Revising Indian trade indices: A suggested methodology

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Brief Background

❑ Foreign Trade Indices indicate temporal fluctuations in the trade i.e. export & import of the country in terms of value, quantum & unit value

❑ These along with derived Terms of Trade statistics provides insights into the trade competitiveness of a country

❑ Directorate General of Commercial Intelligence & Statistics currently computes monthly, quarterly and yearly trade indices using **Chain Base System** with **Fischer' Ideal Index number** formula with **1999-2000** as the base year.

❑Although **HS nomenclature is adopted for commodity classification** involved in processing and dissemination of India's trade data, **for computation of unit value indices SITC** is adopted and trade indices are calculated at **all the section** and some **selected Major Commodity heads of SITC4**.

❑ The overall index is also published as per the **Broad Economic Category (BEC).**

Brief Background (contd.)

❑ Marked shift in the pattern of trade due to changes in Indian economy i.e.,owing to diversification of export, import substitution, structural changes in domestic production and other related factors had made review of the existing **base period (which is quite distant)** and commodity basket for index computation essential.

❑Adoption of **SITC4 for compilation** of indices lead to **significant loss of information in the process of establishing correspondence between HS nomenclature and SITC4** – resulting in a need for review of the commodity basket

❑ A review of the methodology of Index computation was also in order to keep it in line with recent development in Index related literature & international best practices

❑ In view above, DGCI&S approached Indian Statistical Institute to address the issues in the form of a research project. It was accepted by the Sampling and Official Statistical unit (SOSU) of the institute.

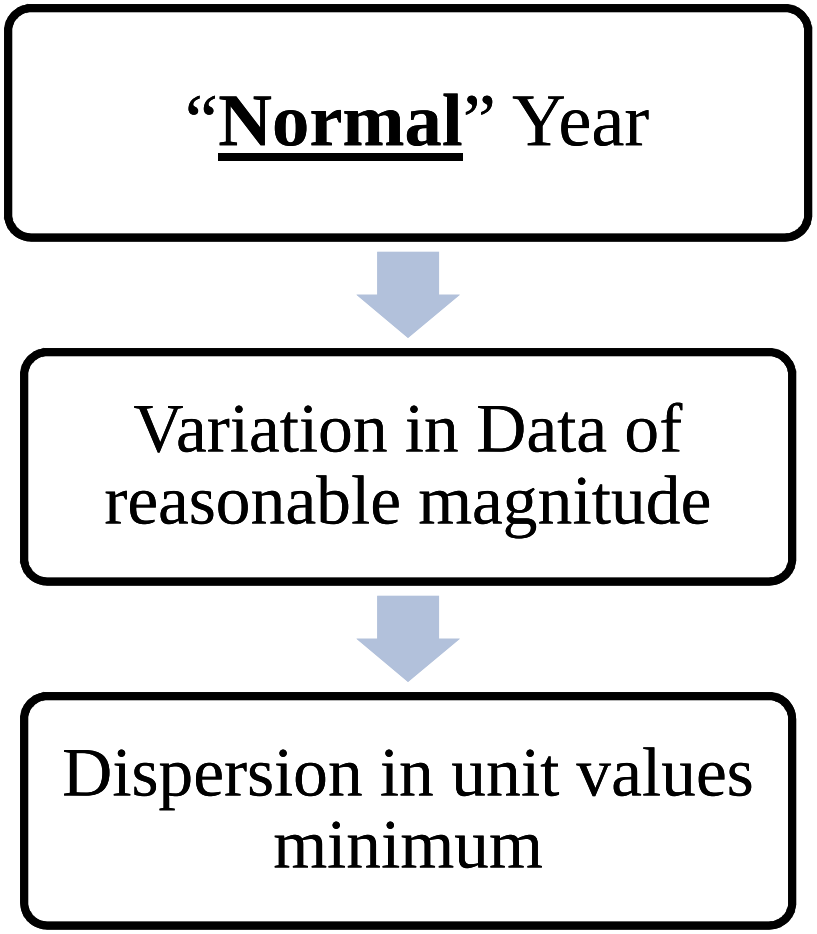
Task of the Project

1. **Selection of Base year**
2. **Commodity Basket revision**
3. **Reviewing the methodology for Index Computation**

Selection of Base Year

Base Year Selection

Consideration



Base Year Selection (contd.)

One Approach for determining the minimum variation year is to calculate

$$F(j) = \sum_{i} \left| P_{ij} - \overline{P_i} \right| \times W_{ij}$$

Where

P_{ij} = unit value for i-th Commodity level for j-th year

W_{ij} = value share of i-th Commodity level for j-th year

$\overline{P_i}$ = average unit value for i-th item over years

Decision Rule – Choose that "j" as base year which minimizes F(.)

The issue faced with is approach is that it always lead to the middle most year as there is increasing trend present in the unit values

Base Year Selection (contd.)

Based on the observations on the monthly trade data certain adjustments are made

- The effect of trend contributing to data variation in the unit values

Adjustment-De-trending of data & working with residuals

- Fluctuations in exchange rates affect the conversion to a common value (INR) and consequently add to the overall variation of unit values

Adjustment-Unit values adjusted by Real Effective Exchange rate (REER)

[REER Value : The weighted average of a country's currency relative to an index or basket of other major currencies adjusted for the effects of inflation. The weights are determined by comparing the relative trade balances, in terms of one country's currency with each other country within the index. The REER value of 36 countries are taken as deflator]

Base Year Selection (contd.)

De-trending of data & working with residuals

$$Y_{imt} = T_{imt} + P'_{imt}$$

T_{imt} determined using

1. **Log Linear Fit**
2. **Cubic Spline fit in log values**

Unit values adjusted by Real Effective Exchange rate (REER)

$$P_{imt} = \frac{P'_{imt}}{REER_{mt}}$$

$REER_{mt}$ Data Source RBI

Base Year Selection (contd.)

Notations used-

Item \ Commodity level : i where i={1,2,3, …M}, M=total no of items
(Export / Import items treated as different)

Month : m where m={1,2,……12}

Year: t where t={1,2, …….T} , T= no of candidate base year

Base Year : b where b={1,2,3…T}

P_{imt} = Real price of an item traded in month m and year t (another year)

P_{imb} = Real price of an item traded in month m and year b (Base year)

Base Year Selection (contd.)

Notations used-

$$w_{it} = \frac{v_{it}}{\sum_{i \in M_{tb}} v_{it}}$$

W_{it} = value share of the item over the total export and import items

$$w_{mb} = \frac{v_{mb}}{\sum_{m=1}^{12} v_{mb}}$$

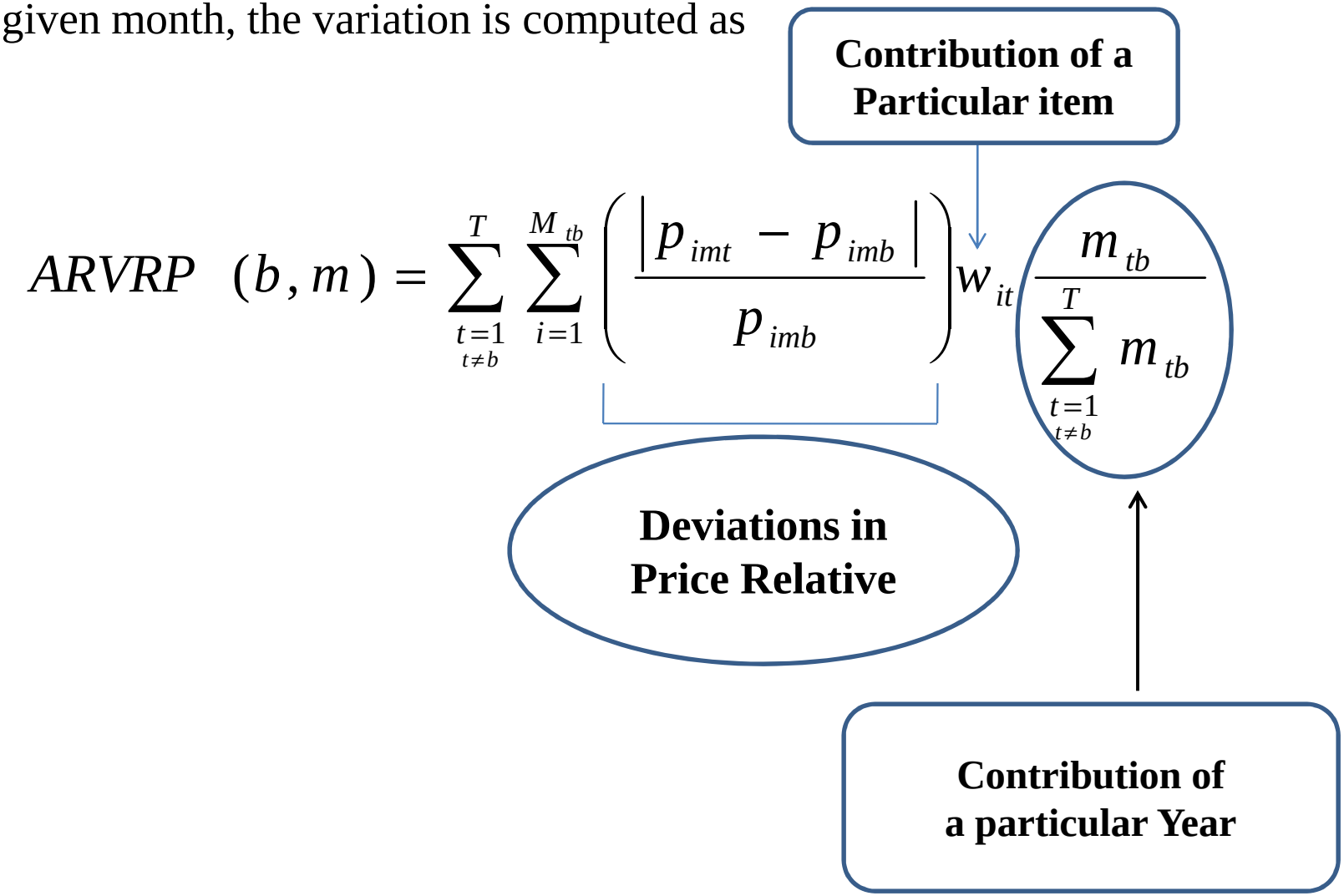
W_{mb} =value share of the month over the total export and import for the base year

M_{tb} = Set of common items between b(the candidate base year) and some other year t!=b

$m_{tb} = | M_{tb} |$

Base Year Selection (contd.)

For a given month, the variation is computed as



Base Year Selection (contd.)

The mentioned measure aggregated over months gives

$$ARVRP(b) = \sum_{m=1}^{12} ARVRP(b,m) \frac{w_{mb}}{\sum_{m=1}^{12} w_{mb}}$$

Decision Rule – Choose that "b" as base year which minimizes ARVRP (.)

Base Year Selection (contd.)

Results

As the choice of base year is sensitive to the choice of the basket **500 Bootstrap samples (through 3% random deletion)** are generated from the original commodity basket.

With Log Linear De-trended Price

Year	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Base Year Choice Frequency	94 (18.80%)	254 (50.80%)	2 (0.40%)	17 (3.40%)	31 (6.20%)	102 (20.40%)

With Log Spline De-trended Price

Year	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Base Year Choice Frequency	300 (60.00%)	60 (12.00%)	1 (0.20%)	19 (3.80%)	23 (4.60%)	97 (19.40%)

Base Year Selection (contd.)

Results

The above results appears to be model dependent.

Dropping the distant year 2007-08 repeating the computation for **100 samples** the following is observed

With Log Linear De-trended Price

Year	2008-09	2009-10	2010-11	2011-12	2012-13
Base Year Choice Frequency	66	2	0	4	28

With Log Spline De-trended Price

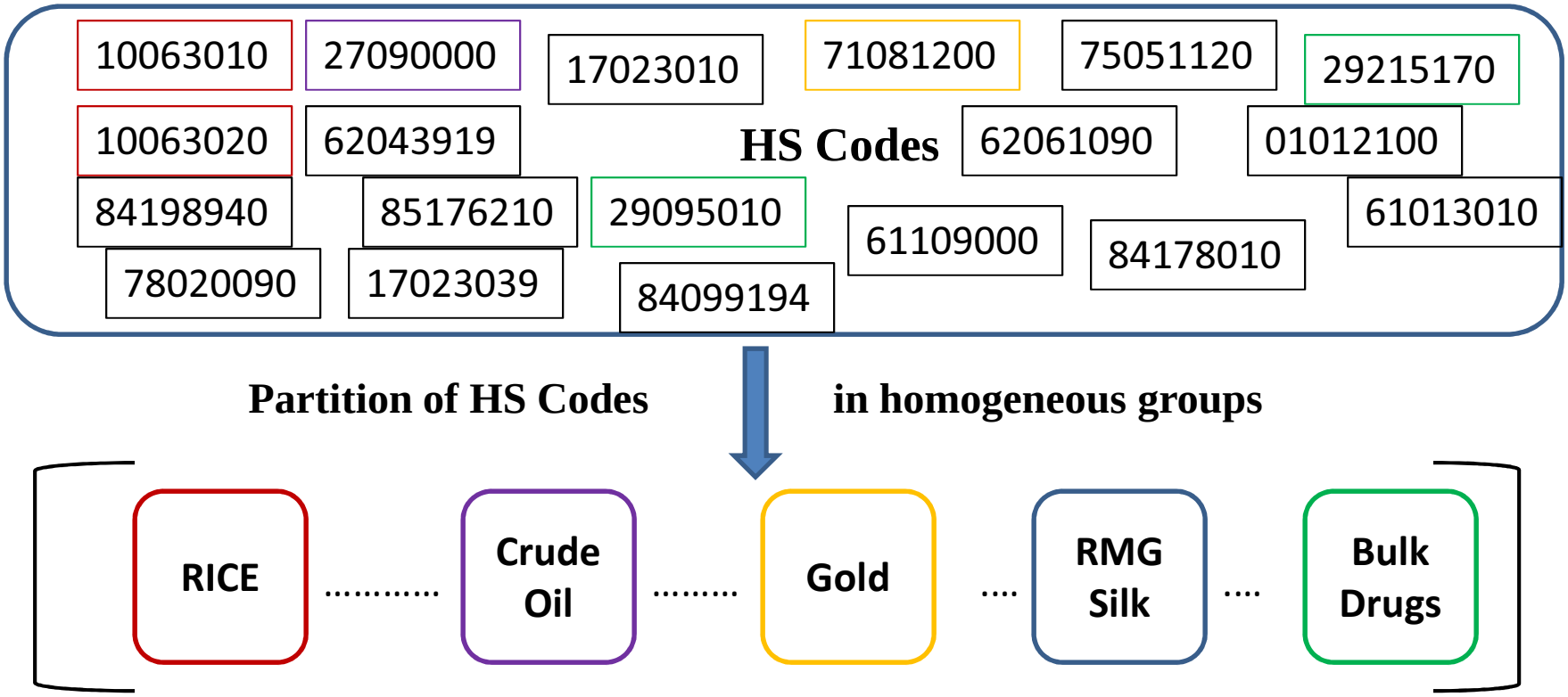
Year	2008-09	2009-10	2010-11	2011-12	2012-13
Base Year Choice Frequency	57	7	5	4	28

Decision – 2008-09 is taken as the BASE YEAR

Commodity Basket Revision

Commodity Basket Revision

Principal Commodity Groups- are major commodity heads formed by suitably clubbing the entire collection of HS codes at 8- digit level such that the groups are as homogeneous as practicable



Commodity Basket Revision

To elucidate the composition of Principal Commodity Groups - Rice (Non Basmati) & Gold are shown below-

PC Group	HS Code	Item Description
Rice (Non Basmati)	10061010	Rice in husk of Seed Quality
	10061090	Other Rice in husk
	10062000	Husked Brown Rice
	10063010	Rice Parboiled
	10063090	Rice except Parboiled (excluding Basmati Rice)
	10064000	Broken Rice
Gold	71081100	Non-Monetary Powder Of Gold
	71081200	Other Non-Monetary Unwrought Forms Of Gold
	71081300	Other Non-Monetary Semi Manufactured Frms Of Gold
	71082000	Monetary Gold
	71189000	Other Coin

Commodity Basket Revision (contd.)

❑ **Coverage** -The 168 Principal Commodity Groups cover **95%** (comprising of 11006 tariff lines at the 8-digut level) **of the entire HS-2012 codes** (consisting of 11545 tariff lines at the 8-digit level)

❑ Keeping in view the computational leverage available - the entire collection of 8-digit codes belonging to the 168 Principal Commodity Groups is taken as the Commodity Basket for index computation instead of going for a smaller representative sample of tariff lines

❑ Also calculation of trade indices at the finer **Principal Commodity group** stage enables identification of important trends at a micro level

Methodology for Index Computation

Index Formula

Notations used-

Item : i where i= {1,2,…….M} and M=Total no. of Items (in Import or Export as the case may be)

(Commodity) Group : j where j= {1,2, ……K}; Here K= 168

Month m: where m= {1,2,……12}

Year: t where t= {1,2,……T} and T: years considered for index determination

Note for the study

1. **At item level (i) : Harmonized System Codes at 8- digit level are considered**
2. **At Group level (j) : Principal Commodity Groups (168 in no.) are considered**

Index Formula (contd.)

Group Index for j-th (pc) group for m-th month given by

$$I_{jmt} = \frac{\sum_{i=1}^{n_{jmt}} \left(\frac{P_{i\ jmt}}{P_{ijmb}} \right) w_{ijmt}}{\sum_{i=1}^{n_{jmt}} w_{ijmt}}$$

where

$\mathbf{P_{i\ jmt}}$ = Real price of an item containing in group j, month m and year t

$\mathbf{P_{ijmb}}$ = Real price of an item containing in group j, month m and year b (Base year)

$$w_{ijmt} = \frac{v_{ijmt}}{\sum_{i=1}^{n_{jmt}} v_{ijmt}}$$

$\mathbf{n_{jmt}}$ = Total no. of items containing in group j ,month m and year t

Index Formula (contd.)

Overall Index arrived at by weighted average of I_G s where weights are value share in overall trade i.e.

Index for m-th month & t-th year

$$I_{mt} = \frac{\sum_{j=1}^{k} I_{jmt} \, w_{jmt}}{\sum_{j=1}^{k} w_{jmt}}$$

where

I_{jmt} = Group index for a particular month in a particular year

and **Value share of the j^{th} group m^{th} month t^{th} year**

$$w_{jmt} = \frac{\sum_{i=1}^{n_{jmt}} v_{ijmt}}{\sum_{j=1}^{k} \sum_{i=1}^{njmt} v_{ijmt}}$$

n_{jmt} = Total no. of items containing in group j ,month m and year t

Index Formula (contd.)

On similar lines overall index for a year can be obtained by weighted average of I_m s.

Index for t-th year

$$I_t = \frac{\sum_{m=1}^{12} I_{mt} w_m}{\sum_{m=1}^{12} w_m}$$

where

w_m = value share of the month m in a year

$$w_m = \frac{\sum_{j=1}^{k} \sum_{i=1}^{n_{jmt}} v_{ijmt}}{\sum_{m=1}^{12} \sum_{j=1}^{k} \sum_{i=1}^{n_{jmt}} v_{ijmt}}$$

n_{jmt} = Total no. of items containing in group j ,month m and year t

Some salient features of the proposed methodology

- As value data are more reliable than quantity; use of value share as weights would make the index stable. The Fischer Index uses two quantity figures.

- The use of de-trended data will help in identifying seasonal component

- The determination of fixed weights by smoothing trend equation on value shares enables capture of obsolescence or emergence nature of an item and hence correctly points out its importance (weights)

Some salient features of the proposed methodology (contd.)

- By the same smoothing function, imputation of missing values (i.e. not traded in the month/year)unit values of items in the base year can be done. For some items where there are very few non zero observations, smoothing by functional form is not appropriate. In that case, average of the observed unit values is taken as the representative value for base year. Hence link indices are not required.

- The **subgroup decomposability** would help in identifying the sensitivity of the index with respect any type of grouping, item basket, regional, major etc. Hence the contribution of any group in the change of index can be singled out which is very important for policy considerations.

- It is to be noted that this decomposability property is an important one which is not shared by the existing Fisher's index. Further it retains another important property of time reversibility of the Fisher's index.

❑ Adaptable to Other Classifications-

The proposed methodology can easily be adapted to other commodity classifications by suitable deciding upon on the **item level (i) and commodity level (j)**

Scenario – 1. Unit Values Indices based on SITC4 System

Taking item (i) as – Basic Headings (5-digit) of SITC4 Classification (making use of the correspondence tables between HS (at 6-digit) & SITC4 Basic Headings)

Taking Commodity Group (j) as – SITC4 Subgroups (i.e. 4-digit level)

Unit Value Indices can be calculated at Subgroup, Group, Division and Section levels of SITC4 using the proposed methodology.

Scenario – 2. Unit Values Indices based on BEC Classification

Taking item (i) as – Basic Category (3-digit) of BEC classification (making use of the correspondence tables between HS (at 6-digit) & BEC Basic Categories)

Taking Commodity Group (j) as–Sub-Category of BEC classification (2-digit level)

Unit Value Indices can be calculated at Sub-Category & Category levels of BEC classification using the proposed methodology.

Some salient features of the proposed methodology (contd.)

A Practical consideration: It has been observed that due to some **grouping heterogeneity or quantity figure variation unit values of a 8-digit item may vary widely** giving a unacceptable value of the index. To overcome this, it is suggested that while **computing price relatives, the comparison will be restricted to "similar" unit values**. By **"similar"** values, we mean values which **fall within a well defined range that is not too wide.** This procedure can also be incorporated in the **data validation/ scrutiny** level in the following manner. If certain group index is found to be unacceptable, the correctness of the data can be checked . If the data is found to be correct, the above procedure can be resorted to .

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QUESTIONS ?

THANK YOU