Labour Productivity Growth in the European Union[1]

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Executive Summary

- Labour productivity is defined as output divided by hours worked and it increases as a result total factor productivity growth or an increase in the capital – labour ratio.

- The labour productivity gap between the United States and the EU-15 was nearly closed by 1995. Since then, however, there has been a sharp turnaround, with labour productivity growing faster in the United States than in the EU-15.

- An increase in the EU-15 capital – labour ratio, possibly brought about by restrictive labour market practices in Europe, played an important role in EU – 15 labour productivity growth during the period 1980 – 1985.

- EU-15 labour productivity growth over the period 1995 – 2004 varied across countries. Ireland, Finland, Greece and Sweden experienced higher labour productivity growth than did the United States, while Spain had no labour productivity growth during this period.

- Differences in labour productivity growth across the EU-15 countries during the period 1995 – 2004 were primarily due to differences in total factor productivity growth, rather than to differences in the growth of the capital – labour ratio. In Italy and Spain, total factor productivity growth was negative during this period.

- Differences in total factor productivity growth across the EU-15 countries during the period 1995 – 2004 were mainly due to differences in total factor productivity growth in the non-ICT sector. The difference between total factor productivity growth in the non-ICT sector in the United States and in the EU-15 was primarily due to a difference in total factor productivity growth rates in ICT-using industries. It is hypothesized that a less rigid institutional environment in the United States fostered a quicker adjustment process after the ICT revolution.

- Economic reforms that make it easier to open and close businesses, hire and fire workers, import and export goods, deal with licenses and taxes and enforce contracts would raise total factor productivity growth.

[1] Briefing paper for the Committee on Economic and Monetary Affairs (ECON) of the European Parliament for the quarterly dialogue with the President of the European Central Bank.

1. *Labour Productivity*

Assume that time-t output (Y_t) is a function of the time-*t* capital stock (K_t) and time-*t* hours worked (L_t) and that is also depends on the amount of "knowledge" or "technology" in the economy. These assumptions can be captured by writing output as

$$Y_t = A_t F(K_t, L_t), \tag{1.1}$$

where *F* is the production function and the variable A_t captures the knowledge or technology in the economy and is referred to as *total factor productivity*.[2]

It is typically assumed that *F* is a Cobb-Douglas production function so that equation (1.1) can be written as:

$$Y_t = A_t (K_t)^{1-\alpha} (L_t)^{\alpha}, \quad \alpha \in (0,1). \tag{1.2}$$

The Cobb-Douglas production function exhibits constant returns to scale and is probably not an unreasonable approximation of actual production functions. It has the property that labour's share of output is constant and equal to the parameter α. For the European Union and the United States, α is roughly equal to 2/3.

Dividing by both sides of equation (1.2) by hours worked yields labour productivity:

$$y_t \equiv Y_t / L_t = A_t (k_t)^{1-\alpha}, \tag{1.3}$$

where $k_t \equiv K_t / L_t$ is the capital-labour ratio, or the capital stock divided by hours worked. Thus, labour productivity depends on total factor productivity and the capital-labour ratio. Equation (1.3) implies

$$\hat{y}_t = (1-\alpha)\hat{k}_t + \hat{A}_t, \tag{1.4}$$

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[2] More generally the term A_t is the residual part of output that cannot be explained by the use of capital and labour. It is affected by such things as government spending and natural disasters.

where a "^" over a variable denotes a percentage rate of change. Equation (1.4) says that the percentage change in labour productivity is equal to about 1/3 multiplied by the percentage change in the capital-labour ratio plus the percentage change in total factor productivity. The percentage change in the capital-labour ratio is often referred to as *capital deepening*. Thus, equation (1.4) says that labour may become more productive either because of technological advances or because the ratio of capital to labour has increased.

2. *Recent Labour Productivity Growth in Europe and the United States*

Table 1. Average Annual Change in Labour Productivity

	1980 – 1995	1995 - 2004
United States	1.41	2.53
EU - 15	2.34	1.46

Source: Gordon and Dew-Becker (2005).

In 1979, labour productivity in the 15 pre-enlargement members of the European Union was only 77 percent of US labour productivity. As a result of faster labour productivity growth in Europe than in the United States – shown in Table 1, the gap was nearly closed by 1995.[3] In that year EU-15 labour productivity was 94 percent of US labour productivity and in some EU member countries, such as France, labour productivity was higher than in the United States. Since, 1995, however there has been a sharp turnaround, with labour productivity growing faster in the United

[3] Much of the data in the cited papers comes from the Groningen Growth and Development Centre.

States than in Europe. By 2004, labour productivity in the EU–15 had fallen to 85 percent of labour productivity in the United States.[4,5]

3. *Explaining European Labour Productivity Growth in the Period 1980 – 95.*

What caused labour productivity to grow sofast in Europe in the period 1980 – 95? In Section 1 it was shown that a rise in productivity growth can be due either to an increase in the growth in total factor productivity or to a rise in capital deepening. During the period 1980 – 95, the latter phenomenon played an important role: capital deepening increased by 1.18 percent in the EU–15, compared with only .82 percent in the United States. It has been hypothesized that restrictive labour market practices in Europe – high minimum wages and restrictions on hiring and firing – made the cost of labour in Europe artificially high, generating unemployment. Meanwhile, flexible labour markets in the United States kept the average US wage relatively low and boosted employment by fostering the creation of low-skilled jobs.[6] European "technology" did not catch up with that in the United States; instead, it appears that distortionary labour market practices in Europe increased the capital – labour ratio in the United States relative to that in Europe, accounting for a third of the apparent catch up.

4. *Explaining Dampened Labour Productivity Growth in Europe in the Period 1995 - 2004*

What caused it labour productivity growth to sputter in Europe while it increased rapidly in the United States during the period 1995 – 2004? The prevailing view is that the growth in US productivity during the period is due to technological innovations in semiconductor manufacturing which led to the information and

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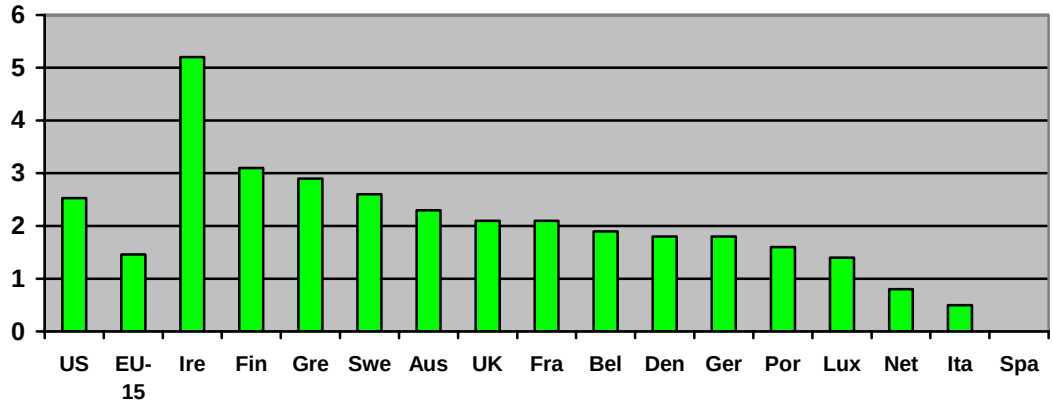
[4] There has been a recent pick up in European productivity growth, but this may be a cyclical phenomenon. See Gomez-Salvadore et al (2006).

[5] The same decline is found if labour productivity is measured as output per person employed rather than as output per hour worked. See Gomez-Salvadore et al (2006).

[6] Gordon and Dew-Becker (2005) elaborate: '… grocery baggers, bus boys, parking lot attendants, and an urban industry in what Americans call "valet parking"'.

communication technology (ICT) revolution.[7] Relatively unregulated product markets and flexible labour markets permitted a rapid restructuring of the US economy and the most efficient use of ICT in other industries. (See, for example, van Ark (2006).)

Figure 1. Labour Productivity Growth: 1995 - 2004

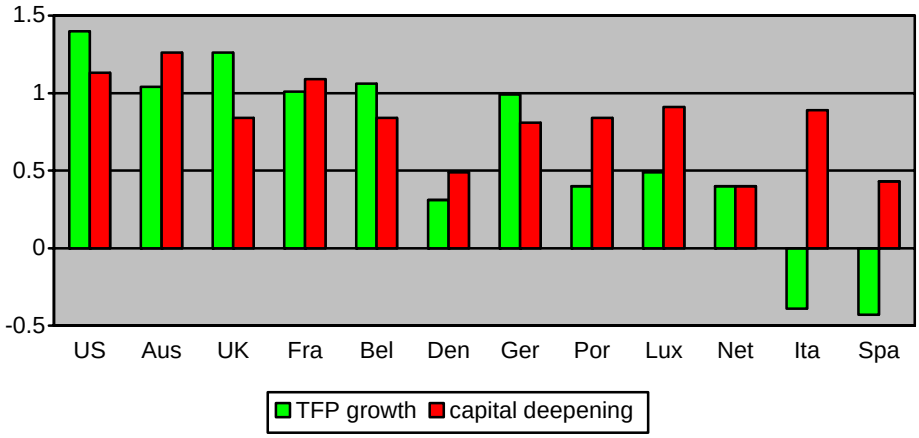


Source: Gordon and Dew-Becker (2005)

The slow down in European productivity growth is less straightforward. Not only was EU-15 productivity growth slow relative to the productivity growth in the United States, it was slow relative to productivity growth in Australia, Canada and Japan.[8] The slowdown was not uniform, however. As is seen in Figure 1, some countries (Ireland, Finland, Greece and Sweden) continued to experience faster labour productivity growth than did the United States, while others experienced much slower labour productivity growth; one country, Spain, experienced no labour productivity growth at all.[9]

[7] See Anderson and Klieson (2006).
[8] Van Ark (2006).
[9] The high labour-productivity growth in Greece is due to a catching-up process.

Figure 3. Sources of Labour Productivity Growth: 1995-2004

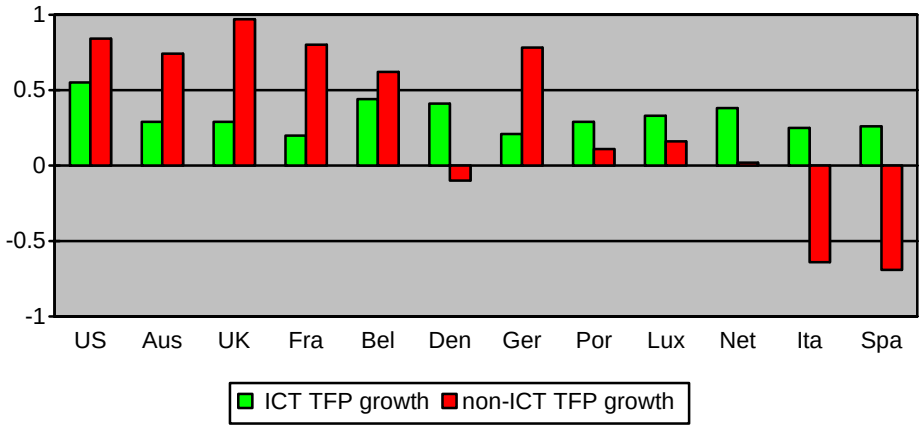


Source: Gordon and Dew-Becker (2005)

What caused the low EU-15 labour productivity growth outside of Ireland, Finland, Greece and Sweden? Figure 3 depicts the two components of labour productivity growth, total factor productivity (TFP) growth and capital deepening. Capital deepening was lower in Europe than in the United States, apparently as a result of wage moderation and labour market reform in Europe.[10] Total factor productivity growth is more variable across countries than is capital deepening. It was higher in Austria than in the United States. Total factor productivity growth in the UK, France, Belgium and Germany was not too dissimilar to total factor productivity growth in the United States. In Italy and Spain, however, it was negative.

[10] See Gomez-Salavadore (2006).

Figure 4. Sources of TFP Growth: 1995-2004



Source: Gordon and Dew-Becker (2005)

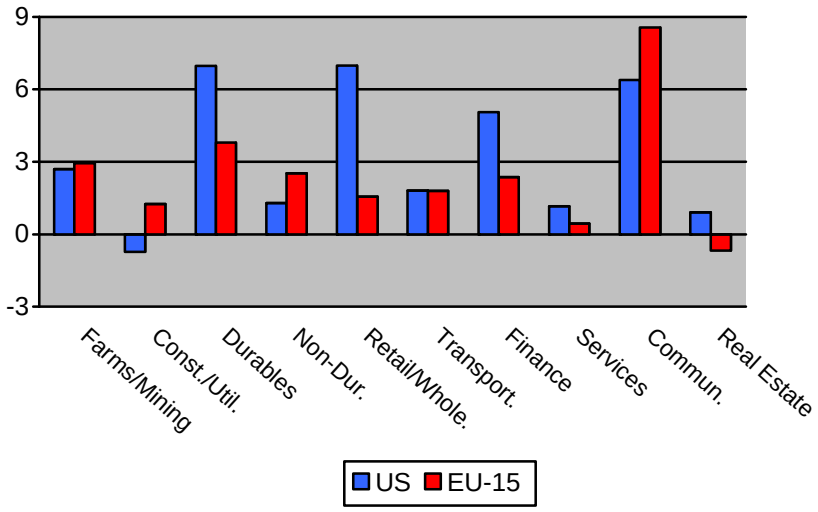
Figure 4 splits total factor productivity growth into two parts: growth in the ICT sector and growth in other sectors. It is seen that there is little variation in total factor productivity growth in the ICT sector, but significant variation in total factor productivity growth in the non-ICT sector.

Where is this difference in non-ICT total factor productivity growth coming from? Figure 5 depicts non-ICT total factor productivity growth for the United States and the EU-15 by sectors. The deviation is particularly large in the ICT-using industries: retail and wholesale and finance. US retailing, for example, was transformed from a low-technology sector to a highly ICT-intensive sector; this has not occurred to the same extent in the EU-15.

ICT-using industries in the United States did not become more productive by simply investing in ICT technology. Instead, these investments were combined with significant changes in the way that these industries did business.[11] Thus, it appears to have been a combination of flexibility and innovativeness that allowed for the increase in US ICT-using factor productivity growth.

[11] See Kroszner (2006).

Figure 5. Labour Productivity Growth by Industry



Source: Gordon and Dew-Becker (2005)

5. *Policy and Productivity*

Rigid labour and product markets, poorly functioning credit markets, high costs of starting and closing businesses, and restrictions on land use and business hours hampered adjustment in many European economies and led to dampened total factor productivity growth. Countries with high total factor productivity growth tend to be countries where it is easy to do business. The World Bank ranks the United States, Ireland, Sweden and Finland 3rd, 10th, 13th and 14th, respectively, in its 2007 Ease of Doing Business Index. In contrast, Spain ranks 39th and Italy ranks 82nd. In comparison with the United States, it is far more difficult, costly and time consuming to start a new business in Italy; it is more costly and time consuming to deal with licenses; it takes longer and costs more to register property; it is more expensive to and takes longer to trade across borders; it is more costly to close a business; it takes over four times as long to enforce a contract; it is more difficult to hire and fire workers and hours are more rigid.

Monetary policy can play little positive role in enhancing total factor productivity growth. The appropriate response in countries where distortions reduce total factor productivity growth is economic reform that increases flexibility.

6. *Measuring Potential Growth*

Using the Cobb-Douglas production function approach of equation (1.2), it is assumed that potential output (Y_t^p) is a function of the capital stock and potential hours worked (L_t^p) and that it also depends on the amount of "knowledge" or "technology" in the economy:[12]

$$Y_t^p = A_t (K_t^p)^{1-\alpha} (L_t^p)^{\alpha}, \quad \alpha \in (0,1). \tag{6.1}$$

Equation (6.1) implies that

$$\hat{Y}_t^p = (1-\alpha)\hat{K}_t^p + \alpha \hat{L}_t^p + \hat{A}_t^L. \tag{6.2}$$

With α equalling about two-thirds, equation (5.2) says that potential percentage growth in output is equal to one-third times the percentage growth in the capital stock plus two-thirds times the percentage growth in potential hours worked plus the percentage change in total factor productivity. Thus, forecasting potential output growth entails forecasting the growth in the potential capital stock, the growth in potential hours worked and the growth in total factor productivity.

Forecasting the growth of the capital stock is relatively straightforward as the contribution of capital to growth changes little over time in the US or the EU.[13] The growth in "potential" hours worked is both difficult to define and difficult to forecast. It is frequently defined as the growth in hours worked that is consistent with stable inflation. In this case, forecasting the change in hours worked entails forecasting both

[12] In July 2002 ECOFIN endorsed the use the production function approach as a reference method for the calculation of output gaps when assessing the stability and convergence programmes for EU member states. See Denis et al (2006).
[13] See Denis et al (2006).

the growth in the working age population and the labour force participation rate to find an estimate of the growth in the available labour force. Then the change in the unemployment rate that is consistent with non-accelerating inflation is found and the change in employment. Finally, hours worked must be forecasted to find the change in hours worked. Forecasting total factor productivity growth presents a challenge. For short-run changes to be used for output gap computations, it may be sufficient to use past trends to forecast future growth.

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