EU KLEMS Growth and Productivity Accounts: Overview November 2007 Release

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1. Introduction

The EU KLEMS Growth and Productivity Accounts is the result of a research project, financed by the European Commission, to analyse productivity in the European Union at the industry level. This database is meant to support empirical and theoretical research in the area of economic growth, such as study of the relationship between skill formation, investment, technological progress and innovation on the one hand, and productivity, on the other. In addition, the database may facilitate the conduct of policies aimed at supporting a revival of productivity and competitiveness in the European Union. These policies require 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 and Productivity Accounts include measures of output growth, employment and skill creation, capital formation and multi-factor productivity (MFP) 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 are developed for individual European Union member states, and are linked with "sister"-KLEMS databases in the U.S. and Japan.

A key strength of the EU KLEMS database is that it moves beneath the aggregate economy level to 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.
In this overview paper we first provide a discussion of the key characteristics of the database and the variables, country and industry coverage (**Section 2**). We then briefly introduce the growth accounting

methodology, including the measurement of labour and capital services (**Section 3**). In **Section 4** we provide a brief analysis of some of the major trends observed from the November 2007 release of the database.

This brief overview paper will in due time be followed by more extensive reviews and research papers, which will also be available from the EU KLEMS website (http://www.euklems.net). The data series are also publicly available from that website. 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*, which are also downloadable from the EU KLEMS website.

2. The EU KLEMS database

2.1 Distinguishing characteristics

The methodology to derive multi-factor productivity (MFP) growth rates has been firmly established since the path-breaking work of Jorgenson, Gollop and Fraumeni (1987), but in practice it has been rarely applied comprehensively, particularly in Europe. The OECD and the Groningen Growth and Development Centre maintain MFP series for aggregate OECD economies, but not at the industry level with the exception of a single study by Inklaar *et al.* (2005) including four European countries (France, Germany, the Netherlands and the United Kingdom).[1] The main bottleneck has been the lack of available statistics on the composition of labour and capital at the industry level for a sufficient number of European countries. As a result, many studies resorted to cruder measures of output, inputs and MFP, mostly based on the OECD Structural Analysis database, STAN and its predecessor the International Sectoral Database - ISDB. These databases provide industry-level series on output, aggregate hours worked and aggregate capital stock for a limited group of countries and years, while ignoring changes in the composition of factor inputs. However, MFP measures based on these aggregate concepts can be seriously biased. Labour input measures in EU KLEMS take account of changes in the composition of the labour force. Capital input measures include the effects of the rapid shift in investment towards Information and Communications Technology (ICT) goods in recent years. Finally, MFP measures are not only derived on a value added basis, but also on a gross-output basis by taking into account changes in the use of intermediate inputs, such as the increasing use of business services through outsourcing.

The EU KLEMS database has been largely constructed on the basis of data from national statistical institutes (NSI's) and were processed by the research consortium according to agreed procedures which have been established over the past two years. 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 rooted in statistics from the National Accounts and follows the ESA95 framework in many respects. Cross-country harmonisation of the basic country data has focused on a number of areas including a common industrial classification and the use of similar price concepts for

[1] For OECD series, see www.oecd.org/dataoecd/27/39/36396940.xls. For GGDC series, see www.ggdc.nl/dseries/growth-accounting.shtml, described in Timmer and van Ark (2005).

inputs and outputs. Various series were linked in order to bridge different vintages of the national accounts according to a common methodology. Labour service input has been measured in a standardised way by distinguishing labour types in terms of gender, age and educational attainment. For these series additional material has been collected from employment and labour force statistics, to the extent that these were not part of the system of national accounts. Capital service input has been measured 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. Although the SNA provides a classification of capital assets, it was not always detailed enough to back out ICT 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. Series on intermediate inputs are broken down into energy, materials and services using a standardised product classification. The EU KLEMS database provides data on a detailed industry level, but also provides higher level aggregates, such as total economy, market economy, market services and goods production for all variables.

2.2 Coverage of countries and variables

The intermediate release of the EU KLEMS database covers 25 EU countries (EU-25)[2], as well as the United States. In general, data for 1970-2005 are available for the "old" EU-15 countries[3] and for the US. Series from 1995 onwards are available for the new EU member states which joined the EU on 1 May 2004 (EU-10). Due to data limitations, the coverage differs across countries, industries and variables. Appendix 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: (1) basic variables; (2) growth accounting variables and (3) additional variables. The basic series contain all the data needed to construct single productivity measures, such as labour productivity (output per hour worked). These series include nominal, volume and price series of output and intermediate inputs, and volumes and prices of employment. Most 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 adjustments to these series were related to filling gaps in industry detail (using industry statistics) and to link series over time, in particular in those cases where revisions were not taken back to 1970 by the NSIs. The variables in the growth accounting series are of an analytical nature and cannot be directly derived from published National Accounts data without additional assumptions. These include series of capital services, of labour services, and of multi factor productivity which are the heart and main aim of the EU KLEMS project. The construction of these series was based on a theoretical model of production, requiring additional assumptions which are spelled out in some more detail in Section 3. Finally, additional series are given which have been used in generating the growth accounts and are informative by themselves. These include, for example, various measures of the relative importance of ICT-capital and non-ICT capital, and of the various labour types within the EU KLEMS classification.

At the lowest level of aggregation, data were collected for 71 industries. The industries are classified according to the European NACE revision 1 classification. But again the level of detail varies across countries, industries and variables due to data limitations. In order to ensure a minimal level of

[2] All member states of the EU as of 1 May 2004.
[3] All member states of the EU as of 1 January 1995

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 minimum lists are met. The minimum lists are different for particular groups of variables and time-periods. Two groups of variables can be distinguished: variables needed for the computation of labour productivity growth and unit labour cost analysis a set of additional variables required to execute growth accounting (including gross output, intermediate inputs, labour composition and capital). The number of industries covered include 62 (for labour productivity post-1995), 48 (for labour productivity pre-1995) and 31 industries (for growth accounts). The industry detail for each country conforms at least to the minimum list of industries, but often more detail is available. Appendix Table 2 provides a listing of industries for which growth accounting variables are available. This list also includes higher level aggregates provided in the EU KLEMS database. Finally, data is provided for four institutional country groupings: EU-25, EU-15, EU-10 and Euro zone. To aggregate across countries use is made of industry-specific Purchasing Power Parities (PPPs).

3. Growth accounting methodology

The EU KLEMS growth accounts are based on the growth accounting methodology as theoretically motivated by the seminal contribution of Jorgenson and Griliches (1967) and put in a more general input-output framework by Jorgenson, Gollop and Fraumeni (1987) and Jorgenson, Ho and Stiroh (2005). Growth accounting allows one to assess the relative importance of labour, capital and intermediate inputs to growth, and to derive measures of multi-factor productivity (MFP) growth. MFP indicates the efficiency with which inputs are being used in the production process and is an important indicator of technological change.[4] Under the assumptions of competitive factor markets, full input utilization and constant returns to scale, the growth of output in industry j can be expressed as the (compensation share) weighted growth of inputs and multifactor productivity (denoted by A^Y):

$$\Delta \ln Y_{jt} = \bar{v}_{jt}^{X} \Delta \ln X_{jt} + \bar{v}_{jt}^{K} \Delta \ln K_{jt} + \bar{v}_{jt}^{L} \Delta \ln L_{jt} + \Delta \ln A_{jt}^{Y} \tag{1}$$

where $\bar{v}^i$ denotes the two-period average share of input *i* in nominal output and $\bar{v}^L + \bar{v}^K + \bar{v}^X = 1$. Each element on the right-hand side indicates the proportion of output growth accounted for by growth in intermediate inputs, capital services, labour services and MFP, respectively. Accurate measures of labour and capital input are based on a breakdown of aggregate hours worked and aggregate capital stock into various components. Hours worked are cross-classified by various categories to account for differences in the productivity of various labour types, such as high- versus low-skilled labour. Similarly, capital stock measures are broken down into stocks of different asset types. Short-lived assets like computers have a much higher productivity than long-lived assets like buildings, and this should be reflected in the capital input measures. The contribution of intermediate inputs is broken down into the contribution of energy goods, intermediate materials and services.

[4] Under strict neo-classical assumptions, MFP growth measures disembodied technological change. In practice, MFP is derived as a residual and includes a host of effects such as improvements in allocative and technical efficiency, changes in returns to scale and mark-ups and technological change proper. All these effects can be broadly summarised as "improvements in efficiency", as they improve the productivity with which inputs are being used in the production process. In addition, being a residual measure MFP growth also includes measurement errors and the effects from unmeasured output and inputs.

3.1 Measurement of capital services

The availability of investment series by asset type and by industry is one of the unique characteristics of the EU KLEMS database. They are based on series obtained from national statistical institutes, allowing for a detailed industry-by-asset analysis. Importantly, we make a distinction between three ICT assets (office and computing equipment, communication equipment and software) and four non-ICT assets (transport equipment, other machinery and equipment, residential buildings and non-residential structures). ICT assets are deflated using a quality-adjusted investment deflator, except for those countries which have not yet implemented adequate quality adjustment where we used the harmonisation procedure suggested by Schreyer (2002). The real investment series are used to derive capital stocks through the accumulation of investment into stock estimates using the Perpetual Inventory Method (PIM) and the application of geometric depreciation rates. Then capital service flows are derived by weighting the growth of stocks by the share of each asset's compensation in total capital compensation as follows:

$$\Delta \ln K_t = \sum_k \bar{v}_{k,t} \Delta \ln S_{k,t} \qquad (2)$$

where $\Delta \ln S_{k,t}$ indicates the growth of the stock of asset *k* and weights are given by the average shares of each asset in the value of total capital compensation. In this way, aggregation takes into account the widely different marginal products from the heterogeneous stock of assets. The weights are related to the user cost of each asset.

The user cost approach is crucial for the analysis of the contribution of capital to output growth. This approach is based on the assumption that marginal costs reflect marginal productivity. If the costs of leasing one Euro of, say, computer assets is higher than leasing of one Euro of buildings, computers have a higher marginal productivity, and this should taken into account. There are various reasons why the costs of computers is higher than for buildings. While computers may typically be scrapped after five or six years, buildings may provide services for several decades. Besides, prices of new computers are rapidly declining and those of buildings are normally not. Hence the user cost of IT-machinery is typically 50 to 60 percent of the investment price, while that of buildings is less than 10 percent. Therefore one Euro of computer capital stock should get a heavier weight in the growth of capital services than one Euro of building stock. This is ensured by using the rental price of capital services as weights

3.2 Measurement of labour services

The productivity of various types of labour input, such as low- versus high-skilled, will also differ. Standard measures of labour input, such as numbers employed or hours worked, will not account for such differences. Hence one needs measures of labour input which take the heterogeneity of the labour force into account in analysing productivity and the contribution of labour to output growth. These measures are called labour services, as they allow for differences in the amount of services delivered per unit of labour in the growth accounting approach. It is assumed that the flow of labour services for each labour type is proportional to hours worked, and workers are paid their marginal productivities. Then the corresponding index of labour services input L is given by:

$$\Delta \ln L_t = \sum_l \bar{v}_{l,t} \Delta \ln H_{l,t} \qquad (3)$$

where $\Delta \ln H_{l,t}$ indicates the growth of hours worked by labour type *l* and weights are given by the average shares of each type in the value of labour compensation. In this way, aggregation takes into account the changing composition of the labour force. We cross-classify labour input by educational attainment, gender and age with the aim to proxy for differences in work experience, which provides 18 labour categories (3*2*3 types). Typically, a shift in the share of hours worked by low-skilled workers to high-skilled workers will lead to a growth of labour services which is larger than the growth in total hours worked. We refer to this difference as the labour composition effect.

Series on hours worked by labour types are not part of the standard statistics reported by NSIs, not even at the aggregate economy level. Also, there is no single international database on skills which can be used for this purpose. For each country covered in EU KLEMS, a choice has been made to use survey data which provide the best sources for consistent wage and employment data at the industry level. In most cases this was a labour force survey (LFS), sometimes together with an earnings survey when wages were not included in the LFS. In other cases, use has been made of establishment surveys or a social-security database, or a mix of sources. Care has been taken to arrive at series which are consistent over time, which was important as most employment surveys are not designed to track developments over time, and breaks in methodology or coverage frequently occur.

4. Some descriptive results from the EU KLEMS Growth and Productivity Accounts[5]

The EU KLEMS database confirms earlier observation, that the growth performance of the European Union has undergone a marked change during the second half of the 1990s (O'Mahony and van Ark, 2003). Even though average GDP growth of the EU-15 remained fairly constant at around 2.2 per cent, labour productivity growth slowed dramatically from 2.7 per cent from 1980-1995 to 1.4 per cent from 1995-2005 (see **Table 1**). Even after including the significantly better productivity growth performance of the new member states of the Union (see **Table 3**), given their relatively small GDP, the labour productivity growth of the aggregate EU-25 was only slightly higher at 1.7 per cent from 1995-2005 (see **Table 2**). This structural slowdown in productivity for the European Union as a whole is striking in the light of a comparison with the United States, where productivity growth significantly accelerated from 1.2per cent averaged over 1970-1995 to 2.4 per cent from 1995-2005. When looking at the market economy only, the forging ahead of the US becomes even more pronounced (see **Figure 1**). [6]

However, the EU KLEMS database documents a wide variation in productivity growth rates across EU member states. Among the "old" member states the fastest productivity growth rates were recorded in Finland and Sweden (see **Figure 2**).[7] Among the larger countries in the "old" EU, the UK has shown the fastest productivity growth since 1995, ahead of France and Germany. At the lower end

[5] For a country-specific analysis of results from the first release in March 2007, see van Ark et al. (2007).
[6] Market economy excludes health (ISIC industry N), education (ISIC M) and government sectors (ISIC L). We also exclude real estate (ISIC 70), because output in this industry mostly reflects imputed housing rents rather than sales of firms..
[7] Greece and Ireland also showed rapid productivity growth but, just as in the new member states, this largely reflects "catching up" growth.

of the productivity ranks are the two large countries in the southern part of the EU, i.e. Italy and Spain. The dismal productivity performance of the latter two countries impacts significantly on the average growth rate in the Union. However, whereas slow productivity growth in Spain was related to rapid improvement in labour input growth, the Italian economy experienced no compensating effect from an acceleration in employment growth. In general, the productivity growth rates from 1995-2005 were by far the highest for the new member states, reflecting the restructuring of the economies in Central and Eastern Europe (see **Figure 2**). However, labour input growth in the new member states has generally been negative, in particular in manufacturing.

The underlying analysis of the industry contributions to labour productivity since 1995 shows that the manufacturing sector continues to contribute significantly to European growth, partly through high labour productivity growth in the electrical machinery sector (which includes, for example, all the ICT production industries), and partly from the rest of the manufacturing sector (0.5 percentage points) (see **Table 2**). Also growth in distribution services and in other goods producing industries contributed respectively 0.3 and 0.4 percentage points to post-1995 growth in the EU-25. Nevertheless, compared to the United States, the striking differences in labour productivity growth originates from the much smaller contribution of market services, notably the distribution sector as well as finance and business services, which contributed 1.4 percentage points in the U.S. (see **Figure 1**). EU aggregates hide considerable country variation in industries driving growth (see **Figure 2**). For example, some European countries (Finland and Sweden as well as Estonia, Hungary and Latvia) showed a major contribution from ICT production. Some have major contributions from other manufacturing, such as some fast-growing new EU-countries, Austria, Ireland and Sweden, while in other countries other goods production (which includes agriculture, mining, utilities and construction) is an important source of growth. Also differences in the productivity contribution of market services appear to be a major driver of divergence within Europe

The growth accounting analysis from the EU Growth and Productivity Accounts is the most innovative and hitherto unavailable component of the database. It concentrates on a sub-sample of ten "old" EU countries and four new member states for which full labour and capital accounts could be constructed.[8] In Table 4, a decomposition of value added growth in the market economy of the old EU countries is given. GDP growth accelerated from 2.1% to 2.2% after 1995, completely due a strong improvement in the contribution of labour input, increasing from a zero contribution to a 0.6 percentage point contribution. About two thirds of this came from faster growth in total hours worked and one third from improved labour composition, as the overall skill level of the workforce has continued to increase significantly (see **Table 4**).

The contribution of capital input to value added growth has not changed much at the aggregate level, but the distribution has shifted somewhat from non-ICT capital to ICT capital. However, compared to the United States the shift towards intensive use of ICT capital has generally not been as pronounced. Notably, when comparing the ratio of capital to labour contributions to growth in the EU, there are

[8] The ten "old" EU countries in the growth accounts analysis refer to Austria, Belgium, Denmark, Finland, France, Germany, Italy, the Netherlands, Spain, Sweden and the United Kingdom. The four new member states refer to Czech Republic, Hungary, Poland and Slovenia.

signs of a declining capital intensity in the EU. This development is in sharp contrast to the US trend in capital intensity since 1995 (see **Table 4**).

The factor contributing most to the diverging trends in Europe and the US is the trend in multi factor productivity growth. While contributing 1.0 and 0.7 per cent to market economy GDP during 1980-1995 in the EU and the US respectively, the trend accelerated to 1.7 per cent in the US, but declined to 0.4 per cent in the ten old EU after 1995 (see **Figure 3)**. This slowdown in MFP growth is recorded almost everywhere across the Union, with the exception of Finland and the Netherlands where it improved since 1995. MFP growth in the market economy has slowed sharply in France, Germany and in the United Kingdom. In Italy and Spain, MFP growth was even negative reflecting the lack of technology and innovation spillovers and market rigidities, in particular in services industries (see **Figure 4**).

When decomposing growth to both industry as well as the sources of growth, it appears that market services tell a major part of the divergent performance of European economies since 1995, both among themselves as well as relative to the United States. Table 4 shows causes of the slowing or stagnation of output growth in various market services. While the contribution of factor inputs to growth has generally stayed up, multi-factor productivity growth in the market services stagnated or even turned negative in many European countries. The reasons for the slowdown in multi-factor productivity growth in market services are an important avenue for further research.

5. Concluding remarks

The EU KLEMS Growth and Productivity Accounts provide a new set of data that provide researchers, policy makers, media and others with a rich source of information on the sources of growth by industry and country in the European Union. Using national accounts and supplementary official statistics in combination with state-of-the-art growth accounting techniques, this database allows one to detect the key areas of growth and slowdown for individual countries, as well as convergence and divergence across economies. More precise measurement of the sources of growth at industry level is important for the analysis of the causes of the growth slowdown. In particular the breakdown of capital and labour inputs into asset types and labour categories (skill, gender and age) is an important step towards a more adequate assessment of the growth sources and less biased measures of multi-factor productivity growth.

The EU KLEMS database confirmed the view that European countries showed a significant slowdown in productivity growth since 1995, which is shown to be widespread across countries and industries but with notable differences. For example, productivity growth rates in Spain and Italy seriously declined, while they moderately slowed in France and Germany. The productivity slowdown in the United Kingdom has been more limited, and in some smaller economies (Greece, Ireland, and the Netherlands) productivity growth even accelerated, at least in the market sector of those economies. Productivity growth in most new member states of the European Union has been much faster as these countries have been catching up on the productivity levels of “old” EU-15, but this has often gone together with a sharp contraction in employment.

The potential for a recovery in productivity growth will to a large extent depend on the EU's capability to transform the economy towards one that makes more productive use of its resources. Much will depend on the capacity of markets to facilitate the reallocation of resources to industries that show rapid productivity growth. However, it is difficult to predict which industries will be the most productive in the future, as technology and innovation trends are inherently difficult to forecast. For now, a productive use of a larger input from skilled employment and the exploitation of ICT investments in service industries appear the most successful policy avenues for a European productivity revival. The EU KLEMS database will be a useful policy tool to track the progress made.

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Table 1 Gross Value Added, Labour Input and Labour Productivity, 1970-1995 and 1995-2005, European Union-15 (old EU-15)

	(annual average volume growth rates, in %)				Average share in total hours worked (%)	Contribution to LP growth in total industries
	Gross Value Added	Total persons engaged	Total hours worked	GVA per hour worked		
1970-1995						
TOTAL INDUSTRIES	2.5	0.4	-0.2	2.7	100.0	2.7
.Electrical machinery, post and communication	4.2	-0.4	-0.8	5.0	4.1	0.2
.Manufacturing, excluding electrical	1.7	-1.2	-1.7	3.3	21.7	0.8
.Other goods producing industries	1.3	-2.0	-2.4	3.7	20.4	1.0
.Distribution services	2.8	0.8	0.3	2.5	19.7	0.4
.Finance and business services	3.8	3.4	3.0	0.9	8.0	0.0
.Personal and social services	2.0	2.1	1.7	0.3	8.1	0.0
.Non-market services	2.9	2.1	1.6	1.3	17.9	0.2
.Reallocation of labour effect						-0.1
1995-2005						
TOTAL INDUSTRIES	2.1	1.2	0.8	1.4	100.0	1.4
.Electrical machinery, post and communication	6.1	-0.5	-0.9	7.0	3.4	0.3
.Manufacturing, excluding electrical	1.1	-0.7	-1.1	2.2	16.2	0.4
.Other goods producing industries	1.1	-0.2	-0.3	1.5	14.2	0.2
.Distribution services	2.5	1.1	0.7	1.8	20.4	0.4
.Finance and business services	3.7	3.5	3.3	0.4	13.6	0.0
.Personal and social services	1.8	2.5	2.1	-0.3	11.0	0.0
.Non-market services	1.6	1.4	1.1	0.5	21.2	0.1
.Reallocation of labour effect						0.0

Table 2 Gross Value Added, Labour Input and Labour Productivity, 1995-2005, European Union-25 (EU-25)

	(annual average volume growth rates, in %)				Average share in total hours worked (%)	Contribution to LP growth in total industries
	Gross Value Added	Total persons engaged	Total hours worked	GVA per hour worked		
1995-2005						
TOTAL INDUSTRIES	2.2	0.9	0.6	1.7	100.0	1.7
.Electrical machinery, post and communication	6.4	-0.4	-0.7	7.1	3.4	0.3
.Manufacturing, excluding electrical	1.4	-0.9	-1.2	2.6	16.7	0.5
.Other goods producing industries	1.1	-1.1	-0.6	1.8	16.9	0.3
.Distribution services	2.6	1.1	0.6	2.1	20.1	0.4
.Finance and business services	3.8	3.5	3.3	0.5	12.4	0.1
.Personal and social services	1.7	2.4	2.0	-0.3	10.1	0.0
.Non-market services	1.6	1.2	1.0	0.6	20.4	0.1
.Reallocation of labour effect						0.0

Table 3 Gross Value Added, Labour Input and Labour Productivity, 1995-2005, European Union-10 (new member states)

	(annual average volume growth rates, in %)				Average share in total hours worked (%)	Contribution to LP growth in total industries
	Gross Value Added	Total persons engaged	Total hours worked	GVA per hour worked		
1995-2005						
TOTAL INDUSTRIES	3.1	-0.7	-0.5	3.6	100.0	3.6
.Electrical machinery, post and communication	12.5	0.5	0.2	12.3	3.5	0.4
.Manufacturing, excluding electrical	5.2	-1.6	-1.6	6.9	19.0	1.4
.Other goods producing industries	1.0	-3.8	-1.3	2.4	30.4	0.7
.Distribution services	4.1	0.7	-0.1	4.3	18.6	0.8
.Finance and business services	5.8	3.8	3.1	2.7	6.5	0.1
.Personal and social services	1.3	1.3	0.7	0.5	5.3	0.0
.Non-market services	1.8	0.2	0.1	1.5	16.7	0.3
.Reallocation of labour effect						-0.2

Table 4 Gross value added growth and contributions, 1980-1995 and 1995-2005 (annual average volume growth rates, in %)

A. European Union-15 (excluding Greece, Ireland, Luxembourg, Portugal and Sweden)

	VA	L	*H*	*LC*	K	*KIT*	*KNIT*	MFP
	(1)= (2)+(5)+(8)	(2)= (3)+(4)	*(3)*	*(4)*	(5)= (6)+(7)	*(6)*	*(7)*	(8)
1980-1995								
MARKET ECONOMY	2.1	0.0	*-0.3*	*0.3*	1.1	*0.4*	*0.7*	1.0
.Electrical machinery, post and communication	3.8	-0.6	*-0.9*	*0.3*	1.6	*0.8*	*0.7*	2.8
.Manufacturing, excluding electrical	1.2	-1.2	*-1.5*	*0.3*	0.7	*0.2*	*0.5*	1.7
.Other goods producing industries	1.2	-1.2	*-1.4*	*0.2*	0.7	*0.1*	*0.6*	1.6
.Distribution services	2.6	0.3	*0.1*	*0.2*	0.8	*0.3*	*0.5*	1.5
.Finance and business services	3.5	2.4	*1.9*	*0.5*	2.1	*0.9*	*1.2*	-1.0
.Personal and social services	1.7	1.8	*1.5*	*0.3*	0.9	*0.2*	*0.7*	-1.1
1995-2005								
MARKET ECONOMY	2.2	0.6	*0.4*	*0.2*	1.2	*0.6*	*0.6*	0.4
.Electrical machinery, post and communication	5.7	-0.4	*-0.6*	*0.2*	1.7	*1.2*	*0.5*	4.4
.Manufacturing, excluding electrical	0.9	-0.4	*-0.7*	*0.3*	0.6	*0.3*	*0.3*	0.8
.Other goods producing industries	1.0	0.1	*-0.1*	*0.1*	0.7	*0.1*	*0.6*	0.3
.Distribution services	2.3	0.6	*0.5*	*0.1*	1.1	*0.5*	*0.7*	0.6
.Finance and business services	3.6	2.2	*1.9*	*0.3*	2.1	*1.2*	*0.9*	-0.7
.Personal and social services	1.7	1.5	*1.4*	*0.1*	1.0	*0.3*	*0.7*	-0.9

B. United States

	VA	L	*H*	*LC*	K	*KIT*	*KNIT*	MFP
	(1)= (2)+(5)+(8)	(2)= (3)+(4)	*(3)*	*(4)*	(5)= (6)+(7)	*(6)*	*(7)*	(8)
1980-1995								
MARKET ECONOMY	3.0	1.2	*1.0*	*0.2*	1.1	*0.5*	*0.6*	0.7
.Electrical machinery, post and communication	6.6	0.1	*-0.3*	*0.4*	1.9	*1.0*	*0.9*	4.6
.Manufacturing, excluding electrical	1.7	0.1	*-0.2*	*0.3*	0.6	*0.3*	*0.3*	0.9
.Other goods producing industries	0.7	0.7	*0.4*	*0.3*	0.7	*0.2*	*0.5*	-0.7
.Distribution services	3.9	1.3	*1.2*	*0.2*	1.2	*0.6*	*0.6*	1.3
.Finance and business services	4.4	2.9	*2.7*	*0.2*	1.8	*1.0*	*0.9*	-0.3
.Personal and social services	2.8	2.5	*2.4*	*0.1*	0.5	*0.2*	*0.3*	-0.2
1995-2005								
MARKET ECONOMY	3.7	0.7	*0.4*	*0.3*	1.3	*0.8*	*0.6*	1.7
.Electrical machinery, post and communication	10.5	-0.4	*-0.8*	*0.5*	2.2	*1.4*	*0.8*	8.7
.Manufacturing, excluding electrical	1.8	-1.0	*-1.4*	*0.3*	0.6	*0.4*	*0.2*	2.2
.Other goods producing industries	1.6	1.1	*1.0*	*0.1*	0.8	*0.2*	*0.6*	-0.3
.Distribution services	4.1	0.6	*0.3*	*0.3*	1.5	*1.0*	*0.5*	2.1
.Finance and business services	4.3	1.9	*1.5*	*0.4*	1.9	*1.2*	*0.7*	0.4
.Personal and social services	2.6	1.7	*1.4*	*0.3*	0.9	*0.4*	*0.6*	0.0

VA= Gross Value Added growth
L= Contribution of Labour input growth
H= Contribution of Total hours worked
LC= Contribution of Labour composition
K= Contribution of Capital input growth
KIT= Contribution of ICT capital
KNIT= Contribution of Non-ICT capital
MFP= Contribution of Multi factor productivity growth

Figure 1 Contributions of Industries to Market Economy Labour Productivity Growth 1995-2005 (in %)

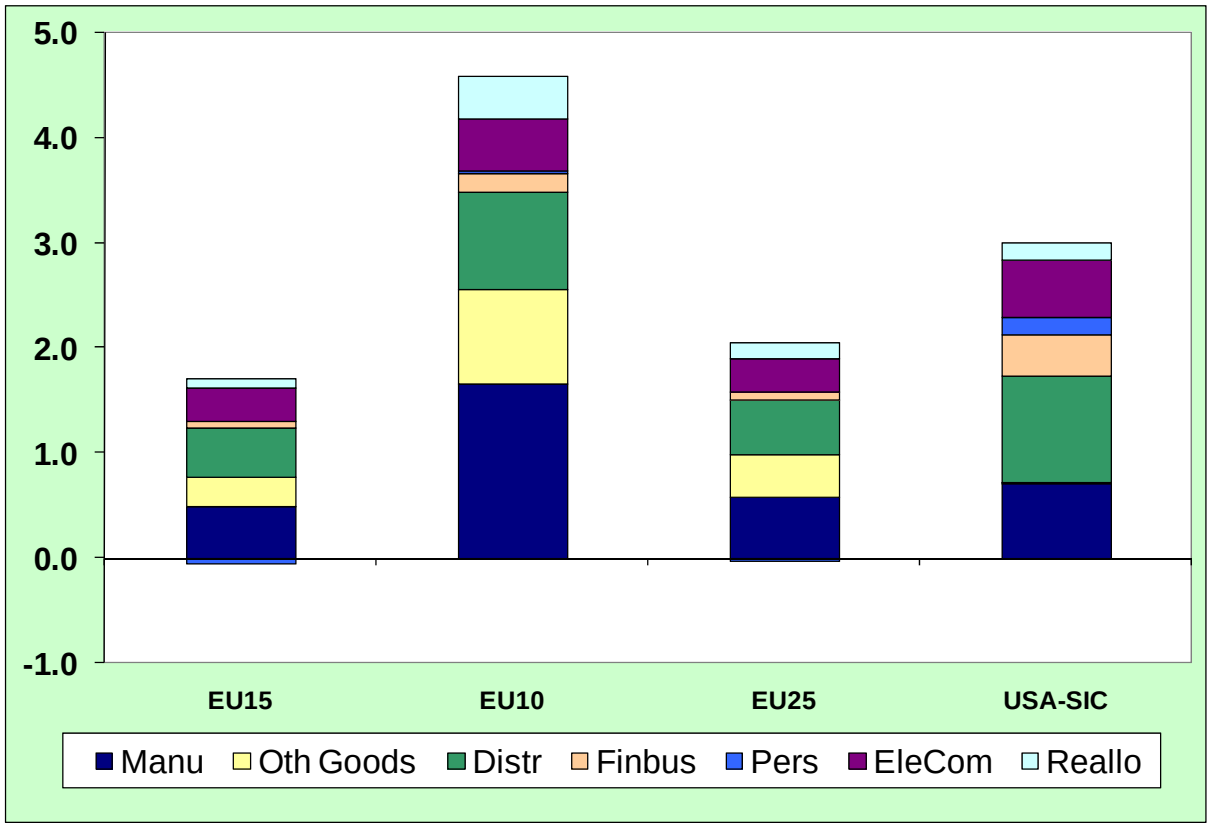
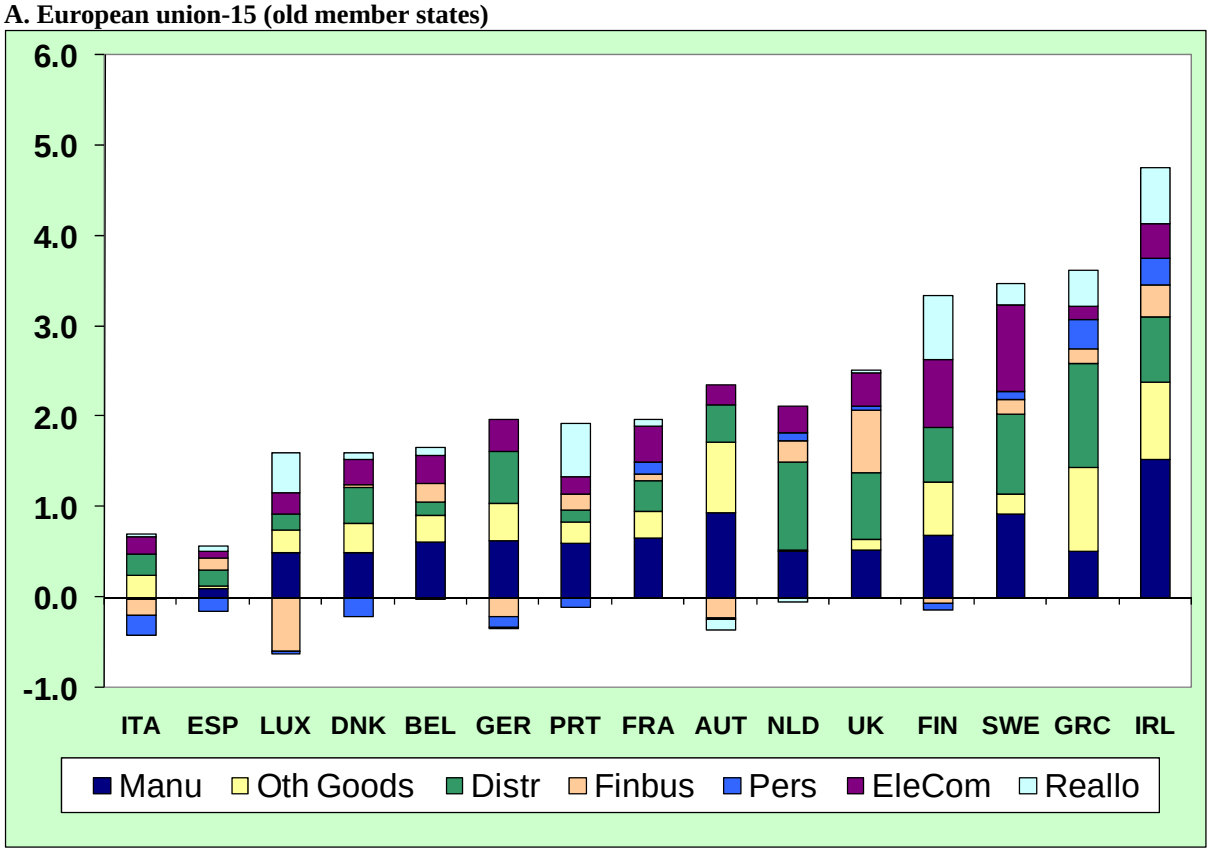


Figure 2 Contributions of Industries to Market Economy Labour Productivity Growth 1995-2005 (in %)

A. European union-15 (old member states)



B. European Union-10 (new member states)

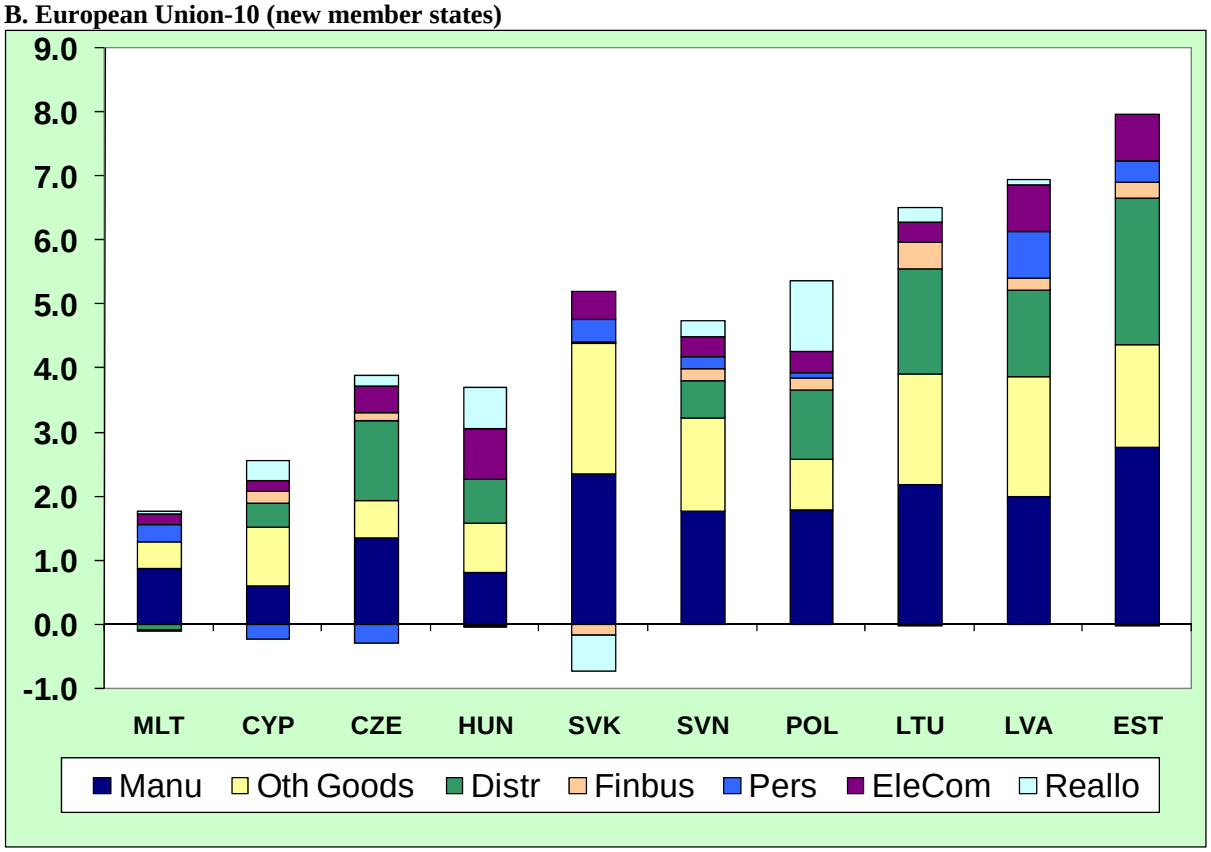


Figure 3 Contributions to Market Economy GDP Growth 1980-1995 vs. 1995-2005 (in %), major regions

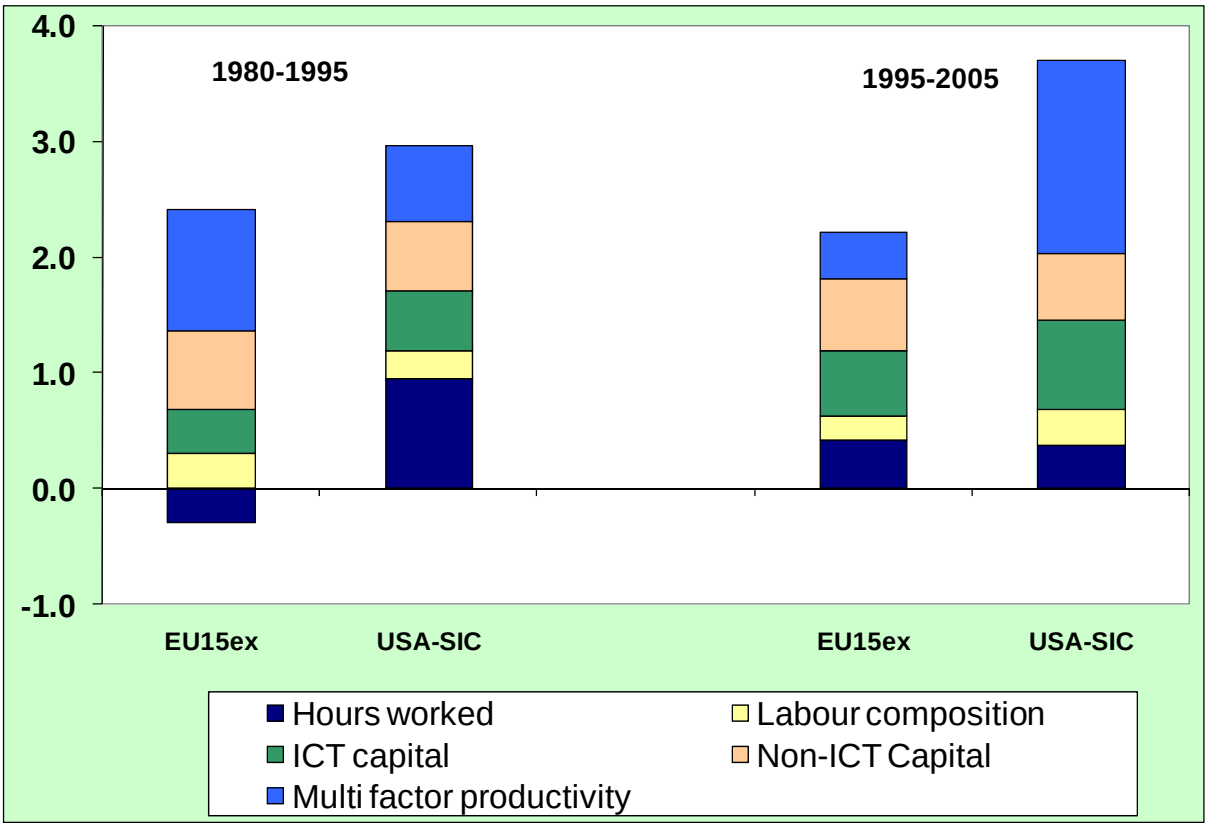
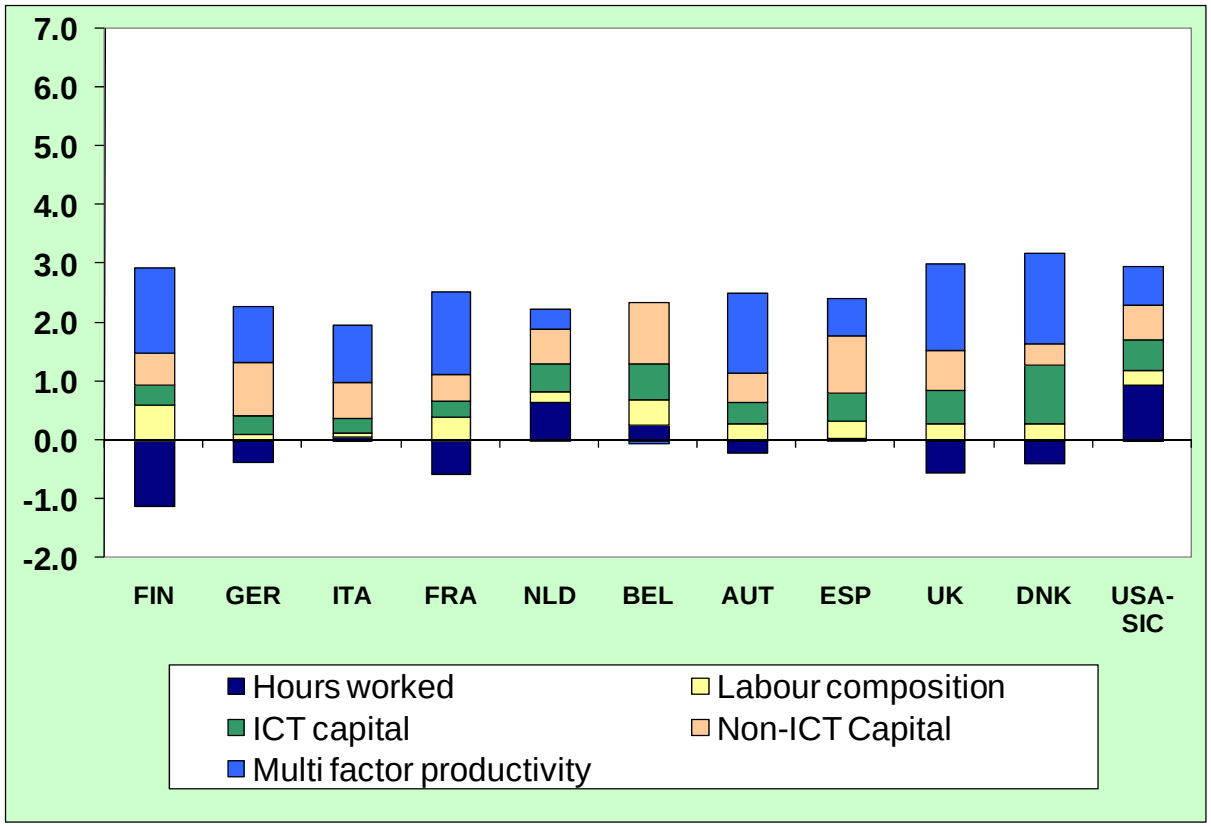
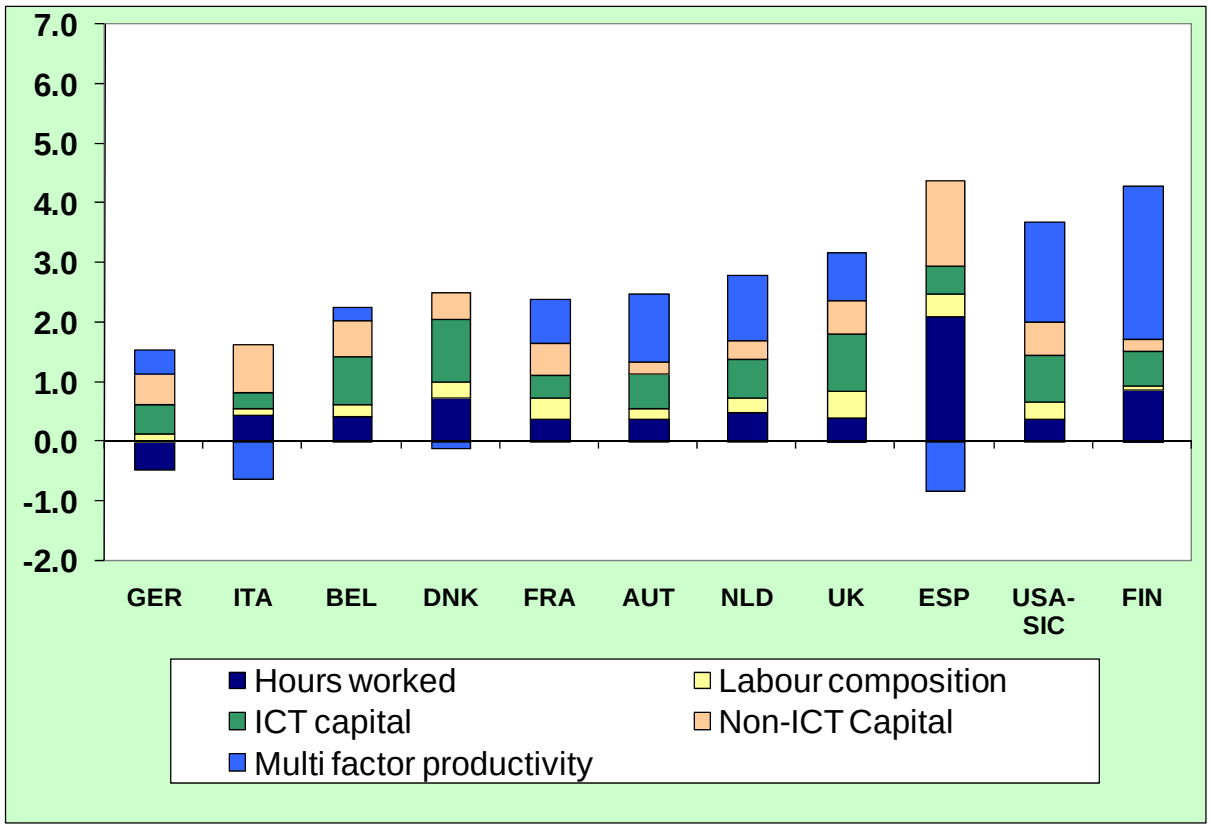


Figure 4 Contributions to Market Economy GDP Growth (in %)

A. 1980-1995



B. 1995-2005



Appendix Table 1 Variables in 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)
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 variables	
LAB	Labour compensation (in millions of local currency)
CAP	Capital compensation (in millions of local currency)
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)

Appendix Table 2 Industry lists for growth accounting variables

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