Real Sector Division
IMF Statistics Department

SUT Balancing tool

SUT Workshop

November 2019

Introduction

FINALIZING SUT
after manual balancing

Resolving small errors to balance rows and columns
- Time consuming
- Errors smaller than accuracy of data sources
- Difficult: sequential adjustments

SUT BALANCING TOOL
(developed by IMF STARE Michael Stanger)

- **Flexible**: works with different products/industries and several constraints
- **Easy to install and use**: only 5 tables in Excel
- **Dynamic and fast**: new balanced tables are generated instantly

Automated approaches to balance SUT

- **Developed for fine-tuning the results of SUTs**
  - To solve final adjustments
  - Manage adjustments ensuring consistency
- **Use with caution in early stages of SUT compilation**
  - To identify and tackle the most important imbalances in a hierarchical way
- **Advantages**
  - All explicit constraints are jointly fulfilled using the knowledge available about the robustness of the data included in the exercise
  - Concurrent and subsequent balancing exercises are carried out consistently
    - Repeated exercises with same setting produce the same results
    - Changes in reliability of source data can be adjusted
    - Short processing time allows more time for analysis of results

RAS method

- **RAS method:** well known procedure for reconciling double-entry system. Consists in estimating the inner components of a double-entry system of which marginal totals are known.

$a_{1,1}$	$a_{1,2}$	$a_{1,3}$	$A_{1,*}$
$a_{2,1}$	$a_{2,2}$	$a_{2,3}$	$A_{2,*}$
$a_{3,1}$	$a_{3,2}$	$a_{3,3}$	$A_{3,*}$
$A_{*,1}$	$A_{*,2}$	$A_{*,3}$	T

Example:

3x3 matrix where the marginal values are balanced (totals by column and rows are equal) and are considered strict constraints (binding).

The adjustment will force the inner data (a) to match these explicit constraints (A). The RAS procedure is an iterative proportional distribution of discrepancies.

Least Squares Methods

- **Least Squares methods:** the inner data is adjusted to fulfill simultaneously horizontal (row) and vertical (column) constraints. Unlike RAS, this method is not iterative, but simultaneously minimizes the proportional distribution of the discrepancies across the two dimensions such that:

a. $\hat{a}_{1,1} + \hat{a}_{1,2} + \hat{a}_{1,3} = A_{1,*}$
b. $\hat{a}_{2,1} + \hat{a}_{2,2} + \hat{a}_{2,3} = A_{2,*}$
c. $\hat{a}_{3,1} + \hat{a}_{3,2} + \hat{a}_{3,3} = A_{3,*}$
d. $\hat{a}_{1,1} + \hat{a}_{2,1} + \hat{a}_{3,1} = A_{*,1}$
e. $\hat{a}_{1,2} + \hat{a}_{2,2} + \hat{a}_{3,2} = A_{*,2}$
f. $\hat{a}_{1,3} + \hat{a}_{2,3} + \hat{a}_{3,3} = A_{*,3}$

Since marginal totals by column equal marginal totals by row (T), one of the constraints must be dropped since any one of the restrictions (Ai,j) can be derived from the others, leaving the system over identified. Thus, solving the balancing problem of a P x Q matrix would imply P + Q – 1 restriction.

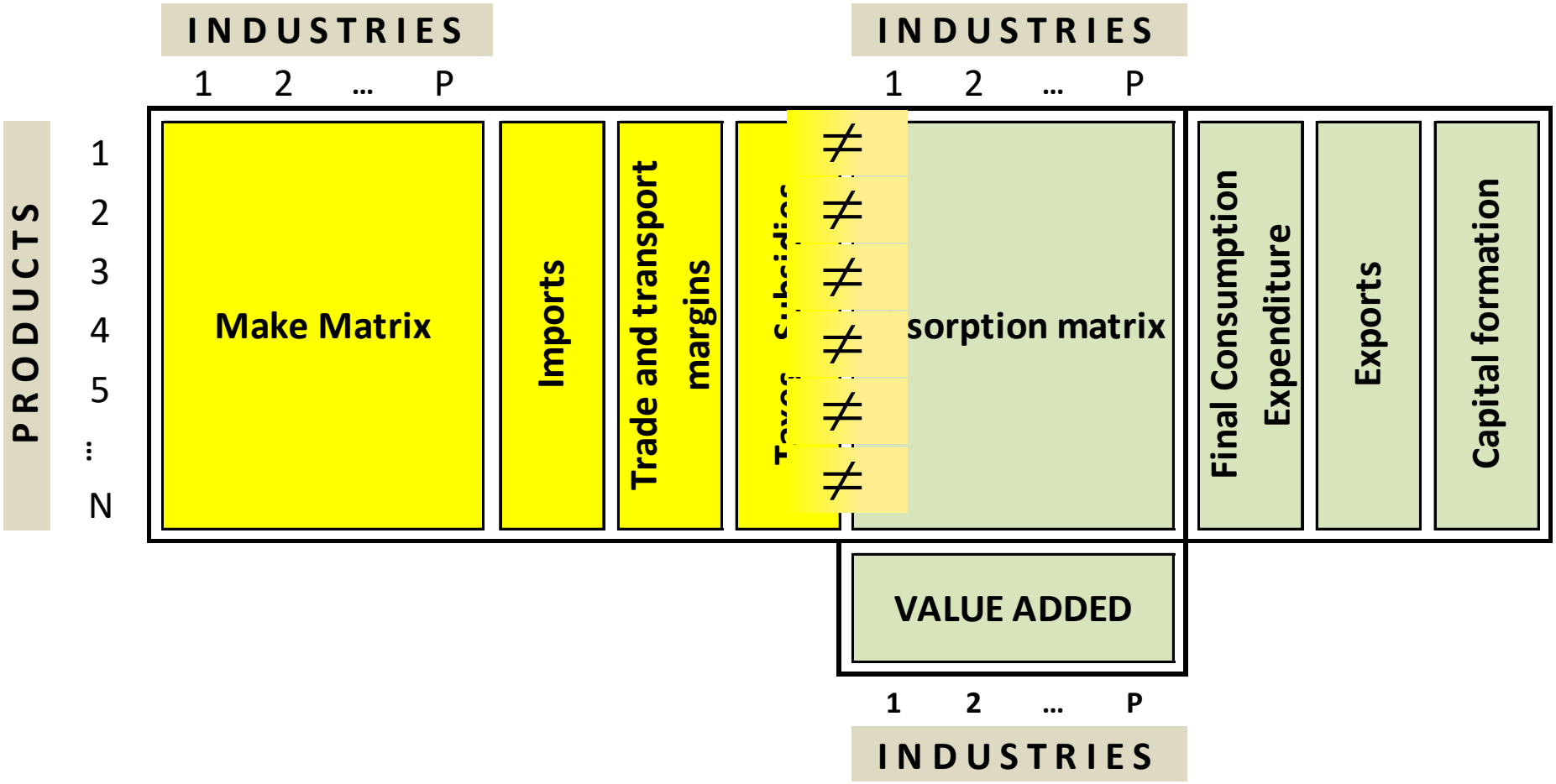
SUTB Balancing Tool

- This procedure is based on the **generalized least squared method** as described by Cholette and Dagum (2006). In particular, in the chapter of general reconciliation framework of two-way classified systems.

- Starts from an **unbalanced SUT.**
- **Explicit constraints** are imposed in a matrix, along with the reliability coefficient (allows for the inclusion of reliability coefficients which are inversely related to the extent the balancer is willing to adjust the data).
- **The result: a SUT that complies with all the imposed constraints**

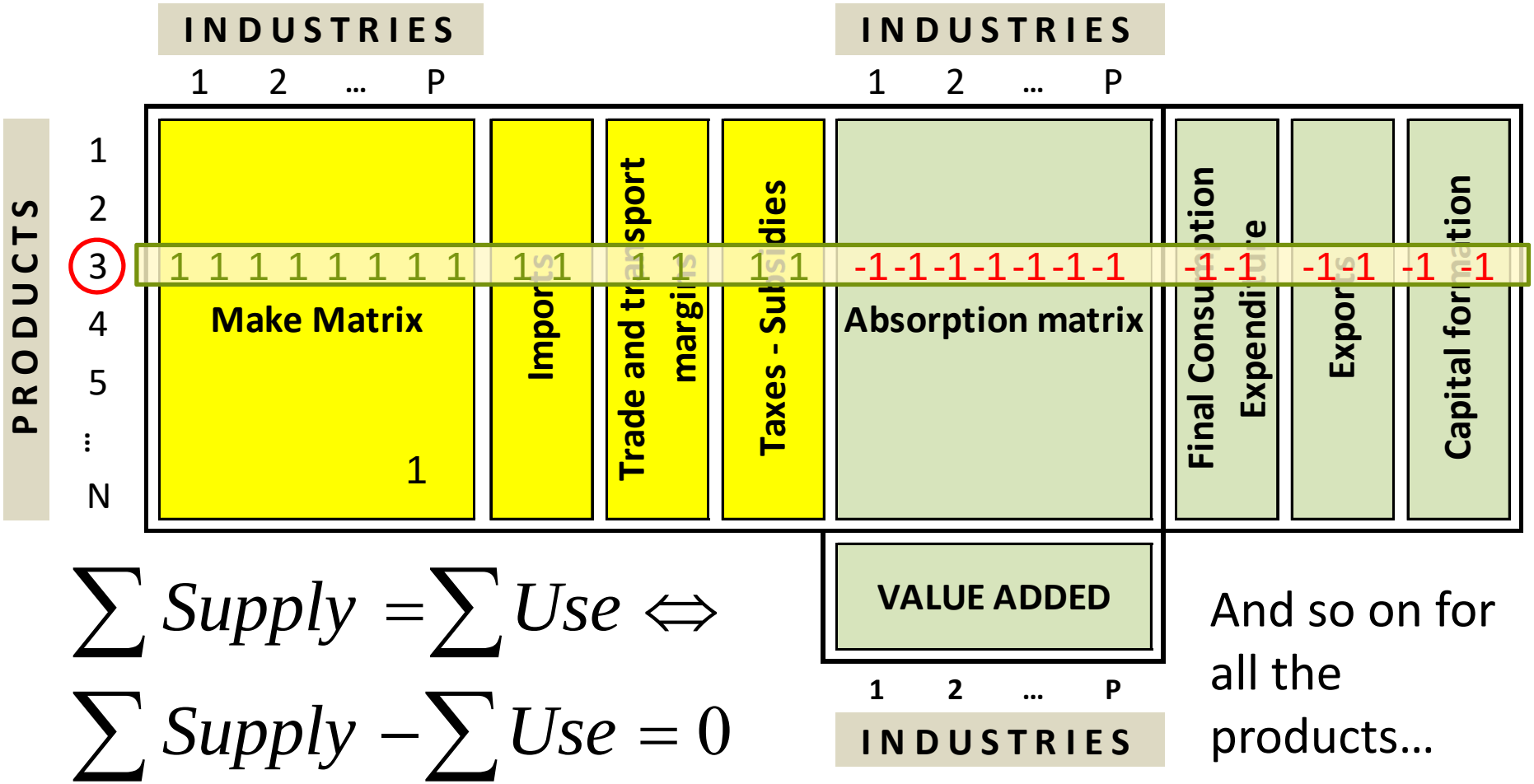
Setting up the Balancing process

1. The unbalanced SUT - Format



Setting up the Balancing process

2. The product-balancing constraint(s)



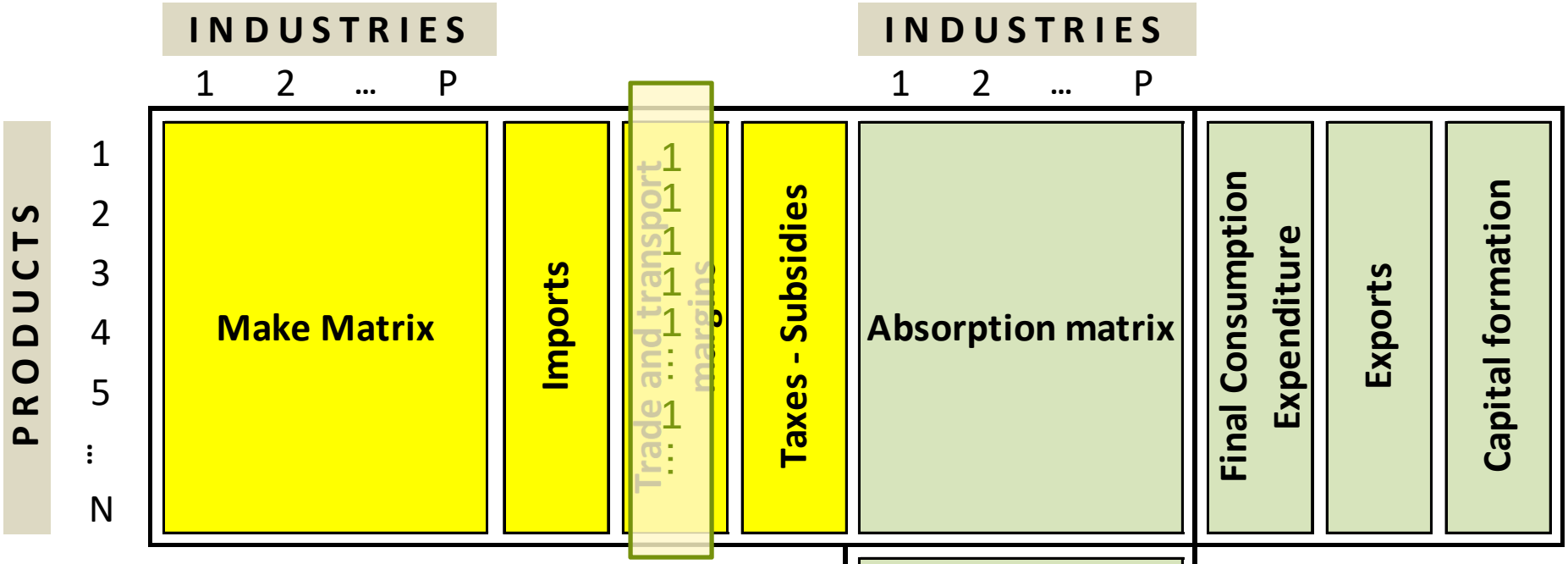
$$\sum Supply = \sum Use \Leftrightarrow$$

$$\sum Supply - \sum Use = 0$$

And so on for all the products…

Setting up the Balancing process

3. Accounting constraint(s) by component



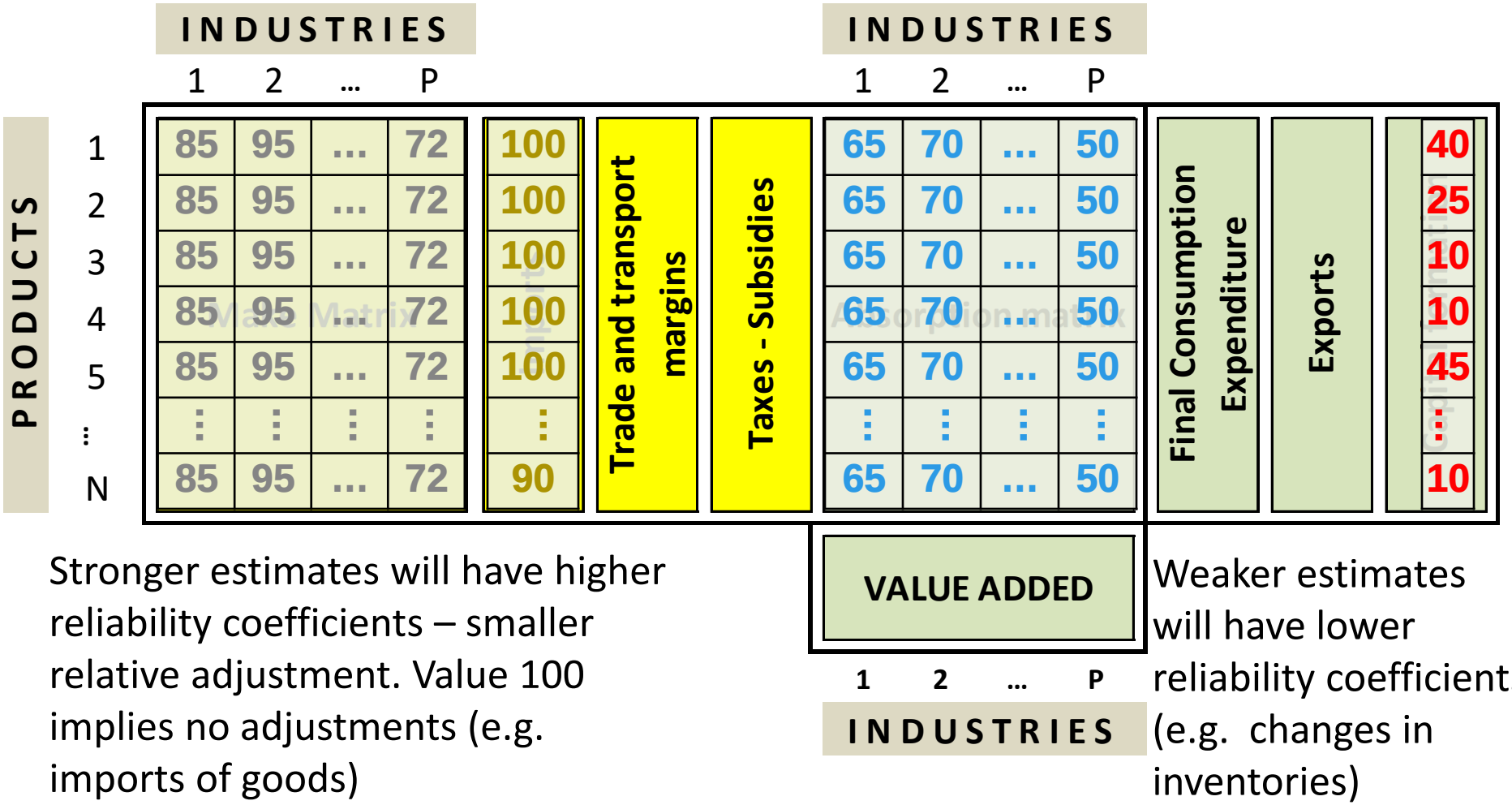
$$\sum T\&T\,Mg(p) = -\sum T\&T\,Mg(a) \Leftrightarrow$$

$$\sum T\&T\,Mg = 0$$

And so on for all the other constraints… (e.g. CIF/FOB)

Setting up the Balancing process

4. Data reliability – Adjustability coefficients

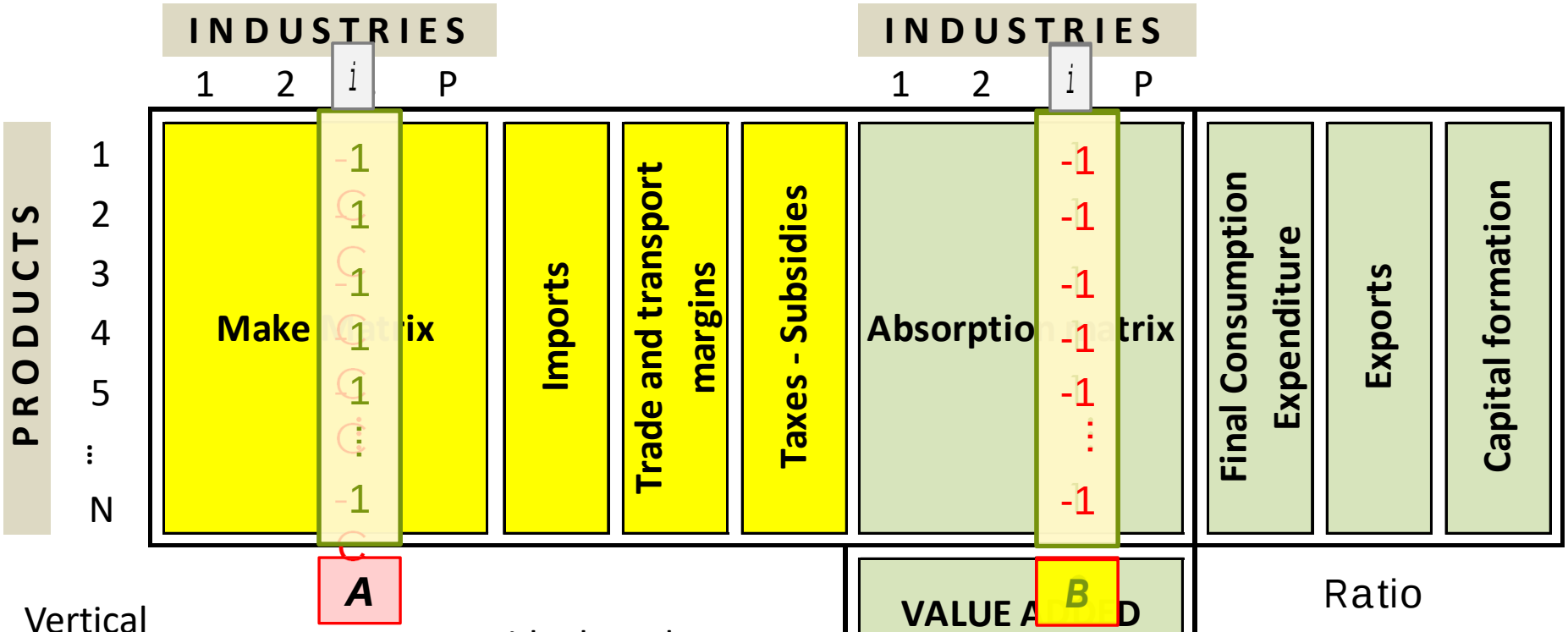


Stronger estimates will have higher reliability coefficients – smaller relative adjustment. Value 100 implies no adjustments (e.g. imports of goods)

Weaker estimates will have lower reliability coefficients (e.g. changes in inventories)

Setting up the Balancing process

5. Additional data constraints – user defined



Vertical totals

$$\sum O_i = A$$

Residual totals

$$VA_i = \sum O_i - \sum IC_i = B$$

Ratio

$$IC_i / O_i = C \Leftrightarrow$$

$$IC_i = C * O_i \Leftrightarrow$$

$$IC_i - C * O_i = 0$$

SUTB Balancing Tool

Basic_Constr - initial **2 basic group of constraints**: product balance (supply = use) and the vertical balance (transport and trade margins cancel out as well as the CIF/FOB adjustment)

AC includes the **reliability coefficients** imposed in the adjustment (from 0 to 100). Being 100 a fully reliable – untouchable- cell, and 0 an unreliable estimate (subject to large relative adjustment).

AdC - remaining **additional constraints**, flexible and depend on the compiler. As the previous ones these constraints are set as a matrix, however, they are different in that these need an explicit restriction.