

# EUKLEMS Road map WP1

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Marcel Timmer

## 1. General

The WP 1 workshop September 2005 in Groningen has been very useful in assessing the current state of data construction in WP 1. On the basis of this meeting, we have developed a new time-line for working towards release of the final EUKLEMS database in October next year. In this note I elaborate on this time-line and try to indicate what steps need to be taken in the upcoming 12 months. The main focus will be on the preliminary database to be delivered in March. We need to take short-cuts for this database and proposals for short-cuts are being made. After the preliminary database (period March-June), further refinements need to be made which will require experimentation with various methods.

## 2. Time Line

For WP 1 the following time-line is being used:

- **15 November:** first data delivery by consortium partners
- **15 January:** second data delivery by consortium partners
- **1 March:** release preliminary database by Groningen
- **30 June:** third data delivery by consortium partners
- **30 September:** final data delivery by consortium partners
- **31 October:** release final database by Groningen

In principle the EUKLEMS output database in October 2006 will contain the following variables (timeseries for 1970-2004 and EUK72 industries):

1. **Gross output** at basic prices (current price and volume indices)
2. **Value added** at basic price (current price and volume indices)
3. **Total intermediate inputs** at purchase prices (current price and volume indices)
  - a. Intermediate **energy** inputs at purchase prices (current price and volume indices)
  - b. Intermediate **material** inputs at purchase prices (current price and volume indices)
  - c. Intermediate **service** inputs at purchase prices (current price and volume indices)
4. **Labour** services (volume indices) (see WP 2)
5. **Capital** services (volume indices) (see WP 3)
6. **Shares** of K,L, E, M and S in gross output (current price)
7. **Contribution** of K,L, E, M, S and MFP to output growth.

## 8. **Supply and use tables** at basic prices plus valuation matrices (current price and volume)

Given the tight time schedule, we will only include SUTs insofar they are readily available from the national statistical offices in the preliminary database in March 2006. This will mean that for most countries, we will not have a full time-series of SUTs in the upcoming months. The period February -June can be used for intrapolation and backcasting of SUTs for missing years. This will a time-consuming process as experimentation with various methods is needed. At the workshop in Groningen various methodologies were presented. Mun Ho presented a methodology to intrapolate between two benchmark tables. Also one might want to use information from older input-output tables to make new benchmarks. Jörg Beutel presented methods to extract an use table from an IO-table. Backcasting (i.e. creating SUT series for the period before the oldest available benchmark table) will be most demanding. The most data intensive methodology has been presented by Kurt Kratena who laid down a methodology to deal with extra information on intermediate input structures and final demand series. A minimal data demanding method would be the EURO method presented by Jörg Beutel. Inbetween alternative are feasible, depending upon the data situation in your country.

However, in the preliminary database we do need the breakdown of total intermediate inputs values and volumes from the national accounts into energy, materials and services. This requires timeseries of use tables and deflators for E,M and S. So we need to construct a preliminary time series of SUTs which will NOT be put in the preliminary database, but only used for this breakdown. Below we outline two short cuts. The first is a short cut for generating current price series of SUT (section 4), and a short cut for deflation (see section 5). These short cuts can be taken and require only a benchmark SUT, and time series on gross output and intermediate inputs (nominal and volume) from the National Accounts. This is explained in the next section.

## 3. Steps for Preliminary database

### **STEP 1 National accounts series on gross output, value added, intermediate inputs in current prices and volume measures, 1970-200x**

The first step is the collection of National accounts series on gross output, value added, intermediate inputs in current prices and volume measures (or deflators) which are compatible with the 2005 revision. Possible problems which will be encountered are breaks in the industrial classification, lack of industry detail and the linking with historical series which have not been revised. Additional source data will be needed and short-cuts to be made. In the past we have done some extensive work on this (for value added and employment), trying to deal with these problems. You might want to take a look at the GGDC 60-industry database (<http://www.ggdc.net/dseries/60-industry.html>) which includes a detailed source description for each country. This source description outlines precisely what additional material we have used to breakdown aggregate industries, and how we have linked old and new series.

## **STEP 2 SUT tables in current prices**

The second step is to collect the data on supply and use tables, revision 2005 which is currently available.

- For most countries this will be available from 1995 onwards, but for some even earlier.
- Some industry detail to get EUK 72 might be needed, but as a first short cut, gross output shares from step 1 can be used (assuming the same input structure for the sub-industries). Product detail is of less importance.
- Make sure that they match with the NA series on output and intermediate inputs.
- For the moment (that is, for the preliminary database), a Supply table at basic prices with trade and tax/sub columns and a Use table at purchaser's prices will do. But if valuation matrices and a breakdown of import and domestic use are available, please deliver. The same for constant price tables.

## **STEP 3 Breakdown of Intermediate inputs into E,M and S (current price)**

For most countries there will not be current price SUTs for the whole period. Therefore, we need to make "quick" short-cuts for the preliminary database to breakdown total intermediate input into E, M and S. In section 4 we propose a short-cut which generates current price SUTs on the basis of national account series of gross output and total intermediate inputs. It is based on the assumption of a constant S matrix combined with a simple proportional correction method.

## **STEP 4 Breakdown of Intermediate inputs into E,M and S (volumes)**

Constant price SUTs will be even more scarce. Therefore, again, we need to have a short-cut for the preliminary database to breakdown volume growth of total II into EMS. It is based on the assumption of a constant S matrix and identical prices of products in all uses, see section 5.

## **4. Short cut for generating timeseries of SUTs (current price)**

Here is a short cut method for generating timeseries of S at basic and U at purchase prices based on the assumption of a constant S matrix combined with a simple proportional correction method. This method has been developed in cooperation with Pirkko and Mun. Suppose the oldest benchmark SUT is for 1995. We aim to estimate a set of SUTs for 1970-1994 based on this benchmark SUT and timeseries on output, II and imports from the national accounts. The notation used is the same as in my WP 1 note from June 23, 2005.

### **STEP 1. Basic data**

- from National Accounts we have for each industry  $j$ , for each  $t$  (say for 1970-1995):

$VY_{jt}$  nominal gross output value at basic price

$VII_{jt}$  total intermediate inputs at purchase price.

- imports by product  $i$  for 1970-1995

$VM_{it}$

This is data which might be collected in the national accounts, or in the trade statistics.

- the benchmark year 1995:

$VY_{ij,1995}$  Supply matrix (at basic price)

$VX_{ij,1995}$  Use matrix (at purchase price)

$TR_{i,1995}, TT_{i,1995}$  trade and transportation margin vectors

$TV_{i,1995}, T_{i,1995}$  VAT(non-deductible) and other taxes on products (net) vectors

### STEP 2. Generate S matrices at basic price for 1970-1994

- assume make matrix in share form to be constant over the whole period.

$$s_{ijt} = \frac{VY_{ij,1995}}{\sum_k VY_{kj,1995}} \quad i=1, \dots, m, \quad j=1, \dots, n, \quad \text{for each } t$$

Unless you have some extra knowledge or data which can be used to improve this estimate.

- multiply the make matrix shares with time series on industry output to get time series of Make matrix, and total domestic supply at basic prices:

$$VY_{ijt} = s_{ijt} VY_{jt} \quad i=1, \dots, m \quad j=1, \dots, n \quad t=1970, \dots, 1994$$

$$VS_{it}^D = \sum_j VY_{ijt} \quad i=1, \dots, m$$

- derive total supply by product at basic prices by adding imports at cif (before tariffs) to total domestic supply

$$VS_{it} = VS_{it}^D + VM_{it} \quad i=1, \dots, m$$

### STEP 3. Generate valuation columns and S column at purchase price 1970-1995

- Generate initial guess of timeseries of valuation columns of the supply table (vectors of taxes and margins by product) using tax, subsidy and margin rates from the 1995 table. The (1) denotes initial guess.

$$tr_{i1995} = \frac{TR_{i1995}}{VS_{i1995}}, \text{ and similarly for } \quad tt_{i1995}, tv_{i1995}, t_{i1995}$$

$$TR_{it}^{(1)} = tr_{i1995} VS_{it} \quad \text{and similarly for } TT^{(1)}, TV^{(1)} \text{ and } T^{(1)}.$$

- Normalize the trade and transport margins to make sure that the totals equal the estimated values of the shares of trade and transport margins in the total supply of the respective products

$$TR_{it} = \frac{TR_{it}^{(1)}}{\sum_k TR_{kt}^{(1)}} VS_{i=trade,t} \frac{\sum_i TR_{i1995}}{VS_{i=trade1995}} \quad \text{and similarly for transport } TT_{it}$$

- If one has time series on total net tax on products ( $T_t$ ) and non-deductible VAT ( $TV_t$ ) do the same normalisation procedure:

$$T_{it} = \frac{T_{it}^{(1)}}{\sum_k T_{kt}^{(1)}} T_t \quad \text{and similarly for } TV_{it}$$

- Take S column at basic price plus valuation columns generated above to get S column at purchase price:

$$VS_{it}^{pp} = VS_{it} + TR_{it} + TT_{it} + T_{it} + TV_{it} \quad \forall i, t$$

#### STEP 4. Generate II matrix at purchase price for 1970-1995

Next, we can do a simple proportional correction method to make sure that supply equals use for each product. This will give an estimate of the intermediate input matrix.<sup>1</sup>

- calculate for each product i and year t the growth in total supply:

$$r_{it} = \frac{VS_{it}^{pp}}{VS_{i1995}^{pp}}$$

- Make first estimate of intermediate input matrix by multiplying each row of II (1995) by this growth rate:

$$VX_{ijt}^{(1)} = r_{it} VX_{ij1995} \quad j=1, \dots, n \quad i=1, \dots, m$$

- The column totals of  $VX^{(1)}$  will not match total intermediate input from the National Accounts ( $VII_{jt}$  as listed in point 1 above), so they need to be normalised:

$$VX_{ijt}^{(1)} = VX_{ijt}^{(1)} \frac{VII_{jt}}{VII_{jt}^{(1)}} \quad \text{where } VII_{jt}^{(1)} = \sum_i VX_{ijt}^{(1)}$$

- The II matrix thus generated has the attractive property that it will be stable over time. I do not expect dramatic changes over time in the supply of products, so the R's will be small. And the II matrix will reflect general technology trends, e.g. when the supply of semiconductors increases, the use of semiconductors will go up in all sectors.<sup>2</sup>

#### STEP 5. Generate USE table at purchase price for 1970-1995

- As we now have II matrix at purchase price and total use at purchase price, final demand vector can be defined as the residual:

<sup>1</sup> Note that this is the first step in a RAS iteration procedure. But as we do not impose totals for intermediate use by product, the second and subsequent iterations will not be made.

<sup>2</sup> A potential danger is that the r's reflect changes in both II and final demand use. It might be that these ratios differ for II and FD. Kurt's presentation at the Groningen workshop provided some evidence on this. If this is a serious issue one should think about adjusting the R's somehow.

$$VFD_{it}^{pp} = VS_{it}^{pp} - \sum_j VX_{ijt}$$

Deriving final demand as a residual is counterintuitive in that sense, that normally we know much more about FD than about II. The FD series in the NA are in general more reliable than II. This is the price we need to pay if we want to stick to the NA's GO and II series, have a balanced S and U table and a stable II. The latter is important for the first phase of the EUKLEMS project. In subsequent work for the final database this short-cut needs to be replaced by more refined RAS procedures in which both II, FD and valuation matrices are taken into account.

## 5. Short cut for II-matrix (volume measure)

### STEP 1. Basic data

- from National Accounts we have for each industry j, for each t (say for 1970-1995):

- $VY_{jt}$  nominal gross output value at basic price in industry j
- $VII_{jt}$  nominal total intermediate inputs at purchase price in industry j
- $Y_{jt}$  real gross output value at basic price in industry j
- $II_{jt}$  real total intermediate inputs at purchase price in industry j
- $VX_{ijt}$  intermediate input i by industry j (from previous section)

### STEP 2. Derive deflator by product

- Define gross output price index of industry j as follows

$$PY_{jt} = \frac{VY_{jt}}{Y_{jt}}$$

- Assume that the price index of all products produced by industry j are equal to the gross output price index of industry j.

$$PY_{ijt} = PY_{jt} \quad \forall i \text{ in } j$$

- Multiply the industry output price vector with the domestic supply matrix to get price series by product

$$PY_{it} = \sum_j \frac{VY_{ijt}}{\sum_j VY_{ijt}} PY_{ijt} \quad \forall i$$

- Note that we have ignored the prices of imports. We assume that the prices of imports move in parallel with domestic prices. In case you have independent prices of imports by product you can use them as well.

### STEP 3. Derive volume indices of intermediate use by product and industry

- Assume that we can use the same product price index to deflate all uses of the product.

$$PX_{ijt} = PY_{it} \quad \forall j$$

- Then we can deflate intermediate use of i to get a first estimate of the volume growth rates of intermediate use of i for each industry j.

$$X_{ijt}^{(1)} = VX_{ijt} - PX_{ijt}$$

- These need to be normalised to match the total intermediate input volume index from the National Accounts

$$X_{ijt} = X_{ijt}^{(1)} \frac{I_{jt}}{\sum_i X_{ijt}^{(1)}}$$