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

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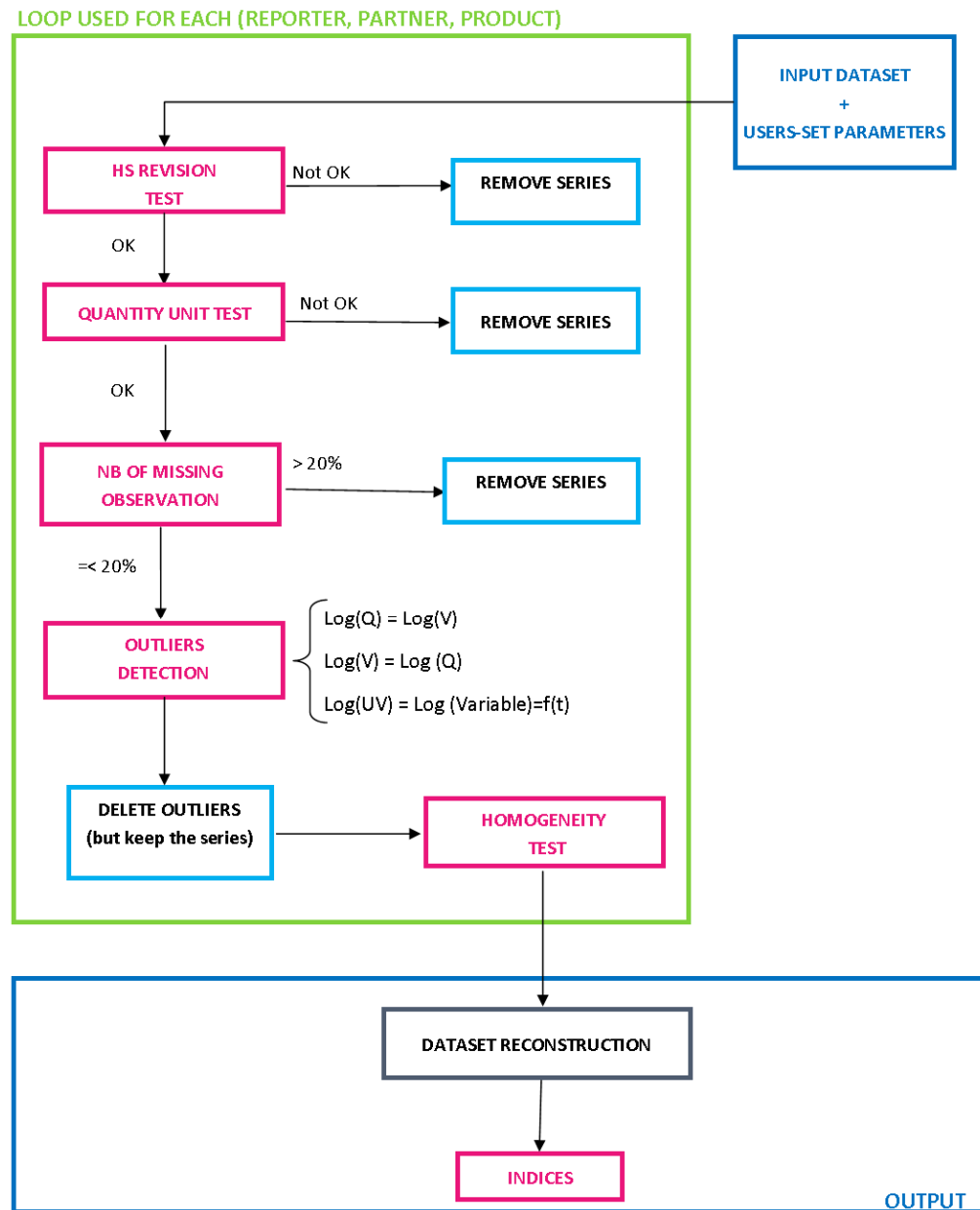New Delhi: 3-6 November 2014

Introduction

ITC is developing a customizeable program in SAS to detect outliers and calculate external trade indices based on unit values
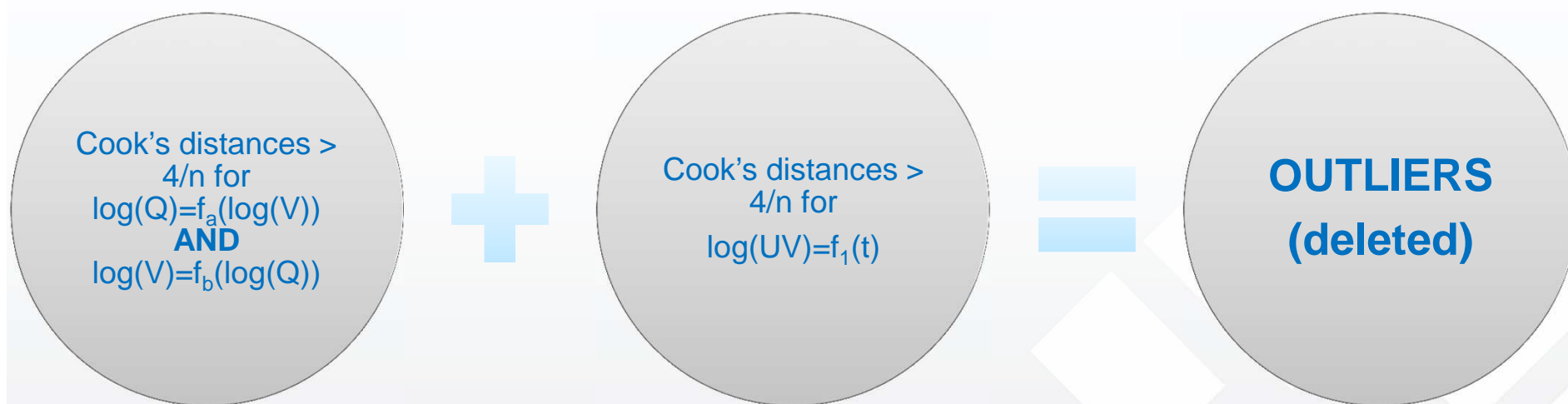
Parameters that can be customized by the user

- **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)

INPUT DATASET
+
USERS-SET PARAMETERS

HS REVISION TEST → Not OK → REMOVE SERIES

OK

QUANTITY UNIT TEST → Not OK → REMOVE SERIES

OK

NB OF MISSING OBSERVATION → > 20% → REMOVE SERIES

=< 20%

OUTLIERS DETECTION

$Log(Q) = Log(V)$

$Log(V) = Log (Q)$

$Log(UV) = Log (Variable)=f(t)$

DELETE OUTLIERS (but keep the series) → HOMOGENEITY TEST

DATASET RECONSTRUCTION

INDICES

OUTPUT

IMPACT FOR GOOD

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Outliers Detection

Values and quantities are log transformed to stabilize the variance

Cook's distances > 4/n for
$\log(Q)=f_a(\log(V))$
AND
$\log(V)=f_b(\log(Q))$

+

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

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Examples of outliers detected in Malawi's exports

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

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

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Calculation of indices

- **Type of indices**

  - Paasche

  $$P_{uv\ t,0} = \frac{\sum_{i=1}^{n} Q_{t(i)} * P_{t(i)}}{\sum_{i=1}^{n} Q_{t(i)} * P_{0(i)}}$$

  - Laspeyres

  $$L_{uv\ t,0} = \frac{\sum_{i=1}^{n} Q_{0(i)} * P_{t(i)}}{\sum_{i=1}^{n} Q_{0(i)} * P_{0(i)}}$$
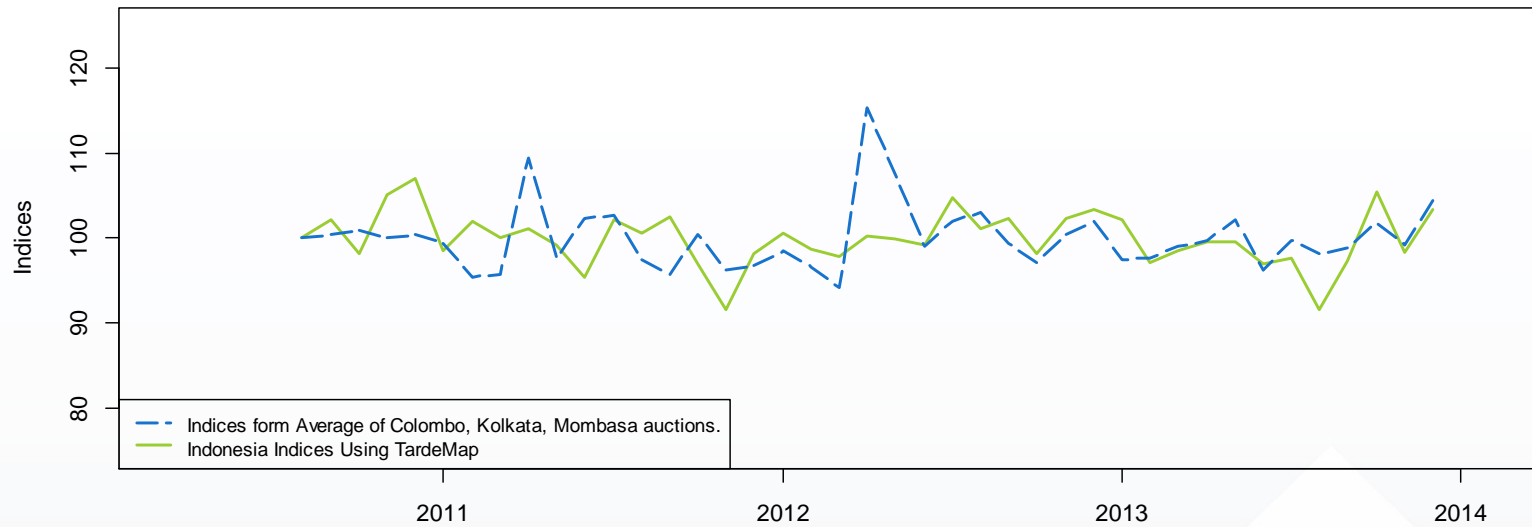
  - Fisher

  $$F_{uv\ t,0} = \sqrt{L_{uv\ t/0} * P_{uv\ t/0}}$$

- Coverage in value

- Grouping by quarter or year, country or region, product or sector is possible by using parameters.

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Examples of trade indices

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

Legend:
- Indices form Average of Colombo, Kolkata, Mombasa auctions.
- Indonesia Indices Using TardeMap

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

Legend:
- Indices from International Cocoa Organization Cash Price. Average of monthy prices
- Cote d'Ivoire Indices Using TardeMap

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