which this rate is the lowest. Chapters whose discrepancies ($M-X$) are positive ($M>X$) or negative ($M<X$) may also conceal opposite situations, because headings and subheadings with higher taxation rates are by nature more affected by issues of underdeclaration of value. Not all tariff positions of a chapter will be eventually investigated.

A sizable discrepancy should not be linked just to under/over declarations of value; they may also be the result of tariff slippage from one chapter to another. The positive discrepancy ($M>X$) of a chapter may be caused by data compilation when moving from the heading to the chapter. Discrepancies of tariff positions whose values are correctly reported by the importers and exporters alike (matching flows) are aggregated with the flows for which data recording problems are observed.

The positive discrepancy at the chapter, heading, or subheading level may be caused by aggregating a "clean" heading or subheading with a heading or subheading that has orphan imports. The rationale is, of course, symmetrical to the case of lost exports, which can generate a negative discrepancy ($M<X$) when moving to a higher level of aggregation.

As the level of aggregation becomes more detailed, the match between flows declines, and investigations are likely to be more successful. In Figure 1, at the lowest level of disaggregation (HS6), only 65 percent and 36 percent, respectively, of the lines match according to whether the analysis is solely of tariff headings or on the couple's partner country-tariff headings. Among the lines that do not match, orphan imports account for 11 percent and 34 percent of total imports in value, respectively.

Recommended Method for Identifying Tariff Headings and Subheadings Whose Situation Should Be Analyzed

Mirror analysis is first used to guide selection of chapters to be verified based on several criteria. The value discrepancies ($M-X$) associated with chapters are the first indicators of potential irregularity/irregularities. They may be very positive ($M>X$) or very negative ($M<X$) discrepancies. Each case is associated with a distinct pattern of potential irregularity. Orphan imports should be included here as well. Weight discrepancies are considered on a priority basis for bulk merchandise or those where value depends directly on weight. The share represented by the chapter in total revenue or total import volume may make this chapter a strategic issue. The effective taxation rate of the chapter may be taken into consideration because of irregularity patterns that may be associated with it; a negative discrepancy ($M<X$) is expected when the effective rate is high and, conversely, the analysis identifies potential "refuge" or false tariff classifications. The discrepancy between the position's effective taxation rate and the legal rate can be used to evaluate the extent of exempted declarations.

Once the chapters to be analyzed have been selected, the $M-X$ discrepancies are observed as well as the orphan imports and lost exports that are associated with them. Then the following level of disaggregation, that is, HS4, is considered. The objective is to identify those that are likely to account for the overall discrepancy among the headings, focusing attention on the $M-X$ discrepancies by heading as well as orphan imports or lost exports. Next the analysis of the following level of disaggregation is repeated (subheading, HS6). This approach breaks down the discrepancies within the chapter and observes potential slippages of a heading or subheading to the other that could offset each other when moving to the higher level of aggregation.

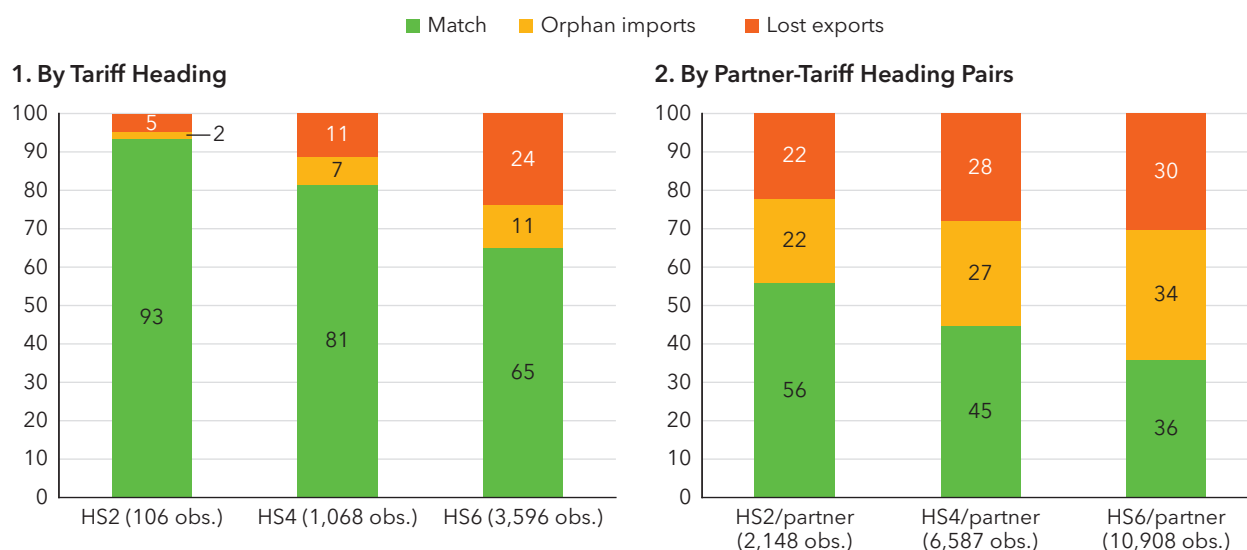
Table 4. Mirror Analyses: Grid for Interpreting the M-X Discrepancy Observed at the HS Chapter Level

Situation	Possible Explanation	Illustration in the Case of a Chapter with Two Sections
<p>No significant discrepancy ($X = M$)</p>	<p>No irregularity; declared imports correctly match exports reported by the partner countries.</p> <p>The aggregation at the chapter level conceals discrepancies in the opposite direction between the positions that offset each other at the aggregated level and that would be observed at a more disaggregated level.</p>	<p>Exports reported by country B match the imports declared by country A for all tariff classifications of two positions in the chapter.</p> <p>Tariff slippage or irregularity/fraud for the value on the origin in the opposite direction for two goods with two different positions in the chapter:</p> <ul style="list-style-type: none"> • $M < X$ (or lost exports) for goods (or origin) with a high tariff, for example, for the first position in the chapter. • $M > X$ (or orphan imports) for goods with a lower tariff, for example, for the second position in the chapter. <p>These offsetting mechanisms may also occur naturally when moving from subheading (HS6) to heading (HS4).</p>
<p>If $M - X < 0$</p>	<p>Lowering the value in at least one part of the chapter.</p> <p>This may be lowering value or quantity, or also a tariff slippage, an irregularity/fraud in the origin, or smuggled merchandise.</p> <p>The discrepancy at the chapter level may come from lost exports. If so, this is not a problem of lowering the value or quantity, but one of tariff slippage, and the aggregation at the chapter level results in an overall discrepancy.</p>	<ul style="list-style-type: none"> • First case: both positions have tariff classifications with significantly lower values that imply a discrepancy ($M < X$) in each position of the chapter. • Second case: the $M - X < 0$ discrepancy comes from aggregating the discrepancies of two positions: one has lost exports (no import declared for a tariff classification declared at export by the partner country $M = 0$). In that case, exports have tariff classifications of both positions, whereas only the import values in the first position are considered since those of the second position are missing.
<p>If $M - X > 0$</p>	<p>Higher value in at least one part of the chapter.</p> <p>This may be the result of a transfer price or capital flight, especially for intragroup trade flows.</p> <p>It may also occur because of a tariff slippage to the advantage of the position with a lower tariff or an irregularity/fraud on the origin in order to be eligible for a preferential tariff.</p> <p>The aggregation may generate a positive discrepancy by adding orphan imports to "matching flows."</p>	<ul style="list-style-type: none"> • First case: the two positions have tariff classifications with higher value or quantity, which implies a discrepancy ($M > X$) in each position of the chapter. • Second case: the discrepancy $M - X > 0$ at the chapter level is caused by the aggregation of the two positions, one of which is to orphan imports. Therefore, imports are for the values of tariff classifications of two positions, whereas only one position is considered on the export side.

Source: Authors.

Note: HS = Harmonized System; M = imports; X = exports.

Figure 1. Matching Flows, Orphan Imports, and Lost Exports (Percent)



Source: Based on hypothetical data.

Note: HS = Harmonized System; HS2 = Chapter of the Harmonized System; HS4 = Heading of the Harmonized System; HS6 = Subheading of the Harmonized System; obs. = observations.

The following examples illustrate the method and analysis that can be performed (Tables 5 to 8). Chapter 30 consists of pharmaceutical products. In this chapter, positive M-X discrepancies are usually observed, given that the taxation of medication is usually low and tariff slippage can occur, mainly for cosmetics. A substantial positive discrepancy is observed on the declared values; nearly all of which is explained by subheading 300410.

Table 5. Case Study 1: Chapter 30. Pharmaceutical Products

Level of Aggregation	Tariff Position	M-X Discrepancy (M US dollars)	M-X Discrepancy (thousands of tons)	Effective Taxation Rate	Legal Rate (HS6)
HS2	30	22.1	1.6	2.5%	
HS4	3004	21.0	0.4	2.8%	
HS6	300410	21.9	0.7	2.6%	3.0%

Source: Based on hypothetical data.

Note: HS2 = Chapter of the Harmonized System; HS4 = Heading of the Harmonized System; HS6 = Subheading of the Harmonized System; M = imports; X = exports.

Chapter 52 consists of cotton, including yarns and fabrics. In this chapter, the M-X discrepancy is often negative. Discrepancies in value are consistent with discrepancies in weight. The detailed data reveal that most of this discrepancy comes from position 520852.

Table 6. Case Study 2: Chapter 52. Cotton, including Yarns and Fabrics

Level of Aggregation	Tariff Position	M-X Discrepancy (M US dollars)	M-X Discrepancy (thousands of tons)	Effective Taxation Rate	Legal Rate (HS6)
HS2	52	-390	-55.1	43.9%	
HS4	5208	-395	-57.3	42.8%	
HS6	520839	-55	-5.2	46.2%	65%
	520852	-310	-50.4	40.1%	60%

Source: Based on hypothetical data.

Note: HS2 = Chapter of the Harmonized System; HS4 = Heading of the Harmonized System; HS6 = Subheading of the Harmonized System; M = imports; X = exports.

Chapter 54 consists of manmade filaments and yarns. The negative M-X discrepancies observed in this chapter are for six subheadings, three of which do not appear in import declarations (540249, 540753, and 540761), yet they are reported among partner country exports. They represent lost exports for a total of \$75 million (FOB value).

Table 7. Case Study 3: Chapter 54. Manmade Filaments and Yarns

Level of Aggregation	Tariff Position	M-X Discrepancy (M US dollars)	M-X Discrepancy (thousands of tons)	Lost Exports (M US dollars)	Effective Taxation Rate	Legal Rate (HS6)
HS2	54	-99	-31.9		41.2%	
HS4	5402	-12.2	-2.3		39.2%	
	5407	-116	-28.2		42.7%	
HS6	540249			18.2		
	540752	-16.8	-2.9		46.1%	50%
	540753			43.9		
	540761			24.3		
	540769	-21.2	-7.1		46.1%	50%

Source: Based on hypothetical data.

Note: HS2 = Chapter of the Harmonized System; HS4 = Heading of the Harmonized System; HS6 = Subheading of the Harmonized System; M = imports; X = exports.

Chapter 3 consists of fish and shellfish. This chapter contains high M-X positive discrepancies. Weight discrepancies are consistent with value discrepancies. These discrepancies are explained by the presence of orphan imports for tariff position 030219 because no partner countries declared exports to the import country.

Table 8. Case Study 4: Chapter 3. Fish and Shellfish

Level of Aggregation	Tariff Position	M-X Discrepancy (M US dollars)	M-X Discrepancy (thousands of tons)	Orphan Imports (M US dollars)	Effective Taxation Rate	Legal Rate (HS6)
HS2	03	42.2	58.2		11.5%	
HS4	0302	39.8	43.7		11.5%	
	0303	5.5	14.9		11.5%	
HS6	030369	12.3	15.8		11.5%	11.5%
	030219			39.9	11.5%	11.5%

Source: Based on hypothetical data.

Note: HS2 = Chapter of the Harmonized System; HS4 = Heading of the Harmonized System; HS6 = Subheading of the Harmonized System; M = imports; X = exports.

III. Mirror Analysis Sustainability and Operational Utilization of Its Results

Once the work described in Section II has been carried out, exploitation of the results obtained can begin. The main actions to be undertaken are set out in the following text. In addition, proposals are made here for an internal organization of customs services with a view to making mirror analysis permanent.

An Intermediate Step: Sorting the Gaps

A discrepancy in the mirror data does not necessarily point to any fraud or irregularity in a customs declaration. The first reason, as previously explained, is the existence of numerous possible explanations for a discrepancy observed for the same transaction between the export data in the country of departure and the import data in the country of arrival. Moreover, discrepancies may accumulate or cancel each other out in whole or in part (Section II). The second reason is legal. A customs offence must be demonstrated by the customs services of the country concerned, with supporting evidence, in accordance with the customs legislation in force. Although, under national legislation and international agreements, certain elements from a foreign source (such as the export declaration or information officially obtained from the authorities of the exporting country) can be accepted as evidence, a mere statistical result is a priori excluded.

The sorting of discrepancies, which will have to be the subject of customs verification, is necessary for reasons of administrative efficiency. Because mirror analyses are carried out on data from past imports, the customs postclearance audit unit will determine whether a discrepancy is a result of customs fraud. Given the number of discrepancies that will initially be revealed by the mirror analysis, the workload, and the limited administrative resources, it is not possible to have all discrepancies systematically checked by this unit. It is therefore necessary to begin with an analysis of mirror results consisting of reconciling the discrepancies obtained with other data and information, available internally or that the customs service will have to collect from various sources.

Customs' objective at this stage is not to prove the existence of fraud. It is to assess the likelihood of fraud being present and its effect on revenue and, where appropriate, on compliance with the regulations that customs is responsible for enforcing. Data discrepancies for which no explanations other than fraud or misrepresentation have been found—for which links have emerged with other risk criteria (for example, a declarant already involved in previous fraud or an origin that is not consistent with the economic fabric of the declared country) or for which the effect on revenue appears to be significant—will be proposed for verification. A small discrepancy that reproduces similarly over time or among importers may reveal a systemic irregularity with a wide effect. A dossier will be developed, putting forward likely fraud scenarios and mechanisms, making recommendations for action, and suggesting the customs units that should take over to carry out the verifications.

Examination of Past Suspect Operations

Customs transactions deemed suspicious at the end of the sorting phase are usually handled by the postclearance audit unit. This customs service does not use mirror data to demonstrate the existence of an infringement. It will conduct an audit according to the rules and powers laid down by customs legislation—the general ones and those specific to each area (for example, customs value, rules of origin, rules of classification in the HS). The customs services normally have an extremely useful legal power (in general, included in the Customs Code), that of the right of access, that is, the right to require the importer, as well as third parties, to provide any documents relating to the operations being verified. The observed discrepancy

in mirror data provides an additional and particularly valid reason for soliciting, among third parties and through official administrative channels, the customs administration of the exporting country to obtain explanations, elements, and documents.¹²

The customs investigation service will be mobilized when the dossier prepared on a suspicious discrepancy suggests that smuggling may be at the origin of it. This service is responsible for investigating imports and exports that have not been subject to customs formalities.

Promotion of traders' compliance with the rules must be a priority objective of customs control. The purpose of control is not solely to directly recover additional revenue. A significant indirect effect on customs revenue can be achieved by deterring fraud and encouraging spontaneous compliance with the rules. This objective will be achieved if customs effectively articulates several measures. If an infringement is detected, customs should first recover the duties and taxes that have been evaded and apply appropriate sanctions (penalties proportionate to the gravity of the facts). In addition, all those involved in the offence should be considered as a high level of risk and be subject to increased control and more frequent checks. In the absence of an infringement detected by a proper verification,¹³ on the contrary, the verified importers should be placed in the segment of low-risk operators. They should then benefit from a reduction in customs control and increased facilitation of procedures.

Preventative Action for Current or Future Imports

Immediate preventive actions applicable at customs clearance are recommended. As soon as fraud is considered probable and likely to recur, by the same importer or by others in the same way, customs should not wait for confirmation of the infringement by postclearance audit before acting on ongoing operations. An obvious action is to incorporate into the customs processing system a criterion for selecting future declarations that will have similar characteristics to past ones and to thoroughly check these new declarations during the customs clearance process. Where suspicions concern a false declaration of the quantities of goods (in particular to reduce the total taxable value), physical inspection and weighing before customs clearance will be the most effective means of detecting fraud.

The dynamic risk analysis systems referred to in Section I shall normally be programmed to target several types of transactions: (1) new transactions, (2) a randomly selected percentage of declarations, (3) declarations automatically selected by the system according to their probability of fraud, and (4) alerts manually added by customs to target a particular declaration. A suspicious mirror data discrepancy falls into the fourth category and should be added as a target. However, care must be taken not to clog the system of selectivity and not to overburden the inspection officers with insufficiently well-founded or overly broad selection criteria. The criteria must therefore be defined only at the end of the sorting phase referred to previously. When an automated risk analysis module is not in place yet, it is usually noted that selection criteria used by customs are excessively broad, stable, and predictable. Mirror data provide, in this case, very useful elements for the customs service to refine and update these criteria.

¹² The current mutual administrative assistance agreements between customs do not generally provide for mass exchanges of information, but for specific and justified requests. A customs administration that has no information on the export declaration in the country of departure of the goods can, of course, request the customs of the country of export, but it can be considered that observing a discrepancy in the statistics will reinforce the legitimacy of a request for assistance.

¹³ The importer has provided evidence to support their declaration, because the discrepancy with the export data may be due, for example, to a customs irregularity that occurred in the country of export or to a difference in legislation or interpretation of rules by the two customs administrations involved.

Other Potential Uses of Results of Mirror Analysis

A change in rules or procedures may be the most appropriate treatment of a risk revealed by mirror analysis (and, more generally, by risk analysis). The identified risk can sometimes be dealt with in more effective ways than repeating controls and sanctions. Where an inappropriate or misapplied procedure or rule is likely to have facilitated customs fraud or irregularity, this procedure or rule should be revised. For example, the criteria or procedures for granting a duty or tax exemption or suspension should be modified if they routinely lead to the same abuses; monitoring of the customs activities of a customs agent should become more rigorous, until possible suspension of the license, if the agent has some responsibility for the commission of customs offences detected.

Estimation of missing customs revenues and risk analysis at strategic level. Although accurate estimates of missing revenue cannot be derived directly from the mirror analysis, the sorted and verified results can help to reconstruct the gaps between revenue collected and potential revenue. This approach is imperfect, but nevertheless useful in a context of scarcity of information available in this area. The relative differences observed between product groups can give an idea of which economic sectors seem to be most affected by customs fraud, reveal trends from one year to the next, and therefore help update customs enforcement priorities and allocation of resources of the customs administration.

Amendment and harmonization of certain customs or statistical practices. Because customs administrations are largely governed by international agreements and standards,¹⁴ differences in customs practices are in some cases abnormal and require correction.¹⁵ In addition, even if differences found are acceptable under international frameworks, the trade facilitation objective should nevertheless encourage convergence of practices between countries. There is also a major interest in having reliable statistics on international trade compiled in accordance with harmonized standards. Inconsistencies generated by methodological issues should also lead to initiatives to improve the collection of external trade statistics.

Possible additional uses are noted here.

- *Evaluation of customs performance.* The link between the fraud originally detected by the administration and that subsequently revealed by mirror analysis can be used to define performance indicators in terms of customs controls, which is useful for monitoring modernization efforts. Cariolle and others (2019) defined the principles and applied them to the case of Gabon. To this end, it is necessary to ensure that findings and irregularities detected by customs services are all reported fully and promptly. This is not yet the case in all jurisdictions, as a result of collusion, as noted previously, managerial shortcomings, and the necessary policies and procedures that are not yet in place.
- *Customs knowledge and capacity building.* The data and information collected when results are sorted and when controls are conducted will make it possible to increase knowledge of fraud mechanisms and to feed customs databases. For example, low-capacity customs administrations would have a particular interest in compiling external data on the value of the main imported products, which is useful for assessing whether a declared value deviates significantly from the average and deserves verification.
- *Instrument for enhanced cooperation between customs administrations.* Customs administrations should consider the establishment of a mechanism for exchanging their data on import and export flows on a routine basis, and the systematization of mirror analyses based on these data. This would

¹⁴ The most important treaties and conventions are the Harmonized System–1988; the World Trade Organization (WTO) Agreement on Customs Valuation–1994; the Arusha Declaration–2003; the Revised Kyoto Convention–2006; the World Customs Organization (WCO) Framework of Standards to Secure and Facilitate Global Trade (SAFE)–2006; and the WTO Agreement on Trade Facilitation in Bali–2013.

¹⁵ The HS consists not only of a single international nomenclature of goods, but also of comprehensive and precise rules for making the classification in this nomenclature. Identical tariff classifications between countries should therefore be the norm and discrepancies limited.

be particularly appropriate and useful in countries that are members of the same customs union as a tool for customs administrations to ensure proper and consistent implementation of the common legal framework, including improved and converging effectiveness of customs controls.¹⁶

Ownership by Customs and Suggested Institutional Framework

Within customs, a permanent administrative structure should be dedicated to the mirror data analysis function. Customs should appropriate the methodology for the collection and analysis of mirror data to establish it as a permanent function. It should also equip itself with the means and methods to exploit them, in operational terms. The most effective way is to establish a lightweight permanent structure (for example, five or six officers) composed, for the most part, of staff with data-analysis skills with the support of intelligence analysts and investigators. It should be noted, especially for customs administrations with limited resources, that staff specialized in data analysis may be employed in other types of analyses during certain periods.

This “Mirror Data Analysis Unit” should be integrated into a broader customs data-analysis structure. The first countries that have established such units have followed this option.

- The core mission of the Mirror Data Analysis Unit is the collection of data and the identification of discrepancies as presented in Section II. This mission is carried out relatively autonomously by staff with skills in data analysis.
- Mirror data analysis is part of a set of initiatives that all customs administrations need to undertake to establish a comprehensive function of data analysis and exploitation. This approach is now a critical instrument for the modernization of customs.
- Gap analysis and sorting to identify those discrepancies that require customs intervention, described earlier in this section, is a task that is similar to the processing and enrichment of fraud intelligence (essentially tactical intelligence). Although the input of the intelligence analysts and investigators mentioned previously is essential here, the data analysis component remains strong.
- In low-capacity customs administrations, both data exploitation and fraud intelligence are in general embryonic, if not nonexistent functions. However, the following elements must be considered: (1) data analysis remains the dominant component of mirror analysis, (2) the current context of exponential growth of data produced and the digitalization of organizations give relative priority to strengthening the data analysis function in customs, and (3) experience suggests that it is more challenging to build the intelligence function than the data analysis function. Taking these elements into account, positioning a Mirror Data Analysis Unit with data analysis is preferable.

It is important that customs set up permanent and formalized functional links between the Mirror Data Analysis Unit and existing specialized customs units. Upstream, links should be established with units that hold relevant information on mechanisms and suspicions of fraud. In customs where the intelligence gathering and analysis function on fraud has not yet been established or is still too weak, the unit will initially work primarily with customs investigation and postclearance control services. These services will have the most relevant information. Their specialist and experienced staff will be able to add value in sorting out the discrepancies. Downstream, for the exploitation of results, functional links will be made with postclearance control as a priority for the audit of suspect past operations and, second, with the risk management team in charge of maintaining, and enhancing, the customs clearance control selectivity process. In practice, the Mirror Data Analysis Unit will provide them with well-founded and detailed files prepared on selected

¹⁶ For example, the application of the common external tariff of a customs union is jeopardized if member states classify the same merchandise in different HS headings with a different rate of customs duty or deviate from the common rules for determining the customs value that forms the basis for calculating these duties.

doubtful cases, ready for exploitation, and will obtain in return regular feedback on the results of completed audits and inspections.

Capacity-building work concluded that automating mirror data analysis, up to the production of gaps, is technically feasible. Customs IT systems could be interfaced with international databases, thus facilitating the exercise and contributing to its sustainability. Automation would consist of four steps: (1) the automatic loading of Comtrade data, (2) the extraction of data from the transactional database of the customs system, (3) the comparison of the two databases, and (4) gap analysis and the production of mirror analysis results.

In the end, the Mirror Data Analysis Unit, in addition to its contribution to risk management, could be the catalyst for a major reform—the establishment in all customs of a full-fledged Statistical Monitoring and Data Processing division.¹⁷ In this case, it is recommended to set up a high-level committee that will oversee the development of both projects.

¹⁷ This topic is beyond the scope of this note, yet among the tasks to be developed at customs for data analysis and exploitation (in addition to mirror analysis) are (1) searching the customs system database to identify trends and anomalies; (2) automated cross-checking, particularly with the tax authorities; (3) continuing to modernize risk management systems for selectivity in customs clearance controls; (4) monitoring compliance with procedures, including undischarged operations and arrears; and (5) producing the quantitative elements needed for dashboards and reports to authorities. The customs division for statistical monitoring and data processing should also be responsible for improving the quality of foreign trade statistics, in particular by resolving the statistical difficulties generated by special regimes, such as free zones and procedures for processing products under customs supervision.

Annex 1. Seven Steps for Extracting Mirror Data in WITS

The following are the seven steps for extracting mirror data in WITS.

Step 1: Connect to the following address: <https://wits.worldbank.org/WITS/WITS/Restricted/Login.aspx>. Registration is free.

The screenshot shows the WITS Login page in a browser. The address bar contains the URL <https://wits.worldbank.org/WITS/WITS/Restricted/Login.aspx>, which is circled in red. The page layout includes a header with the WITS logo and navigation menu. The main content area features a login form with the following elements:

- * Email address:
- * Password:
- Login button
- Links: [Trouble logging in](#), [Not registered yet? Create your user identity here](#), [Forgot password?](#)

Below the login form is a navigation menu with icons for:

- QUICK SEARCH
- ADVANCE QUERY
- TARIFF AND TRADE SIMULATIONS
- RESULTS
- UTILITIES
- SUPPORT MATERIALS

A 'Data Availability' table is also present, showing data for UN Comtrade, TRAINS, and WTO IDB/CTS.

Data Availability			
UN Comtrade	TRAINS	WTO IDB/CTS	
Last Updated	Earliest Available Year	Latest Available Year	No. of Countries Available
02/01/2021	1962	2019	223

Step 2: Register to obtain a login.

This screenshot is identical to the previous one, showing the WITS Login page. A red circle highlights the login form fields: the 'Email address' input, the 'Password' input, and the 'Login' button.

Step 3: Make a query (“ADVANCED QUERY”) and select “Trade Data (UN Comtrade).”

The screenshot shows the WITS interface with the 'ADVANCED QUERY' menu item circled in red. A dropdown menu is open, showing 'Trade Data (UN Comtrade)' as the selected option. Below the menu, there are fields for 'Query Name' and 'Query Description', and buttons for 'Proceed', 'Save As', 'Delete', and 'Reset'.

Home > Advanced Query > Trade Data (UN Comtrade)

Trade Data (UN Comtrade)

The UN COMTRADE Data option within the Advanced Query provides you with UNSD's trade value and quantity data. It allows you to construct sophisticated queries by including multiple reporters, partners, products, trade flows, and years in a single query. You can select from your own customized country and product groups or use pre-defined aggregates. Advanced Queries can be saved and reused. This is particularly useful for more complex queries. More details...

All users can download UN COMTRADE data with a limit of 100,000 rows/request. If you (or your organization) have UN COMTRADE subscriptions, to enable unlimited download (no limit on number of rows) through WITS click here to subscribe. To subscribe to UN COMTRADE click here

New Query Existing Query - Select a Query -

Query Name:

Query Description:

Proceed Save As Delete Reset

Source: UN Comtrade.

Step 4: Create a “New Query.” Define a “Query Name,” and add a “Quick Description” of the query. Then proceed.

The screenshot shows the WITS interface with the 'Trade Data (UN Comtrade)' page. The 'Query Name' field is filled with 'Kenyamirror2018' and the 'Query Description' field is filled with 'Extraction of mirror data for Kenya 2018 (HS06)'. The 'ADVANCED QUERY' menu item is circled in red.

Home > Advanced Query > Trade Data (UN Comtrade)

Trade Data (UN Comtrade)

The UN COMTRADE Data option within the Advanced Query provides you with UNSD's trade value and quantity data. It allows you to construct sophisticated queries by including multiple reporters, partners, products, trade flows, and years in a single query. You can select from your own customized country and product groups or use pre-defined aggregates. Advanced Queries can be saved and reused. This is particularly useful for more complex queries. More details...

All users can download UN COMTRADE data with a limit of 100,000 rows/request. If you (or your organization) have UN COMTRADE subscriptions, to enable unlimited download (no limit on number of rows) through WITS click here to subscribe. To subscribe to UN COMTRADE click here

New Query Existing Query - Select a Query -

Query Name:

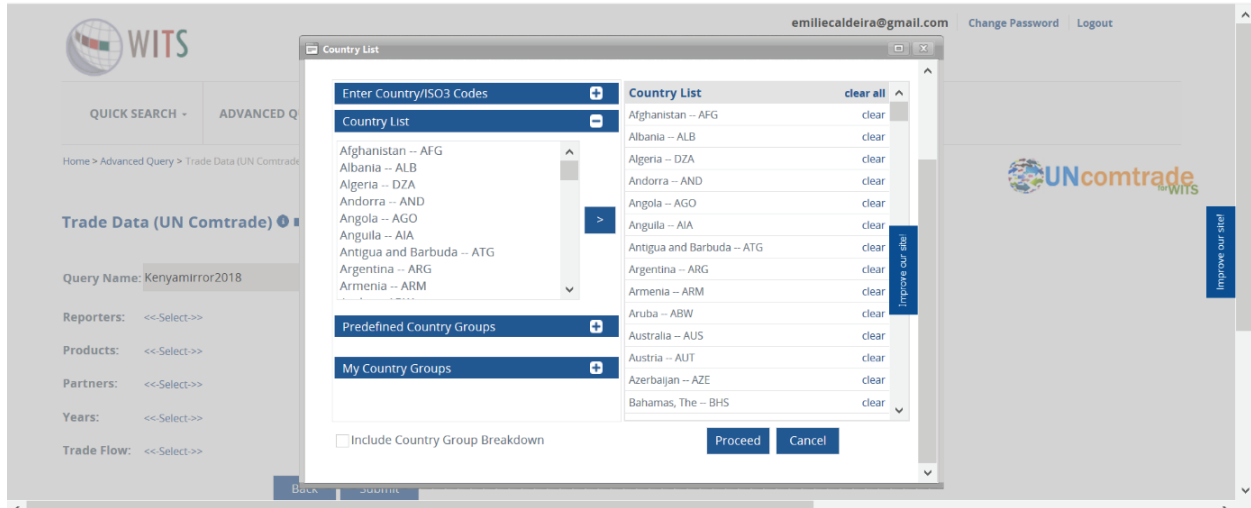
Query Description:

Proceed Save As Delete Reset

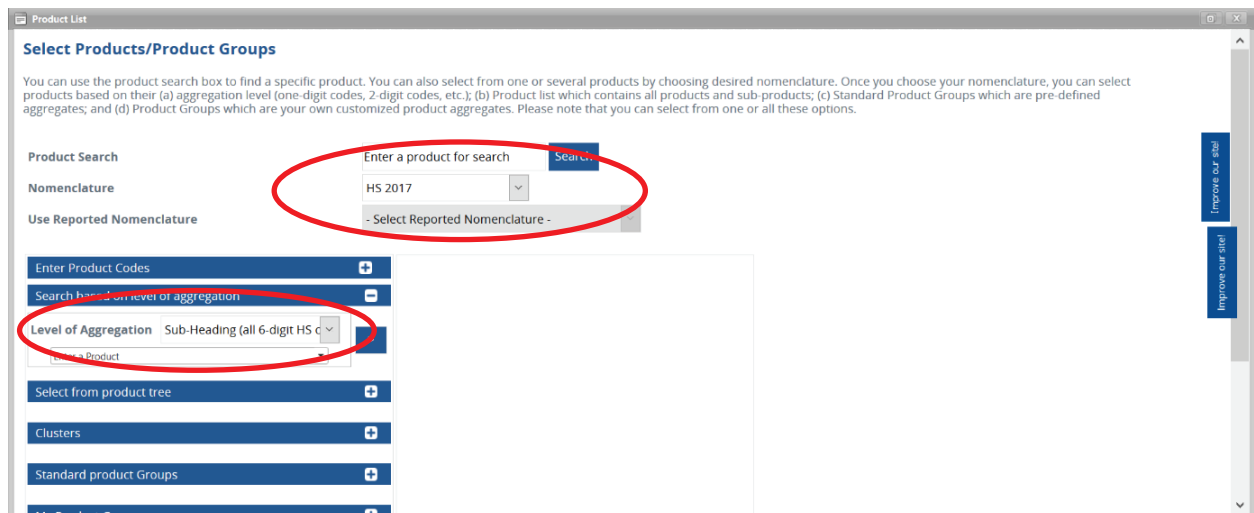
Source: UN Comtrade.

Step 5: Indicate the query.

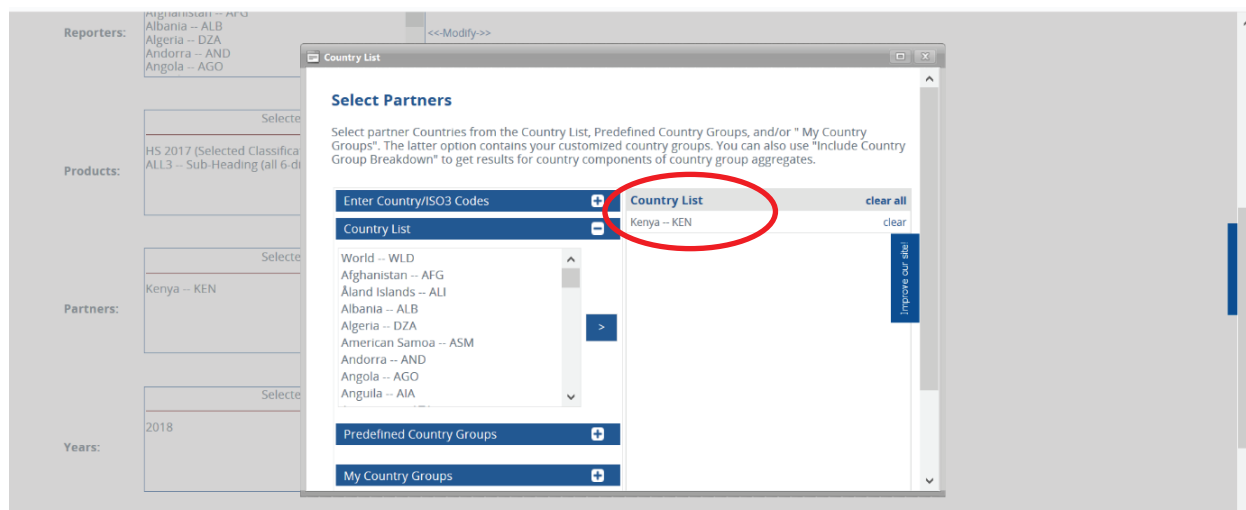
- **“Reporters”** are the countries whose exports are going to the country being studied. The **“Reporters”** are the countries that reported their exports in UN Comtrade. Select all countries in the country list (>) and proceed.



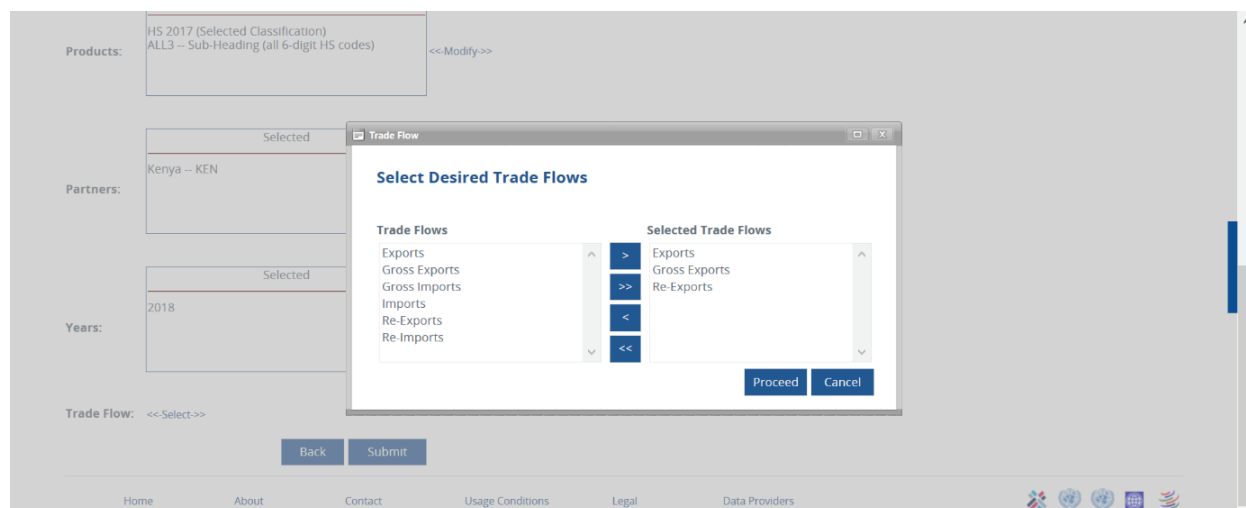
- In **“Products,”** indicate (1) in **“Nomenclature,”** the HS used (for example, HS 2017); (2) the **“Level of data disaggregation”** by choosing Sub-Heading (all 6-digit HS codes); and (3) in **“Clusters,”** select (>) All3 Sub-Heading (all 6-digit HS codes). Then proceed.



- **"Partners"** is the importing country; thus, the country being studied (for example, Kenya). You also must choose the benchmark year in "Year."



- In "Trade Flow," select "Gross Export," "Export," and "Re-Export." "Gross Export" equals "Export" plus "Re-Export." In the UN statistics system (<https://unstats.un.org/unsd/tradekb/Knowledgebase/Reexports-and-Reimports>), re-exports are goods that are first imported into a country and then exported by that same country to another country without any processing. The UN statistics system identifies them for analysis, but they must be recorded as exports from the country. Thus, "Gross Export" must be used to calculate the discrepancies in mirror analysis.



Step 6: Submit the query and check the status of your submitted query.

The screenshot shows the WITS interface with the user 'emiliecaldeira@gmail.com'. The navigation menu includes 'QUICK SEARCH -', 'ADVANCED QUERY -', 'TARIFF AND TRADE SIMULATIONS -', 'RESULTS -', 'UTILITIES -', and 'SUPPORT MATERIALS -'. The breadcrumb trail is 'Home > Results > Download and View Results'. The main heading is 'Download and View Results' with a help icon. Below it, a sub-heading explains the options: 'This option allows you to check the status of your submitted queries including simulations, view results, add/remove indicators from your results, and download the data. More details...'. There are two tabs: 'View and Request Download' and 'Download Data'. A table lists the query results:

ID	Query/Simulation Name	View	Chart	Download	Delete	Log	Status	Source	Date
1899930	Kenyamirror2018						Waiting	UN COMTRADE	2/2/2021 9:23:00 AM

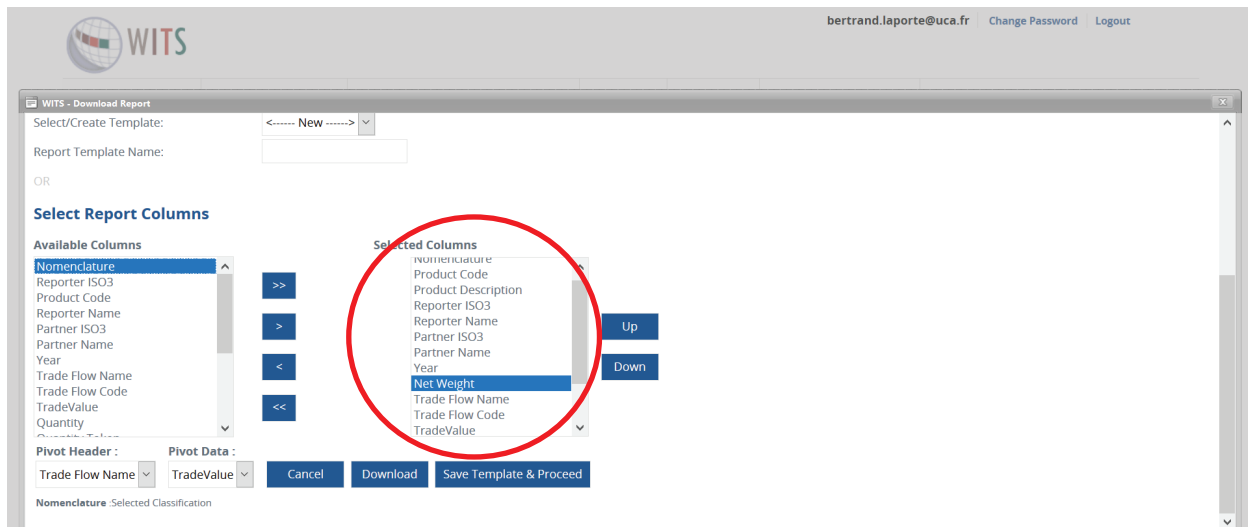
The 'Log' and 'Status' columns for the first row are circled in red. The 'Status' cell contains the text 'Waiting'. At the bottom, there are links for 'Home', 'About', 'Contact', 'Usage Conditions', 'Legal', and 'Data Providers', along with several logos.

Step 7: When the status is “Completed,” download the data. Several data extraction formats are possible. For large files, Stata is the most suitable format. In addition, with Stata, it is easier to merge the mirror data file (WITS) with the customs data of the country being studied. Many administrations do not have Stata. This work can be done with Microsoft Access; it can also be done with Microsoft Excel, but with greater difficulty. Excel can save the first 1,048,576 rows; any remaining will be truncated.

This screenshot is similar to the previous one, but the 'Status' column for the query 'Kenyamirror2018' is now circled in red and shows 'Completed'. The 'File Size' is 941 and 'Total Rows' is 46,058. The rest of the interface remains the same.

The screenshot shows the 'WITS - Download Report' dialog box. The 'Job Name' is 'ExportdepuisPartenaire' and the 'Job Description' is 'commercebilateral'. The 'File Format' dropdown menu is open, showing options: 'CSV', 'Excel', 'Text (Tab delimited)', and 'STATA'. The 'CSV' option is selected and circled in red. Below the dropdown, there are fields for 'Select/Create Template' (set to 'New'), 'Report Template Name', and 'OR Select Report Columns'. The 'Available Columns' and 'Selected Columns' sections both show 'Nomenclature Reporter ISO2'.

Initially, it is useful to extract all available data (see “selected Columns” in the following figure) to avoid having to go back to WITS afterward, if a more detailed analysis of the discrepancies is needed. Remember to fill in “Pivot Header” and “Pivot Data”; otherwise, it will be impossible to perform the extraction. To have a file that is easy to handle with all the information in columns, choose “Trade Flow Name” for “Pivot Header” and “Trade Value” for “Pivot Data.” To put the columns in order, simply place them in the desired order in “Selected Columns.” You can add columns in selected columns from available columns.



The result of the extraction to Excel and Stata must be in the format shown here.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
	Nomenclature	ProductCode	ProductDescription	ReporterISO3	ReporterName	PartnerISO3	PartnerName	Year	NetWeight in KGM	Export in 1000 USD	Gross Exp. in 1000 USD	Re-Export in 1000 USD	Quantity	QuantityToken	QtyUnit	
2	H5	350610	Glues or adhesives; prepared, produ	AGO	Angola	KEN	Kenya	2018	1005	3.847	3.847		1005.030	8	Kg	
3	H5	391799	Plastics; tubes, pipes and hoses th	AGO	Angola	KEN	Kenya	2018	2074	7.413	7.413		2074.410	8	Kg	
4	H5	391890	Floor, wall or ceiling coverings; o	AGO	Angola	KEN	Kenya	2018	5798	19.814	19.814		5798.310	8	Kg	
5	H5	392112	Plastics; plates, sheets, film, foi	AGO	Angola	KEN	Kenya	2018	950	5.421	5.421		949.490	8	Kg	
6	H5	392290	Plastics; bidets, lavatory pans, fi	AGO	Angola	KEN	Kenya	2018	1723	6.503	6.503		1722.950	8	Kg	
7	H5	392520	Plastics; builders' ware, doors, wi	AGO	Angola	KEN	Kenya	2018	10488	38.929	38.929		10488.480	8	Kg	
8	H5	392590	Plastics; builders' ware, n.e.c. or	AGO	Angola	KEN	Kenya	2018	461	2.477	2.477		461.400	8	Kg	
9	H5	392690	Plastics; other articles n.e.c. in	AGO	Angola	KEN	Kenya	2018	2	0.177	0.177		2.000	8	Kg	
10	H5	401693	Rubber; vulcanised (other than hard	AGO	Angola	KEN	Kenya	2018	5	0.014	0.014		5.000	8	Kg	
11	H5	441299	Plywood, veneered panels and simila	AGO	Angola	KEN	Kenya	2018	5617	21.236	21.236		5616.500	8	Kg	
12	H5	441820	Wood; doors and their frames and th	AGO	Angola	KEN	Kenya	2018	1456	8.311	8.311		1455.960	8	Kg	
13	H5	690229	Bed linen; of textile materials (ot	AGO	Angola	KEN	Kenya	2018	55	1.057	1.057		55.000	8	Kg	
14	H5	691990	Ceramic sinks, wash basins, wash ba	AGO	Angola	KEN	Kenya	2018	3439	12.537	12.537		0.000	1	N.Q.	
15	H5	701090	Glass; carboys, bottles, flasks, ja	AGO	Angola	KEN	Kenya	2018	2694	9.207	9.207		2694.160	8	Kg	
16	H5	701990	Glass fibres; n.e.c. in heading no.	AGO	Angola	KEN	Kenya	2018	216	1.234	1.234		216.230	8	Kg	
17	H5	720840	Iron or non-alloy steel; (not in co	AGO	Angola	KEN	Kenya	2018	4392	15.011	15.011		4392.000	8	Kg	
18	H5	721621	Iron or non-alloy steel; L sections	AGO	Angola	KEN	Kenya	2018	1886	6.445	6.445		1885.910	8	Kg	
19	H5	730661	Iron or steel (excluding cast iron)	AGO	Angola	KEN	Kenya	2018	2229	7.618	7.618		2229.270	8	Kg	
20	H5	730830	Iron or steel; structures and parts	AGO	Angola	KEN	Kenya	2018	5325	18.198	18.198		5325.360	8	Kg	
21	H5	730890	Iron or steel; structures and parts	AGO	Angola	KEN	Kenya	2018	96023	404.773	404.773		96022.920	8	Kg	
22	H5	731512	Chain; articulated link, (other tha	AGO	Angola	KEN	Kenya	2018	0	0.476	0.476		0.100	8	Kg	
23	H5	731815	Iron or steel; threaded screws and	AGO	Angola	KEN	Kenya	2018	1173	5.017	5.017		1172.780	8	Kg	
24	H5	732490	Iron or steel; sanitary ware and pa	AGO	Angola	KEN	Kenya	2018	171	0.977	0.977		171.180	8	Kg	
25	H5	732690	Iron or steel; articles n.e.c. in h	AGO	Angola	KEN	Kenya	2018	12886	66.536	66.536		12885.950	8	Kg	
26	H5	820299	Tools, hand; saw blades n.e.c. in h	AGO	Angola	KEN	Kenya	2018	307	1.049	1.049		306.970	8	Kg	
27	H5	820320	Tools, hand; pliers (including cutt	AGO	Angola	KEN	Kenya	2018	57	0.282	0.282		57.190	8	Kg	
28	H5	820411	Tools, hand; hand-operated spanners	AGO	Angola	KEN	Kenya	2018	108	0.405	0.405		107.670	8	Kg	
29	H5	820412	Tools, hand; hand-operated spanners	AGO	Angola	KEN	Kenya	2018	42	0.157	0.157		42.020	8	Kg	

Data Editor (Browse) - [DataJobID-2113880_2113880_Kenymirror2018]

File Edit View Data Tools

Nomenclature[1] 1

	Nomenclature	ReporterISO3	ProductCode	ProductDes-n	ReporterName	PartnerISO3	PartnerName	Year	NetWeighti-M	Quantity	QuantityTo-n	QtyUnit
1	H5	AGO	350610	Glues ...	Angola	KEN	Kenya	2018	1005	1005.03	8	Kg
2	H5	AGO	391739	Plasti...	Angola	KEN	Kenya	2018	2074	2074.41	8	Kg
3	H5	AGO	391890	Floor,...	Angola	KEN	Kenya	2018	5798	5798.31	8	Kg
4	H5	AGO	392112	Plasti...	Angola	KEN	Kenya	2018	950	949.69	8	Kg
5	H5	AGO	392290	Plasti...	Angola	KEN	Kenya	2018	1723	1722.95	8	Kg
6	H5	AGO	392520	Plasti...	Angola	KEN	Kenya	2018	10488	10488.48	8	Kg
7	H5	AGO	392590	Plasti...	Angola	KEN	Kenya	2018	461	461.4	8	Kg
8	H5	AGO	392690	Plasti...	Angola	KEN	Kenya	2018	2	2	8	Kg
9	H5	AGO	401693	Rubber...	Angola	KEN	Kenya	2018	5	5	8	Kg
10	H5	AGO	441299	Plywoo...	Angola	KEN	Kenya	2018	5617	5616.5	8	Kg
11	H5	AGO	441820	Wood; ...	Angola	KEN	Kenya	2018	1456	1455.96	8	Kg
12	H5	AGO	630229	Bed li...	Angola	KEN	Kenya	2018	53	53	8	Kg
13	H5	AGO	691090	Cerami...	Angola	KEN	Kenya	2018	3439	0	1	N.Q.
14	H5	AGO	701090	Glass;...	Angola	KEN	Kenya	2018	2694	2694.16	8	Kg
15	H5	AGO	701990	Glass ...	Angola	KEN	Kenya	2018	216	216.23	8	Kg
16	H5	AGO	720840	Iron o...	Angola	KEN	Kenya	2018	4392	4392	8	Kg
17	H5	AGO	721621	Iron o...	Angola	KEN	Kenya	2018	1886	1885.91	8	Kg
18	H5	AGO	730661	Iron o...	Angola	KEN	Kenya	2018	2229	2229.27	8	Kg
19	H5	AGO	730830	Iron o...	Angola	KEN	Kenya	2018	5325	5325.36	8	Kg
20	H5	AGO	730890	Iron o...	Angola	KEN	Kenya	2018	96023	96022.92	8	Kg
21	H5	AGO	731512	Chain;...	Angola	KEN	Kenya	2018	0	.1	8	Kg
22	H5	AGO	731815	Iron o...	Angola	KEN	Kenya	2018	1173	1172.76	8	Kg

Ready Vars: 15 Order: Dataset Obs: 46 395 Filter: Off Mode: Browse CAP NUM

References

- Bhagwati, J. 1964. "On the Under Invoicing of Imports." *Oxford Bulletin of Economics and Statistics* 27: 389-97.
- Cantens, T. 2015. "Mirror Analysis and Revenue Fraud." WCO Research Paper No. 35, World Customs Organization, Brussels.
- Cariolle, J., A-M. Geourjon, B. Laporte, and C. Chalendar. 2019. "Measuring and Improving the Performance of Customs Valuation: An Illustration with Gabon." *The World Economy* 42 (6): 1850-72.
- Carrère, C., and C. Grigoriou. 2015. "Can Mirror Data Help to Capture Informal International Trade?" FERDI Working Paper P123, Foundation for Studies and Research on International Development, Clermont-Ferrand, France.
- Chalendar, C., G. Raballand, and A. Rakotoarisoa. 2016. "The Use of Detailed Statistical Data in Customs Reform: The Case of Madagascar." Policy Research Working Paper 7625, World Bank, Washington, DC.
- Chalendar, C., A. Duhaut, A. M. Fernandes, A. Mattoo, G. Raballand, and B. Rijkers. 2020. "Does Better Information Curb Customs Fraud?" Policy Research Working Paper 9254, World Bank, Washington, DC.
- Eurostat. 2009. "MEDSTAT II: Asymmetry in Foreign Trade Statistics in Mediterranean Partner Countries." Methodologies and Working Papers, European Commission, Brussels.
- Ferrantino, M. J., X. Liu, and Z. Wang. 2012. "Evasion Behaviors of Exporters and Importers: Evidence from the U.S.-China Trade Data Discrepancy." *Journal of International Economics* 86 (1): 141-57.
- Fisman, R., and S. J. Wei. 2004. "Tax Rates and Tax Evasion: Evidence from 'Missing Imports' in China." *Journal of Political Economy* 112 (2): 471-96.
- Grigoriou, C., F. Kalizinje, and G. Raballand. 2019. "How Helpful are Mirror Statistics for Customs Reform? Lessons from a Decade of Operational Use." *World Customs Journal* 13 (2): 105-14.
- Hummels, D., and V. Lugovskyy. 2006. "Are Matched Partner Trade Statistics a Usable Measure of Transportation Costs?" *Review of International Economics* 14 (1): 69-86.
- Jean, S., and C. Mitaritonna, 2010. "Determinants and Pervasiveness of the Evasion of Custom Duties." CEPII Working Paper 2010-26, CEPII, Paris.
- Kalizinje, F. 2018. "Combating Fraud in WCO East and Southern African Region: A Mirror Analysis Through the Lens of Malawi." *Global Trade and Customs Journal* 13 (5): 224-33.
- Levin, J., and L. Widell. 2014. "Tax Evasion in Kenya and Tanzania: Evidence from Missing Imports." *Economic Modelling* 39 (C): 151-62.
- Mishra, P., A. Subramanian, and P. Topalova. 2008. "Tariffs, Enforcement, and Customs Evasion: Evidence from India." *Journal of Public Economics* 92 (10-11): 1907-25.
-

- Nitsch, V. 2012. "Trade Mispricing and Illicit Flows." In *Draining Development? Controlling Flows of Illicit Funds from Developing Countries*, edited by P. Reuter. Washington, DC: World Bank.
- Pérez Azcarraga, A. A., T. Matsudaira, G. Montagnat-Rentier, J. Nagy, and R. James Clark. 2022. *Customs Matters: Strengthening Customs Administration in a Changing World*. International Monetary Fund, Washington, DC.
- Rijkers, B., L. Baghdadi, and G. Raballand. 2015. "Political Connections and Tariff Evasion: Evidence from Tunisia." *The World Bank Economic Review* 31 (2): 459-82.
- Stoyanov, A. 2012. "Tariff Evasion and Rules of Origin Violations under the Canada-U.S. Free Trade Agreement." *Canadian Journal of Economics* 45 (3): 879-902.
- Van Dunem, J. E., and C. Arndt. 2009. "Estimating Border Tax Evasion in Mozambique." *Journal of Development Studies* 45 (6): 1010-25.
- Worku, T., J. P. Mendoza, and J. L. Wielhouwer. 2016. "Tariff Evasion in SSA: The Influence of Corruption in Importing and Exporting Countries." *International Tax and Public Finance* 23 (4): 741-61.
- World Customs Organization. 2015. "Tools for Reducing Revenue Risks and the Revenue Gap: (I) Mirror Analysis Guide, Including Case Study (Cameroon)." Brussels, Belgium.
- Yeats, A. 1995. "Are Partner Country Statistics Useful for Estimating Missing Trade Data?" Policy Research Working Paper 1501, World Bank, Washington, DC.



PUBLICATIONS

The Use of Mirror Data by Customs Administrations:
From Principles to Practice

TNM/2023/05

ISBN 979-8-40-025128-3



9 798400 251283