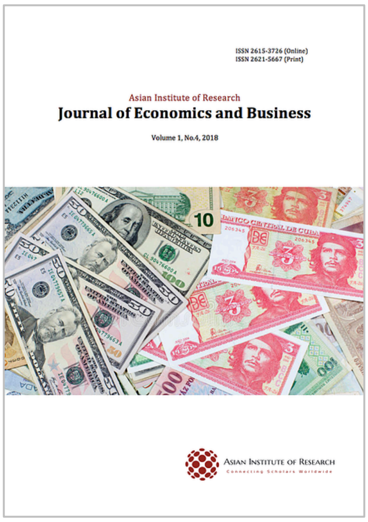

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The RAS Method with Random Fixed Points

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Abstract
Today many economists believe that RAS is the initials of economist Richard Stone, who is also the father of the National Financial System (SNA). This idea was introduced to update and reconcile the total supply and total use vectors in the input output table (I.O.T), supply and use tables (S.U.T) and social account matrix (SAM). This article attempts to explain and devise new algorithms so that the user can easily feel the practical application with more variable customized assumptions based on the application of information technology to the processing of the algorithm. This article appears to be a continuation of the article "A Short Note on RAS Method" at Advances in Management and Applied Economics (2013) vol.6, Issue 4.

Keywords: RAS method, Supply-Use tables, Input-Output Tables, Correct Row Total, Correct Column Total.

JEL Classification Numbers: I32, I31, C43

I. Introduction

For many researchers around the world and statistical offices of some countries, the application of the RAS method can be said in both easy and difficult ways. In this study, we want to give readers the best way to understand the balance of the supply and use tables or the input-output table in the normal process. This job will become easier if there is effective software to automatically make all necessary balancing steps in the quickest and easiest way.GDP can be estimated by three approaches: income, expenditure, and production, see Lee (2011) and Lequillier and Blades (2006). In theory, these three approaches will yield the same estimate; In fact, they are different because they are based on different data sources, each with its own fault structure as well as different estimation methods. The Swedish Statistical Office has developed A System for Product Improvement, Review and Evaluation basic indicators of the National Accounts system called ASPIRE.

The difference between the GDP estimates generated by each approach is called "statistical error." The size of the statistical error is a measure of the quality of Country account statistics. In many statistical agencies, including Sweden, steps are taken to balance different estimates of GDP. A number of techniques are used but are usually based on the RAS methodology, and the Trinh and Phong (2013) research are applied in a number of countries, especially Sweden, which are named of economist Richard Stone, who proposed this idea.

In previous research by B. Trinh and N.V. Phong (2013) molecules of the origin, matrix are allocated with the equal role of the elements, meaning that all elements in the original matrix can be modified upon updating. But when updating a table S.U.T or table, I.O.T may be some element in the matrix is constant. This article attempts to solve this problem. This article appears to be a continuation of the article "A Short Note on RAS Method" at Advances in Management and Applied Economics (2013) vol.6, Issue 4

II. Problem solving

The main objective of the RAS method is to balance the columns and rows of the input - output table or supply and use tables when updating or modifying these tables. The basic equations are cycles depending on the degree of difference. These equations are described as follows:

$$X_C^{new}(tn).\, X_C^{new}(tn-1)..X_C^{new}(t1).A.X_R^{new}(t1)\ldots X_R^{new}(tn-1).\, X_R^{new}(tn) = A^{new} \qquad (1)$$

With:

X_C^{new} (ti) is a diagonal matrix with elements on the diagonal that is the element of the column vector of new output in the time ti; X_R^{new} (ti) is a diagonal matrix with elements on the diagonal that is the element of the row vector of new output in the time ti; A is coefficients of direct input matrix or original matrix that can be updated by time.
X_C^{new}(ti) has form;

$$X_C^{new}(ti) = \begin{matrix} X_{C1}^{new}(ti) & 0 & 0 \\ 0 & Xci^{new}(ti) & 0 \\ 0 & 0 & Xcn^{new} \end{matrix} \qquad (2)$$

Same with X_R^{new}(ti)

$$X_R^{new}(ti) = \begin{matrix} X_{R1}^{new}(ti) & 0 & 0 \\ 0 & X_{Ri}^{new}(ti) & 0 \\ 0 & 0 & X_{Rn}^{new} \end{matrix} \qquad (3)$$

In the case where matrix A has fixed elements in the time of update or modification, then analysis of matrix A:

$$A = A_1 + A_2 \qquad (4)$$

A_1 is a matrix with mutable elements, A_2 is a matrix with immutable elements, such as A_{i1} and A_{1n} are constant,

Matrices A, A1, and A2 are shown below:

$$A = \begin{matrix} A_{11} & A_{1i} & A_{1n} \\ A_{i1} & A_{ii} & A_{in} \\ A_{n1} & A_{ni} & A_{nn} \end{matrix} \qquad (4)$$

$$A1 = \begin{matrix} A_{11} & A_{1i} & 0 \\ 0 & A_{ii} & A_{in} \\ A_{n1} & A_{ni} & A_{nn} \end{matrix} \quad (5)$$

And:

$$A2 = \begin{matrix} 0 & 0 & A_{1n} \\ A_{i1} & 0 & 0 \\ 0 & 0 & 0 \end{matrix} \quad (6)$$

Or:

$$A_2 = \begin{matrix} A_{11} & A_{1i} & A_{1n} & 0 & 0 & 1 \\ A_{i1} & A_{ii} & A_{in} & 1 & 0 & 0 \\ A_{n1} & A_{ni} & A_{nn} & 0 & 0 & 0 \end{matrix} \quad (7)$$

$$\text{Put: } B = \begin{matrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 0 & 0 \end{matrix}$$

Matrix B implies that elements of the original matrix A are fixed in the update, and thus relational (7) is easily simulated using a simple software.

A2 is the constant consisting of constant elements, the remainder being 0
And

$A^{new} = A_1^{new} + A_2$
A_1^{new} apply relationship (1)

III. Case study

The original matrix with dimension is (10 x 10) shown in table 1, two columns and rows are the sum of them and correct vectors (column and row) that need to adjust origin matrix. The vectors to be adjusted are the CORR COLUMN. SUM and CORR. ROW

Table 1. Origin matrix

	1	2	3	4	5	6	7	8	9	10	Row SUM	Corr. Row
1	41,845	16,269	47,279	93,040	29,050	88,709	88,072	20,847	57,283	7,502	489,896	489,891
2	41,176	72,797	17,788	71,340	25,068	11,251	21,610	55,919	61,651	58,134	436,734	436,736
3	29,401	22,413	93,191	30,336	87,009	49,762	61,830	9,813	74,335	49,266	507,356	507,359
4	54,873	45,663	78,843	6,113	65,307	42,004	83,710	65,059	89,662	44,981	576,215	576,208
5	93,838	76,045	77,752	22,148	3,088	37,941	52,996	5,670	87,146	43,373	499,997	500,005
6	60,949	36,728	69,028	89,716	44,044	31,459	52,891	80,338	52,734	33,153	551,040	551,044
7	89,093	85,460	45,861	94,053	69,782	49,051	38,189	63,176	76,580	96,277	707,522	707,526
8	93,430	31,165	31,492	48,101	89,338	74,046	16,372	11,045	38,275	30,581	463,845	463,842
9	88,845	88,563	19,492	47,562	37,621	64,296	3,073	15,736	26,801	34,550	426,539	426,537
10	23,190	30,187	74,229	19,800	39,272	97,604	86,543	47,041	98,545	87,367	603,778	603,774
Col. SUM	616,640	505,290	554,955	522,209	489,579	546,123	505,286	374,644	663,012	485,184	5,262,922	5,262,922
Corr. SUM	616,634	505,295	554,958	522,200	489,573	546,119	505,291	374,642	663,018	485,192	5,262,922	

After that determine the constant elements in the original matrix ($A = (A_{ij})$), the determination of the A_{ij} values unchanged in the above matrix is done customarily. In the example above, the A_{ij} defined as constant are: $A_{1,4}$; $A_{1,7}$; $A_{2,1}$; $A_{2,5}$; $A_{2,8}$; $A_{3,3}$; $A_{3,8}$; $A_{4,6}$; A49; $A_{6,1}$; $A_{6,8}$; $A_{7,2}$; $A_{7,5}$; $A_{7,9}$; $A_{8,4}$; $A_{9,3}$; $A_{9,10}$; $A_{10,7}$; $A_{10,9}$.

Table 2. Matrices define constant variables

Mã	1	2	3	4	5	6	7	8	9	10
1	-	-	-	1	-	-	1	-	-	-
2	1	-	-	-	1	-	-	1	-	-
3	-	-	1	-	-	-	-	1	-	-
4	-	-	-	-	-	1	-	-	1	-
5	-	-	-	-	-	-	-	-	-	-
6	1	-	-	-	-	-	-	1	-	-
7	-	1	-	-	1	-	-	-	1	-
8	-	-	-	1	-	-	-	-	-	-
9	-	-	1	-	-	-	-	-	-	1
10	-	-	-	-	-	-	1	-	1	-

Applying the algorithm above gets the matrix to be adjusted.

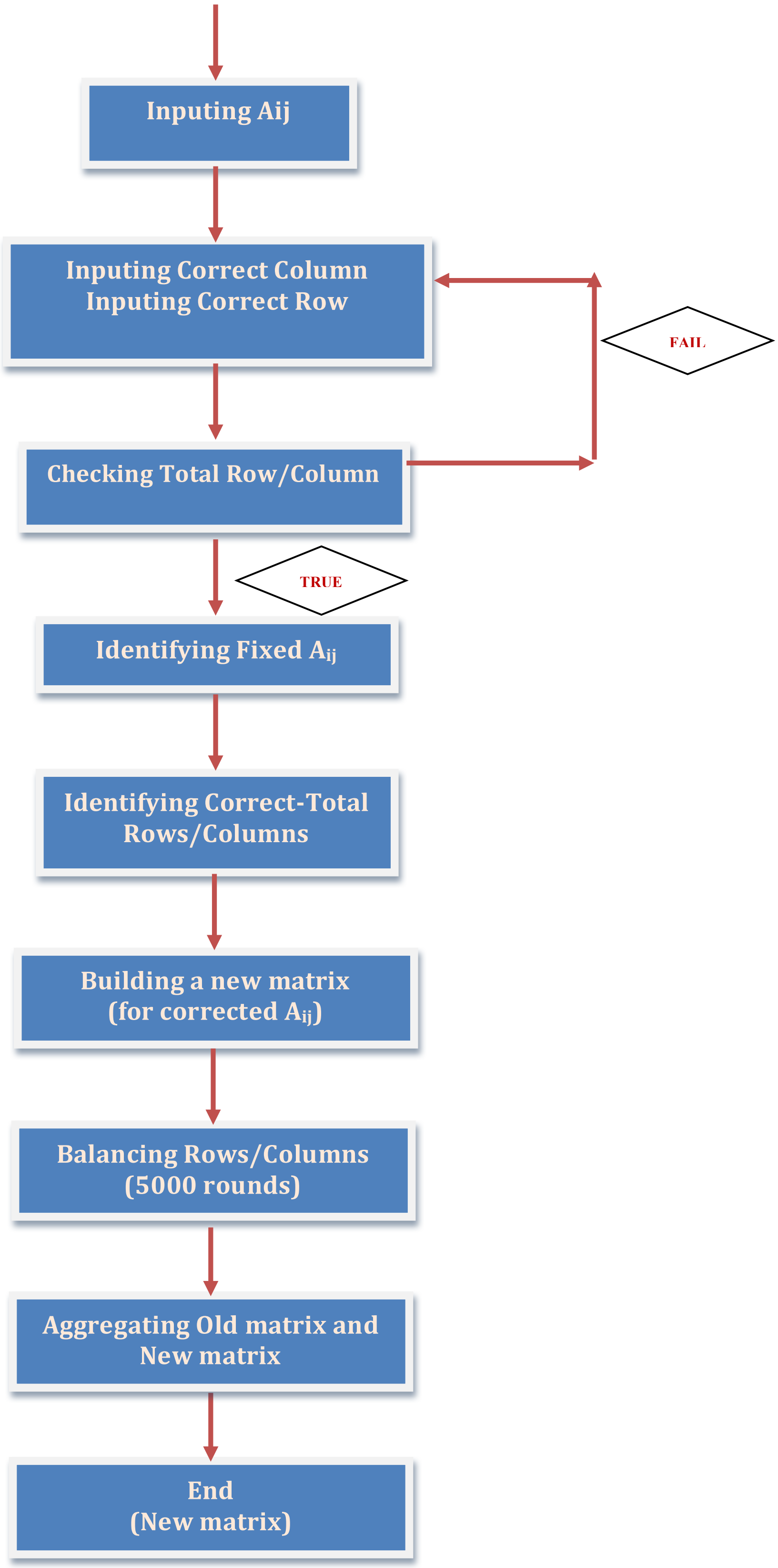
Table 3. Adjusted matrix

	1	2	3	4	5	6	7	8	9	10	Row SUM	Corr. Row
1	41,844	16,269	47,279	93,040	29,049	88,707	88,072	20,847	57,283	7,502	489,891	489,891
2	41,176	72,798	17,788	71,338	25,068	11,251	21,610	55,919	61,652	58,135	436,736	436,736
3	29,401	22,413	93,191	30,335	87,009	49,762	61,831	9,813	74,336	49,267	507,359	507,359
4	54,871	45,663	78,842	6,113	65,305	42,004	83,710	65,058	89,662	44,981	576,208	576,208
5	93,838	76,047	77,754	22,148	3,088	37,941	52,997	5,670	87,148	43,374	500,005	500,005
6	60,949	36,729	69,029	89,714	44,044	31,459	52,892	80,338	52,735	33,154	551,044	551,044
7	89,093	85,460	45,862	94,051	69,782	49,051	38,190	63,177	76,580	96,280	707,526	707,526
8	93,428	31,165	31,492	48,101	89,337	74,045	16,372	11,045	38,275	30,581	463,842	463,842
9	88,844	88,564	19,492	47,561	37,621	64,296	3,073	15,736	26,801	34,550	426,537	426,537
10	23,190	30,187	74,229	19,799	39,271	97,603	86,543	47,040	98,545	87,368	603,774	603,774
Col. SUM	616,634	505,295	554,958	522,200	489,573	546,119	505,291	374,642	663,018	485,192	5,262,922	5,262,922
Corr. SUM	616,634	505,295	554,958	522,200	489,573	546,119	505,291	374,642	663,018	485,192	5,262,922	

IV. Discussions

In previous studies, the RAS method was mostly used to balance the supply and use tables (or input output table) when the total input or output varied. It does not solve the problem when the total input or output changes but some elements in the matrix of the intermediate cost or the coefficient of the make matrix do not change, such as a sector or a group of industries has a dramatic change in technology in the years following the year in which the supply and use tables can be investigated, and only some industries have changed the Aij coefficient in the intermediate cost matrix or the main product and by-product ratios in the production. This method makes it easy to update the supply and uses tables, and it is also easy to write application software for the RAS method with random fixed points. The steps for solving in the diagram below:

The RAS method with random fixed points



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