CAUSES OF PRODUCTIVITY SLOWDOWN IN THE EUROPEAN UNION

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Abstract. In this study we have analyzed the evolution of the EU-15 labour productivity in the last years to identify the structural problems of the European economy. According to statistical data, the productivity per hour has decreased from 2% in 1981-1995 to 1.6% in the 1995-2000 period and then to only 1.3% in 2000-2006. The main causes of the productivity slowdown refer to lower investment, which caused a smaller increase of the capital stock and to smaller growth rate of total factor productivity. In the last thirteen years, labour productivity growth in Europe was below the level from United States, which leads to larger gap between the two economies.

Key words: *Hodrick-Prescott filter, potential growth, ICT capital, total factor productivity.*

The term "productivity" describes labour productivity, measured by real GDP per worker or by GDP per hour worked. According to Cobb Douglass production function form, labour productivity growth is influenced by capital stock accumulation, by stock of capital per employed person, and by total factor productivity (TFP). Among these three factors, capital deepening and total factor productivity change after a long time after investment or technological process, while employment is a variable production factor on short term. Otherwise, the employment may be more easily measured, while the other two factors are measured by more complex methodologies. For example, the capital stock accumulation results from net investment, assuming that there is a known initial capital stock. Also, total factor productivity may be interpreted as residual of the Cobb Douglass function, being equal with difference between output growth and the growth of labour, respectively capital stock.

The sources of labour productivity results from the decomposition of national output, which can be expressed by use of a Cobb-Douglas production function with constant returns to scale:

$Y = TFP \cdot K^{\beta} \cdot L^{1-\beta}$, where,

Y denotes GDP; L is the number of persons employed; K is the stock of capital; TFP represents total factor productivity; β is the elasticity of output with respect to stock of capital, assumed to be constant over time. It results that labour productivity has the following form:

$$\frac{Y}{L} = TFP \cdot \left(\frac{K}{L}\right)^{\beta}$$

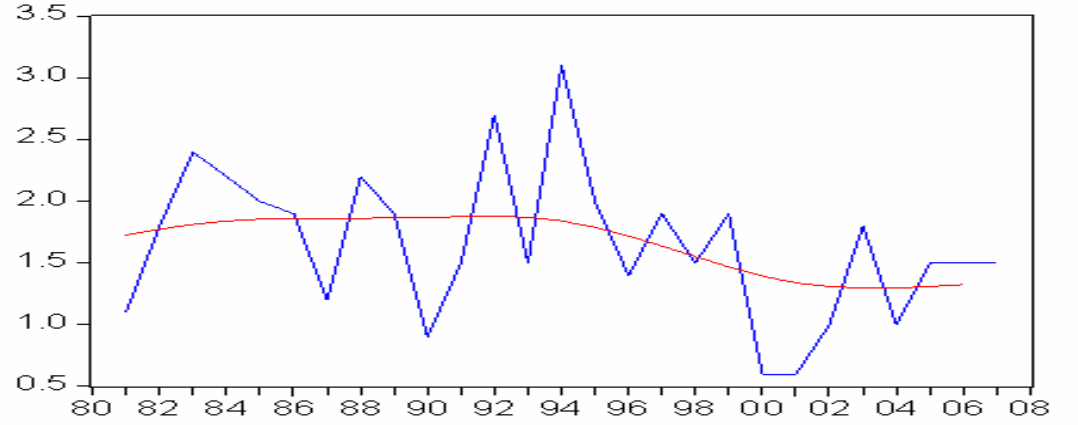
If the above relation is logarithmed, it can be expressed the change of the labour productivity in change of the total factor productivity and in change of the stock of capital per employed person, according to below equation:

$\%\Delta(Y/L) = \%\Delta TFP + \beta \cdot \%\Delta(K/L)$.

The trend of labour productivity in the European Union

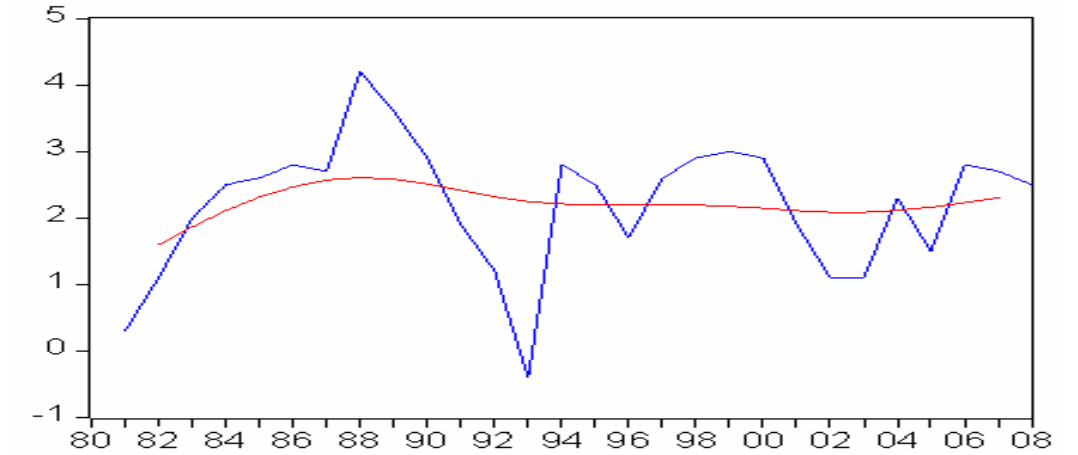
The growth of the labour productivity is mostly influenced by economic business cycle of a country. Thus, in a recessionary period, the economy produces below potential and the labour productivity will fall below trend. In this study we have used a Hodrick-Prescott (HP) filter to decompose the evolution of the output growth and of the productivity growth in two components – trend and cycle. The HP filter was used, for example, in the calculation of trend labour productivity growth for the euro area in European Commission (2006).

The trend of labour productivity growth and economic growth rate is illustrated by Figures 1 and 2 in which we have presented the evolutions of the output and productivity growth in the European Union over the period 1980-2008. As can be seen, the two variables move closely together, with a contemporaneous correlation of 0.76.



Source of data: European Commission (2007)

Figure 1. The HP trend of labour productivity in European Union



Source of data: European Commission (2007)

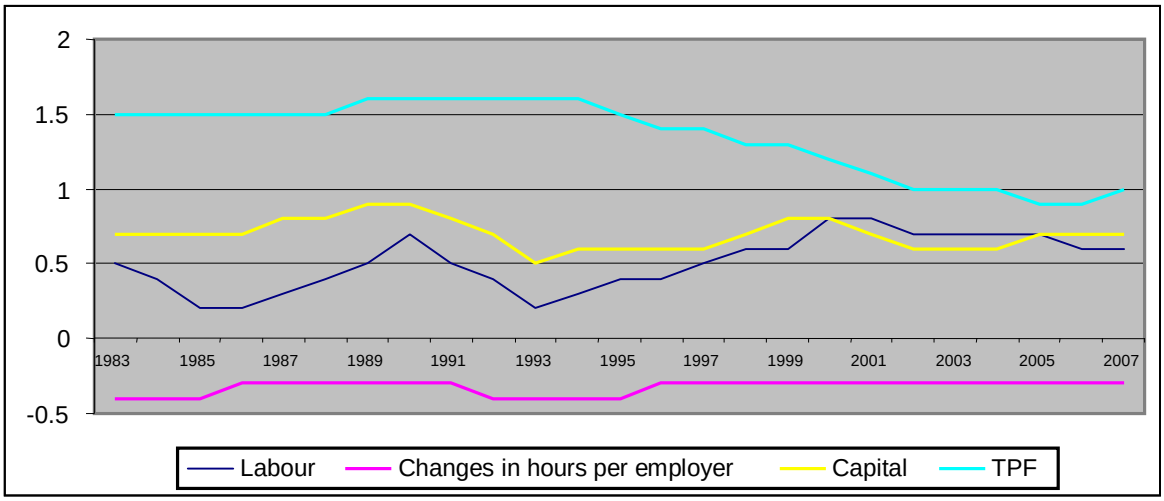
Figure 2. The trend of economic growth in European Union

In accordance with these figures, it results that the trend of the labour productivity was almost 1.8% during ten years (between 1984 and 1994), and has declined rapidly below 1.5% after euro introduction. The weaker performance in terms of the labour productivity can be explained both by decrease of the trend and by recessionary phase of the economy, as seen in figure 2. Concerning the potential growth rate of the economy, it was relatively stable in the last fifteen years, being situated at

2% per year. Generally, the European economy has register a negative output gap especially after 2000 year.
The actual evolution of the potential GDP (estimated by the HP trend of economic growth rate) is characterised by the increase of number of persons employed beginning at 2000 year that has compensated the reduction of hours worked per employer (about -0.3% per year contribution). The total factor productivity explains about half of the potential growth rate and the contribution of capital accumulation is stable around the 0.6-0.7 percentage points. In the graph 3, we have showed the decomposition of potential GDP (Y_P) , according to following equation:

$$Y_P = TFP \cdot K^{\beta} \cdot (L \cdot \frac{H}{L})^{1-\beta} \Rightarrow \%\Delta Y_P = \%\Delta TFP + \beta \cdot \%\Delta K + (1-\beta) \cdot \%\Delta L + (1-\beta) \cdot \%\Delta (H / L)$$

where, the labour contribution is evaluated by the total number of hours worked.



Source of data: European Commission (2007)

Figure 3. The factors that influence the potential GDP in the European Union

The significant decrease of total factor productivity growth in the EU since 1995 (as in the figure 3) has generated a reduction of labour productivity growth (in figure 1). If European Union will be characterised by same evolution in the next years, then long-run economic growth rate will reduce. This is calculated by the sum of changes in labour productivity and in employment.
According to the three figures represented above, it can be concluded that European Union has interrupted the favourable evolution after Second World War, which has sustained a convergence with US level of productivity. Thus, in the 2006 year, the level of output per capita in European Union was at roughly 73 % of US levels, level similar with that existing in the 1970 year. It results that in the last thirty years it has not registered a convergence of the output per capita in European Union relative to United States economy. However, there is a good news about the labour productivity contribution. Such it is observed in the figure 4, labour productivity measured as output per hour worked has increased from 70% of US level to 103% in 1995 year, respectively to 92% in 2005 year. In the last ten years, European Union has lost around 20% of the gains obtained after the Second World War. Beginning with 1995 year, the gap between US and EU has increased, in context of the higher labour productivity growth rate in the first country. European Competitiveness Report (2001) considers that "the mid-1990s marked a turning point in this process. A rapid acceleration of productivity growth in the US coincided with a deceleration in the EU and led to a renewed widening of the productivity gap, thus erasing to some extent the convergence gains made. EU performance in

the second half of the 1990s was not by itself especially discouraging, with GDP growth accelerating and employment rising".

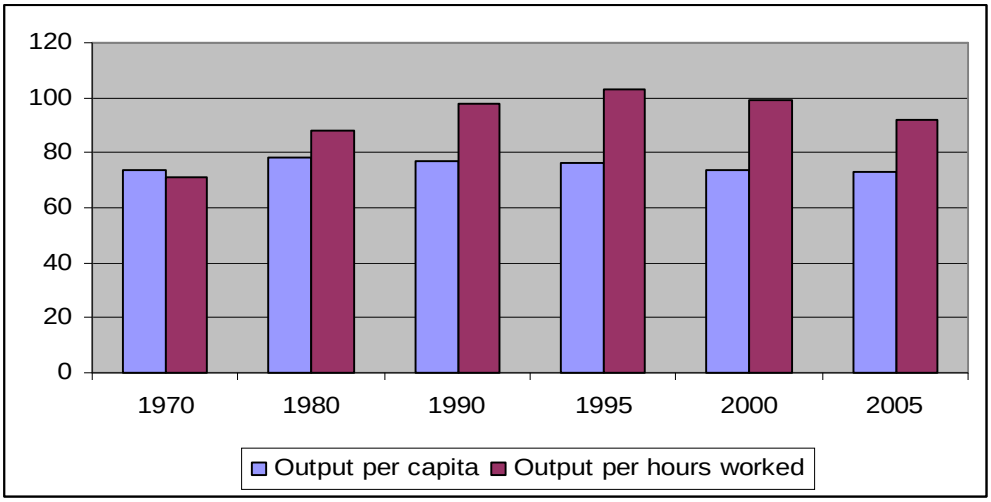


Figure 4. Output per capita and productivity in the EU relative to the US (in PPP)

Effects of ICT on labour productivity

In this section we have tried to explain the labour productivity gap between US and EU by slower propensity of the European economy to Information and Communication Technologies (ICT). Over the past few decades, ICT has become increasingly pervasive in development economies. Two main evolutions have spurred this uptake of the ICT technology. The first reason refers to rapid technological progress which has driven down the cost of ICT goods. The second reason refers to the ICT process enabled by this technological progress. There are at least three possible reasons why ICT has stronger effects on productivity than other capital stock, according to Ark and Inklaar (2005):

- effects of ICT investment through ICT capital deepening;
- rapid technological change in ICT producing industries leading to TFP growth;
- Total Factor Productivity (TFP) growth in industries that make intensive use of ICT (knowledge spillovers)

Ark and Inklaar (2005) consider that "total factor productivity (TFP) growth in ICT producing industries will quite naturally contribute to aggregate TFP growth and hence labour productivity growth. In a neo-classical framework, the contribution from ICT investment is also well defined: firms will invest in ICT up to the point where further output gains are equal to the marginal cost of the investment". These economists have proposed a theoretical framework to analyze the contribution of ICT to economic growth, respectively to labour productivity. They have decomposed the capital stock of the country into ICT capital (K_{ICT}) and non-ICT capital (K_N). The first type of the capital is obtained in industries such electronics, informatics, while the last is specific to traditional industries. They used a traditionally Cobb Douglass production function in which indluded the two types of the capital stock, as in the following relation:

$$Y = TFP \cdot K_N^{\beta} \cdot K_{ICT}^{\alpha} \cdot L^{1-\alpha-\beta}.$$

$$\frac{Y}{L} = TFP \cdot \left(\frac{K_N}{L}\right)^{\beta} \cdot \left(\frac{K_{ICT}}{L}\right)^{\alpha}.$$

TFP growth can then be derived as the growth of output minus the growth of aggregate inputs:

$$\%\Delta TFP = \%\Delta\frac{Y}{L} - \beta \cdot \%\Delta(\frac{K_N}{L}) - \alpha \cdot \%\Delta(\frac{K_{ICT}}{L}).$$

To offer an another explanation of the ICT impact on labour productivity gaps, Ark and Inklaar (2005) made a decomposition of the TFP - originating in manufacturing industries producing ICT goods and other industries.

Table 1 summarizes the main findings for the EU-15 and the U.S. for the periods 1987-1995, 1995-2000 and 2000-2005. The table shows a decomposition of labour productivity growth into the effects of ICT capital deepening, TFP growth from ICT producing industries, non-ICT capital deepening and TFP growth other than that from ICT production. "The main findings are that the EU-15 as a whole has been lagging behind the U.S. in terms of ICT capital deepening in each period" (Ark and Inklaar, 2005). The deepening of the ICT capital process has emphasized in European Union and in United States beginning with 1995 year, but after 2000 year its growth has returned to levels pre-1995. The intensity of the process was higher in United States and led to stimulate the labour economic growth rate, from 1.2% pre-1995 to 2.3% after this year. Despite the role of the ISC sector, the divergence between labour productivity growth rates was mostly influenced by higher TFP growth in other industries. Thus, the increase of this form of TFP was zero in European Union and 1.4% in United States.

	1987-1995	1995 - 2000	2000-2005
Labour productivity growth in the EU, of which:	**2.3**	**1.8**	**1.2**
- ICT capital deepening	0.4	0.6	0.4
- non-ICT capital deepening	0.8	0.4	0.5
- TFP in ICT industries	0.2	0.4	0.3
- TFP in other industries	0.9	0.4	0.0
Labour productivity growth in the US, of which:	**1.2**	**2.3**	**2.8**
- ICT capital deepening	0.5	1.0	0.6
- non-ICT capital deepening	0.1	0.2	0.5
- TFP in ICT industries	0.4	0.7	0.3
- TFP in other industries	0.2	0.4	1.4

Source of data: EU KLEMS (2008)

Table1. Sources of labour productivity in EU and US

Based on the data included in the table above, Ark and Inklaar (2005) have concluded that "European economy are still in a transition process towards a new phase of productivity gains from ICT usage, which the United States have already realized. To this end the direct relationship between ICT use and TFP growth at the industry level has been estimated, to identify any productivity spillover effects of ICT use. The European slowdown in productivity growth is a reflection of an adjustment process towards a new economic structure, which has developed more slowly in the EU than in the U.S.". Therefore, these authors have identified a structural cause of the labour productivity weaker performance in the European Union, which can be neutralized by rapid diffusion of ICT in the European industries.

Determinants of labour productivity

In this section, we have summarized the most important factors to enhance labour productivity in the European Union, on the basis of the economic literature:

1. rising the education level of the employed population. Generally there is a positive correlation between the education and the living standard of the population.
2. ensuring a free competition in all the economic sector, inclusive in the service sector or in innovation sector. A free competition forces the firms to higher specialization process, which can lead to higher productivity.
3. stimulating the innovation process by tax burden reduction, by tax facilities, by promoting the entrepreneurship, respectively by rising of the research and development spending share in GDP. This factor is positive influenced by education and is into a concave relation with competition. Thus, innovation process increases at low and higher level of competition.
4. investing in physical capital, which rise the degree of the worker endowment and the level of their efficiency.

References:

[1] Ark, B. van and R.C. Inklaar (2005), 'Catching Up or Getting Stuck? Europe's Troubles to Exploit ICT's Productivity Potential', Research Memorandum GD-79, Groningen Growth and Development Centre, September;

[2] European Commission (2001), "European Competitiveness Report "

[3] European Commission (2006), "Quarterly Report on the Euro Area", Vol. 5, No 4, Economic and Financial Affairs DG, 2006;

[4] EU KLEMS Database, March 2008, http://www.ggdc.net;

[5] Gordon, R. J. and I. D. Becker (2005) 'Why did Europe's productivity catch-up sputter out? A tale of tigers and tortoises', paper presented at the Federal Reserve Bank/CSIP Conference, San Francisco, November 18;

[6] Inklaar, R;, M. O'Mahony and M.P. Timmer (2005), "ICT and Europe's Productivity Performance: Industry Level Growth Account Comparisons with the US", Review of Income and Wealth;

[7] Schreyer, P (2006), "International Comparisons of Levels of Capital Input and Productivity", paper presented at the conference on the "Determinants of Productivity Growth", Vienna;

[8] Van Ark, B., M O'Mahony (2007), "The EU KLEMS Productivity Report", Issue 1, University of Groningen and University of Birmingham.