

Input-output table: RAS balancing of import-export subcomponents

Resumé:

This note explains the RAS procedure applied to harmonize given initial matrices for imports and exports with available margins.

DSI

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Modelgruppepapirer er interne arbejdsrapporter. De konklusioner, der drages i papirerne, er ikke endelige og kan være ændret inden opstillingen af nye modelversioner. Det henstilles derfor, at der kun citeres fra modelgruppepapirerne efter aftale med Danmarks Statistik.

1. Introduction

The input-output table in ADAM has been updated for the current model version – October 2014, based on the new commodity flow dataset (*tilgangs- og anvendelsesmatricer*) from the national accounts. The import and export totals are provided back to 1966, however, the import-export matrices at the detailed level are available only for 2005-2010 in current prices and 2008-2010 in previous year prices. As a result, it is necessary to take detailed data for the inner cells before 2005/2008 from an older model version databank. The problem is that the row and column aggregates of the inner cells from the earlier model version do not add up to the given import and export totals from the national accounts. To harmonize the input-output cells with the given margins we apply RAS method. The procedure is explained below.¹

2. The RAS method

The problem is that we have an initial matrix Z of dimension $n \times m$ with elements $z_{ij} \in R^+$, and a corresponding target matrix Z^* of dimension $n \times m$. However, only the margins, the row and column sums, of Z^* are known. The objective is to find a third matrix \tilde{Z} with the same dimension and margins as Z^* that fulfils:

$$\sum_{i=1}^n z_{ij}^* = \sum_{i=1}^n \tilde{z}_{ij} \quad \text{and} \quad \sum_{j=1}^m z_{ij}^* = \sum_{j=1}^m \tilde{z}_{ij} \quad (1)$$

This is achieved by a series of bi-proportional adjustments of Z to \tilde{Z} until (1) is satisfied.

RAS balancing

First check the condition:

$$\left| \sum_{i=1}^n \sum_{j=1}^m z_{ij}^* - \sum_{j=1}^m \sum_{i=1}^n z_{ij}^* \right| \leq 1 \quad (2)$$

Let $p = 0, 1, 2, \dots, x$, denote the number of iterations carried out until (1) is fulfilled. Denote $\tilde{z}_{ij}|_p$ as \tilde{z}_{ij} after p iterations.

Initialization: for $p = 0$, $\tilde{z}_{ij}|_0 = z_{ij}$

For $p = 1, \dots, x$

Step 1: Row scaling, $\tilde{z}_{ij}|_p = \tilde{z}_{ij}|_{p-1} \otimes \sum_{j=1}^m z_{ij}^* / \sum_{j=1}^m \tilde{z}_{ij}|_{p-1}$

Step 2: Column scaling, $\tilde{z}_{ij}|_p = \tilde{z}_{ij}|_p \otimes \sum_{i=1}^n z_{ij}^* / \sum_{i=1}^n \tilde{z}_{ij}|_{p-1}$

Step 1 and 2 constitute a full iteration and are repeated until (1) is satisfied.

¹ See also Bartholdy, K. (1983), Metoder til afstemning af nationalregnskabs-matricer.

Data source

Table 1 below presents a sketch of the import-export cells to be harmonized with RAS procedure. The re-exports depend on whether imports or exports are adjusted first. To avoid that we first fix the values of re-exports by proportionally adjusting them to the given total re-exports including import duties, M_E , from the national accounts. Then the cells for imports and exports are treated separately with a predetermined value for re-exports.

The initial matrices are taken from ADAMBK.BNK, import and export margins are available in okt14-databank, and the total imports including duties to each use ($M_{<j>}$) and the total exports from each supply ($<i>_E$) are obtained from the national accounts. With these values in hand RAS-balancing is applied for imports and exports separately. Harmonized data are available in okt14-databank.

Table 1. ADAM input output table

	xa	xe	xng	xne	xnf	xnz	xb	xqz	xqs	Xqf	xh	xo	Cf	Cv	Ce	Cg	Cb	Ch	Cs	Ct	- Et	CO	IM	ik n	IB	IT	IL	E01	E2	E3	E59	E7Y	ES	ET			
xa																																				x	
xe																																					x
xng																																					x
xne																																					x
xnf																																					x
xnz																																					x
xb																																					x
xqz																																					x
xqs																																					x
xqf																																					x
xh																																					x
xo																																					x
M01																						x	x													X	
M2																						x	x													X	
M3K																						x	x													X	
M3R																						x	x													X	
M3Q																						x	x													X	
M59																						x	x													X	
M7B																						x	x													X	
M7Y																						x	x													X	
MS																						x	x													x	
MT	x	x	x	x	x	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Spm																																					
spp																																					x
spg																																					x
Spz																																					x
yw																																					x
Yr																																					x

Note: besides re-exports some cells have been preliminarily fixed, as they are either zero or negative, and some values such as *et* and *mt* are also predetermined due to special conditions in ADAM. These cells are marked with 'x'.