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What explains the differences in income and labour utilisation and drives labour and economic growth in Europe? A GDP accounting perspective

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WHAT EXPLAINS THE DIFFERENCES IN INCOME AND LABOUR UTILISATION AND DRIVES LABOUR AND ECONOMIC GROWTH IN EUROPE? A GDP ACCOUNTING PERSPECTIVE

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Abstract

The paper decomposes GDP both in terms of level per capita and growth rate, so as to identify the sources of income differences and of economic growth for all EU27 member states. This accounting approach has multiple advantages, although a number of substantial caveats should be borne in mind when interpreting the results. In particular, the detailed accounting approach helps distinguish exogenous from policy-influenced growth drivers. The gap in per capita GDP across EU Member States is wide. The combination of lower per-hour productivity and lower labour utilisation (i.e. hours worked per capita) is the cause of relatively low per capita GDP in euro area and EU15 countries, while weak productivity remains the main concern in the new member states. GDP growth rate has been broken down into 12 items, including an indicator of labour quality, based upon the composition of employment by educational attainment. Over the five years following the launch of Lisbon strategy (2001-2006), labour productivity growth and labour input growth respectively contributed to around two thirds and one third of the average economic growth of almost 2% in the EU15. In contrast, the strong economic growth in the new member states, standing at around 4% on average, was essentially explained by labour productivity growth.

Keywords: GDP accounting; European Union; Aggregate employment; Average hours worked; Quality of Labour.

JEL classification: J21, J24, O47, O52

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Summary of the main results

The analysis consists in decomposing GDP, both in terms of level per capita and growth rate, so as to identify the sources of income differences across countries and the main components of economic growth.

As regards the decomposition of the level of GDP per capita, several results emerge:

- The gap in per capita GDP across EU Member States is wide. The combination of lower hourly productivity and lower labour utilisation (i.e. hours worked per capita) is the cause of relatively low per capita GDP in euro area and EU15 countries, while weak productivity is the main concern in the EU10.
- Looking at the EU15 and the euro area, the relatively low labour utilisation explains around two thirds of the per capita GDP gap in the EU15 and the euro area vis-à-vis the US (16 p.p. out of 26% in the EU15), while the hourly labour productivity accounts for the remaining third. This is due to the negative contribution of average hours worked and, to a lesser extent, the relatively low labour market participation and the relatively high level of unemployment. The gap in the euro area is slightly wider than that in the EU15 because of even weaker participation and higher unemployment. The productivity gap of the EU15 vis-à-vis the US stems from lower Total Factor Productivity (TFP) and, to a lesser extent, the lower initial education of labour. In the euro area, the negative TFP gap is greater than in the EU15, but the gap in labour quality is also wider: this implies that the overall productivity gap of EU15 and the euro area vis-à-vis US is almost identical.
- Looking at the EU10, the per capita GDP gap vis-à-vis the US remained huge in 2006, almost reaching 60% of the US per capita GDP. It is mostly attributable to labour productivity (54 p.p.), with labour utilisation only explaining 6 p.p. The very strong negative productivity gap in the EU10 vis-à-vis the five richest Member States is to be attributed, by descending of order of importance, to lower capital intensity and lower TFP growth despite of slightly higher labour quality. The underutilisation of labour is much lower in the 10 new member states (EU10) that acceded in 2004 and in the most recently acceded countries in 2007 (Romania and Bulgaria) than in the EU15 and the euro area. The labour utilisation in the EU10 is only 9% below the US level and is 2% above the labour utilisation in the five richest EU Member States. The underutilisation in the new member states vis-à-vis the US is due to a low rate of participation and a

high rate of unemployment (extensive margins), whereas the average hours worked per person employed (intensive margins) and the share of working-age population (demographic margins) are higher than in the US.

- The dispersion of hourly productivity in the EU is clearly higher than the dispersion of labour utilisation. TFP is by far the main driving force behind productivity dispersion in the EU15 and the euro area, while both capital accumulation and TFP explain the high productivity dispersion in the new member states. The initial education of labour appears a minor driver of hourly productivity dispersion. Therefore, TFP, which is the "unexplained" part of GDP accounting, appears to be the main driver behind per capita GDP differences across EU countries. This does not come as a surprise and confirms the key result found by the development accounting literature that production factors as such only explain a minor part of the cross-country variation in income.

- Labour productivity lags behind the US in 2006 in most EU countries, with only five countries showing greater labour productivity than the US (LU, BE, NL, FR and IE). Labour utilisation lags behind the US in 2006 in most EU countries, with six countries managing to have a greater utilisation of labour than the US (LU, BG, CZ, EE, CY and LV). Amongst the eight worst performers, six are EU15 countries, of which the four big euro area economies (FR, DE, ES and IT). The reason behind this low performance varies from country to country, but the main drivers in the big countries are generally low participation or low average hours worked, aggravated by high unemployment.

- When one decomposes the labour utilisation into its demographic component (share of working-age population in total population) and its labour market component (total hours worked per working-age person), the latter appears as the dominant contributor to both the level and dispersion of labour utilisation. The dispersion of labour utilisation in the EU15 is mainly related to the average hours worked and (to a lesser extent) the labour market participation, while the dispersion in EU10 is explained by all labour-market components (unemployment rate, average hours worked and the labour market participation).

- It is important to recall that the per capita GDP components might partly be tied with each other, illustrating the existence of interlinkages across components. The most obvious illustration is the negative relationship in most countries between labour utilisation and productivity level. An economic explanation of this negative relationship

is that a dynamic labour market manages to include the least productive, even though this negative relationship does not hold anymore when high productivity mainly stems from strong innovation, materialising as high TFP.

Labour utilisation should also be assessed in terms of recent growth of labour input (i.e. total hours worked in the economy) and its effect on GDP growth.

- Over the last ten years (1995-2006), the growth in hourly productivity was the driving force behind two thirds of average annual GDP growth (i.e. 1.6 p.p. out of 2.3%) in the EU15 as a whole. TFP growth, capital deepening and the increase of the initial education of labour explained respectively 0.8 p.p., 0.5 p.p. and 0.3 p.p. of productivity developments. The growth in labour input explained the remaining third of the average annual GDP growth in the EU15. The labour market component accounted for over one half of labour input growth, with the demographic component contributing to the remainder. Migration explained the entire demographic component. As regards the labour market component, the rise of the employment rate (extensive margins) contributed to 0.8 p.p. owing to the strong contribution of both female and older-worker participation and, to a lesser extent, the decline in unemployment. By contrast, while youth and male participation had a mute effect on growth, the decrease in the average hours worked per worker (intensive margins) exercised a negative effect of –0.4 p.p. Compared with the US, the average EU15 growth rate was around 0.8 p.p. lower in 1995-2006, owing to the much less favourable demographic developments and, second, the lower growth in hourly productivity. However, the labour market situation improved vis-à-vis the US, especially due to the contribution of participation and despite the negative impact of hours worked, and the initial education of labour grew more in the EU15 than in the US as well.
- Over the last ten years, the annual average growth was 4.4% in the EU10 as a whole. Labour productivity growth accounted for almost all of it. While TFP growth and capital deepening each explained around 2 p.p., the contribution of the initial education of labour to labour productivity growth was only modest (0.3 p.p.). Labour input growth was only contributing to 0.3 p.p. of total GDP growth. Unlike in the EU15, the contribution of the labour market component to GDP growth was negative. However, the contribution of labour varies a lot across its components. The rising share of

working-age population, increasing older worker participation and dropping unemployment contributed to 0.8 p.p. of labour input growth in total. This was partly counterbalanced by the adverse contribution of sharply declining youth participation and declining native population. Compared with the US, the average EU10 growth rate was around 1.2 p.p. higher in 1995-2006, owing to much higher capital deepening and TFP growth and, to a lesser extent, stable average working hours, the fast rising share of working population and the rise in older worker participation.

- The growth pattern remains very different across countries. Almost half of the variation of GDP growth across EU15 countries in 1995-2006 was driven by the dispersion of TFP growth, while unemployment, female participation, migration and the share of working-age population explain in total around 45% of total variance. The variation of growth within EU10 was close to that in the EU15 but mostly accounted for by TFP growth and capital deepening, while the average hours worked and youth participation and unemployment stand out amongst secondary factors, representing each over 10%.
- Since the EU is still lagging behind the US in terms of per capita GDP and some EU member states are still far behind the EU15 per capita GDP, it is crucial to examine if the laggards have converged in the recent period. The speed of this convergence process depends upon whether the movement in the two components of per capita GDP (labour utilisation and hourly productivity) is reinforcing or offsetting each other. In fact, they seem to have evolved in opposite direction, which might explain why the catch-up process of European economies toward the US has been quite limited (and even negative sometimes).
- Developments in labour utilisation should also be considered in close relation to the starting condition. The first examination also suggests that while the relative growth is negatively correlated with the starting condition in both the EU15 and the new member states, the relationship between the two variables remains loose and does not appear valid for many countries. By contrast, no such relationship is seen with the hourly productivity in the EU15, where highly productive countries continue to see a sharp growth in productivity. However, the growth in productivity seems to be highly correlated with the initial productivity lag in the new member states (EU10).

1. INTRODUCTION

Europe is often pointed at as lagging behind the US in terms of both per capita GDP and economic growth. It is also often said to make an insufficient use of its potential labour, which would partly explain the lower GDP per capita and the slower growth in Europe compared with the US. This gap with the US is also attributed to insufficient and slow-moving productivity.

A large vein of literature uses a GDP accounting approach, very often in growth rate (the so-called "growth accounting) rather than in level, to identify the lower use of labour in the EU15. The GDP accounting methodology is based on a production function framework and is derived from the seminal work of Solow (1956) on the neoclassical growth theory and of Jorgenson (1995) and Jorgenson and Griliches (1967) on the empirical decomposition of growth.

Although the literature focuses mostly on the accounting of growth, some important contributions look at the accounting of the level of per capita GDP, also referred to as "development accounting" (King and Levine 1994, Prescott 1998, Hall and Jones 1999 and Caselli 2005) following the seminal contribution of Mankiw, Romer and Weil (1992).

As regards the growth accounting strictly speaking, a wealth of recent studies are available for EU15 and OECD countries (Scarpetta et al., 2000), big EU countries (Barrell et.al., 2007), various developing countries (Senhadji A., 2000) or the Central and Eastern European Members States (Arratibel et al., 2007). This literature strand on growth accounting could be related to a wider vein of policy research considering the reason for slow growth in Europe and the way to unleash the growth and employment potential in the near future (Aghion et al, 2004; Pisani-Ferry and Sapir, 2006; Sapir, 2007).

The first merit of this paper is its scope: it consistently examines labour underutilisation in *all* EU27 countries (including Cyprus, Malta, Bulgaria and Romania) in the *most recent period* (1995-2006) employing a comparable GDP accounting approach *both* in level (per-capital GDP difference) and in terms of GDP growth rate. Second, the accounting methodology offers a more detailed decomposition of labour inputs (including demographic variables and age- and gender-specific participation) than those often found in the literature, which generally give a stronger emphasis on productivity at the expense of the description of

labour. Given the level of disaggregation of labour, the detailed GDP accounting analysis carried in this paper would also allow for a detailed investigation of the components of both GDP and labour utilisation. Third, it also attempts to apprehend (a part of) the impact of labour quality (that is, the initial education of labour), which is often lumped in the Solow residuals, commonly named Total Factor Productivity. This cross-country comparable indicator is based on the composition of employment by educational attainment.

Last and not least, this GDP accounting analysis could help meet the broader need to identify the underperformance of European economy. In particular, the GDP accounting is a flexible tool that might help distinguish broadly exogenous factors from policy-influenced factors. Some GDP components are potentially influenced by governmental policies in the short and medium run, while the others are clearly out of the reach of governmental actions in the short and medium run (demographic and deeply-rooted societal factors). This is crucial from a policy perspective and, in particular, with regard to the Growth and Jobs Strategy (also called Lisbon strategy), which provides the EU with a framework for policy coordination that supports the process of structural reforms at national level with a view to raising growth and employment potential. The revised Lisbon strategy, launched in 2005, seeks to re-establish national ownership, principally by leaving it up to Member States to define what they consider to be the "key challenges" facing their country in terms of raising the growth and employment potential, and to define the measures/reforms that they intend carrying out to achieve these goals. While the "partnership approach" has helped regain national ownership of the Lisbon strategy, Member States identified "key challenges" in a heterogeneous manner in their National Reform Programmes, and thus it is difficult to carry out a consistent assessment across broad policy areas, across countries and over time.

A detailed GDP accounting approach will meet the policy need for having a consistent assessment benchmark against which starting position and progress of the EU economies can be measured. In this context, the paper will help cast light on the factors behind the economic performance in the EU27 (e.g. demographic, labour market and productivity components) and their consequences in terms of income and growth differences across Member States. The approach developed in the paper and its findings fed through the LIME Assessment

Framework (LAF), which is an analytical tool that can help underpin the assessment of policy challenges facing Member States in raising growth potential.[2]

The remainder of the paper is structured as follows. Section 2 sets out the methodological framework of the GDP accounting and discusses key issues. Section 3 focuses on labour utilisation[3] and GDP per capita in terms of level, simultaneously considering its underlying factors and its variation across member states. For sake of clarity, the paper first comments on developments at the aggregate level, i.e. EU15, EU10 and euro area. Results are, however, reported for each member state and where possible the text comments on the most pertinent country specific results and the country heterogeneity. Section 4 takes a closer look at the different components of GDP growth in EU member states between 1995 and 2006. The analysis carried out in section 3 and 4 is benchmarked against the US and the five best performing EU member states. Several annexes are attached describing the methodology and data sources in more detail.

2. THE GDP ACCOUNTING ANALYSIS AND KEY METHODOLOGICAL ISSUES

2.1. A supply side approach and different concepts of labour input

The analysis consists in decomposing GDP, both in terms of level per capita and growth rate. Table 1 shows eleven examples of possible breakdown. The simple decomposition into two or three items (e.g. labour input and labour productivity) uses a basic accounting relation (multiplicative in per capita GDP level and additive in terms of growth rate). The more refined decompositions, such as those in columns III, IV, V and IV, are based upon a

[2] The analytical approach of LAF is described in detail in European Commission (2008), "The LIME assessment framework (LAF): a methodological tool to compare, in the context of the Lisbon Strategy, the performance of EU Member States in terms of GDP and in terms of twenty policy areas affecting growth". DG ECFIN European Economy Occasional paper No 41. Building upon the results of an extensive literature survey, it systematically compares the performance of Member States in terms of GDP and twenty policy areas affecting growth (looking at both levels and changes) relative to a benchmark (in this exercise EU15). This involves the utilisation of scores calculated from quantitative indicators whose choice was based on the literature survey to lead to an assessment of relative performance. Additional information on country specific conditions and circumstances is an integral part of the LAF as a complement to the indicator-based assessment. This tool was developed by the Commission services working together with national authorities in the EPC Lisbon Methodology Working Group (LIME), and in close collaboration with EMCO.

[3] The results of the comparison with the reference benchmark (US and five richest member states) will allow one to qualify the current labour utilisation as insufficient or, to put it another way, as "underutilisation".

standard production function, generally following the Cobb-Douglas specification which relates output to the quantity of production factors (labour, capital, technology).

An advantage is that the degree of decomposition can be tailored to policy needs. For example, in section 3, which considers current differentials in GDP per capita across Member States, the breakdowns described in columns IX, X and XI are used.

In contrast, the decomposition of the growth rate in section 4 is made according to column V with twelve components, namely the contribution of natural population increase, migration rate, ratio of working-age population to total population, participation of youth, prime-age men, prime-age women and older workers, unemployment, average hours worked, labour quality, capital deepening and TFP (as the Solow's residual). The advantage of this detailed growth accounting is to dig deeper into three dimensions:

Table 1 Different decomposition of GDP and correspondence with GDP per capita

	I 2 items	II 3 items	III 4 items	IV 7 items	**V** **12 items**	VI 3 items	VII 2 items	VIII 2 items	**IX** **7 items** **(GDP per capital)**	X 2 items (GDP per capital)	XI 3 items (GDP per capital)
GDP	Employment	Total hours worked in the economy	Working age population	Working age population	Native population	Demographic component of GDP = Working age population	Total labour inputs (Total hours worked in the economy)	Total population	Total population	Total population	Total population
					Net migration						
					Share of working age population in total population				Share of working age population in total population	Labour utilisation (Hours worked over working-age population)	Demographic component of GDP per capita = Share of working age population in total population
			Employment rate	Labour market Participation	Youth Participation	Labour market component (Total hours worked in the economy over working age population)		**GDP per capital**	Labour market Participation		Labour market component (Total hours worked in the economy over working age population)
					Male prime-age participation						
					Female prime-age participation						
					Older-worker participation						
				Unemployment rate	Unemployment rate				Unemployment rate		
	Labour productivity (in head count)		Capital deepening (capital *per person employed*)	Working time (Average Hours worked per person)	Working time (Average Hours worked per person)				Working time (Average Hours worked per person)		
		Labour productivity per hour worked		Labour quality (power the labour share 65%)	Labour quality (power the labour share 65%)	(Per-hour) Productivity components	(Per-hour) Productivity components		Labour quality (power the labour share 65%)	(Per-hour) Productivity components	(Per-hour) Productivity components
				Capital accumulation (capital *per hour worked*)	Capital accumulation (capital *per hour worked*)				Capital accumulation (capital *per hour worked*)		
			Total factor productivity (Solow's residuals)	Total factor productivity (Solow's residuals)	Total factor productivity (Solow's residuals)				Total factor productivity (Solow's residuals)		

- *demographics*: the working-age population growth is decomposed into natural population increase, the contribution of the change in the migration rate and the change in the age-structure of total population;

- *labour participation:* the contribution of the total participation rate is broken down by relevant age and gender groups: youth, prime-age men (aged 25-54), prime-age women, old-age workers (aged 55 and over). Given that the last two groups are particularly sensitive to policies[4], and display the most dynamic increase recently, their specific monitoring is fully warranted. The relevance of this further breakdown is confirmed by *ex post* analysis showing that youth participation and male prime-age participation are often behaving very differently from the participation of prime aged women and older-workers;

- *labour quality:* an indicator of initial education of labour is added (i.e. the employment composition by educational attainment). This inclusion helps better specify TFP as technical progress, which would otherwise have encompassed the initial education of labour[5].

We also resort to different concept of labour utilisation. When it comes to GDP per capita, we use labour utilisation, i.e. total hours worked over total population. This can be divided into a demographic component (i.e. working-age population over total population) and a labour market component (i.e. total hours worked per working-age person). Turning to GDP, we use the concept of total labour input (i.e. total hours worked in the economy), which can also be split between a demographic component (i.e. working-age population, aged 15-64) and labour-market components (i.e. total hours worked per working-age person).

[4] e.g. childcare facilities, part-time employment regulation, flexible working time arrangements, the removal of fiscal distortions, reforms of old-age pension regimes and early-retirement schemes.

[5] Notwithstanding these extensions, labour productivity can only be broken down into TFP and capital accumulation, and a better understanding of what lies behind them could be most desirable outside the scope of this paper. The EUKLEMs data became available in March 2007 and provides detailed insights into sectoral productivity developments. Some relevant questions will include whether: (i) the sectoral composition and specialisation influence on aggregate productivity, (ii) the size of GDP per capita gap amongst leading economies attributable to specific service sectors (e.g. financial services, retailed sectors), (iii) an analysis of the impact of the size of ICT sectors on productivity growth.

2.2. The value added and caveats of the approach

2.2.1. Main advantages

The accounting approach, and especially the growth accounting, has several advantages from the perspective of policy analysis. It is based on a commonly used description, based on a Cobb-Douglas representation of the production function[6]. This is feasible for all EU27 countries, making cross-country comparison possible and relatively easy. It is also a flexible tool as growth components can be broken down to a level that best fits policy needs. The graphical representation allows one to intuitively identify the areas of growth weaknesses, the trade-offs between components and the large components such as TFP for which further insights might be required (e.g. from sectoral analysis). It is also a flexible approach, as the different contributions are additive and could be rearranged at will to fit the analytical needs. We use this flexibility to develop the standard GDP accounting towards a more detailed description of labour inputs, which also attempts to distinguish broadly exogenous factors from policy-influenced factors. Some GDP components are potentially influenced by governmental policies in the *short* and *medium run*, while the others are clearly out of the reach of governmental actions *in the short* and *medium run* (demographic and deeply-rooted societal factors). More specifically, three groups of components can be identified:

Some factors are outside the direct control of government (mainly exogenous), such as the growth of *native population* and the ageing of population captured by *the declining share of working age population* in total population (i.e. increased dependency ratio). Of course, those factors are strictly speaking exogenous in the short and medium term only but may potentially be changed by policies in the long term, although with great uncertainty. For instance, policies designed to restore positive population growth will not have direct (supply side) effects on population size until the long run but the intermediate result (higher fertility rate) can be immediately measured;[7]

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[6] For instance, the Cobb-Douglas production function approach is the commonly agreed method underlying the assessment of stability and convergence programmes and used to correct for cyclical fluctuation. However, other more refined specification could be considered such as Translog or CES.

[7]Some policies (reconciliation of working and family life and income policy) might help raise fertility, but the impact on working age population mathematically takes almost one year to materialise. Health care policy might also help to reduce mortality, although the effect on EU15 countries should be limited given the existence of "mature" health care system.

Some growth components can partly be influenced by governmental policies (partly endogenous), such as *female participation* thanks to reduced tax distortion, family friendly policies and less discrimination[8]. However, the cohort effect, associated with societal change and rising educational levels, contributes to mechanically raising the female participation rate. Likewise, while *net migration flows* are partly at the government discretion, they also partly depend upon uncontrollable illegal immigration, family reunification rules, binding refugee convention and the normal play of globalisation (e.g. migration of students). In the same vein, while *average hours worked* per person employed are in part related to the business cycle and people's preference for leisure, it will also be determined by the interplay of tax and benefit systems, which could cause poverty traps, preventing additional working hours from paying off. *Capital deepening* (i.e. the rise in capital intensity) is sensitive to the quality of the macroeconomic framework, the rigidity of the labour and product markets, the level of entrepreneurship and the relative price of labour and capital, but also depends upon many determinants such as initial capital stock, world demand and the business cycle. TFP could partly be enhanced by good innovation policies, more efficient ICT dissemination policies, the stimulation of R&D and a flexible functioning of labour and product markets, although numerous factors of structural nature might play a great part such as the distance to the production frontier, the average age of capital stock, etc.

A set of growth factors are crucially influenced by public policies and the institutional setting (mainly endogenous). The *initial education of labour* (as a rough proxy for labour quality) should greatly depend upon the existence of an efficient system of initial education and upon the design of tax and benefit systems, which could greatly affect the return of human capital investment. However, while the impact of the improvement of vocational training systems and on-the-job training could be seen in the medium run, the reform in the initial education system may take much longer time to materialise as higher growth. This will occur only when the younger generations replace the older ones in the labour market. Moreover, the *participation of youth* to the labour market will be affected by educational policies, the rigidity in the labour market and, to some extent, the business cycle. Besides the effect of the economic cycle, male prime-age participation primarily hinges upon the existence of inactivity traps generated by tax and benefit systems. The change in *old-worker*

[8] For example, childcare facilities, part-time employment regulation, flexible working time arrangement, fiscal distortion removal.

participation is primarily caused by the removal of early-retirement schemes, the reforms of pension system, which reduces the implicit rate of taxation, and other policies to make work pay. The development of flexible work arrangements and combating age discrimination might help[9]. *Unemployment* is affected by the business cycle and by all types of institutional rigidities influencing the labour demand and the labour supply (unemployment traps and tax wedge, insufficient labour mobility and matching, rigid employment protection legislation, inadequate wage-setting, etc). Malfunctioning product market may play an additional part in hindering business development.

2.2.2. Caveats and limitations

In contrast, the accounting approach presents a couple of limitations. Five caveats should be mentioned and duly borne in mind.

The approach is descriptive and does not inform about causality *per se*. For instance, growth and its components can be affected by common caused such as the business cycle, which plays an important role if the time period being considered is short. More generally, developments in each component might be difficult to interpret in practice, given the multiplicity of factors affecting them, the existence of trade-off/interaction between variables and the residual role of TFP as a catchall variable.

The potentially substantial role of trade-off/interactions between components calls for a "dynamic reading" of the GDP accounting instead of a static examination, where each component is considered one by one in isolation. Although, the approach does not allow for a quantification of trade-offs or interactions, a careful and dynamic interpretation should pay attention to a couple of interactions (complementarities or trade-offs), which are well known in the economic literature. In particular, five types of interactions deserve being a systematically borne in mind. First, a strong (weak) employment could be associated with a weak (strong) hourly productivity, through relatively low (high) capital accumulation per worker, lower (higher) initial education of those employed or weaker (stronger) TFP induced by the lower (higher) average level of skills that are not captured by initial education. Indeed, an inclusive labour market tends to reduce capital-labour intensity mechanically –as the capital stock is divided by more labour) and attracts less productive people into employment.

[9] Of course, some mechanical cohort effect might be at play for old-female workers.

It might also signal a higher return of labour relative to capital, leading to less capital accumulation. Likewise, high average hours worked might mean lower productivity, due to lower capital/hours-worked intensity and negative marginal returns of long working-time. Second, a high female participation might mean in some countries a high level of part-time employment, which bears negatively upon the average hours worked per person employed[10]. There could then be a partial trade-off between higher participation (external margins) and average hours worked (internal margins), although the net effect on total hours worked is often found to be positive (e.g. Garibaldi and Mauro, 2002 and Mourre, 2006). Third, a high level of initial education of labour could mean a relatively low participation of youth to the labour market, as young people are enrolled massively in schools and universities. Fourth, in countries with relatively high per capita GDP, decreasing population or a relatively low share of working-age population might be associated with higher contribution of migration.

The data issue is a well-known practical limitation of all kinds of GDP accounting exercises, as some data are undergoing frequent and substantial revisions. Therefore, although the underlying data presented in this paper for the period 1995-2006 were retrieved in early 2008 and show a broad stability for most countries, we also display recently updated data for the recent period 2001-2007 (extracted in November 2008). When looking into each GDP component, the estimation of average hours worked per person appears to be the most fragile and in constant revisions. Data on hours worked have substantially been revised in some member states recently, which does affect the relative per capital GDP level slightly and the growth rate of GDP more substantially. There have been important revisions in the total annual hours worked time series in AT, CY, EE, GR, IE, MT, PT and RO. This also has a mechanical impact on TFP - since the latter is computed as a residual and changes in labour input was not accompanied by similar changes in GDP - and on capital deepening -as the ratio capital to labour is affected by a change in hours worked. Moreover, the indicator of initial education of labour has been affected in some countries such as LT and UK by the change in the underlying data, that is, employment by educational attainment[11]. Lastly, some revisions

[10] High participation of prime-age female might be associated with a better balance between genders, which might stimulate youth and older-worker participation, as the gap in employment rate between men and women is very strong at both ends of the age distributions.

[11] In the UK, the breakdown of employment by educational attainment, provided by Eurostat Labour Force Survey, was revised in September 2008. The revision affects data from 1999 onwards. As a result, the UK now records positive initial education of labour growth over the period 2001-2007. For LT, there are new employment figures for 1999 and 2000, which differ from the previously –estimated- ones. As a result, LT now records negative initial education of labour growth over the period 2001-2007. Moreover, there have also been

in the 2006 level of GDP per capita were recorded in late 2008 after the drafting of the current paper. Compared to the set of data used in this paper, changes in GDP per capita largely stem from revision in GDP in PPS rather than from changes in population figures. Finally, in five countries –AT, EE, IT, MT and SE- the new average real GDP growth figures are more than one thousandth points higher in absolute value than the previous ones.

A special note of caution should be mentioned as regards the data on migration and its mechanical interpretation as a growth component. Since most countries either do not have accurate figures on immigration, and especially emigration, or have no figures at all (gross flows), we use estimates of net migration derived from the difference between the population change and the natural increase of population between two dates (i.e. the difference between the number of births and deaths during the year). Moreover, net migration data are defined as the difference between immigration into and emigration from a given country during a particular year: net migration is therefore negative when the number of emigrants exceeds the number of immigrants[12]. It should be borne in mind that net migration flow data are not disaggregated between intra- and inter-EU flows. As there is also no breakdown of migrants by age, gender, or educational attainment, the growth accounting analysis mechanically considers the role of migration *in the change in overall population size*. When the analysis highlights an increasing role of migration as a source of economic growth, it cannot assess the full economic impact of migration, which broadly depends on the efficient integration of migrants in the labour market and on the skills and productivity of migrants. The impact of migration is also partly captured by the other components of growth, such as labour quality, productivity, participation rates or the unemployment rate, which is not taken into account by the mechanical effect of migration on total population, presented in the growth accounting. The growth accounting approach therefore tends to overestimate the impact of migration on growth in the short to medium term, as the migrants compared with the natives tend to participate less in the labour market, to suffer from higher unemployment and to display a lower level of education on average (Diez Guardia and Pichelmann, 2006).

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changes to the net migration rates in BG, LU and RO, affecting the growth contribution of native population and net migration.

[12] Eurostat does also provide data on stocks for some countries, with some information on the gender, age and labour status of the population by nationality (using "foreigners" as a proxy for immigrants). Data are also available from the OECD, including educational attainment.

More technical and ancillary issues include the choice of a Cobb-Douglas specification of the production function, the supposed absence of economy of scale, the choice of labour share calibration, etc. Statistical and measurement problems (identification of the quality of productive factors, measures of hours worked) can also weigh upon the reliability of any detailed growth decomposition.

2.3. Computing a comparable indicator of labour quality: the initial education of labour

The indicator of "initial education of labour" measures the average productivity per person employed relative to the productivity of those with lower secondary education or less. The indicator moves with the change in the employment composition by educational attainment. If this change is neglected, it is implicitly incorporated in TFP movements (i.e. Solow's residual) and could be misinterpreted as a change in technical progress. The indicator is computed as follows:

(1) $$Q_t = \frac{1}{E_{L\,t} + E_{M\,t} + E_{H\,t}} \cdot \sum_{S \in \{Low, Medium, High\}} \left(E_{S\,t} \cdot \frac{W_{S\,2002}}{W_{L\,2002}} \right).$$

where E_s and W_s are respectively employment and hourly wage (without overtime) for each skill group. Q is the relative hourly wage of those with the educational attainment *s* (low, medium or high) compared with the low skilled (i.e. those with lower secondary education or less). As it is commonly assumed in the literature despite the non-competitive determination of wages in real life, this ratio is used here as a rough proxy of the relative productivity of those with skill *s* compared with the low skilled[13]. The data are stemming from the Structure of Earning Survey SES2002 and are only available for the year 2002[14]. In this framework, Q measures average productivity per person employed in low-skilled equivalent and Q*E*H

[13] While, in perfect competition, the level of employment in equilibrium is such that the marginal productivity of labour is equal to the hourly wage, in the real world, this assumption is clearly not verified for several reasons including: adjustment costs (hiring/firing costs, training costs), discrimination, monopsony, rent-sharing, frictions, automatic wage increases as a function of tenure, etc. A large literature, essentially based on matched employer-employee (panel) data, highlights that non competitive forces play an important role in the wage determination process. However, the purpose of our "labour quality indicator" is not to determine the relative productivity across educational attainments but just to illustrate the impact of the composition of employment by educational attainment on overall productivity. The value for this indicator fortunately appears only sensitive to material changes in the assumption about relative productivity.

[14] The indicator is based on the 2002 proxy of relative productivity by educational attainment: however, its real value should not change dramatically over a ten-year period.

measures total labour input expressed in low-skill equivalent. In this setting, a low skilled worker is worth one unit, while high skilled labour is worth the relative productivity of the high skilled compared with the low skilled (which is higher than 1). Although this method somehow resembles to that used by OECD (Scarpetta, Bassanini, Pilat and Schreyer, 2000), it is slightly different in the sense they compute the average wage per person employed rather than the average wage in low skill equivalent (that is, the average wage per person employed compared with that of the low skilled.). They use different data of wages by educational attainment. Indeed, another crucial point is that the relative wages used here to compute the indicator correspond to the EU15 average and not to the values of individual countries. Although using the latter might partly allow for reflecting the fact that the level of professional skills are not equivalent across countries for the same level of educational attainment, it faces the major shortcoming of also capturing the degree of wage compression and the existence (and level) of minimum wages, which strongly differ amongst EU countries. In countries with relatively high minimum wages compared with the average earnings, such as Belgium and France, the relative productivity of the high skilled as measured by relative wages is distorted and artificially low. Therefore, using a common standard for relative wages across all EU27 countries ensures that the indicator only measures differences in the initial education of those employed.

This indicator, which captures the impact of the compositional change of employment by educational attainment, is not entirely covering the very complex concept of "skill", and calls for a couple of caveats. It only includes initial education, but does not capture "on-the-job" gains in competence, professional experience and "soft-skills" which can be acquired through professional activity. It is a degree-based indicator, and does cater for early-school leavers who may have accumulated useful passive knowledge, which is not recognised by a formal diploma. More broadly, it measures the potential skills obtained in the schooling system and not the skills actually exploited through economic activity. The "over-qualification" of the workforce is indeed frequent in many European countries characterised by high unemployment rates. Moreover, it does not include the skills acquired through vocational training systems and life-long leaning policies[15].

[15] As an additional note of caution, the indicator does not take into account the imperfect substitutability across skill groups. A refinement would consist in using CES function to compute the indicator.

Having that in mind, the indicator provides useful insights and there is no obvious alternative. Its inclusion in the decomposition of economic growth has a number of significant advantages. It has clear economic meaning, albeit only capturing one dimension of the complex skill issue. It represents a significant effect, contributing to 0.3 p.p. of annual GDP growth in EU15 on average between 1995 and 2006. It is calculable and requiring neither model-based estimates nor micro-data, which are very complex and time-consuming to handle. One can compute it for all EU27 countries from 2006 back to the early 1990s, with annual update, based on relatively harmonised macro data coming from Labour Force Survey and following the international ISCED1997 classification. Moreover, there is no obvious operational alternative. Caselli (2005) constructs a measure of human capital using the specification found in Hall and Jones (1999) based on the Mincerian (log-linear) relationship between wages and years of schooling[16]. The difficulty is that the available data on the average years of education, coming from Barro and Lee (2001) dataset, are fairly old –mid 1990s – and unable to cover the changes occurred between 1995 and 2006, which is particularly problematic for many new member states where the average schooling years have risen a lot in the recent past. In an influential paper, De la Fuente and Domenech (2006) show that these data are fairly noisy and propose a more comprehensive and robust indicator of average number of years of schooling, and they measure its impact on growth by taking into account the positive externalities of human capital accumulation on growth. However, the raw data available at country level are not harmonised and generally of very poor quality. They only cover the adult population, not those employed and contributing to the economic activity. De la Fuente and Domenech (2006) use various econometric techniques to estimate the real contribution of average number of years of schooling to GDP growth. Their series are only computed from 1960 to 1999 and cover main OECD European countries only, leaving out half of the new member states. Their methodology is complex, not easily replicable for missing countries, and runs into data availability problems. It also faces the issue of excluding "on-the-job" learning and any kind of training[17].

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[16] Hall and Jones (1999) assume that human capital h is a log-linear function of the average years of schooling s $h = e^{\phi(s)}$, where $\phi(s)$ is a piecewise linear function with a constant slope for OECD countries, i.e. for most EU countries. In the latter, the average years of schooling are generally higher than 8 and the return to one extra year of education is around 6.8 percent according to Psacharopoulos (1994).

[17] Improvements in the measurement of labour quality have recently been proposed by Caselli and Coleman (2006) who trace the differences in cross-country residual to differences in the efficiency of skilled labour. Weil (2007) accounts for differences in the productive capacity of labour caused by differences in health.

How could one interpret the measured contribution of the "labour quality" component to economic growth? The structure of employment by skill is changing fast with the share of low skilled workers declining sharply over time. For instance, the share of those with lower-secondary education or less in total employment in EU27 fell from 37% in 1995 to 35% in 2000 and 30% in 2005, while the weight of those tertiary educated rose from 20% in 1995 to 23% in 2000 and 25% in 2005. Labour quality indicator in absolute terms made a positive contribution to growth over the period 1995 to 2006 in all countries except EE. This might reflect two trends of different nature, both contributing to the positive growth but difficult to disentangle:

- *the rise in the average educational attainment of the working-age population.* The average number of years of schooling has increased across the EU. This has partly been explained by the growing part played by education and knowledge in modern economies, but also by past policies which have (either deliberately or unintentionally) curtailed the labour supply, in particular, by delaying the entry of youth into the labour market;

- *the exclusion of the low-skilled from employment.* Three explanations for that are conventionally put forward, i.e. globalisation and the pressure exercised by low-wage countries, the "skill-bias" of technical progress which demands a more qualified and adaptable workforce at the expense of the low skilled, and increasing competitive pressures pushing firms to race for innovation and to implement or develop ICT, which are intensive in highly skilled employees.

3. WHERE DO EUROPEAN COUNTRIES STAND IN TERMS OF LABOUR UTILISATION AND PER CAPITA GDP?

3.1. Accounting for the level of living standard and labour utilisation: a multiplicative breakdown

In this section, we focus on differentials in GDP per capita across Member States, in particular looking at the gaps in levels in 2006. GDP per capita depends upon labour utilisation and hourly productivity. When it comes to explaining GDP per capita, the relevant concept of labour utilisation is total hours worked over total population, i.e. hours worked per capita. It is also often called “labour resource utilisation”. This can be divided into a demographic component (i.e. working-age population over total population) and a labour

market component (i.e. total hours worked per working-age person). We can relate the labour utilisation to the decomposition of GDP per capita, as follows:

$$GDP\ per\ capita = \frac{GDP}{Total\ population} = \left(\frac{Total\ hours\ worked}{Total\ population}\right)\cdot\left(\frac{GDP}{Total\ hours\ worked}\right) = Labour\ utilisation \times Hourly\ productivity$$

$$= \left(\frac{Working-age\ 15-64\ population}{Total\ population}\right)\cdot\left(\frac{Total\ hours\ worked}{Working-age\ 15-64\ population}\right)\cdot\left(\frac{GDP}{Total\ hours\ worked}\right)$$

$$= Demographic\ component\ for\ GDP\ per\ capita \times Labour-market\ component \times Hourly\ productivity$$

Then we split each of those sub-aggregates according to the decomposition outlined in Column IX in Table 1. While data sources are explained in Annex 1, the remainder of the section provides a detailed description of the methodology to decompose GDP per capita relative to a given benchmark: EU5, the five best performing EU5 countries (EU5) or the US.

We use the standard production function approach utilised by Hall and Jones (1999) and based on a Cobb-Douglas specification. Total output, measured by GDP and often denoted Y, can be expressed as:

$$(2) \qquad Y = A(E\cdot H\cdot Q_L)^{\alpha}K^{1-\alpha} = A(E\cdot H)\ Q_L{}^{\alpha}(E\cdot H)^{\alpha-1}K^{1-\alpha} = A\cdot Q_L{}^{\alpha}\left(\frac{K}{E\cdot H}\right)^{1-\alpha}(E\cdot H)$$

where A is an index measuring the level of technology, E stands for employment (labour in headcount), Q_L for labour quality (initial education of labour), H for the average number of hours worked and K for the stock of capital. Total output could be written as the product of the level of technology, total labour input (total hours worked) and the estimated impact of labour quality (power the labour share). An alternative and mathematically identical expression would be:

$$(3) \qquad Y = A\cdot\left(\frac{K}{E\cdot H.Q_L}\right)^{1-\alpha}\cdot(E\cdot H.Q_L)$$ where total labour input is expressed in terms of *hour worked by low-skilled persons* (incorporating the indicator of initial education of labour). However, in the following, we will consider the labour input in terms of total hours worked, as in specification (2).

E could be decomposed as the product of the total population *POP*, the share of working age population S*WP,* the participation rate *PART* and the rate of non-unemployment *(1-ur)*[18]*:*

(4) $$E = POP \cdot \frac{POP\,15-64}{POP} \cdot \frac{LF}{POP\,15-64} \cdot \frac{E}{LF} = POP \cdot SWP \cdot PART \cdot (1-ur)$$, where *POP15-64*, *LF* and *ur* are the working-age population, the labour force and the unemployment rate respectively.

Combining (2) and (4), GDP can be rewritten as:

(5) $$Y = \frac{Y}{H \cdot E} H \cdot E = \left(A \cdot Q_L{}^{\alpha} \cdot \left(\frac{K}{H \cdot E} \right)^{1-\alpha} \right) \cdot \left(H \cdot POP \cdot SWP \cdot PART \cdot (1-ur) \right)$$

If we consider GDP per capita, we get:

(6) $$\frac{Y}{POP} = \frac{Y}{H \cdot E} \cdot \frac{H \cdot E}{POP} = \left(A \cdot Q_L{}^{\alpha} \cdot \left(\frac{K}{H \cdot E} \right)^{1-\alpha} \right) \cdot \left(H \cdot SWP \cdot PART \cdot (1-ur) \right)$$

Considering the relative per capita GDP vis-à-vis the reference country or group of countries *B* (e.g. the EU15, the US or the five richer EU Member States), we can express it as the product of the relative level of each component. *A* could be renamed as Total Factor Productivity (*TFP*), which is the empirical measure of *A*.

(7) $$\frac{\frac{Y}{POP}}{\frac{Y_B}{POP_B}} = \frac{\frac{Y}{H \cdot E}}{\frac{Y_B}{H_B \cdot E_B}} \cdot \frac{\frac{H \cdot E}{POP}}{\frac{H_B \cdot E_B}{POP_B}}$$

Therefore, relative per capital GDP could be decomposed into (i) the relative effect of labour resource utilisation (i.e. ratio of total number of hours worked to total population) and (ii) the relative hourly productivity (i.e. ratio of total GDP to total number of hours worked). These two multiplicative components can be expressed as the product of the following relative sub-components:

[18] The non-unemployment rate is equal to one minus the unemployment rate *ur* and identical to the ratio of employment *E* over total labour force: *1-ur=1-U/LF=1-(E-LF)/LF=E/LF,* with *U* denoting the total number of unemployed people and *LF* denoting the labour force, that is, those participating in the labour market, either employed or available and actively looking for a job.

(8) $$\frac{\frac{Y}{H \cdot E}}{\frac{Y_B}{H_B \cdot E_B}} = \frac{TFP}{TFP_B} \cdot \left(\frac{\frac{K}{H \cdot E}}{\frac{K_B}{H_B \cdot E_B}} \right)^{1-\alpha} \left(\frac{Q_L}{Q_{LB}} \right)^{\alpha}$$

(9) $$\frac{\frac{H \cdot E}{POP}}{\frac{H_B \cdot E_B}{POP_B}} = \frac{H}{H_B} \cdot \frac{SWP}{SWP_B} \cdot \frac{PART}{PART_B} \cdot \frac{(1-ur)}{(1-ur_B)}$$

The decomposition for (i) the effect of labour utilisation is fourfold:

- the share of working age population (over total population)
- the total participation rate (i.e. labour force over working age population)
- the share of non-unemployment over total labour force, which is equal to one minus the unemployment rate. It is also equal to employment over labour force and also to the difference of labour force and unemployment over labour force. The higher the non-unemployment rate *1-ur*, the lower the unemployment rate *ur* and the higher the level of GDP per capita. For sake of simplicity, we henceforth call this component of per capita GDP "the unemployment component".
- average hours worked per person employed.

All these components are considered relatively to the chosen benchmark.

The decomposition for (ii) effect of labour productivity per hour worked is threefold:

- the capital intensity CI

$$CI = \cdot \left(\frac{K}{H \cdot E} \right)^{0.35} = \left(\frac{K}{H \cdot WP \cdot PART \cdot (1-ur)} \right)^{0.35}$$

CI is equal to the ratio (power the capital share 0.35) of total capital stock over total hours worked, which is the multiplication of average hours worked divided by the product of total working age population, total participation rate, the non-unemployment rate and the labour quality indicator in level.

- the labour quality $Q^{0.65}$ with $Q_t = \frac{1}{E_{L\,t} + E_{M\,t} + E_{H\,t}} \cdot \sum_{S \in \{Low, Medium, High\}} \left(E_{S\,t} \cdot \frac{W_{S\,2002}}{W_{L\,2002}} \right)$.

- Total factor productivity is obtained, as

TFP in level= GDP/CI/Total labour input/ Q^{α} *= GDP/[CI.H.WP.PART.(1-ur).* Q^{α} *]*

When we combine equations 7, 8 and 9, we get the final expression decomposing the relative per capita GDP into 7 components:

$$(10) \qquad \frac{\frac{Y}{POP}}{\frac{Y_B}{POP_B}} = \underbrace{\frac{\frac{E.H}{POP}}{\frac{E_B.H_B}{POP_B}}}_{\text{Relative labour utilisation}} \cdot \underbrace{\frac{\frac{Y}{E.H}}{\frac{Y_B}{E_B.H_B}}}_{\text{Relative labour productivity}} = \underbrace{\left(\frac{H}{H_B} \cdot \frac{SWP}{SWP_B} \cdot \frac{PART}{PART_B} \cdot \frac{(1-ur)}{(1-ur_B)} \right)}_{\text{Relative GDP per capita}} \cdot \left(\frac{TFP}{TFP_B} \cdot \left(\frac{\frac{K}{H \cdot E}}{\frac{K_B}{H_B \cdot E_B}} \right)^{1-\alpha} \left(\frac{Q_L}{Q_{LB}} \right)^{\alpha} \right)$$

where:

Y total GDP
α the share of labour in total value added, which is set equal to 65% in all countries
SWP the share of working age population (15-64) in total population
POP total population
PART total participation rate
ur the overall unemployment rate and (1-*ur*) the non-unemployment rate
H the annual hours worked per person employed
E total employment, which the product of *POP, SWP, PART* and *(1-ur)*
Q_L indicator of initial education of labour (proxy for labour quality)
K The stock of capital
TFP Total factor productivity as a residual
B the reference country or group of countries B (e.g. the US or the five richer EU Member States*)*

This decomposition could be made additive by taking the logarithm of the relative level. However, while the logarithm gives a proxy of relative per capita GDP gap[19], the second order terms are often far from being negligible making the two values differ substantially in some cases.

The analysis uses per capita GDP as the measure of the level of economic performance of a Member State. Per capita GDP seems to be the appropriate variable of wealth creation per capita when assessing the productive capacity of an economy, although it might not be the

[19] This proxy is mathematically derived from a limited development of order one.

best indicator to capture economic well-being. The relatively short period of assessment (1995-2006) enhances the relevance of using GDP per capita. Despite the weaknesses of GDP per capita as a measure of general well-being, changes in this indicator observed over a limited time period can generally be considered as a fairly good proxy for developments in well-being. In principle, the changes in GDP per capita are highly correlated with changes in other national account aggregates such as Gross National Incomes (GNI) or Net national incomes (NNI). Moreover, many other factors that have a significant effect on well-being but which are not reflected in GDP (such as leisure, wealth or income distribution) are in general slow-moving variables. While their secular evolution can considerably affect the overall well-being of the population over the long run (e.g. increasing leisure caused by the post-World War II decline of working hours in Europe), they can largely be treated as constant in the short time horizon considered.

When examining the level of per capita GDP across countries, it is useful to consider a *reference benchmark*. Here, we assess performance against two main benchmarks: the five richest EU Member States (hereafter referred to as EU5, consisting of AT, DK, IE, LU and NL) and the US. This is a reasonable choice, which provides a convenient yardstick to compare levels and has no consequence on the ranking of countries. The US data are somewhat less comparable statistics, as series coming from the *Bureau of Labour Statistics* for participation and labour quality are not fully equivalent to Eurostat concepts[20]. The *base year is 2006*, which is the last year for which data was available when this study was carried out.

3.2. Aggregate findings for the EU15, the euro area and the new member states

The gap in per capita GDP across EU Member States is very wide. In 2006, the EU27 average per capita GDP was 34% below that of the US and 26% below the average of the EU5 (LU, IE, DK, NL, AT).

When defining the labour utilisation as total hours worked over total population, the labour *underutilisation* in the EU27 appears to be substantial in comparison with the level of labour utilisation prevailing in the US: the gap is equal to -16% of the US level. Labour productivity in the EU27 is 22% below the US level. However, the situation regarding the

[20] Furthermore, taking the US is often found more debatable from a policy standpoint, as its social model and income distribution pattern are very different from Europe.

underutilisation of labour and the gap in labour productivity is very different between the EU15 and the new member states, which warrants looking at them separately. In the two following sub-sections, the driving forces behind labour underutilisation and labour productivity gap as well as their outcome in terms of per GDP capita gap will be examined for the EU15 and the euro area on the one hand and the new member states on the other hand.

3.2.1. Focus on the EU15 and the euro area[21].

The labour utilisation is defined as total hours worked over total population. The labour underutilisation vis-à-vis the US is even worse for the euro area (EUR-12) (-19%) and the EU15 (-17%) than for the EU27 (see Table 3 in Annex). When considering the five richest EU countries as a benchmark (by order LU, IE, NL, AT and DK), henceforth called EU5, the relatively low labour utilisation is confirmed, although the situation looks a bit brighter with a negative gap of -7% in the euro area and -5% in the EU15.

Considering the logarithmic decomposition of GDP per capita in Figure 1 and Table 4 in annex, the gap in labour utilisation vis-à-vis the US is due to the negative contribution of average hours worked (-9 percentage points) and, to a lesser extent, the relatively low labour market participation (-4 p.p.) and the high level of unemployment (-3 p.p.). The smaller share of working-age population in the EU15 adds marginally to the gap (-1 p.p.). Compared with the EU5, the labour utilisation gap of the EU15 and the euro area is only caused by the extensive margins, i.e. the relatively low labour market participation and the higher level of unemployment, despite the positive contribution of intensive margins (i.e. average hours worked)[22]. The gap in the euro area is slightly wider than that in the EU15 because of even weaker participation and, to a lesser extent, higher unemployment.

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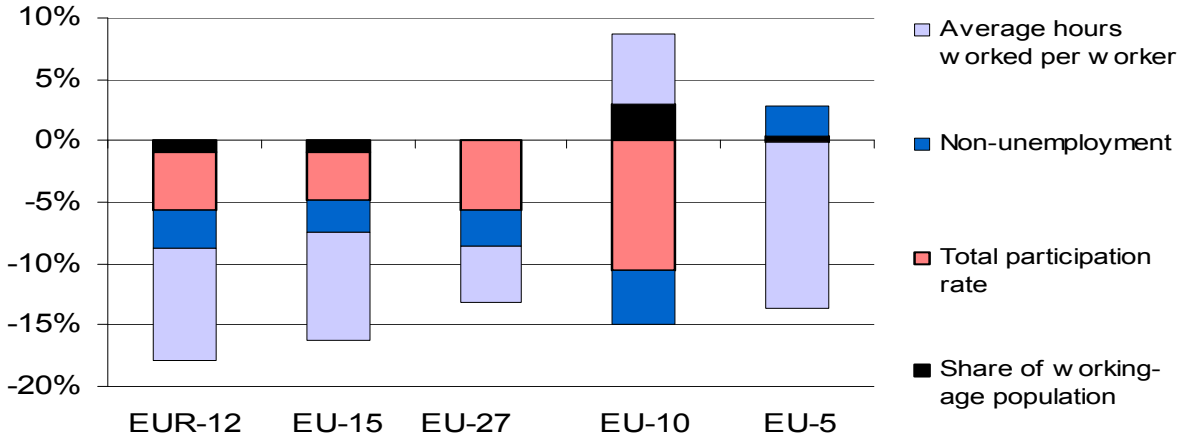
[21] The figures for the euro area correspond to the euro area with its 12 historical members (including Greece), as it stood until 31 December 2006. Thereafter, Slovenia joined the euro area on 1 January 2007 and Cyprus and Malta joined on 1 January 2008. Data were generally lacking for these countries, especially for the middle of the 1990s. Given the economic and demographic weight of these new members, the results for the euro area 12 are fairly close to those of the complete euro area with 15 members. Slovakia will be the next country to join the common currency from 1 January 2009.

[22] The relatively low level of average hours worked in the 5 best performing economies (EU5) is largely explained by the NL, which has the largest weight in EU5 and carried out policy of working-time reduction since 1982.

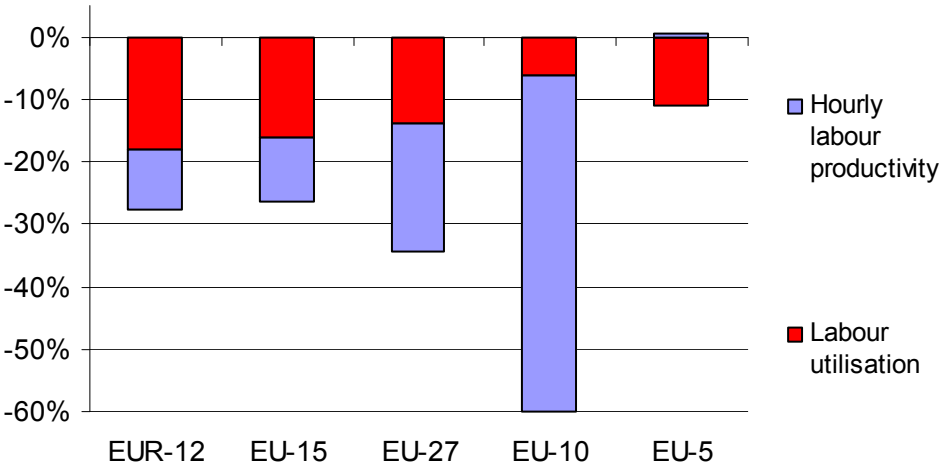
Figure 1 Labour utilisation gap vis-à-vis the US: driving forces



Note: The multiplicative components of per capita GDP relative to the US are expressed in logarithm so as to render them additive. The logarithm of the relative value of a variable vis-à-vis a benchmark is a first-order approximation for the gap compared with the benchmark (US). The value of each component is rescaled so that they add up to that of the per capita GDP gap relative to the US.

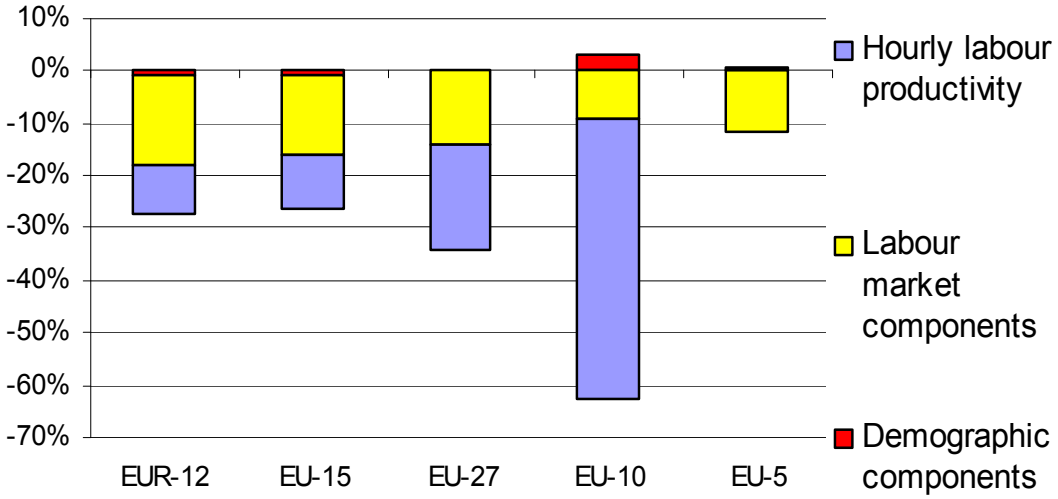
As a result and as shown in Figure 2 and Table 4 in annex, the relatively low labour utilisation explains around two third of the per capita GDP gap in the EU15 relative to US (16 p.p. out of 26%), while hourly labour productivity accounts for 10 p.p. only. The underutilisation of labour is even slightly higher in the euro area (18 p.p. out of 28%). While the labour underutilisation vis-à-vis the US is definitely smaller in the five richest countries, it entirely explains the gap of per capita GDP in EU5 relative to the US, with hourly productivity being even slightly higher than in the US. Figure 3 separates out the contribution of labour utilisation between demographic component (the share of working-age population - aged 15-64 - in total population) and labour market component (total hours worked over working-age population). The low labour utilisation is mainly related to the gap in the labour market component, with the demographic components only playing a marginally aggravating role in the EU15 and the euro area.

Figure 2 Decomposition of per capita GDP gap vis-à-vis the US into productivity gap and labour utilisation gap



Note: see figure 1.

Figure 3 Decomposition of per capita GDP gap vis-à-vis the US into productivity, demographic components and labour-market components

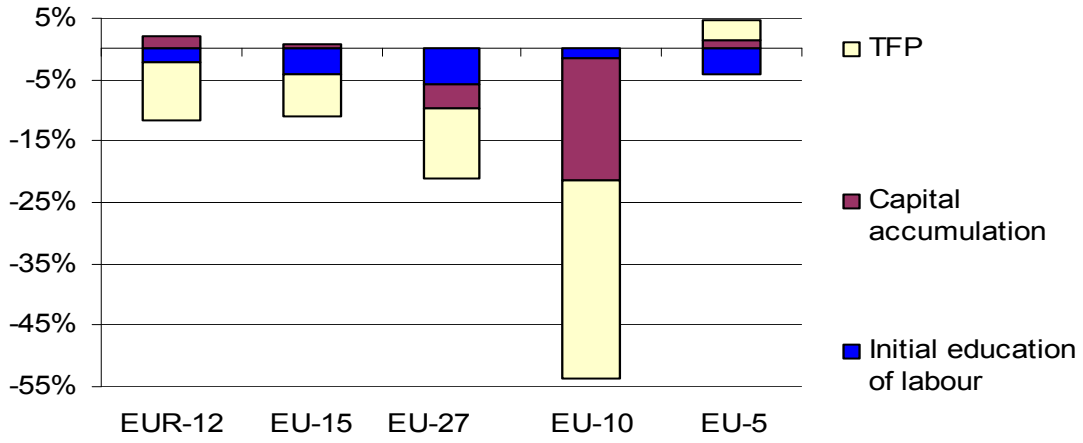


Note: see figure 1.

As seen in Figure 4 and Table 4 in annex, the negative productivity gap of EU15 vis-à-vis the US mainly stems from lower TFP level (-7 p.p.), aggravated by a lower initial education of labour (-4 p.p.), with the slightly stronger capital accumulation only having a marginal offsetting role. In the euro area, the negative TFP gap vis-à-vis the US is the same as in the EU15 (-9 p.p.). Moreover, while the negative contribution of labour quality is slightly lower in the euro area (-5 p.p.), the positive contribution of capital accumulation is slightly higher (2 p.p.). This implies that the overall productivity gap in the EU15 and the euro area vis-à-vis the five richest EU Member States (EU5) is almost identical. The contribution of the initial

education of labour to per capita GDP growth is exactly the same in the EU15 as in the EU5 and stands 1 p.p. lower in the euro area.

Figure 4 Labour productivity gap vis-à-vis the US: driving forces



3.2.2. Focus on the new member states (EU10+RO+BG)

Looking at the EU10, the income gap remains substantial in 2006, as per capita GDP in the EU10 is nearly 60% below the level of the US (64% including Romania and Bulgaria). However, it is only marginally attributable to labour underutilisation (-9 p.p.). While the combination of lower per-hour productivity and lower labour utilisation (i.e. hours worked per capita) is the cause of relatively low per capita GDP in euro area and EU15 countries[23], weak productivity is the main concern in the EU10.

The very strong negative productivity gap in the EU10 vis-à-vis the US, about 54% (57% in EU10+BG+RO) can be accounted for by lower TFP (-31 p.p.) and lower capital accumulation (-20 p.p.). By contrast, the initial education of labour plays a marginal role (-6 p.p.). The picture remains broadly the same, when turning to EU5 as a benchmark. It should be noted that the quality of labour is higher in the new member states than the EU15. However, the interpretation should remain very careful as the level of education in each category (lower secondary education at most, higher secondary education and tertiary education) may not be equivalent across countries, and in particular between the new member states and EU15 countries, due to the heterogeneity and lack of comparability across

[23] While the contribution of the gap is broadly shared between labour utilisation and labour productivity in the euro area, productivity growth explained almost two thirds of the gap in EU15.

educational systems. As displayed in Figure 1 and Table 3 in annex, the situation in terms of labour utilisation is more favourable in the 10 new member states acceded in 2004 (EU10) with an average gap of only -9% of the US level. This average gap is identical to that seen in the recently acceded countries in 2007 (Romania and Bulgaria). The EU10 even records a lead (positive gap) of 2% vis-à-vis the 5 richest EU countries (EU5).

This gap is due to the labour market component and more precisely to the extensive margins (with the participation rate contributing to 10 p.p. and unemployment to 4 p.p.), which are clearly lower than in EU15 and euro area countries. However, the number of hours worked per person employed (intensive margin) and the share of working-age population (demographic margin), which is higher in the EU10 than in the US, contribute to reducing the gap by 6 p.p. and 3 p.p. This feature is shared by most EU10 countries (except for MT) and by the newly acceded countries (Bulgaria and Romania), where demographics and average hours worked partly counterbalance the effect of a low rate of participation and a high rate of unemployment. When considering the EU5 as a benchmark, the labour utilisation appears clearly higher in the EU10, owing to much higher average hours worked and despite lower participation.

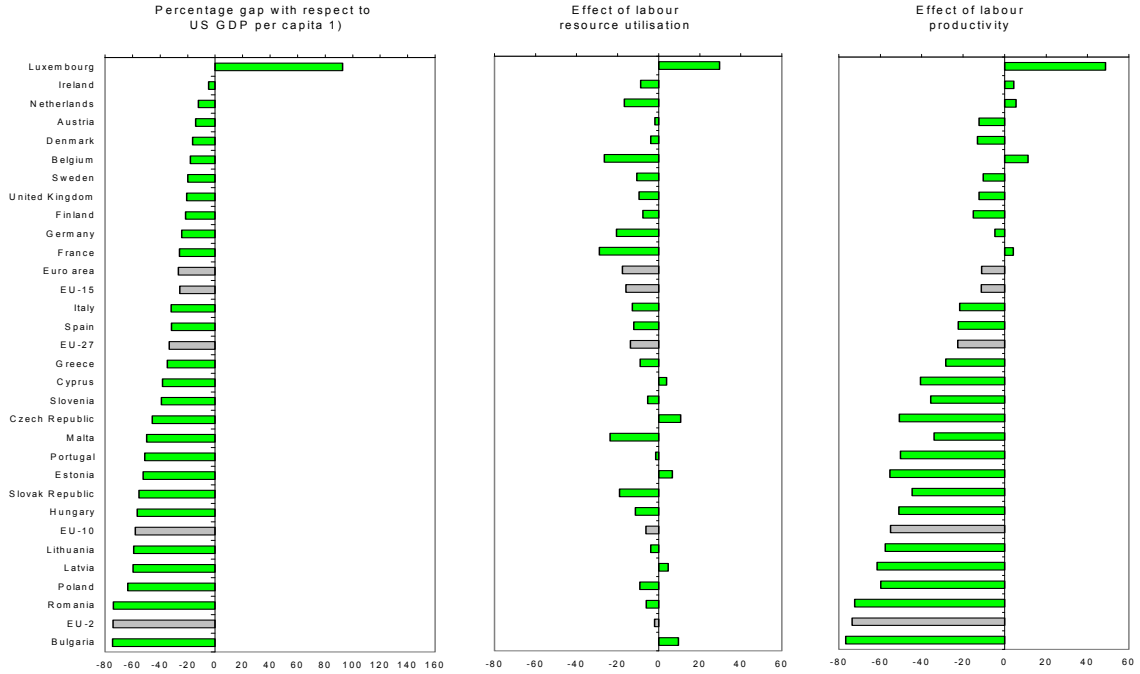
Labour utilisation is higher in the EU10 than in the five richest EU Member States, with a positive labour gap of 2%. The lead in labour utilisation relative to the EU5 is caused by the higher number of hours worked per person employed (intensive margin), while extensive margins (i.e. participation rate and, to a lower extent, unemployment) are clearly lower than in EU5. This feature is shared by most EU10 countries, except for SK, PL and MT, where the labour utilisation gap is negative vis-à-vis the EU5.

3.3. Results across countries

3.3.1. Sizeable heterogeneity in the level of labour utilisation and productivity across countries

Figure 5 shows the degree of heterogeneity in the EU27 in terms of GDP per capita and its two main components, i.e. labour utilisation and labour productivity. The gap in per capita GDP across EU Member States is wide. The picture appears broadly similar whether we take the five richest EU countries (LU, IE, DK, NL, AT) or the US, although the gap is slightly greater with the US as a reference benchmark.

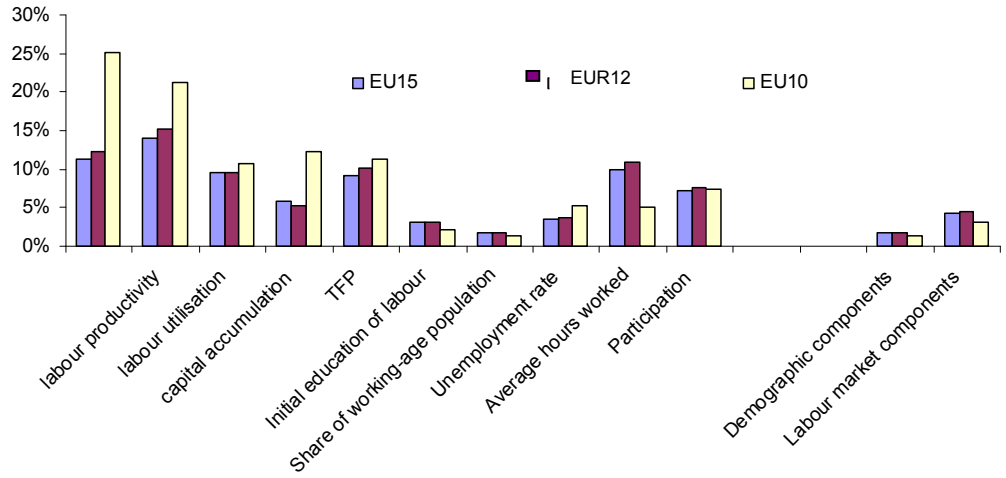
Figure 5. The sources of real per capita GDP differences vis-à-vis the US in 2006 (current PPS)



Labour utilisation lags behind the US in 2006 in most EU countries, with only six countries (of which five new member states) managing to have greater utilisation of labour than the US (LU, BG, CZ, EE, CY and LV). The picture appears similar whether we take the EU15, the five richest EU countries or the US as a reference benchmark, although the gap is slightly greater with the US. In addition, amongst the eight worst performers, six are EU15 countries, of which four large member states (FR, DE, ES and IT). The reason behind this low performance varies from country to country, but the main drivers in the large countries are generally low participation or low average hours worked, aggravated by high unemployment.

Labour productivity, however, remains the main source of per capita GDP dispersion (see Figure 6). In the EU15 and the euro area, the dispersion of hourly productivity is one third higher than the dispersion of labour utilisation. In the EU10, the coefficient of variation of labour utilisation is almost the same as that in the EU15, while the dispersion of productivity is virtually the double, explaining the higher overall dispersion of per capita GDP in EU10. Labour productivity lags behind the US in 2006 in most EU countries, with only five countries showing greater labour productivity than the US (LU, BE, NL, FR and IE).

Figure 6 Coefficient of variation of each component of per capita GDP



Note: The coefficient of variation is the ratio of the standard deviation to the average value. The coefficient of variation of each component of per capita GDP level for one particular set of countries (e.g. EU15) is mathematically equivalent to the standard deviation of the relative value of the component to the average value (i.e. EU15 here).

3.3.2. Looking into the dispersion in labour utilisation and productivity level

As displayed in Figure 6 and 7 breaking down the dispersion and the level of per capita GDP respectively, labour utilisation could be decomposed for each country into its demographic component (share of working-age population in total population) and its labour market component (total hours worked over working-age population). The latter appears as the dominant contributor to both the average level and the dispersion of labour utilisation. In general, in the EU15 countries (except for IE, NL, AT, ES and EL), the demographic component has a slightly negative bearing on the labour utilisation gap with the US, while it turns slightly positive in all new member states (EU10 + BG & RO). This decomposition is insightful for two reasons. First, while the labour market component is influenced by the institutions (e.g. financial incentives) and policies shaping the labour market, the demographic component of labour utilisation is exogenous, at least in the short to medium run[24]. Second, demographic evolutions are more easily predictable than the labour market component, as the current level of fertility and life expectancy allows one to foresee the trend impact of ageing on the share of working-age population. For instance, according to most recent Eurostat projection (Europop 2004), the country with higher current contribution to demographic will

[24] Family-friendly policies tend to operate with two decade lags (with newly born population needing to age 15 years before being considered as working-age population) and have not entirely proven their efficiency in terms of simulating the fertility rate. Moreover, migration flows and structure can be influenced by policies but only to some extent because of the importance of illegal migration and the human-right and politically charged dimension of the issue.

undergo a fast and sharp process of population ageing in the two decades to come, which would almost mechanically entail a dramatic reduction of labour utilisation in the near future (assuming no changes in migration policy).

Figure 7 Decomposition of labour utilisation vis-à-vis the US into its demographic and labour market components; 2006

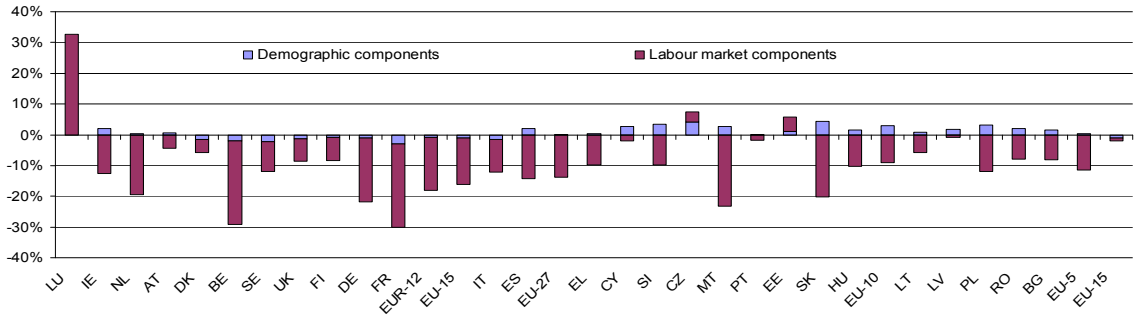


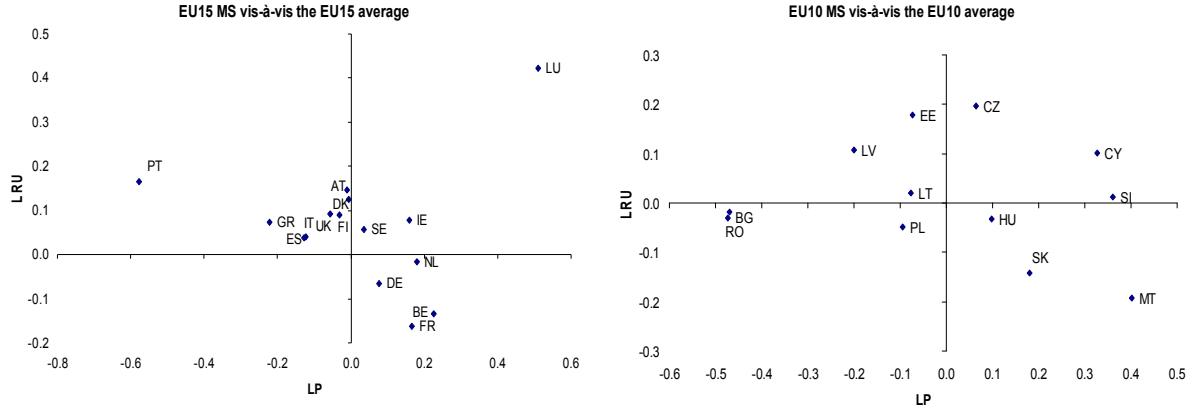
Figure 6 suggests that the dispersion of labour utilisation in the EU15 is mainly related to the average hours worked and (to a lesser extent) the labour market participation, while in EU10 the dispersion is broadly shared by the main labour market components (unemployment rate, average hours worked and the labour market participation). When looking into hourly productivity dispersion, the initial education of labour appears a minor driver, especially compared with TFP (and capital accumulation in the new member states).

Figure 6 also indicates that TFP is by far the main driving force behind productivity dispersion in the EU15 and the euro area, while both capital accumulation and TFP explain the high productivity dispersion in the new member states. The substantial contribution of TFP to per capita GDP dispersion does not come as a surprise and confirms the key result found by Caselli (2005) that "the answer to the development accounting question – do observed differences in the factors employed in production explain most of the cross-country variation in income – is: no, way no." Basically, TFP, which is the "unexplained" part of development accounting, is the main driver behind per capita GDP differences across EU countries. He also found that this conclusion is robust to many refinements in the measurement of production factors.

Although we do not claim to investigate this issue in detail, it is important to recall that the per capita GDP components might partly be tied with each other, illustrating the existence of interlinkages across components (complementarities or tradeoffs). The most blatant illustration is the negative relationship seen in most countries between productivity level and labour utilisation. The first panel of Figure 8 suggests that most countries perform relatively

well in one dimension only and relatively poorly in the other. The upper-left quadrant features the countries with above-EU15-average labour utilisation but below-EU15-average labour productivity (PT, GR, ES, IT, UK, DK, FI, AT), while the lower-right quadrant spots the countries with below-EU15-average labour utilisation but above-EU15-average labour productivity (DE, NL, BE and FR). Only SE, IE and LU manage to perform relatively well in terms of both labour utilisation and productivity, which is graphically seen through their presence in the upper-right quadrant. As regards the new member states, the existence of negative relationship between labour productivity and labour utilisation is less obvious, as CZ, CY and SI perform relatively well on both fronts and BG, PL and RO experience relative underperformance of labour utilisation and hourly productivity. The economic explanation of a negative relationship between the two dimensions is that a dynamic labour market succeeds in including the least productive persons (which is likely to reduce "the initial education of labour" by a sheer compositional effect), while high productivity might partly result from the fact that the least productivity are excluded from poorly-performing labour market. Of course, this negative relationship does not hold when high productivity mainly stems from strong innovation, materialising as high TFP.

Figure 8 Relationship between the gap of labour productivity (LP) and labour utilisation (LRU) in 2006



4. DECOMPOSING THE GROWTH OF LABOUR AND GDP

4.1. Accounting for the growth of GDP and labour input: an additive breakdown

The methodology is close to the one outlined above for the level of living standards (per capita GDP level). However, the additive nature of the growth decomposition and its absolute dimension – considering the absolute growth rate for each country, as opposed to the relative per capita GDP vis-à-vis a reference benchmark – allow for going further in the decomposition.

When it comes to explaining GDP per capita, the relevant concept of labour utilisation is total labour input (i.e. total hours worked in the economy), which can also be split between a demographic component (i.e. working-age population, aged 15-64) and a labour-market component (i.e. total hours worked per working-age person). We can relate total labour input to the decomposition of GDP, as follows:

$$GDP = Total\ hours\ worked\ .\left(\frac{GDP}{Total\ hours\ worked}\right) = Labour\ input \times Hourly\ productivity$$

$$= Working-age\ 15-64\ population\ .\left(\frac{Total\ hours\ worked}{Working-age\ 15-64\ population}\right).\left(\frac{GDP}{Total\ hours\ worked}\right)$$

$$= Demographic\ \ component\ for\ GDP \times Labour-market\ \ component \times Hourly\ productivity$$

The growth rate over time is decomposed into twelve components instead of seven in the accounting of per capita GDP, namely the contribution of natural population increase, migration rate, share of working-age population in total population, participation of youth, prime-age men, prime-age women and older workers, unemployment, hours worked, labour quality, capital deepening and Total Factor Productivity (as the Solow's residual). As regards the time horizon, the GDP growth in the period 1995-2006 is considered. This period of 11 years roughly corresponds to a complete business cycle in most EU15 countries. This can broadly be seen by the output gap, which was close to zero (-0.1%) on average over this period in the EU15 and was almost identical at the beginning and at the end of the period.

The detailed decomposition of GDP growth - into 12 components - used in this paper and presented in column V on Table 1 is based on the data described in Annex 1. It could theoretically be derived as follows.

The production function approach presented in equation 2 in section 3 can be rewritten in growth rate (or logarithm) so that the GDP growth rate follows the equation below:

(11) $$g_Y = g_A + (1-\alpha)(g_K - g_E - g_H) + \alpha g_{Q_L} + g_H + g_E$$

where g is the growth rate, Y total output, E employment (labour in headcount), H average hours worked, α the share of labour in output. A measures that part of output that cannot be explained by growth of either labour or capital. This term is referred to as the growth rate of total factor productivity (TFP).

We can also further decompose employment E in headcount, using the mathematical identity captured by equation 4:

(12) $$g_Y = g_A + (1-\alpha)(g_K - g_E - g_H) + \alpha g_{Q_L} + g_H + g_{POP-M} + g_m \cdot \frac{m_{t-1}}{1-m_{t-1}} + g_{SWP} + g_{PART} - g_{ur} \cdot \frac{ur_{t-1}}{1-ur_{t-1}} \cdot$$

where *PART* denotes the participation ratio as a share of working-age population and *ur* the rate of unemployment. Q_L is the indicator of quality of labour input (proxied by the structure of employment by skilled) and *SWP* is the share of working-age population (15-64) in total population POP, *(POP-M)* is population without net migration, *gPOP-M* the natural population increase, *m* the net migration rate *m=M/POP*

Each item of this formula can be computed as follows:

The expression $g_m \cdot \frac{m_{t-1}}{1-m_{t-1}}$ corresponds to the growth rate of the ratio *POP/(POP-M)= 1/(1-m)*.

The expression $-g_{ur} \cdot \frac{ur}{1-ur}$ corresponds to the growth rate of the non-unemployment rate *1-ur*, which is defined as one minus the unemployment rate *ur*. When the growth in the unemployment rate decreases, the contribution of the non-unemployment rate to GDP growth rises, and vice-versa. For sake of simplicity and as in section 3, we will name the growth rate of the non-unemployment rate the “contributions of unemployment to growth” or more simply the "unemployment contribution".

The expression $(g_K - g_L - g_H)$ is capital deepening, where labour input is expressed in total hours worked. K stock is derived from AMECO.

The expression $\alpha.g_{Q_L}$ is the contribution of the initial education of labour, which proxies the quality of labour. It is generally considered as a component of labour productivity.

The expression $g_H + g_{POP-M} + g_m \cdot \frac{m}{1-m} + g_{SWP} + g_{PART} - g_{ur} \cdot \frac{ur}{1-ur}$ is the contribution (and the growth rate) of labour input expressed in total hours worked, while $g_A + (1-\alpha)(g_K - g_E - g_H) + \alpha . g_{Q_L}$ is the contribution (and the growth rate) of hourly labour productivity.

The growth rate of labour market participation g_{part} can be decomposed as the weighted average of the growth rate of participation of each gender and age group.

$$g_{part\ t} = \sum_{G \in \{(15-24),\,(25-54)men,\,(25-54)women,\,(55-64)\}} g_{G\ t} \cdot \frac{WP_{G\ t-1}}{WP_{t-1}}$$

g_{part} is computed as the sum of the contribution of each gender- and age-group. It may differ slightly from the direct calculation of g_{part} owing to rounding and the omission of cross terms of second order. As the participation rates by age and gender come from the Labour Force Survey (Eurostat), we rescale them. Therefore, the contribution of each gender- and age-group is recalculated so as to add up to the value of g_{part} computed directly from the National account (taken from AMECO database). This statistical rescaling is necessary to convert the LFS data on participation for specific age group into National Account concepts, which are consistent with the concept of GDP and are systematically employed in the GDP accounting exercise. The chosen rescaling correction is of additive nature and consists of the gap between the overall contribution of total participation in LFS and Nationals accounts, weighted by the share of the group in the working-age population.

The growth rate of TFP corresponds in first approximation to a growth residual:

$g_{TFP} = g_A \approx g_{GDP} - \left((1-\alpha)(g_K - g_E - g_H) + \alpha g_{Q_L} + g_H + g_{POP-M} + g_m \cdot \frac{m_{t-1}}{1-m_{t-1}} + g_{SWP} + g_{PART} - g_{ur} \cdot \frac{ur_{t-1}}{1-ur_{t-1}} \right)$. In all rigors, g_{TFP} should be derived from the TFP in level and calculated as a multiplicative residual. However, given that each component of GDP has a low growth rate, i.e. below 1% often, we could safely take the first-order limited development. The difference between the two derivations (additive residual in growth rate or growth of the multiplicative residual in level) provides virtually the same results (in percentage) at the first decimal.

We can finally rewrite equation 10 as:

(11) $$g_Y = g_{POP-M} + g_m \cdot \frac{m_{t-1}}{1-m_{t-1}} + g_{SWP} + s_{15-24} g_{PART-15-24} + s_{25-54-M} g_{PART-25-54-M} + s_{25-54-F} g_{PART-25-54-F} + s_{55-64} g_{PART-55-64} - g_{ur} \cdot \frac{ur_{t-1}}{1-ur_{t-1}} + g_H + (1-\alpha)(g_K - g_E - g_H) + \alpha g_{Q_L} + g_{TFP}$$

where:

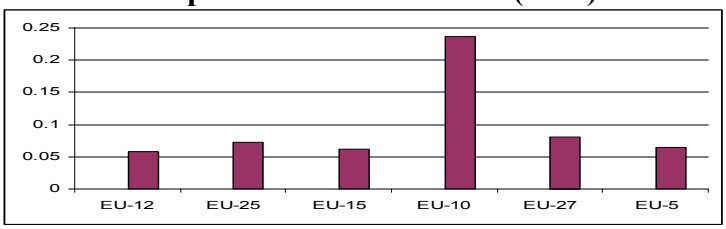
g denotes the rate of growth
α the share of labour in total value added, which is set equal to 65% in all countries.
t-1 preceding time period (generally the year before the reference year)
POP-M Native population
m net migration rate (net migration flow over total population)
SWP the share of working-age population in total population
S15-24, S55-54-M, S55-54-F, S55-64, the share in total working age population (15-64) of those aged 15-24, the male prime-aged, the female prime-aged and those aged 55-64 respectively.
PART-15-24 the youth participation rate
PART-25-54-M the participation rate of the male prime-aged
PART-25-54-F the participation rate of the female prime-aged
PART-55-64 the participation rate of older-workers
ur the overall unemployment rate and (1-*ur*) the non-unemployment rate
H the annual hours worked per person employed
E total employment, which the product of *POP, SWP, PART* and *(1-ur)*
Q_L indicator of initial education of labour (proxy for labour quality)
K the stock of capital
TFP Total factor productivity computed as a residual

It is relevant at this stage to discuss the impact of the labour share assumptions on the growth decomposition. The *share of labour* is set equal to 65%. In other words, the per capita GDP analysis is carried out with a constant and cross-country identical value for the labour share and the capital share. The share of 65% is exactly the EU15 value reported for the last available year (2005) in the Groningen (GGDC) Total Economy Growth Accounting Database. Surveying the literature on development accounting, Caselli (2005) uses an almost identical labour share of 2/3, which corresponds to the long-run and broadly constant average value in the US, although he acknowledges that the accounting results appear fairly sensitive to the choice of labour share value. The major rationale behind imposing the *same* labour share to all countries is that we wish to compare the sheer difference in growth performance in labour and capital across countries without bothering about the difference in the labour and capital shares. Implicitly, the comparison of growth components across EU countries is carried out with a *common* production function, allowing only the difference in growth rates to matter and leaving aside the different economic structure. As shown in equation 11, imposing a common labour share has only an impact on the decomposition of hourly productivity into capital deepening, TFP (as a residual) and the initial education of labour, the

other components remaining unaltered. Of course, the decomposition of productivity might slightly be affected if the actual labour share is far from 65%.

When one adopts a different labour share assumption, say 70% instead of 65% in the baseline, the impact on TFP remains limited in the EU15 and EU27 with a rise of 0.05 p.p. in TFP growth, as seen in Figure 9. The contribution of capital deepening is affected with broadly the same magnitude but in the opposite direction, so that the growth of labour productivity remains unchanged. While TFP growth in the EU10 is altered more significantly (0.25 p.p.), this remains proportionate to the higher TFP growth rate prevailing in the EU10 (1.6%).

Figure 9. Impact of adopting 70% labour share assumption on TFP growth in 2001-2006 compared with the baseline (65%)



4.2. Main findings at the aggregate level

4.2.1. Focus on the EU15

Over the last ten years (1995-2006), annual average growth was 2.3% in the EU15 as a whole, as seen in Figure 10. Of this:

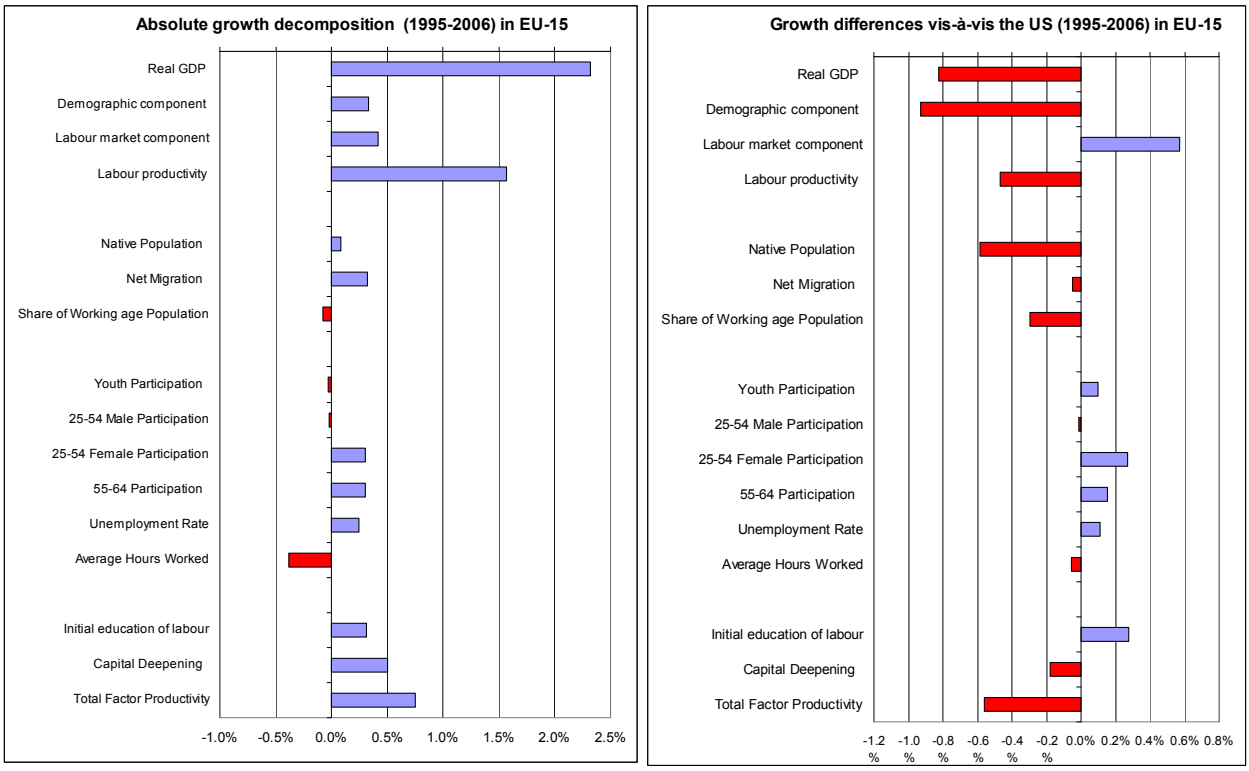
- *labour productivity* explained around two thirds of it. TFP growth accounted for 0.8 p.p. of total productivity increase, while 0.5 p.p. and 0.3 p.p. were attributable to capital deepening and the initial education of labour respectively, as shown in Figure 4.

- *labour input growth*, i.e. the growth in total hours worked, was the driving force behind the remaining third of the annual average GDP growth (0.8 p.p.). The demographic component explained 0.3 p.p., while the labour market component accounted for 0.4 p.p. As regards the former, migration explained all of it, with the negative contribution of the share of working-age population counterbalancing the slight increase in the native population. As regards the labour market component, the rise of the employment rate (extensive margins) contributed to 0.8 p.p. owing to the increase of both female and older-worker participation and, to a lesser extent, the decline in unemployment, which was partly offset by the negative contribution of

male participation. By contrast, youth and male participation was stalling and therefore had no effect on growth. The decrease in the average hours worked per worker (also called the intensive margin) exercised a negative effect of –0.4 p.p.

Compared with the US, the average EU15 growth rate was around 0.8 p.p. lower in 1995-2006, as shown in Figure 10. The main drivers were, first, the much less favourable demographic developments and, second, the lower growth in productivity. On the demographic side, the native population and, to a lesser extent, the share of working-age population grew much less than in the US. On the productivity side, TFP was the main factor behind the EU15 gap, with capital deepening being an aggravating factor. However, the labour market situation improved vis-à-vis the US, especially due to the fairly strong contribution of participation and despite the negative impact of hours worked. It should be noted that the stronger increase in the participation rates in EU15 partly reflects the still wide gap prevailing with the US. Moreover, the initial education of labour grew more in the EU15, although the results should be interpreted very carefully, as the available data are not fully harmonised across the Atlantic and the data on employment breakdown by educational attainment for the US are only available from 2001.

Figure 10. Growth decomposition in the EU15. 1995-2006
(annual average growth rate and contribution per component in p.p.)



The picture in the euro area is broadly similar to that in the EU15 over the period 1995-2006, although the average GDP growth was slightly lower in the euro area (2.2%). This weaker performance could be attributed to lower TFP growth and lower growth in the initial education of labour. As regards the labour input in the euro area, the labour market component counterbalanced the negative demographic contribution: the slightly more marked consequence of ageing on working-age population was offset by more dynamic female participation.

When one looks at the period following the launch of the Lisbon strategy (2001-2007) using recently updated data, the annual average growth rate in the EU15 appears to be 0.3 p.p. lower (i.e. 2.0%) than in the period 1995-2006 (see Table 6 in annex)[25]. This is consistent with the overall poorer cyclical conditions. The difference is mainly due to a slower growth in TFP (-0.3 p.p.) in the period 2001-2007. Annex 4 shows that, in the EU15, the picture for 2001-2006 remains broadly valid once corrected for the business cycle. The deterioration of the business cycle is estimated to have cut GDP growth by 0.2 p.p. a year on average, due to cyclically-depressed TFP. The latter incorporates the movements in productive capacity utilisation that are not captured by cyclical movements in labour input: for instance, a high level of labour hoarding in a cyclical downturn will be reflected in lower TFP.

4.2.2. Focus on the EU10

Over the last ten years (1995-2006), the annual average growth rate was 4.4% in the EU10 as a whole. Labour productivity explained almost all of it (4.3 p.p.), compared with only 0.1 p.p. for labour input. Capital deepening and TFP growth accounted for 1.9 p.p. and 2.1 p.p. of total productivity growth, while the contribution of the initial education of labour was much more modest (0.3 p.p.).

Although labour input growth explained a minor part of annual average growth, its contribution varied a lot across its components. While demographics contributed positively to labour input growth (+0.3), the labour market component displayed a negative contribution in the EU10 (-0.2), as opposed to +0.4 in the EU15. The rising share of working-age population, increasing older worker participation and dropping unemployment contributed to 0.5 p.p., 0.2

[25] The annual average growth rate in 2001-2006 comes down to comparing the level of 2006 with the 2000 level..

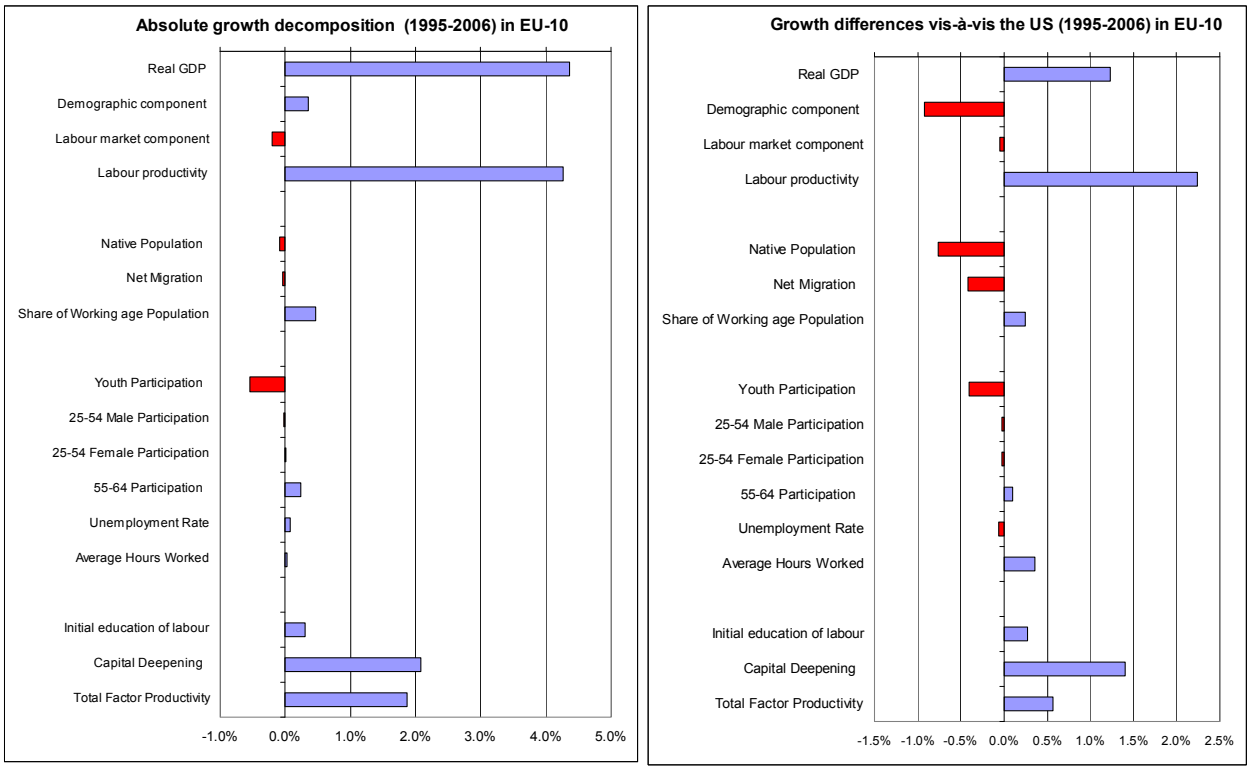
p.p. and 0.1 p.p. of labour input growth respectively. This was partly counterbalanced by the adverse contribution of sharply declining youth participation (-0.5 p.p.) and declining native population (-0.1 p.p.). Net migration, male participation and average hours worked were broadly stable, therefore having no bearing on EU10 economic growth.

Beyond the mechanical reading of each component separately, one could consider the interaction between components, albeit in a fairly qualitative manner. For instance, the sharp drop in youth participation is likely to be due, in part, to the massive increase in university enrolment in the new member states, which has translated into an increase in the initial education of labour. Moreover, the absence of decline in average hours worked unlike in the EU15 might be related to stalling or even falling part-time employment rates in most new member states, which might in turn have contributed to the stagnation of female participation. The contrast is striking with EU15 countries, often characterised by fast-rising female participation associated with increasing part-time employment rate (Buddelmeyer et al. 2008). Lastly, we may wonder whether the strong rise in capital deepening and TFP would have been somewhat smaller, if the labour market had been more inclusive: beyond the dominant catching-up effect, the strong capital deepening may reflect some substitution of capital for labour. Likewise, the timid growth in labour input might mean that the low skilled are kept outside the labour market, which induces a positive impact on TFP but not necessarily on total GDP growth.

Compared with the US, the average GDP growth rate in the EU10 was around 1.2 p.p. higher in 1995-2006, as seen in the second panel of Figure 15 in annex. The main driver of the difference was the much higher capital deepening, higher TFP growth. These factors correspond to the economic process of real convergence. The stable average hours worked, the fast rising share of working population and the rise in older worker participation were additional factors: the first one partly arises from the decline in part-time employment;. the second one is due to the very dynamic fertility rate, i.e. around 2%, prevailing in EU10 countries until the collapse of the Eastern block in the early 1990s;[26] the last one might partly relate to a cohort effect, that is, the gradual replacement of the current generation of older workers by younger people reaching 54 years one, more educated and more attached to the labour market.

[26] This baby boom henceforth interrupted and was followed by a baby "crash".

Figure 11. Growth decomposition in the EU10 1995-2006
(annual average growth rate and contribution per component in p.p.)



However, the labour market component grew at the same pace as the US, while the contribution of the demographic component of labour input was much lower than in this US, due to the lower growth of native population and the existence of a net emigration in the new member states (compared with the net immigration in the US).

Taking a shorter perspective and using up-to-date data, i.e. the period following the launch of the Lisbon strategy (2001-2007), the annual average growth rate in the EU10 appears to be only 0.3 p.p. higher (i.e. 4.7%) than in the period 1995-2006, due to higher labour input growth despite slightly less dynamic productivity (see Table 6 in annex). The latter is mainly due to a slower capital deepening. The growth in labour input was 0.4 p.p. higher compared with the period 1995-2006: the contribution of unemployment and, to a lesser extent, older worker participation was more favourable but partly offset by the lower contribution of declining average hours worked and youth participation in 2001-2007. By contrast, Romania and Bulgaria enjoyed a much stronger growth in the period 2001-2007, due to almost doubled growth in labour productivity and more favourable movements in the labour market component. Annex 4 shows that, once the effect of the business cycle is taken into account, the picture for 2001-2007 is somehow altered in the new member states for some specific growth components. The latter are TFP and unemployment and to a lower extent, capital deepening and initial education of labour. The magnitude and direction of the business cycle

effects hinge on the cyclical conditions (i.e. level and change in the output gap), which were much varying across the new member states in 2001-2007 (e.g. RO and BG, the Baltics, the other EU10 countries). This method of cyclical correction used here is based on a simple and transparent approach and is applicable to each GDP component. It is carried out for purely illustrative purposes.

4.3. The high variation of labour growth and economic growth across countries

4.3.1. First hint at the different patterns of economic growth

This section draws a tentative typology of countries regarding their growth pattern with particular attention to labour input. Table 2 provides a decomposition of growth into labour input growth and labour productivity growth, both per head and per hour worked. We preferably use the latter in this paper since the average hours worked is a key component of the labour input, as illustrated by the difference between the two measures.

Table 2 Breakdown of GDP growth between labour and productivity, 1995-2006, EU27 countries

1995-2006	Real GDP	Labour measured per person employed		Labour measured by total hours worked (labour input)	
		Employment	Labour productivity per head	Labour input	Hourly labour productivity
BE	2.2	1.0	1.2	1.0	1.2
CZ	3.2	0.0	3.4	-0.2	3.5
DK	2.3	0.6	1.7	1.1	1.2
DE	1.5	0.3	1.1	-0.3	1.8
EE	7.1	-0.4	7.5	0.0	7.1
EL	3.8	0.9	2.9	0.8	3.0
ES	3.6	3.4	0.2	3.0	0.6
FR	2.2	1.0	1.2	0.3	1.9
IE	7.6	4.2	3.4	3.4	4.2
IT	1.5	1.1	0.4	0.8	0.6
CY	4.1	2.1	2.0	2.6	1.5
LV	6.6	0.0	6.6	-0.1	6.7
LT	6.1	0.0	6.2	0.6	5.5
LU	4.7	1.7	3.1	1.4	3.4
HU	3.9	0.4	3.6	0.2	3.7
MT	3.0	1.0	2.0	0.7	2.3
NL	2.7	1.5	1.2	1.1	1.6
AT	2.3	0.5	1.7	0.3	2.0
PL	4.6	0.0	4.6	0.1	4.5
PT	2.5	1.0	1.5	1.3	1.2
SI	4.2	1.1	4.0	1.0	4.1
SK	4.7	0.8	3.9	0.3	4.4
FI	3.8	1.6	2.2	1.3	2.5
SE	3.0	0.7	2.3	0.5	2.5
UK	2.8	1.1	1.8	0.7	2.2
BG	2.7	0.9	1.8	1.2	1.5
RO	3.1	-1.2	4.4	-0.6	3.7
US	3.1	1.4	1.7	1.1	2.0
Euro area	2.2	1.2	1.0	0.8	1.4
EU-25	2.4	1.0	1.4	0.6	1.8
EU-15	2.3	1.1	1.2	0.8	1.6
EU-10	4.4	0.1	4.3	0.1	4.3
EU-27	2.4	0.9	1.5	0.6	1.8
EU-5	3.1	1.4	1.7	1.3	1.8

Based on a cursory examination of the absolute contributes of labour input and hourly labour productivity (see Table 2) to GDP growth between 1995 and 2006, four groups of countries emerge:

- one Member States have both low labour input growth (at or below the EU27 average of 0.6%) and low hourly productivity growth (at or below the EU27 average of 1.8%): DE;

- ten Member States had low labour input growth (at or below the EU27 average of 0.6%) and high productivity growth (over the EU27 average of 1.8%): CZ, EE, FR, LV, HU, AT, PL, SK, SE and RO. These are a mix of EU10 Member States and mature economies plus RO;

- eight Member States had high labour input growth (over the EU27 average of 0.6%) and low productivity growth (at or below the EU27 average of 1.8%), i.e. BE, DK, ES, IT, CY, NL, PT and BG. These are Mediterranean countries plus BG and the two main Benelux countries;

- eight Member States had high labour input (over the EU27 average of 0.6%) and high productivity growth (over the EU27 average of 1.8%), i.e. EL, IE, LT, LU, MT, SI, FI and UK. These are the faster growing catching-up EU10 countries plus dynamic EU15 economies such as Ireland, Greece, Finland and UK.

When looking deeper into subcomponents, some tentative stylised facts emerge (see Annex 5). Countries with low labour input growth in 1995-2006 tend to have experienced a sharp decline of their working time, which was often aggravated by either a fall in youth participation or a rise in unemployment (reflected by its negative contribution). Moreover, the contribution of female participation seems to have been relatively weak. Other factors, such as the decline in native population or population ageing, deteriorated the picture further in some countries. Conversely, countries with low labour productivity growth in 1995-2006 recorded both weak TFP growth and capital accumulation contribution. In a few countries, TFP growth was even negative (ES and IT), possibly partly due to statistical problems. Symmetrically, countries with high labour productivity growth in 1995-2005 (over 1.8%) experienced both buoyant growth in TFP and strong capital deepening contribution.

An interesting exercise would be to consider the period following the launch of the Lisbon strategy (2000-2006). The results above are not altered dramatically. However, the

comparison with the EU27 average is a coarse method to classify countries into groups, as a country in a given group could be close to or very far from the average. We then further identify groups of countries with similar growth pattern running a preliminary cluster analysis, which is a common and well-established statistical technique. There are two major methods of clustering, namely hierarchical clustering and non-hierarchical k-means clustering. As a first exploration, we run non hierarchical clustering analysis (with 5 groups) on all of the twelve components of growth. The number of groups (5 groups) has been chosen recursively so that the final grouping could be interpreted easily from an economic point of view. A robustness check is then carried out using a complete linkage cluster analysis, where the degree of desegregation is not pre-determined. For the period 2000-2006, the following five groups emerge from the statistical analysis:

- Cluster 1 consists of six "*moderately growing mature EU15 economies"* (BE, DE, FR, NL, DK, AT, UK) plus SI. The six EU15 Member States registered a low GDP growth rate in the period 2000-2006. SI presented similar patterns in terms of participation change, unemployment change and population growth.

- Cluster 2 is mainly composed of *"Mediterranean countries"* (CY, ES, MT, IT and PT) together with LU. These countries distinguish themselves from the moderately growing mature EU15 group because they registered lower productivity growth and higher labour input growth.

- Cluster 3 refers to "*Dynamic growth EU15 economies and most recently acceded countries".* It is composed of fast growing EU15 countries (EL, IE, FI and SE) plus the two newly acceded countries (BG and RO). These countries present high productivity growth (TFP+ capital deepening);

- Cluster 4 corresponds to four "*Catching-up EU10 Member States"* (CZ, HU, SK and PL), characterized by high GDP growth due to buoyant productivity growth and despite stalling labour input;

- Cluster 5 is made up of the three *"Very fast catching up Baltics"* (EE, LV and LT), characterized by very high growth in both productivity and labour input.

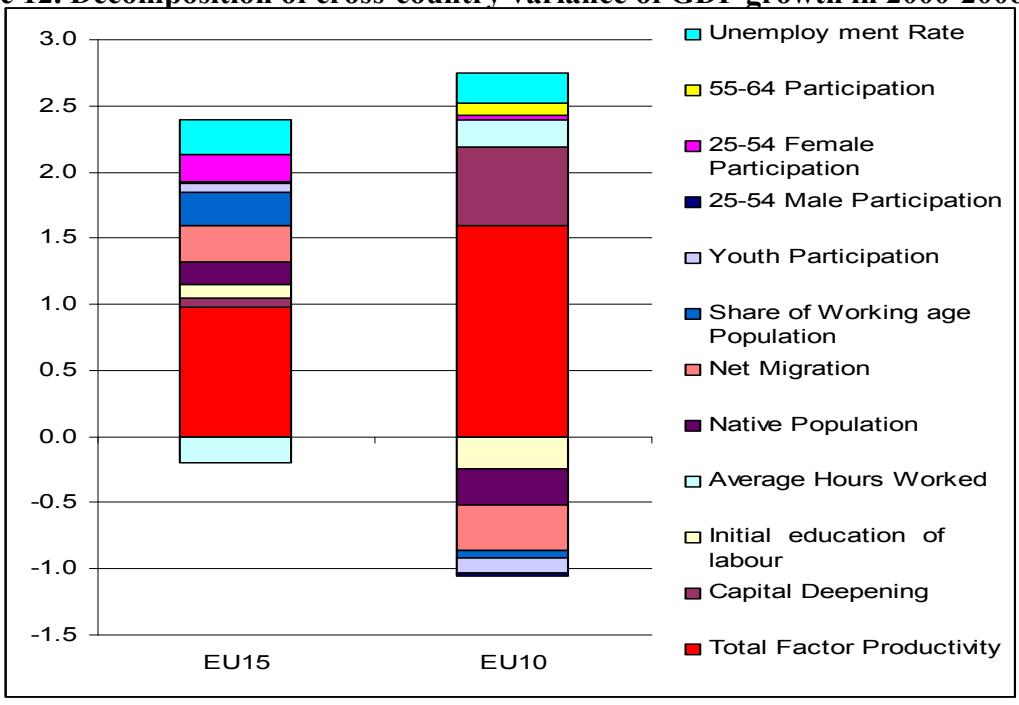
4.3.2. The main drivers of growth heterogeneity across countries and the role of labour input and hourly productivity: decomposition of growth variance by GDP components

Table 2 suggests that the growth pattern was very different across countries over the period 1995-2006. While the economic growth rate differs substantially amongst countries, this is also very much the case for its components. We decompose the GDP variance into the contribution of its components. Mathematically, the contribution of each component to the overall dispersion is the variance of the given component plus the sum of the covariances with the other components. The Figure 12 suggests that:

- Almost half of the variation of GDP growth across EU15 countries in 1995-2006 was driven by the dispersion of TFP growth. While unemployment, female participation, migration and the share of working-age population explain each around 10% of total variance, the other components contribute more marginally to it. The average hours worked has a negative contribution to the overall dispersion, meaning that it is negatively correlated with the other components, which is consistent with the "part-time story" elaborated earlier;

- The variation of growth within EU10 is close to that in the EU15. However, TFP growth accounts for most of it in EU10, while the contribution of capital deepening explains one third of the overall dispersion. The average hours worked and youth participation and unemployment stand out amongst secondary factors, representing each over 10% of the overall dispersion. The migration, the initial education of labour and the native population negatively contribute to the overall dispersion, which implies that there are negatively correlated with the main drivers of dispersion.

Figure 12. Decomposition of cross-country variance of GDP growth in 2000-2006

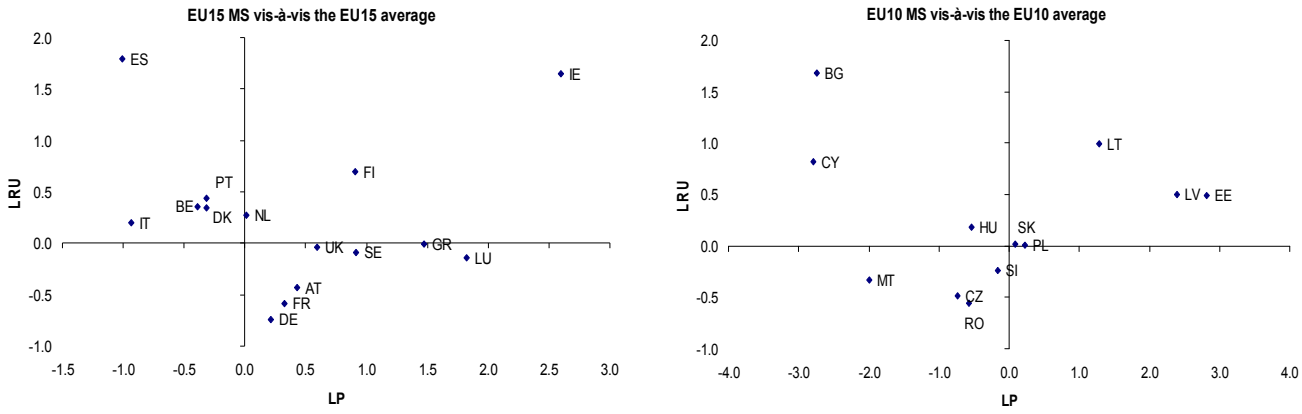


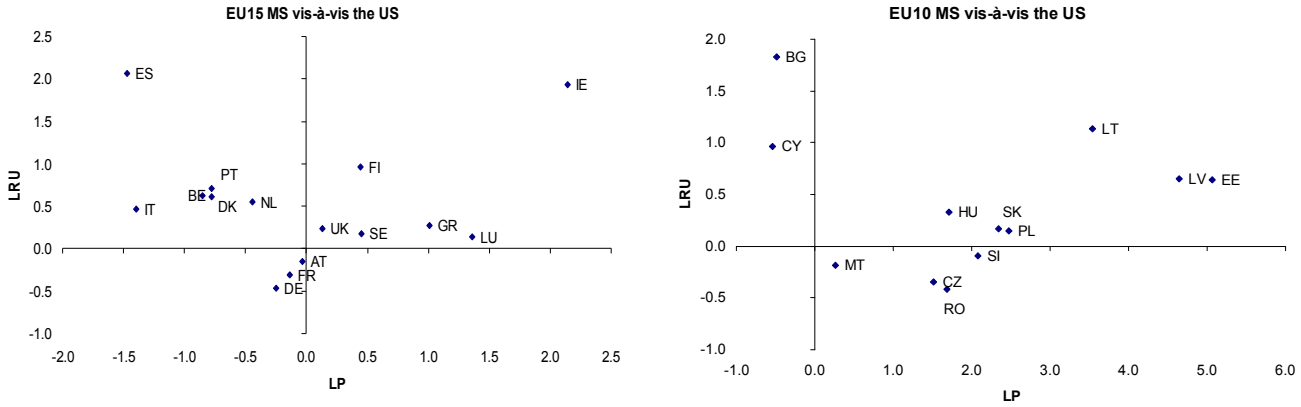
4.3.3. Shifting the per capita GDP frontier: did labour utilisation and labour productivity develop in the same direction?

Europe is still lagging behind the US in terms of per capita GDP and some EU member states (MS) are still far behind the EU15 average (PT, GR, ES, EU10 countries, RO and BG). It is therefore important to know if the laggards have converged in the recent period. The speed of this convergence process depends on whether the movements in the two components of per capita GDP (labour utilisation and hourly productivity) have cumulated or have offset each other.

If we consider the EU15 (upper-left panel of Figure 13), the change in labour utilisation and hourly productivity has counterbalanced each other since 1995, except in FI and IE where both have increased strongly. The convergence toward the EU15 in terms of labour utilisation in ES, IT, BE, DK and PT was partly offset by a diverging pattern in terms of hourly productivity. In contrast, in SE, AT, LU, FR and DE, there was a concomitant movement of convergence in productivity growth and divergence in labour utilisation growth. If the US is taken as the benchmark (lower-left panel of Figure 13), the picture is fairly close: while IE, FI, UK, SE, GR and LU converged to the US in terms of both productivity and labour utilisation, FR and DE diverged in both dimensions.

Figure 13 Relationship between the relative change in labour productivity (LP) and the relative change in labour utilisation (LRU) in 1995-2006





As regards the new member states (upper-right panel of Figure 13), the picture appears somewhat different, as the relative change vis-à-vis the EU10 average in both productivity and labour utilisation seems to reinforce mutually in either direction (convergence or divergence). While the three Baltics (LV, LT and EE) improved their relative situation in both dimensions, MT, SI, RO and CZ saw their relative position deteriorating under both dimensions. SK and PL improved slightly their position in terms of productivity with their labour utilisation remaining unchanged. Vis-à-vis the US (lower-right panel of Figure 13), the situation looks more favourable, with six member states improving their situation in both dimensions (HU, SK, PL, LV, LT and EE). The remaining countries witnessed an opposite movement in relative productivity and relative labour utilisation.

Therefore, there is no clear convergence of both productivity and labour utilisation vis-à-vis the benchmarks considered. They seem to evolve in opposite direction, which might explain why the catch-up of European economies toward the US has been quite limited (and even negative sometimes).

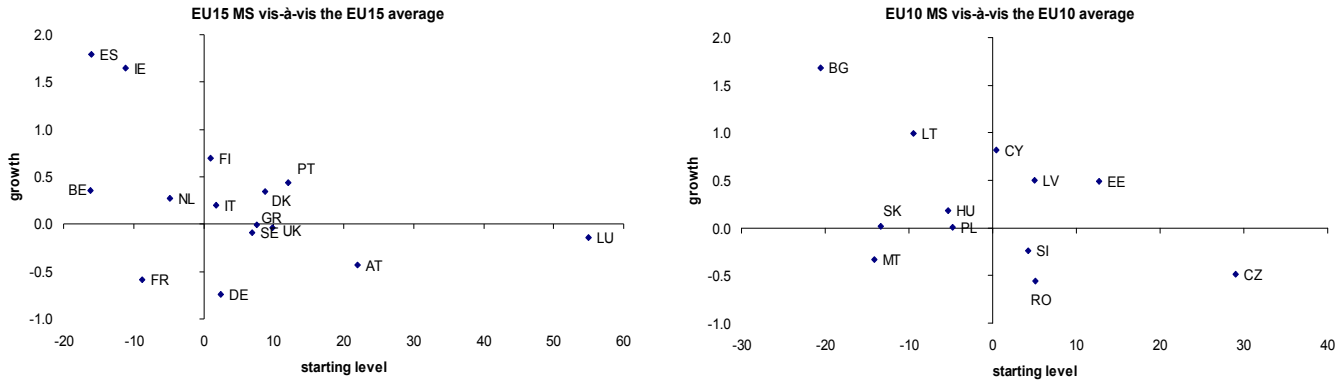
4.3.4. Putting labour utilisation and hourly productivity developments in perspective: growth in relation to starting condition

Developments in labour utilisation and labour productivity should be considered in close relation to the starting condition.

The first panel of Figure 14 shows the growth in labour utilisation relative to the EU15 average in the x-axis and the labour utilisation gap vis-à-vis the EU15 in the y-axis. The second panel of Figure 14 depicts the relative labour utilisation growth versus the labour utilisation gap in the new member states, taking the EU10 as a benchmark. The countries displaying a gap with the EU15 in 1995 experienced stronger growth in the labour utilisation

(BE, ES, IE, NL) in the period 1995-2006. The countries characterised by a level of labour utilisation above the EU15 average in 1995 tended to have registered a growth rate of labour utilisation slower than the EU15 growth (DE, AT, LU, SE) or equal to it (UK, GR). The first examination also suggests that while the relative growth is negatively correlated with the starting condition, the relationship between the two remains loose and does not appear valid for all countries[27]. Three examples are telling in this respect. In France, the initial negative gap in labour utilisation recorded in 1995 widened further in the subsequent decade. By contrast, IT, FI, DK and PT, which were already standing above the EU15 average in 1995, recorded a higher growth rate in labour utilisation than the EU15 as a whole did. IT, DE and FI had the same labour utilisation in 1995, but FI saw its labour utilisation grow significantly faster than in IT, which in turn witnessed a much more dynamic growth rate than in DE. The picture is broadly unchanged when considering the labour component only (excluding demographic component) instead of the labour utilisation.

Figure 14 Relationship between the starting condition in 1995 and the relative change in labour utilisation (LRU) in 1995-2006

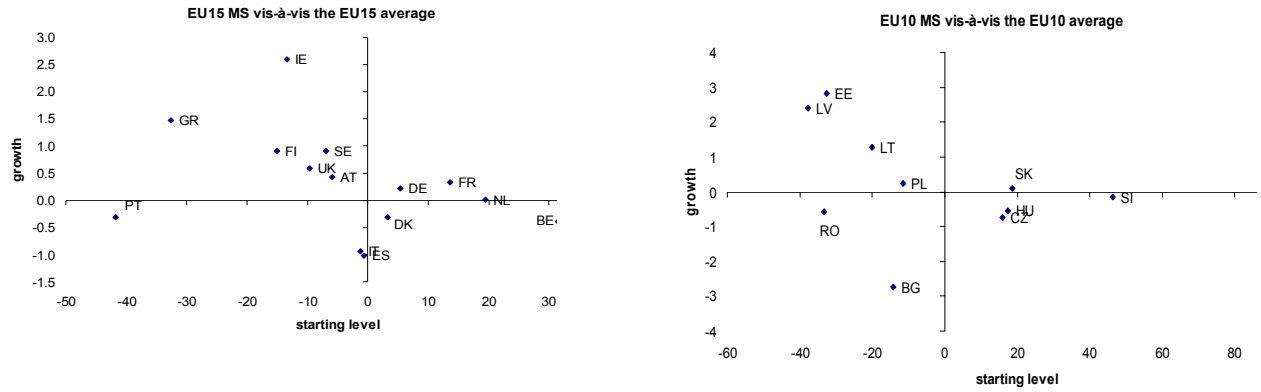


Turning to the new member states (EU10 plus RO and BG), a similar picture emerges: the relative growth in labour utilisation is negatively, albeit loosely, related to the initial gap in 1995. BG, LT and HU saw their labour utilisation rise above the EU10 growth, from a below-average initial position. SI, RO and CZ, which were standing above the EU10 average in terms of labour utilisation in 1995, experienced a below-average growth. The negative relationship between level and growth is not strict indeed. LV, EE and CY improved further their position in the past decade, although their labour utilisation was already higher than the EU10 average. The labour utilisation in MT increased less than in the EU10, notwithstanding

[27] The relation is: (relative growth) = -0.018(relative growth)+0.3 with a $R^2 = 0.19$.

an unfavourable starting condition. The labour utilisation in SK and PL both grew at the same rate as the EU10 over 1995-2006, although its level was much higher in PL than in SK in 1995.

Figure 15 Relationship between the starting condition in 1995 and the relative change in labour productivity in 1995-2006



The first panel of Figure 15 depicts the growth in labour productivity relative to the EU15 average in the x-axis (change) and the labour productivity gap vis-à-vis the EU15 in the y-axis (level). The second panel of Figure 14 shows the relative labour productivity growth versus the labour productivity gap in the new member states, taking the EU10 as a benchmark. The countries displaying a gap with the EU15 in 1995 generally experienced stronger growth in the labour productivity (IE, GR, FI, UK, SE, AT) in the period 1995-2006. The main exception is PT, far behind in 1995 and experiencing a negative productivity growth thereafter. Moreover, ES and IT, standing slightly below the EU15 productivity average in 1995, witnessed a strong productivity decline by around 1% a year from 1995 to 2006. By contrast, the majority of countries characterised by a level of labour productivity above the EU15 average in 1995 (except BE and DK) tended to record a growth rate of labour productivity higher than the EU15 average growth (DE, FR and LU) or equal to it (NL): the more productive countries in the mid 90s have often become even more productive ten years later. This first examination would indicate that, unlike with labour utilisation, the relative growth is not clearly correlated with the starting condition, as dynamic growth in productivity was seen in both laggards and front-runners[28].

[28] Unlike with labour utilisation, the goodness of fit regarding the linear relationship between initial productivity level and productivity growth is close to zero (R2 = 0.01).

Turning to the new member states, a different picture emerges: the relative growth in labour productivity is negatively related to the initial gap in 1995, especially in EU10 Member States, BG and RO standing as exceptions. In other words, the laggards seem to have caught up faster. The goodness of fit is particularly high[29]. The case of BG and RO are not really contradicting the relationship seen in the EU10, as they recorded buoyant productivity growth but mainly after 2000.

5. CONCLUSION

The level of labour utilisation in the EU, defined as total hours worked per capita, is clearly lower than that seen in the US and the 5 richest EU countries. The relatively low labour utilisation explains around two thirds of the per capita GDP gap in the EU15 vis-à-vis the US (17 p.p. out of 26%), while the hourly labour productivity accounts for 10 p.p. only. This is due to the negative contribution of average hours worked and, to a lesser extent, the relatively low labour market participation and the relative high level of unemployment. The gap in the euro area is slightly wider than that seen in the EU15 because of even weaker participation and higher unemployment. The productivity gap of the EU15 vis-à-vis the US stems from lower TFP level and, to a lesser extent, the lower initial education of labour. In the euro area, the negative TFP gap is greater than in the EU15, but the lead in labour quality is also wider: this implies that the overall productivity gap of EU15 and the euro area vis-à-vis US is almost identical.

While the combination of lower per-hour productivity and lower labour utilisation (i.e. hours worked per capita) is the cause of relatively low per capita GDP in euro area and EU15 countries, weak productivity is the main concern in the EU10. In the latter, the huge per capita GDP gap vis-à-vis the US is mostly attributable to labour productivity (54 p.p.), with labour utilisation only explaining 6 p.p. This very strong productivity gap in the EU10 vis-à-vis the five richest Member States is to be attributed to lower capital intensity and lower TFP growth despite of slightly higher labour quality. By contrast, the utilisation of labour is much higher in the new member states (EU10, BG and RO) than in the EU15, being only 9% below the US level and is even above that in the five richest EU Member States.

[29] The relation in the EU10 is: (relative growth) = -0.0354(relative growth)+ 0.69 with a $R^2 = 0.86$.

There is a sizeable heterogeneity of the level of labour utilisation and hourly productivity across countries, although the dispersion of labour utilisation in the EU15 and the euro area is one-third lower than the dispersion of hourly productivity. The dispersion of labour utilisation in the EU15 is mainly related to the average hours worked and (to a lesser extent) the labour market participation, while in EU10 the dispersion is broadly based across labour-market components.

As regards GDP growth, it could be broken down into the growth of labour input (i.e. total hours worked in the economy) and the growth in hourly productivity. Over the last ten years (1995-2006), the growth in labour input was the driving force behind one third of annual average GDP growth annual in the EU15 as a whole. Migration explains the entire demographic component of labour input growth, which is almost half of the latter. The strong contribution of both female and older-worker participation and, to a lesser extent, the decline in unemployment (extensive margins) strongly contributed to the labour market component, which represents over one half of labour input growth. However, the decrease in the average hours worked per worker (intensive margins) and declining male participation exercised a negative effect on labour input growth. Compared with the US, the average EU15 growth rate was lower in 1995-2006, despite the labour market improvement vis-à-vis the US induced by dynamic participation and, to a lesser extent, the initial education of labour. In the EU10, the labour input and the initial education of labour explained only a very modest part of the buoyant GDP growth. The average growth rate in EU10 was over one percentage point higher than that in US in 1995-2006, owing to much higher capital accumulation, TFP growth and, to a lesser extent, average hours worked, the fast rising share of working population and the rise in older worker participation.

The growth pattern was very different across countries. Most of the variation of GDP growth across EU27 countries in 1995-2006 was driven by the dispersion of TFP growth, while unemployment, youth and female participation, migration, the share of working-age population and the average hours worked only had a secondary role.

The speed of the convergence process toward the US depends on whether the movement in the two components of per capita GDP (labour utilisation and hourly productivity) cumulated or offset each other. Unfortunately, they seem to have evolved in opposite direction, which might explain why the catch-up of European economies toward the US has been quite limited. The first examination also suggests that while the relative growth is

negatively correlated with the starting condition in both the EU15 and the new member states, the relationship between the two variables remains loose and does not appear valid for all countries.

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ANNEX 1: DATA DESCRIPTION

Most of the data used are coming from AMECO database and are consistent between them. The per capita GDP value of 2006 in the level accounting corresponds to the current 2006 PPP value given by the EC structural indicators, which is the headline indicator in Europe. As a rule, current PPP values are recommended for cross-country comparison (while changes in GDP per capita require constant PPP values). Please note that the OECD uses GDP in 2000 constant prices at PPP exchange rate in its *Going from growth* publication.

GDP variable used in the growth account corresponds to the gross domestic product at 2000 market prices in national currency. The aggregates are built with the 2000 PPS weights. The growth rates are used to back-cast the GDP per capita and its components back to 1995. The data issue is a well-known practical limitation of all kinds of GDP accounting exercises, as some data are undergoing frequent and substantial revisions. Therefore, although the underlying data presented in this paper for the period 1995-2006 were retrieved in early 2008 and show a broad stability for most countries, we also display recently updated data for the recent period 2001-2007 (extracted in November 2008). It should be noted that the average annual hours worked per person have registered important revisions over time[30].

The sources and construction of labour market variables

Employment *E* means the number of persons in all domestic industries (AMECO database using National accounts) and not national employment. This concept is fully consistent with the coverage of GDP. In order to have a series of labour market participation rates consistent with the National Account concept of domestic employment, the rate of labour market participation (PR) is reconstructed using the relation: $PR = E/(1-u)/WP$ where *WP* is the working population (aged 15-64) contained in AMECO database and coming from Eurostat and u is the standardised unemployment rate. The latter is produced by Eurostat in compliance with official ILO definition and derived from Labour Force Survey (LFS).

The growth rate of labour market participation (National account data extracted from AMECO dataset) is decomposed as the weighted average of the growth rate of participation

[30] For instance, there were substantial revisions to hour worked data in 2007, affecting CY, EE, IE, MT, PT and RO, which are not taken into account in this paper, written before the release of these new data. These revisions affects total labour input but also, as a mechanical result, capital accumulation and TFP.

of each gender and age group (youth, prime-aged men, prime-aged women and older workers). As the participation rates by age and gender comes from the Labour Force Survey (LFS, Eurostat), we rescale them so as to add up to the overall computed directly from the (taken from AMECO database). This statistical rescaling is necessary to convert the LFS data on participation for specific age group into National Account concepts, which are consistent with the concept of GDP and are systematically employed in the GDP accounting exercise. We chose to apply *an additive* rescaling correction. It consists of the gap between the overall contribution of total participation in LFS and Nationals accounts, weighted by the share of the group in the working-age population. The consequence can be a discrepancy in some cases between the direction of changes in the LFS participation rates (Eurostat) and the sign of its contribution to growth. An alternative would have been to use a multiplicative rescaling correction, consisting in multiplying each contribution by the ratio between the aggregate contribution derived from National Account data and aggregate contribution derived calculated from LFS data. This rescaling would have left the direction of change unaltered and consistent between the LFS participation rates and their calculated contribution to growth. However, the risk was to infer very large and unrealistic age-specific and gender-specific contributions if the corrective ratio is very high, which occurs often, in particular when the aggregate contribution computed from LFS is close to zero.

Migration data are coming from Eurostat (NewCronos). It should be borne in mind that net migration flow data are not disaggregated between intra- and inter-EU flows. Moreover, net migration data are defined as the difference between immigration into and emigration from the area during the year (net migration is therefore negative when the number of emigrants exceeds the number of immigrants). Since most countries either do not have accurate figures on immigration and emigration or have no figures at all, net migration is generally estimated on the basis of the difference between population change and natural increase between two dates (i.e. the difference between the number of live births and the number of deaths during the year.) The statistics on net migration are therefore affected by all the statistical inaccuracies in the two components of this equation, especially population change.

We use the AMECO data of average hours worked per person employed, which comes from the OECD database. For a couple of countries (EE, CY, LV, MT, AT, PL and SI), we back-cast missing data on hours worked using "The Conference Board and Groningen Growth and Development Centre, Total Economy Database", September 2006. For instance, AMECO data

are missing before 2001 for CY, EE, MT and PL, before 1999 for LV and before 1997 for SI and before 1996 for AT, LT and SK.

We linearly back-cast various AMECO data (working age population, employment) missing in 1994 for some EU10 countries, using the average growth rate between 1995-2000. This enables us to technically estimate the contributions to growth in 1995.

Sources and construction of labour productivity variables (EU10 capital stock, labour quality)

For EU10 Member States plus BG and RO, no reliable data of capital stock data are available. We construct the series of net capita stock (at constant prices), assuming that the capital intensity ratio (capital stock over GDP) is 2 in 1995 and applying the standard perpetual inventory method:

$$\Delta K(t)=I(t)-\delta K(t-1), \text{ where:}$$

I stands for investment (Gross formation of fixed capital derived from AMECO) and δ for the rate of capital depreciation, which is set equal to 5%[31]. Alternative assumptions for the rate of depreciation and the capital intensity ratio for 1995 do not give rise to very different results, especially as regards the change in capital stocks. Therefore, given these coarse assumptions, the capital stock computed here should be considered as a consistent but very rough estimate, especially regarding the level of capital stock.

We compute the initial education of labour (which is a rough indicator of labour quality) as the average productivity per person employed relative to the productivity of the low-skilled. Data on employment by educational attainment come from New Cronos (Eurostat) and are available annually from 1992. There are breaks in the employment series by educational attainment in six countries (PT in 1998, RO in 2002, IT and AT in 2004, ES and SE in 2005). Therefore, we compute the growth rate of the initial education of labour by disregarding the

[31] Following an alternative method based on the expression for the capital stock in the steady state, Caselli (2005) computes the initial capital stock as K_0 as $I_0/(g+\delta)$ instead of $2.GDP$, where I_0 is the investment in the first year available (here 1995) and g the average geometric growth rate of investment in a time period following the first year. However, the results are very sensitive to the choice of g and δ and based upon the dubious assumption – particularly inadequate for the new member states - that the member states considered have reached the steady state.

year of the break. Relative wages by educational attainment, which represents a commonly assumed proxy of relative productivity in the literature, stem from the Structure of Earning Survey SES2002 (available in New Cronos, Eurostat). These are only available for the year 2002.

ANNEX 2: ADDITIONAL COUNTRY RESULTS OF GDP ACCOUNTING IN LEVEL

Figure 16 The sources of differences in labour utilisation (total hours worked per capita) vis-à-vis the US; 2006 (current PPS).

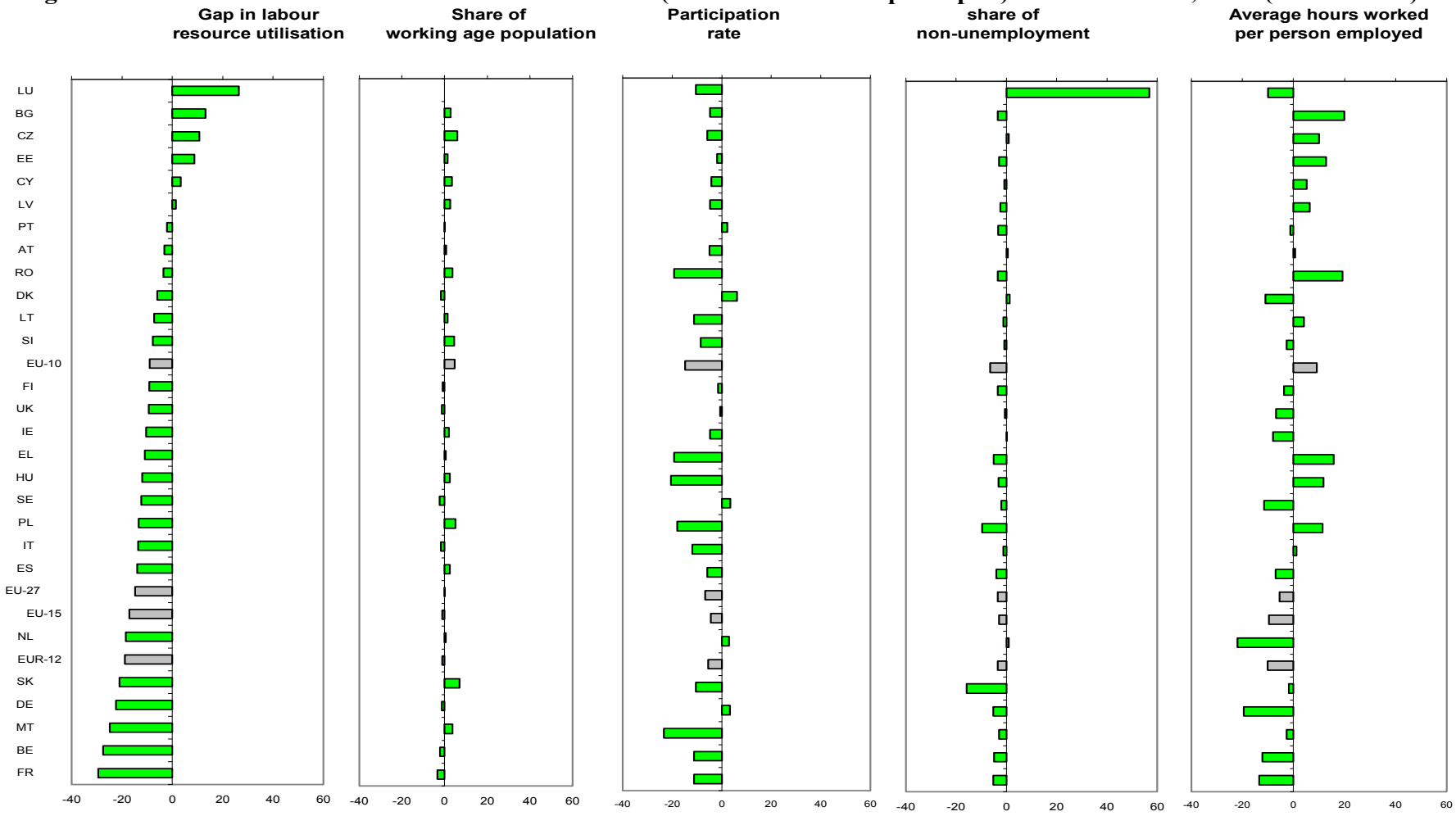


Figure 17 The sources of differences in per hour productivity (GDP per hour worked) vis-à-vis the US; 2006 (current PPS)

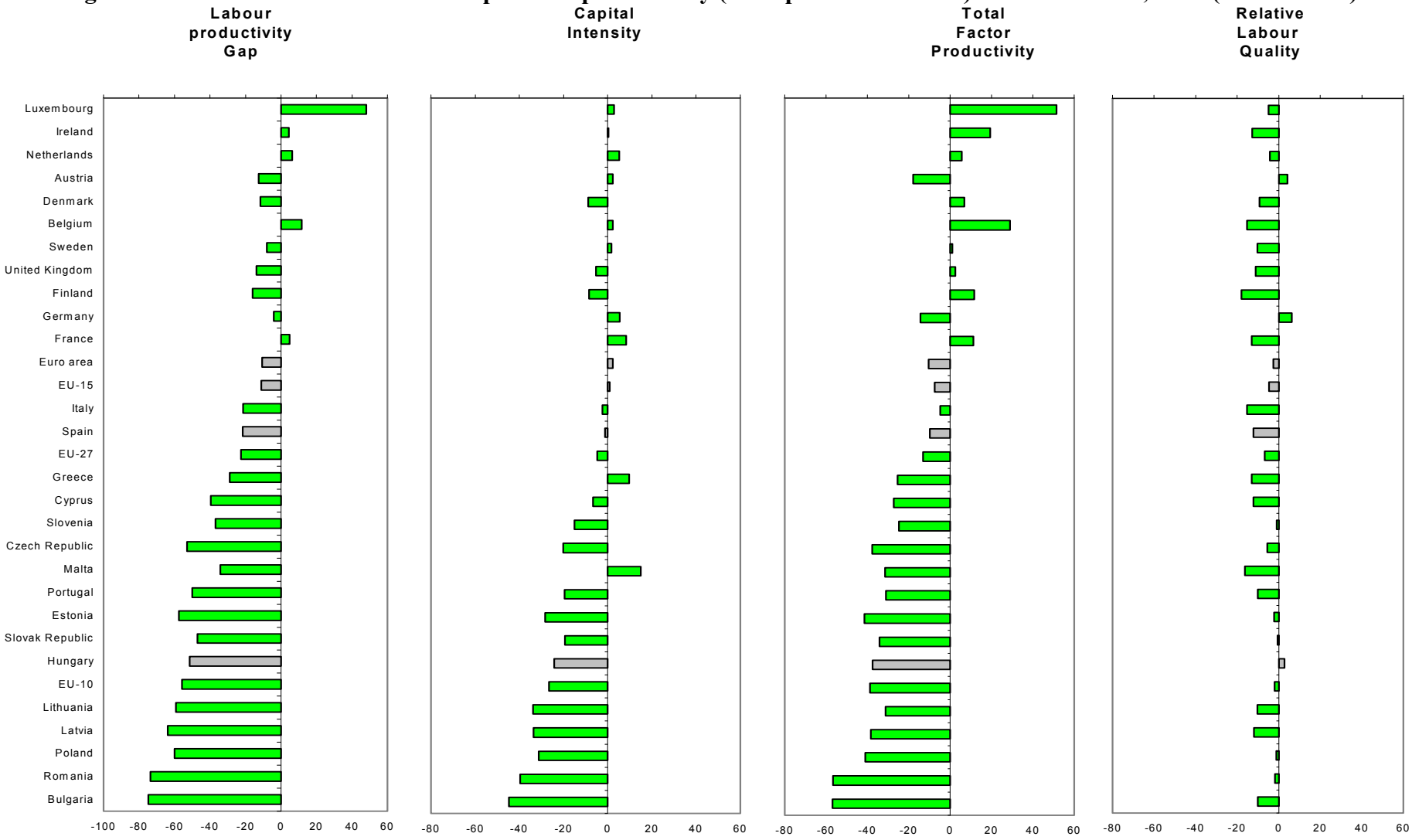


Table 3 Gap vis-à-vis US (relative differential in percentage of US value)

(multiplicative breakdown of 1+"gap")

	GDP per capita	Labour productivity	Labour utilisation	Capital Deepening	Total Factor Productivity	Initial education (Labour quality)	Share of Working age Population	Unemployment Rate	Total Participation rate	Average Hours Worked	Labour market component	Demographic component
BE	-19%	12%	-28%	2%	11%	-1%	-2%	-5%	-11%	-12%	-26%	-2%
BG	-76%	-73%	-12%	-40%	-53%	-3%	3%	-3%	-5%	-7%	-14%	3%
CZ	-48%	-53%	11%	-20%	-38%	-4%	6%	1%	-6%	10%	5%	6%
DK	-17%	-12%	-6%	-9%	-1%	-2%	-2%	1%	6%	-11%	-4%	-2%
DE	-25%	-4%	-22%	5%	-6%	-3%	-1%	-5%	3%	-20%	-21%	-1%
EE	-55%	-59%	9%	-28%	-43%	0%	1%	-3%	-2%	13%	7%	1%
IE	-7%	4%	-10%	0%	7%	-3%	2%	0%	-5%	-8%	-12%	2%
GR	-36%	-29%	-11%	10%	-30%	-7%	1%	-5%	-19%	16%	-11%	1%
ES	-33%	-22%	-14%	-1%	-15%	-6%	2%	-4%	-6%	-7%	-16%	2%
FR	-26%	5%	-30%	8%	1%	-4%	-3%	-5%	-11%	-13%	-27%	-3%
IT	-32%	-21%	-14%	-2%	-10%	-10%	-2%	-1%	-12%	1%	-12%	-2%
CY	-38%	-39%	1%	-6%	-33%	-3%	3%	0%	-4%	1%	-3%	3%
LV	-63%	-64%	1%	-34%	-44%	-3%	3%	-2%	-5%	6%	-1%	3%
LT	-62%	-59%	-7%	-34%	-38%	0%	1%	-1%	-11%	4%	-8%	1%
LU	87%	48%	26%	3%	52%	-5%	0%	57%	-10%	-10%	26%	0%
HU	-57%	-51%	-12%	-24%	-33%	-4%	2%	-3%	-21%	12%	-14%	2%
MT	-50%	-34%	-25%	15%	-34%	-13%	4%	-3%	-23%	-3%	-28%	4%
NL	-13%	6%	-19%	5%	5%	-4%	0%	1%	3%	-22%	-19%	0%
AT	-16%	-12%	-4%	2%	-9%	-5%	1%	0%	-5%	1%	-5%	1%
PL	-65%	-60%	-13%	-31%	-40%	-3%	5%	-10%	-18%	11%	-18%	5%
PT	-51%	-50%	-2%	-19%	-26%	-16%	0%	-3%	2%	-1%	-2%	0%
RO	-75%	-72%	-11%	-38%	-52%	-8%	4%	-3%	-19%	11%	-14%	4%
SI	-42%	-37%	-8%	-15%	-23%	-4%	5%	-1%	-9%	-3%	-12%	5%
SK	-58%	-47%	-21%	-19%	-32%	-4%	7%	-16%	-10%	-2%	-26%	7%
FI	-24%	-16%	-9%	-8%	-7%	-1%	-1%	-3%	-1%	-4%	-8%	-1%
SE	-19%	-8%	-12%	2%	-8%	-2%	-2%	-2%	4%	-11%	-10%	-2%
UK	-22%	-14%	-9%	-5%	-7%	-3%	-1%	-1%	-1%	-7%	-8%	-1%
EU27	-34%	-22%	-16%	-4%	-14%	-5%	0%	-4%	-7%	-6%	-16%	0%
EU15	-26%	-11%	-17%	1%	-8%	-5%	-1%	-3%	-4%	-10%	-16%	-1%
Euro area	-28%	-11%	-19%	2%	-7%	-6%	-1%	-4%	-5%	-10%	-18%	-1%
EU5	-11%	0%	-11%	2%	2%	-4%	0%	2%	0%	-13%	-11%	0%
EU10	-60%	-56%	-9%	-26%	-38%	-3%	5%	-7%	-15%	9%	-13%	5%
EU10+BG+RO	-64%	-60%	-9%	-28%	-40%	-4%	4%	-6%	-15%	8%	-13%	4%
US	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Note: The multiplicative components of per capita GDP relative to the US are expressed in logarithm so as to render them additive. The logarithm of the relative value of a given per capita GDP components is a first-order approximation for the relative gap. The value of each component is rescaled so that they add up to that of the per capita GDP gap relative to the US.

Table 4 Logarithmic decomposition of GDP per capita
(additive breakdown, allowed by logarithmic transformation)

	GDP per capita	Labour productivity	Labour utilisation	Capital Deepening	Total Factor Productivity	Initial education (Labour quality)	Share of Working age Population	Unemployment Rate	Total Participation rate	Average Hours Worked	Labour market component	Demographic component
BE	-19%	10%	-29%	2%	9%	-1%	-2%	-5%	-11%	-12%	-27%	-2%
BG	-76%	-69%	-7%	-27%	-40%	-2%	1%	-2%	-3%	-4%	-8%	1%
CZ	-48%	-55%	7%	-17%	-36%	-3%	4%	1%	-4%	7%	3%	4%
DK	-17%	-11%	-6%	-8%	-1%	-2%	-2%	1%	5%	-11%	-4%	-2%
DE	-25%	-4%	-22%	5%	-5%	-3%	-1%	-5%	3%	-19%	-21%	-1%
EE	-55%	-61%	6%	-23%	-38%	0%	1%	-2%	-1%	8%	5%	1%
IE	-7%	4%	-11%	0%	7%	-3%	2%	0%	-5%	-8%	-13%	2%
GR	-36%	-27%	-9%	7%	-29%	-6%	0%	-4%	-17%	12%	-10%	0%
ES	-33%	-20%	-12%	-1%	-14%	-5%	2%	-3%	-5%	-6%	-14%	2%
FR	-26%	4%	-30%	7%	1%	-4%	-3%	-5%	-10%	-12%	-27%	-3%
IT	-32%	-20%	-12%	-2%	-9%	-9%	-2%	-1%	-11%	1%	-11%	-2%
CY	-38%	-39%	1%	-5%	-32%	-2%	3%	0%	-3%	1%	-2%	3%
LV	-63%	-64%	1%	-26%	-36%	-2%	2%	-2%	-3%	4%	-1%	2%
LT	-62%	-57%	-5%	-26%	-31%	0%	1%	-1%	-8%	3%	-6%	1%
LU	87%	54%	32%	4%	58%	-7%	0%	63%	-15%	-15%	33%	0%
HU	-57%	-49%	-9%	-19%	-27%	-3%	2%	-2%	-16%	7%	-10%	2%
MT	-50%	-30%	-21%	10%	-30%	-10%	3%	-2%	-19%	-2%	-23%	3%
NL	-13%	6%	-19%	5%	4%	-3%	0%	1%	3%	-23%	-19%	0%
AT	-16%	-12%	-4%	2%	-9%	-5%	1%	0%	-5%	1%	-4%	1%
PL	-65%	-56%	-9%	-23%	-31%	-2%	3%	-6%	-12%	7%	-12%	3%
PT	-51%	-50%	-2%	-15%	-22%	-12%	0%	-2%	2%	-1%	-2%	0%
RO	-75%	-69%	-6%	-26%	-39%	-4%	2%	-2%	-12%	5%	-8%	2%
SI	-42%	-35%	-6%	-13%	-20%	-3%	3%	-1%	-7%	-2%	-10%	3%
SK	-58%	-43%	-16%	-14%	-26%	-2%	4%	-12%	-7%	-1%	-20%	4%
FI	-24%	-15%	-8%	-8%	-7%	-1%	-1%	-3%	-1%	-3%	-8%	-1%
SE	-19%	-7%	-12%	2%	-7%	-2%	-2%	-2%	3%	-11%	-10%	-2%
UK	-22%	-13%	-9%	-5%	-6%	-2%	-1%	-1%	-1%	-6%	-8%	-1%
EU27	-34%	-20%	-14%	-4%	-13%	-4%	0%	-3%	-6%	-5%	-14%	0%
EU15	-26%	-10%	-16%	1%	-7%	-4%	-1%	-3%	-4%	-9%	-15%	-1%
Euro area	-28%	-10%	-18%	2%	-7%	-5%	-1%	-3%	-5%	-9%	-17%	-1%
EU5	-11%	0%	-11%	2%	2%	-4%	0%	2%	0%	-13%	-11%	0%
EU10	-60%	-54%	-6%	-20%	-31%	-2%	3%	-4%	-10%	6%	-9%	3%
EU10+BG+RO	-64%	-57%	-6%	-21%	-33%	-2%	3%	-4%	-10%	5%	-9%	3%

Note: The multiplicative components of per capita GDP relative to the US are expressed in logarithm so as to render them additive. The logarithm of the relative value of a given per capita GDP components is a first-order approximation for the relative gap. The value of each component is rescaled so that they add up to that of the per capita GDP gap relative to the US.

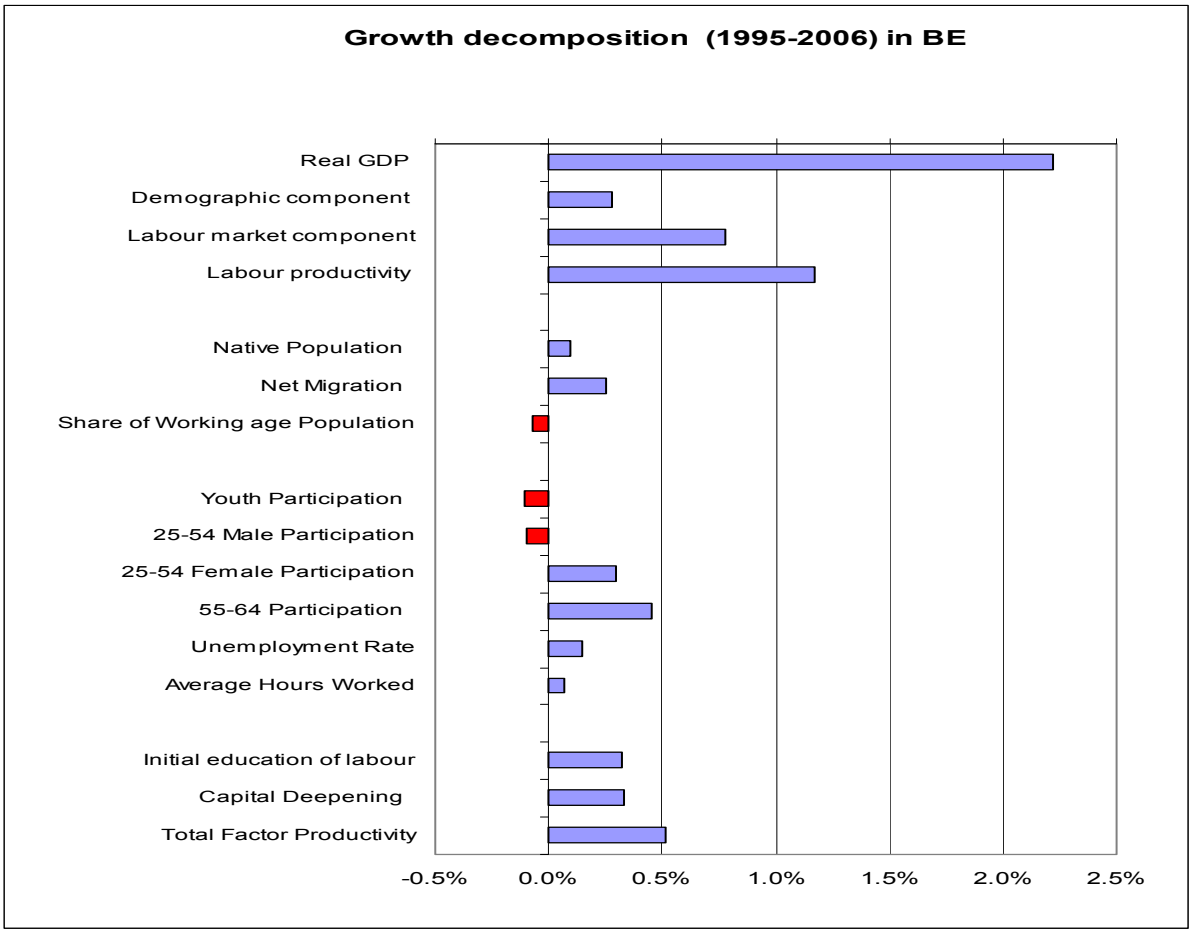
ANNEX 3: ADDITIONAL COUNTRY RESULTS OF GROWTH ACCOUNTING

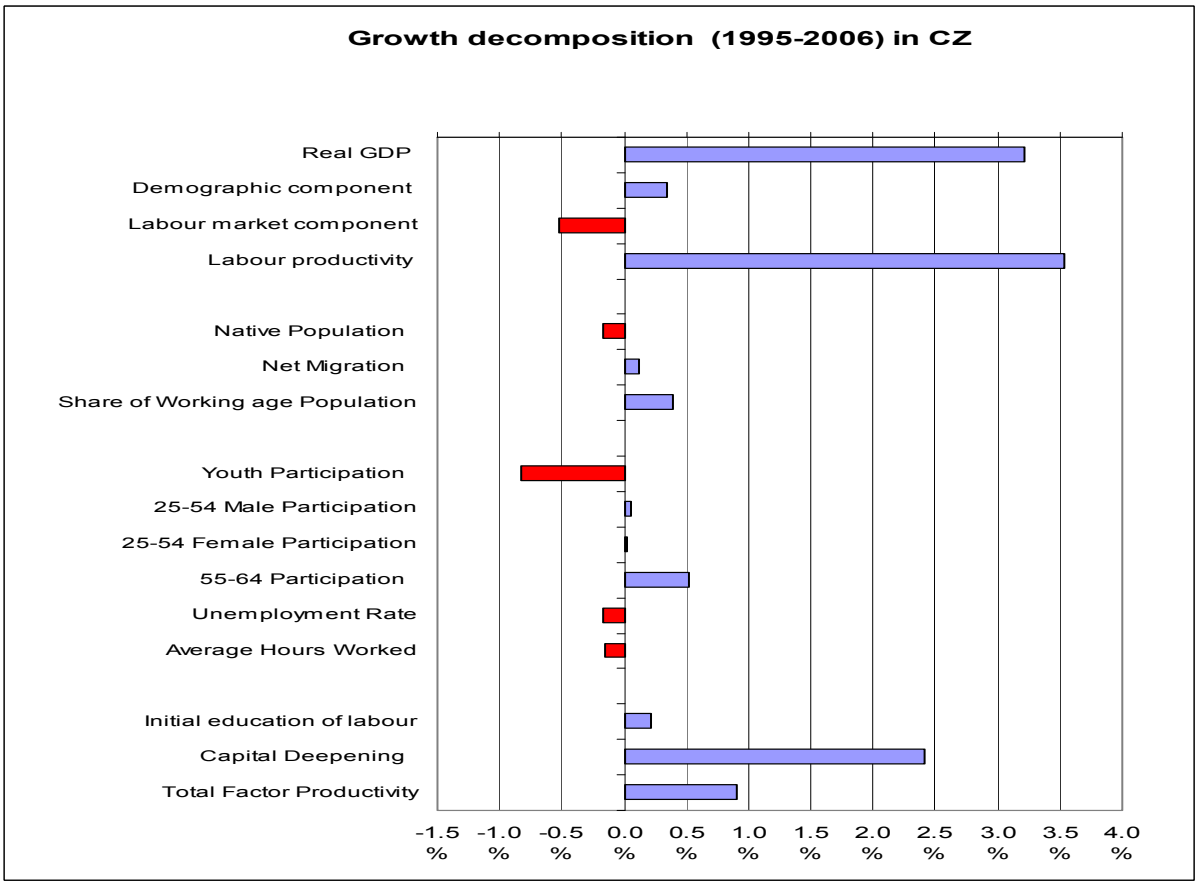
Table 5 Growth accounting by country, 1995-2006

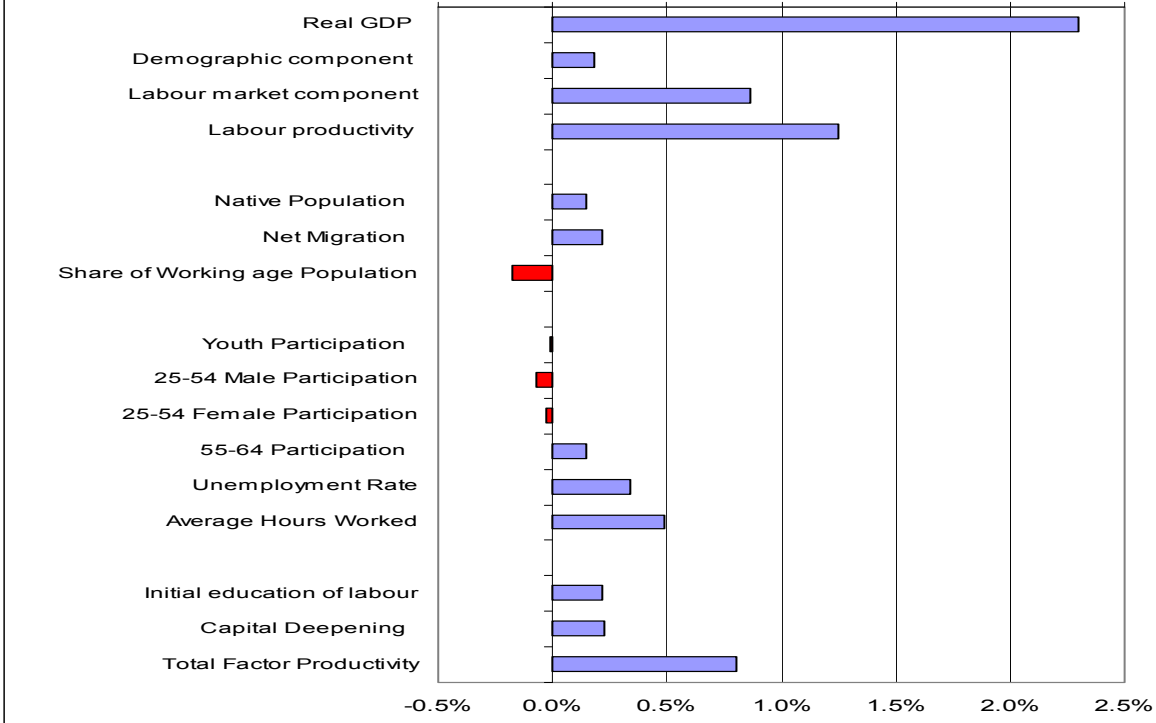
	GDP per capita	Labour productivity	Labour utilisation	Capital Deepening	Total Factor Productivity	Initial education (Labour quality)	Share of Working Population	Native Population	Net Migration	Unemployment Rate	Youth Participation	25-54 Male Participation	25-54 Female Participation	55-64 Participation	Average Hours Worked	Labour component	Demo-graphic component
BE	2.2	1.2	1.0	0.3	0.5	0.3	-0.1	0.1	0.3	0.1	-0.1	-0.1	0.3	0.5	0.1	0.8	0.3
BG	2.7	1.5	1.2	0.8	0.5	0.2	0.3	-0.5	-0.2	0.6	-0.1	0.0	0.0	0.9	0.3	1.7	-0.5
CZ	3.2	3.5	-0.2	2.4	0.9	0.2	0.4	-0.2	0.1	-0.2	-0.8	0.1	0.0	0.5	-0.1	-0.5	0.3
DK	2.3	1.2	1.1	0.2	0.8	0.2	-0.2	0.1	0.2	0.3	0.0	-0.1	0.0	0.1	0.5	0.9	0.2
DE	1.5	1.8	-0.3	0.7	1.1	0.0	-0.3	-0.1	0.2	-0.1	-0.1	0.0	0.3	0.4	-0.6	-0.1	-0.2
EE	7.1	7.1	0.0	3.2	4.4	-0.4	0.3	-0.4	-0.3	0.2	-0.3	-0.1	0.1	0.1	0.3	0.4	-0.4
IE	7.6	4.2	3.4	0.5	3.3	0.5	0.6	0.6	0.8	0.9	0.3	0.0	0.7	0.3	-0.9	1.3	2.1
GR	3.8	3.0	0.8	0.8	1.7	0.5	0.0	0.0	0.4	0.0	-0.2	0.0	0.6	0.1	-0.1	0.3	0.5
ES	3.6	0.6	3.0	0.3	-0.4	0.6	0.1	0.0	0.9	1.1	0.2	0.0	0.8	0.3	-0.4	2.0	1.0
FR	2.2	1.9	0.3	0.6	1.0	0.3	-0.1	0.4	0.1	0.2	0.0	-0.1	0.1	0.3	-0.7	-0.2	0.5
IT	1.5	0.6	0.8	0.3	-0.1	0.4	-0.4	-0.1	0.4	0.3	-0.2	0.1	0.7	0.2	-0.3	0.9	-0.1
CY	4.1	1.5	2.6	0.5	0.2	0.7	0.7	0.5	1.0	-0.2	0.2	-0.2	0.1	0.0	0.5	0.3	2.3
LV	6.6	6.7	-0.1	3.0	3.5	0.2	0.4	-0.6	-0.2	1.0	-0.6	-0.4	-0.4	0.8	-0.1	0.3	-0.4
LT	6.1	5.5	0.6	2.0	3.2	0.3	0.3	-0.2	-0.4	-0.1	-1.0	0.2	0.2	0.9	0.7	1.0	-0.4
LU	4.7	3.4	1.4	1.2	1.8	0.3	-0.1	0.2	1.0	-0.1	-0.7	0.1	0.9	0.5	-0.3	0.3	1.1
HU	3.9	3.7	0.2	2.0	1.3	0.4	0.2	-0.4	0.2	0.3	-0.8	-0.2	-0.1	1.2	-0.2	0.3	-0.1
MT	3.0	2.3	0.7	1.4	0.4	0.5	0.4	0.4	0.4	-0.2	0.2	0.0	-0.3	0.1	-0.3	-0.5	1.2
NL	2.7	1.6	1.1	0.4	1.0	0.3	-0.1	0.4	0.1	0.3	0.1	-0.2	0.4	0.5	-0.4	0.7	0.4
AT	2.3	2.0	0.3	0.8	1.0	0.2	0.1	0.0	0.3	-0.1	-0.2	-0.1	0.2	0.3	-0.3	-0.1	0.4
PL	4.6	4.5	0.1	1.9	2.3	0.4	0.6	0.0	-0.1	0.1	-0.3	-0.1	0.0	-0.2	0.2	-0.4	0.5
PT	2.5	1.2	1.3	0.8	0.3	0.2	0.0	0.1	0.4	-0.1	-0.2	0.1	0.5	0.2	0.3	0.8	0.5
RO	3.1	3.7	-0.6	1.6	2.0	0.1	0.4	-0.2	-0.1	0.0	-0.8	0.0	-0.1	-0.4	0.7	-0.7	0.1
SI	4.2	4.1	1.0	2.3	1.4	0.4	0.1	0.0	0.1	0.1	-0.2	0.0	0.1	0.9	-0.1	0.8	0.2
SK	4.7	4.4	0.3	2.5	1.6	0.3	0.7	0.1	0.0	0.1	-0.9	0.0	-0.1	1.0	-0.5	-0.5	0.8
FI	3.8	2.5	1.3	-0.1	2.1	0.5	0.0	0.2	0.1	0.9	0.3	-0.1	-0.1	0.4	-0.3	1.1	0.2
SE	3.0	2.5	0.5	0.3	1.9	0.2	0.2	0.0	0.2	0.2	0.0	0.0	-0.1	0.1	-0.2	0.0	0.5
UK	2.8	2.2	0.7	0.6	1.0	0.5	0.2	0.2	0.2	0.4	-0.1	-0.1	0.1	0.2	-0.4	0.1	0.6
EU27	2.4	1.8	0.6	0.6	0.9	0.3	0.0	0.0	0.2	0.2	-0.1	0.0	0.2	0.3	-0.3	0.3	0.3
EU15	2.3	1.6	0.8	0.5	0.8	0.3	-0.1	0.1	0.3	0.2	0.0	0.0	0.3	0.3	-0.4	0.4	0.3
Euro area	2.2	1.4	0.8	0.5	0.6	0.3	-0.1	0.1	0.3	0.2	0.0	0.0	0.4	0.3	-0.4	0.5	0.3
EU5	3.1	1.8	1.3	0.4	1.1	0.3	0.0	0.3	0.3	0.2	0.0	-0.1	0.3	0.4	-0.1	0.7	0.6
EU10	4.4	4.3	0.1	2.1	1.9	0.3	0.5	-0.1	0.0	0.1	-0.5	0.0	0.0	0.2	0.0	-0.2	0.3
EU10+BG+RO	3.8	3.4	0.4	1.6	1.5	0.2	0.4	-0.2	-0.1	0.2	-0.4	0.0	0.0	0.4	0.2	0.3	0.1
US	3.1	2.0	1.1	0.7	1.3	0.0	0.2	0.7	0.4	0.1	-0.1	0.0	0.0	0.1	-0.3	-0.2	1.3

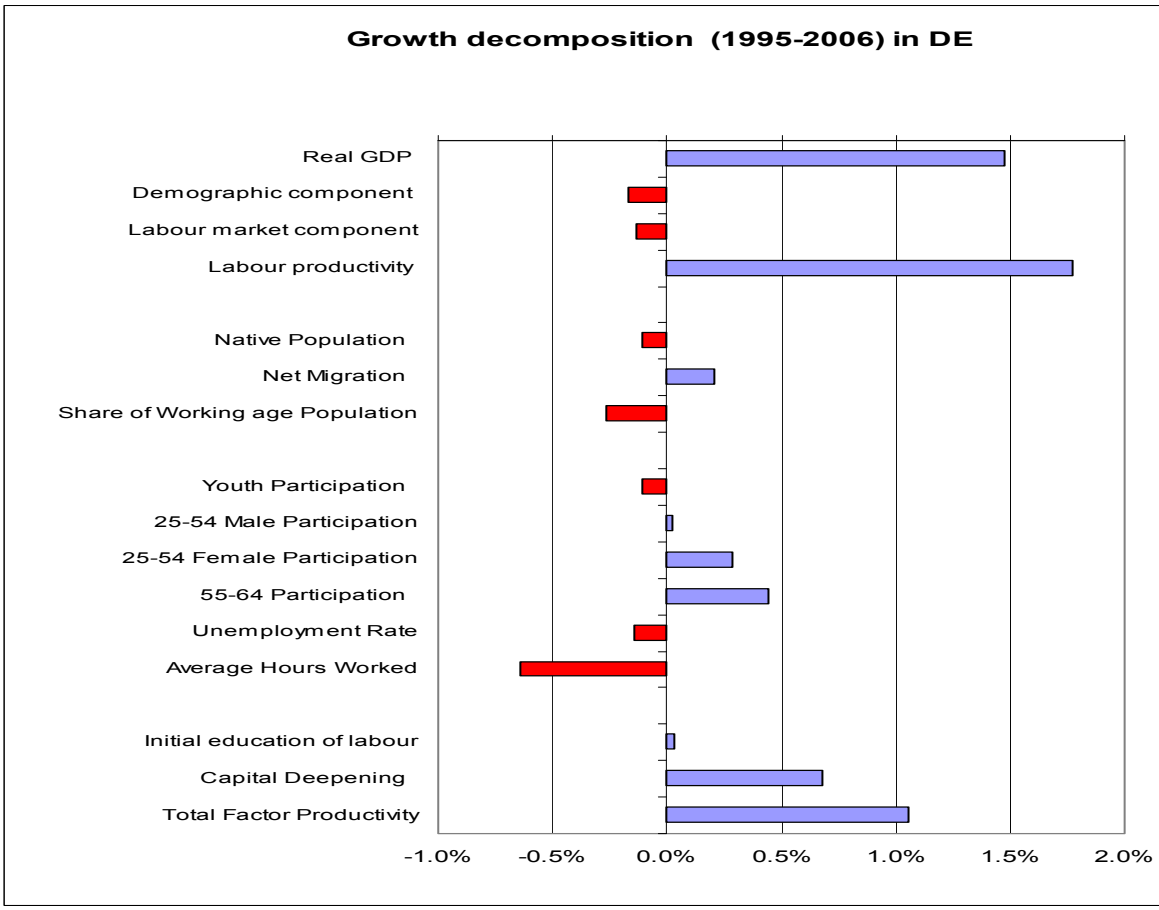
Table 6 Growth accounting by country, 2001-2007 *(revised figures, November 2008)*

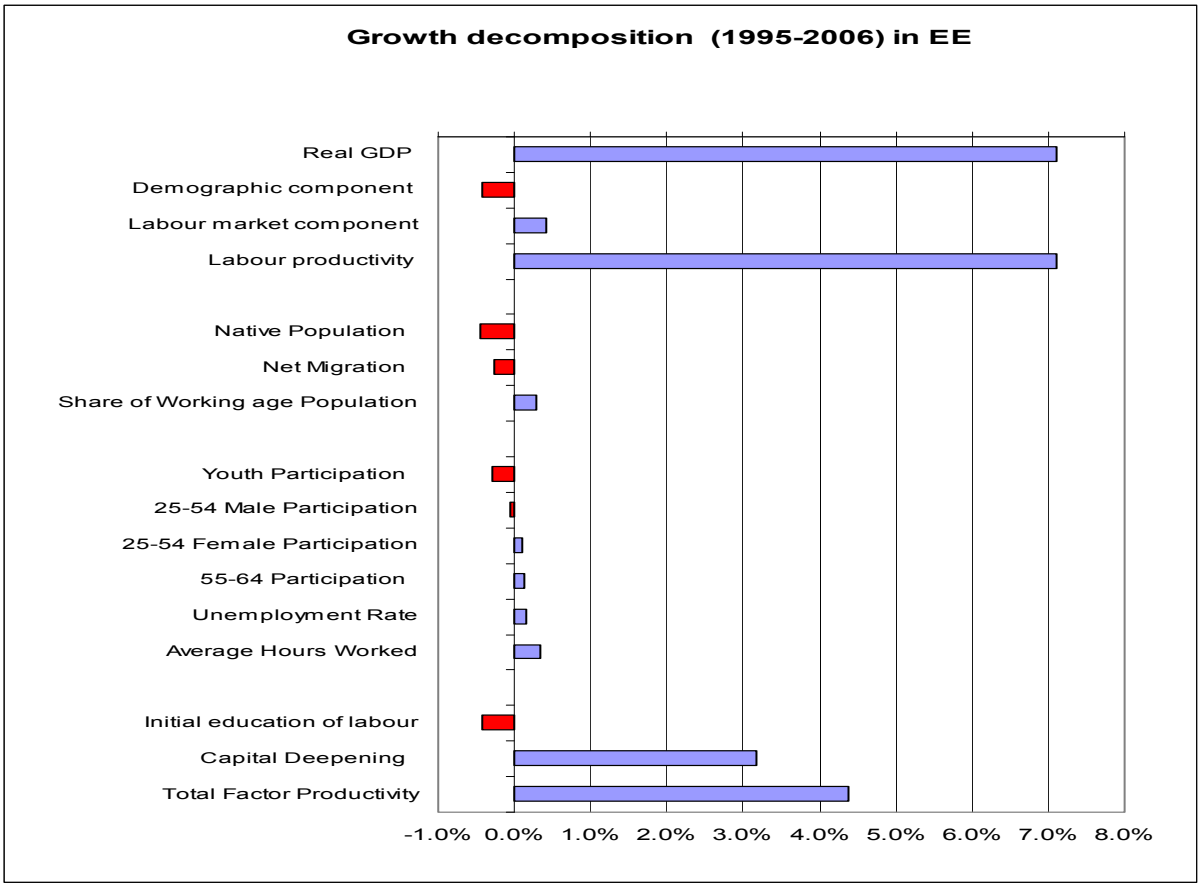
	GDP per capita	Labour productivity	Labour utilisation	Capital Deepening	Total Factor Productivity	Initial education (Labour quality)	Share of Working Population	Native Population	Net Migration	Unemployment Rate	Youth Participation	25-54 Male Participation	25-54 Female Participation	55-64 Participation	Average Hours Worked	Labour component	Demographic component
BE	2.0	1.0	1.0	0.4	0.3	0.4	0.1	0.1	0.4	-0.1	-0.2	-0.1	0.2	0.6	0.1	0.4	0.6
BG	5.6	3.3	2.2	1.6	1.5	0.3	0.3	-0.5	-0.4	1.6	-0.3	-0.1	-0.1	1.5	0.2	2.8	-0.6
CZ	4.5	4.5	0.0	1.9	2.4	0.2	0.3	-0.2	0.2	0.5	-0.9	0.1	0.0	0.6	-0.7	-0.3	0.3
DK	1.6	1.0	0.7	0.4	0.4	0.1	-0.2	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.0	0.5	0.2
DE	1.2	1.4	-0.2	0.5	0.9	0.0	-0.4	-0.1	0.2	-0.1	-0.1	-0.1	0.2	0.7	-0.4	0.2	-0.4
EE	8.0	6.3	1.7	3.0	3.2	0.1	0.2	-0.3	0.0	1.3	0.1	0.1	0.0	0.4	0.0	1.8	-0.1
IE	5.6	2.9	2.7	1.0	1.3	0.6	0.3	0.8	1.2	0.0	0.0	0.0	0.5	0.3	-0.4	0.4	2.3
GR	4.2	2.4	1.8	0.6	1.4	0.5	-0.2	0.0	0.4	0.5	-0.5	0.3	0.7	0.3	0.4	1.7	0.1
ES	3.4	0.9	2.5	0.7	-0.2	0.4	0.1	0.1	1.4	0.4	0.2	0.0	0.7	0.3	-0.8	0.8	1.7
FR	1.8	1.1	0.7	0.5	0.2	0.3	0.0	0.4	0.2	0.1	0.1	-0.3	-0.1	0.3	0.0	0.1	0.7
IT	1.1	0.1	1.0	0.3	-0.5	0.3	-0.3	-0.1	0.7	0.6	-0.5	0.0	0.5	0.5	-0.3	0.8	0.2
CY	3.5	1.1	2.4	0.7	-0.1	0.5	0.8	0.3	1.4	0.1	-0.1	-0.2	0.4	0.2	-0.5	-0.2	2.6
LV	9.1	7.1	2.0	3.1	3.9	0.1	0.3	-0.5	-0.1	1.2	0.4	0.1	-0.1	1.0	-0.4	2.2	-0.3
LT	8.0	6.6	1.4	2.2	4.8	-0.4	0.5	-0.3	-0.2	2.0	-0.9	-0.1	-0.2	0.5	0.2	1.4	0.0
LU	4.2	1.9	2.3	1.1	0.3	0.4	0.1	0.6	0.7	-0.3	-0.3	0.6	1.3	0.7	-1.1	0.9	1.4
HU	3.8	4.1	-0.3	2.2	1.6	0.3	0.1	-0.4	0.1	-0.2	-1.1	0.2	0.3	1.1	-0.5	-0.2	-0.1
MT	1.7	-0.5	2.2	0.5	-1.8	0.9	0.2	0.4	0.4	0.0	-0.5	-0.2	0.9	-0.1	1.0	1.2	1.0
NL	1.9	1.5	0.4	0.5	0.6	0.4	-0.1	0.4	0.0	-0.1	-0.1	-0.2	0.3	0.6	-0.4	0.1	0.3
AT	2.1	1.5	0.6	0.6	0.9	0.0	0.0	0.0	0.5	-0.1	0.1	-0.3	0.0	0.6	-0.2	0.0	0.6
PL	4.1	3.4	0.7	1.4	1.5	0.5	0.4	-0.1	0.0	1.1	-0.5	-0.1	-0.1	0.0	-0.1	0.3	0.3
PT	1.1	0.9	0.2	0.9	-0.5	0.5	-0.1	0.1	0.5	-0.6	-0.2	0.1	0.4	0.1	-0.1	-0.2	0.4
RO	6.1	6.1	0.0	1.9	3.8	0.4	0.4	0.1	-0.4	0.1	-0.8	0.0	-0.1	-0.2	0.8	-0.1	0.2
SI	4.4	4.0	0.5	2.0	1.6	0.4	0.0	-0.1	0.3	0.3	0.0	-0.3	-0.1	0.8	-0.4	0.3	0.2
SK	6.2	5.4	0.8	1.7	3.5	0.2	0.6	0.0	0.1	1.3	-1.1	-0.3	-0.4	0.8	-0.2	0.2	0.7
FI	3.1	2.3	0.8	0.3	1.8	0.2	-0.1	0.2	0.2	0.5	0.0	-0.1	0.0	0.6	-0.3	0.6	0.2
SE	2.8	2.3	0.5	0.4	1.8	0.1	0.3	0.1	0.4	-0.1	0.1	-0.1	-0.1	0.0	-0.2	-0.3	0.8
UK	2.6	2.1	0.4	0.7	1.1	0.3	0.3	0.2	0.3	0.0	-0.2	0.0	0.0	0.3	-0.4	-0.3	0.8
EU27	2.1	1.5	0.6	0.6	0.6	0.3	0.0	0.1	0.3	0.2	-0.1	-0.1	0.1	0.4	-0.3	0.2	0.4
EU15	2.0	1.2	0.8	0.5	0.5	0.3	-0.1	0.1	0.4	0.1	-0.1	-0.1	0.2	0.4	-0.3	0.3	0.5
Euro area (12)	1.9	1.1	0.7	0.5	0.4	0.3	-0.2	0.1	0.5	0.1	-0.1	-0.1	0.3	0.5	-0.4	0.3	0.4
Euro area (16)	1.9	1.1	0.8	0.5	0.3	0.3	-0.1	0.1	0.5	0.2	-0.1	-0.1	0.2	0.5	-0.3	0.4	0.4
EU5	2.4	1.6	0.8	0.6	0.7	0.3	0.0	0.3	0.3	-0.1	0.0	-0.1	0.2	0.5	-0.3	0.2	0.6
EU10	4.7	4.1	0.5	1.7	2.0	0.3	0.4	-0.1	0.0	0.8	-0.7	0.0	-0.1	0.4	-0.3	0.2	0.3
EU10+BG+RO	5.0	4.3	0.5	1.7	2.2	0.3	0.4	-0.1	-0.1	0.8	-0.7	0.0	0.0	0.4	-0.1	0.3	0.2
US	2.3	2.1	0.3	0.9	1.2	-0.1	0.2	1.0	0.0	-0.1	-0.2	0.0	-0.1	0.2	-0.7	-1.0	1.2

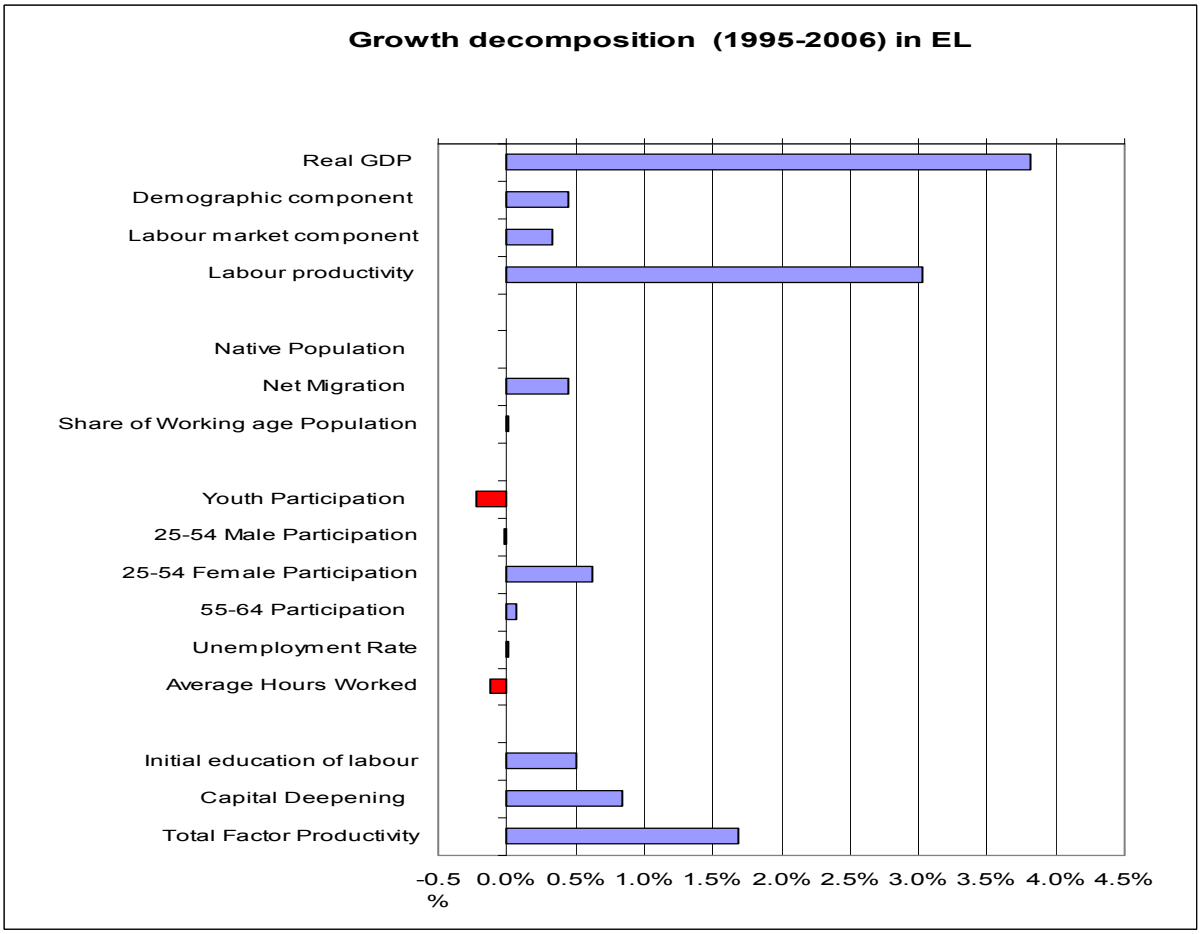

Growth decomposition (1995-2006) in BE
Real GDP
Demographic component
Labour market component
Labour productivity
Native Population
Net Migration
Share of Working age Population
Youth Participation
25-54 Male Participation
25-54 Female Participation
55-64 Participation
Unemployment Rate
Average Hours Worked
Initial education of labour
Capital Deepening
Total Factor Productivity
-0.5%
0.0%
0.5%
1.0%
1.5%
2.0%
2.5%

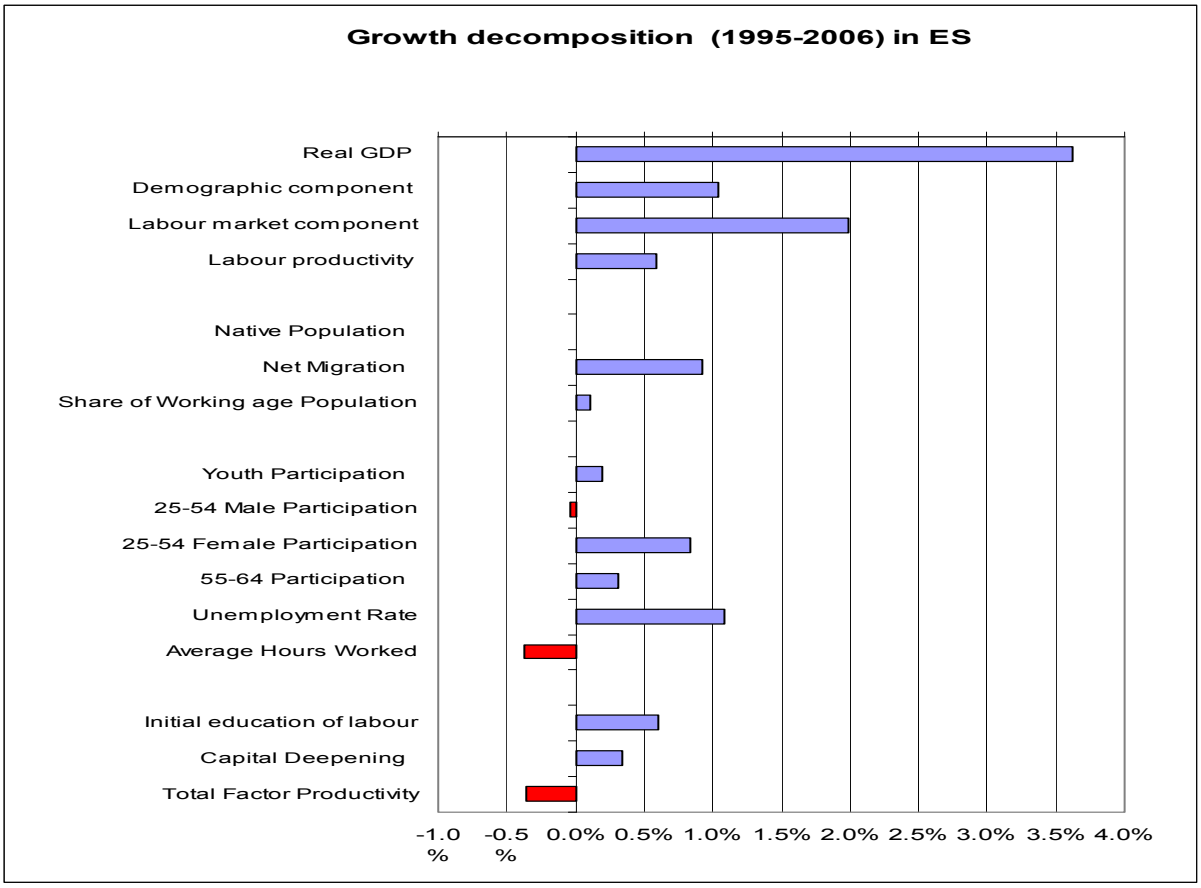

Growth decomposition (1995-2006) in CZ
Real GDP
Demographic component
Labour market component
Labour productivity
Native Population
Net Migration
Share of Working age Population
Youth Participation
25-54 Male Participation
25-54 Female Participation
55-64 Participation
Unemployment Rate
Average Hours Worked
Initial education of labour
Capital Deepening
Total Factor Productivity
-1.5 %
-1.0 %
-0.5 %
0.0 %
0.5 %
1.0 %
1.5 %
2.0 %
2.5 %
3.0 %
3.5 %
4.0 %

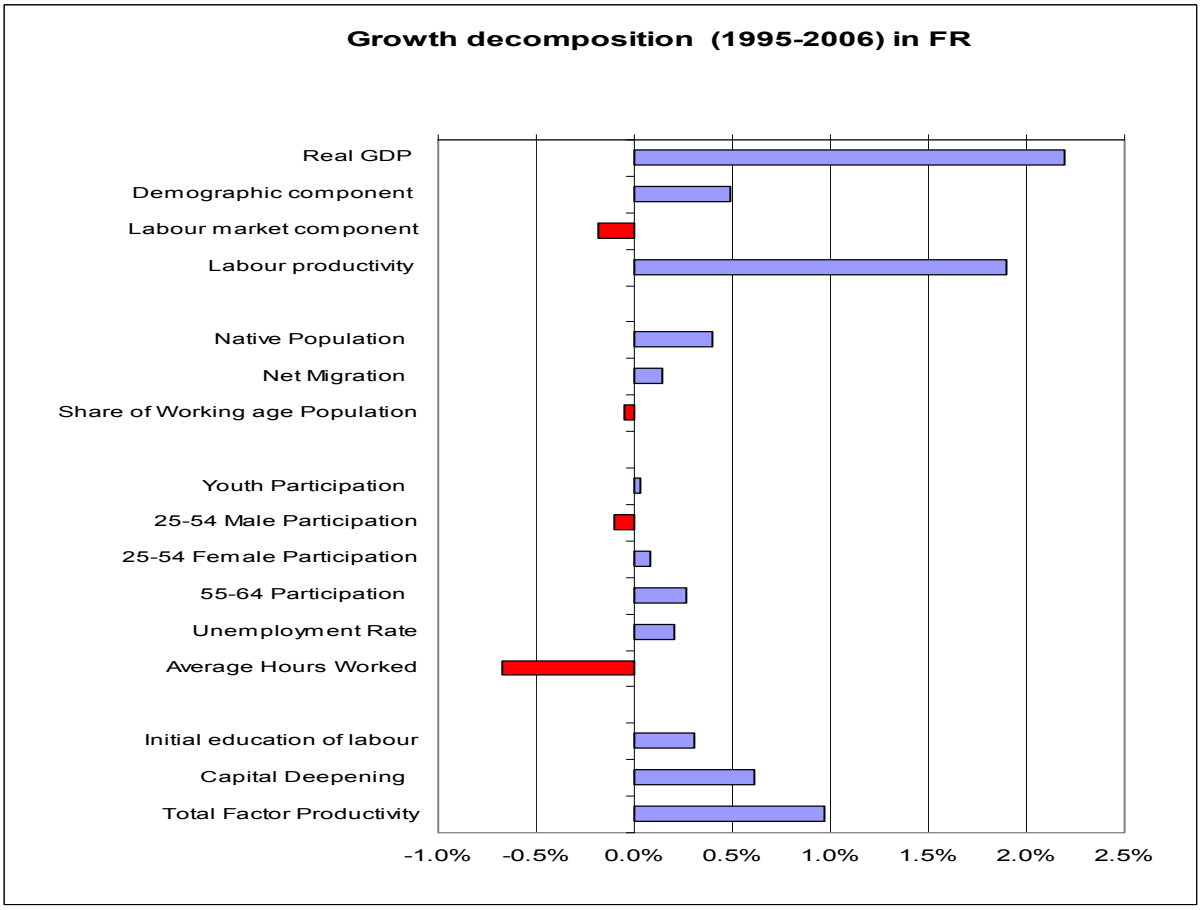

Growth decomposition (1995-2006) in DK
Real GDP
Demographic component
Labour market component
Labour productivity
Native Population
Net Migration
Share of Working age Population
Youth Participation
25-54 Male Participation
25-54 Female Participation
55-64 Participation
Unemployment Rate
Average Hours Worked
Initial education of labour
Capital Deepening
Total Factor Productivity
-0.5%
0.0%
0.5%
1.0%
1.5%
2.0%
2.5%

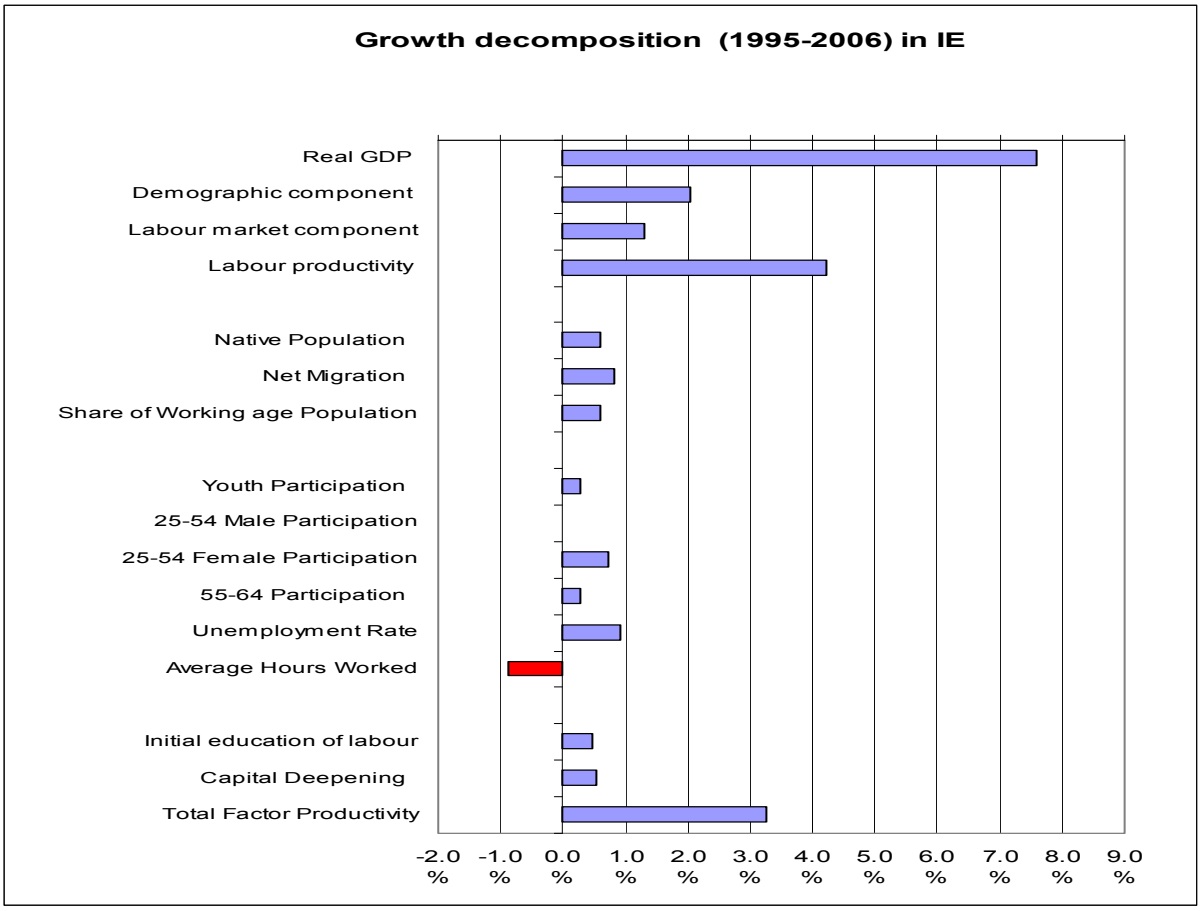

Growth decomposition (1995-2006) in DE
Real GDP
Demographic component
Labour market component
Labour productivity
Native Population
Net Migration
Share of Working age Population
Youth Participation
25-54 Male Participation
25-54 Female Participation
55-64 Participation
Unemployment Rate
Average Hours Worked
Initial education of labour
Capital Deepening
Total Factor Productivity
-1.0%
-0.5%
0.0%
0.5%
1.0%
1.5%
2.0%

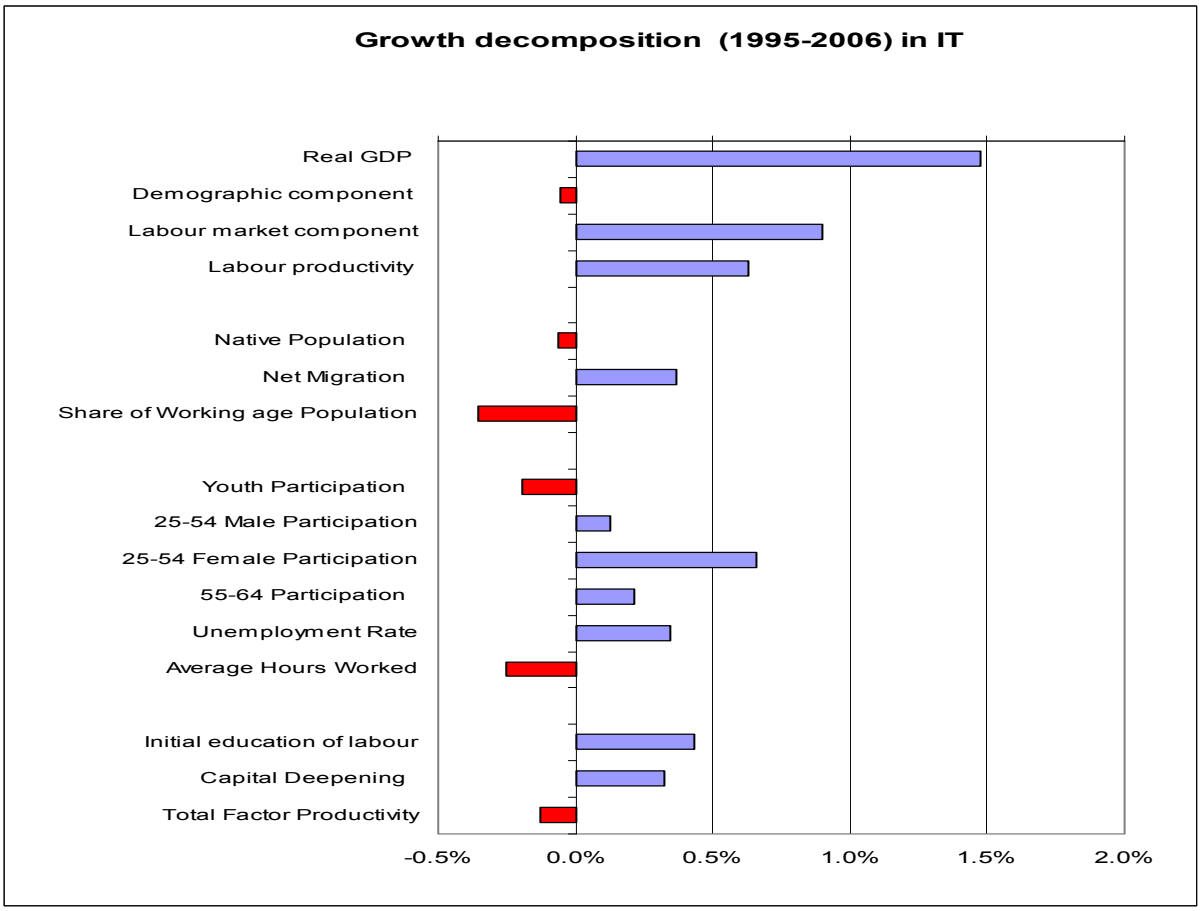

Growth decomposition (1995-2006) in EE
Real GDP
Demographic component
Labour market component
Labour productivity
Native Population
Net Migration
Share of Working age Population
Youth Participation
25-54 Male Participation
25-54 Female Participation
55-64 Participation
Unemployment Rate
Average Hours Worked
Initial education of labour
Capital Deepening
Total Factor Productivity
-1.0% 0.0% 1.0% 2.0% 3.0% 4.0% 5.0% 6.0% 7.0% 8.0%

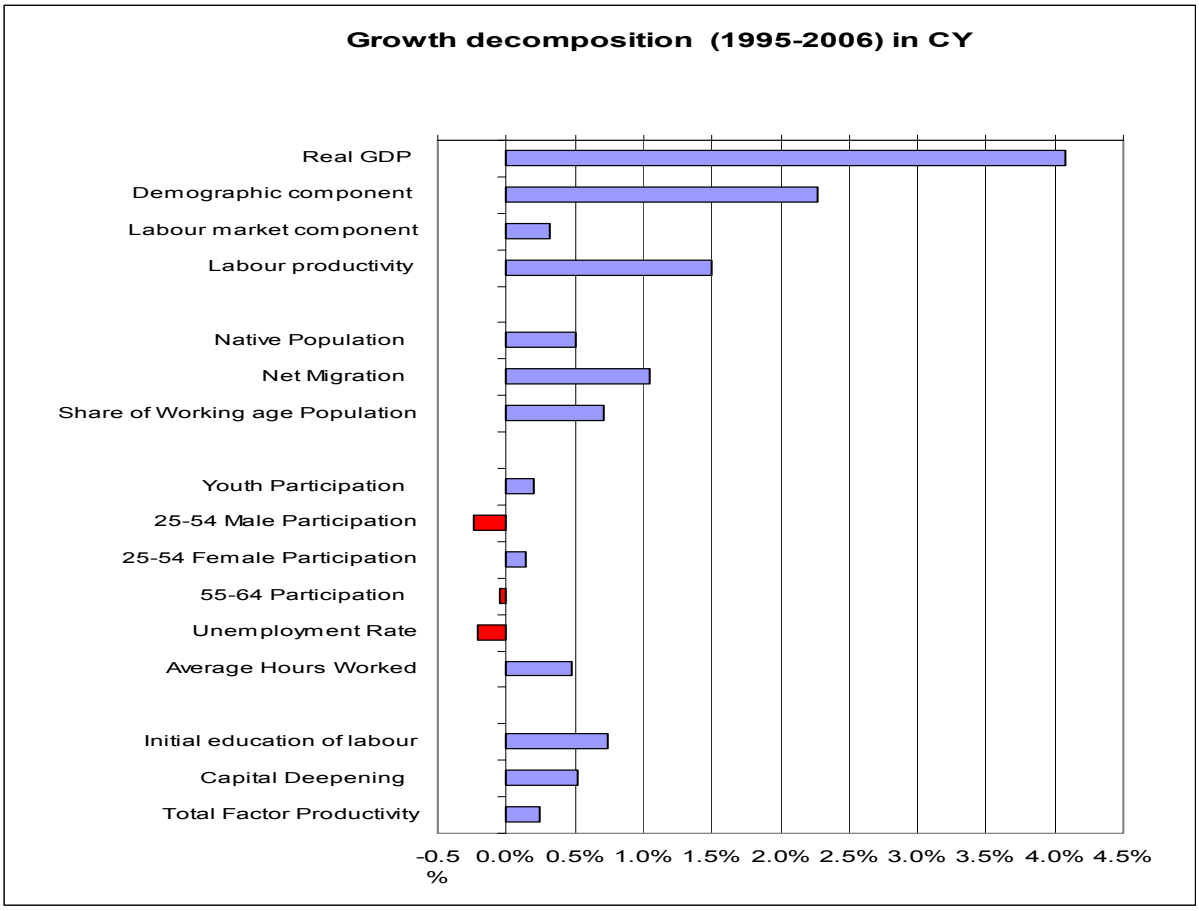

Growth decomposition (1995-2006) in EL
Real GDP
Demographic component
Labour market component
Labour productivity
Native Population
Net Migration
Share of Working age Population
Youth Participation
25-54 Male Participation
25-54 Female Participation
55-64 Participation
Unemployment Rate
Average Hours Worked
Initial education of labour
Capital Deepening
Total Factor Productivity
-0.5 0.0% 0.5% 1.0% 1.5% 2.0% 2.5% 3.0% 3.5% 4.0% 4.5%
%

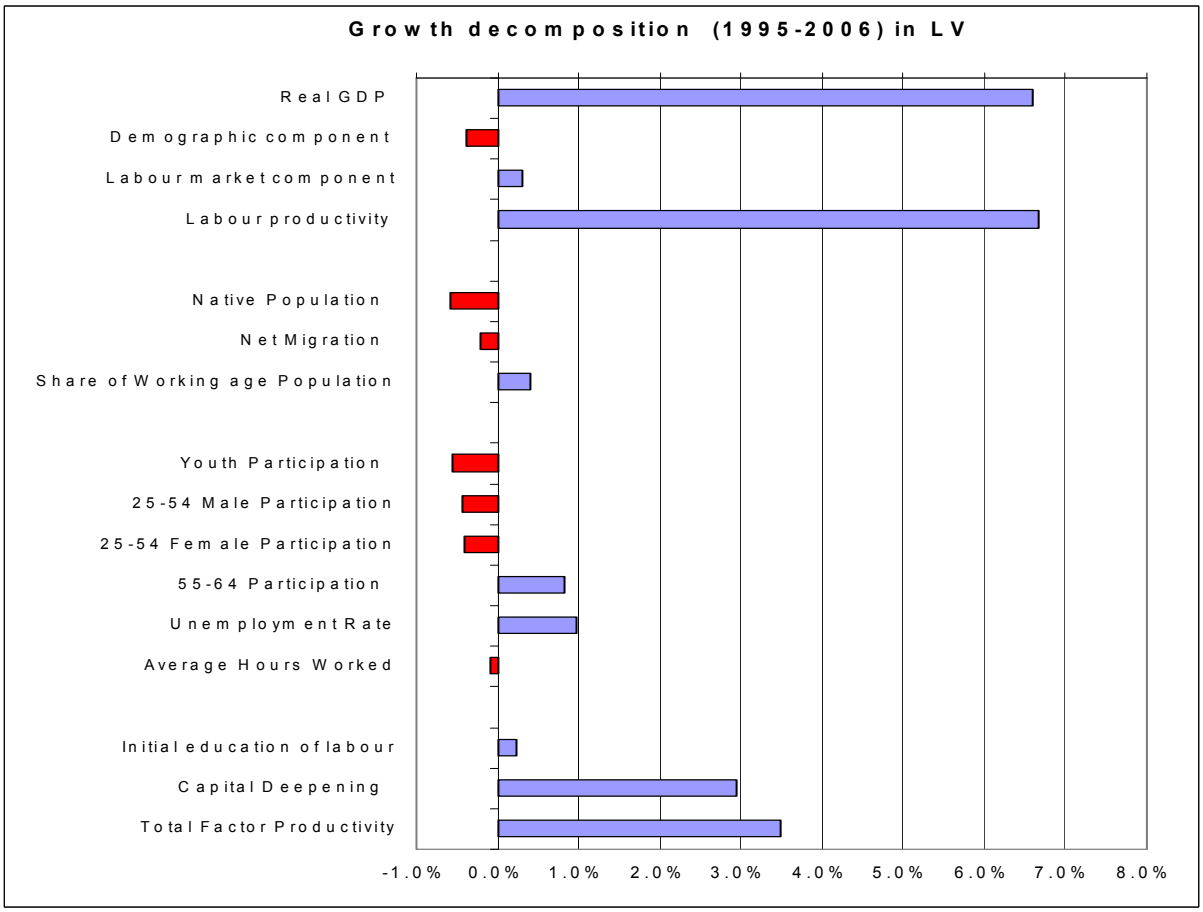

Growth decomposition (1995-2006) in ES
Real GDP
Demographic component
Labour market component
Labour productivity
Native Population
Net Migration
Share of Working age Population
Youth Participation
25-54 Male Participation
25-54 Female Participation
55-64 Participation
Unemployment Rate
Average Hours Worked
Initial education of labour
Capital Deepening
Total Factor Productivity
-1.0 %
-0.5 %
0.0%
0.5%
1.0%
1.5%
2.0%
2.5%
3.0%
3.5%
4.0%

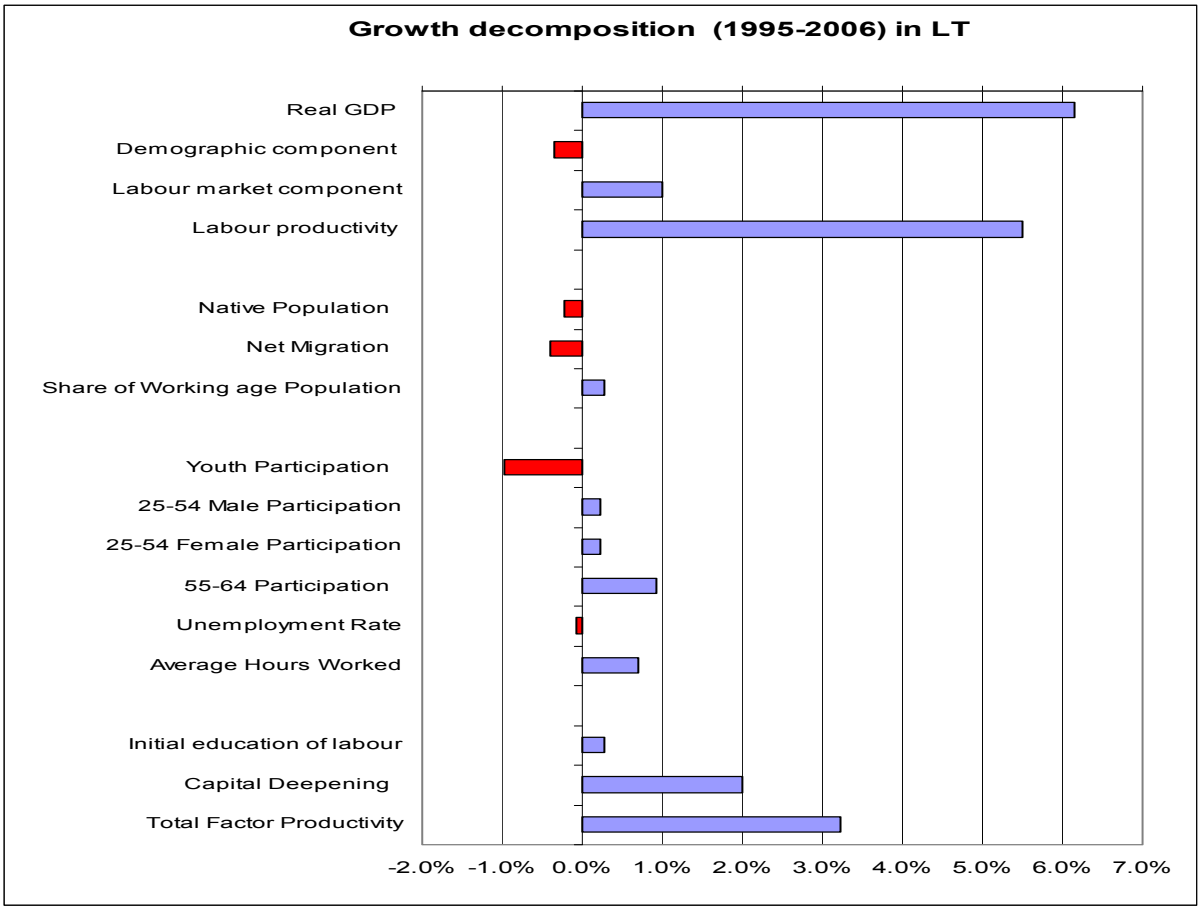

Growth decomposition (1995-2006) in FR
Real GDP
Demographic component
Labour market component
Labour productivity
Native Population
Net Migration
Share of Working age Population
Youth Participation
25-54 Male Participation
25-54 Female Participation
55-64 Participation
Unemployment Rate
Average Hours Worked
Initial education of labour
Capital Deepening
Total Factor Productivity
-1.0%
-0.5%
0.0%
0.5%
1.0%
1.5%
2.0%
2.5%

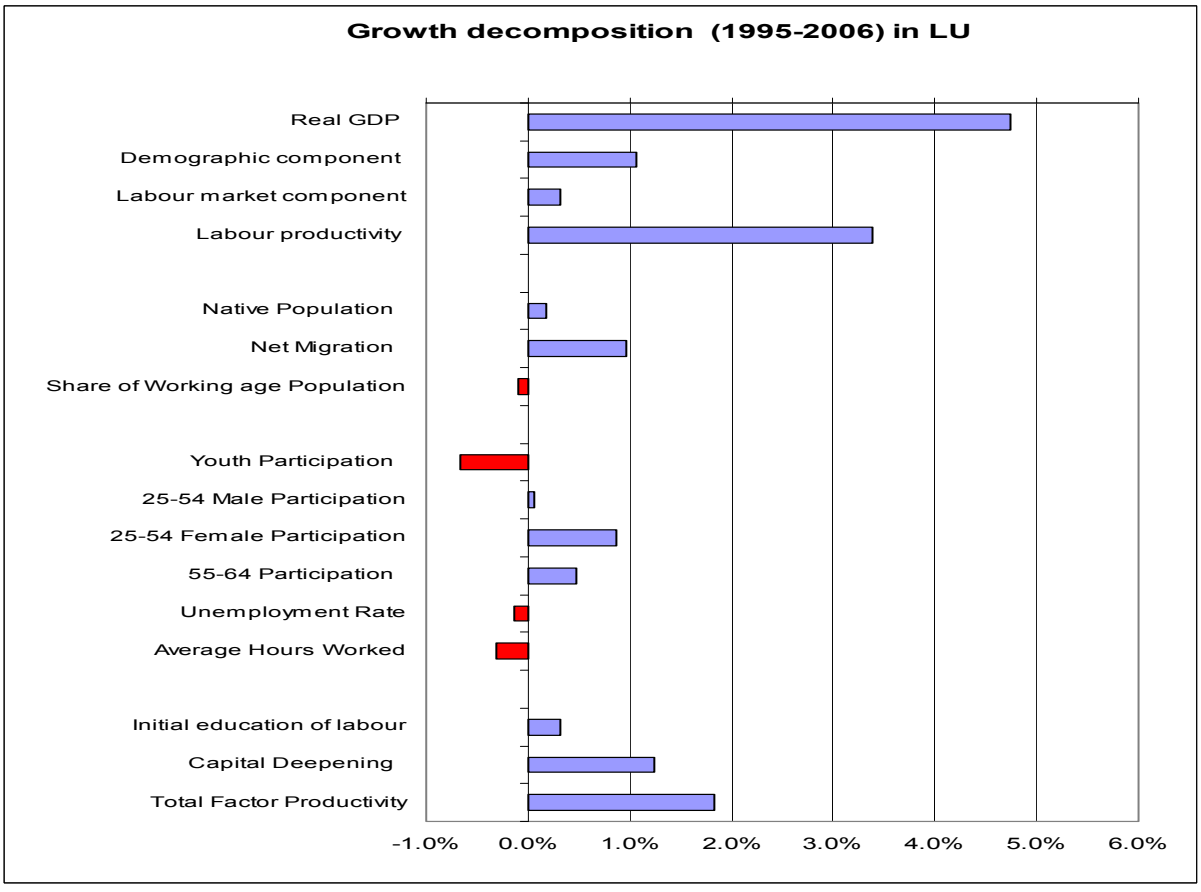

Growth decomposition (1995-2006) in IE
Real GDP
Demographic component
Labour market component
Labour productivity
Native Population
Net Migration
Share of Working age Population
Youth Participation
25-54 Male Participation
25-54 Female Participation
55-64 Participation
Unemployment Rate
Average Hours Worked
Initial education of labour
Capital Deepening
Total Factor Productivity
-2.0 %
-1.0 %
0.0 %
1.0 %
2.0 %
3.0 %
4.0 %
5.0 %
6.0 %
7.0 %
8.0 %
9.0 %

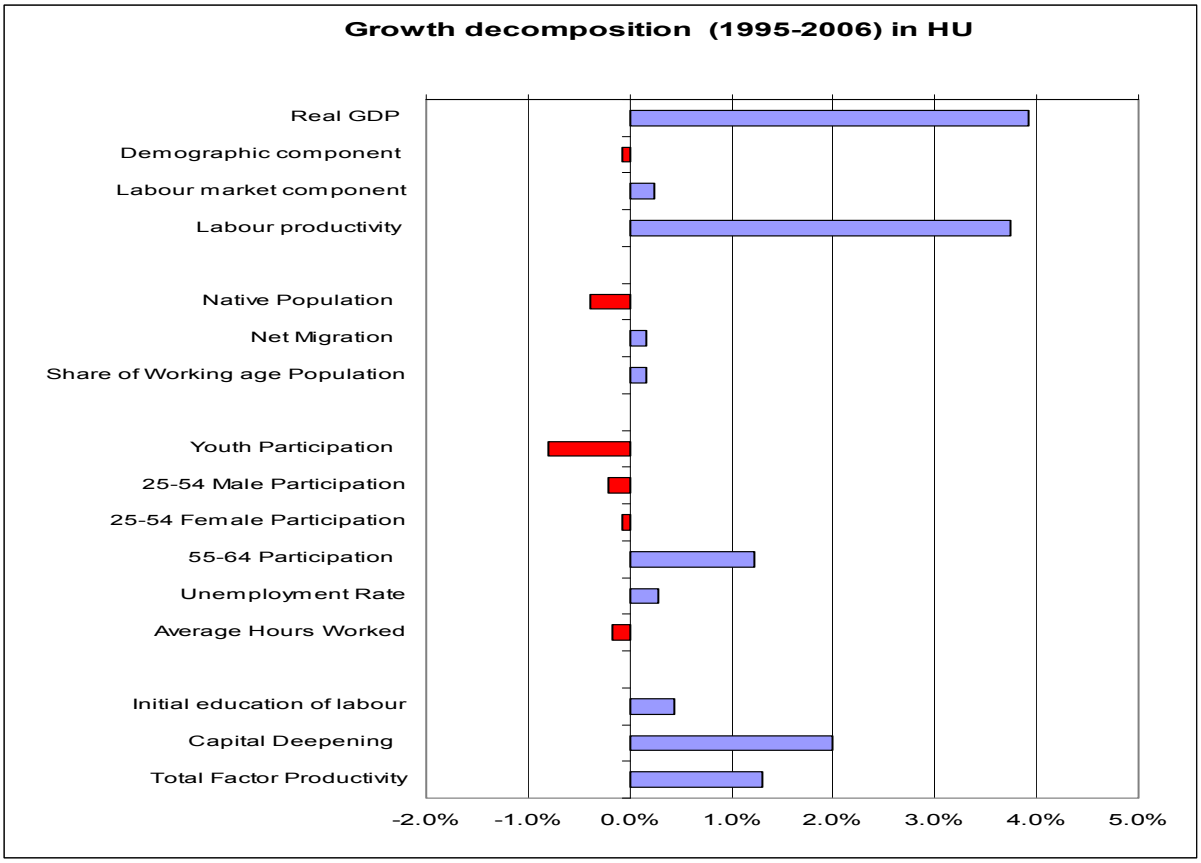

Growth decomposition (1995-2006) in IT
Real GDP
Demographic component
Labour market component
Labour productivity
Native Population
Net Migration
Share of Working age Population
Youth Participation
25-54 Male Participation
25-54 Female Participation
55-64 Participation
Unemployment Rate
Average Hours Worked
Initial education of labour
Capital Deepening
Total Factor Productivity
-0.5%
0.0%
0.5%
1.0%
1.5%
2.0%

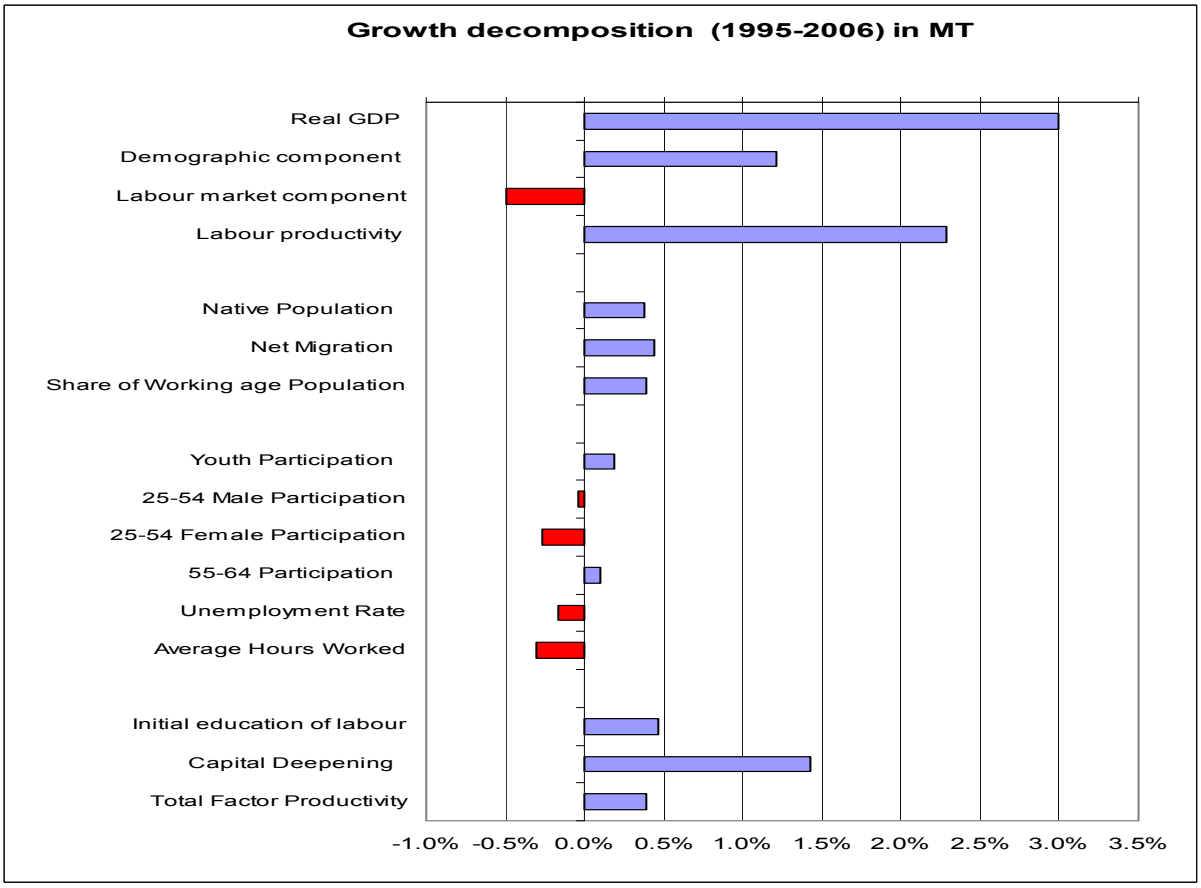

Growth decomposition (1995-2006) in CY
Real GDP
Demographic component
Labour market component
Labour productivity
Native Population
Net Migration
Share of Working age Population
Youth Participation
25-54 Male Participation
25-54 Female Participation
55-64 Participation
Unemployment Rate
Average Hours Worked
Initial education of labour
Capital Deepening
Total Factor Productivity
-0.5 % 0.0% 0.5% 1.0% 1.5% 2.0% 2.5% 3.0% 3.5% 4.0% 4.5%

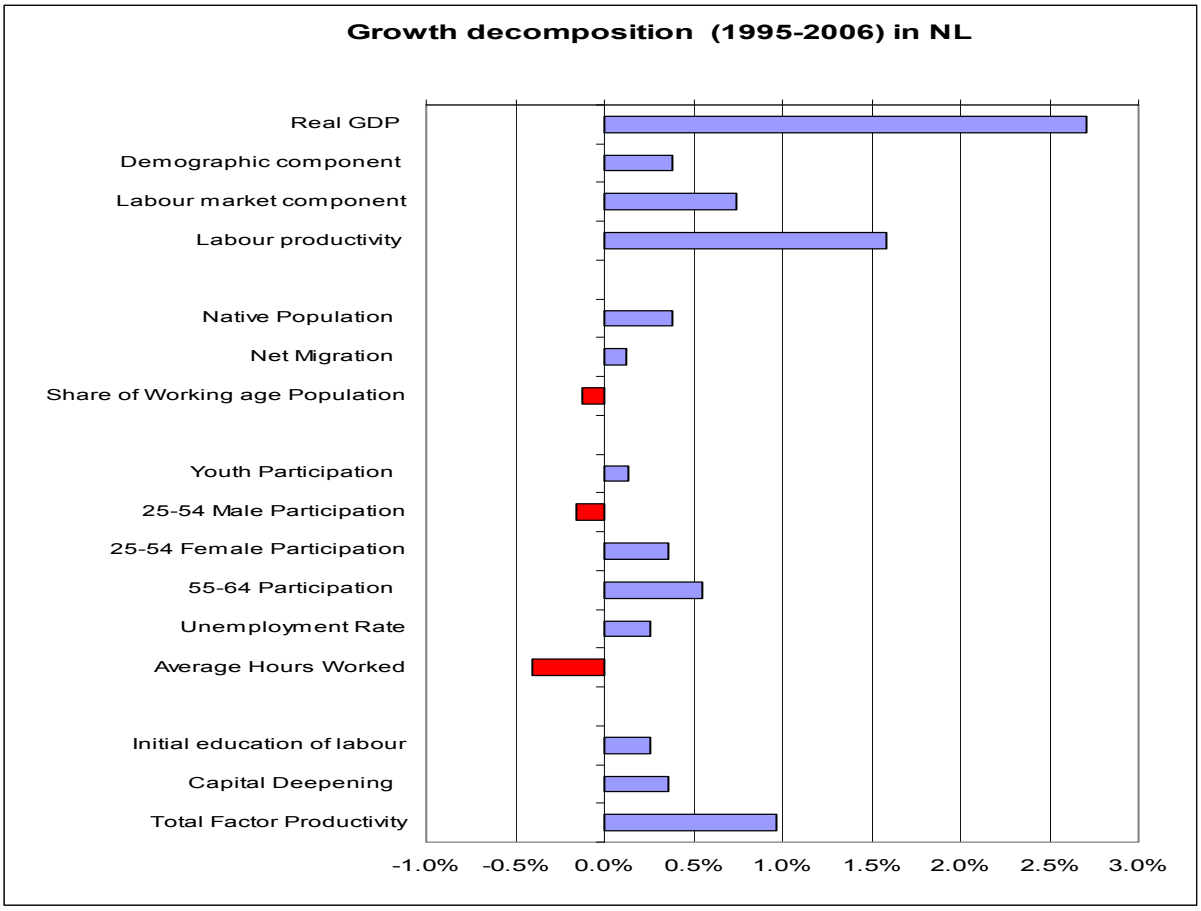

Growth decomposition (1995-2006) in LV
Real GDP
Demographic component
Labour market component
Labour productivity
Native Population
Net Migration
Share of Working age Population
Youth Participation
25-54 Male Participation
25-54 Female Participation
55-64 Participation
Unemployment Rate
Average Hours Worked
Initial education of labour
Capital Deepening
Total Factor Productivity
-1.0% 0.0% 1.0% 2.0% 3.0% 4.0% 5.0% 6.0% 7.0% 8.0%

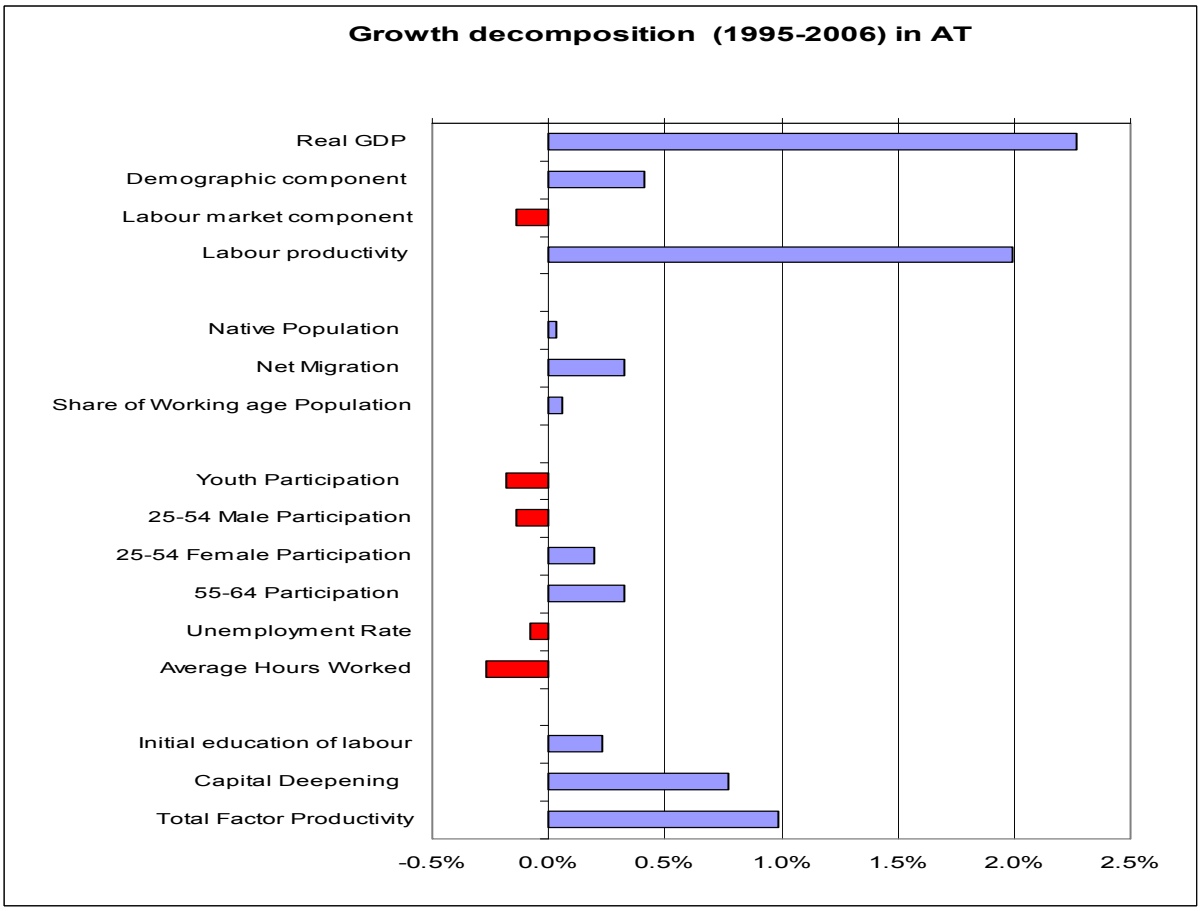

Growth decomposition (1995-2006) in LT
Real GDP
Demographic component
Labour market component
Labour productivity
Native Population
Net Migration
Share of Working age Population
Youth Participation
25-54 Male Participation
25-54 Female Participation
55-64 Participation
Unemployment Rate
Average Hours Worked
Initial education of labour
Capital Deepening
Total Factor Productivity
-2.0% -1.0% 0.0% 1.0% 2.0% 3.0% 4.0% 5.0% 6.0% 7.0%

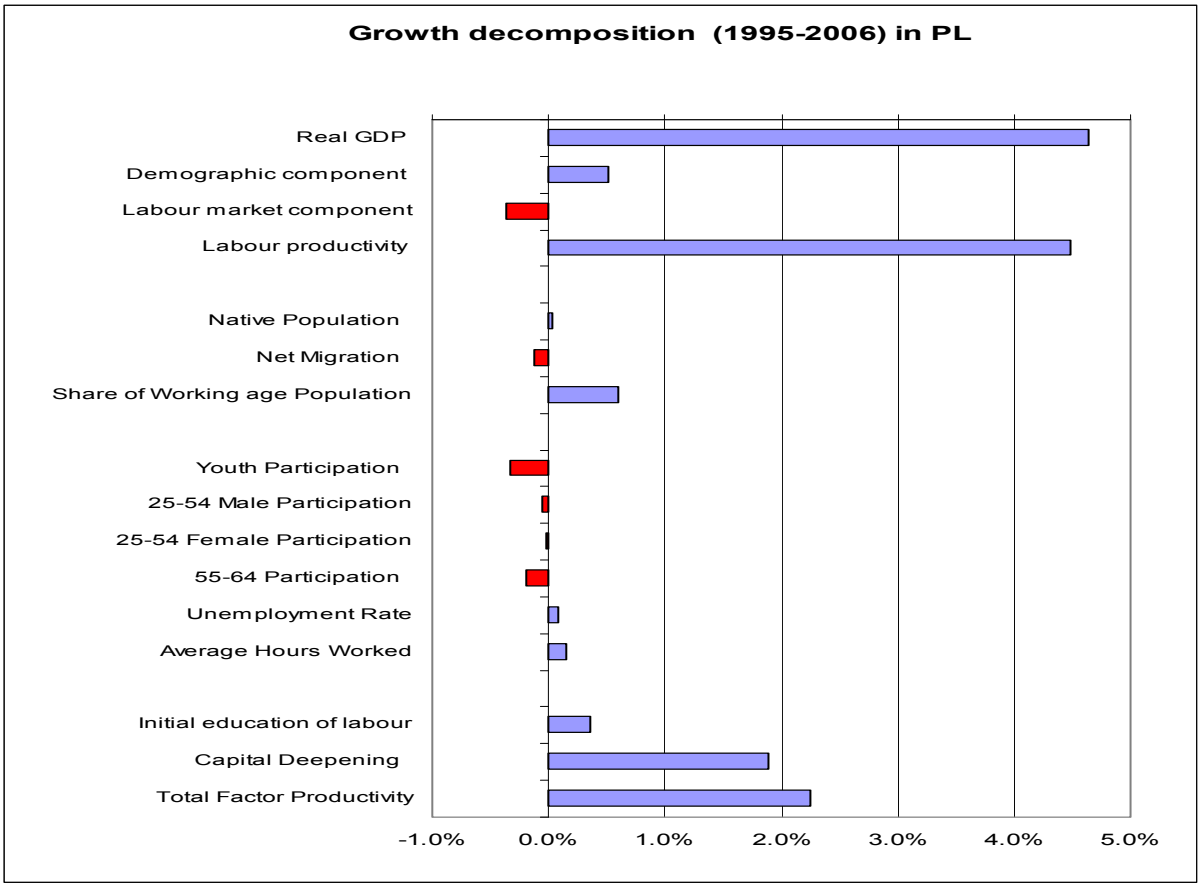

Growth decomposition (1995-2006) in LU
Real GDP
Demographic component
Labour market component
Labour productivity
Native Population
Net Migration
Share of Working age Population
Youth Participation
25-54 Male Participation
25-54 Female Participation
55-64 Participation
Unemployment Rate
Average Hours Worked
Initial education of labour
Capital Deepening
Total Factor Productivity
-1.0% 0.0% 1.0% 2.0% 3.0% 4.0% 5.0% 6.0%

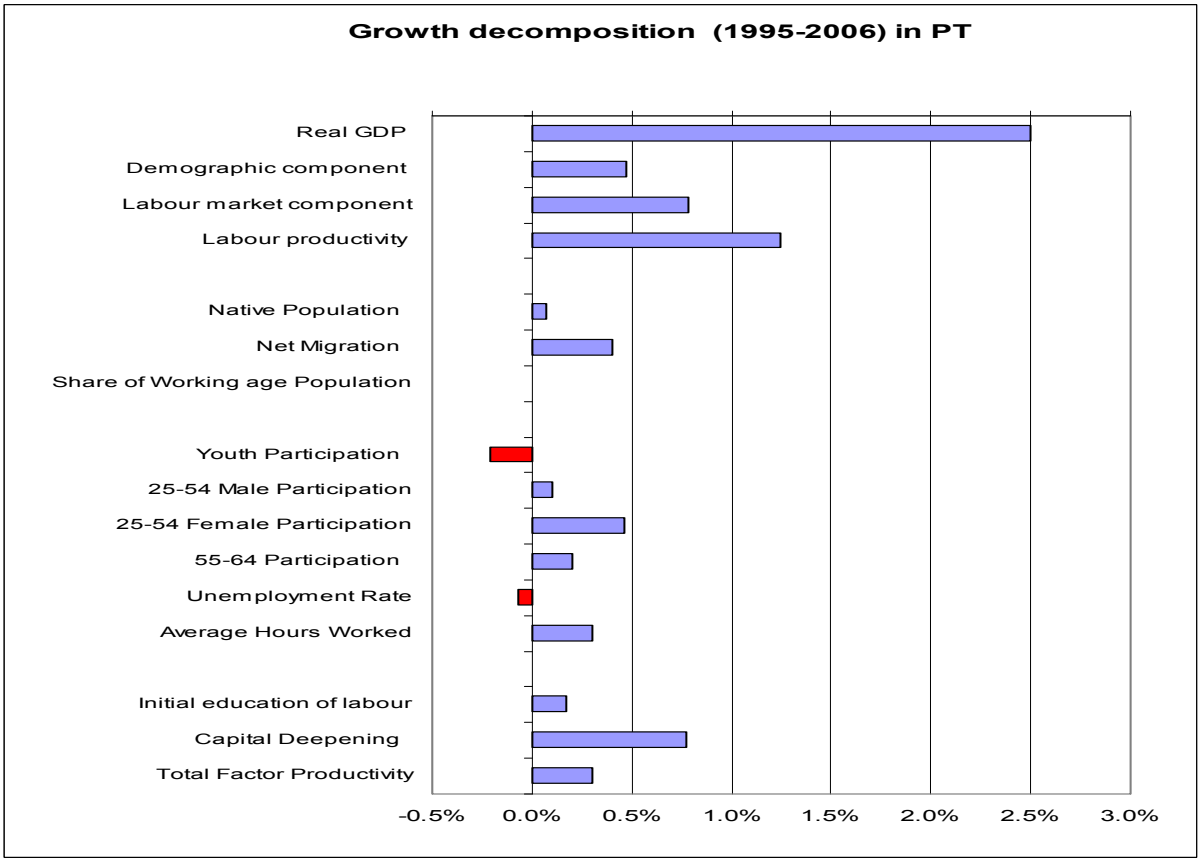

Growth decomposition (1995-2006) in HU
Real GDP
Demographic component
Labour market component
Labour productivity
Native Population
Net Migration
Share of Working age Population
Youth Participation
25-54 Male Participation
25-54 Female Participation
55-64 Participation
Unemployment Rate
Average Hours Worked
Initial education of labour
Capital Deepening
Total Factor Productivity
-2.0% -1.0% 0.0% 1.0% 2.0% 3.0% 4.0% 5.0%

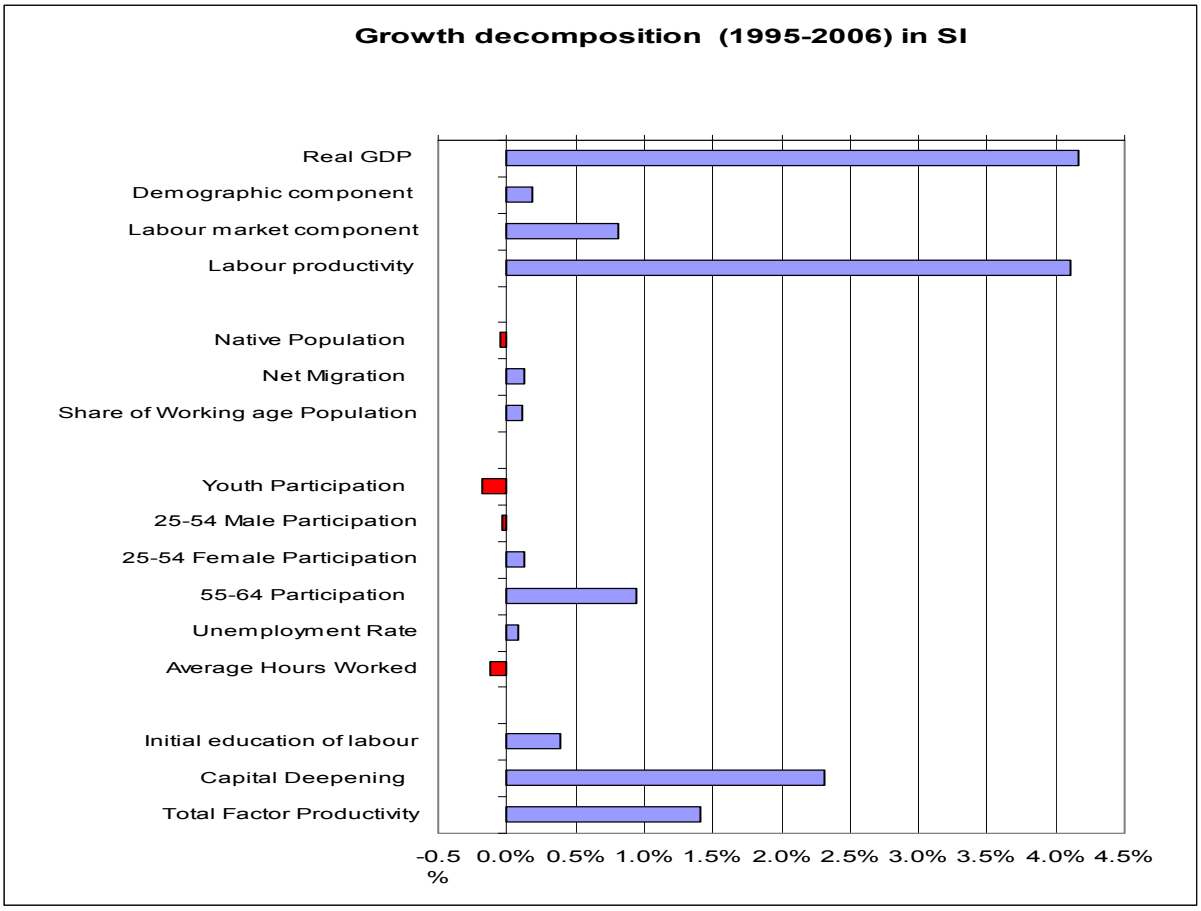

Growth decomposition (1995-2006) in MT
Real GDP
Demographic component
Labour market component
Labour productivity
Native Population
Net Migration
Share of Working age Population
Youth Participation
25-54 Male Participation
25-54 Female Participation
55-64 Participation
Unemployment Rate
Average Hours Worked
Initial education of labour
Capital Deepening
Total Factor Productivity
-1.0% -0.5% 0.0% 0.5% 1.0% 1.5% 2.0% 2.5% 3.0% 3.5%

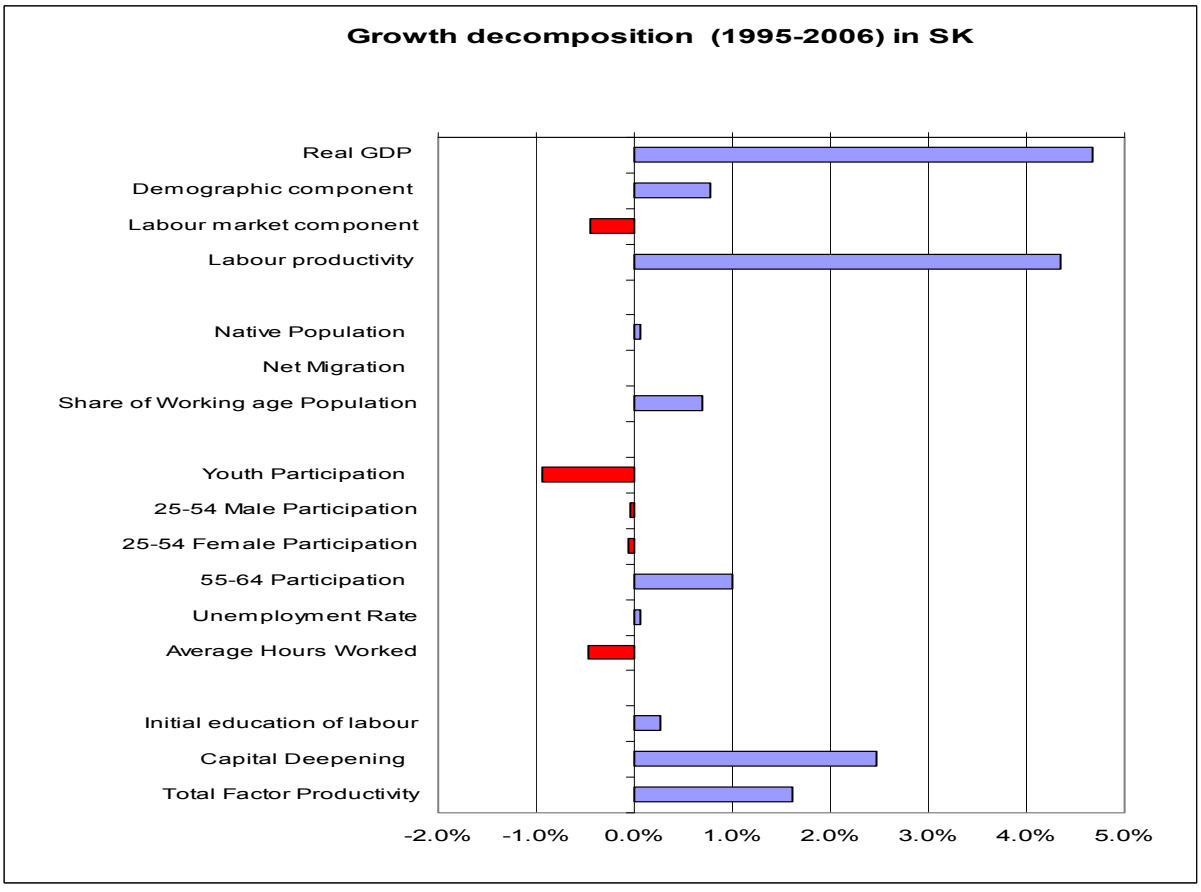

Growth decomposition (1995-2006) in NL
Real GDP
Demographic component
Labour market component
Labour productivity
Native Population
Net Migration
Share of Working age Population
Youth Participation
25-54 Male Participation
25-54 Female Participation
55-64 Participation
Unemployment Rate
Average Hours Worked
Initial education of labour
Capital Deepening
Total Factor Productivity
-1.0% -0.5% 0.0% 0.5% 1.0% 1.5% 2.0% 2.5% 3.0%

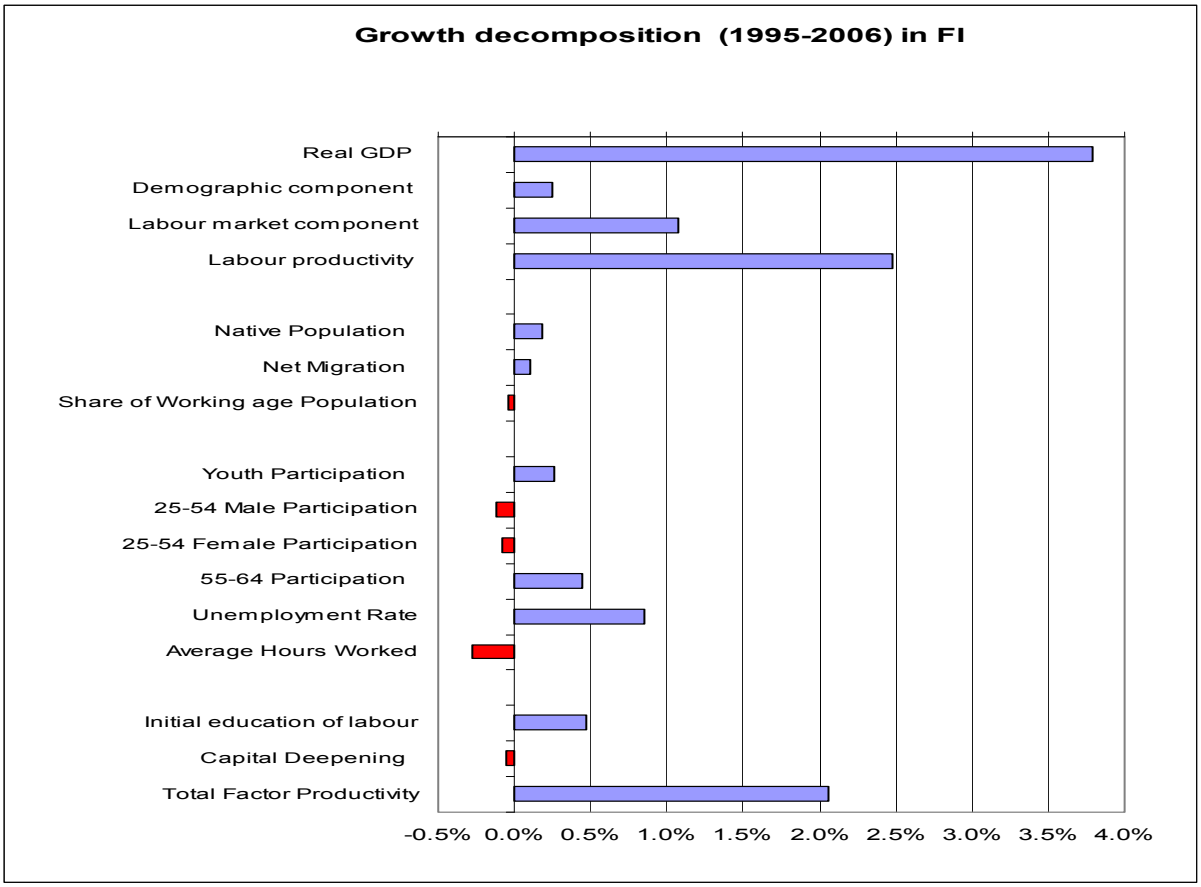

Growth decomposition (1995-2006) in AT
Real GDP
Demographic component
Labour market component
Labour productivity
Native Population
Net Migration
Share of Working age Population
Youth Participation
25-54 Male Participation
25-54 Female Participation
55-64 Participation
Unemployment Rate
Average Hours Worked
Initial education of labour
Capital Deepening
Total Factor Productivity
-0.5% 0.0% 0.5% 1.0% 1.5% 2.0% 2.5%

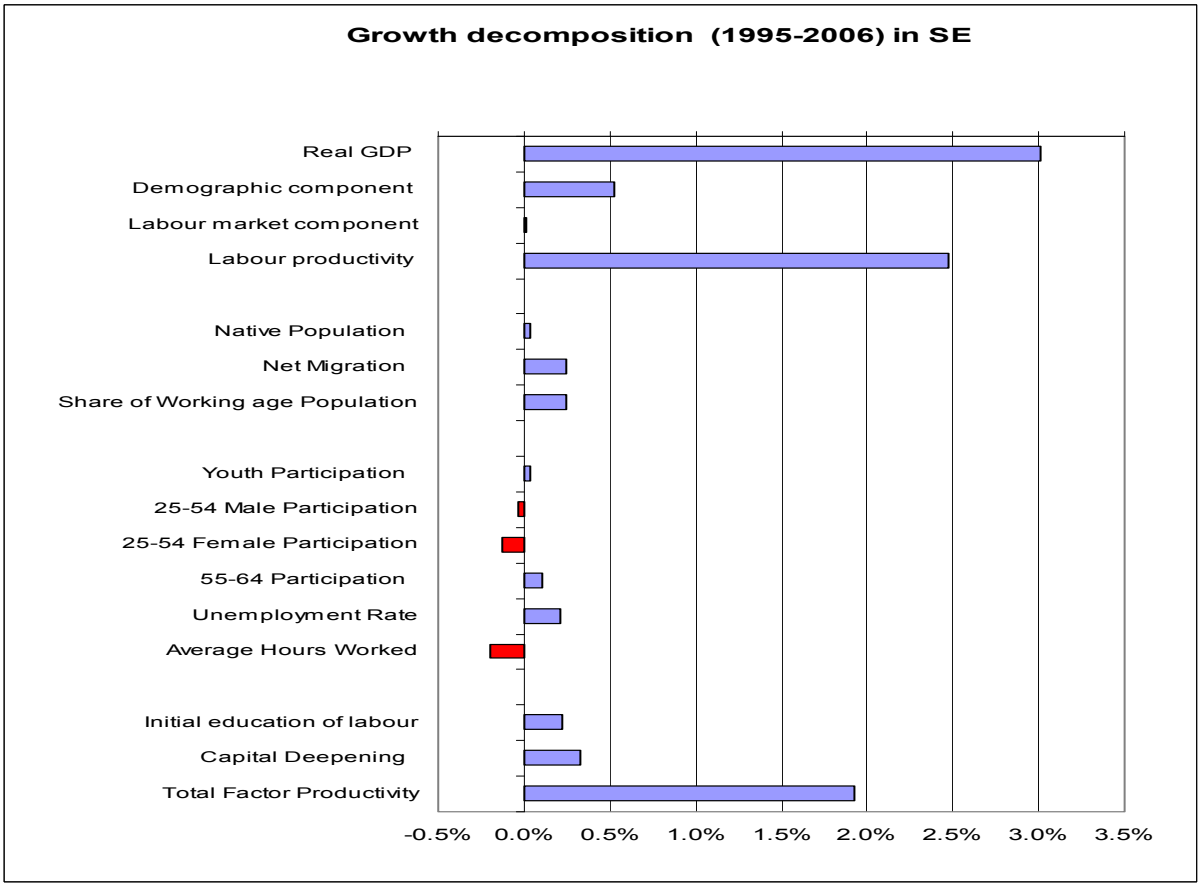

Growth decomposition (1995-2006) in PL
Real GDP
Demographic component
Labour market component
Labour productivity
Native Population
Net Migration
Share of Working age Population
Youth Participation
25-54 Male Participation
25-54 Female Participation
55-64 Participation
Unemployment Rate
Average Hours Worked
Initial education of labour
Capital Deepening
Total Factor Productivity
-1.0%
0.0%
1.0%
2.0%
3.0%
4.0%
5.0%

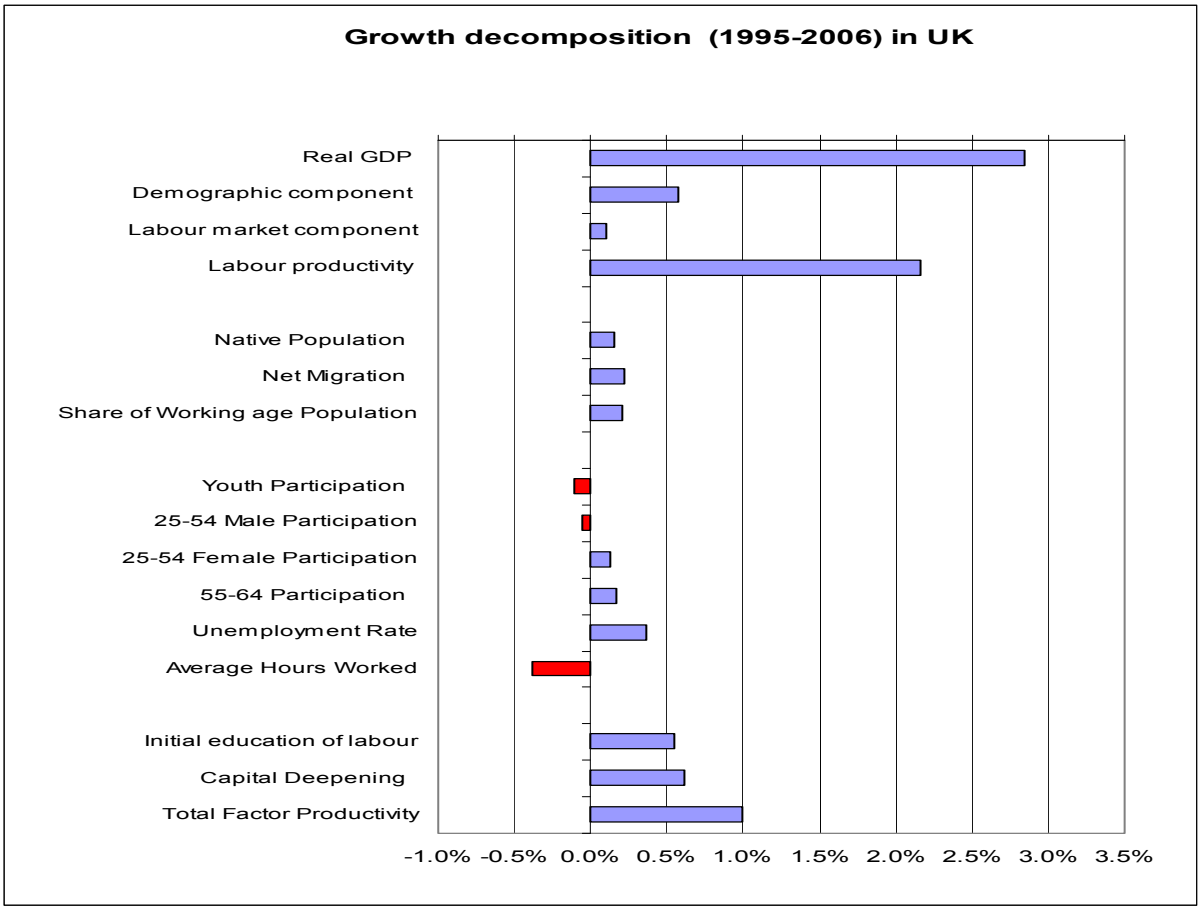

Growth decomposition (1995-2006) in PT
Real GDP
Demographic component
Labour market component
Labour productivity
Native Population
Net Migration
Share of Working age Population
Youth Participation
25-54 Male Participation
25-54 Female Participation
55-64 Participation
Unemployment Rate
Average Hours Worked
Initial education of labour
Capital Deepening
Total Factor Productivity
-0.5%
0.0%
0.5%
1.0%
1.5%
2.0%
2.5%
3.0%

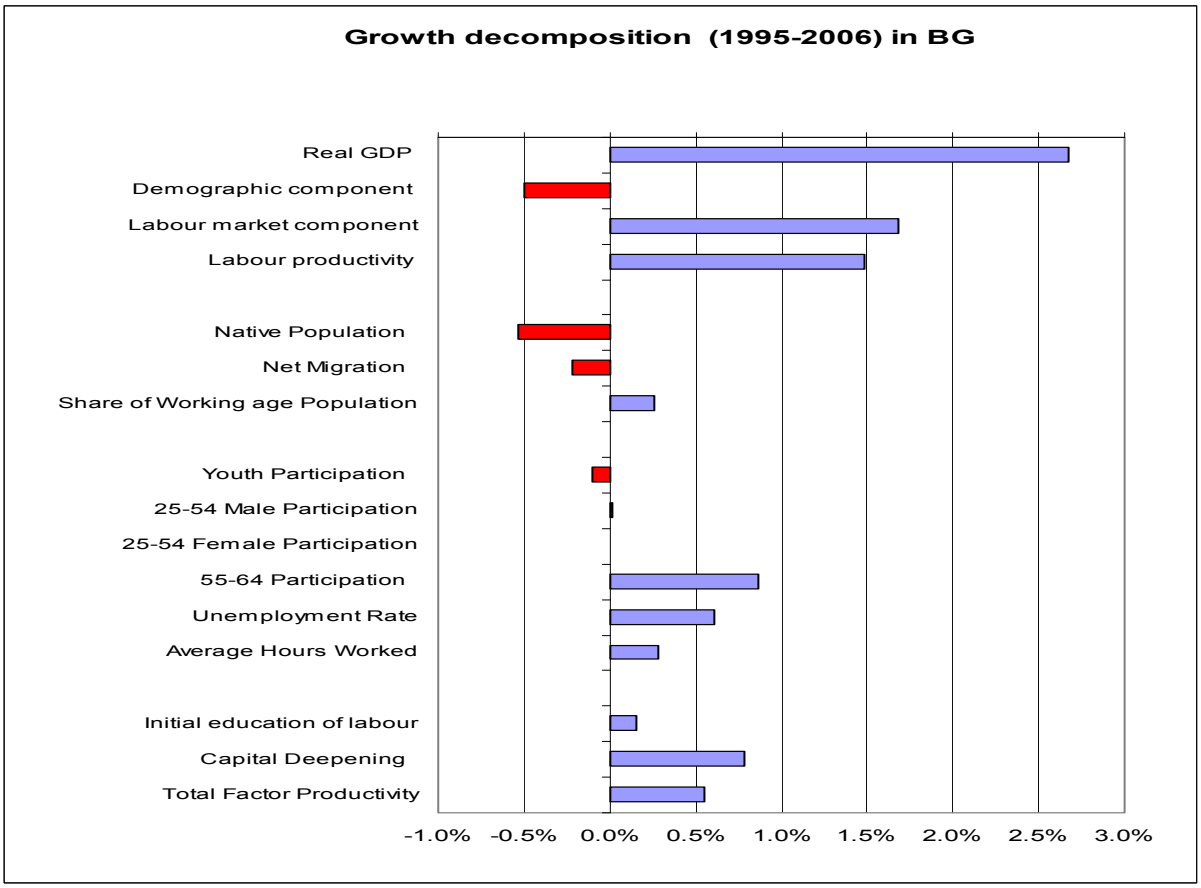

Growth decomposition (1995-2006) in SI
Real GDP
Demographic component
Labour market component
Labour productivity
Native Population
Net Migration
Share of Working age Population
Youth Participation
25-54 Male Participation
25-54 Female Participation
55-64 Participation
Unemployment Rate
Average Hours Worked
Initial education of labour
Capital Deepening
Total Factor Productivity
-0.5 0.0% 0.5% 1.0% 1.5% 2.0% 2.5% 3.0% 3.5% 4.0% 4.5%
%

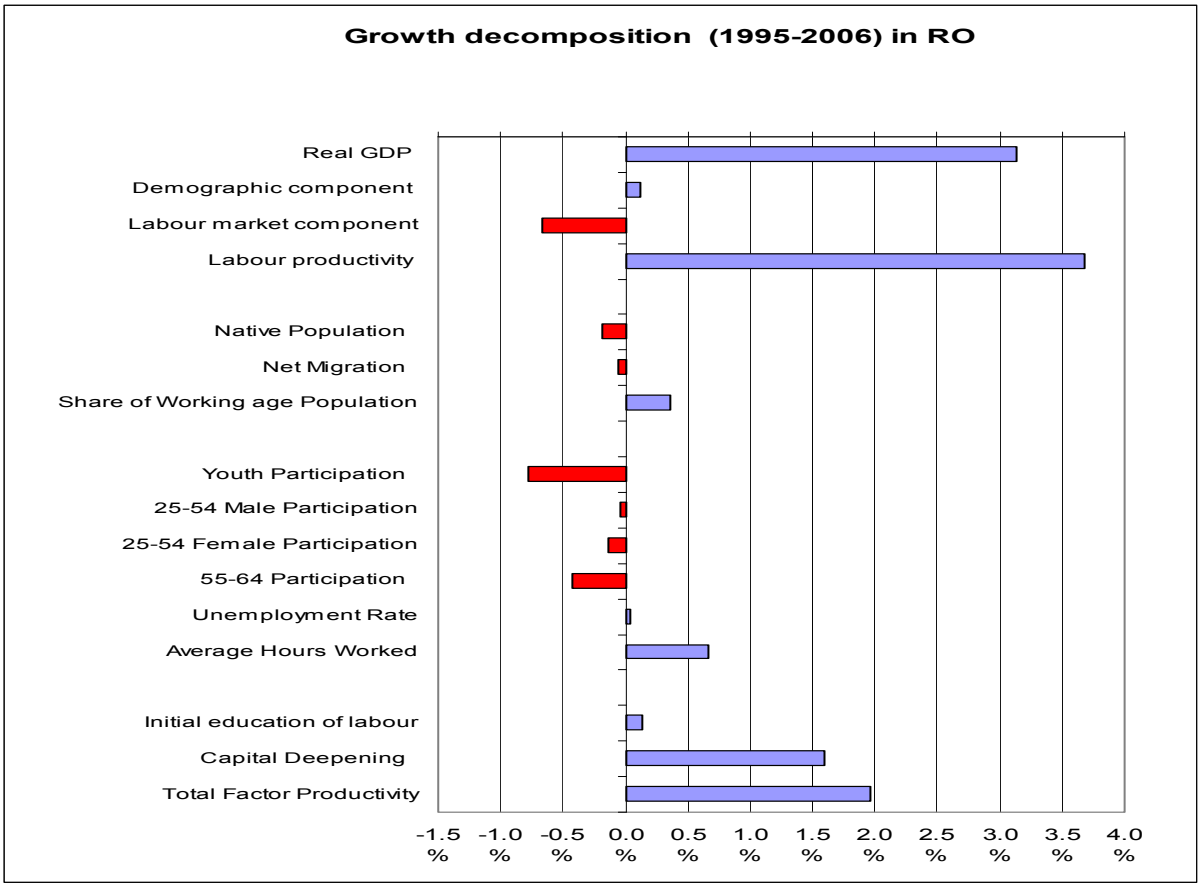

Growth decomposition (1995-2006) in SK
Real GDP
Demographic component
Labour market component
Labour productivity
Native Population
Net Migration
Share of Working age Population
Youth Participation
25-54 Male Participation
25-54 Female Participation
55-64 Participation
Unemployment Rate
Average Hours Worked
Initial education of labour
Capital Deepening
Total Factor Productivity
-2.0% -1.0% 0.0% 1.0% 2.0% 3.0% 4.0% 5.0%

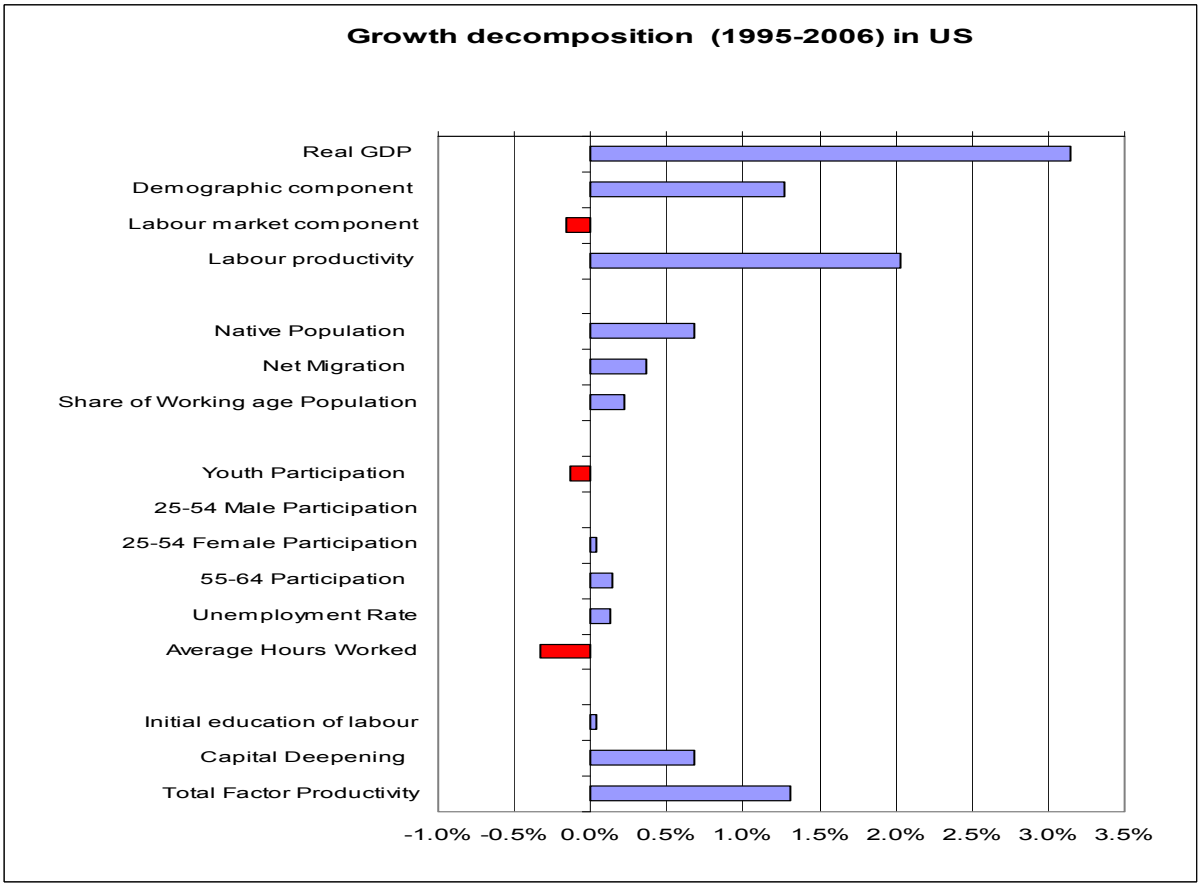

Growth decomposition (1995-2006) in FI
Real GDP
Demographic component
Labour market component
Labour productivity
Native Population
Net Migration
Share of Working age Population
Youth Participation
25-54 Male Participation
25-54 Female Participation
55-64 Participation
Unemployment Rate
Average Hours Worked
Initial education of labour
Capital Deepening
Total Factor Productivity
-0.5% 0.0% 0.5% 1.0% 1.5% 2.0% 2.5% 3.0% 3.5% 4.0%


Growth decomposition (1995-2006) in SE
Real GDP
Demographic component
Labour market component
Labour productivity
Native Population
Net Migration
Share of Working age Population
Youth Participation
25-54 Male Participation
25-54 Female Participation
55-64 Participation
Unemployment Rate
Average Hours Worked
Initial education of labour
Capital Deepening
Total Factor Productivity
-0.5% 0.0% 0.5% 1.0% 1.5% 2.0% 2.5% 3.0% 3.5%


Growth decomposition (1995-2006) in UK
Real GDP
Demographic component
Labour market component
Labour productivity
Native Population
Net Migration
Share of Working age Population
Youth Participation
25-54 Male Participation
25-54 Female Participation
55-64 Participation
Unemployment Rate
Average Hours Worked
Initial education of labour
Capital Deepening
Total Factor Productivity
-1.0% -0.5% 0.0% 0.5% 1.0% 1.5% 2.0% 2.5% 3.0% 3.5%


Growth decomposition (1995-2006) in BG
Real GDP
Demographic component
Labour market component
Labour productivity
Native Population
Net Migration
Share of Working age Population
Youth Participation
25-54 Male Participation
25-54 Female Participation
55-64 Participation
Unemployment Rate
Average Hours Worked
Initial education of labour
Capital Deepening
Total Factor Productivity
-1.0% -0.5% 0.0% 0.5% 1.0% 1.5% 2.0% 2.5% 3.0%


Growth decomposition (1995-2006) in RO
Real GDP
Demographic component
Labour market component
Labour productivity
Native Population
Net Migration
Share of Working age Population
Youth Participation
25-54 Male Participation
25-54 Female Participation
55-64 Participation
Unemployment Rate
Average Hours Worked
Initial education of labour
Capital Deepening
Total Factor Productivity
-1.5 % -1.0 % -0.5 % 0.0 % 0.5 % 1.0 % 1.5 % 2.0 % 2.5 % 3.0 % 3.5 % 4.0 %


Growth decomposition (1995-2006) in US
Real GDP
Demographic component
Labour market component
Labour productivity
Native Population
Net Migration
Share of Working age Population
Youth Participation
25-54 Male Participation
25-54 Female Participation
55-64 Participation
Unemployment Rate
Average Hours Worked
Initial education of labour
Capital Deepening
Total Factor Productivity
-1.0% -0.5% 0.0% 0.5% 1.0% 1.5% 2.0% 2.5% 3.0% 3.5%

ANNEX 4: TAKING ACCOUNT OF THE BUSINESS CYCLE

The economic cycle may impact the results of the growth accounting. While the business cycle is muter across the period 1995-2006, which almost corresponds to a full cycle, this is less true to the period 2001-2007, where most EU15 countries were running below their potential output. The current annex illustratively shows the cyclical effect for the period 2001-2007.

Therefore, we have estimated the cyclical reaction of each growth component by regressing them on output gap from AMECO with an (unbalanced) panel of 27 EU countries covering the period 1995-2006[32].

Cyclical-adjustment: a hybrid model with output gap and change in output gap

This method does not claim to be the best way of identifying the cyclical effects but has the great merit of being applicable consistently to all twelve GDP components (unlike the Output Gap Working group method, which is more reliable and economically-sound), while remaining relatively clear and simple. We first use the following simple fixed-effect specification where k is the identifier of growth components, OG denotes a measure of the cyclical position of the economy, ΔOG the change in cyclical position from the previous year and αi are i country dummies.

$$Contrib_{k\,it} = \alpha_{k\,i} + \beta_k \; OG_{it} + \gamma_k \; \Delta OG_{it} + \varepsilon_{k\,it}$$

We then remove the effect of the business cycle from the contribution to growth.

$$CycleAdjusted\ Contrib_{k\,it} = \hat{\alpha}_{k\,i} + \hat{\varepsilon}_{k\,it}$$

This model is hybrid in the sense that there is no choice made on the specification of the cyclical pattern. Indeed, except for GDP growth, which theoretically depends upon the

[32] For the whole period 1995-2006, output gap data was not available for most member states. Data are missing for 1995, 1996 and 1997 for around half of the new member states.

change in output gap only, there is no compelling theoretical rationale in favour of apprehending the effect of the business cycle with the level of output gap only or the change in output gap. As seen in Table 7, the estimation seems to back this approach using both level and change of output gap, as the cyclical pattern (i.e. the role of level or change in output gap) varies across growth components.

We run this equation for each policy area, except for native population and the share of working-age population, for which there is no sound theoretical reason justifying any cyclical pattern. We select the output gap coefficients with the highest t-statistics in the first two equations, as marked in bold in Table 7. The third equation, which is run over fewer observations due to the inclusion of lagged variables, is only shown as a robustness check. The selected coefficients are used to correct the growth in GDP components from the cyclical components.

The estimated coefficients are in compliance with the expected sign, except for hours worked. The following growth contributions appear to be procyclical: unemployment and TFP, to a lesser extent, youth participation, prime-age male participation and prime-age female participation, older-worker participation, unemployment and migration, which complies with the expectations of the economic theories. Conversely, average hours worked per person, the initial education of labour and capital deepening appear countercyclical. The surprising negative correlation of output gap with average hours worked should be investigated further, as it is at odds with the counter–cyclical pattern of part-time employment rate, which is one key driver of average hours worked. On the other hand, a high output gap might coincide with more recruitment as an alternative to overtime to raise productive capacity. The initial education of labour increases in good time (and declines in bad times), as booming labour markets are more inclusive for low-skilled employees. As for TFP, it will incorporate the movements in productive capacity utilisation that are not captured by cyclical developments in labour input: for instance, a high level of labour hoarding in a cyclical downturn will be reflected in lower TFP. Prime-age participation does not seem to be significantly related to output gap. Moreover, except for migration and as already mentioned above, we assume that demographic growth components are not influenced by the business cycle, as there is no theoretical reason to believe so.

Table 7 Estimation of the cyclical impact on each growth component score
(in **bold** the coefficients used in the cyclical adjustment)

	Residual following common AR(1)				**Residual following country-specific AR(1)**				**Instrumental variable: one-year-lagged output gap and change in output gap**			
	Output gap		Change in output gap		Output gap		Change in output gap		Output gap		Change in output gap	
GDP			1.006	(83.20)***			1.027	(94.57)***	0.285	(5.40)***	1.135	(21.31)***
Native Pop	-0.01	(-3.37)***	0.013	(3.84)***	-0.015	(4.91)***	0.016	(5.01)***	-0.016	(-1.04)	0.031	(2.01)**
Migration	0.029	(4.59)***	-0.026	(-4.34)***	**0.034**	(6.02)***	**-0.031**	(-5.98)***	-0.005	(-0.21)	-0.09	(-4.17)***
Working-age pop. share	0.002	(0.55)	-0.005	(-1.42)	0.003	(0.87)	-0.007	(-1.93)*	0.008	(0.85)	-0.002	(-0.24)
Youth participation	0.029	(1.42)	0.079	(3.39)***	0.005	(0.29)	**0.084**	(4.28)***	0.086	(1.88)*	0.154	(3.34)***
Prime-age male part	0.007	(0.69)	**0.032**	(2.62)***	0.006	(0.59)	0.03	(2.60)***	0.057	(2.14)**	0.08	(2.98)***
Prime-age female part.	-0.015	(-1.12)	**0.04**	(2.78)***	-0.015	(-1.24)	0.034	(2.56)**	0.012	(0.39)	0.034	(1.09)
Older-worker part.	0.035	(2.62)***	-0.023	(-1.34)	**0.037**	(3.16)***	-0.012	(-0.81)	0.082	(2.31)**	0.018	(0.51)
Unemployment	0.161	(5.20)***	0.137	(4.16)***	**0.196**	(8.70)***	**0.121**	(4.52)***	0.221	(2.84)***	0.218	(2.78)***
Average hours worked per person	-0.043	(-1.90)*	0.034	(1.6)	**-0.041**	(-2.01)**	0.03	(1.57)	-0.18	(-2.72)***	-0.065	(-0.97)
Initial education of labour	**-0.068**	(-2.98)***	0.034	(1.4)	-0.057	(-2.62)***	0.023	(0.99)	-0.096	(-1.29)	-0.002	(-0.03)
Capital deepening	0.036	(1.73)*	-0.128	(5.23)***	**0.042**	(-2.34)**	**-0.129**	(-6.12)***	0.082	(1.81)*	-0.102	(-2.22)**
TFP	-0.017	(-0.51)	0.802	(20.71)***	-0.016	(-0.54)	**0.841**	(25.41)***	0.033	(0.47)	0.861	(12.21)***
Number of observation	265				265				238			

*Value of t- statistics in parentheses: * significant at 10%; ** significant at 5%; *** significant at 1%. Note: The first two equations are estimated over the period 1995-2005 by feasible generalised least squares allowing for heteroskedastic errors and first order serial correlation. The later is estimated as common across countries in the first equation and as specific to each country in the second equation. The first two equations contain country dummies to account for cross-country heterogeneity. The third equation is estimated with instrumental variable techniques, using one-year-lagged output gap and one-year-lagged change in output gap as instrumental variables.*

The result of the cyclical adjustment

Table 8 shows the estimated cyclical component of each growth contribution in percentage point, which is generally moderate in terms of annual average. However, for some countries and some GDP components, the cyclical effect is not negligible (e.g. for unemployment or TFP, especially in new member states), even more if we consider cumulated growth over a multi-annual period, when the annual growth rate cumulate. The strongest impact of the business cycle on the score is seen for the contribution of TFP and, to a lower extent, unemployment, capital deepening and initial education. These effects can be important for particular countries, especially amongst the new member states. Marginal impacts only show up for average hours worked, youth participation, older worker participation and migration. The cyclical adjustment of GDP growth, obtained as the sum of the adjusted contributions to growth, is close but not identical to the rougher method consisting in applying the method directly to GDP growth. The former method leads to an annual average cyclical adjustment of -0.3 p.p., -0.2 p.p. and -0.3 p.p. for the EU27, the EU15 and the euro area respectively. While only TFP is affected (downward) by the business cycle in the EU15 and the euro area

as a whole, the EU10+BG +RO also recorded a negative cyclical impact on labour utilisation (mainly in terms of unemployment deterioration). The impact on labour productivity and TFP is very different across new member states, even in terms of sign, because of differing cyclical conditions. Removing the estimated cyclical components to actual figures allows one to obtain an estimation of the cyclically-adjusted contribution to growth, as shown in Table 9.

Table 8. Estimation of the cyclical component of each growth contribution in percentage point

Cyclical effects 2001-2007			Capital Deepening	Total Factor Productivity	Initial education (Labour quality)	Share of Working age Population	Native Population	Net Migration	Unemployment Rate	Youth Participation	25-54 Male Participation	25-54 Female Participation	55-64 Participation	Average Hours Worked
	GDP aggregate	GDP component sum	CI	TFP	LQ	SWP	Npop	MI	Unempl	YP	MP	FP	OPR	AHW
AT	-0.2	-0.3	0.0	-0.1	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0
BE	-0.2	-0.2	0.0	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BG	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
CY	-0.4	-0.4	0.1	-0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CZ	0.5	0.3	-0.1	0.4	0.1	0.0	0.0	-0.1	-0.2	0.0	0.0	0.0	0.0	0.0
DE	-0.1	-0.2	0.0	-0.1	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0
DK	-0.3	-0.2	0.0	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EE	0.8	1.0	0.0	0.7	-0.1	0.0	0.0	0.0	0.4	0.1	0.0	0.0	0.1	-0.1
ES	-0.4	-0.3	0.1	-0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FI	-0.4	-0.4	0.0	-0.3	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0
FR	-0.3	-0.3	0.1	-0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GR	0.3	0.5	0.0	0.3	-0.1	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
HU	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
IE	-0.6	-0.3	0.1	-0.5	-0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0
IT	-0.3	-0.2	0.0	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LT	1.0	1.1	-0.1	0.8	-0.1	0.0	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.0
LU	-0.6	-0.5	0.1	-0.5	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0
LV	1.0	1.0	-0.1	0.8	-0.1	0.0	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.0
MT	-0.8	-0.9	0.1	-0.6	0.1	0.0	0.0	0.0	-0.3	-0.1	0.0	0.0	0.0	0.0
NL	-0.4	-0.5	0.0	-0.3	0.0	0.0	0.0	0.0	-0.2	0.0	0.0	0.0	0.0	0.0
PL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PT	-0.6	-0.7	0.1	-0.5	0.0	0.0	0.0	0.0	-0.2	0.0	0.0	0.0	0.0	0.0
RO	1.5	1.4	-0.2	1.3	0.0	0.0	0.0	-0.1	0.2	0.1	0.0	0.1	0.0	0.0
SE	-0.2	-0.2	0.0	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SI	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0
SK	0.9	0.3	-0.2	0.7	0.2	0.0	0.0	-0.1	-0.4	0.1	0.0	0.0	-0.1	0.1
UK	-0.1	-0.1	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EU27	-0.6	-0.3	-0.1	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	0.0
EU15	-0.3	-0.2	0.0	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
euro area 16	-0.3	-0.3	0.0	-0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EU5	-0.4	-0.4	0.0	-0.3	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0

Table 9. Estimation of each cyclically-adjusted growth contribution in percentage point

Cyclically-adjusted contributions Average growth 2001-2007			Capital Deepening	Total Factor Productivity	Initial education (Labour quality)	Share of Working age Population	Native Population	Net Migration	Unemployment Rate	Youth Participation	25-54 Male Participation	25-54 Female Participation	55-64 Participation	Average Hours Worked
	GDP aggregate	GDP component sum	CI	TFP	LQ	SWP	Npop	MI	Unempl	YP	MP	FP	OPR	AHW
AT	2.3	2.4	0.6	1.1	0.0	0.0	0.0	0.5	0.0	0.1	-0.3	0.0	0.6	-0.3
BE	2.2	2.2	0.3	0.5	0.4	0.1	0.1	0.4	-0.1	-0.2	-0.1	0.2	0.6	0.1
BG	5.5	5.4	1.5	1.5	0.3	0.3	-0.5	-0.4	1.5	-0.3	-0.1	-0.1	1.5	0.2
CY	4.0	3.9	0.6	0.3	0.5	0.8	0.3	1.4	0.2	-0.1	-0.2	0.4	0.1	-0.5
CZ	4.0	4.2	2.0	2.0	0.1	0.3	-0.2	0.3	0.7	-0.9	0.1	0.0	0.7	-0.8
DE	1.3	1.4	0.5	0.9	0.0	-0.4	-0.1	0.2	0.0	0.0	-0.1	0.2	0.7	-0.4
DK	1.9	1.9	0.4	0.6	0.1	-0.2	0.1	0.2	0.1	0.1	0.1	0.2	0.1	0.0
EE	7.2	7.0	3.0	2.5	0.2	0.2	-0.3	0.0	0.9	0.0	0.0	-0.1	0.4	0.0
ES	3.8	3.7	0.7	0.1	0.4	0.1	0.1	1.4	0.4	0.3	0.0	0.7	0.3	-0.8
FI	3.5	3.5	0.3	2.1	0.2	-0.1	0.2	0.2	0.5	0.1	-0.1	0.0	0.6	-0.3
FR	2.2	2.1	0.5	0.5	0.4	0.0	0.4	0.2	0.1	0.1	-0.3	-0.1	0.3	0.0
GR	3.9	3.7	0.6	1.1	0.5	-0.2	0.0	0.3	0.3	-0.5	0.2	0.7	0.3	0.4
HU	3.7	3.6	2.2	1.5	0.3	0.1	-0.4	0.1	-0.2	-1.1	0.2	0.3	1.1	-0.5
IE	6.2	6.0	0.9	1.8	0.7	0.3	0.8	1.1	-0.2	0.1	0.0	0.5	0.3	-0.4
IT	1.4	1.3	0.3	-0.3	0.3	-0.3	-0.1	0.7	0.6	-0.5	0.0	0.5	0.5	-0.3
LT	7.0	6.8	2.2	4.0	-0.3	0.5	-0.3	-0.2	1.6	-1.0	-0.2	-0.3	0.4	0.3
LU	4.8	4.8	1.1	0.8	0.4	0.1	0.6	0.7	-0.2	-0.3	0.6	1.3	0.7	-1.1
LV	8.1	8.0	3.2	3.1	0.2	0.3	-0.5	-0.1	1.0	0.3	0.0	-0.1	1.0	-0.3
MT	2.5	2.6	0.4	-1.2	0.8	0.2	0.4	0.4	0.3	-0.4	-0.2	0.9	-0.1	1.0
NL	2.3	2.4	0.5	0.9	0.3	-0.1	0.4	0.0	0.1	-0.1	-0.2	0.3	0.7	-0.4
PL	4.1	4.1	1.4	1.5	0.5	0.4	-0.1	0.0	1.1	-0.5	-0.1	-0.1	0.0	-0.1
PT	1.7	1.8	0.8	0.0	0.5	-0.1	0.1	0.4	-0.5	-0.2	0.1	0.4	0.2	-0.1
RO	4.6	4.7	2.1	2.5	0.4	0.4	0.1	-0.3	0.0	-0.9	-0.1	-0.1	-0.2	0.8
SE	3.0	3.0	0.4	2.0	0.1	0.3	0.1	0.4	-0.1	0.1	-0.1	-0.1	0.0	-0.2
SI	4.3	4.4	2.0	1.5	0.3	0.0	-0.1	0.3	0.4	0.0	-0.3	-0.1	0.8	-0.4
SK	5.4	5.9	1.9	2.8	0.1	0.6	0.0	0.2	1.7	-1.2	-0.3	-0.4	0.9	-0.3
UK	2.7	2.6	0.7	1.2	0.4	0.3	0.2	0.3	0.0	-0.1	0.0	0.1	0.2	-0.4
EU12	4.5	4.5	1.8	1.9	0.3	0.4	-0.1	-0.1	0.8	-0.7	0.0	-0.1	0.4	-0.1
EU27	2.7	2.4	0.6	0.8	0.3	0.0	0.1	0.3	0.2	-0.1	-0.1	0.2	0.4	-0.3
EU15	2.2	2.2	0.5	0.7	0.3	-0.1	0.1	0.4	0.1	-0.1	-0.1	0.2	0.4	-0.3
euro area 16	2.2	2.2	0.5	0.5	0.3	-0.1	0.1	0.5	0.2	-0.1	-0.1	0.3	0.5	-0.3
EU5	2.7	2.8	0.6	1.0	0.3	0.0	0.3	0.3	0.1	0.0	-0.1	0.3	0.5	-0.3

Based on this analysis, it could be concluded that the effect of business cycle might be particularly relevant for some countries and some growth components (e.g. unemployment, hours worked and TFP, especially in the new member states). This analysis may then be found useful when considering the effects of economic cycle on GDP accounting and drawing overall policy conclusions, whenever relevant. Of course the cyclical dimension should not be over-emphasised in many cases where the estimated effect remains weak.