RAS Reconciliation Method

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Outline

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  - Negative transactions
  - Incomplete
  - Add control totals
  - Uncertain control totals

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Introduction

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Introduction

"[I]f we put all these initial estimates together [for a SAM] we reach the familiar situation: an incomplete and inconsistent social accounting matrix"
(Stone, 1977, p xxiv).

- Infinite number of possible solutions to achieve a consistent SAM
- Even with the best efforts to collect complete data, the prior will be incomplete and inconsistent
- Mathematical methods cannot make the prior complete
- RAS was a simple reconciliation method of its time

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Why use RAS?

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Why use RAS?

- It is simple, which allows focus on
  - Mechanics
  - Principles
- It provides a 'laboratory' to aid understanding of
  - Mathematical methods
  - Information theoretic issues
- There are situations in which variants of RAS remain pragmatically 'optimal'
- RAS has links to information theory
  - SAMEST is based on information theory

The developers of RAS for use with SAMs explicitly sought solutions to information problems

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Objectives

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Objectives

- A consistent matrix (SAM) of data
- Reconciled with selected 'control' totals
  - Income and expenditures by accounts
  - Selected aggregate totals
  - Selected exogenous information
  - ….

'Appropriate' conditions for use
1. 'Smallish' inconsistencies
   a. Final reconciliation
   b. Fine 'tuning'
2. A prior based on 'good' data

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RAS solution Methods

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$$\mathbf{X}^* = \hat{\mathbf{r}}\mathbf{X}\hat{\mathbf{s}}$$

$$\mathbf{X}^*\mathbf{i} = \mathbf{u} \qquad and \qquad \left(\mathbf{X}^*\right)'\mathbf{i} = \mathbf{v}$$

$$x_{ij}^* = r_i x_{ij} s_j$$

$$\sum_{j=1}^{n} x_{ij}^* = u_i \qquad \text{and} \qquad \sum_{i=1}^{n} x_{ij}^* = v_j$$

$$\sum_{j=1}^{n} x_{ij}^* . \log \frac{x_{ij}^*}{x_{ij}}$$

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Iterative solution method

'Original' method

- Iterative generation of row and column multipliers
  - Each row iteration ensures the row control is satisfied
  - Each column iteration ensures the column control is satisfied
  - Bi-proportionality ensures the solution will converge with each iteration
- Costs
  - Low demand for computational power
- Preserves
  - Zeros
  - Positive transactions
  - (Relatively) robust for negative transactions

Example in Excel provided

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RAS: Optimisation Problem

$$SAM\_RAS_{sac,sacp} = R_{sac} * S_{sacp} * SAM\_prior_{sac,sacp}$$

$$col\_con0_{sac} = \sum_{sac} SAM\_RAS_{sac,sacp}$$

$$row\_con0_{sac} = \sum_{sacp} SAM\_RAS_{sac,sacp}$$

$$OB = \sum_{sac,sacp} \left\{ \begin{array}{l} SAM\_RAS_{sac,sacp} \\ *\left[\log\left(SAM\_RAS_{sac,sacp} + \beta\right) - \log\left(SAM\_prior_{sac,sacp} + \beta\right)\right] \end{array} \right\}$$

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RAS: Optimisation Problem

Weights

Logs

$$OB = \sum_{sac,sacp} \left\{ \begin{array}{l} SAM\_RAS_{sac,sacp} \\ *\left[\log\left(SAM\_RAS_{sac,sacp} + \beta\right) - \log\left(SAM\_prior_{sac,sacp} + \beta\right)\right] \end{array} \right\}$$

Solution

Prior

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RAS: Optimisation Problem

```
BIPROP(sac,sacp)..
 SAM_ras(sac,sacp) =E= R(sac)*S(sacp)
                        *SAM_prior(sac,sacp) ;

CCONT(sacp)..
 col_con0(sacp) =E= SUM(sac,SAM_ras(sac,sacp)) ;

RCONT(sac)..
 row_con0(sac) =E= SUM(sacp,SAM_ras(sac,sacp)) ;

OBJ.. OB =E=SUM{(sac,sacp)$SAM_prior(sac,sacp),
             SAM_ras(sac, sacp)
         * [log(SAM_ras(sac, sacp) + beta)
         - log(SAM_prior(sac,ssp) + beta)]} ;
```

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Optimisation method

- 'Technical' method
- Maximise an objective function subject to
  - Selected row and column control totals
  - Bi-proportionality ensures a solution
  - Optimand allows a simple evaluation metric
- Costs
  - Modern computational power
- Preserves
  - Zeros
  - Positive transactions
  - —

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Extensions to RAS

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Extensions to RAS Method

- Adding information (modified RAS)
  - Exogenous data as cell specific control totals
- Implications of an incomplete prior
  - Subtracting information
- Negative transactions
  - Transpose negative and adjust control totals
  - Make negative transactions exogenously fixed
- Add extra control totals
  - Reorganise the prior and final matrix
- Uncertain control totals
  - Add errors to control totals (as additional accounts)

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Extensions to RAS

- MRAS
  - Known values
  - Errors
- GRAS
- KRAS
- ….

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RAS Reconciliation Method

The End

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