Detection of outliers and calculation of trade indices based on unit values

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Regional seminar on trade statistics
New Delhi: 3-6 November 2014
Introduction

ITC is developing a customizeable program in SAS to detect outliers and calculate external trade indices based on unit values.

Parameters that can be customized by the user

- **Partner countries**: by default all countries are included
- **Product codes**: by default all products belonging to HS except 99
- **Aggregation level**: by HS level or by time period
- **Calculation method**: fixed based or chained indices
- **Type of Indices**: Laspeyres, Paasche, Fisher
- **Time reference**: indices are calculated either with the classical formula or on a year-to-date basis
Program algorithm

LOOP USED FOR EACH (REPORTER, PARTNER, PRODUCT)

- HS REVISION TEST
  - OK
  - Not OK
- QUANTITY UNIT TEST
  - OK
  - Not OK
- NB OF MISSING OBSERVATION
  - <= 20%
  - > 20%
- OUTLIERS DETECTION
  - Log(Q) = Log(Y)
  - Log(Y) = Log(Q)
  - Log(LV) = Log (Variable)=f(t)
- DELETE OUTLIERS (but keep the series)
- HOMOGENEITY TEST
- DATASET RECONSTRUCTION
- INDICES

INPUT DATASET + USERS-SET PARAMETERS

OUTPUT
Outliers Detection

Values and quantities are log transformed to stabilize the variance

Cook’s distances > 4/n for
\(\log(Q) = f_a (\log(V))\)

\(\log(V) = f_b (\log(Q))\)

Cook’s distances > 4/n for
\(\log(UV) = f_1 (t)\)

OUTLIERS (deleted)

Outliers detected are deleted from the time series but saved in a specific file for further analysis
Examples of outliers detected in Malawi’s exports

<table>
<thead>
<tr>
<th>Date</th>
<th>Partner Country</th>
<th>Product code</th>
<th>Product name</th>
<th>Cook's distance</th>
<th>Unit Value</th>
<th>UV mean</th>
<th>UV median</th>
<th>Compared to the median</th>
</tr>
</thead>
<tbody>
<tr>
<td>12/09</td>
<td>United Kingdom</td>
<td>09024000</td>
<td>Black tea (fermented) &amp; partly fermented tea in packages exceeding 3 kg</td>
<td>0.986</td>
<td>0.0438</td>
<td>0.0029</td>
<td>0.0019</td>
<td>22.8</td>
</tr>
<tr>
<td>12/09</td>
<td>Zambia</td>
<td>39249000</td>
<td>Household and toilet articles nes, of plastics</td>
<td>0.744</td>
<td>0.0984</td>
<td>0.0043</td>
<td>0.0021</td>
<td>46.4</td>
</tr>
<tr>
<td>03/09</td>
<td>Mozambique</td>
<td>39249000</td>
<td>Household and toilet articles nes, of plastics</td>
<td>0.710</td>
<td>0.0661</td>
<td>0.0051</td>
<td>0.0021</td>
<td>31.8</td>
</tr>
<tr>
<td>06/09</td>
<td>Zambia</td>
<td>94037000</td>
<td>Furniture, plastic, nes</td>
<td>0.608</td>
<td>0.3526</td>
<td>0.0087</td>
<td>0.0021</td>
<td>165.3</td>
</tr>
<tr>
<td>03/09</td>
<td>Mozambique</td>
<td>94037000</td>
<td>Furniture, plastic, nes</td>
<td>0.539</td>
<td>0.1380</td>
<td>0.0070</td>
<td>0.0026</td>
<td>53.6</td>
</tr>
<tr>
<td>12/11</td>
<td>Zimbabwe</td>
<td>39249000</td>
<td>Household and toilet articles nes, of plastics</td>
<td>0.539</td>
<td>0.1117</td>
<td>0.0051</td>
<td>0.0028</td>
<td>39.8</td>
</tr>
</tbody>
</table>
Assessment of homogeneity

\[ RIQ = \frac{Q_3 - Q_1}{M} \]
\[ MMI = \frac{(m_1 + \cdots + m_k)^2}{m_1^2 + \cdots + m_k^2} \]

Two conditions are recommended to conclude on homogeneity for the series under review:
• The Relative InterQuartile (RIQ) is less than 1
• The MultiModality Index (MMI) is less than 2 or (RIQ * MMI) < 1

All non-homogeneous series are deleted

Source: UNSD - Calculation of External Trade Indices based on Unit Values – Training Module – November 2009
Calculation of indices

• Type of indices
  • Paasche
    \[ P_{uv\ t,0} = \frac{\sum_{i=1}^{n} Q_{t(i)} \times P_{t(i)}}{\sum_{i=1}^{n} Q_{t(i)} \times P_{0(i)}} \]
  • Laspeyres
    \[ L_{uv\ t,0} = \frac{\sum_{i=1}^{n} Q_{0(i)} \times P_{t(i)}}{\sum_{i=1}^{n} Q_{0(i)} \times P_{0(i)}} \]
  • Fisher
    \[ F_{uv\ t,0} = \sqrt{L_{uv\ t,0} \times P_{uv\ t,0}} \]

• Coverage in value

• Grouping by quarter or year, country or region, product or sector is possible by using parameters.
Examples of trade indices

Comparing Unit Value Indices for Tea exported from Indonesia with International Tea Price Indices

Indices from Average of Colombo, Kolkata, Mombasa auctions.
Indonesia Indices Using TradeMap

Comparing Unit Value Indices for Cocoa exported from Cote d'Ivoire with International Cocoa Price Indices

Indices from International Cocoa Organization Cash Price. Average of monthly prices
Cote d'Ivoire Indices Using TradeMap