# Trade Misinvoicing Analysis (Mirror Analysis)

## General Process[[1]](#footnote-1)

Download and Clean 16-year Global Comtrade Data

Pair Trade Data and Separate Matched, Orphaned, and Lost

Prepare Data for Modeling

Build Model to Estimate CIF FOB Difference

Calculate Trade Misinvoicing

(branching global and national)

Calculate Tariff Loss

(only for national analysis)

## Data Sources:

##### UN Comtrade

Illicit financial flows were estimated from a subset of annual UN Comtrade data where our preliminary requirements hold: (1) non-zero values for the trade are reported by both the reporting country and its partner; (2) non-zero volumes for the trade are reported by both the reporting country and its partner; and, (3) volumes are reported in the same physical units for both the reporting country and its partner. The time span used is from 2001 to 2016 and only countries listed in Appendix 1 were included.

##### Census and Statistics Department of the Government of Hong Kong Special Administrative Region

Hong Kong re-export data for adjusting effect of re-export passing Hong Kong in UN Comtrade database.

##### NSF-Kellogg Institute for International Studies Data Base on Economic Integration Agreements (April 2017)

Data of types of regional trade agreement between countries from 1950 to 2012. GFI used 2012 data for every subsequent year. Types of regional trade agreement was used in a regression model to estimate gaps between CIF and FOB reporting, in other words, the cost of transportation and insurance.

##### Centre d’Études Prospectives et d’Informations Internationales (CEPII)

Geographical information used in the regression model to estimate gaps between CIF and FOB reporting.

##### Swiss Customs Administration

Swiss foreign trade in gold, silver and coins by trading partner, 1982-2013

##### World Bank WITS[[2]](#footnote-2)

Tariff rates were based on weighted effectively applied tariff rates in TRAINS and WTO-IDB. In case of duplication, TRAINS data was used.

## Preliminary data treatments:

##### Non-reporting of Swiss trade flows of precious metals in Comtrade for years prior to 2012

GFI added trade data in gold, nonmonetary, unwrought others (other Than Powder) from Swiss Customs Administration for 2001 to 2011.

##### Entrepôt trade through Hong Kong

GFI followed OECD’s practice in BALANCE INTERNATIONAL MERCHANDISE TRADE DATA: VERSION 1.

##### Slovakia and Montenegro

Beginning in 2006, adjust Slovakia reports to reflect Montenegro independently from Serbia-Montegro.

## FOB equivalents:

For those countries that report import values to the United Nations on a CIF basis only, FOB equivalents are calculated using margins predicted by a regression model that utilizes geographical information, regional trade agreements, infrastructure quality (proxied by level of development based on IMF), global median price (based on reported export prices at 6-digit level), commodity classification methods, and year of trade. The training set was a subset of 2001 to 2016 Comtrade data that has been applied preliminary treatments, filtered by our preliminary requirements, and satisfied the following criteria: (1) the mirror trade volumes differed by more than 2.5 percent, and (2) the ratio of the (implied) unit values of imports to exports was greater than 1.8 or less than 0.8.

Table 1 Independent Variables in Regression for Gaps between CIF and FOB

|  |  |  |  |
| --- | --- | --- | --- |
| **Mnemonic** | **Variation** |  | **Description (Source)** |
| ln\_distw | {i,j} |  | log of the weighted distance between i & j (CEPII) |
| ln\_distw\_squared | {i,j} |  | ln\_distw x ln\_distw |
| log(uvmdn) | {t,k} |  | log of the median "world" price of good k at time t |
| d\_contig | {i,j} |  | dummy = 1 if i and j share a border (CEPII) |
| d\_conti | {i,j} |  | dummy = 1 if i and j are on the same continent (CEPII) |
| d\_rta | {t,i,j} |  | categorical variable for type of regional trade agreement between i and j in year t (Bergstrand & Baier (2015), extended to 2015 by GFI) |
| d\_landlocked\_i | {i} |  | dummy = 1 if i is landlocked (CEPII) |
| d\_landlocked\_j | {j} |  | dummy = 1 if j is landlocked (CEPII) |
| d\_dev\_i | {i} |  | dummy = 1 if i is a developing economy (IMF) |
| d\_dev\_j | {j} |  | dummy = 1 if j is a developing economy (IMF) |
| d\_hs\_diff | {t,i,j} |  | dummy = 1 if i and j used different HS classification in year t |
| d\_2001 ... d\_2015 | {t} |  | dummy = 1 for corresponding years |

## Weighted trade gaps:

Discrepancies in the volumes reported for each mirrored trade are then used to weight the raw trade gaps: a higher weight is applied to a given discrepancy in value the smaller is the associated volume discrepancy. The use of weighted measures (rather than the raw trade gaps) in the Comtrade estimates is intended to improve the reliability of the trade misinvoicing estimates. The weighting scheme is described in formal terms as follows: let QD and QA denote, respectively, the reported volume of trade (of a particular good in a particular year) between a developing country reporter (D) and its advanced-country trade partner (A). The weight applied to the trade gap in value terms was specified as



Appendix 1 Countries Covered in GFI’s Analysis

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Developing Economies (148)** | | | | | **Advanced Economies (36)** |
| **Sub-Saharan Africa (45)** | **Asia (25)** | **Developing Europe (23)** | **Middle East & N. Africa (22)** | **Western Hemisphere (33)** |
| Angola | Bangladesh | Albania | Afghanistan, Islamic Republic of | Antigua and Barbuda | Australia |
| Benin | Bhutan | Armenia, Republic of | Algeria | Argentina | Austria |
| Botswana | Brunei Darussalam | Azerbaijan, Republic of | Bahrain, Kingdom of | Aruba | Belgium |
| Burkina Faso | Cambodia | Belarus | Djibouti | Bahamas, The | Canada |
| Burundi | China, P.R.: Mainland | Bosnia and Herzegovina | Egypt | Barbados | Cyprus |
| Côte d'Ivoire | Fiji | Bulgaria | Iran, Islamic Republic of | Belize | Czech Republic |
| Cabo Verde | India | Croatia | Iraq | Bolivia | Denmark |
| Cameroon | Indonesia | Georgia | Jordan | Brazil | Estonia |
| Central African Republic | Kiribati | Hungary | Kuwait | Chile | Finland |
| Chad | Lao People's Democratic Republic | Kazakhstan | Lebanon | Colombia | France |
| Comoros | Malaysia | Kyrgyz Republic | Libya | Costa Rica | Germany |
| Congo, Democratic Republic of | Maldives | Macedonia, FYR | Mauritania | Dominica | Greece |
| Congo, Republic of | Mongolia | Moldova | Morocco | Dominican Republic | Hong Kong |
| Equatorial Guinea | Myanmar | Montenegro | Oman | Ecuador | Iceland |
| Eritrea | Nepal | Poland | Pakistan | El Salvador | Ireland |
| Eswatini, Kingdom of | Papua New Guinea | Romania | Qatar | Grenada | Israel |
| Ethiopia | Philippines | Russian Federation | Saudi Arabia | Guatemala | Italy |
| Gabon | Samoa | Serbia, Republic of | Sudan | Guyana | Japan |
| Gambia, The | Solomon Islands | Tajikistan | Syrian Arab Republic | Haiti | Korea, Republic of |
| Ghana | Sri Lanka | Turkey | Tunisia | Honduras | Latvia |
| Guinea | Thailand | Turkmenistan | United Arab Emirates | Jamaica | Lithuania |
| Guinea-Bissau | Timor-Leste, Dem. Rep. of | Ukraine | Yemen, Republic of | Mexico | Luxembourg |
| Kenya | Tonga | Uzbekistan |  | Nicaragua | Malta |
| Lesotho | Vanuatu |  |  | Panama | Netherlands |
| Liberia | Vietnam |  |  | Paraguay | New Zealand |
| Madagascar |  |  |  | Peru | Norway |
| Malawi |  |  |  | St. Kitts and Nevis | Portugal |
| Mali |  |  |  | St. Lucia | San Marino |
| Mauritius |  |  |  | St. Vincent and the Grenadines | Singapore |
| Mozambique |  |  |  | Suriname | Slovak Republic |
| Namibia |  |  |  | Trinidad and Tobago | Slovenia |
| Niger |  |  |  | Uruguay | Spain |
| Nigeria |  |  |  | Venezuela, Republica Bolivariana de | Sweden |
| Rwanda |  |  |  |  | Switzerland |
| Sao Tome and Principe |  |  |  |  | United Kingdom |
| Senegal |  |  |  |  | United States |
| Seychelles |  |  |  |  |  |
| Sierra Leone |  |  |  |  |  |
| Somalia |  |  |  |  |  |
| South Africa |  |  |  |  |  |
| Tanzania |  |  |  |  |  |
| Togo |  |  |  |  |  |
| Uganda |  |  |  |  |  |
| Zambia |  |  |  |  |  |
| Zimbabwe |  |  |  |  |  |
| Note: The designation of an economy as either "advanced" or "developing" is determined by the International Monetary Fund. Advanced economies are used as a benchmark against which potential trade misinvoicing is estimated. Not every developing country reported bilateral trade with advanced economies in every year published in the DOTS and Comtrade databases. | | | | | |

1. Refer to the master flow chart for detailed process in a technical aspect. [↑](#footnote-ref-1)
2. Only for national reports. [↑](#footnote-ref-2)