



# **THE EU KLEMS PRODUCTIVITY REPORT**

**An Overview of Results from the EU KLEMS Growth and Productivity  
Accounts for the European Union, EU Member States and Major Other  
Countries in the World**

**Edited by Bart van Ark\*, Mary O'Mahony\*\* and Gerard Ypma\***

**\* Groningen Growth and Development Centre, University of Groningen**

**\*\* University of Birmingham**

**with contributions of individual consortium members**

**Issue no. 1**

**March 2007**

*This project is funded by the European Commission, Research Directorate General as part of the 6th Framework Programme, Priority 8, "Policy Support and Anticipating Scientific and Technological Needs".*













































































































































## EU KLEMS GROWTH AND PRODUCTIVITY ACCOUNTS: A QUICK OVERVIEW

The EU KLEMS database is part of a research project, financed by the European Commission, to analyse productivity in the European Union at the industry level. This work is meant to support empirical and theoretical research in the area of economic growth, studying the relationship between skill formation, technological progress and innovation on the one hand, and productivity, on the other. In addition the database is meant to support the conduct of policies aimed at supporting a revival of productivity and competitiveness in the European Union, requiring comprehensive measurement tools to monitor and evaluate progress. The construction of the database should also support the systematic production of high quality statistics on growth and productivity using the methodologies of national accounts and input-output analysis.

The EU KLEMS growth accounts include measures of economic growth, productivity, employment creation, capital formation and technological change at the industry level for European Union member states from 1970 onwards. The input measures include various categories of capital (K), labour (L), energy (E), material (M) and service inputs (S). A major advantage of growth accounts is that it is embedded in a clear analytical framework rooted in production functions and the theory of economic growth. It provides a conceptual framework within which the interaction between variables can be analysed, which is of fundamental importance for policy evaluation. The measures will be developed for individual European Union member states, and are linked with “sister”-KLEMS databases in the U.S. and Japan. In a later stage, more countries will be added.

### *Distinguishing features of the EU KLEMS database*

A key objective of the EU KLEMS database is to move beneath the aggregate economy level and examine the productivity performance of individual industries and their contribution to aggregate growth. Previous studies have shown that there is enormous heterogeneity in output and productivity growth across industries, so analysts should focus on the industry-level detail to understand the origins of the European growth process. The database has been constructed on the basis of data delivered by the consortium partners with cooperation of national statistical offices, and processed according to agreed procedures which have been discussed within the consortium over the past 18 months. These procedures were developed to ensure harmonisation of the basic data, and to generate growth accounts in a consistent and uniform way. Importantly, this database is deeply rooted in statistics from the National Accounts, following the ESA95 where appropriate.

Harmonisation of the basic data has focused on a number of areas:

- *Industrial classifications*: although harmonisation was relatively easy to realise for the recent period for which NACE1 has been in use (with the exception of the US and Japan), older statistics were often in NACE70 or country specific classifications. Additional data had to be found to provide links across diverse classification systems.
- *Aggregation levels*: the level of industry detail in the national accounts statistics varied widely across countries, variables and periods. The EU KLEMS consortium has generated a system which allows the comparisons of statistics at various levels of aggregation by using a common industry hierarchy for all countries.
- *Reference year for volume measures*: countries differ in the reporting of volume measures, e.g. previous year prices vis-à-vis different base years. All series have been put on a 1995 reference year.
- *Price concepts*: the price concept for gross output (basic prices) and intermediate inputs (purchasers' prices) have been harmonised across countries.
- *Solving breaks*: various series had to be linked in order to bridge different vintages of the national accounts. This has been done according to standardised methodologies.
- *Labour input*: various concepts of labour input (employees, self-employed, hours worked) and harmonised measures of persons engaged and hours worked have been developed.

- *Labour services input*: labour service input has been measured in a standardised way by distinguishing a variety of labour types in terms of gender, age and educational attainment. For these series additional material has been collected, as they are not part of the system of national accounts.
- *Asset classification*: although the SNA provides a classification of capital assets, it was not always detailed enough to back out information and communication equipment from the investment series. Additional information has been collected to obtain investment series for these assets. In addition, the level of asset detail has been put on a comparable basis.
- *Capital services input*: capital service input has been measured in a standard way, using harmonised depreciation rates and common rules to deal with a variety of practical problems, such as weighting and rental rates. Importantly, capital input is measured as capital services, rather than stocks.
- *Multifactor productivity measures*: MFP has been generated on both a gross output and value added basis according to a standard methodology developed by Jorgenson, Gollop and Fraumeni (1987).
- *Intermediate input measures*: Series on intermediate inputs are broken down into energy, materials and services using a standardised classification.

#### *Coverage of countries and variables*

Table 1 provides an overview of all the series included in the EU KLEMS database. The variables covered can be split into three main groups: Basic variables, growth accounting variables and additional variables. The basic series contain all the data needed to construct single productivity measures such as output per hour worked. They include nominal, volume and price series of output and intermediate inputs, and volumes and prices of employment. All these series are part of the present European System of National Accounts (ESA 1995) and can be found in the National Accounts of all individual countries, at least for the most recent period. The main assumptions used to construct these series were those required to fill up gaps in industry detail and to link series over time, in particular in those cases where revisions were not taken back to 1970 by the national statistical institutes (NSIs). The variables in the growth accounting series are of an analytical nature and cannot be derived from published National Accounts data without additional assumptions. These include series of capital services, of labour services, and of total factor productivity which are the heart and main aim of the EU KLEMS project. The construction of these series is based on a theoretical model of production, requiring a number of assumptions standard in the literature. Finally, additional series are given which have been used in generating the growth accounts and are informative by themselves. They include various measures of the relative importance of IT- and non-IT capital, and of the various labour types within the EU KLEMS classification.

Table 2 provides a list of countries covered in this preliminary database. It also indicates the period for which data are available. In general, data for 1970-2004 are available for the old EU-15 countries, and series from 1995 onwards are available for the new EU member states (EU-10). But due to data limitations this differs across countries, industries and variables.

At the lowest level of aggregation, data were collected for 71 industries, the so-called Euk industries. The industries are classified according to the European NACE revision 1 classification. Table 3 provides a listing of the industries, including higher aggregates. The level of detail in the EU KLEMS database varies across countries, industries and variables due to data limitations. In order to ensure a minimal level of industry detail for which comparisons can be made across all countries, so-called minimum lists of industries have been used. All national datasets have been constructed in such a way that these minimums are met. The minimum list is different for particular groups of variables and time-periods. Three groups of variables can be distinguished: variables needed to undertake labour productivity growth and unit labour cost analysis (for the period from 1995 onwards, and the period before 1995), and additional variables needed to undertake growth accounting (gross output, intermediate input, labour composition and capital). The industries included in each of these three groups are indicated in Table 2.3. They include respectively 62, 48 and 31 industries. The industry detail for each country conforms at least to the minimum list of industries, but often more detail is available

For analytical convenience, the EU KLEMS database also provides files with an alternative aggregation scheme. It includes useful aggregates such as market economy, market services and goods production. This aggregation scheme is given in Table 4.

More information on the methodology used in EU KLEMS can be found in the document *EU KLEMS Growth and Productivity Accounts, Version 1.0, PART I Methodology*. Detailed source descriptions are given in *PART II Sources*

On the EU KLEMS website, the database has been presented in separate Excel files for each country. Two files are available for all countries. The basic files contain all data and variables according to the EU KLEMS industry list, which corresponds with the NACE rev. 1 classification. The additional files contain the same series, but aggregated according to the alternative aggregation scheme. EU-aggregates are presented in exactly the same way. Next to the Excel files we have also constructed comma separated text files for those who want to read the database in to statistical programs.

Marcel Timmer, Ton van Moergastel, Edwin Stuivenwold and Gerard Ypma  
Groningen Growth and Development Centre

For more information and updates, see: [www.euklems.net](http://www.euklems.net)

**Contact persons: Marcel Timmer and Gerard Ypma, Groningen Growth and Development Centre, University of Groningen, [euklems@eco.rug.nl](mailto:euklems@eco.rug.nl)**

**Table 1 Variables in the EU KLEMS database****Basic variables****Values**

GO	Gross output at current basic prices (in millions of local currency)
II	Intermediate inputs at current purchasers' prices (in millions of local currency)
IIE	Intermediate energy inputs at current purchasers' prices (in millions of local currency)
IIM	Intermediate material inputs at current purchasers' prices (in millions of local currency)
IIS	Intermediate service inputs at current purchasers' prices (in millions of local currency)
VA	Gross value added at current basic prices (in millions of local currency)
COMP	Compensation of employees (in millions of local currency)
GOSTXSP	Gross operating surplus and Taxes minus subsidies on production (in millions of local currency)
GOS	Gross operating surplus (in millions of local currency)
TXSP	Taxes minus subsidies on production (in millions of local currency)
EMP	Number of persons engaged (thousands)
EMPE	Number of employees (thousands)
H_EMP	Total hours worked by persons engaged (millions)
H_EMPE	Total hours worked by employees (millions)

**Prices**

GO_P	Gross output, price indices, 1995 = 100
II_P	Intermediate inputs, price indices, 1995 = 100
VA_P	Gross value added, price indices, 1995 = 100

**Volumes**

GO_QI	Gross output, volume indices, 1995 = 100
II_QI	Intermediate inputs, volume indices, 1995 = 100
IIE_QI	Intermediate energy inputs, volume indices, 1995 = 100
IIM_QI	Intermediate material inputs, volume indices, 1995 = 100
IIS_QI	Intermediate service inputs, volume indices, 1995 = 100
VA_QI	Gross value added, volume indices, 1995 = 100
LP_I	Gross value added per hour worked, volume indices, 1995=100

**Growth accounting**

LAB	Labour compensation (in millions of international Euros)
CAP	Capital compensation (in millions of international Euros)
LAB_QI	Labour services, volume indices, 1995 = 100
CAP_QI	Capital services, volume indices, 1995 = 100
VA_Q	Growth rate of value added volume (% per year)
VAConL	Contribution of labour services to value added growth (percentage points)
VAConH	Contribution of hours worked to value added growth (percentage points)
VAConLC	Contribution of labour composition change to value added growth (percentage points)
VAConKIT	Contribution of ICT capital services to output growth (percentage points)
VAConKNIT	Contribution of non-ICT capital services to output growth (percentage points)
VAConTFP	Contribution of TFP to value added growth (percentage points)
TFPva_I	TFP (value added based) growth, 1995=100
GO_Q	Growth rate of gross output volume (% per year)
GOConII	Contribution of intermediate inputs to output growth (percentage points)
GOConIIM	Contribution of intermediate energy inputs to output growth (percentage points)
GOConIIE	Contribution of intermediate material inputs to output growth (percentage points)
GOConIIS	Contribution of intermediate services inputs to output growth (percentage points)
GOConL	Contribution of labour services to output growth (percentage points)
GOConK	Contribution of capital services to output growth (percentage points)
GOConTFP	Contribution of TFP to output growth (percentage points)
TFPgo_I	TFP (gross output based) growth, 1995=100

**Additional variables**

CAPIT	ICT capital compensation (share in total capital compensation)
CAPNIT	Non-ICT capital compensation (share in total capital compensation)
CAPIT_QI	ICT capital services, volume indices, 1995 = 100
CAPNIT_QI	Non-ICT capital services, volume indices, 1995 = 100
CAPIT_QPH	ICT capital services per hour worked, 1995 reference
CAPNIT_QPH	Non-ICT capital services per hour worked, 1995 reference
LABHS	High-skilled labour compensation (share in total labour compensation)
LABMS	Medium-skilled labour compensation (share in total labour compensation)
LABLS	Low-skilled labour compensation (share in total labour compensation)
LAB_QPH	Labour services per hour worked, 1995 reference
H_HS	Hours worked by high-skilled persons engaged (share in total hours)
H_MS	Hours worked by medium-skilled persons engaged (share in total hours)
H_LS	Hours worked by low-skilled persons engaged (share in total hours)
H_M	Hours worked by male persons engaged (share in total hours)
H_F	Hours worked by female persons engaged (share in total hours)
H_29	Hours worked by persons engaged aged 15-29 (share in total hours)
H_49	Hours worked by persons engaged aged 30-49 (share in total hours)
H_50+	Hours worked by persons engaged aged 50 and over (share in total hours)

<b>Table 2 Countries covered</b>		
<b>Country code</b>	<b>Countries</b>	<b>Period</b>
<i>AUT</i>	Austria	1970-2004
<i>BEL</i>	Belgium	1970-2004
<i>CYP</i>	Cyprus	1995-2004
<i>CZE</i>	Czech Republic	1995-2004
<i>DEW</i>	West Germany	1970-1991
<i>DNK</i>	Denmark	1970-2004
<i>ESP</i>	Spain	1970-2004
<i>EST</i>	Estonia	1995-2004
<i>FIN</i>	Finland	1970-2004
<i>FRA</i>	France	1970-2004
<i>GER</i>	Germany	1970-2004
<i>GRC</i>	Greece	1970-2004
<i>HUN</i>	Hungary	1995-2004
<i>IRL</i>	Ireland	1970-2004
<i>ITA</i>	Italy	1970-2004
<i>JPN</i>	Japan	1970-2004
<i>LVA</i>	Latvia	1995-2004
<i>LTU</i>	Lithuania	1995-2004
<i>LUX</i>	Luxembourg	1970-2004
<i>MLT</i>	Malta	1995-2004
<i>NLD</i>	Netherlands	1970-2004
<i>PRT</i>	Portugal	1970-2004
<i>POL</i>	Poland	1995-2004
<i>SVK</i>	Slovakia	1995-2004
<i>SVN</i>	Slovenia	1995-2004
<i>SWE</i>	Sweden	1970-2004
<i>UK</i>	United Kingdom	1970-2004
<i>US2</i>	United States (NAICS based)	1977-2004
<i>USA</i>	United States (SIC based)	1970-2004

**Table 3 Industries in EU KLEMS database and minimum requirements**

	GA	LP70-95	LP 95-04
<b>TOT TOTAL ECONOMY</b>	X	X	X
<b>AIB AGRICULTURE, HUNTING, FORESTRY AND FISHING</b>	X	X	X
<b>A ...AGRICULTURE, HUNTING AND FORESTRY</b>		X	X
1 .....Agriculture		X	X
2 .....Forestry		X	X
<b>B ...FISHING</b>		X	X
<b>C MINING AND QUARRYING</b>	X	X	X
<b>10t12 ...MINING AND QUARRYING OF ENERGY PRODUCING MATERIALS</b>		X	X
10 .....Mining of coal and lignite; extraction of peat			
11 .....Extraction of crude petroleum and natural gas and services			
12 .....Mining of uranium and thorium ores			
<b>13t14 ...MINING AND QUARRYING EXCEPT ENERGY PRODUCING MATERIALS</b>		X	X
13 .....Mining of metal ores			
14 .....Other mining and quarrying			
<b>D TOTAL MANUFACTURING</b>	X	X	X
<b>15t16 ...FOOD PRODUCTS, BEVERAGES AND TOBACCO</b>	X	X	X
15 .....Food products and beverages			X
16 .....Tobacco products			X
<b>17t19 ...TEXTILES, TEXTILE PRODUCTS, LEATHER AND FOOTWEAR</b>	X	X	X
17t18 .....Textiles and textile products		X	X
17 .....Textiles			X
18 .....Wearing Apparel, Dressing And Dying Of Fur			X
19 .....Leather, leather products and footwear		X	X
<b>20 ...WOOD AND PRODUCTS OF WOOD AND CORK</b>	X	X	X
<b>21t22 ...PULP, PAPER, PAPER PRODUCTS, PRINTING AND PUBLISHING</b>	X	X	X
21 .....Pulp, paper and paper products		X	X
22 .....Printing, publishing and reproduction		X	X
221 .....Publishing			X
22x .....Printing and reproduction			X
<b>23t25 ...CHEMICAL, RUBBER, PLASTICS AND FUEL PRODUCTS</b>	X	X	X
23 .....Coke, refined petroleum products and nuclear fuel	X	X	X
24 .....Chemicals and chemical products	X	X	X
244 .....Pharmaceuticals			X
24x .....Chemicals excluding pharmaceuticals			X
25 .....Rubber and plastics products	X	X	X
<b>26 ...OTHER NON-METALLIC MINERAL PRODUCTS</b>	X	X	X
<b>27t28 ...BASIC METALS AND FABRICATED METAL PRODUCTS</b>	X	X	X
27 .....Basic metals		X	X
28 .....Fabricated metal products		X	X
<b>29 ...MACHINERY, NEC</b>	X	X	X
<b>30t33 ...ELECTRICAL AND OPTICAL EQUIPMENT</b>	X	X	X
30 .....Office, accounting and computing machinery		X	X
31t32 .....Electrical engineering		X	X
31 .....Electrical machinery and apparatus, nec		X	X
313 .....Insulated wire			X
31x .....Other electrical machinery and apparatus nec			X
32 .....Radio, television and communication equipment		X	X
321 .....Electronic valves and tubes			X
322 .....Telecommunication equipment			X
323 .....Radio and television receivers			X
33 .....Medical, precision and optical instruments		X	X
331t3 .....Scientific instruments			X
334t5 .....Other instruments			X
<b>34t35 ...TRANSPORT EQUIPMENT</b>	X	X	X
34 .....Motor vehicles, trailers and semi-trailers		X	X
35 .....Other transport equipment		X	X
351 .....Building and repairing of ships and boats			
353 .....Aircraft and spacecraft			
35x .....Railroad equipment and transport equipment nec			
<b>36t37 ...MANUFACTURING NEC; RECYCLING</b>	X	X	X
36 .....Manufacturing nec			
37 .....Recycling			

<b>Table 3 Industries (continued)</b>			
<b>E ELECTRICITY, GAS AND WATER SUPPLY</b>	<b>X</b>	<b>X</b>	<b>X</b>
<b>40 ...ELECTRICITY AND GAS</b>			
40x .....Electricity supply			
402 .....Gas supply			
<b>41 ...WATER SUPPLY</b>			
<b>F CONSTRUCTION</b>	<b>X</b>	<b>X</b>	<b>X</b>
<b>G WHOLESALE AND RETAIL TRADE</b>	<b>X</b>	<b>X</b>	<b>X</b>
50 .....Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of fuel	X	X	X
51 .....Wholesale trade and commission trade, except of motor vehicles and motorcycles	X	X	X
52 .....Retail trade, except of motor vehicles and motorcycles; repair of household goods	X	X	X
<b>H HOTELS AND RESTAURANTS</b>	<b>X</b>	<b>X</b>	<b>X</b>
<b>I TRANSPORT AND STORAGE AND COMMUNICATION</b>	<b>X</b>	<b>X</b>	<b>X</b>
<b>60t63 ...TRANSPORT AND STORAGE</b>	<b>X</b>	<b>X</b>	<b>X</b>
60 .....Inland transport		X	X
61 .....Water transport		X	X
62 .....Air transport		X	X
63 .....Supporting and auxiliary transport activities; activities of travel agencies		X	X
<b>64 ...POST AND TELECOMMUNICATIONS</b>	<b>X</b>	<b>X</b>	<b>X</b>
<b>JtK FINANCE, INSURANCE, REAL ESTATE AND BUSINESS SERVICES</b>	<b>X</b>	<b>X</b>	<b>X</b>
<b>J ...FINANCIAL INTERMEDIATION</b>	<b>X</b>	<b>X</b>	<b>X</b>
65 .....Financial intermediation, except insurance and pension funding			X
66 .....Insurance and pension funding, except compulsory social security			X
67 .....Activities related to financial intermediation			X
<b>K ...REAL ESTATE, RENTING AND BUSINESS ACTIVITIES</b>	<b>X</b>	<b>X</b>	<b>X</b>
70 .....Real estate activities	X	X	X
71t74 .....Renting of m&eq and other business activities	X	X	X
71 .....Renting of machinery and equipment		X	X
72 .....Computer and related activities		X	X
73 .....Research and development		X	X
74 .....Other business activities		X	X
741t4 .....Legal, technical and advertising			X
745t8 .....Other business activities, nec			X
<b>LtQ COMMUNITY SOCIAL AND PERSONAL SERVICES</b>	<b>X</b>	<b>X</b>	<b>X</b>
<b>L ...PUBLIC ADMIN AND DEFENCE; COMPULSORY SOCIAL SECURITY</b>	<b>X</b>	<b>X</b>	<b>X</b>
<b>M ...EDUCATION</b>	<b>X</b>	<b>X</b>	<b>X</b>
<b>N ...HEALTH AND SOCIAL WORK</b>	<b>X</b>	<b>X</b>	<b>X</b>
<b>O ...OTHER COMMUNITY, SOCIAL AND PERSONAL SERVICES</b>	<b>X</b>	<b>X</b>	<b>X</b>
90 .....Sewage and refuse disposal, sanitation and similar activities			X
91 .....Activities of membership organizations nec			X
92 .....Recreational, cultural and sporting activities			X
921t2 .....Media activities			
923t7 .....Other recreational activities			
93 .....Other service activities			X
<b>P ...PRIVATE HOUSEHOLDS WITH EMPLOYED PERSONS</b>	<b>X</b>	<b>X</b>	<b>X</b>
<b>Q ...EXTRA-TERRITORIAL ORGANIZATIONS AND BODIES</b>			

Notes: GA: Growth accounting (1970-2004)

LP70-95: Labour Productivity and Unit Labour Costs (1970-1995)

LP95-04: Labour Productivity and Unit Labour Costs (1995-2004)

**Table 4 Alternative aggregation scheme**

<b>TOT TOTAL INDUSTRIES</b>	
<b>MARKT</b>	<b>MARKET ECONOMY</b>
<b>ELECOM</b>	<b>ELECTRICAL MACHINERY, POST AND COMMUNICATION SERVICES</b>
30t33	Electrical and optical equipment
64	Post and telecommunications
<b>GOODS</b>	<b>GOODS PRODUCING, EXCLUDING ELECTRICAL MACHINERY</b>
<b>MexElec</b>	<b>TOTAL MANUFACTURING, EXCLUDING ELECTRICAL</b>
Mcons	Consumer manufacturing
15t16	<i>Food products, beverages and tobacco</i>
17t19	<i>Textiles, textile products, leather and footwear</i>
36t37	<i>Manufacturing nec; recycling</i>
Minter	Intermediate manufacturing
20	<i>Wood and products of wood and cork</i>
21t22	<i>Pulp, paper, paper products, printing and publishing</i>
23	<i>Coke, refined petroleum products and nuclear fuel</i>
24	<i>Chemicals and chemical products</i>
25	<i>Rubber and plastics products</i>
26	<i>Other non-metallic mineral products</i>
27t28	<i>Basic metals and fabricated metal products</i>
Minves	Investment goods, excluding hightech
29	<i>Machinery, nec</i>
34t35	<i>Transport equipment</i>
<b>OtherG</b>	<b>OTHER PRODUCTION</b>
C	Mining and quarrying
E	Electricity, gas and water supply
F	Construction
AtB	Agriculture, hunting, forestry and fishing
<b>MSERV</b>	<b>MARKET SERVICES, EXCLUDING POST AND TELECOMMUNICATIONS</b>
<b>DISTR</b>	<b>DISTRIBUTION</b>
50t52	Trade
50	<i>Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of fuel</i>
51	<i>Wholesale trade and commission trade, except of motor vehicles and motorcycles</i>
52	<i>Retail trade, except of motor vehicles and motorcycles; repair of household goods</i>
60t63	Transport and storage
<b>FINBU</b>	<b>FINANCE AND BUSINESS, EXCEPT REAL ESTATE</b>
J	Financial intermediation
71t74	Renting of m&eq and other business activities
<b>PERS</b>	<b>PERSONAL SERVICES</b>
H	Hotels and restaurants
O	Other community, social and personal services
P	Private households with employed persons
<b>NONMAR</b>	<b>NON-MARKET SERVICES</b>
LtN	Public admin, education and health
L	<i>Public admin and defence; compulsory social security</i>
M	<i>Education</i>
N	<i>Health and social work</i>
70	Real estate activities