Understanding global trade estimates by HS product

Methodology guide for data users

This guide explains how reported merchandise trade data are supplemented with estimates and reconciled into a consistent product hierarchy to present global exports and imports by HS product. It focuses on statistical reasoning, interpretation and limitations.

Purpose and scope

Reported Comtrade data do not always provide complete country coverage for every year. The methodology estimates eligible gaps using historical trade patterns, then aligns the product estimates with an overall trade benchmark. The objective is to provide a more complete and internally consistent picture of global merchandise trade by product, while retaining a distinction between the reported component and the gap component (estimated or balancing).

The estimates are annual and cover three levels of the Harmonized System (HS): two-digit chapters (AG2), four-digit headings (AG4) and six-digit subheadings (AG6). A four-digit heading belongs to the chapter identified by its first two digits; a six-digit subheading belongs to the heading identified by its first four digits. These levels describe the same trade at different degrees of detail.

Exports and imports are estimated and reconciled separately. Export totals are matched to export benchmarks and import totals to import benchmarks. The methodology does not force global exports and imports to equal each other.

The five methodological steps

- 1. Prepare the data and estimate missing trade.
- 2. Reconcile AG2 with the trade matrix.
- 3. Reconcile AG4 with adjusted AG2.
- 4. Reconcile AG6 with adjusted AG4.
- 5. Bring the reconciled estimates together.

What consistency means

For each year and trade flow, adjusted AG2 values sum to the trade-matrix benchmark where a matching benchmark is available (Step 2). AG4 headings sum to their adjusted AG2 chapter targets where chapter coverage is compatible (Step 3). Ordinary AG6 subheadings sum to their adjusted AG4 heading targets where the necessary child coverage exists; the special residual category described in Step 4 can preserve the overall AG6 total when detailed coverage is incomplete. Consistency is a balancing property, not proof that every individual product estimate is exact.

Step 1. Prepare the data and estimate missing trade

1.1 Establish eligible observations

The starting point is reported Comtrade merchandise trade values and information on country reporting availability. Observations are organized by country, year, product and trade flow. Multiple reported observations within the same estimation unit are added together before estimation.

HS codes are restricted to their configured valid periods. Observations and estimates outside those periods are excluded. This prevents a code from being estimated for years in which it is not eligible under the configured validity rules. It does not, by itself, convert trade between different HS revisions or remove all breaks caused by classification changes.

Country coverage is based on the reporting-availability information. A missing year is identified when a country in the available reporting universe has no availability record for that year. The absence of a particular product in an otherwise available country-year is not automatically classified as missing trade. A zero, an absent product record and an unavailable country-year therefore have different meanings.

1.2 Choose a reported reference value

For an eligible missing country-year, the method selects the nearest usable reported value for the same country and product. This reference may be from an earlier or later year. If two observations are equally close, the earlier observation is preferred. A country without a usable reference observation cannot receive an estimate through this method and remains an unresolved coverage gap.

1.3 Apply a suitable growth pattern

For a short gap with sufficient recent country history, the method uses a typical recent growth rate for that country and product. Otherwise, it uses growth observed among countries reporting the same product in both years. A median-based approach and treatment of extreme ratios reduce the influence of unusually large changes in individual reporters.

When the reference and target years are several years apart, annual growth factors are linked across the intervening years. Backward estimation reverses the direction of the growth calculation. Limits on annual and cumulative factors help prevent implausible extrapolation. If no usable growth factor is available, the method carries the reference value forward or backward without growth.

1.4 Check plausibility and aggregate

Candidate estimates are compared with the country's own historical product values where enough history exists. A candidate outside the permitted historical range is replaced by the nearest reported reference value. With insufficient history, the historical-range test cannot provide the same assurance. This is a country-level plausibility check, not a separate validation of country existence dates or territorial succession.

Reported and estimated country values are then added to produce an initial estimated world value for each year, product and flow. At this stage, the gap component represents the contribution from estimated country observations. Remaining unresolved coverage should not be interpreted as observed zero trade.

Step 2. Reconcile AG2 with the trade matrix

Why an overall benchmark is needed

Product-by-product estimation can improve coverage without necessarily reproducing the intended overall global trade total. The trade matrix supplies the annual total-trade benchmark used to anchor the product hierarchy. Matching AG2 to this benchmark establishes the top-level total before the more detailed product levels are adjusted.

Compare like with like

For each year, the initial AG2 chapter values are added separately for exports and imports. Each sum is compared with the corresponding trade-matrix total for that year and flow. The difference between the benchmark and the initial AG2 sum is the amount that must be reconciled. Benchmark alignment applies to years and flows for which matching targets are available.

Adjust the estimated component first

The method first adjusts estimated country values so that the reported component plus the revised estimated component equals the benchmark. Where estimated values already exist, the required amount is distributed proportionally. If the initial estimated component is zero but estimated observations exist, the required amount can be distributed equally across those observations.

The reported component is retained where this estimated-component adjustment is sufficient. If it cannot achieve the target, reported values may be scaled as a last resort. Users should therefore not assume that the reported component in the final adjusted AG2 estimates is always identical to the original reported input.

Check the result and establish chapter targets

After adjustment, country values are aggregated again into AG2 chapters. The sum of the adjusted chapters is checked against the trade-matrix total, allowing only a small numerical rounding tolerance. These adjusted chapter values become the targets for AG4 reconciliation in Step 3.

Illustrative example

Suppose the initial global export estimate across AG2 chapters is 950, while the trade-matrix benchmark is 1,000. The reported component is 800 and the initial estimated component is 150. The estimated component must become 200, an increase of 50, to reach the benchmark. If proportional adjustment is feasible, the existing estimates are scaled by 200 / 150. The revised total is 800 + 200 = 1,000.

This example is hypothetical. It illustrates the balancing principle and is not a production result.

How the benchmark affects interpretation

The resulting product totals are conditional on the trade-matrix benchmark. Agreement with that benchmark is achieved by design; it is not an independent validation of the benchmark or of the detailed product distribution. A change to the benchmark can change the reconciled estimates even when the underlying reported product data remain unchanged.

Step 3. Reconcile AG4 with adjusted AG2

Set a target for each chapter

For each year and flow, the adjusted AG2 chapter value from Step 2 is compared with the sum of its AG4 headings. The reported AG4 component is preserved. The difference between the chapter target and the sum of reported AG4 values determines the total gap component (estimated or balancing) required across the headings.

Distribute the chapter difference

The required amount is allocated using the relative magnitudes of the original estimated gaps. Where those gaps provide no usable weights, the method uses a smoothed historical gap profile, then the relative magnitudes of reported trade, and finally equal allocation if no other basis is available. A final rounding correction ensures that the headings sum to the chapter target.

This adjustment changes the detailed estimates, not the chapter benchmark. It does not introduce a new independent estimate of total global trade. Chapter coverage at AG2 and AG4 must be compatible for this reconciliation to succeed.

Illustrative example

An adjusted AG2 chapter target is 1,000. Its two AG4 headings have reported values of 500 and 300, leaving 200 to allocate. If their original gap magnitudes are in a ratio of 3 to 1, the allocated gaps are 150 and 50. Their adjusted values become 650 and 350, which sum to 1,000. These figures are hypothetical.

Step 4. Reconcile AG6 with adjusted AG4

Repeat the balancing principle at finer detail

The adjusted AG4 headings from Step 3 become the targets for their AG6 subheadings. For each year, flow and heading, the reported AG6 values are preserved and the required gap is allocated among existing subheadings using the sequence of weighting options described in Step 3 under “Distribute the chapter difference”. The revised subheading values are checked against their heading target.

Handle incomplete detailed coverage

An ordinary AG6 subheading must have a corresponding AG4 parent. Where an AG4 heading has no ordinary AG6 children, its value cannot be assigned to named subheadings by this method. A special residual category, 999999, can account for the difference between the overall adjusted AG4 total and the sum of ordinary AG6 values, provided the required residual category exists.

The residual is a balancing category, not a newly identified product. It can maintain the overall total while detailed coverage remains incomplete. Consequently, agreement between overall AG4 and AG6 totals does not establish that every AG4 heading has a complete six-digit breakdown. No new ordinary subheadings are created to fill such gaps.

Step 5. Bring the reconciled estimates together

The final estimates bring together the three product levels and both trade flows. This last step organizes the results for analysis; it does not perform further statistical estimation or balancing. Each observation retains its year, product code, trade flow, estimated world value, reported component, gap component and coverage indicators.

Key measures

- Estimated world value: the reported component plus the gap component (estimated or balancing).
- Reported component: the component retained from reported data, subject to the possible AG2 benchmark adjustment described in Step 2. AG4 and AG6 reported components are preserved during reconciliation in Steps 3 and 4, respectively.
- Gap component: initially the contribution from estimated country observations; after reconciliation, it can also include signed balancing adjustments.
- Gap share: the gap component divided by the estimated world value. It is not a confidence interval or a direct measure of statistical accuracy.
- Reporter counts: the numbers of reported and estimated reporters underlying the estimation. Adjusting AG4 and AG6 values does not recalculate these coverage counts.

How to use the estimates responsibly

Choose one product level for totals

AG2, AG4 and AG6 are overlapping descriptions of the same trade. Do not add values across all three levels: doing so counts the same trade more than once. Select one level appropriate to the analysis, and compare exports and imports separately. Preserve leading zeros when identifying products.

Understand negative gaps

If reported child values exceed their higher-level target, reconciliation requires a negative balancing gap. A negative gap does not mean negative missing trade. It indicates a downward adjustment needed for consistency. The method does not impose a non-negativity constraint on all reconciled child values, so unusual or negative estimated world values warrant careful review.

Distinguish coverage from certainty

A large positive gap share can indicate substantial reliance on estimation. A small gap share does not guarantee high accuracy, and a negative share has a balancing interpretation. Estimates depend on historical patterns, reporting availability, classification validity and benchmark choices. Abrupt structural changes may not be captured by historical extrapolation.

Read hierarchy checks together with coverage checks

Review unresolved countries, fallback estimates, missing detailed children and residual categories alongside the value totals. Country-level plausibility checks do not establish territorial validity, and HS validity checks do not fully harmonize revisions. Exact arithmetic consistency can coexist with uncertainty about coverage and product allocation.

In summary, the methodology combines reported evidence, guarded estimation and top-down reconciliation. It provides a coherent estimated view of global trade while requiring users to distinguish observed data, imputed coverage and balancing adjustments.