Working Party on International Trade in Goods and Trade in Services Statistics

OECD PROGRESS REPORT ON CALCULATION OF UVIS

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This document for item 3.1 of the agenda presents an OECD progress report on calculation of Unit Value Indexes.

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OECD PROGRESS REPORT ON CALCULATION OF UVIS

STD Statistics Directorate
Katia Sarrazin, Bettina Wistrom

1. Introduction

1. This note is a progress report on the OECD project to implement Unit Value Indexes (UVIs) for OECD countries with data available in the International Trade by Commodity Statistics (ITCS) database. The present note will focus on comparisons of OECD results at the total commodity level with partner world against import and export price and quantity index series available from other sources.

2. Although UVIs are only proxies for export and import price indexes and the corresponding quantity indexes are only proxies for volume measures, they are available at considerable level of product detail and in a timely manner. Many analytical questions can be addressed with UVI and quantity indexes – they include the analysis of terms of trade, price and non-price competitiveness in exports and imports and the transmission of inflation via foreign trade. But by comparing estimates and methods across countries, they can also reveal statistical issues that lead to the development of improvements in estimates of GDP and volume estimates of international trade, amongst others.

3. The paper begins by giving a brief summary of the assumptions used in calculating UVI indices from the available data in the ITCS database, with a brief summary of the methods used to detect and correct for outliers. Finally comparisons of the OECD indexes with existing indexes will be presented.

2. Comparison of OECD results with National indexes, Annual National Accounts and Eurostat

4. Chained Laspeyres, Paasche and Fisher price and quantity Exports and Imports indexes have been computed for the 34 OECD member countries for total exports and imports based on all 6 digits commodities series of the HS1988 classification. Results shown in this section will only refer to series where identified outliers were removed following the Asymmetric Fence Method and Mean Absolute Deviation (AFM-MAD) (see Annex IV). No estimation of missing values was performed.

5. The indices were compared to those found in the:
   - Eurostat database  
     http://epp.eurostat.ec.europa.eu/portal/page/portal/international_trade/data/main_tables;
   - OECD Annual National Accounts  http://stats.oecd.org/index.aspx (SNA);
Comparing Quantity, Unit Value and Price indexes with National indexes, SNA and Eurostat

6. Looking at the comparisons performed at the total level, it appears that broadly, there appears to be a better match of price and quantity indexes on the import side.

7. Also, the OECD noted that comparisons of quantity indexes give better results than comparisons of price indexes. It could be explained by exchange rates effect as OECD UVI are calculated from data converted to US dollars. The conversion from national currency data to US dollars data introduces a bias in value or price data.

8. Finally, OECD calculates Laspeyres, Paasche and Fisher chain indexes to compare with the results obtained by national offices or other international organisations.

9. As reflected in Annex II, the type of indexes calculated by member countries is diverse (however within the three classic Laspeyres, Paasche and Fisher indexes). Most often, when the "ideal" Fisher is not used, countries use the Paasche for calculating the unit value indexes and the Laspeyres for quantity (Greece, Sweden)

10. Several countries thus calculate Fisher indexes, in its chained form (Austria, Greece, Italy, Japan, Mexico, New Zealand, Switzerland and Turkey). Other countries expect to move from Laspeyres or Paasche towards Fisher (this is the case for Germany). Some others, depending on the frequency considered, apply different index formulae (this is the case for Ireland that apply and intermediate Laspeyres index calculation on monthly series and a Fisher formula on annual values). For more detailed information of national method of trade indexes calculation please refer to Annex I and Annex II at the end of this paper.
Comparing Quantity indexes with National indexes, SNA and Eurostat

Good results obtained for Italy for both imports and exports.
For Germany, the indexes calculated by OECD match perfectly for exports but there are some differences for imports from 2006 which also corresponds to a change in regulation on the collection of quantities at Eurostat\(^1\) so there may be a link.

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\(^1\) Commission Regulation (EC) No 1915/2005 (amendments with regard to the simplification of the recording of the quantity and specifications on particular movements of goods), valid from 1 January 2006. Eurostat (July 2010), European legislation applicable to the statistics relating to the trading of goods.
Exports indexes for Ireland are different compared with those calculated by national statistical office and with those of Eurostat and SNA. Irish imports indexes match much better with indexes collected from other sources.

OECD indexes are very volatile.
Figure 7 - Imports Quantity Indexes, Japan  
*year 2005=100*

Figure 8 - Exports Quantity Indexes, Japan  
*year 2005=100*

- The Japan quantity index (which is a Fisher index) extracted from MSIT is closer to the Fisher index calculated by the OECD especially for imports.

Fisher national index corresponds to Laspeyres OECD index at the beginning of the period.
The imports and exports results for New Zealand are fine in the period presented in the graph above, but it was not the case for the preceding years.
The quantity index for Iceland has a huge difference at the end of the presented period in comparison with the index calculated by Eurostat. Looking at the 2 digit level disaggregation, the trend shown by the Icelandic total quantity index seem to be influenced by the huge increase in Aluminium exports over recent years (See figure 13). Why is this effect flattened in SNA? Is there an adjustment made or a different outlier detection method? The calculation at the 2-digit level will perhaps confirm the importance of the aluminium in the Icelandic exports.
Aluminium exports represented 40% of total exports in value in 2011. In 2005 Aluminium exports represented only 19% of exports.
Comparing Unit Value and Price indexes with National indexes and Eurostat

The Turkish results give a good correspondence with the national indexes for both imports and exports.
For the United States, as noted in Annex II, export and import price indexes are derived via a market basket approach, since UVI fail in distinguishing between quality and price variation. The correspondence between the index calculated by OECD and the national price index series is then quite poor but may be due to the underlying data and needs to be further investigated. It can
The correspondence between the national index and the one calculated by Eurostat is good. The indexes generated by the OECD are close to the two previous both at the import and the export level.
The correspondence between the national index and those calculated by the OECD is quite good on the export side. But this is not the case on the import side at the beginning of the period, the national index shows a linear trend, which is not the case for the OECD indexes.
Comparing Export and import UVI - Fisher type - between OECD countries at two digit level, the example of the aluminium products, chapter 76 of the harmonised classification 1988

**Figure 22 - Export & Import UVI for Aluminium products (HS88, Chap.76)**

*Year 2005=100*

**Figure 23 - Export & Import UVI for Aluminium products (HS88, Chap.76)**

*Year 2005=100*
Figure 24 - Export & Import UVI for Aluminium products (HS88, Chap.76)

Year 2005 = 100

Figure 25 - Export & Import UVI for Aluminium products (HS88, Chap.76)

Year 2005 = 100
Figure 26 - Export & Import UVI for Aluminium products (HS88, Chap.76)

Year 2005 = 100

Figure 27 - Export & Import UVI for Aluminium products (HS88, Chap.76)

Year 2005 = 100
Figure 28 - Export & Import UVI for Aluminium products (HS88, Chap.76)  
*Year 2005 = 100*

Figure 29 - Export & Import UVI for Aluminium products (HS88, Chap.76)  
*Year 2005 = 100*
For most countries, we notice a decrease on the UVI in 2002 on the import side. In 2009, we can see the impact of the world financial crisis on both export and import sides.

On these figures, we noticed that UVIs on exports side are smaller than UVIs on the imports side for a lot of countries:

- For all the presented period for Australia, Austria Denmark, the Netherlands and Spain
- From 1999 to 2008 for Hungary and Turkey
- From 1999 to 2006 for Greece
- From 2001 to 2008 for Czech Republic
- From 2006 to 2008 for Chile, Luxembourg and Switzerland
- From 2004 to end of period for Estonia
- From 2006 to end of period for Germany, Italy and Mexico
- From 2007 to end of period for France, Ireland and the United Kingdom
- In 2009 for Canada, Slovenia and the United States

The countries showing the biggest increase over the period on the export side are Australia, Republic Slovak and Poland; on the import side are Chile, Australia and Iceland. Those having the smallest increase on the export side are Mexico, Luxembourg and United Kingdom; on the import side are Japan, Canada Turkey.

Two countries have an UVI more than 150 (base 2005=100) at the end of the period which are New-Zealand and Iceland on the export side, and one country, Iceland, on the import side which has an index equal to 143.

Estonia has an UVI less than 90 at the end of the period on the export side. On the import side at the end of period, Turkey has an UVI less than 105.
Conclusion and next steps

11. This paper examines Unit Value and Quantity indexes for total exports and imports as calculated by OECD compared with indexes available from other sources and frameworks.

12. The results, particularly for those countries where the UVIs show large spikes or volatility suggest that further work will be needed on quality assuring the process but also perhaps in investigating the underlying raw data (both in quantities and qualities). The long term objective will be to continue with this long term quality assurance by focusing on implied price indices (the UVIs) at an as detailed commodity level as possible. Certainly one might expect the price indices at the commodity level to reflect similar price movements across countries, especially for natural commodities or semi-manufactured goods. The results comparing movements in aluminium prices however suggest that the underlying data may require improvement, notwithstanding the differences in price movements that will be driven by national circumstances (e.g. domestic inflation, movements in exchange rates, national competitiveness, and specialisation). In this sense there the next step is to extend the calculation of exports and imports indexes to a more disaggregated level of commodities (4 digits of HS). At a later stage, the presentation of quantity and unit value indexes following classifications other than HS will be explored to respond to requests by users for trade indexes following for instance ISIC and SITC.

13. A more complete matrix with values and quantity indexes will be provided to delegates by mid 2013 for comments at the 2013 WPTGS.
## ANNEX I

**National indexes availability in Monthly Statistics of International Trade (MSIT)**

In MSIT, unless otherwise stated, Volume and Price indexes are Laspeyres type and Unit Value indexes are Paasche type. The “Yes” in the cell indicates that the index is available.

<table>
<thead>
<tr>
<th>Country</th>
<th>Unit Value index</th>
<th>Price index</th>
<th>Volume index</th>
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<tbody>
<tr>
<td>Australia</td>
<td>..</td>
<td>Yes</td>
<td>..</td>
</tr>
<tr>
<td>Austria</td>
<td>Fisher</td>
<td>..</td>
<td>Fisher</td>
</tr>
<tr>
<td>Belgium</td>
<td>Yes</td>
<td>..</td>
<td>Yes</td>
</tr>
<tr>
<td>Canada</td>
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<td>..</td>
<td>Yes</td>
</tr>
<tr>
<td>Chile</td>
<td>..</td>
<td>..</td>
<td>..</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>..</td>
<td>Yes</td>
<td>..</td>
</tr>
<tr>
<td>Denmark</td>
<td>Fisher</td>
<td>..</td>
<td>Fisher</td>
</tr>
<tr>
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<td>..</td>
<td>..</td>
</tr>
<tr>
<td>Finland</td>
<td>Laspeyres</td>
<td>..</td>
<td>Paasche</td>
</tr>
<tr>
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<td>..</td>
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</tr>
<tr>
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<td>Yes</td>
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<tr>
<td>Greece</td>
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<tr>
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</tr>
<tr>
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<tr>
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<td>Yes</td>
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<tr>
<td>United States</td>
<td>..</td>
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</tr>
</tbody>
</table>
ANNEX II

This document is a compilation of country responses regarding question 5 d) Country and International Organization’s reports on UVI/trade volumes Meeting of the Working Party on International Trade in Goods and Trade in Services Statistics (WPTGS), Paris, 4-6 October 2010. The questionnaire was updated with supplementary responses following the 2011 WPTGS meeting.

<table>
<thead>
<tr>
<th>Country</th>
<th>Country response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>The ABS produces monthly quantity and value information for merchandise trade statistics based on the most detailed level of the import and export classifications (both of which are based on the Harmonized System 2012). Unit values and quantities can be derived from the detailed Merchandise trade dataset for some detailed statistical codes (noting that these codes do not control for changes in quality or composition). Quarterly chain volume measures and implicit price deflators are produced at the SITC division and section levels for both merchandise trade exports and imports. The ABS also produces quarterly chain volume measures at a broad level of classification for balance of payments goods and services. The ABS also produces annually reweighted quarterly Export and Import Price Indexes, presented using various broad level classifications (including SITC Rev 4, BEC).</td>
</tr>
<tr>
<td>Austria</td>
<td>In Austria, the foreign trade index is generated as a Fisher chain index with the current reference year 2005 = 100. The basis update is quinquennial and the Fisher chain index involves a unit value index, volume index and a value index for “total”, “EU” and “third countries”. Creation and publication are carried out quarterly and the current index figures as well as the foreign trade indexes for the final years 2008/2009 are available on our homepage at the following link: <a href="http://www.statistik.at/web_de/statistiken/aussenhandel/aussenhandelsindizes/index.html">http://www.statistik.at/web_de/statistiken/aussenhandel/aussenhandelsindizes/index.html</a> this publication is available in German only.</td>
</tr>
<tr>
<td>Denmark</td>
<td>Currently, Statistics Denmark uses a rather simple method, which may be replaced by a more sophisticated model in the future. How this should be done is not decided on yet, but we look forward to see other countries methods.</td>
</tr>
<tr>
<td>Estonia</td>
<td>Estonia do not calculate UVI and trade volume indexes at the moment but we are looking forward to start producing such indicators. Therefore we are interested in methodological guidelines and experience of other countries in this field.</td>
</tr>
<tr>
<td>Country</td>
<td>Information on Volume Indexes</td>
</tr>
<tr>
<td>---------</td>
<td>------------------------------</td>
</tr>
</tbody>
</table>
| Germany | The requested information on volume indexes:  
  - Currently we calculate and publish two indexes: The Laspeyres volume index shows the development of foreign trade adjusted for unit value changes.  
  - The Paasche unit value index gives information on changes of the import and export unit values on the basis of the statistical value.  
  - Probably starting from 2011 also a Fisher-Index will be calculated and published.  
  - All indexes are calculated and published monthly according to different nomenclatures (SITC, prodcom, and national classifications) and country groupings (EU, third countries, and total). |
| Greece | The external trade indexes express the changes occurring in imports-exports between two time periods, the current and the corresponding period of the base year.  
  The changes in the amount of the imports-exports value during the current period as compared to the corresponding value during the base year are due to changes in both prices and quantities of imported or exported commodities.  
  Given the above, it is considered necessary to calculate the following indexes:  
  - Index on the changes of prices of imported or exported commodities (Unit Value Index).  
  - Index on the changes in the volume of imported or exported commodities (Volume Index).  
  The indexes are compiled:  
  - Monthly  
  - Cumulatively, for the period of January-surveyed month within the year, and for the four quarters of each year.  
  With reference to the above indexes we would like to communicate the following:  
  - The Unit Value Index is computed according to the Paasche formula.  
  - The Volume Index is computed according to the Laspeyres formula. |
| Hungary | The price indexes for measurement of price level changes in external trade in goods have a hybrid characteristic, so the calculation is based on two sources of data: unit value indexes (UVI) are calculated for product groups SITC 0-4 (Food, beverages, tobacco, Crude materials and Fuels) information from enterprise survey is used for product groups SITC 5-8 (Manufactured goods and Machinery and transport equipment). The price indexes are calculated by Fisher-formula, and the Fisher price indexes are used for the computation of volume indexes. The development of price and volume indexes for international trade in services is underway, but the prices are currently collected only for exports. It would be welcome if some description on experiences of other countries in the import price estimation were available by OECD. |
| Iceland | Fisher unit value indexes are calculated monthly based on accumulated customs declarations giving HS6+2 + country import and exports data. The quantity indexes are implicitly derived from the calculation of the price indexes. |
| Ireland | **Trade Monthly Indexes Methodology**  
  The monthly unit value index measures monthly unit value trends relative to the annual levels in the preceding year using value weights relating to that year’s trade (Laspeyres index). The monthly index series should be regarded as interim measures suitable for month-to-month comparisons within a given year.  
  **Trade Annual Indexes Methodology**  
  The annual index is compiled using value weights for both the current and previous year (Fisher index) to allow for change in the structure of external trade. The indexes |
are initially calculated from a combination of value and net mass data or value and supplementary units (SU) data. The calculations are done at HS (6-digit CN) level using net mass or SU as appropriate for each CN. When the annual unit value index is compiled, the monthly unit value indexes are rescaled to make their average equal to the annual index.

**Commodities basket**

At the end of each calendar year a new basket of commodities is created based on annual trade data. Each record on this file represents a combination of flow, trading partner area, and HS (six digit CN) in addition to unit value information. The calculation of unit value data at HS (six digit CN) level is based on a weighted average of unit values calculated at CN commodity code level (8 digit). In these calculations the value of trade is used as a weight and separate annual and monthly files are created.

**Statistical editing of merchandise goods data**

Prior to the calculation of the indexes, the data returned by the traders is edited. These edits include comparing the unit value against upper and lower unit value limits that have been calculated from previous data. The net mass or supplementary unit data are adjusted to bring the unit values inside the edit thresholds. The value data returned by very large enterprises is subjected to consistency checking against similar data returned in Balance of Payments and Industrial Production surveys. Hence arising from these detailed examinations of returns from very large enterprises to the various statistical inquiries, the value of international trade in goods is subject to revision on a quarterly basis, which may result in a revision to the indexes.

**Handling of new CN codes**

Eurostat on an annual basis produce revisions to CN codes. These generally do not involve changes at HS (6-digit CN) level and hence do not effect the calculation of indexes. In situations where a change in the HS code does occur as a result of changes introduced at CN level the change results in the particular HS dropping out of index calculation as no year on year match is available between the reference and previous year.

**Use of Indexes by Trade Section**


Import and export seasonally adjusted volume indexes are also published each month in this release. The indexes are published one month in arrears i.e. when the CSO publish the preliminary merchandise trade data for October, they publish the volume and unit value indexes for September in the same release. The indexes are not disaggregated by commodity in this monthly release.

**Trade Indexes provided to National Accounts**

The monthly indexes are calculated for the following geographical areas for National Accounts purposes: United Kingdom; Other EU; North America; and Other countries. National Accounts use the annual (Fisher) and monthly (Laspeyres) Trade indexes, in conjunction with export price indexes from the Wholesale Price Index, to deflate the following quarterly and annual merchandise goods indexes:

- Annual Unit Value Indexes: Fisher Indexes
  - Price Indexes 1990 = 100, Exports and Imports
    - Food, Drink & Tobacco
<table>
<thead>
<tr>
<th>Country</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Italy</td>
<td>ISTAT disseminates monthly UVIs and volume indexes at CPA 3-digit level and country groupings from 1996. UVIs are calculated by means of the Fisher-formula and then used for the computation of volume indexes. In 2008, a robust statistical method for outliers detection and correction of measurement errors has been adopted for computing elementary indexes. Trimmed means, instead, are used at the final stage of aggregation.</td>
</tr>
<tr>
<td>Mexico</td>
<td>The methodological notes on the Mexican calculation of Unit Value Indexes are best described in the following paper: Zetina (2011), Mexican Export and Import Unit Values Indices Methodological Notes, Banco de Mexico</td>
</tr>
</tbody>
</table>
| Sweden      | Statistics Sweden calculates quarterly volume indexes for foreign trade of goods according to Laspeyres formula. For this purpose Statistics Sweden uses:  
  a. trade values in current prices from the foreign trade statistics on goods and  
  b. export and import price indexes calculated in the producer price index system in Statistics Sweden. Statistics Sweden publishes volume indexes only for very high levels of SITC and CPA.  
In order to compare export and import price indexes with other calculations/estimations on price changes - for an internal control of data before publishing - Statistics Sweden also calculates unit value indexes. For big discrepancies between price indexes and unit value indexes (for areas where unit values are supposed to be of some quality) Statistics Sweden tries to (depending on resources) look closer at the differences which in some cases could lead to that Statistics Sweden uses some kind of average between unit values and price indexes or unit values.  
Statistics Sweden is very interested to learn more about guidelines and experiences about calculations on unit value indexes in other countries and welcome an OECD work in this area. |
| Switzerland | Services: Regarding a trade volume index, neither exists one for the international trade in services for Switzerland, nor is one scheduled.  
Merchandise:  
Swiss foreign trade statistics (Sfts) calculate the unit value indexes (UVI) for merchandise trade according to Fisher’s formula on a moving base. The volume
Index is a residual value resulting from the nominal index and the unit value index. All indexes are compiled for total trade as well as for groups of goods according to their nature (breakdown by branches) or their broad economics categories (breakdown by basic categories of the national account). In contrast, no index by country or by tariff heading is available. The chain indexes (reference year 1997 = 100) and seasonally adjusted indexes are computed as well. Sfts publish all indexes for the following periods (number of periods):

- year (1)
- semester (2)
- trimester (4)
- month (12)
- cumulated months: e.g. January to April

It’s compilation is best described in the technical notes:
http://www.ezv.admin.ch/themen/00504/01531/index.html?lang=de&download=M3wBPgDB8uIl6Du36WenojQ1NTTjaXZnqWfVpzLhmfhnapmmc7Zi6rZnqCkklN2gn eEbKbXrZ6lhuDZz8mMps2gpKfo&typ=.pdf

**Turkey**

Monthly, quarterly and yearly unit value indexes are calculated by SITC Rev.3, BEC, ISIC Rev.3, CPA classifications. Indexes are obtained by Fisher chain index formula. Volume index is derived from the dividing value index by unit value index. TURKSTAT plans to compute price index in addition to UVI.

- TurkStat applies statistical threshold, the transactions below 100$ are excluded.
- The denominator of the UV is net weight.
- Similar product’s unit value relatives are used for missing values.

Further information can be reached from:
http://www.tuik.gov.tr/disticaretendeksapp/endeks_ing.zul

**USA**

United States does not calculate any unit value indexes, and has not since the late 1980s. Instead, USA uses a market basket approach, since the UVIs don't distinguish between changes in item mix or the quality of items from changes in price.
ANNEX III

SUMMARIZING THE OECD ASSUMPTIONS

14. The OECD aims at calculating quantity and unit value indexes on long time series at total, 2 digit and 4 digit level based on six digit series of the Harmonised System (HS) from 1988 to 2010. This means that these series will incorporate four different versions of HS (HS 88, HS 96, HS 2002 and HS 2007).

15. However, in the context of the present progress report, as the data for several countries have been found to be more volatile before 1999, the data prior to 1999 have not been taken into account here for the calculation of UVIs. The results presented will then cover series covering the period 1999-2010.

16. Unit value and quantity indexes can be calculated at a later stage on other classifications like the Standard International Trade Classification (SITC). This is common practice in member countries as reflected in the Annex II which present country responses to an OECD questionnaire on the methodology used for calculating UVIs, Price and quantity indexes nationally. It should be noted that some countries use mixed methodologies, using UVIs on commodity groups that lend themselves to such calculations (as is the case of Hungary where UVIs are used only for SITC categories 0-4 :Food, beverages, tobacco, crude materials and fuels and price indexes collected via surveys for other SITC categories. New Zealand is another example of a country using both UVIs and Price indexes).

17. As price indexes are often presented to be more reliable then Unit Value indexes as the later do not distinguish between changes in item mix or the quality of items from change in price, some countries are now only disseminating export and import price indexes extracted from producer price index system and calculate UVIs for internal control of data (Sweden and USA).

18. Weights in kilograms is the chosen denominator, unit values are calculated as the ratio of values in dollars (current value) and weight in kilograms. The unit values are consequently expressed in dollars per kilo.

19. As reported at the 2011 WPTGS and noted above, the OECD tested various methods of detection of outliers. The retained method giving better results is the Asymmetric Fence Method and Mean Absolute Deviation (AFM-MAD). The methodology is detailed later in this document.

20. OECD didn’t retain any method of estimations of missing values as for instance calculating missing values via moving average did not satisfactory results, often due to the absence of any data on many consecutive years.

21. Both chained and unchained indexes have been calculated. The OECD retained chained calculation, the chained form implies not using a price structure that become more and more remote from the current price structure as the reference year is the preceding year.\(^2\)

\(^2\) Wistrom, Serve (2010), *Implementing quantity and unit value indices in the OECD ITCS database.*
22. The OECD has calculated three different indexes, Laspeyres, Paasche, and Fisher type. The methodology of these three types of indexes is presented later in this document.
ANNEX IV

CALCULATION OF INDEXES

23. Chained Laspeyres, Paasche and Fisher price and quantity exports and imports indexes in fixed base 2005 = 100 have been computed for the 34 OECD member countries for total exports and imports based on all 6 digits commodities series of the HS 1988 classification. Outliers have been detected using the Asymmetric Fence Method and Mean Absolute Deviation.

Asymmetric Fence method and Mean absolute deviation

24. OECD has chosen to retain an outlier detection method which is used on Italian merchandise trade data and has recently been implemented in Mexico. These methods suppose that the distribution is not symmetric. The logarithms of the unit values are also used because it has been proved that the log-transformation improves the outlier detection method by reducing the Type I Error (i.e. observations that are not outliers but that the method would detect as such).

25. The outlier detection strategy chosen by Italy is based on a “double filtering”: the first filter is applied to simple unit values at the single transaction level within flow/country/commodities. The second filter is applied to the elementary index distribution at more aggregated levels in order to insure the consistency at the dissemination level.

26. The selected method for the first filter on unit value levels is an extended version of the Asymmetric Fence Method (AFM) where the log distribution of each stratum is considered. The general formulation is as following:

\[
\begin{align*}
q_1 - u_{hs}^i & > k_{AFM} \times \max(q_2 - q_1, c^* | q_2 |) \\
u_{hs}^i - q_3 & > k_{AFM} \times \max(q_3 - q_2, c^* | q_2 |)
\end{align*}
\]

27. Where \(uv_{hs}^i\) is the logarithm of the unit value, \(q_1\), \(q_2\) and \(q_3\) respectively correspond to the first, the second, and the third quartiles of the population distribution of log unit values of trade, \(k_{AFM}\) and \(c\) are parameters of the method, that are set to \(c = 0.05\) and \(k_{AFM} = 1\).

28. Nevertheless, as explained both in the papers by Anitori (2008) and Zetina (2011), the method is not efficient if the number of “transactions” is too small. In this case the MAD method is applied. The “transaction” is considered as outlier if the following conditions are satisfied simultaneously:

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3 Paola Anitori, Maria Serena Causo (2008): Outlier detection and treatment: quality improvements in the Italian Unit Value Indexes ISTAT.
4 Zetina, 2011 Mexican Export and Import Unit Values indices Methodological notes, Banco de Mexico
5 Thompson and Ozcoskun L. (2007), Thompson et al. (1999), and Thompson (2007).
6 Paola Anitori, Maria Serena Causo (2008).
7 Zetina, 2011 Mexican Export and Import Unit Values indices Methodological notes, Banco de Mexico
The second filter of the Italian methodology is based on the distribution at elementary level, checking the volatility of the indexes generated by the previous method and here a trimmed mean is calculated. This means discarding a certain percentage of the lowest and highest values of the elementary indexes and computing the mean of the remaining values. This second filter is performed at an aggregated level in series to be publicly disseminated in order to avoid that these are affected by implausible changes.

The Mexican methodology keeps all trade operations that represent at least 30 per cent of trade of a commodity to compute indexes. No outlier detection is made for those operations in order to retain the sample representativity and avoid biases in the estimation.

Calculating Laspeyres, Paasche and Fisher quantity and price indexes.

The target indexes to be calculated by OECD are Laspeyres, Paasche and Fisher indexes of a chained type so the reference year would then be revised each year. In order to present the chained indexes following the OECD base year 2005 = 100, two steps are needed: first, variations between successive periods are cumulated e.g. multiplied by each other, from the first available year 1999 = 100. Secondly, OECD rebases in order to set the base year at 2005.

Laspeyres Quantity index

The Laspeyres quantity index is an arithmetic mean of quantity changes for which the weighting system describes the structure of the reference period values. Laspeyres quantity indexes compare the quantities of a basket of goods in year \( t \) valued at prices of the reference year (here \( t-1 \)). The chained Laspeyres quantity index between year \( t \) and \( t-1 \), rewritten to make apparent the value share (or weighing system) and quantity ratio form, is then defined as

\[
L_{t/t-1}(Q) = \frac{\sum P_{t-1} Q_{t}}{\sum P_{t-1} Q_{t-1}} = \frac{\sum P_{t-1} Q_{t-1}}{\sum P_{t-1} Q_{t-1}} \times \frac{Q_t}{Q_{t-1}}
\]

Paasche Quantity index

The Paasche quantity index is a harmonic mean of quantity changes with a weighting system that describes the structure of the values in the present period \( t \).

\[
P_{t/t-1}(Q) = \frac{\sum P_t Q_t}{\sum P_t Q_{t-1}} = \frac{1}{\sum P_t Q_t} \times \sum P_t \frac{Q_t}{Q_{t-1}}
\]
Laspeyres and Paasche price indexes

34. The Laspeyres price index measures the price variation of the basket of goods consumed in the reference period while the Paasche index weights prices by current quantities. The Paasche index, which is a harmonic average of elementary indexes weighted by the share of each product in the current traded value thus better captures changes in the structure of trade. (Gaulier et al, (2008) p.12)

\[ L_{t/t-1}(P) = \frac{\sum P_t \cdot Q_{t-1}}{\sum P_{t-1} \cdot Q_{t-1}} = \sum \frac{P_{t-1} \cdot Q_{t-1} \cdot P_t}{P_{t-1}} \]

\[ P_{t/t-1}(P) = \frac{\sum P_t \cdot Q_t}{\sum P_{t-1} \cdot Q_t} = 1/\sum \frac{P_{t} \cdot Q_{t} \cdot P_{t-1}}{P_{t}} \]

35. Unit values indexes are sensitive to exchange rates fluctuations. Trade values are expressed in dollars in the ITCS database, the conversion is made using a trade-weighted average exchange rate. If one decomposes the price component of the unit value indexes formula as a multiplication of a price in national currency multiplied by an exchange rate, the impact of an eventual fluctuation of exchange rates on unit values indexes would be revealed. This algebraic property is not true for quantity indexes formula, the exchange rate component in this case, vanishes from the numerator and denominator.

Fisher Quantity and Price indexes

36. Computing a chained Fischer index\(^9\), which is the geometric mean of the Laspeyres and Paasche indexes, is a good way to approach the unobserved real unit value index (and the quantity index). Fisher quantity and price indexes is written as follows:

\[ F_{t/t-1}(Q) = \sqrt{P_{t/t-1}(Q) \cdot L_{t/t-1}(Q)} \]

\[ F_{t/t-1}(P) = \sqrt{P_{t/t-1}(P) \cdot L_{t/t-1}(P)} \]

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\(^9\) The Export and Import Price Index Manual notes that although most statistical agencies have traditionally used the Laspeyres index (XMPIM, p. xvii) as their target index when compiling export and import price indexes, according to both economic and index number theory, a more appropriate target would be the Fisher, Walsh or Tornqvist-Theil indexes, in their chained form. These “superlative” or “ideal” indices have a number of advantages in their chained form, principally, they take into account that when price changes are observed, substitution to cheaper products may occur (Gerschenkron effect) and they can deal with margin effects (disappearance and appearance of new products).
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