

Topic 4

Elteto-Koves-Szulc Method for Spatial Comparisons



Elteto-Koves-Szulc (EKS) Method

- **A commonly used method in international comparisons**
- **It is the chosen method of aggregation for above basic heading level for the ICP 2005 round**
- **OECD and EUROSTAT have been using this since 1990**
- **EKS method uses binary indexes (satisfying country reversal) as building blocks**
- **EKS method is mathematical technique to generate transitive multilateral indices from non-transitive binary indices**



EKS Method - continued

- Starts with a matrix of Fisher Binary Indices
- EKS multilateral indices, for each j and k

$$\text{EKS}_{jk} = \prod_{\ell=1}^M [F_{j\ell} \cdot F_{\ell k}]^{1/M}$$

Properties:

1. Transitive
2. Maintain characteristicity
3. It is a non-additive procedure



EKS Method

Least Squares property:

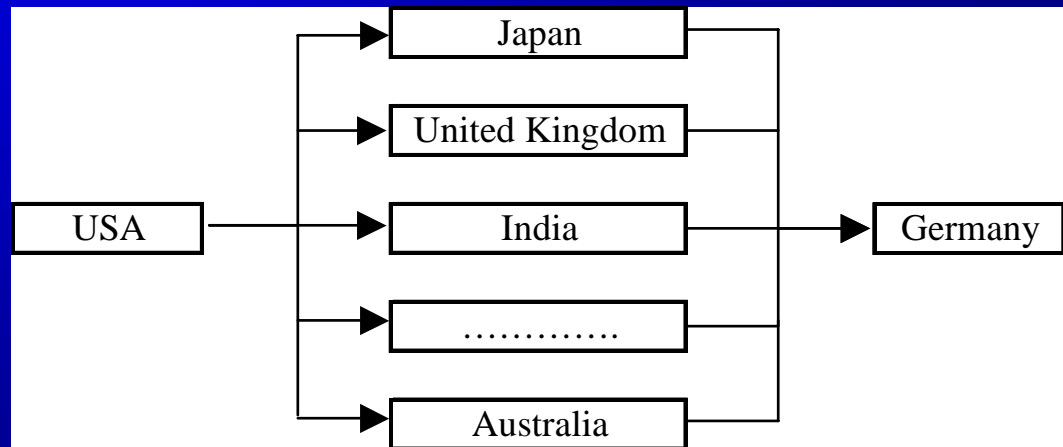
Minimise

$$\sum_j \sum_k (\ln I_{jk} - \ln F_{jk})^2$$

subject to

$$I_{jk} = I_{jl} \cdot I_{lk} \quad \forall j, k, l$$

A simple interpretation



EKS Method

1. A possible generalisation of EKS method is to minimise

$$\text{Minimise } \sum_j \sum_k g_j g_k (\ln I_{jk} - \ln F_{jk})^2$$

$$\text{subject to } I_{jk} = I_{jl} \cdot I_{lk} \quad \forall j, k, l$$

2. Another possible generalisation is to give weights to each link country comparison, leading to the following index

$$EKS_{jk} = \prod_{\ell=1}^M [F_{j\ell} \cdot F_{\ell k}]^{w_\ell}$$



Generalised EKS Method

Aim: To accord weights to each link comparison reflecting its “reliability”

- **EKS indices are based on OLS estimates of the parameters of:**

$$\ln F_{jk} = \Pi_k - \Pi_j + u_{jk}$$

$$\text{with } E(u_{jk}) = 0 \quad \text{and} \quad v(u_{jk}) = \sigma^2$$

- **Generalised EKS indices can be generated using error specification**

$$V(u_{jk}) = \frac{\sigma^2}{W_{jk}}$$

- **This type of formulation also makes it possible to derive standard errors for the index**



Alternative specifications of w_{jk}

- No. of matched products (Rao and Timmer, 2000)

$$w_{jk} = n_{jk} / n$$

- Coverage Ratio (Rao and Timmer, 2000 and O'Donnell, 2001)

$$w_{jk} = \frac{\sum_i d_{ijk} (p_{ij} q_{ij} + p_{ik} q_{ik})}{\sum_i (p_{ij} q_{ij} + p_{ik} q_{ik})} \quad \text{with } d_{ijk} = 1 \text{ if } q_{ij} > 0 \text{ and } q_{ik} > 0; = 0 \text{ otherwise}$$

- Inverse of Laspeyres-Paasche Spread (Hill's distance)

$$w_{jk} = \frac{1}{|\ln L_{jk} - \ln P_{jk}|}$$



Alternative specifications of w_{jk}

- Treatment of representative items in ICP (Rao, 2001)

$$w_{jk} = \frac{1}{\frac{1}{4} \left[\frac{1}{n_j} + \frac{1}{n_k} + \frac{2n_{jk}}{n_j n_k} \right]}$$

- Weights based on economic distance (Selvanathan and Rao, 1992)

$$w_{jk} = \frac{1}{|\ln(Y_j) - \ln(Y_k)|}$$

- Similarity of price structures (van Ark *et al.* 1996)

$$w_{jk} = (s_{jk}(j) s_{jk}(k))^{1/2} \text{ where } s_{jk}(j) = \frac{\sum (p_{ij} q_{ij})(p_{ik} q_{ij})}{\sqrt{\sum (p_{ij} q_{ij})^2 \sum (p_{ik} q_{ik})^2}}$$



Multilateral PPPs for food Manufacturing, 1987 (in national currency per US\$)

	Fisher	EKS	Weighted EKS Number of matches	Weighted EKS Coverage ratios	Weighted EKS Hill's distance	Weighted EKS Price Similarity index	Weighted EKS Quantity Similarity index	Max difference between weighted EKS and unweighted EKS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
USA	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Australia	1.20	1.06	1.09	1.06	1.07	1.07	1.08	2.8%
Canada	1.47	1.48	1.49	1.47	1.48	1.49	1.48	0.7%
Germany	2.20	2.13	2.17	2.14	2.06	2.11	2.09	-3.3%
Indonesia	1215.9	1295.0	1285.2	1304.2	1338.3	1315.9	1316.3	3.3%
Japan	307.2	327.1	321.4	320.5	321.0	330.1	328.7	-1.9%
S Korea	904.7	913.0	917.1	914.3	903.5	916.4	921.1	-1.0%
Taiwan	35.4	35.8	35.6	35.2	35.2	36.0	35.5	-1.7%

Some Remarks

1. EKS method retains the important properties of the binary index numbers like the Fisher index.
2. EKS method maintains “characteristicity” of the binary comparisons.
3. The weighted EKS methods do not appear to produce results that are significantly different from the unweighted EKS method.
4. Lack of additivity appears to cause problems in some instances – real aggregates for components of GDP do not add up to real GDP. Some times differences appear to be quite large.

