Decomposition of final demand

ISus shows emissions and resource use per sector, as well as total emissions. In order to help interpret changes in total emissions, we use logarithmic mean Divisia index decomposition (Ang, 2005).

Emissions M_t at time t follow from the identity

$$(1)\qquad M_t = \sum_{i=1}^{I} M_{i,t} = \sum_{i=1}^{I} x_{i,t}^{1} x_{i,t}^{2} \ldots x_{i,t}^{n}$$

where i denotes sector, and n is the number of components x.

The proportional change D in emission M is decomposed as follows:

$$(2)\qquad D_t = \frac{M_t}{M_0} = D_t^1 D_t^2 \ldots D_t^n$$

where

$$(3)\qquad D_t^j = \exp\left[\sum_{i=1}^{I} \frac{\left(M_{i,t} - M_{i,0}\right) \big/ \left(\ln M_{i,t} - \ln M_{i,0}\right)}{\left(M_t - M_0\right) \big/ \left(\ln M_t - \ln M_0\right)} \ln\left(\frac{x_{i,t}^j}{x_{i,0}^j}\right)\right]$$

In ISus, we use

$$(4)\qquad M_t = \sum_{i=1}^{I} M_{i,t} = \sum_{i=1}^{I} \frac{M_{i,t}}{Y_{i,t}} \frac{Y_{i,t}}{Y_t} Y_t$$

where Y_i is the gross value added in sector i and Y is total production. That is, we decompose the change in emissions into the change in emission intensity (M_i/Y_i), the change in the structure of the economy (Y_i/Y), and the size of the economy (Y). We refer to this as technology, structure, and output. Note that the technology term in fact is a residual: it captures true technological change (emissions per activity level) as well as changes in production (activities per value added) and changes in the structure of the sector. Note also that (2-3) is a first-order approximation. There is a typically small, unexplained change in emissions.

References

B.W. Ang (2005), ‘The LMDI Approach to Decomposition Analysis: A Practical Guide’, *Energy Policy*, **33**, 867-871.